Life Science Standard **LS2B**

Content Standard:

Students know that living *organisms* have the capacity to produce very large *populations*. *Population density* is the number of individuals of a particular *population* living in a given amount of space.

Performance Indicators:

Evaluate the conditions necessary for rapid *population growth* (e.g., given adequate living and nonliving resources and no disease or predators, *populations* of an *organism* increase at rapid rates).

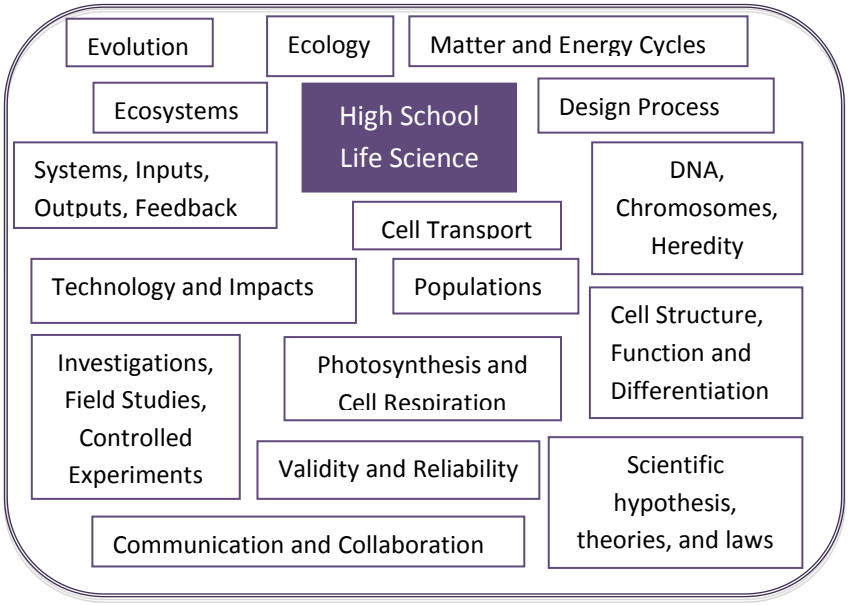
Given *ecosystem* data, calculate the *population density* of an *organism*.

Item Specifications:

Describe conditions necessary for populations to increase rapidly (e.g., adequate living and nonliving resources, no disease or predators).

Describe population density and/or the factors that affect population density.

Calculate population density given an area and the number of a given organism within the area.



Reflective Questions for Students:

How do populations and the changes in populations affect ecosystems?

When you think about the answer to this question, think about models that you could develop and diagrams that would demonstrate the systematic processes occurring. Analyze how the system can change. Make predictions based on feedback mechanisms.

Assessment Information

http://www.k12.wa.us/Science/Assessments.aspx

Quick Links for Students:

The following link takes you to a site by Annenberg called the "Habitable Planet," which reviews several keys topics that will help you better understand the factors that influence populations. There are five different interactive laboratories but the one on ecosystems is most likely of interest to you.

http://www.learner.org/courses/envsci/interactives/index.php

This next website discusses how a species can become invasive and impact populations.
http://oceanservice.noaa.gov/education/stories/lionfish/welcome.html

Teacher Center
Elements of Effective Science Instruction

Disciplinary Core Ideas

Essential teaching components leading to the big ideas:

Student acquisition of the content of science involves opportunities to meet state crosscutting and domain standards and recognize how the big ideas fit within a large conceptual framework. Learning is best achieved through sequencing learning targets into learning progressions that inform the teacher's instructional decision making.

- Students need to understand how a healthy ecosystem has various components, both living and non-living, that depend on each other and affect one another.
- Predict the changes in the population size of a species given a quantitative description of an ecosystem (e.g., predator-prey graph; J-curve of carrying capacity of ecosystem available range vs population-size graph.
- Draw a systems diagram to illustrate and explain why introduced (non-native) species often do poorly and have a tendency to die out, as well as why they sometimes do very well and force out native species.

Additional supports and extensions for understanding how students grasp the concept:

- Classroom simulation of carrying capacity and predator-prey interactions. http://frank.mtsu.edu/~gladectr/teaching/21_Limiting%20Factors%20in%20the%20Glades.pdf
- Information on global population and our planet's carrying capacity, illustrated with graphs. http://www.paulchefurka.ca/Population.html

Cross Cutting Ideas:
Designing for Learning

Strategies to reveal student understanding include:

- Paige Keeley's Formative assessment probes available through nsta.org
- Teacher's Toolkit: Misconceptions in the science classroom, Science Scope at www.nsta.org
  This article in Science Scope offers suggestions for identifying science misconceptions in general.
- Private Universe Project in Science at http://www.learner.org/resources/series29.html is a collection of videos probing misconceptions of several important science concepts and offers insight into how these misconceptions interfere with learning.
- http://www.doe.mass.edu/omste/ste/default.html: Go to the life science file on this page for extensive descriptions of common student misconceptions about concepts in biology.

Prerequisite knowledge required:

Student learning progressions can be found at:

http://www.doe.mass.edu/omste/ste/default.html Scroll down the page, click on the life science icon and go to page 39 to see learning progressions for this standard.

Scientifically oriented questions focused on clarifying and extending student understanding include:

- How do organisms within an ecosystem affect one another?
- What factors can affect ecosystems to change them?

- What happens if one component of an ecosystem changes dramatically?
- What is carrying capacity and what happens when it is exceeded?

Activities supporting opportunities for students to make claims, use evidence and communicate reasonings include:

- **SYSTEMS (EALR 1):**
  - This website is free, but you download the player. This site has thousands of different simulations. http://demonstrations.wolfram.com/PredatorPreyEcosystemARealTimeAgentBasedSimulation/
- **INQUIRY (EALR 2):**
  - This lesson also could be used as an application or to teach about systems. http://www.teachersdomain.org/resource/nat08.living.eco.humeco.lpsymstra/
- **APPLICATION (EALR 3):**
  - How well do we understand human effects on our global ecosystem? http://www.teachersdomain.org/resource/ess05.sci.ess.earthsys.globalqz/
- **LIFE SCIENCE (EALR 4):**
  - This lesson models predator/prey relationships in the classroom. http://www.biologycorner.com/worksheets/predatorsim.html

Cross Cutting Ideas: *Sense Making*	Cross Cutting Ideas: *Classroom Culture and Environment*
Planning time in the lessons to support time for students to make sense of what they are learning include: • Professional development in designing effective inquiry lessons. http://www.teachersdomain.org/resource/tdpd.sci.hlssc4/ • An eight hour professional development course on teaching in the science classroom. http://www.teachersdomain.org/resource/tdpd.sci.hls/	**Activities that show how this content standard relates to students' everyday lives include:** • http://www.populationeducation.org/ Zero Population Growth has free materials for teachers. The following URL for YouTube allows you to download the ZPG video, though it is also available through ZPG itself. • http://www.youtube.com/watch?v=4BbkQiQyaYc YouTube video published by Zero Population Growth about world population from 1A.D. to 2000.
Strategies to focus on student conversations, interactive notebook prompts, model-building include: • http://www.ncosp.wwu.edu/ North Cascades and Olympics Science Partnership has many ideas and strategies for use in your classroom. • http://nsta.org/publications/article.aspx?id=Z349URi8cV6bBbX1vjDQMEl3BOcgfN!plus!suJNn!plus!IJMjBQ= NSTA journal article (The Science Teacher) written by a high school teacher about using interactive notebooks in the science classroom.	**Activities that show how scientists think and do science in relationship to this content standards include:** • http://www.facingthefuture.org/GlobalIssuesResources/GlobalIssuesTours/Ecosystems/tabid/362/Default.aspx This site, done by World Wildlife Fund and The Nature Conservancy, is very comprehensive, showing work done worldwide with all kinds of ecosystems, with lots of illustrations and interactive maps. • http://oceanservice.noaa.gov/education/stories/oilymess/welcome.html tells the story of the Exon Valdez and its impact on the ecosystem of the Prince William Sound.