Supporting California Public Schools Life Science Curriculum Standards

Recent years have seen an increased emphasis on classroom curriculum standards in California public schools. This handout has been developed to help Nature Education docents illustrate relevant Life Sciences standards during class visits to Filoli. The following pages contain the standards for grades kindergarten through five, together with suggestions of creatures, plants and ecosystems seen on the trails at Filoli that exhibit the concepts defined in the standards.

The examples, which are shown in *italics* interleaved with the text of the standards, are meant to be suggestive and not exhaustive. It is hoped that they will act as pump-primers to remind you of your own favorite seasonally varying sights along the trail system, assisting you in making the words of the standards come alive for the visiting students and their accompanying teachers.

Filoli EDU October, 2009

KINDERGARTEN: STANDARD 4

Investigation and Experimentation

Scientific progress is made by asking meaningful questions and conducting careful investigations, students will

- *Observe common objects using the five senses:*
  see, hear, smell, touch, and probably not taste
- *Describe properties of common objects:*
  plants and animals: color, shape, texture, size, and weight

GRADE 1: STANDARD 2

Plants and animals meet their needs in different ways.

As a basis for understanding this concept:

- *Most of the activities involve observation-encouraging the use of the senses and comparison-i.e. describing what a particular leaf/flower/fruit/tree/animal looks like (size, shape, etc.) feels like, smells, where it lives. Etc. Tell how things are similar or different. Etc.*
- *Students know different plants and animals inhabit different kinds of environments and have external features that help them thrive in different kinds of places.*

Compare:
- *newts and lizards*
- *hawks, jays, and hummingbirds*
- *butterflies, bees, and yellow jackets, water striders*
- *oaks and redwoods*

Students know both plants and animals need water and light, animals need food
Students know animals eat plants or other animals for food and may use plants or even other animals for shelter and nesting.

What do all animals need? - discuss basic needs

- *Look for signs that animals have been grazing or hunting- chewed leaves, banana slug eating, birds*
- *gathering insects.*
- *Look for signs of cavity dwellers- possibly feathers in a hole in a tree.*

GRADE 1: STANDARD 2 (CON'T)

What do plants need?

- *Look for plants which are competing for sunlight*
- *Look for special plant adaptations- thorns, poisons, bitter taste*
- *Compare full sun to shady environments, wet environments compared to dry*

Students know roots are associated with the intake of water and soil nutrients and green leaves are associated with making food from sunlight.

- *Look for variety of leaves and needles.*
- *Look for seeds and cones.*
- *Compare stems and trunks.*
- *Can you see any roots? Maybe a fallen tree with roots exposed.*
- *Feel the coolness of the Madrone Trees.*

Students know how to infer what animals eat from the shapes of their teeth (e.g. sharp teeth:eats meet; flat teeth:eats plants).

- *Observe skulls in the Nature Center*
- *Observe bird beaks and bills in the Nature Center*
- *Discuss wading feet, talons*
- *Use the terms herbivore, carnivore, and omnivore*
- *Discuss bone samples along the trails-skulls and teeth*

GRADE 2: STANDARD 2

II. Plants and animals have predictable life cycles.

As a basis for understanding this concept:

1. Students know that organisms reproduce offspring of their own kind and that the offspring often resemble their parents and one another.

   Many young plants and animals look similar to their parents. (but note differences, also)
   - *Does and fawns*
   - *Birds and fledglings*
   - *Buckeyes and buckeye seedlings – same leaf patterns*
   - *mature and young redwoods*

2. Students know the sequential stages of life cycles are different for different animals, such as butterflies, frogs, and mice.

Some young are initially unlike their parents

- *Newts – eggs, gilled larva, adult – Spring Creek Trail, pond*
- *Frogs – eggs, tadpoles, adult (tadpoles in sunken garden pond)*
- *Oak moths – caterpillars, chrysalis, moths*

GRADE 2: STANDARD 2 (CON'T)

3. Students know that many characteristics of an organism are inherited from the parents. Some characteristics are caused or influenced by the environment.

    - *Madrone alle (trees arching towards sun, vs straight cousins)*
    - *Variation in size depending on availability of food sources for animals, competition from neighbors for plants*

4. Students know there is a variation among individuals of one kind within a population.

    - *individual differences among the students and adults in the group and in their own families*
    - *different size deer seen on the trails – some age, gender related differences*
    - *different size madrones along Scarp trail*

5. Students know light, gravity, touch, or environmental stress can affect the reproduction, growth, and development of plants.

    - *Madrone alle (trees arching towards sun, vs straight cousins)*
    - *Rings in large oak stump at entrance to Meadow Trail (variation in spacing revealing different growth patterns in the same tree depending on annual environment*
    - *One side of the Moroccan Blue Cedar just off the parking lot lacks branches – effect of now-missing oak tree*
    - *Redwoods can reproduce via shoots, since the presence of thick layers of duff make it difficult for seeds to germinate. (Seeds do germinate after fire clears the duff.)*

6. Students know flowers and fruits are associated with production in plants.

    - *Flowers or fruit or seeds on wildflowers, grasses, some trees in various locations on the trails*
    - *Seasonal variations in Heritage Orchard, olive grove in front of mansion*

GRADE 3: STANDARD 3

III. Adaptations in physical structure or behavior may improve an organism's chance for survival.

As a basis for understanding this concept:

1. Students know plants and animals have structures that serve different functions in growth, survival, and reproduction.

GRADE 3: STANDARD 3 (CON'T)

- *Shock absorbing material between the skull and brain in woodpeckers*
- *Antlers in deer appearing before mating season*
- *Camouflage value of banana slug's color allows the slug to blend in with fallen bay, coffeeberry leaves, slime distasteful to many predators*
- *Oil in bay leaves provides protection from insects*
- *Coyote – large ears, canine teeth, binocular vision – all helpful tools for a predator*
- *Many leaves in the chaparral are small, hairy or sticky to prevent water loss*

2. Students know examples of diverse life forms in different environments, such as oceans, deserts, tundra, forest, grasslands, and wetlands.

   Variation in different ecosystems at Filoli – riparian, woodland, redwood, chaparral (see many examples in Trail Guide)
   - *Grassland – deer, ground squirrels, pocket gophers, snakes, predatory birds*
   - *The pond – water bugs, newts, frogs, ducks*
   - *Redwoods – banana slugs, newts, ferns*

3. Students know living things cause changes in the environment in which they live ; some of these changes are detrimental to the organism or other organisms, and some are beneficial.

   - *Changes to trail area made by humans – positive and negative impact of clearing areas*
   - *Trails made by deer*
   - *Reuse of nest built by one species by another*
   - *Tanins in redwood trees inhibits growth of many plants*
   - *Banana slugs, fungi clear debris*
   - *Wood rats' nests provide cover*
   - *Oak moths stripped oak trees, impacting acorns production, forcing out acorn woodpeckers and leaving few leaves for next generations of moths*
   - *Scrub jays distribute acorns*

4. Students know when the environment changes, some plants and animals survive and reproduce; others die or move to new locations.

   - *Dry stream bed vs running stream – insects, slugs, etc?*

- *Seasonal variation –wet to dry to wet. Deciduous trees vs evergreen.*
- *Slugs need to seek out damp, cool spots during dry months*
- *Bird migration*

5. Students know that some kinds of organisms that once lived on Earth have completely disappeared and that some of those resembled others that are alive today.

    - *Horsetails at pond similar to giant horsetails existing eons ago*
    - *Lizards are modern relatives of dinosaurs*
    - *Birds are thought to have evolved from dinosaurs*

GRADE 4: STANDARDS 2 AND 3

II. All organisms need energy and matter to live and grow.

As a basis for under-standing this concept:

1. Students know plants are the primary source of matter and energy entering most food chains.

    - *seeds consumed by birds and deer (acorns)*
    - *roots and seeds consumed by pocket gophers*
    - *leaves consumed by caterpillars*
    - *nectar from flowers consumed by insects and hummingbirds*

2. Students know producers and consumers (herbivores, carnivores, omnivores, and decomposers) are related in food chains and food webs and may compete with each other for resources in an ecosystem.

    - *competition for nuts & berries (birds, humans, some mammals) – thimbleberries, hazelnuts*
    - *food chains*
        - *seeds, roots -> pocket gopher -> hawk*
        - *fruit -> wood-rat -> coyote*
        - *leaves -> banana slug -> raccoon*

3. Students know decomposers, including many fungi, insects, and micro-organisms, recycle matter from dead plants and animals.

    - *underside of decaying log - insects hard at work*
    - *banana slugs recycle leaf debris*
    - *fungus on logs in various locations*
    - *Suggested questions:*

- *What is happening?*
- *What is its purpose?*
- *What will it be?*

GRADE 4: STANDARDS 2 AND 3 (CONT)

III. Living organisms depend on one another and on their environment for their survival.

As a basis for understanding this concept:

1. Students know ecosystems can be characterized by their living and nonliving components.

    - *Observe differences when viewing meadow, chaparral, woodlands*
    - *Note both biotic and abiotic characteristics*

2. Students know that in any particular environment, some kinds of plants and animals survive well, some survive less well, and some cannot survive at all.

    - *Variations in plant and animal communities across the various ecosystems at Filoli*
    - *Ask what might not be seen in a hot, sunny area vs a wet, cold location.*
    - *Possible questions to ask*
        - *What do plants/animals need to survive?*
        - *What might animals/plants do to improve their chance of survival?*
        - *What is the impact of wind? (knocking down, drying up)*

3. Students know many plants depend on animals for pollination and seed dispersal, and animals depend on plants for food and shelter.

    - *Seed dispersal & pollination*
    - *burrs of Hounds Tongue plants*
    - *Paths on Douglas Iris to guide in pollinators*
    - *Food – berries, acorns, grasses (deer)*
    - *Shelter – trees (birds), branches (woodrat), downed trees (fawns), undergrowth (quail)*

4. Students know that most microorganisms do not cause disease and that many are beneficial.

    - *Soft decaying logs*
    - *Gut microbes help deer and many other herbivores digest their food*

GRADE 5: STANDARD 2

Plants and animals have structures for respiration, digestion, waste disposal, and transport of materials.

As a basis for understanding this concept:

1. Students know how sugar, water, and minerals are transported in a vascular plant.

    - *Vascular rings in a tree trunk*
    - *Refrigerator tree – cool due to water flowing through trunk*

2. Students know plants use carbon dioxide and energy from sunlight to build molecules of sugar and release oxygen.

    - *Thimbleberry has large leaf surface in shady areas to collect adequate sunlight*

3. Students know plant and animal cells break down sugar to obtain energy, a process resulting in carbon dioxide and water (respiration.)

    - *Rabbits eat grass for energy and breathe out CO_2 and moisture*
    - *Redwoods generate moisture via respiration*