

# **Learning Progression Framework for Biodiversity in Communities**

## **Reference:**

**Biodiversity: Diversity in a Leaf Pack Aquatic Teaching Experiment, Written by: Jennifer Doherty, Cornelia Harris, and Laurel Hartley**

**With assistance from Andy Anderson, Marcia Angle, Mitch Burke, Terry Grant, Michele Johnson, Debi Kilmartin, Shawna McMahan, John Moore, MaryAnn Murphy, Liz Ratashak, Michael Schiebout, Jonathon Schramm, Scott Simon, Lori Spindler, Brook Wilke**

**Culturally relevant ecology, learning progressions and environmental literacy**

**Long Term Ecological Research Math Science Partnership**

**September 25, 2010, revised June 7, 2012**

## Learning Progression Framework for Biodiversity in Communities

Level	Biotic Interactions	Abiotic Interactions	Dispersal	Community Composition
<b>4</b>	<p>a. explain how modification of the abiotic environment by one organism can have effects on other biota</p> <p>b. Recognizes both direct (trophic, mutualisms, etc.) and indirect (competition mediated through other biota or resources, etc.) interactions as driven by constant appropriation of matter and energy from other organisms for purposes of growing/reproduction.</p> <p>(L3 students recognize that organisms can change the abiotic environment, but L4 students can articulate the consequences of those interactions.)</p>		<p>a. Dispersal is an integral process to the structure of communities and a major way in which species cope with change</p> <p>b. Dispersal is limited by both an organism's traits and external factors (e.g., distance, biotic and abiotic characteristics of the environment) Student can acknowledge explain multiple influences on dispersal</p>	<p>Understand effect of multiple biotic and abiotic interactions is not additive, but complex in nature (i.e. arrangement of components and interactions heavily influences outcomes); recognize that dispersal is important; communities change over time and space (dynamic); also understand the idea of feedback</p>
<b>3</b>	<p>a. Describes different types of interactions besides predator-prey (e.g. competition, mutualism).</p> <p>b. Describe that predator-prey interactions influence life-cycles, including reproduction (i.e. if an animal doesn't get enough food, it may not be able to reproduce).</p> <p>c. Explain how a change in one population may affect populations one step up or down in the food web/chain AND <i>more</i> than one step up or down in the food web/chain (i.e. a trophic cascade).</p> <p>d. Describe that the effect of positive interactions is that an organism gets matter and energy</p> <p>e. Explain how an organism's traits affect its interactions with other organisms.</p>	<p>a. List abiotic factors and explain how the factors influence the growth, survival, or reproduction</p> <p>b. Explain how one key trait of an organism influences how it interacts with specific parts of the abiotic environment, but can't explain that an organism simultaneously interacts with different parts of the environment using different traits</p> <p>c. Acknowledges that an organism can be affected by its abiotic environment and that an organism can affect its abiotic environment</p>	<p>a. Dispersal is important to communities and persistence of species</p> <p>b. Dispersal of a species is limited by the traits of an organism</p> <p>c. Dispersal of a species is limited by the environment</p>	<p>Understands that both biotic and abiotic components of a community are important, but not the feedback mechanisms among these. Or combines a combo of 2 of the following: dispersal, abiotic, biotic.</p>
<b>2</b>	<p>a. Describes predator-prey as only relevant interaction and the effect of the interaction as life or death ("organisms need to eat to live") and leaves out the idea of reproduction</p> <p>b. Acknowledge that a change in one species may affect species one step up or down in the food web/chain, but don't understand that interactions can affect other interactions further along in the food web/chain</p>	<p>a. List abiotic factors but can't explain how factors affect growth, survival, or reproduction</p> <p>b. Doesn't link trait(s) of orgs with how it interacts with the environment</p> <p>c. Acknowledges that an organism can be affected by its abiotic environment but not that an organism can affect its abiotic environment</p>	<p>a. Dispersal is not limited (i.e. all species move around at will)</p> <p>b. Dispersal ability is not connected to traits of organisms</p> <p>c. Isn't important on the scale of community (even if dispersal happens, it doesn't change things)</p>	<p>Any combination of L2 indicator sets in columns 1-3</p>
<b>1</b>	<p>a. Sees organisms as helping or harming each other, i.e. sees anthropomorphic result of an interaction as good or bad; OR</p> <p>b. Don't recognize interactions w/ other biota</p>	<p>a. Only sees abiotic environment as scenery or supply of needs (as an enabler); OR</p> <p>b. Can't distinguish living and non-living aspects of the ecosystem</p>	<p>a. Dispersal not acknowledged as happening or necessary for presence;</p> <p>b. Dispersal only occurs through humans moving organisms</p>	<p>Community is structured solely by external forces acting upon it (e.g. God, humans, catastrophe); L1 elements from columns 1-3.</p>

Level	Taxa Recognition	Grounds for Relatedness	Understanding of Ecological Roles/Function
4	Mixture of broad and fine groups and specific designations, including microscopic or other 'hidden' species (i.e. soil organisms that aren't typically visible – e.g. fungus that is large enough to see, but growing underground)	<p>a. Group organisms in multiple ways using multiple traits (e.g. function, feeding group, morphology, evolutionary relatedness). <b>AND</b></p> <p>b. Explain traits of an organism if told where the organism fits in the phylogeny (i.e. they know some of the basic traits of groups like plant, animals, fungi etc.)</p> <p>c. Acknowledge that dissimilar looking organisms can be phylogenetically related (i.e. groups are put together based on evidence of evolutionary common ancestry--even if students don't know what that evidence is)</p>	<p>a. Discuss more than one functional role of an organism (i.e. moving beyond feeding) <b>AND</b></p> <p>b. Explain how a function being carried out by one organism can modify the abiotic environment and in turn have affects on other biota (e.g. the nitrogen released by decomposers can be used by algae for growth)</p> <p>c. Explain the implications and limitations of functional redundancy (i.e. sometimes there is more than one species capable of carrying out a function so removing one species may not eliminate an ecosystem function, however, sometimes species with overlapping functions have different biotic or abiotic requirements)</p> <p>d. Explain that decomposers are just like other heterotrophs in that they take in and use food for matter and energy</p>
3	Mixture of broad and fine groups and specific designations (e.g. common or scientific name of a species)	<p>a. Group organisms in multiple ways using multiple traits (e.g. function, feeding group, morphology, evolutionary relatedness).</p>	<p>a. Discuss more than one functional role of an organism (i.e. moving beyond feeding)</p> <p>b. Recognizes functional redundancy (i.e. sometimes there is more than one species capable of carrying out a function)</p> <p>c. Explain that decomposers break down dead things for the purpose of obtaining food for themselves, not to decompose things</p>
2	Some finer designations (e.g. robins and jays, beetles and flies) in addition to broad groups	<p>a. Recognize similarities and differences among familiar groups of animals and plants that may not seem related (e.g. birds and mammals - L1 students may only see that mammals are animals, while L2 may see that mammals and birds are both animals).</p> <p>b. Recognize the idea of lineage, insomuch as they acknowledge that like organisms descend from like organisms (e.g. poodles descended from poodles).</p> <p>c. Acknowledge there can be differences within the same group (e.g. poodles and labs are both dogs even though they don't look the same, a sapling and a tree might be the same even though they are different sizes).</p>	<p>a. Discuss feeding relationships</p> <p>b. Explain the idea of "role" in a general sense ("everything has a job to do in the ecosystem")</p> <p>c. Know that decomposers are organisms that decompose dead things</p>
1	Common name groups (e.g. birds, insects, etc)	Recognize that one organism is different from others based on outward physical similarities and differences.	Explain that organisms have human-like roles, like taking care of other organisms