

Lesson 8 - Block Island
Field Trip

Ferry ~ 9 AM
Bicycles

Stop #1: Southeast Lighthouse

□ About Block Island: 13 mi south of the coast of RI
14 mi east of Metacomb Point
↗ 12 mi from Long Island

7000 acre

7 mi long
3 mi wide

Have students convert to km w/o calc.

$$1 \text{ mi} = 1.609 \text{ km}$$

$$1 \text{ in} = 2.54 \text{ cm}$$

$$1 \text{ mi} = 5280 \text{ ft}$$

$$100 \text{ cm} = 1 \text{ m}$$

$$1 \text{ ft} = 12 \text{ in}$$

$$1000 \text{ m} = 1 \text{ km}$$

□ 2010 census 4,051 people

□ Part of the outer land region made by the terminal moraine that resulted from the Wisconsinan Laurentide Glacier Retreat

~ 22,000 years ago

□ In your journal

• location

• Date/Time

• observations @ each location

look for - physical gradients, plant adaptations, impacts (humans), evidence of past

• Information Told

Physical - Temperature

Visible signs of pollution

Dead Animals? Debris? None?

Weather - Clear? Partly cloudy? Overcast?

Wind - calm? Gentle? Light? Direction NW, N, E, SE,
S, SW, W

Rain - w/in 48 hrs? None? Light? Moderate? Heavy?

Smin

⇒ write observations in journal

History - First described as a tree-ed island, then cut

down all trees & tried to reforest land

→ fewer species than mainland

Plants: Golden Red (varies around island)

Bayberry (no berries @ bottom/successional)

Bittersweet

Dune Grass

Beach Rose (pink, white, purple)

Cinnamon Fern (cut fern)

Cherry Tree

* A lot of shrubs -
great for birds

Deer Berry

Lighthouse

- Island sometimes called "stumbling block" due to dangerous shoals & ledges

→ several vessels went down until lighthouses built

- N. Lighthouse built 1829

- SE. Lighthouse built 1875

◦ illuminated by kerosene oil Feb 1, 1875

◦ deactivated in 1990

◦ 115 years of erosion was listed as one of America's most endangered structures

→ use to be 300 ft from bluff

→ 55 feet from bluff

- raised 2 million to pay for lighthouse to be moved in 1993 to present location 300 ft from bluff
- Named historical landmark 1997

Stop #2 Mohegan Bluffs

- Observations
- Hills - created from glaciers
 - specifically Illinois & Wisconsin
- Terminal Moraine = maximum advance of glaciers
 - Outer Lands (name of moraine) encompasses Block Island, Cape Cod, Nantucket, Martha's Vineyard & Long Island)
- Illinois - oldest glacier
 - ended 130,000 years ago
 - darkest rocks
- Wisconsin - newest glacier
 - ended 22,000 years ago
 - lighter rocks

Why am I providing you with this information?

- Glaciers example of primary succession
 - what does that mean?

No soil present

Pioneer species? Lichen to break down rocks & create soil.

No other plants established here now?

What do they need to survive? Consider Abiotic & Biotic
How are their adaptations different compared to
the top of the steps & SE Lighthouse?

What do these organisms compete w/?

Discuss intertidal zone, waves, wind, erosion
(notice water leaking from rocks on cliff)

U Shape of Cliff from water

Types of rocks? Granite from Canada

(Igneous rock - Intrusive)

Plants? Dune grass - survive salt, little water

Golden rod - 4 of adaptations

Beach rose - like soil conditions

bayberry

Fern

Cherry

Hackberry

Soil Makeup? pH test?

In Notebooks - Ecological Stand Point

Ecology - how organisms interact in & w/ natural world

"oikos" greek word for house

→ Think about scale → Discuss as class

Biosphere (global process)

Ecosystem (energy flux/cycling)

Community (interactions among pop.)

Population (population dynamics)

Organism (exchange of energy & materials
w/ environment)

Variation - referring to scale, 2 Types

① Temporal

- perceived how environment changes over time
ex. day/night, seasons etc.
- Climate - avg. atmospheric conditions over long periods of time
- Weather - atmospheric phenomena that vary over periods of days or hours
- Why Important?? Look @ how organisms respond to change
 - depends on how often it occurs
 - quicker - respond quicker

② Spatial

- environment varies from place to place
- due to climate, topography & soil
- Plant structure, animal activity & content of soil (small scale)
- How does soil differ in spatial variation?

Earth's Systems - Geosphere

Pedosphere

Hydrosphere

Biosphere

Atmosphere

Systems governed by basic physical & biological principles. What are they??

① Obey Laws of Physics

life builds on physical/chem rxn of matter

ex. diffusion of O_2 , nerve impulses

⇒ all obey fundamental principles of matter
& energy

③ Exist in dynamic (constant Δ) states

- look @ BECO - system continuously Δ by
exchanging matter & energy w/ surroundings

⇒ gains/losses balanced (steady state)

organism ex. animal loses heat to cold but gains
heat from metabolism of food

population ex. births/deaths

community ex. new species/extinctions

ecosystem ex. biogeochemical pathway

biosphere ex. cycling of matter - plate tectonics

③ Living systems must expend energy to maintain
themselves

- Organisms must procure (obtain) lots of energy
& materials so it has to expend energy to
capture & assimilate so it can replace heat
& metabolism of food

④ Ecological systems evolve over time

- process of evolution

- adaptation (clarify!)

- natural selection

How did we come to this understanding?
Observation & experimentation

What are some biological or physical properties of soil?

Biological - organisms

aeration

nutrients

decomposition

Physical - water

- holds, dissolves inorganic nutrients (powerful solvent), capillary action (H₂O cling to one another), picks minerals from rocks/soils (transport)

pH

- critical role in dissolving minerals from rocks/soil

• concentration H⁺ acidic

pH 7 → pH¹⁰ moles/liter hydrogen ions

(most streams 6-9 although w/acid stream may be 4)

• Acidic soils (more needle plants)

slow decomposition, usually

pH 4 → pH 8

Inorganic Compounds

- important for plant growth

ex. N, ammonia (NH₄⁺)

phosphate ion (PO₄³⁻),

ammonium (NO₃⁻),

calcium Ca²⁺, potassium (K⁺)

↑
limiting factor

Soil Structure

Sand \uparrow 0.05 mm = coarse grain (feels gritty)
Silt 0.002 - 0.05 mm = mid grain
Clay \downarrow 0.002 mm = fine grain

→ combo of these plus organic matter

Best grown soil 40% sand
 40% silt } LOAM
 20% clay

* allows plants to access H₂O

Clay → smaller ⇒ holds more H₂O

Sand → larger ⇒ holds less H₂O

Soil is not dirt - thin layer of earth's crust
consisting of mineral & organic matter

Takes 1 in soil ~ 1000 years to be created!

⇒ Pass out Time Soil Handout

How is soil formed?

weathering & erosion
or mechanical

- Physical weathering (water, wind, temp Δ)
- Chemical weathering (acidic breakdown of rocks)

→ what could do this?

quality of rain, H₂O, lichen, minerals in H₂O

- Erosion (physical removal of rock)

Soil's 5 State Factors

- 1) Parent Material
- 2) Climate (arid, humid, hot, cold, etc.)
- 3) Topography (arrangement of landscape)
- 4) Organisms (aeration, use of nutrients, weather)
- 5) Time (immature, young, old soil)

Soil Composition

45% minerals

5% organic

25% water

25% air

How does the soil profile here compare to the last site? What do you think it will be like @ Rodman's Hollow?

Bluffs

- more parent material exposed (R)
- maybe some B + C layer.

Lighthouse

- small (very small) O
- small A
- larger B + C than Bluffs
- About same R (little smaller)

Rodman's Hollow

- less R + C
- larger O + A + B

Soil Horizons

- O Dead organic litter, most soil organisms
- A Rich layer of humus - partly decomposed organic matter mixed w/ mineral soil
- E Region of leaching of minerals since they dissolve in H_2O
→ Eluviation Horizon - downward movement of dissolved / suspended material w/in soil by leaching)
- B Little organic material, chemical composition of underlying rock
→ Illuviation Horizon - Rich in oxidized Aluminum + Iron
- C Weakly altered materials, similar to parent
- Calcium + Magnesium carbonates in layer
- Usually saturated w/ ground water
- R Unaltered Parent Material

Stop #3

Lunch

- near Bluffs before entering
Rodman's Hollow

Stop #4

Rodman's

Hollow

Discuss
First

Observations

- off of lakeside road
- Kettle Pond
created by glacier (watershed)
Fresh H₂O
- Known as a metal rock = only place
in KI left behind by glacier (terminal
moraine)

Plants

American Basswood

Ash - compound leaves

Cherry - cracks in it

Sedge - have edges (more wet environment)

Queen's Ann Lace

Striped Maple

Golden Rod - how changed? why?

Think about adaptations

- thinner leaves & smaller flowers

Wild Red Raspberries

Bayberry

European Alder

- Discuss Δ in soil / productivity of area
in comparison to other two spots
(NPP / GPP)

→ Think about lake ... is it classified
by which of the following? Why? Back up
w/ evidence

- Oligotrophic
- Mesotrophic
- Eutrophic

Oligotrophic = ↓ primary productivity due to low
nutrients (Phosphorus + Nitrogen)

Mesotrophic = moderate primary productivity

Eutrophic = ↑ primary productivity

*** Use H₂O test kits to determine ***

The watershed on Block Island is drained
into these lakes. Highest point on map is
SE Lighthouse.

→ Briefly draw out topography lines on
map + show where water drains to

What organisms do you think live in this
watershed? Create a brief food web / chain.

- Discuss

What scale did we observe this area at? Explain.

- B
- * E
- * C
- P
- * O

Stop # 5

Great Salt Pond

- Observations

Talk about Salt Marsh

- biomass
- NPP
- Food web/chain
- How old it may be
~ grows 1 foot every 100 years
- Functions of marsh
 - 1) Nursery
 - 2) Filters toxins
 - 3) Absorbs Flood water

1 mi salt marsh takes in 1 FT³ H₂O

- Discuss species adaptations

Fiddler Crab, Blue Crab, Cord Grass,
Pickle Grass, Bird

- Peat - Anaerobic environment

Type of organisms?

Bacteria - Methanogens + other

anaerobic bacteria

- Discuss Disturbance.

1) What are the different types of disturbance?

Natural $\left\{ \begin{array}{l} \text{ex. hurricanes, ice storms, tsunamis, volcanic} \\ \text{eruptions, forest fires etc.} \end{array} \right.$

Anthropogenic $\left\{ \begin{array}{l} \text{ex. settlement, agriculture, air pollution,} \\ \text{clear-cutting, Mt. top removal} \end{array} \right.$

Intermediate Disturbance Hypothesis

\rightarrow Is this occurring in this system?

Definition - ecosystems experiencing intermediate levels of disturbance are more diverse than those w/ high or low levels

• Rare disturbance \Rightarrow Intense competition

• Frequent disturbance \Rightarrow Sp. must grow quick enough to counter disturbance & prevent species extinction (most likely ruderals)

Resistance

Definition - measure of how much a disturbance can affect the flow of energy & matter

• High resistance = no effect on flow of energy & matter

Resilience

Definition - rate at which an ecosystem returns to its original state after a disturbance (Positive Feedback or Negative Feedback??)

\rightarrow Positive = away from norm

\rightarrow *Negative = toward norm

Stop #41

Beach

(if time)

- observations
- Discuss disturbance shore (dunes) - Intertidal zone - deep water
- Wrap up

Ecosystem - particular location on Earth distinguished by its particular mix of abiotic + biotic components

nonliving \uparrow living
 \rightarrow dependent of climate

Ecosystem Boundaries - distinguish one ecosystem from another

\rightarrow subjective to scientists + are defined by particular species of interest, topography etc.

\rightarrow some are clear boundaries + some are not (gradual vs. steep transition)
ex. cave, marsh, bluffs etc.

Today you studied ecology which is the study of systems that include interactions among organisms + between organisms + their environment.

- Ernst Haeckel was a 19th century scientist who developed the concept of ecology

eco = house in Greek \Rightarrow study of one's house
logy = study

So what do ecologists do?

look at...

- biotic & abiotic components
- why organisms are distributed the way they are
- why some species are more abundant than others
- ecological roles of different organisms in their environment
- interactions between organisms & their environment help maintain overall health of our living world

Has a global or local focus which is why it is the broadest field within ecological sciences

Think about today in a systems perspective. Discuss one place's interactions in your notebook and write a reflection of the trip. Your thoughts, went well / didn't, change, learned