Class 9

1:30 – 2:15

- Quiz 1: Review
- Slides: Ecosystem Disturbance and Resilience

2:00 – 2:40

- Activity 1: 3 Challenges and 3 Successes – Ecosystem Restoration

2:40 – 3:20

- Activity 2: Mid-term presentation team meeting #2

Quiz Review

1. Food Web involving Venus Fly Trap
   - Arrow direction ***same*** as nutrient flow
   - Plants are at the bottom of the terrestrial food chain
   - Phytoplankton are at the bottom of aquatic food chain
   - Detritus is at the bottom of the Detritus food chain
   - Food chains begin with producer/detritus and end in a predator (secondary or higher consumer)
2. Environmental Conditions are non-consumables, Environmental Resources are consumables
3. Confusion between impact of wildfire ON Carbon Cycle and impact OF increased C in atmosphere
   - E.g., Oxygen depletion in the atmosphere is an impact OF the C Cycle
4. Question was about ecological impact (not on human health) of using excessive germicides. But, it may not have been clear.
5. Passive Solar
   - means utilizing Sun's light and heat directly without converting to other energy forms
   - (solar panels ***convert*** sunlight to electricity)

- **Answer key will be emailed at end of the week**

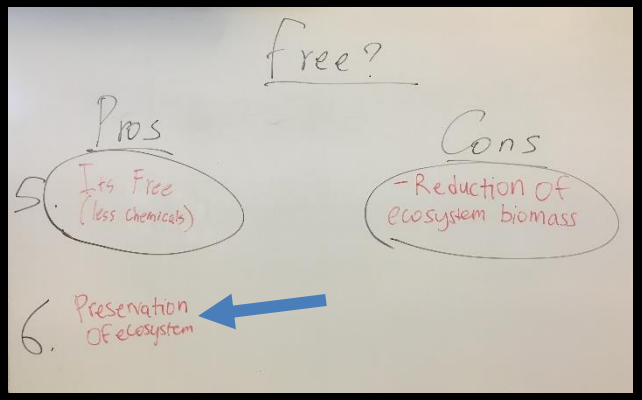
Ecosystems

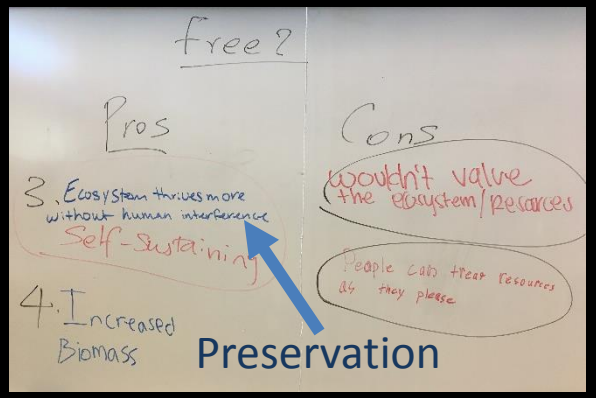
Ecosystem Disturbance and Resilience

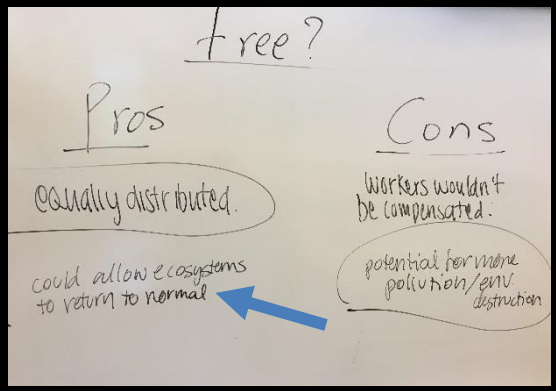
Team responses from last class

Pros and Cons of Considering Ecosystem Services as Free

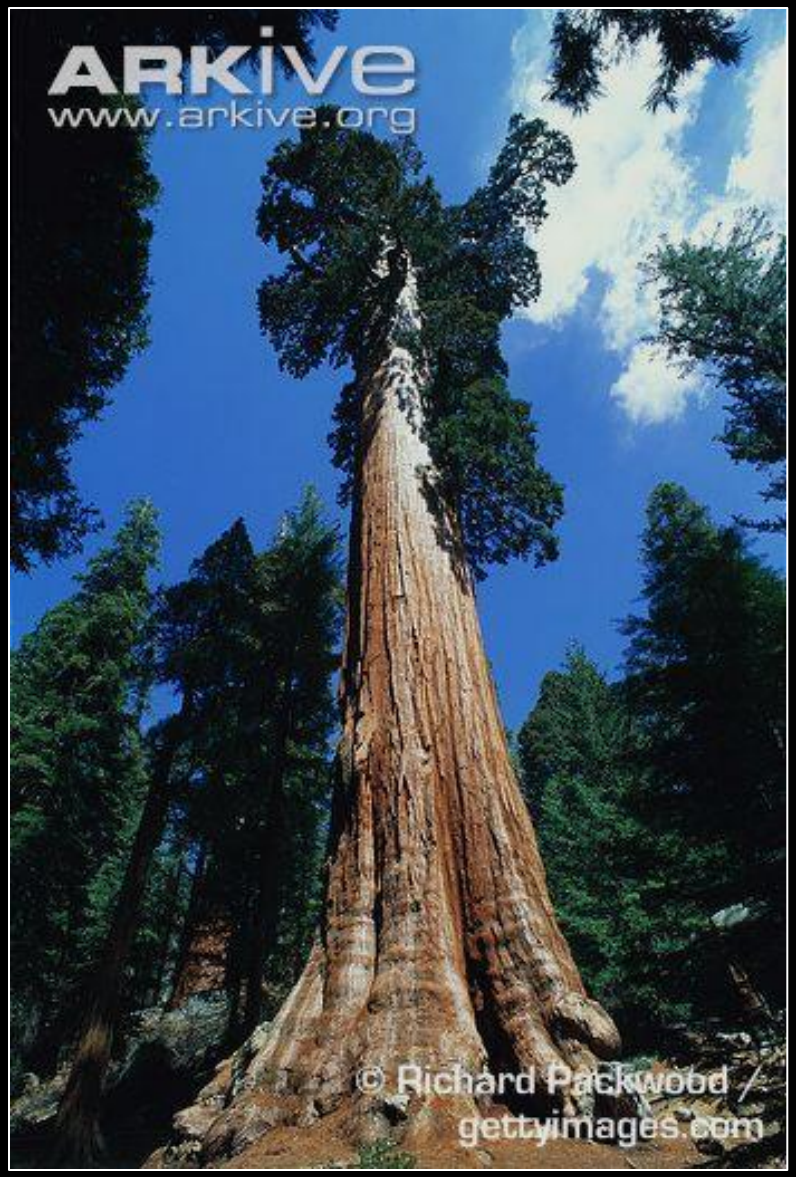
- Pro - Preservation of ecosystem
- Pro - Could allow ecosystems return to normal
  - What does “normal” mean?
  - Stable!







California Coast Redwood

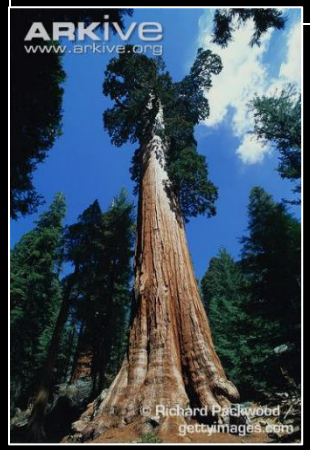


Chilean Alerce

Ecosystem Stability – *Climax Community*

- **Ecosystems** are
  - A *complex of stable biotic communities* – **Climax Community**
  - Interacting with each other and the abiotic environment
  - Each ecosystem in a particular geographic location has its own climax community

- **Biomes** are
  - Similar Ecosystems composed of different Climax Communities
    - Geographically separated, but similar abiotic environment
    - Organisms evolve separately in response to similar abiotic environments
    - Different climax communities but composed of similar organisms



Save The Redwoods
LEAGUE

Coast Redwoods grow in the cool moist forests of the California Coastal Range.

by **Emily Burns** on **July 14, 2016**

The beautiful **Alerce trees, *Fitzroya cupressoides***, grow in the cool rainforests of Chile, just to the west of the Andes. The Alerce are members of the **same conifer family as the redwoods** (the Cupressaceae) and the two species share many striking similarities.

As Ruskin mentioned, the Alerce live as far south of the equator as redwoods live north of the equator. Mature Alerce can reach heights of **nearly 200 feet,** grow trunks up to **16 feet in diameter**, and live for more than **3,000 years**. However, the Alerce giants were logged in the twentieth century and from the stumps left behind it is thought that many of the largest trees are gone. Noted for their timber value, many Alerce forests in Chile were **heavily logged** to extract Alerce wood **for building materials**, including roof shingles. One account notes that Alerce shingles placed on a roof more than 130 years ago are still perfectly intact, a testament to the amazing rot-resistance of the wood.

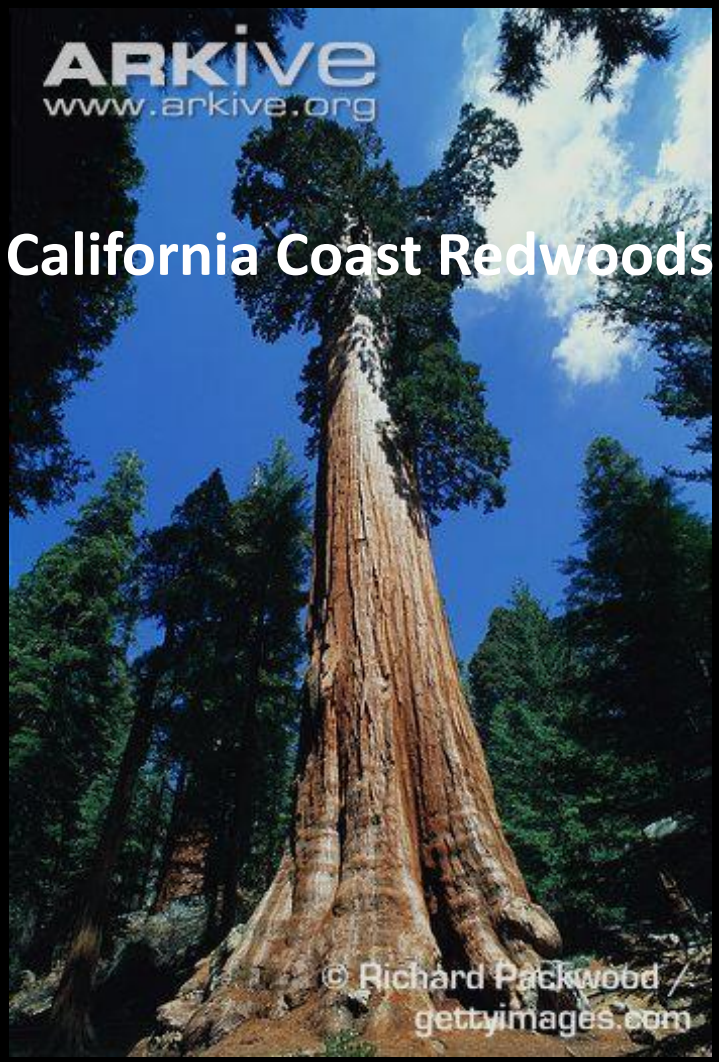
Alerce. Photo by andrea ugarte, Flickr Creative Commons

The Chilean government **banned harvesting of Alerce** trees and export of Alerce wood in **1976**, but this legislation came too late to protect the magnificent species in many of the lowland areas of Chile, where it historically dominated the forests. Unlike redwoods, Alerce are **very slow-growing** and **restoration** of harvested forests is **extremely difficult**. Today, the remaining Alerce giants can only be found standing at the **base of the Andes**. I'm ready to pay them a visit and see for myself how much they have in common with redwoods!

In 2012, Save the Redwoods League's collaborated with Chilean conservationists to help create a sister national park to California's Redwood National and State Parks. Learn more about other **redwood relatives** found throughout the world and visit our new webpage!

Conditions for maintaining/preserving climax communities

- Abiotic factors must be stable
- Biotic components must be in balance



California Coast Redwoods

Chilean Alerce

Ecosystem Resilience

Ecosystems are Stable but not Static

What happens when

- **New land is formed**
  - ***Volcanic action, Receding of glaciers, Sea level decline***
- **A stable ecosystem is disturbed**
  - **Due to Natural Causes**
  - **Wild fire, floods, volcanic eruptions**

Organisms

- **Respond to Disturbance**
  - **Subject to current biotic and abiotic environment**
- **Process called Ecological Succession**
  - **How quickly does ecosystem form or recover?**
- **Two types of Ecological Succession**
  - **Primary Succession: New land**
  - **Secondary Succession: Pre-existing ecosystem disturbed**
  - **Involve Pioneer Species: The first to occupy**

Primary Succession

When new land formed

No life initially, no soil

Lichen, Bacteria: Pioneer Species

Form Soil - break down rock

Migrants from nearby land start visiting the new land

- **Volcano erupts under the ocean**
- **Glacier Retreats**
- **Sea level decreases**

New Land Formation

- How brand new ecosystems are formed
  - When new land is formed as during volcanic eruptions in oceans
  - E.g., Island of Surtsey

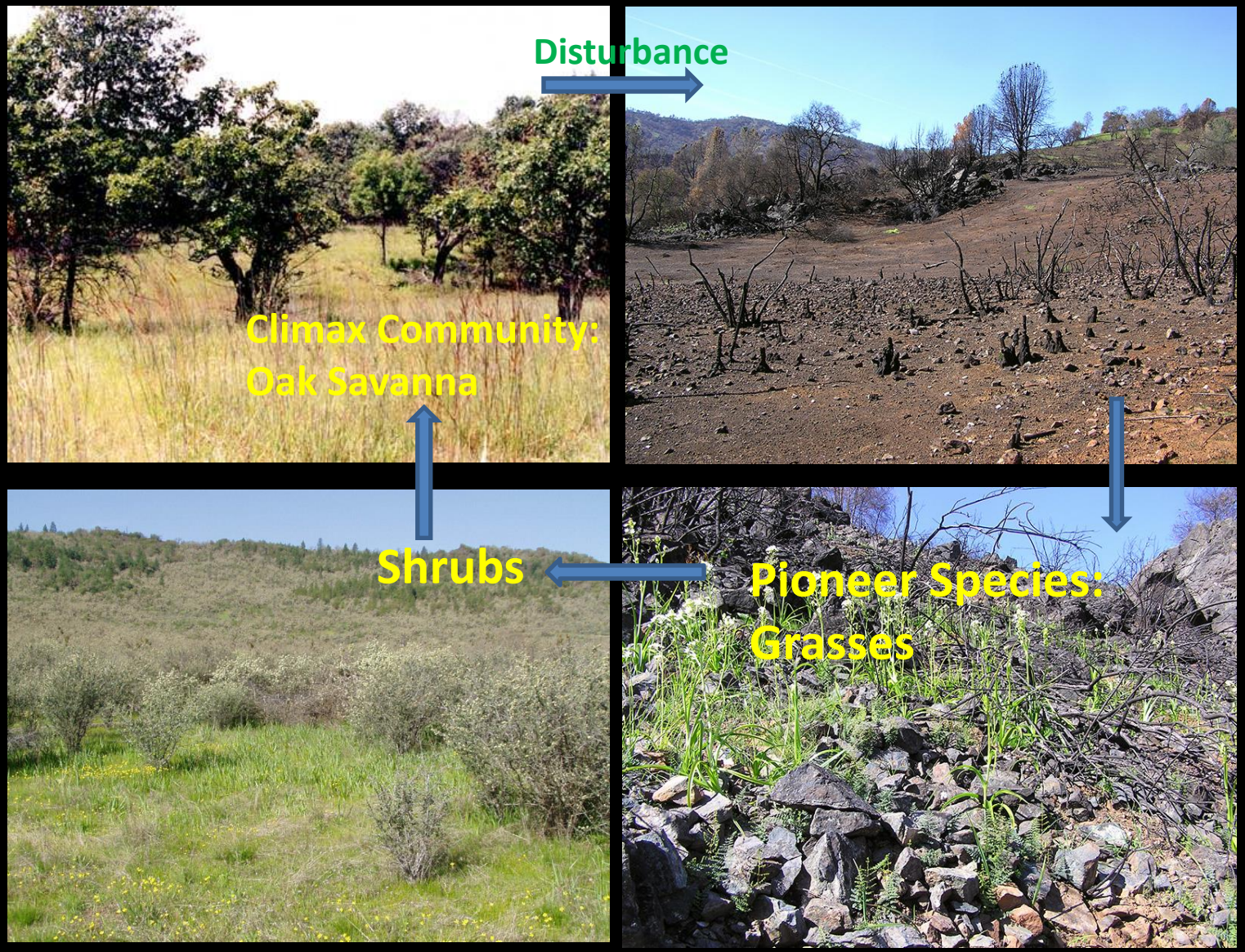
1963

1966

A few decades later…

Secondary Succession

Natural Disturbance – Wild fire



Wild Fire in an Oak Savannah Ecosystem

Additional resource
Watch at home

Ecological Succession Video: 6min.

https://www.youtube.com/watch?v=V49IovRSJDs

Ecosystem Resilience
Human-caused Disturbances


Clear cut logging


Invasive species

- How are Human-caused Disturbances Different?
  - *More persistent*
  - *More widespread*
  - *More frequent*

Human Disturbances - HIPPO

- **Habitat Change**
  - **Fragmentation, Intrusion, Simplification**
  - ***E.g., Dams, Mining, Channeling rivers, Urbanization***
- **Invasive Species** introduced to natural ecosystems
- **Pollution** of natural ecosystems
  - ***E.g., Global warming + Climate Change***
  - ***Ocean acidification***
  - ***Eutrophication***
- **Population** growth and overconsumption
- **Over-exploitation**
  - **Clear-cutting, over-fishing, over-hunting**

Can Ecosystems Recover?

- What if climate of the location changed?
- What if there were no remaining viable populations of what used to be there?
- What if some new species occupies the land before the original species can recover?

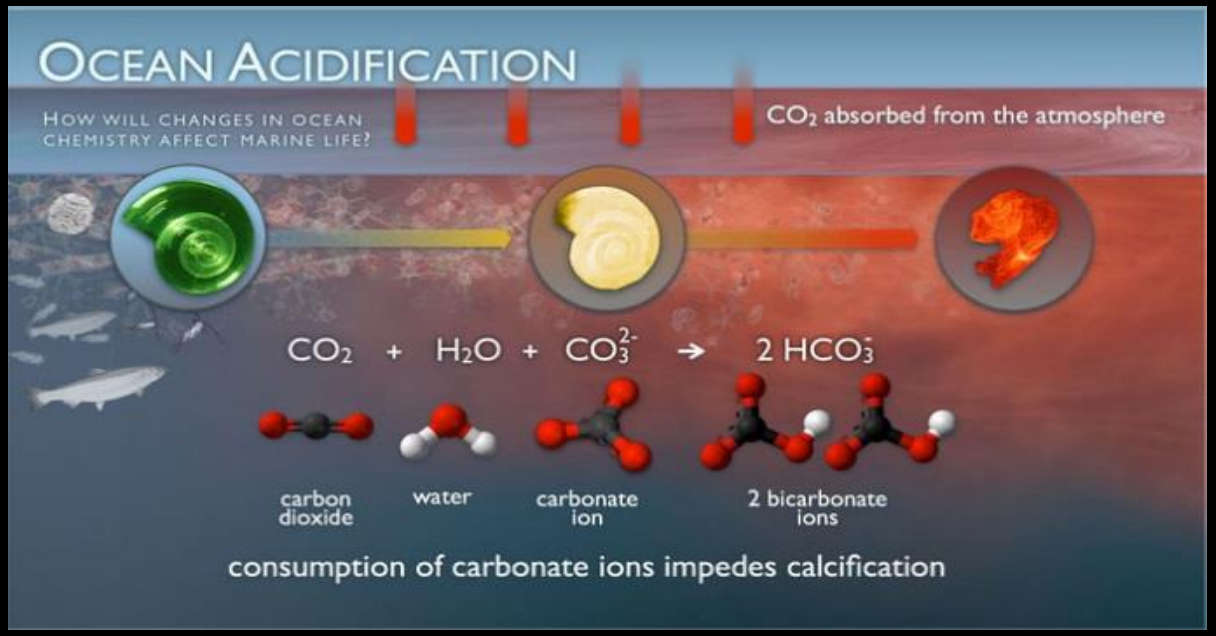
When Can Ecosystems Recover?

- What if climate of the location changed?
  - *Cannot go back to the original Climax Community*
- What if there were no remaining viable populations of what used to be there?
  - *Uncertain*
  - *At least the seeds or a few individuals of the dominant communities must remain*
- What if some new species occupies the land before the original species can recover?
  - *The new species would "invade" the space occupied by the original species*
  - *The original species may not recover*

Ecosystems
Global Changes

Too much green house gases in the atmosphere

Global Warming
Climate Change



Ocean Acidification
Loss of Sea Life

LOSS of BIODIVERSITY

Ecosystems

Human Caused Disturbances

- Can it recover, i.e., can the Climax Community come back?
- How far can we push nature before it reaches a tipping point and climax communities are lost?

Class 9: Team Activity – 2 Cases of Restoration

Use the resource web site for each of the topics summarize highlights (1/2 journal page per topic)

Research the following 2 cases of restoration:

- **Elwha Dam Removal (Olympic National Park website)**
- **Restoration of Salt Ponds (US Fish and Wildlife Services)**

In your summary, *also include*

- the cause of ecological disturbance
- whether man-made or natural
- what type of succession occurred/is occurring.