NSTA WEB SEMINARS

LIVE INTERACTIVE LEARNING @ YOUR DESKTOP

NASA/UCAR: Effects of Climate Change to Life on Earth

Presented by: Dr. Lisa Gardiner

Thursday, April 22, 2010

6:30 p.m. - 8:00 p.m. Eastern time

How is climate change affecting life on Earth?

A web seminar for the NSTA community
By the UCAR Office of Education and Outreach,
with support from NASA.

Overview

- Introduction to how climate change affects life
- Examples of how climate change affects…
  - Plants
  - Marine life
  - Human health

Presenter:
Dr. Lisa Gardiner
Educational Designer
UCAR
Office of Education and Outreach

UCAR
UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH

NASA

WINDOWS TO THE UNIVERSE

Introduction to how climate change is affecting life of Earth

NSTA WEB SEMINARS

Lodgepole pines near
Granby, CO
(Carlye Calvin)

West of the
Continental Divide
(USGS)

Beetle kill can be seen from space

Pine beetle infestation in British Columbia as seen by NASA's Terra satellite

Climate change affects one species…
…which affects the entire ecosystem

Mountain pine beetles are
1/8” to 1/3” long.
Little insect – big impact.

- Higher temperatures speed up reproductive cycles
- Fewer cold snaps that kill beetles.
- Drought weakens trees, making them more susceptible to beetles.
- Dense older forests are more susceptible to beetle outbreak.

“Several of the current outbreaks, occurring simultaneously across western North America, are the largest and most severe in recorded history”
- US Forest Service

What have you heard?

Think about the news stories you've heard of recently.

What is the news media reporting about how climate change is affecting life on Earth?

(Respond in the chat!)

How is climate change affecting life on Earth?

Species & ecosystems are affected by many things…

•Changes in water/ice availability
•Change in temperature
•Changes in extreme
• weather events
•Pollution, habitat fragmentation and other stresses not caused by climate change

What's a species to do?

- **Move**
  - Warmer temperatures are causing some species to migrate into new areas, affecting ecosystems.
- **Change lifestyle**
  - Some species of plants and animals are changing the timing and frequency of reproductive cycles, food sources, and habitat.
- **Die**
  - Some species will go extinct.

Did past climate changes affect life?

An area of active research!

Scientists compared the fossil record and temperature for the past 520 million years.

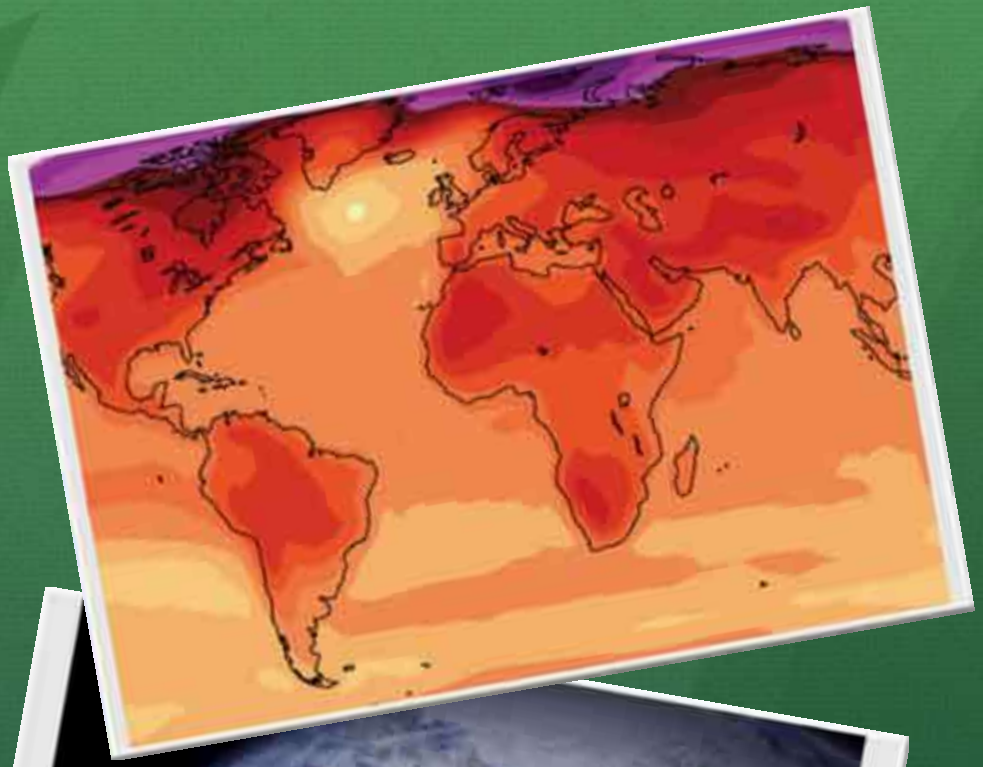
They found: biodiversity is related to temperature.

During warm "greenhouse" times:
- Biodiversity lower
- Extinction rate higher

"The rule appears to be that greenhouse worlds adversely affect biodiversity."
- Peter Mayhew, University of York, England

The End-Permian Mass Extinction
- Rapid global warming
- 251 million years ago
- 70% of life on land died
- 84% of marine life died

Questions?



How is climate change affecting plants?

(Learn about Project BudBurst!)

Project BudBurst

Getting Students Involved With Project BudBurst Climate Change Research in Your Schoolyard

Dr. Sandra Henderson,
Director Project BudBurst
NCAR/UCAR, Boulder, CO

UCAR EDUCATION AND OUTREACH

Lowell Cemetery, Massachusetts

5/30/1868

5/30/2005

What similarities & differences can you find in these two photographs?

What is Phenology?

Phenology is the science that measures the timing of life cycle events for all organisms.

Migration

Nesting

First pollen

First leaf

Brief History of Plant Phenology

The Japanese have been recording the timing of Cherry Blossoms since 900AD

Grape harvest dates in Switzerland have been recorded by wine makers since 1480 AD

Thomas Jefferson referred to the progression of blooms in his garden as “acts in a play”

Henry David Thoreau and Aldo Leopold kept extensive phenological records that are being used today

There are also numerous ‘shoebox’ naturalists whose data may prove extremely valuable

Project BudBurst

A National Phenology Network Field Campaign for Citizen Scientists

Join us in collecting important climate change data on the timing of leafing and flowering of trees and flowers in your area through Project BudBurst! This national citizen science field campaign targets native tree and flower species across the country.

www.budburst.org

Photos courtesy of USDA-NRCS PLANTS Database and USA National Phenology Network

Steps to Getting Started
www.budburst.org

1. Select and identify your plant.
2. Describe the site including latitude and longitude.
3. Determine the phenophases you are looking for.
4. Begin observations.
5. Report your observations online!

Project BudBurst

Timing is everythi

A National Phenology and Climate Change Field Campaign for Citizen Scie

Participate! | Resources | Report Observations | Phenology | Climate Change | Results

Project BudBurst wants you to share your observations of phenophases such as first leaf, first flower, and first fruit of trees, shrubs, flowers, and grasses.

Download the **Steps to Getting Started** to begin your Project BudBurst investigations!

Check out new and upcoming features for 2010.

BudBurst Buddies | Educator Resources | Special Projects

Become A Member
Register | **Login**

Scientist Blog Featuring Dr. Kay & Dr. Paul

Update from Chicago
- Mar 19, 2010

It's not quite spring yet in the Chicago region, but we've been given a teaser. The temperature crept up above 60 degrees for ...

Project Budburst and planning a native garden
Update from Chicago

America's 10 Most Wanted Plants!

Chokecherry
(Prunus virginiana)

Have you seen these plants? If so, we want your observations! Scientists working with Project BudBurst have determined that these plant species are of particular interest in the 2010 field campaign.

More...

Plant of the Week

Are your Common Lilacs in bloom?

How Can Participation in Project Budburst Help Science?

- Help unravel the complex interactions between temperature and precipitation and plant phenology
- Better understand effects of local environmental change
- Make valuable comparisons with historical data

Comparisons of 2007, 2008, and 2009 PBB data with historical data from Chicago made by Dr. Kay Havens

Forsythia – earliest from historical record – April 25

Forsythia – earliest from PBB – April 1

Spiderwort – earliest from historical record – May 14

Spiderwort – earliest from PBB – May 3

Source: Swink, F. and G. Wilhelm. 1994. Plants of the Chicago Region

How has flowering changed where you live?

How can you get your students involved?

Register for Project BudBurst (teacher registration option coming soon) and make observations

Share photos with us (plants, phenophases, and people)

Encourage others (friends, family members) to participate

BudBurst Buddies for younger students

Project BudBurst

Questions about
Project BudBurst?

www.budburst.org

budburstinfo@ucar.edu

Plants on the move!

- **Geographic** response to climate change
- Species migrating into new areas as temperatures warm

White spruce trees in the upper Savage River in Denali National Park, AK.

Credits: Fred Dean (upper) and NPS (lower) http://www.nature.nps.gov/yearinreview/YIR2006/02_g.html

Drought & plants

Image Credit: UCAR

- Periodic drought is a normal part of the climate in many regions
- However, climate change is causing drought-prone regions to become more drought prone

Wildfires

- Drier conditions (including droughts) are creating environments ideal for wildfires
- Warmer temperatures dry underbrush
- The area burned by wildfires in the western US may increase by 50% by the 2050s. (Logan et al., J.G.R., June 18, 2009)
- More fires release more carbon dioxide into the atmosphere, causing more climate change

Questions about plants and climate change?

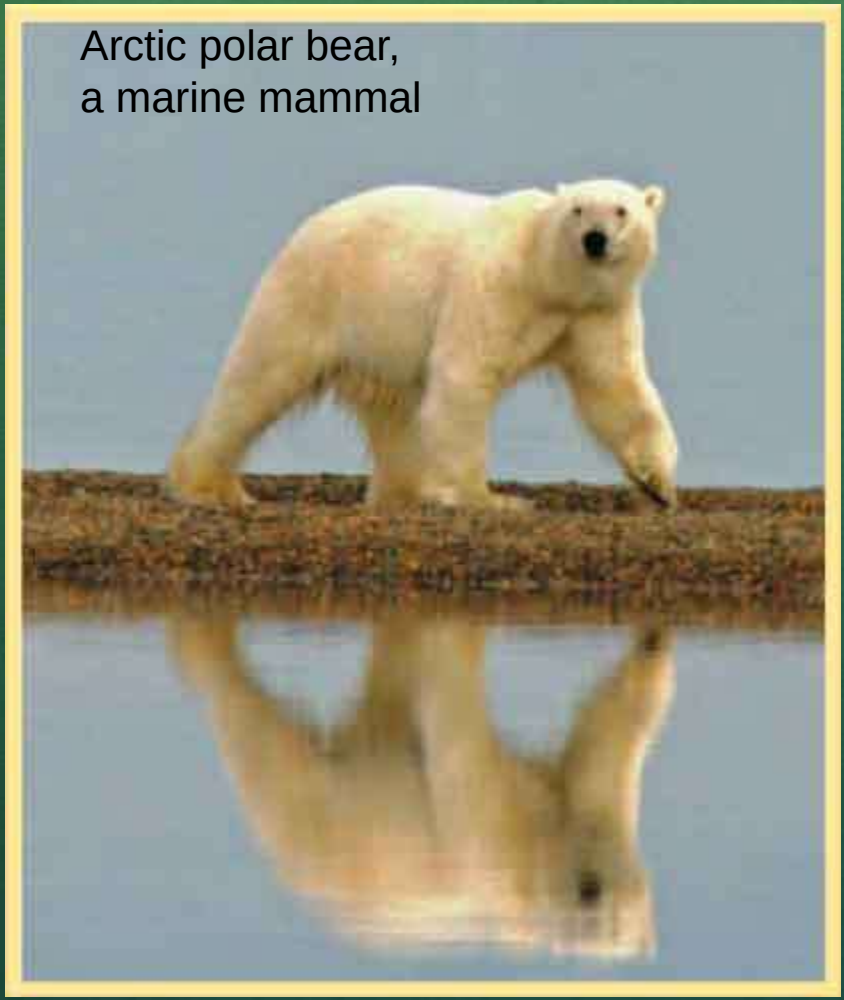
How is climate change affecting marine life?

From the poles to the tropics

How is the ocean changing?

- Water warming
  - Surface temperature of tropical ocean has warmed 0.5-0.7 C over the past two to three decades
  - Temperatures sometimes spike much higher than normal.
- Water becoming acidic
  - Carbon dioxide is getting into the ocean, forming carbonic acid, reducing the pH of seawater
- Sea ice melting
  - Less sea ice is changing polar ecosystems that depend on sea ice cover.

The affect of less sea ice on polar bears



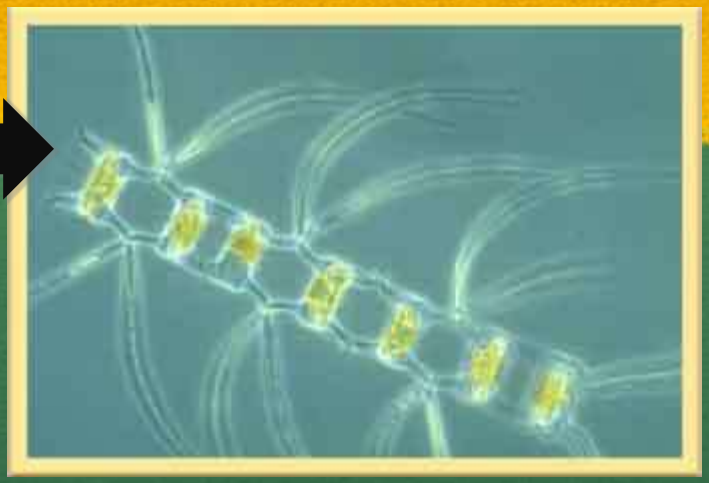
Credit: US FWS, Photo taken at ANWR

- May 14, 2008: US Fish and Wildlife Service made polar bears a threatened species.
- They estimate that rapid melt of Arctic sea ice could make bears endangered species in 45 years.
- Polar bears hunt from sea ice platforms, but have been increasingly moving on land to look for food.

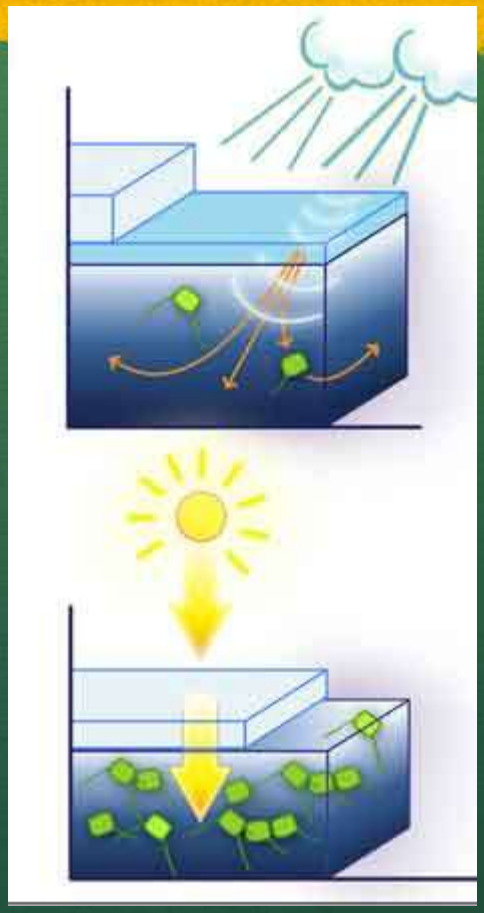
Note that whether polar bears will be able to adapt is an active area of research.

The affect of less sea ice on plankton*

A diatom -
The tiny start of the
Antarctic food web



Credit: Alfred Wegener Institute



Credit: NSF

- Warmer temperatures are changing Antarctic phytoplankton, according to satellite data.
- Less sea ice makes an inhospitable environment for the plankton when windy.
- Less sea ice leads to huge diatom populations where winds are calm.

* Some changes in polar ecosystems don't involve fuzzy white bears.

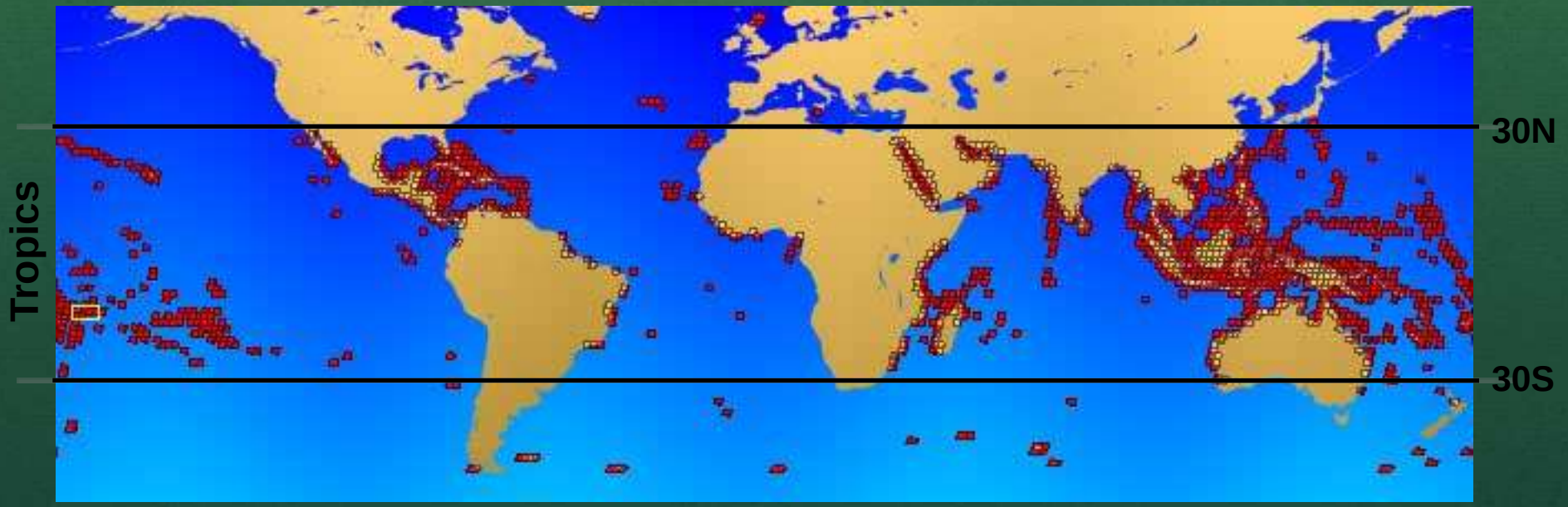
Changing climate, changing coral reef ecosystems

- **Acidification** of ocean water makes it difficult for coral and algae to build reef
- **Warming** water stresses corals, causing them to release the algae that live within their bodies, a process called bleaching

P.S. Reefs are also affected by a other environmental concerns such as pollution and overfishing.

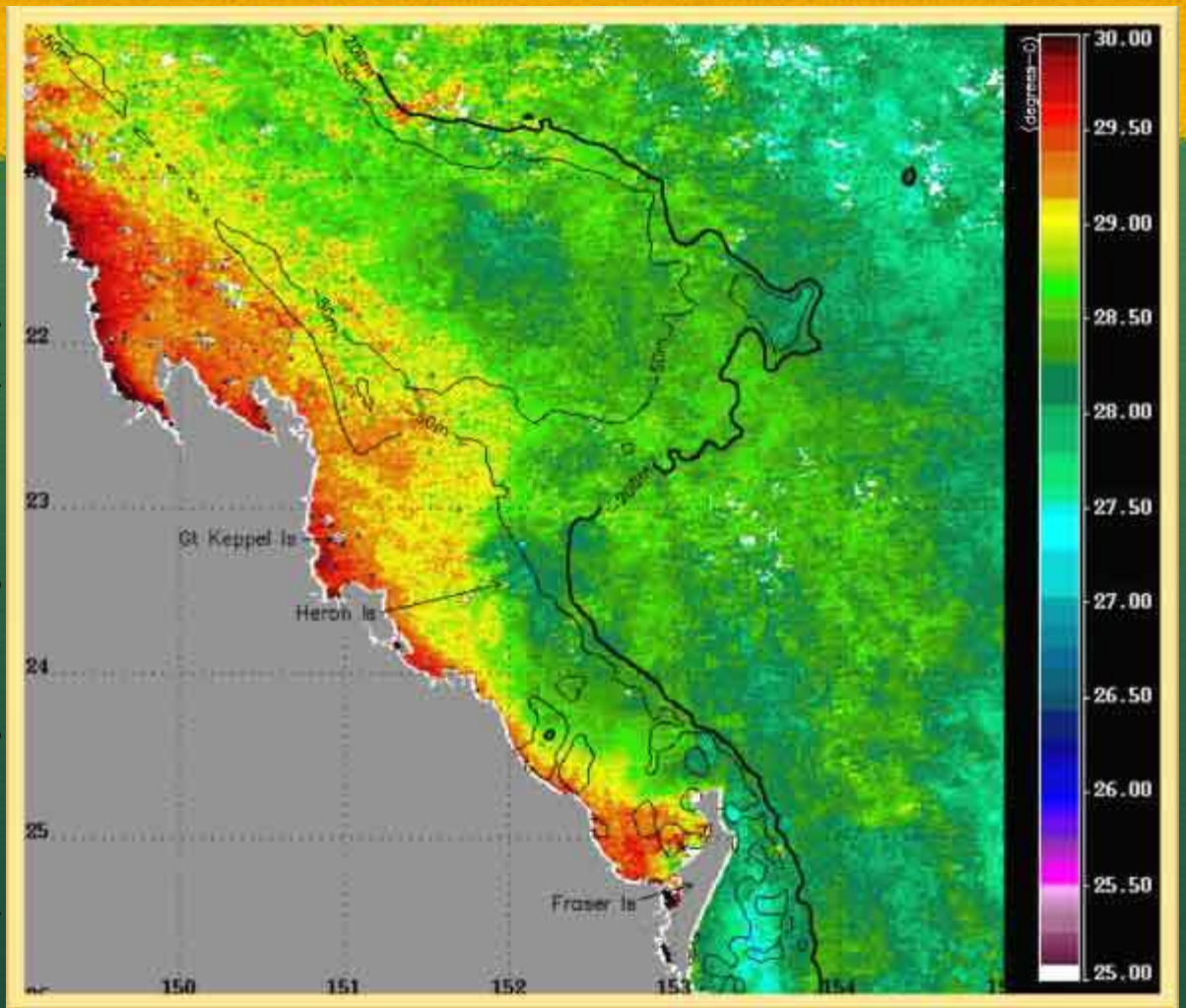
Reefs grow in warm water…

- Coral reefs are found in the tropics (30 degrees North and South of the equator)
- Optimum water temperature for reef growth is 26-27 C



Credit: NASA Millenium Coral Reef Landsat Archive

…but not *too* warm.

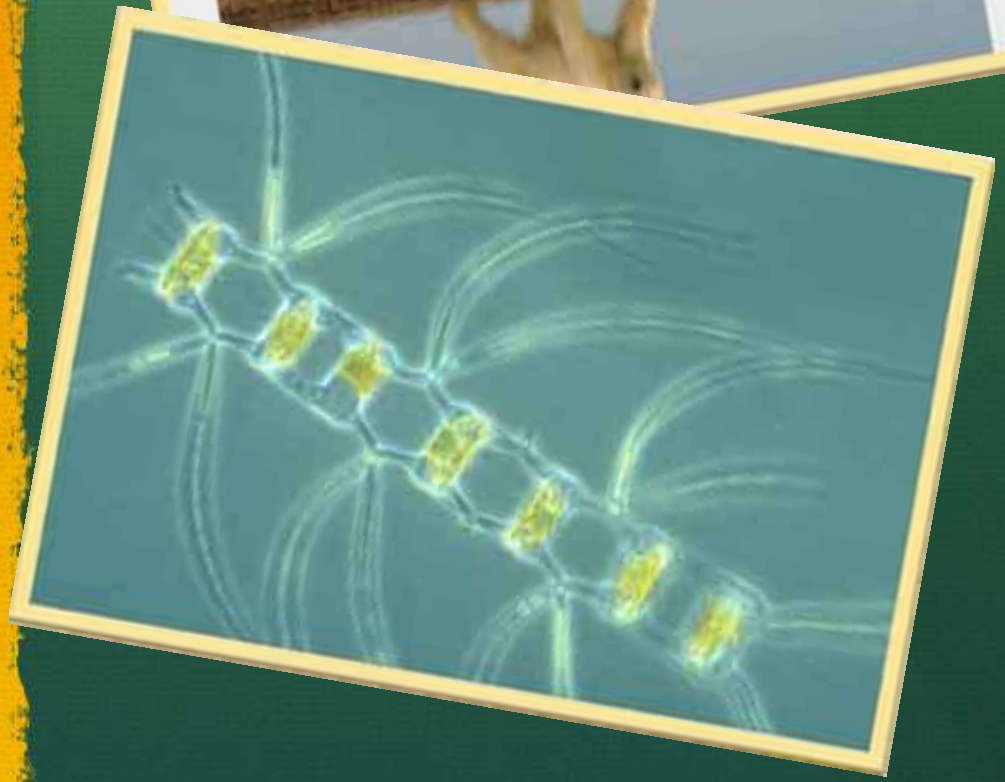


Sea surface temperatures off Australia in 2006. Warm coastal waters caused numerous shallow reef corals to bleach that year.

Image: NASA, MODIShttp://www.nasa.gov/centers/goddard/news/topstory/2006/coral_bleach.html

- 1-2°C warmer waters for several weeks can cause bleaching.
- Coral bleaching is predicted to become more common in the next few decades due to climate warming.

Questions?



How is climate change affecting human health?

Patient receiving treatment for malaria, which may become more common as climate changes (*Image: CDC*)

Changing climate affects animals that carry disease

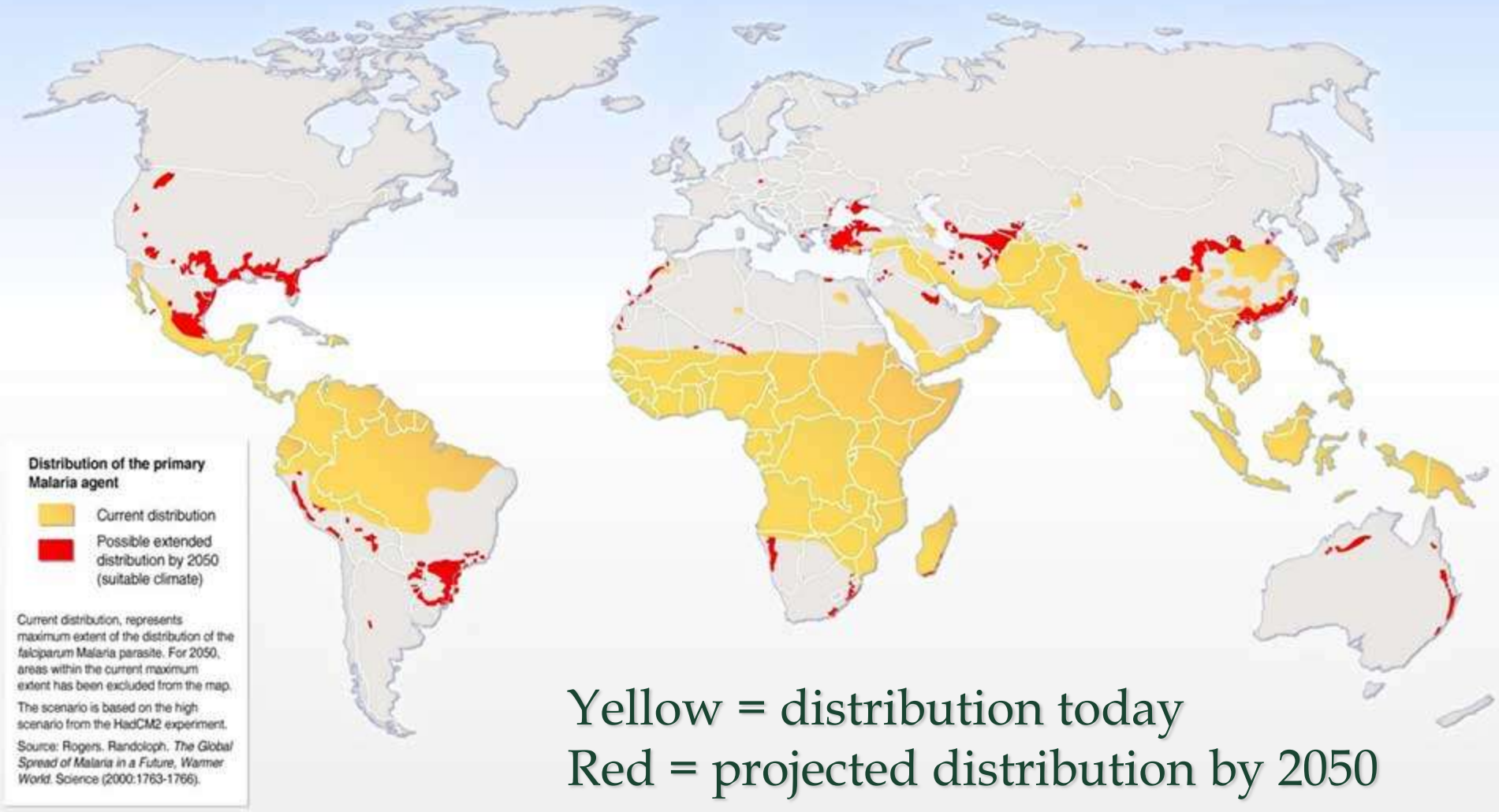
An Anopheles mosquito - Carries malaria

- Mosquitoes and other animals that carry infectious diseases (vectors) flourish in certain environments.
- As regional climates shift, the geographic distribution of vectors change too.

How vectors and the diseases they carry are changing

- **Lyme disease** (carried by ticks) is spreading north into parts of Canada that used to be too cold for the ticks.
- **Dengue** is spreading more rapidly in Bolivia as high rainfall allows the mosquito population to grow.
- **Malaria** may expand into new regions where temperatures become warm. There will be less malaria in regions that become drier.

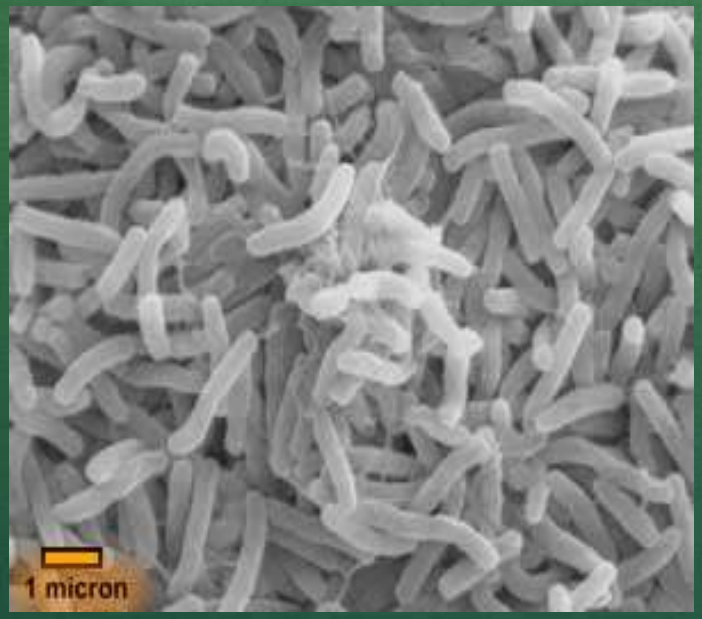
Climate Change and Malaria



Yellow = distribution today

Red = projected distribution by 2050

Water-borne diseases and climate change



Vibrio cholerae bacteria, which cause cholera

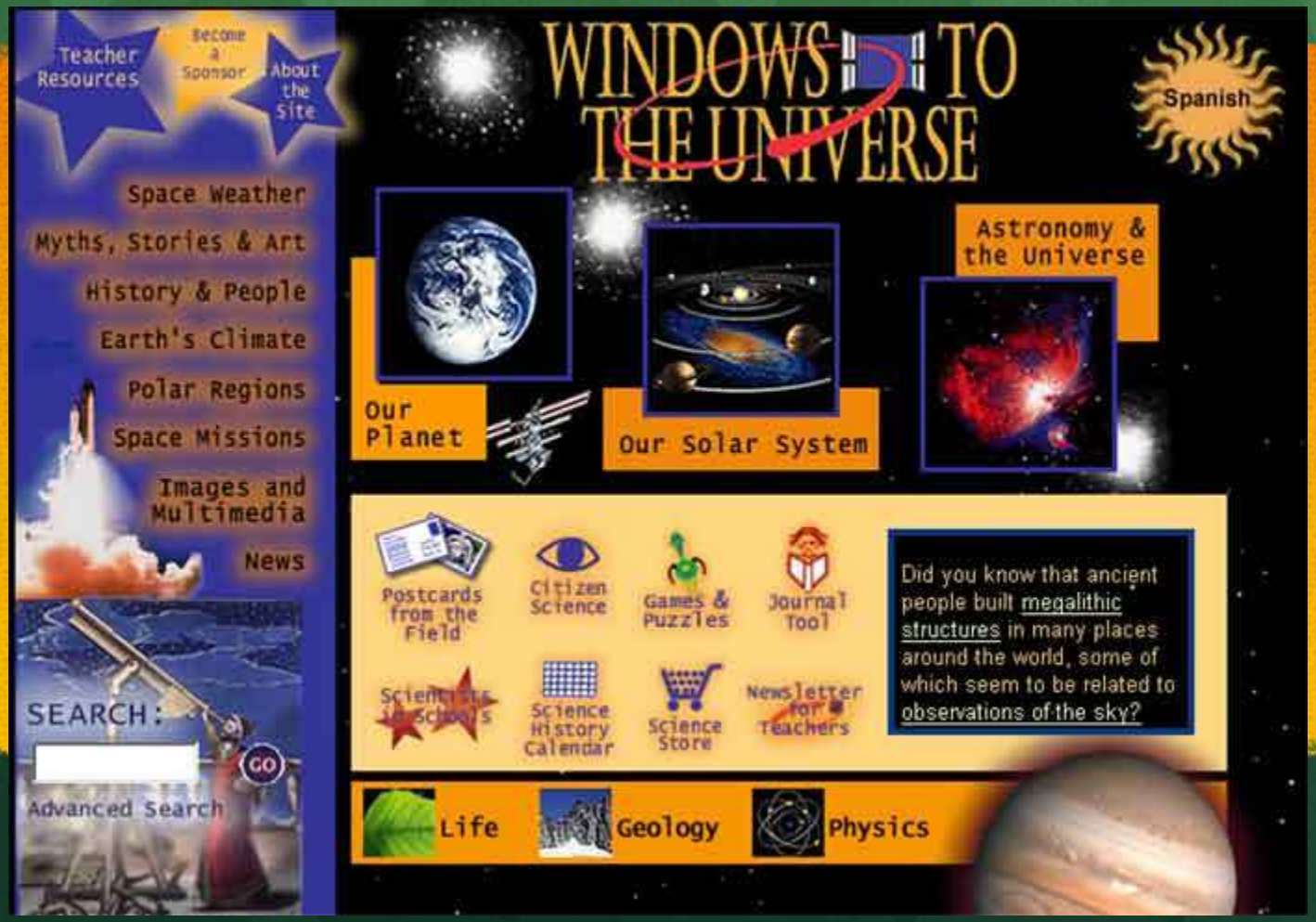
- Includes a number of different "diarrheal diseases"
- Caused by ingesting bacteria, viruses or other microbes via unclean water or food cleaned with unclean water
- Can occur anywhere that water is not clean. A cholera epidemic has been ongoing in Africa for 30 years.
- Extreme rainfall events can facilitate water-borne disease outbreaks. Climate change is expected to bring more extreme rainfall events to some regions.

Water-washed diseases and climate change

- Diseases that spread because of a lack of washing
- Includes the eye infection trachoma that causes blindness, skin mites called scabies, conjunctivitis, typhus, and lice
- Many regions that are currently arid are projected to become more arid in the future, increasing the risk of water-washed diseases.

Questions about climate and human health?

Climate and Global Change on Windows to the Universe



http://www.windows2universe.org

Climate Discovery

A series of online professional development courses for middle and high school educators

CD 501 – Introduction to Climate Change

CD 502 – Earth System Science: A Climate Change Perspective

CD 503 – Understanding Climate Change Today

http://ecourses.ncar.ucar.edu

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The Global Climate Change Educator Professional Development Network Hello everyone! Register at the NSTA Learning Center for these free climate change web seminars this spring. And invite all your secondary science teacher friends to join us too!

March 12 at 3:50pm · Comment · Like

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Web Seminar: Predicting Future Climate and Considering Solutions
Time: 5:30PM Wednesday, April 28th
Location: (Time listed is Eastern Standard Time)

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