AMERICAN MUSEUM OF NATURAL HISTORY

Ecology Disrupted

Human impact demonstrates ecological principles

(We will begin shortly)

AMERICAN MUSEUM OF NATURAL HISTORY

Ecology Disrupted

Human impact demonstrates ecological principles

AMERICAN MUSEUM OF NATURAL HISTORY

Who we are:

Yael Wyner, City College of New York

Janice Koch, Hofstra University

Steve Gano, American Museum of Natural History

Who this is for:

- For use with 7th- 12th graders
- Supplementary - Units vary in length (7 lesson max)
- In full or in part
  - 12th graders may just use the data
  - May use components for specific goals – like inbreeding

What is Ecology Disrupted?

- An instructional approach for linking ecological function to daily life and human environmental impact
  - Scope and Sequence Guidelines, & Textbooks often separate ecology and human impact into two units
  - Can use human impact to understand ecological function

What is Ecology Disrupted?

- An instructional approach for linking ecological function to daily life and human environmental impact

Daily Life → Environmental Issue

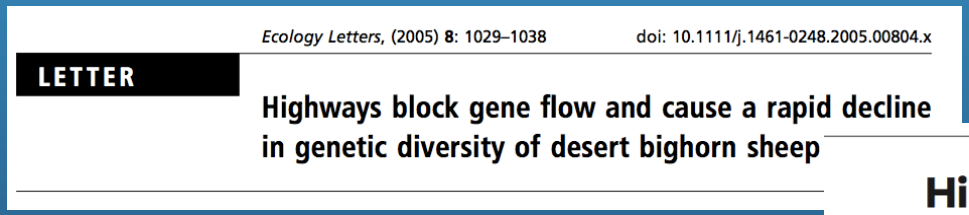
Example: Highways Block Bighorn Sheep

Daily Life → Ecological Function → Environmental Issue

Building highways to make travel fast can disrupt bighorn sheep habitat by making barriers that prevent sheep from from different populations from breeding with one another.

What is Ecology Disrupted?

- An instructional approach for linking ecological function to daily life and human environmental impact
- Each topic is based upon PUBLISHED DATA. Real data collected by scientists



Ecology Letters, (2005) **8**: 1029–1038 doi: 10.1111/j.1461-0248.2005.00804.x

LETTER

Highways block gene flow and cause a rapid decline in genetic diversity of desert bighorn sheep

Increased salinization of fresh water in the northeastern United States

Sujay S. Kaushal*†‡, Peter M. Groffman*, Gene E. Likens*‡, Kenneth T. Belt§, William P. Stack¶, Victoria R. Kelly*, Lawrence E. Band‖, and Gary T. Fisher**

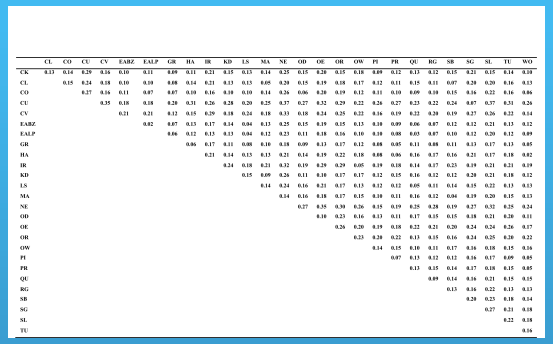
ECOLOGY THROUGH TIME

REVIEW

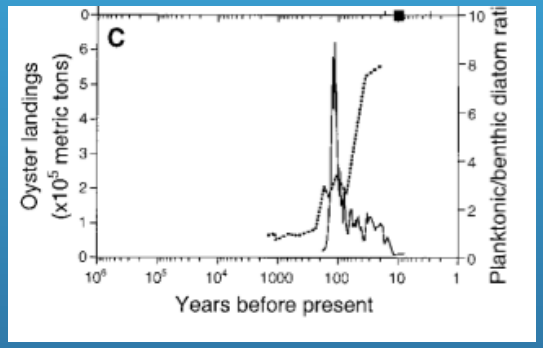
Historical Overfishing and the Recent Collapse of Coastal Ecosystems

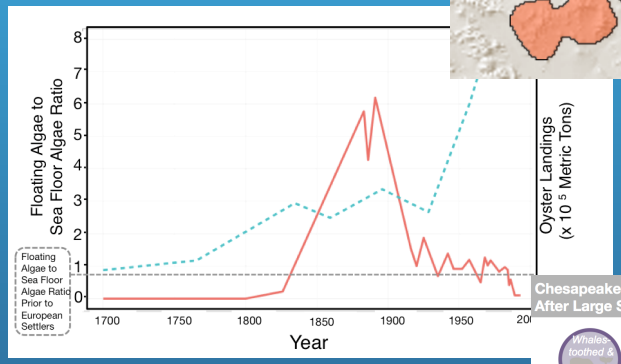
Jeremy B. C. Jackson,[1,2*] Michael X. Kirby,[3] Wolfgang H. Berger,[1] Karen A. Bjorndal,[4] Louis W. Botsford,[5]

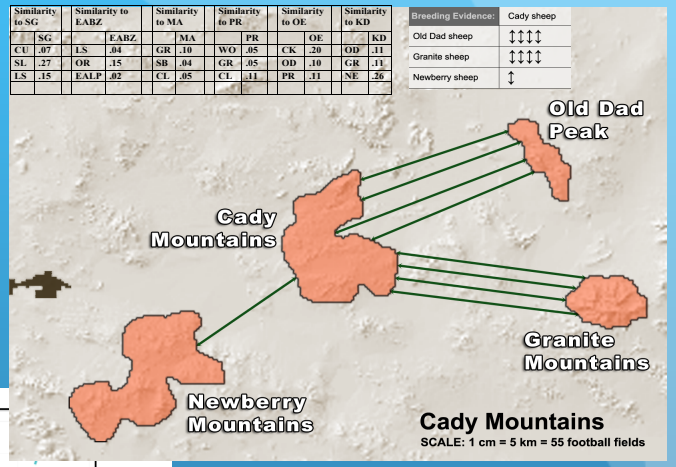
Published Scientific Data



	CL	CO	CU	CV	EABZ	EALP	GR	HA	IR	KD	LS	MA	NE	OD	OE	OR	OW	PI	PR	QU	RG	SB	SG	SL	TU	WO
CK	0.33	0.14	0.29	0.16	0.10	0.11	0.09	0.11	0.21	0.15	0.13	0.14	0.25	0.15	0.20	0.15	0.18	0.09	0.12	0.13	0.12	0.15	0.21	0.15	0.14	0.10
CL		0.15	0.24	0.18	0.10	0.10	0.08	0.14	0.21	0.13	0.13	0.05	0.20	0.15	0.19	0.18	0.17	0.12	0.11	0.15	0.11	0.07	0.20	0.20	0.16	0.13
CO			0.27	0.16	0.11	0.07	0.10	0.16	0.10	0.10	0.10	0.14	0.26	0.06	0.20	0.19	0.12	0.11	0.10	0.09	0.10	0.15	0.16	0.22	0.16	0.06
CU				0.35	0.18	0.18	0.20	0.31	0.26	0.28	0.29	0.25	0.37	0.27	0.32	0.29	0.22	0.26	0.27	0.23	0.22	0.24	0.07	0.37	0.31	0.26
CV				0.21	0.21	0.12	0.15	0.29	0.18	0.24	0.18	0.33	0.18	0.24	0.25	0.22	0.16	0.19	0.22	0.20	0.19	0.27	0.26	0.22	0.14	
EABZ					0.82	0.07	0.13	0.17	0.14	0.04	0.13	0.25	0.15	0.19	0.15	0.13	0.10	0.09	0.06	0.07	0.12	0.12	0.21	0.13	0.12	
EALP						0.06	0.12	0.13	0.13	0.04	0.12	0.23	0.11	0.18	0.16	0.10	0.10	0.08	0.03	0.07	0.10	0.12	0.20	0.12	0.09	
GR							0.06	0.17	0.11	0.08	0.10	0.18	0.09	0.13	0.17	0.12	0.08	0.05	0.11	0.08	0.11	0.13	0.17	0.13	0.05	
HA								0.21	0.14	0.13	0.13	0.21	0.14	0.19	0.22	0.18	0.08	0.06	0.16	0.17	0.16	0.21	0.17	0.18	0.02	
IR									0.24	0.18	0.21	0.32	0.19	0.29	0.29	0.05	0.19	0.18	0.14	0.17	0.23	0.19	0.21	0.21	0.19	
KD										0.15	0.09	0.26	0.11	0.10	0.17	0.17	0.12	0.15	0.16	0.12	0.12	0.28	0.21	0.18	0.12	
LS											0.14	0.24	0.16	0.21	0.17	0.13	0.12	0.12	0.05	0.11	0.14	0.15	0.22	0.13	0.13	
MA												0.14	0.16	0.18	0.17	0.15	0.10	0.11	0.16	0.12	0.04	0.19	0.20	0.15	0.13	
NE													0.27	0.35	0.30	0.26	0.15	0.19	0.25	0.28	0.19	0.27	0.32	0.25	0.24	
OD														0.10	0.23	0.16	0.13	0.11	0.17	0.15	0.15	0.18	0.21	0.20	0.11	
OE															0.26	0.20	0.19	0.18	0.22	0.21	0.20	0.24	0.24	0.26	0.17	
OR																0.23	0.20	0.22	0.13	0.15	0.16	0.24	0.25	0.20	0.22	
OW																	0.14	0.15	0.10	0.11	0.17	0.16	0.18	0.15	0.16	
PI																		0.07	0.13	0.12	0.12	0.16	0.17	0.09	0.05	
PR																			0.13	0.15	0.14	0.17	0.18	0.15	0.05	
QU																				0.09	0.14	0.16	0.21	0.15	0.15	
RG																					0.13	0.16	0.22	0.13	0.13	
SB																						0.29	0.23	0.18	0.14	
SG																							0.27	0.21	0.18	
SL																								0.22	0.18	
TU																									0.16	

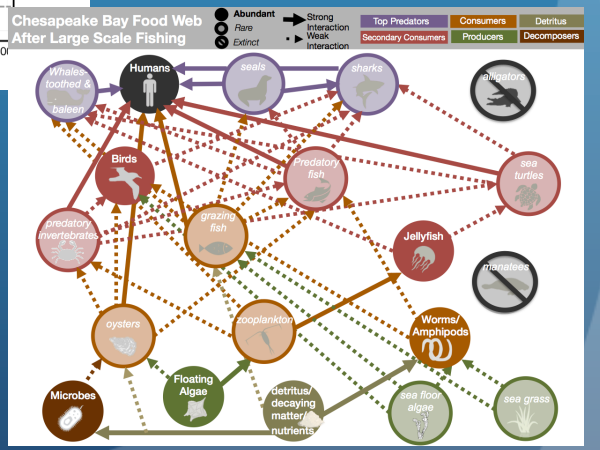


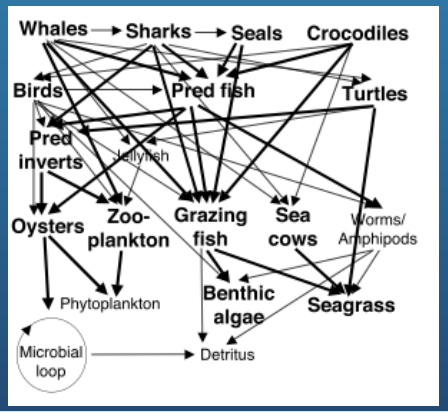




Similarity to SG		Similarity to EABZ		Similarity to MA		Similarity to PR		Similarity to OE		Similarity to KD	
	SG		EABZ		MA		PR		OE		KD
CU	.07	LS	.04	GR	.10	WO	.05	CK	.20	OD	.11
SL	.27	OR	.15	SB	.04	GR	.05	OD	.10	GR	.11
LS	.15	EALP	.02	CL	.05	CL	.11	PR	.11	NE	.26

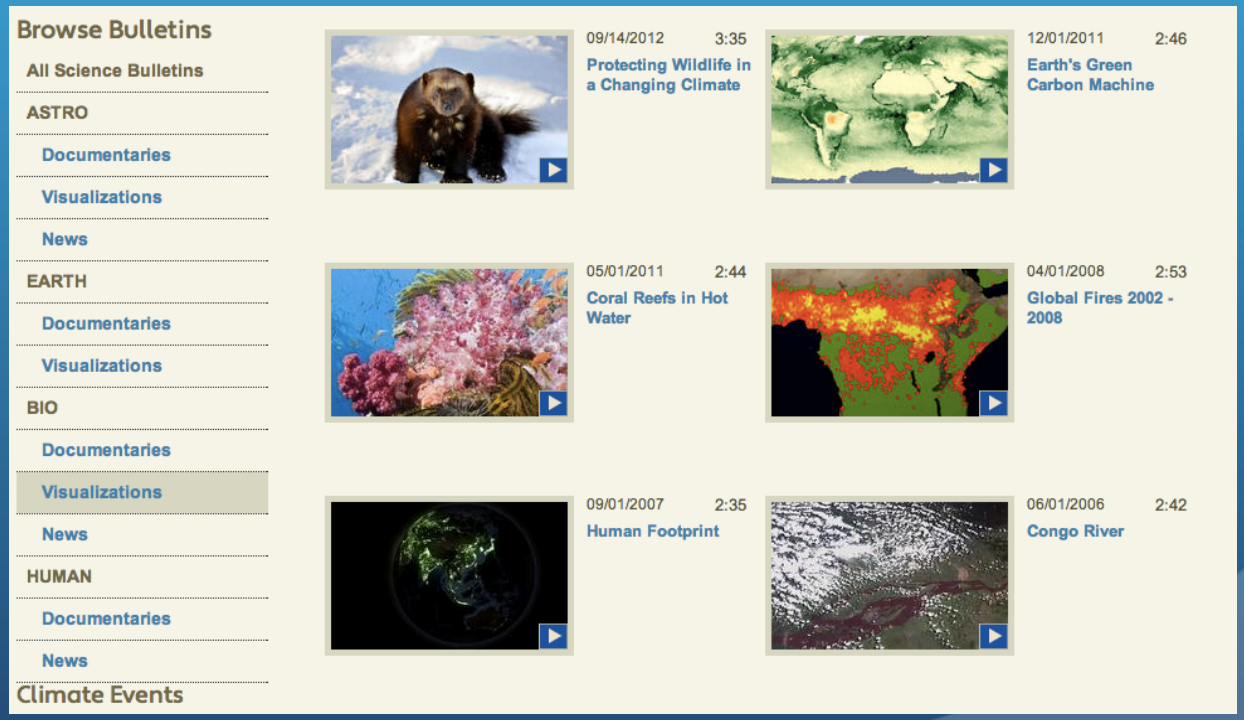
Breeding Evidence:	Cady sheep
Old Dad sheep	↕↕↕↕
Granite sheep	↕↕↕↕
Newberry sheep	↕





What is Ecology Disrupted?

- An instructional approach for linking ecological function to daily life and human environmental impact
- Each topic is based upon PUBLISHED DATA. Real data collected by scientists
- Includes media from American Museum of Natural History



Major Overarching Learning Goals

- Learning of the relationship of human impact and daily life to ecological function
- The role of data in making scientific conclusions

Common Core Standards

- Evidence - make reasoned judgments based on research
- Determine central ideas and summarize
- Follow multi-step procedure
- Integrate quantitative information in both words and diagrams
- Compare and contrast information gained from experiments with video, multi-media or text

Common Core Continued

- Cite specific textual evidence to support analysis of science and technical texts (CCSS.ELA-Literacy.RST.6-8.1)
- Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions (CCSS.ELA-Literacy.RST.6-8.2)
- Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
- Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table) (CCSS.ELA-Literacy.RST.6-8.7)
- Distinguish among facts, reasoned judgment based on research findings, and speculation in a text (CCSS.ELA-Literacy.RST.6-8.8)
- Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic (CCSS.ELA-Literacy.RST.6-8.9)

National Science Education Standards

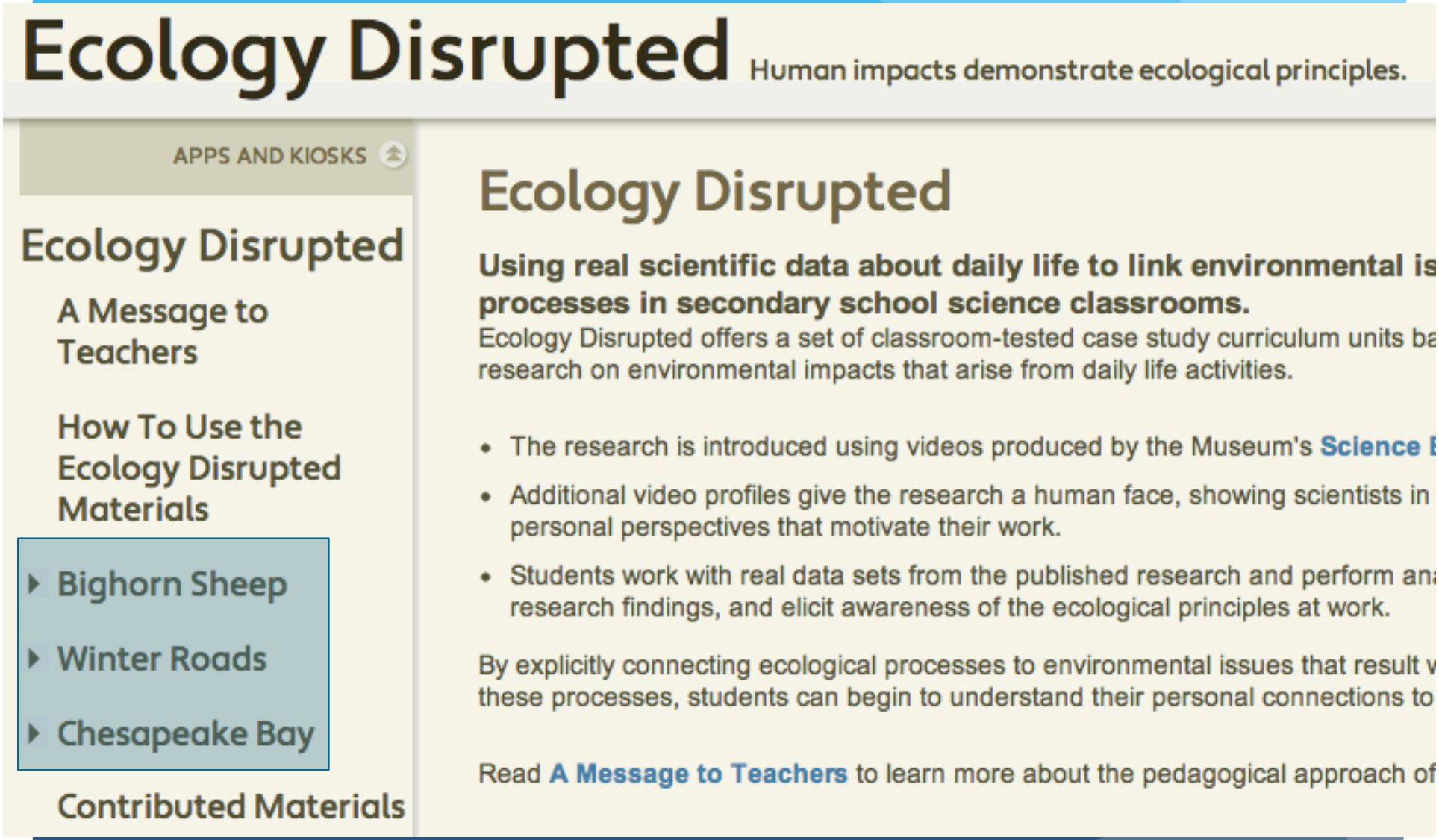
- **Science as Inquiry, Content Standard A -** abilities necessary to do inquiry
- **Life Science, Content Standard C**
  - Populations and Ecosystems
  - The Interdependence of Organisms
  - Reproduction and Heredity
- **Science in Personal and Social Perspectives, Content Standard F**
  - Populations, Resources and Environments
  - Environmental Quality
  - Natural Hazards and Human Induced Hazards

Next Generation Science Standards

- Practice of Science
  - Analyzing and interpreting data
  - Constructing explanations
  - Engaging in argument from evidence
- Crosscutting Concepts
  - Cause and effect
  - Systems and system models
  - Energy and matter: Flows, cycles, and conservation
  - Stability and change
- Disciplinary Core Ideas
  - Ecology
  - Human Impact
  - Genetic Diversity

Ecology Disrupted

Human impacts demonstrate ecological principles.



Bighorn Sheep

APPS AND KIOSKS

Ecology Disrupted

- A Message to Teachers
- How To Use the Ecology Disrupted Materials
- Bighorn Sheep
  - Learning Goals and Standards
  - Lesson Plans
  - Assessments
- Winter Roads

Learning Goals and Standards

Working through the "Bighorn Sheep" unit, students will develop a deeper understanding of the following big ideas:

1. Ecological and Biological Concepts in the Context of Human Impact

- Habitat
  - Habitat is the full area and physical environment where an organism lives.
  - Habitat fragmentation, when an ecosystem is broken into pieces, can threaten the survival of some species.

Bighorn Sheep Overarching Goals

- How people impact
  - Habitat
  - Populations
- Sustainable strategies for minimizing habitat impact
- Inbreeding
- Data analysis
  - Making claims based on evidence
  - Measurement
  - Genetic Diversity – F_{ST} Values
- Science as a human endeavor

- Bighorn Sheep
  - Learning Goals and Standards
  - Lesson Plans
    - Setting the Stage: The Scientific Process in Action
    - Exploring the Role of Isolated Populations in Inbreeding
    - How Do You Investigate and Represent Data?
    - Representing and Making Meaning from Data
    - Ecology Disrupted
  - Assessments

- Lesson Plans
  - Setting the Stage: The Scientific Process in Action
    - Highways Block Bighorn Sheep
    - Meet the Bighorn Sheep
    - Highways Impact
    - Boundaries and Isolation
    - Isolation and Mate Choice
    - Scientist Profile: Dr. Clinton Epps
    - How can DNA be used to determine if populations are isolated from one another?

Setting the Stage: The Scientific Process in Action

LEARNING GOALS
What We Are Hoping For: Learning Goals

DOWNLOADS

Download the files below to use offline,
or to incorporate into your own lesson
planning tools.

Setting the Stage lesson plan

PDF

Text

DOC

Setting the Stage investigation booklet

PDF

Slideshow Function

Orientation to:

- Region
- Bighorn Sheep
- Maps
- Map key
- Role of highways in Vegas economy
- Essential question “How might being able to drive between LA and Las Vegas in just four hours impact bighorn sheep?”

Setting the Stage

- Lesson Plans
  - Setting the Stage: The Scientific Process in Action
    - Highways Block Bighorn Sheep
    - Meet the Bighorn Sheep
    - Highways Impact
    - Boundaries and Isolation
    - Isolation and Mate Choice
    - Scientist Profile: Dr. Clinton Epps
    - How can DNA be used to determine if populations are isolated from one another?

Full Profile (6:27)

2 Videos

Full Profile (6:27)

Excerpt (0:57)

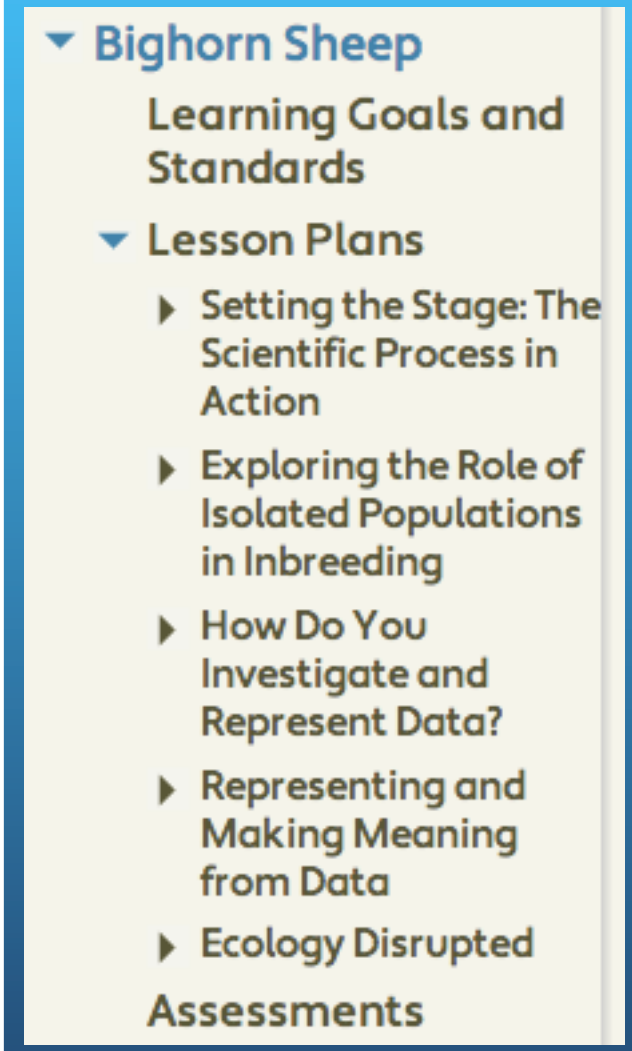
8. Complete an activity that models how DNA can be used to detect isolated bighorn sheep populations. (5 minutes)

CLASSROOM ACTIVITY

How can DNA be used to determine if populations are isolated from one another?

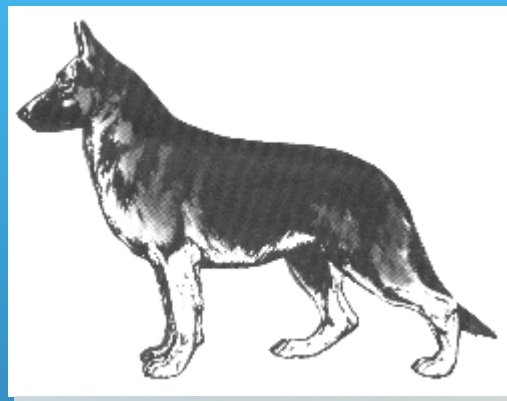
Use popsicle sticks, M&Ms or other colored tokens to demonstrate how DNA can be used to determine whether populations are isolated from one another.

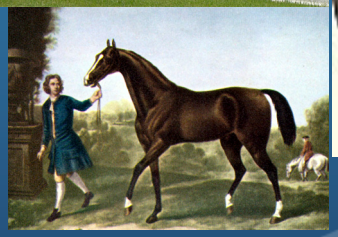
Exploring the Role of Isolated Populations in Inbreeding



Exploring the Role of Isolated Populations in Inbreeding

- Dogs
- Thoroughbred horses
- Florida Panther
- Maple syrup urine disease in Amish
- Habsburg Royal Family





Examples of Inbreeding in Wild and Domestic Animals			
	Domestic Dogs	Florida Panthers	Thoroughbred Horses
Why has inbreeding occurred?			
Describe the related health problems			

- Bighorn Sheep
  - Learning Goals and Standards
  - Lesson Plans
    - Setting the Stage: The Scientific Process in Action
    - Exploring the Role of Isolated Populations in Inbreeding
    - How Do You Investigate and Represent Data?
    - Representing and Making Meaning from Data
    - Ecology Disrupted
  - Assessments

- How Do You Investigate and Represent Data?
  - DNA from Droppings
  - Introducing the DNA Datasets
  - Analyzing the DNA Datasets
  - Instructions on How to Analyze the DNA Datasets
  - Extension: Genetic Distance Values

How Do You Investigate and Represent Data?

DOWNLOADS

Download the files below to use offline, or to incorporate into your own lesson planning tools.

How Do You Investigate and Represent Data? lesson plan

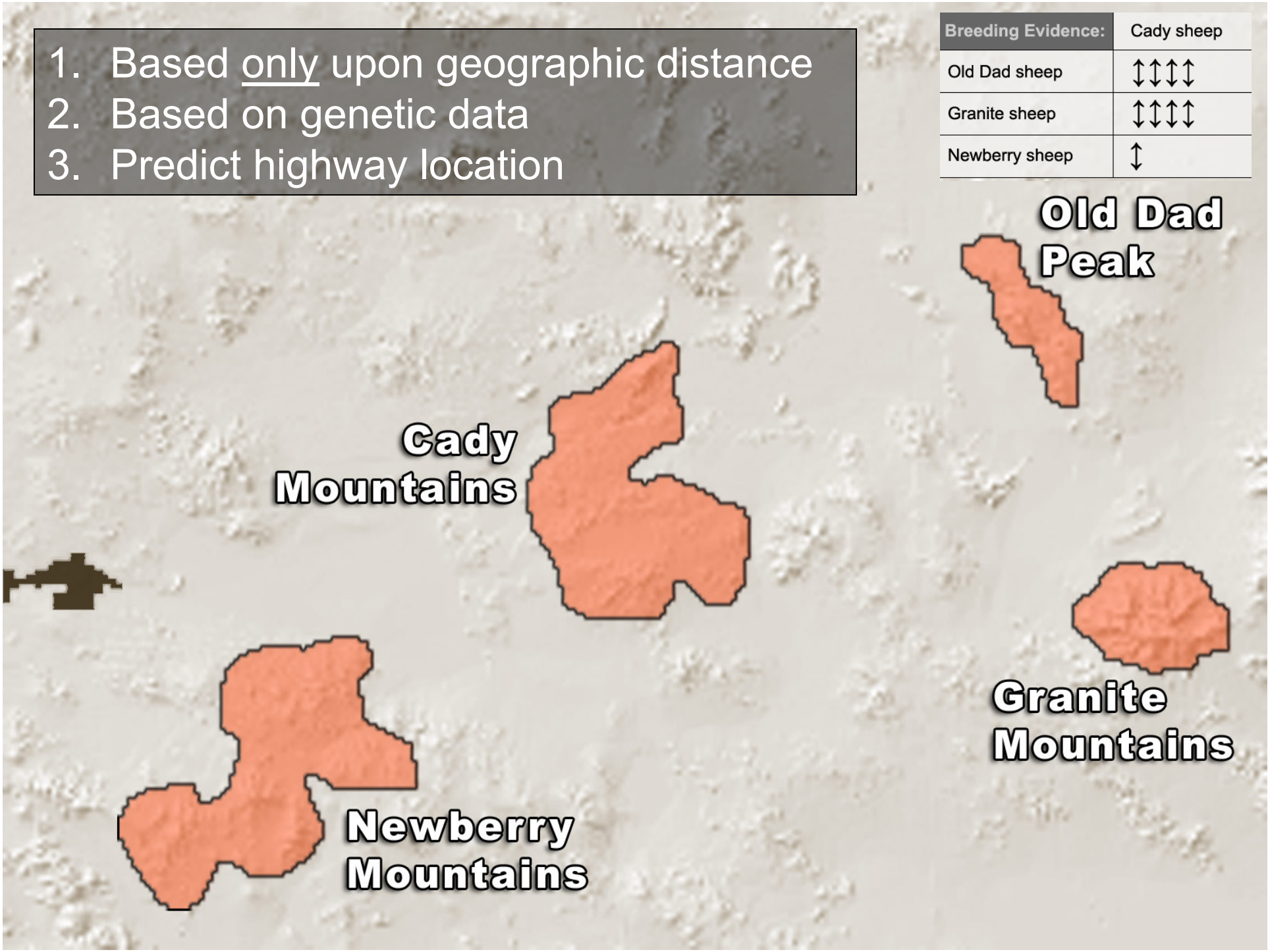
PDF
Text
DOC

How Do You Investigate and Represent Data? investigation booklet


How would a highway running through two sheep populations affect their mating habits?
LAS VEGAS
Clark
Indian Spring
Piute Range
Wood
Old Dad
Hackberry
Cady
Providence
Granite
Clipper
Newberry
Marble
South Bristol
Cushenbury
San Gabriel
San Gorgonio
LOS ANGELES
Little San Bernardino
Eagle–Lost Plains
Eagle–Buzzard Spring
Orocopeia
KEY
BIGHORN SHEEP POPULATIONS
URBAN AREAS
ROADS

1. Based only upon geographic distance
2. Based on genetic data
3. Predict highway location

Breeding Evidence:	Cady sheep
Old Dad sheep	↕↕↕↕
Granite sheep	↕↕↕↕
Newberry sheep	↕



1. Based only upon geographic distance
2. Based on genetic data
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Breeding Evidence:	Cady sheep
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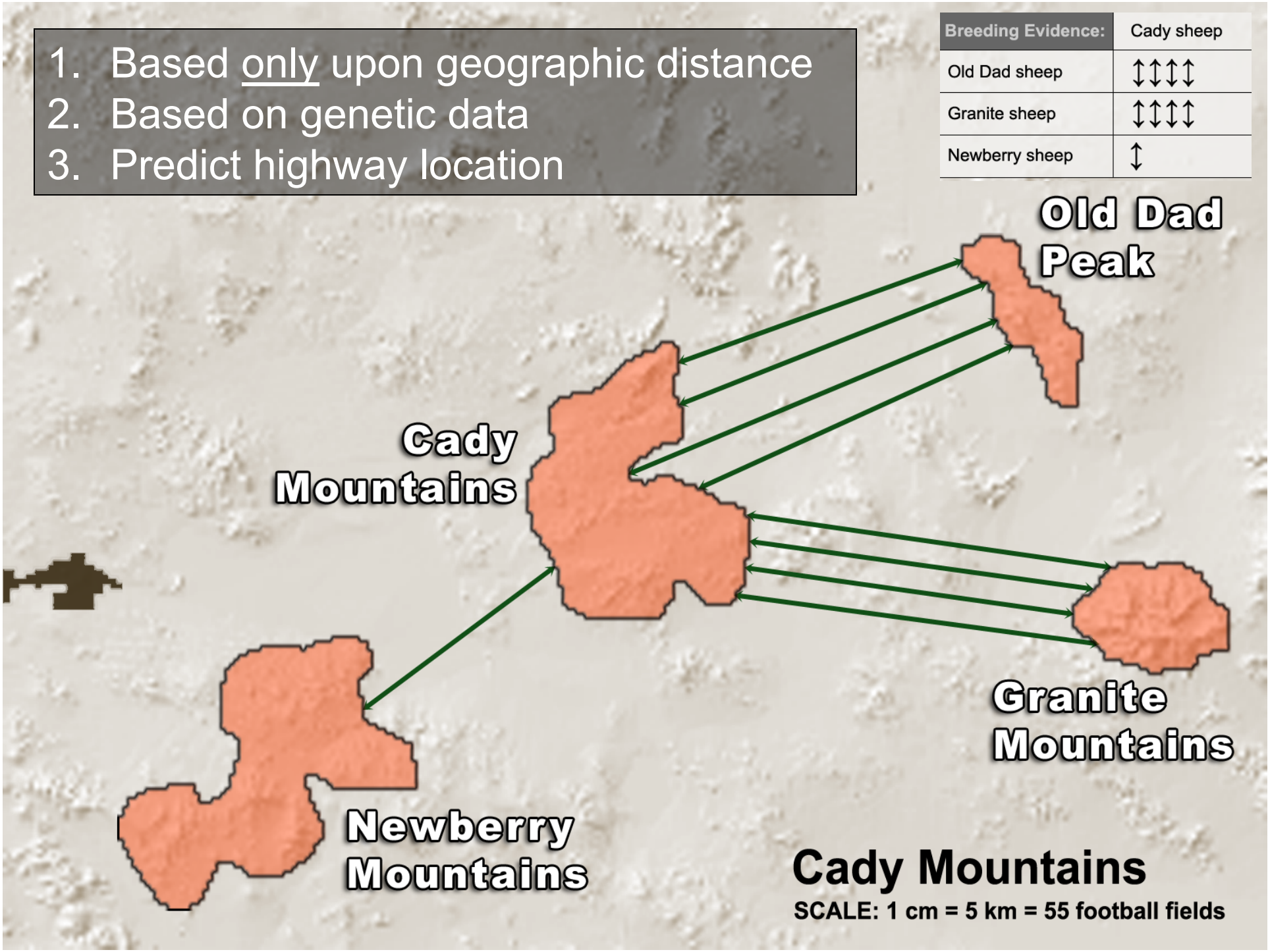
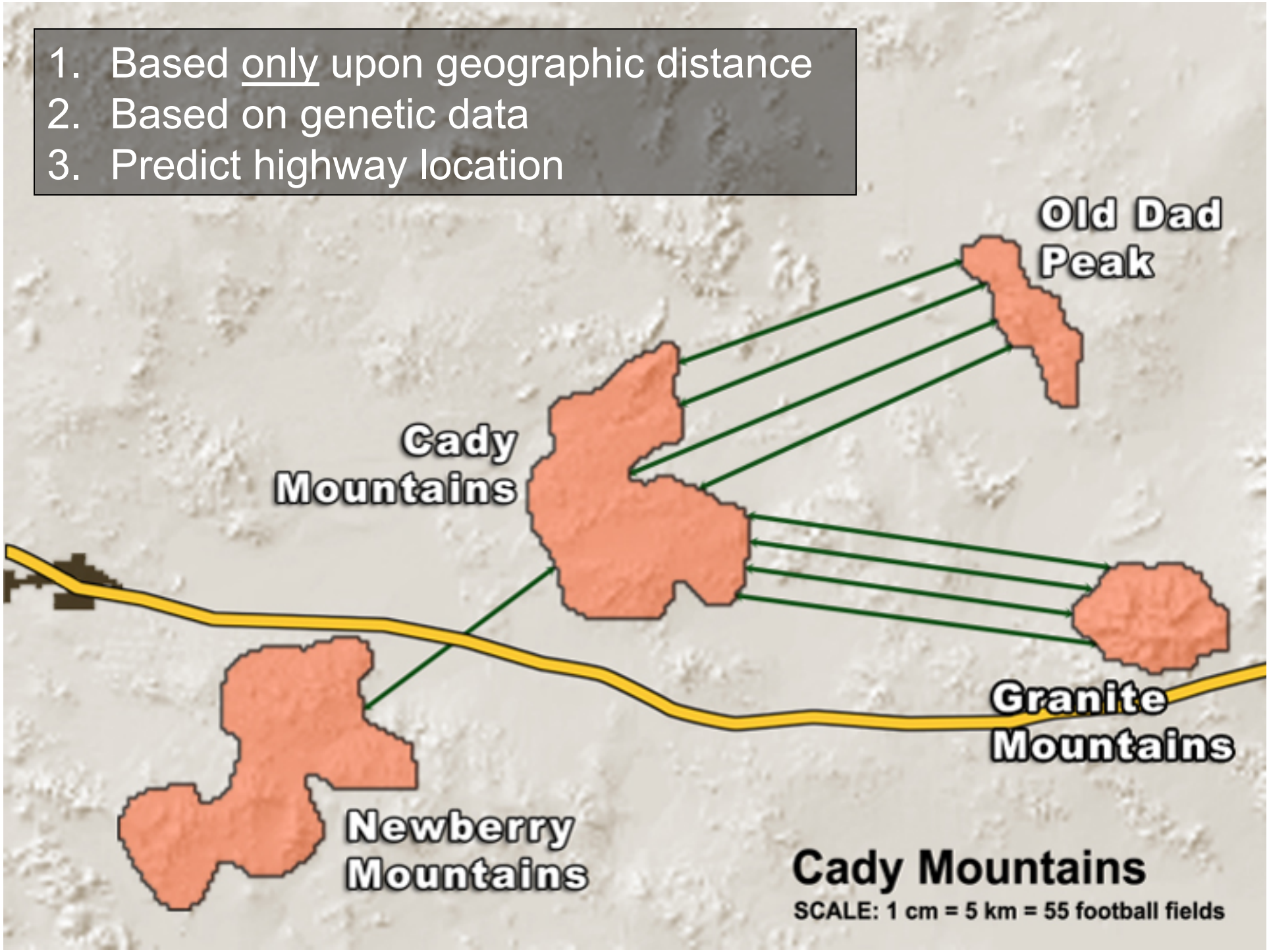
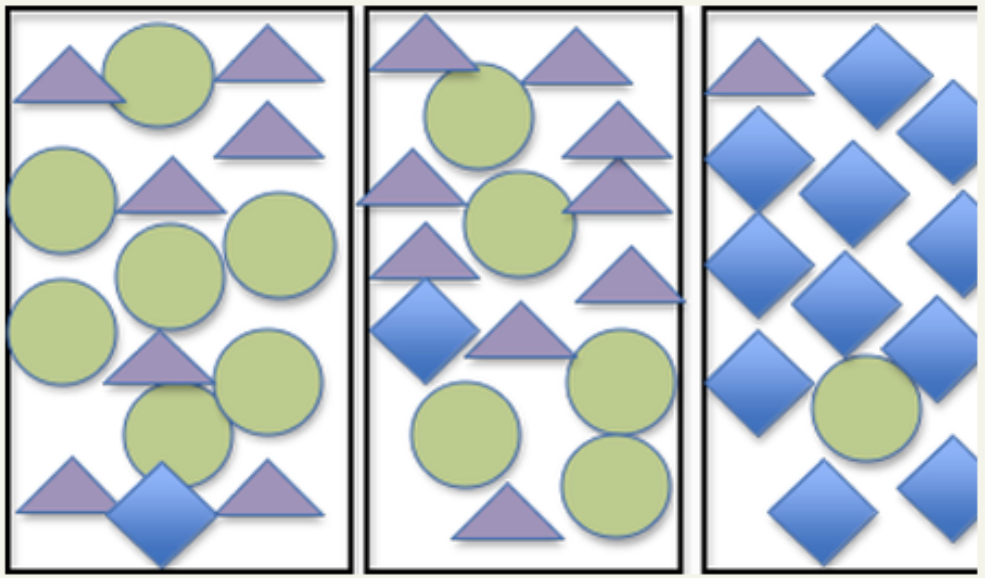



1. Based only upon geographic distance
2. Based on genetic data
3. Predict highway location
Old Dad Peak
Cady Mountains
Granite Mountains
Newberry Mountains
Cady Mountains
SCALE: 1 cm = 5 km = 55 football fields

How do you investigate and represent data?

- How Do You Investigate and Represent Data?
  - DNA from Droppings
  - Introducing the DNA Datasets
  - Analyzing the DNA Datasets
  - Instructions on How to Analyze the DNA Datasets
  - Extension: Genetic Distance Values

Extension: Genetic Distance Values

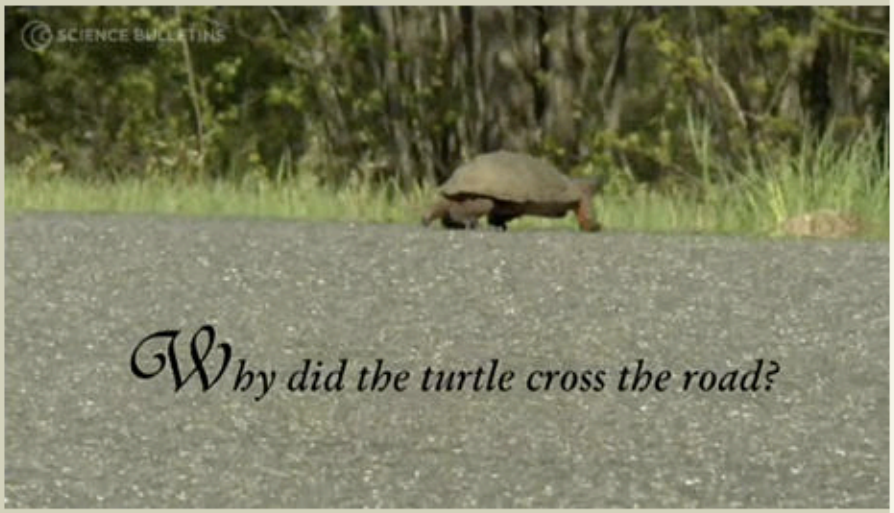


- Bighorn Sheep
  - Learning Goals and Standards
  - Lesson Plans
    - Setting the Stage: The Scientific Process in Action
    - Exploring the Role of Isolated Populations in Inbreeding
    - How Do You Investigate and Represent Data?
    - Representing and Making Meaning from Data
    - Ecology Disrupted
  - Assessments

- Representing and Making Meaning from Data
  - Representing the Data on a Map
  - Using Data to Make Claims

- Ecology Disrupted
  - Populations Live in Habitats
  - Highways Block Bighorn Sheep Graphic Organizer
  - Science Bulletin: Roads Influence Animal Genes
  - Science Bulletin: New Blood Gives New Life to Florida Panthers
  - Science Bulletin: Loggers Imperil Monarch Butterflies
  - Science Bulletin: Oil Spill's Other Victims
  - Science Bulletin: Plastic Trash Threatens Remote Seabirds
  - Science Bulletin: Species and Sprawl: A Road Runs Through It
  - Bringing the Stories Together

Ecology Disrupted: Changes to Habitats Can Unexpectedly Disrupt Populations



DOWNLOADS

Download the files below to use offline, or to incorporate into your own lesson planning tools.

Ecology Disrupted: Changes to Habitats lesson plan

PDF

Text

DOC

Investigation Booklet: Bighorn Sheep: Lessons 5 and 6: Ecology Disrupted:
Complete the tables below:

Questions	Bighorn Sheep	Monarch Butterflies
1. How have people **changed** the **habitat** in this example?		
2. **Why** do people **change** the **habitat**? How does it help us?	.	
3. How do the habitat changes **impact populations** in this area?		
4. How do you know that the habitat is being changed and that local populations are affected? Describe the **evidence** or **data**.		
5. Suggest how to **solve** this problem.		

3. Watch other *Science Bulletins* and complete the graphic organizers for each. (50 min)

Students watch additional Science Bulletins videos to learn about how human daily life can affect ecological function, and to pull out the ecological principles.

SCIENCE BULLETINS

Science Bulletin: Roads Influence Animal Genes

Roads connect people, but they separate animals.

SCIENCE BULLETINS

Science Bulletin: New Blood Gives New Life to Florida Panthers

Endangered Florida panthers benefited from the introduction of Texan pumas in their ranks.

SCIENCE BULLETINS

Science Bulletin: Loggers Imperil Monarch Butterflies

Satellites show severe deforestation in a rare monarch butterfly overwintering site.

SCIENCE BULLETINS

Science Bulletin: Oil Spill's Other Victims

Beyond oil-coated pelicans, the spill imperils many lesser-known species.

SCIENCE BULLETINS

Science Bulletin: Plastic Trash Threatens Remote Seabirds

Even isolated colonies of Pacific albatrosses can eat a stomach-full of plastic trash.

SCIENCE BULLETINS

Science Bulletin: Species and Sprawl: A Road Runs Through It

As the suburbs flourish, animals struggle to survive.

Science Bulletin: Species and Sprawl: A Road Runs Through It

ONLINE MEDIA

- **Science Bulletin: Species and Sprawl: A Road Runs Through It video**

TEACHER'S GUIDE

Recall the Ecology Disrupted curriculum learning goals:

1. Human daily life can disrupt ecological function leading to environmental issues.
2. Scientists can collect data to investigate human impact local ecology.

Students watch additional Science Bulletins videos to learn about how human daily life can affect ecological function, and to pull out the ecological principles. An introduction to the video and background information are provided below.

DOWNLOADS

Download the files below to use offline, or to incorporate into your own lesson planning tools.

Science Bulletin:
Species and Sprawl:
A Road Runs Through It
HD Video
SD Video (iPod)

Species and Sprawl:
A Road Runs Through It
teacher's guide

PDF

Text

DOC

Species and Sprawl:
A Road Runs Through It
graphic organizer

PDF

Text

DOC


Bighorn Sheep
Learning Goals and Standards
Lesson Plans
Setting the Stage: The Scientific Process in Action
Exploring the Role of Isolated Populations in Inbreeding
How Do You Investigate and Represent Data?
Representing and Making Meaning from Data
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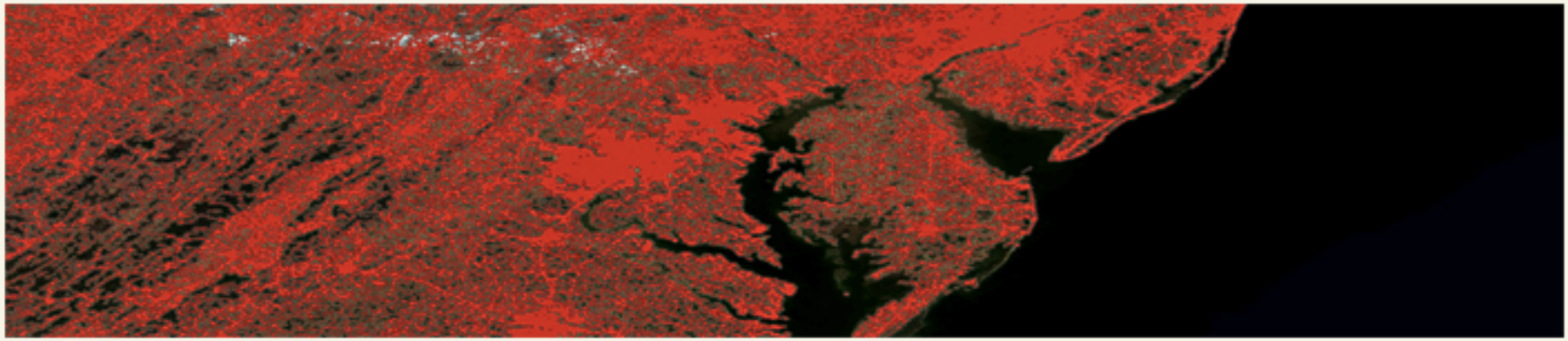
Assessments
Bighorn Sheep
Winter Roads
Chesapeake Bay
Winter Roads
Learning Goals and Standards
Lesson Plans
Assessments
Media

Learning Goals and Standards



Working through the "Winter Roads" unit, students will develop a deeper understanding of the following big ideas:

1. Ecological and Biological Concepts in the Context of Human Impact

- Abiotic and Biotic Factors
  - An ecosystem is comprised of non-living (abiotic) and living (biotic) components.
  - Changing abiotic factors of an ecosystem affects the living organisms (biotic factors) in the ecosystem.
- Water is essential to life
  - Organisms need a clean water supply.
  - Changing abiotic characteristics can make water inhospitable to life.
  - Drinking water supplies are often located far from the cities that use them.
- Runoff
  - Water circulates through natural and human-made environments.
  - Water picks up man-made and natural materials as it moves across surfaces.

Winter Roads
Overarching Goals

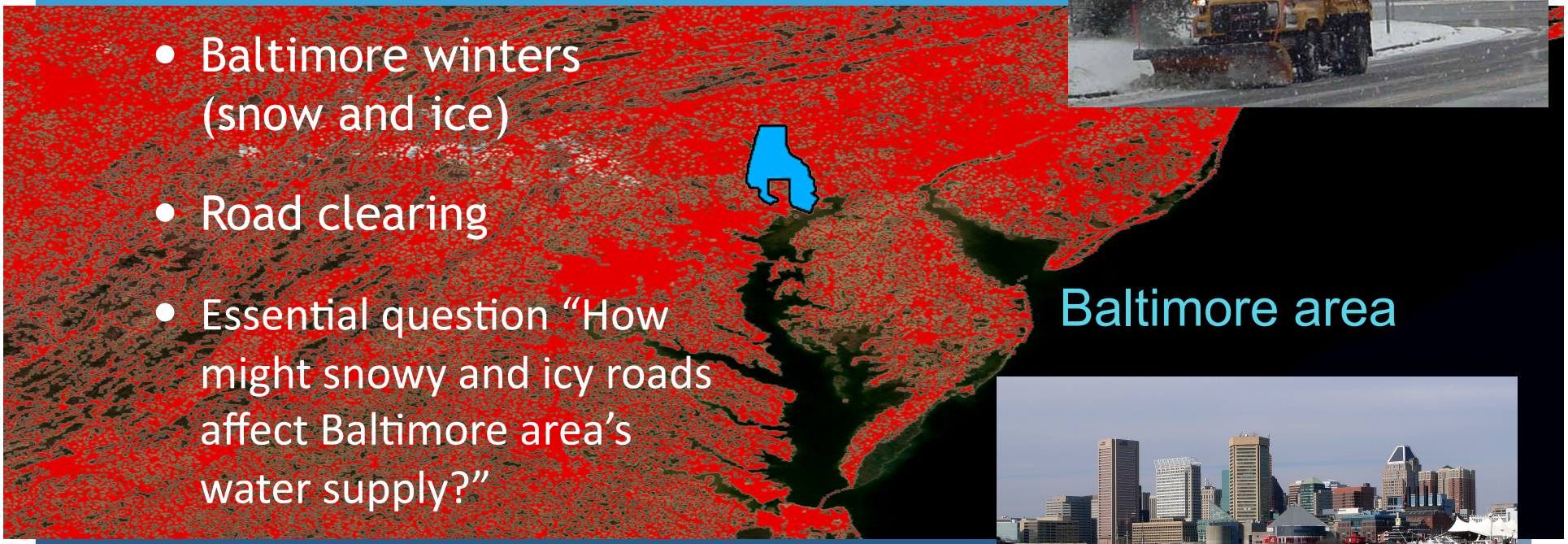
- How people impact
  - Abiotic Factors/Biotic Factors
  - Runoff
- Sustainable strategies for minimizing changing abiotic factors
- Water is essential to life
- Data analysis
  - Making claims based on evidence
  - Graphing
    - The importance of scale
    - The importance of graphs for comparing data
  - Science is a human endeavor


Winter Roads
Learning Goals and Standards
Lesson Plans
Setting the Stage
Salt in Our Lives
Water in Our Lives
How Do You Investigate and Represent Data?
Representing and Making Meaning from Data
Ecology Disrupted
Assessments
Media
Lesson Plans
Setting the Stage
Accessing Prior Knowledge
Winter Roads Make Salty Streams
Baltimore Winters
Scientist Profile: Dr. Sujay Kaushal
How Can We Test?

Baltimore Winters Function

Orientation to:

- Baltimore area
- Baltimore winters (snow and ice)
- Road clearing
- Essential question "How might snowy and icy roads affect Baltimore area's water supply?"



Baltimore area


Lesson Plans
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Accessing Prior Knowledge
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Salt in Our Lives
Salt and Tomato Plants
Salt and Plant Cells
Salt and Ecosystems
Salt Level Demonstration
Dose Makes the Difference

Tomato plant w/o salt

Tomato plant w/ salt

The Effect of Salt on Plant Cells

TEACHER'S GUIDE
Salting an eggplant demonstrates the effect of salt on plant cells.

DOWNLOADS

Salt and Plant Cells teacher's guide

PDF

Text

DOC

Osmosis Demonstration worksheet

PDF

Text

DOC

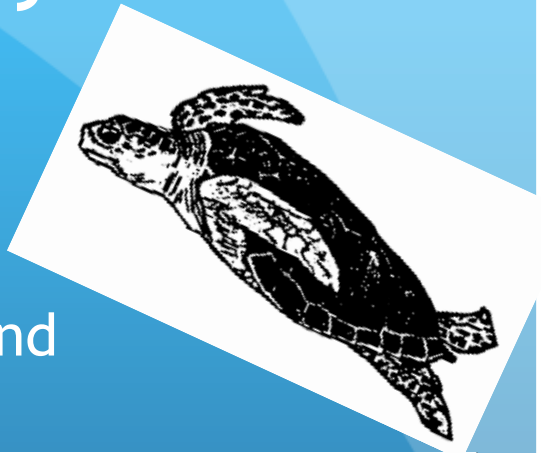
Answer Key (PDF)

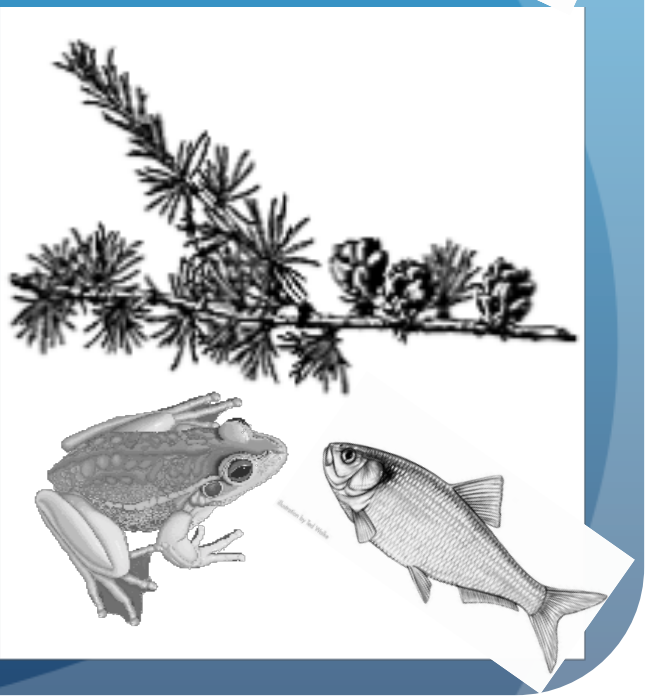
Salting the eggplant

- Salt in Our Lives
  - Salt and Tomato Plants
  - Salt and Plant Cells
  - Salt and Ecosystems
  - Salt Level Demonstration
  - Dose Makes the Difference

Salt and Ecosystems

- Forest
- Freshwater
- Wetlands (Marsh and Swamp)
- Estuary
- Ocean





A SALT CONCENTRATION GUIDE in mg/L:

67.5	Harms forest pine trees
100	Maximum allowed in NYC drinking water
226	Kills tiny freshwater plants and animals
250	Tastes salty. Maximum allowed in drinking water by the Environmental Protection Agency
400	Will kill some freshwater frogs
1,000	Will kill some freshwater fish like trout. Considered to be brackish or salty water
3,000	Lowest salt level found in the New York/New Jersey estuary
30,000	Highest level in the New York/New Jersey estuary
32,000	Average in ocean off of Long Island and New Jersey

- Winter Roads
  - Learning Goals and Standards
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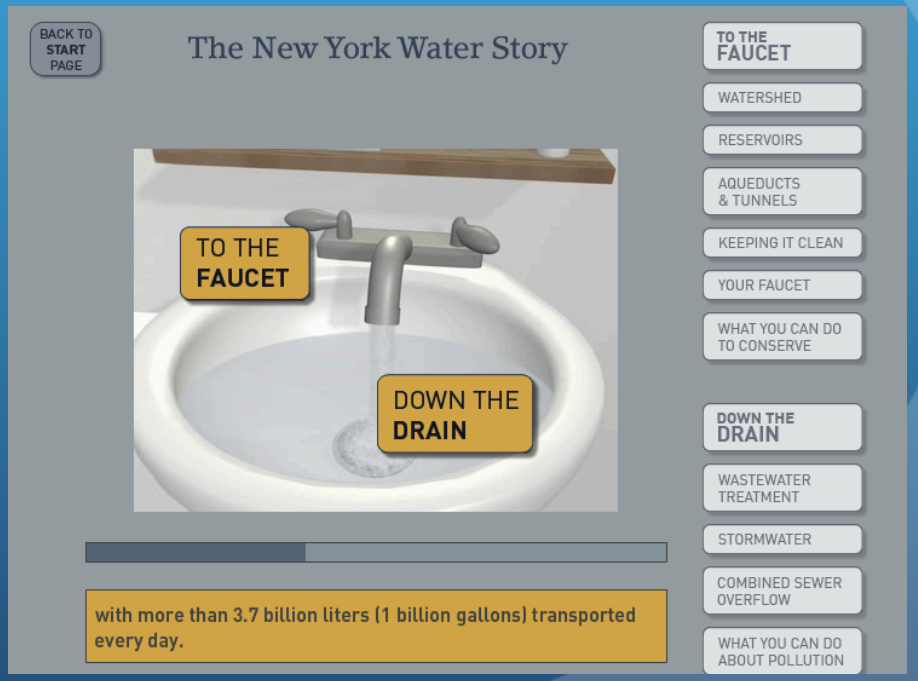
    - Salt in Our Lives
    - Water in Our Lives
    - How Do You Investigate and Represent Data?
    - Representing and Making Meaning from Data
    - Ecology Disrupted
  - Assessments
  - Media

- Water in Our Lives
  - Where Water Comes From
  - How Water Moves
  - Water Tale of Two Cities



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- How Do You Investigate and Represent Data?
  - Land Affects Water
    - Where to Collect Data
    - How to Represent Data
    - Setting Up Graphs

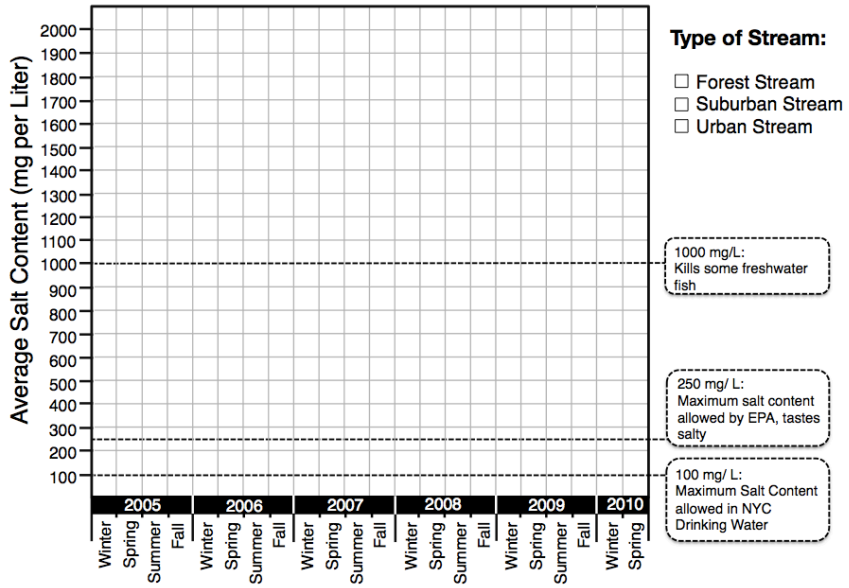
Annual Average Salt Levels in Baltimore County Streams

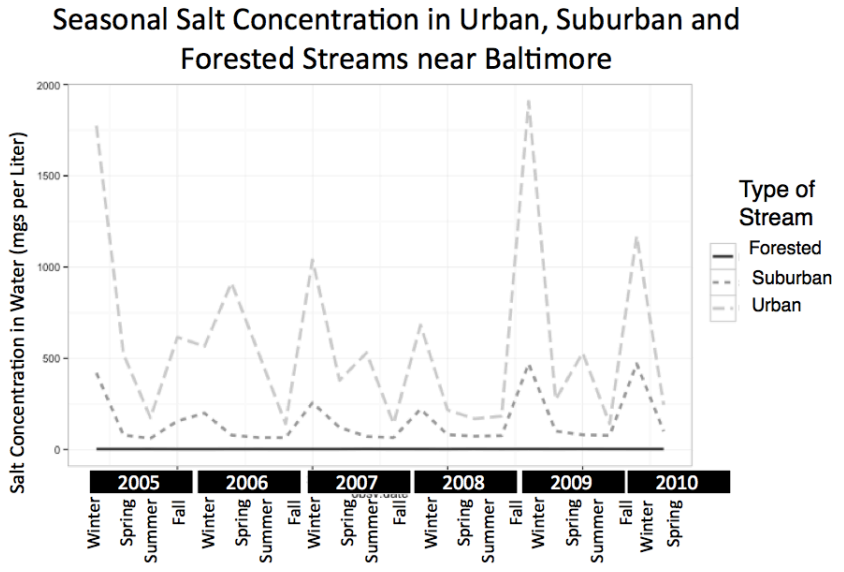
Year	Forested Area Population Density 0 people/mile^2	Suburban Area Population Density 3000 people/mile^2	Urban Area Population Density 8050 people/mile^2
	Average Salt Content in mg/L		
1999	2.60	243.79	332.22
2000	2.54	62.43	344.98
2001	2.66	68.81	235.47
2002	2.39	89.08	256.34
2003	2.69	96.74	358.47
2004	2.77	115.70	454.90
2005	2.66	181.23	777.73
2006	2.62	98.05	548.36
2007	2.88	141.39	427.17
2008	2.86	110.37	303.64
2009	3.03	211.17	716.44

SEASONAL SALT CONTENT IN A BALTIMORE STREAM

Population Density (people per square mile): _____

Name: _____
Class: _____
Date: _____





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- Representing and Making Meaning from Data
  - Setting Up Graphs
  - Contextualizing Data
  - Comparing Graphs, Making Conclusions
  - Generalizing Conclusions to Your Water Supply

Ecology Disrupted: A Change in Any Ecosystem Factor, Living or Non-Living, Can Unexpectedly Disrupt the Ecosystem

- Ecology Disrupted
  - Biotic and Abiotic Factors
  - Winter Roads Make Salty Streams Graphic Organizer
  - Light Pollution: Beyond the Glare
  - Urban Heat Island Effect
  - Climate Change Affects Ecosystems
  - Bronx River Restoration
  - Bringing the Stories Together

Questions	Winter Roads
1. What **abiotic** factor(s) have **people changed**?	
2. **Why** do people **change** the **abiotic** factor? Why does it help us?	
3. How do these changes **impact** the living (**biotic**) and non-living (**abiotic**) parts of the ecosystem? Use the terms abiotic and biotic factors in your answer.	
4. How do you know these are the impacts? Describe the **evidence** or **data** that support the claim that changing this abiotic factor impacts the surroundings.	
5. Suggest how you might **solve** this problem	

Light Pollution: Beyond the Glare

1. Discuss ecosystems, abiotic, and biotic factors in the context of Baltimore streams. (5 min)

CLASSROOM ACTIVITY

Biotic and Abiotic Factors

Discuss biotic and abiotic factors in the context of salt and the Baltimore streams.

2. Complete the graphic organizer for *Winter Roads Make Salty Streams*. (5 min)

CLASSROOM ACTIVITY

Winter Roads Make Salty Streams Graphic Organizer

This exercise should familiarize the students with the graphic organizers.

3. Watch other *Science Bulletins* and complete the graphic organizers for each. (50 min)

Students watch additional Science Bulletins videos to learn about how human daily life can affect ecological function, and to pull out the ecological principles.

SCIENCE BULLETINS

Light Pollution: Beyond the Glare

Light reflected off cars, buildings, and roads can derail wildlife.

3. Watch other *Science Bulletins* and complete the graphic organizers for each. (50 min)

Students watch additional Science Bulletins videos to learn about how human daily life can affect ecological function, and to pull out the ecological principles.

SCIENCE BULLETINS

Light Pollution: Beyond the Glare

Light reflected off cars, buildings, and roads can derail wildlife.

SCIENCE BULLETINS

Urban Heat Island Effect

In cities like Atlanta, the high concentration of buildings, roads, and other artificial surface areas retain heat, making urban environments up to 10° C (18° F) warmer than rural areas.

SCIENCE BULLETINS

Climate Change Affects Ecosystems

Impacts from the Intergovernmental Panel on Climate Change (IPCC) 2007 report.

SCIENCE BULLETINS

Bronx River Restoration

Can an urban waterway reclaim its historical ecological health?


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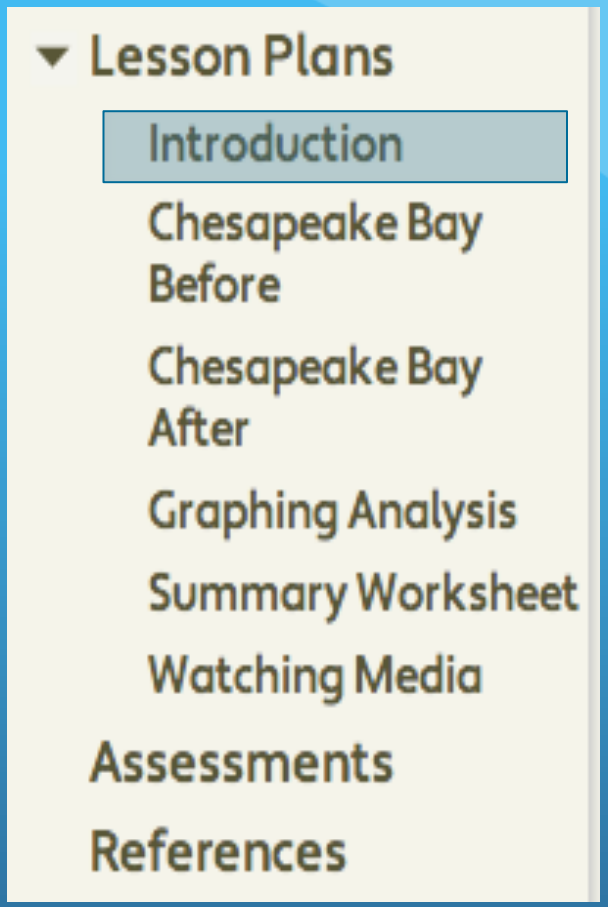
Bighorn Sheep
Winter Roads
Chesapeake Bay
Chesapeake Bay
Learning Goals and Standards
Lesson Plans
Assessments
References
Media

Chesapeake Bay Learning Goals and Standards

- How people impact
  - Food Webs
  - Nitrogen Cycle
- Sustainable seafood choices
- Eutrophication
- Data analysis
  - Making claims based on evidence
  - The importance of food webs for understanding ecosystems
  - Graphing - The importance of graphs for comparing data


Lesson Plans
Introduction
Chesapeake Bay Before
Chesapeake Bay After
Graphing Analysis
Summary Worksheet
Watching Media
Assessments
References


Lesson Plans
Introduction
Chesapeake Bay Before
Chesapeake Bay After
Graphing Analysis
Summary Worksheet
Watching Media
Assessments
References

Introduction

- Location of the Chesapeake Bay
- Wildlife of the bay and economic importance
- The problem of dead zones and algal blooms in the bay
- Eutrophication and nutrient input into the bay through sewage and farm runoff
- Essential Question: “Have fishing and harvesting sea life of the bay ecosystem made the bay more vulnerable to algal blooms and dead zones?

- Lesson Plans
  - Introduction
  - Chesapeake Bay Before
  - Chesapeake Bay After
  - Graphing Analysis
  - Summary Worksheet
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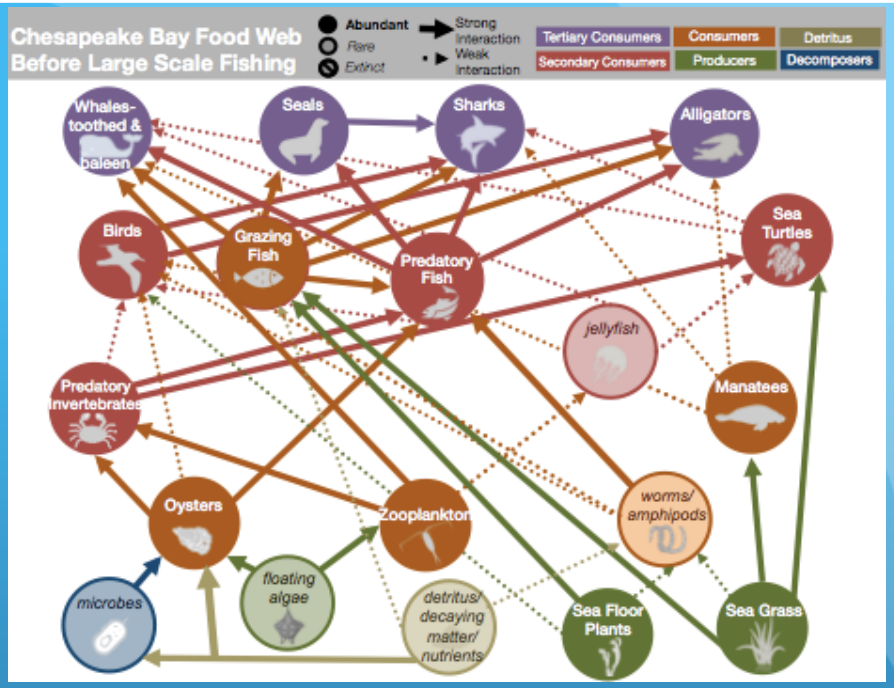

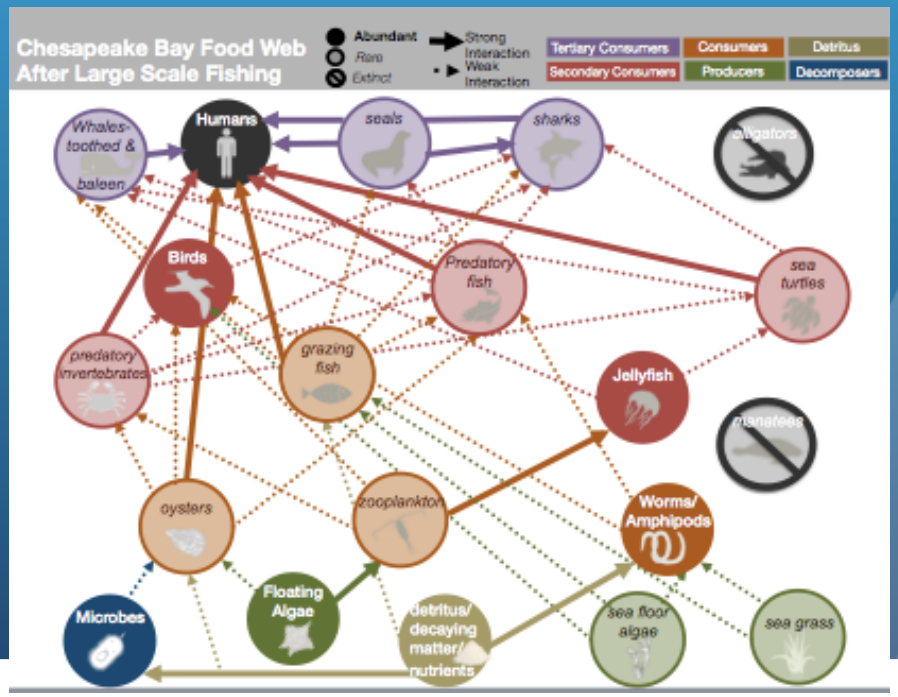

- Lesson Plans
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  - Chesapeake Bay After
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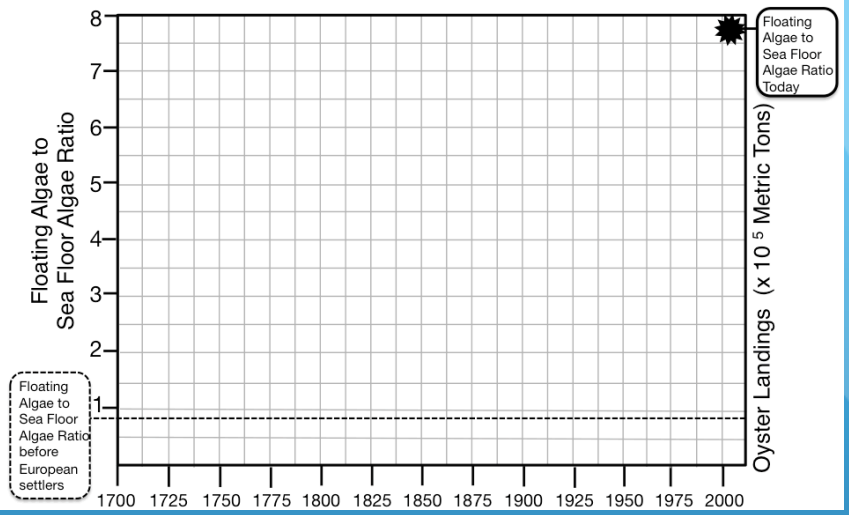
OYSTER LANDINGS & FLOATING ALGAE / SEA FLOOR ALGAE RATIO IN THE CHESAPEAKE

Legend:
- ☐ Oyster Landings
- ☐ Floating Algae to Sea Floor Algae Ratio

Name: _____
Class: _____
Date: _____



OYSTER LANDINGS & FLOATING ALGAE / SEA FLOOR ALGAE RATIO IN THE CHESAPEAKE

Legend
- Oyster Landings
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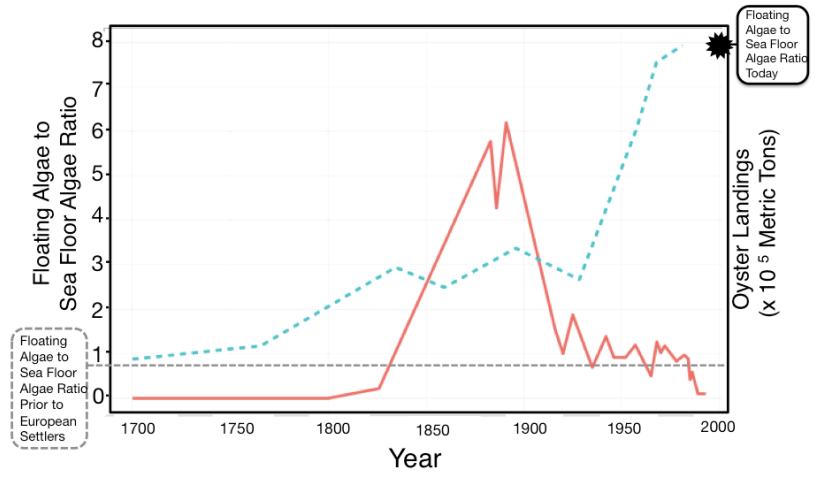

- Lesson Plans
  - Introduction
  - Chesapeake Bay Before
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  - Graphing Analysis
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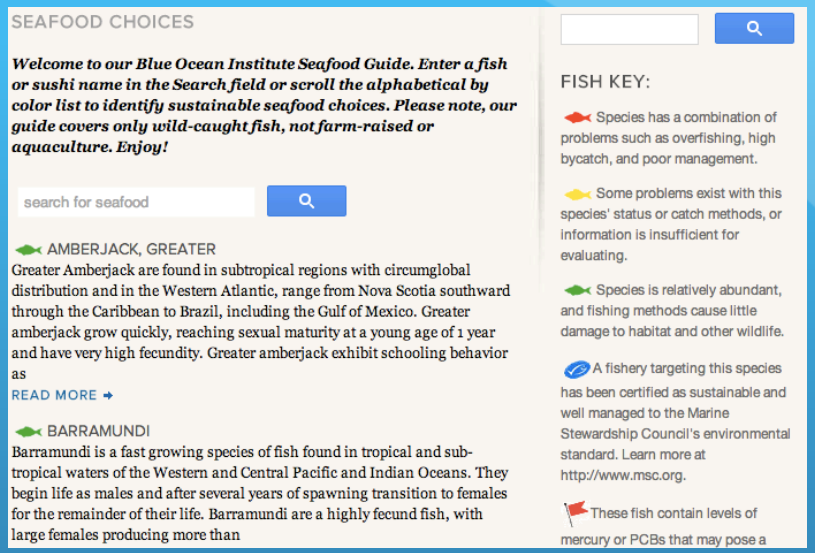
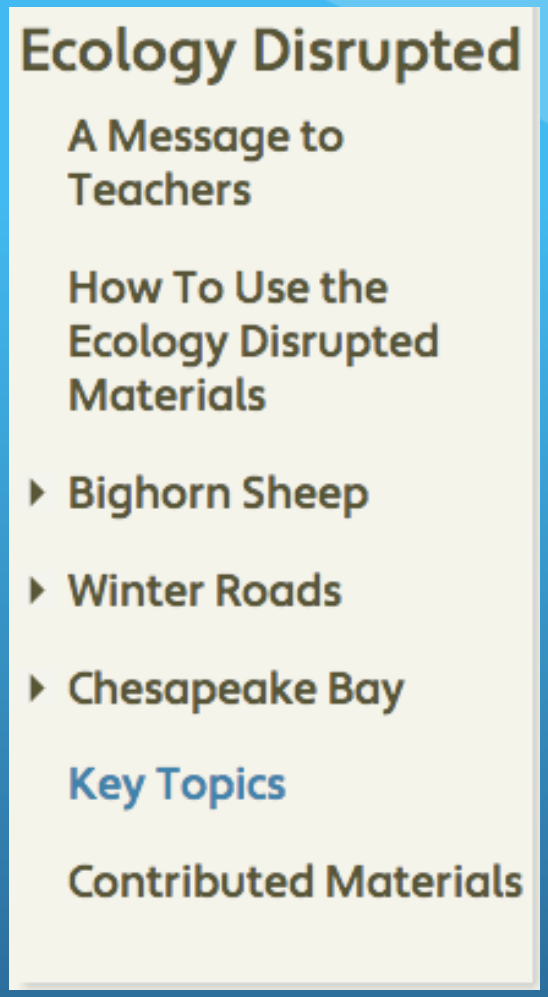


http://blueocean.org/seafoods/

www.shiftingbaselines.org/videos/index.html



Key Topics

- Abiotic Factors
- Data Representation
- Inbreeding and Genetic Diversity
- Scientists Doing Science

Key Topics

Scientists Doing Science

- Videos that show scientists at work in the field.

Scientist Profile: Dr. Clinton Epps
Scientist Profile: Dr. Sujay Kaushal

SCIENCE BULLETINS

Bronx River Restoration

Can an urban waterway reclaim its historical ecological health?

SCIENCE BULLETINS

Science Bulletin: Species and Sprawl: A Road Runs Through It

As the suburbs flourish, animals struggle to survive.

Ecology Disrupted

- A Message to Teachers
- How To Use the Ecology Disrupted Materials
- Bighorn Sheep
- Winter Roads
- Chesapeake Bay
- Key Topics
- Contributed Materials

Hantavirus and Human Health

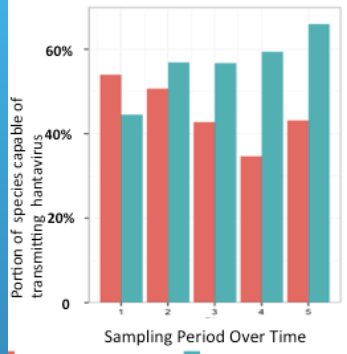
How does human-caused habitat loss unintentionally lead to human health threats by reducing community biodiversity?

Data Format: Bar and Line Graphs

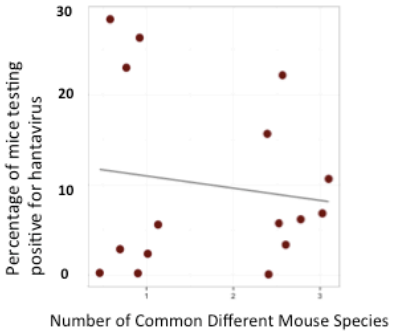
Keywords: Habitat, Community, Biodiversity, Human Health

The Role of Community and Habitat in Disease Protection

A. The percentage of carrier species (capable of transmitting the Hanta virus) at control sites, which were left untouched, and experimental sites where non-carrier species were removed.



B. The relationship between the percentage of mice testing positive and the number of common different mouse species in the tested sites.



1. According to graph A, what happened to the prevalence of carrier species when non-carrier species were removed by scientists?

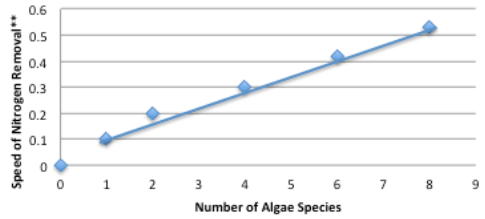
_____

2. In graph B, as the number of common different mouse species increases, what happens to the percentage of mice that test positive for hantavirus?

_____

White-Nose Fungus and Bats

Nitrogen Pollution Removal vs Number of Species of Algae



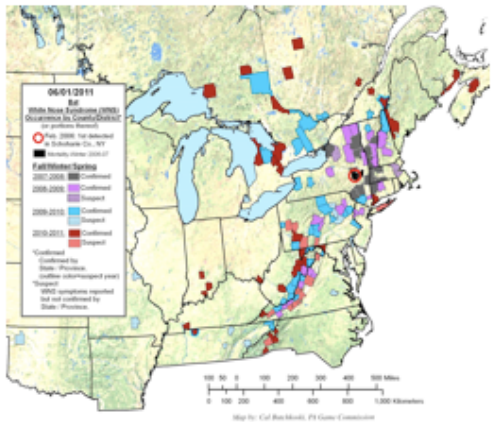
** Speed of nitrogen removal, measured in micrograms (mass) per square centimeter per hour (mcg/cm^2/hr)

1. How quickly is nitrogen removed with one species? _____
   - With 2 species?_____
   - With 4 species?_____
   - With 6 Species?_____
   - With 8 Species?_____
2. How does species number affect the rate of nitrogen removal?

   _____
3. If we want to have less nitrogen in water or cleaner water, what do these data suggest for us to do?

   _____
4. Why does a biodiverse community of algae keep the water clean?

Map of White Nose Syndrome by County and District



1. At about what time was white nose syndrome **first** detected?

   _____
2. Where was white nose syndrome first detected?

   _____
3. Name 3 states or places where white nose syndrome has spread?
   - _____
   - _____
   - _____
4. What do you see is happening over

Ecology Disrupted

Human impacts demonstrate ecological principles.

SHARE: 0

APPS AND KIOSKS

Ecology Disrupted

Using real scientific data about daily life to link environmental issues to ecological processes in secondary school science classrooms.

Ecology Disrupted offers a set of classroom-tested case study curriculum units based on recent scientific research on environmental impacts that arise from daily life activities.

- The research is introduced using videos produced by the Museum's **Science Bulletins** program.
- Additional video profiles give the research a human face, showing scientists in the field talking about personal perspectives that motivate their work.
- Students work with real data sets from the published research and perform analyses that replicate the research findings, and elicit awareness of the ecological principles at work.

By explicitly connecting ecological processes to environmental issues that result when human daily life disrupts these processes, students can begin to understand their personal connections to ecological processes.

Read **A Message to Teachers** to learn more about the pedagogical approach of Ecology Disrupted.

Review **How to Use the Ecology Disrupted Materials** to learn how to navigate the Ecology Disrupted web site, and how to locate and use specific materials for creating your own lesson plans.

Look through the list of **Key Topics** that are covered in the Ecology Disrupted lessons. For each topic, we have selected a few of the materials that are especially good for teaching the topic.

Ecology Disrupted

Human impacts demonstrate ecological principles.

SHARE: 0

APPS AND KIOSKS

How To Use the Ecology Disrupted Materials

DOWNLOADS

Download the files below to use offline, or to incorporate into your own lesson planning tools.

How To Use the Ecology Disrupted Materials

PDF

Text

DOC

Introduction

Ecology Disrupted is the product of five years of extensive in-service testing that have demonstrated their effectiveness in the classroom. This web site has been designed to make these materials available in their proven format and sequence, while also enabling teachers the flexibility to customize lessons for their classrooms, or to extract individual components to incorporate in any other kind of lesson.

BRIEF RECAP OF SITE

QUESTIONS