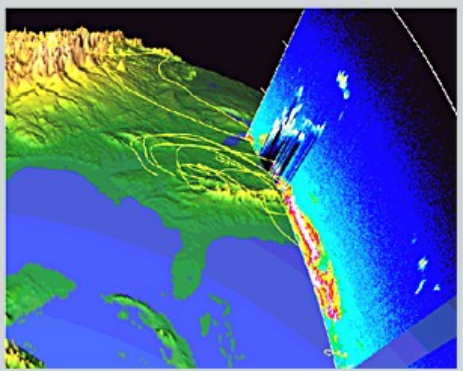
Air Quality



A 3D visualization of data collected by the LITE in September 1994 showing a deep haze layer (yellow and red) over the eastern US and extending into the Atlantic Ocean. Yellow lines trace wind back trajectories, computed from ECMWF data, at the 850 mb level over the 5 days previous to the LITE overpass. The altitude scale is exaggerated. The LITE data extends from sea level to 20 km.

Source: NASA

MAPS

- Measures distribution of CO 3-10km above the earth's surface
  - Near global CO database

TOMS

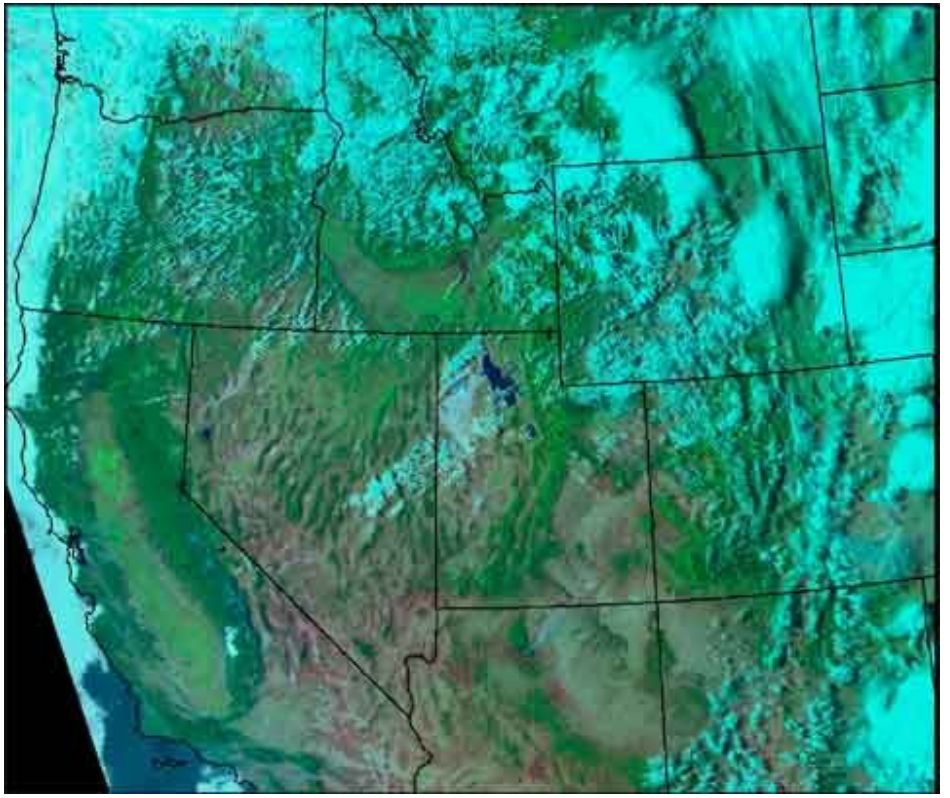
- Measures ozone, UV, aerosols, and volcanic ash emissions

Landsat 7 and Calipso

- Air Pollution Monitoring
  - Ozone, CO, Sulfur Dioxide, Nitrogen Dioxide
- Measure the proportion of light blocked by particulate matter for atmospheric modeling of contaminants

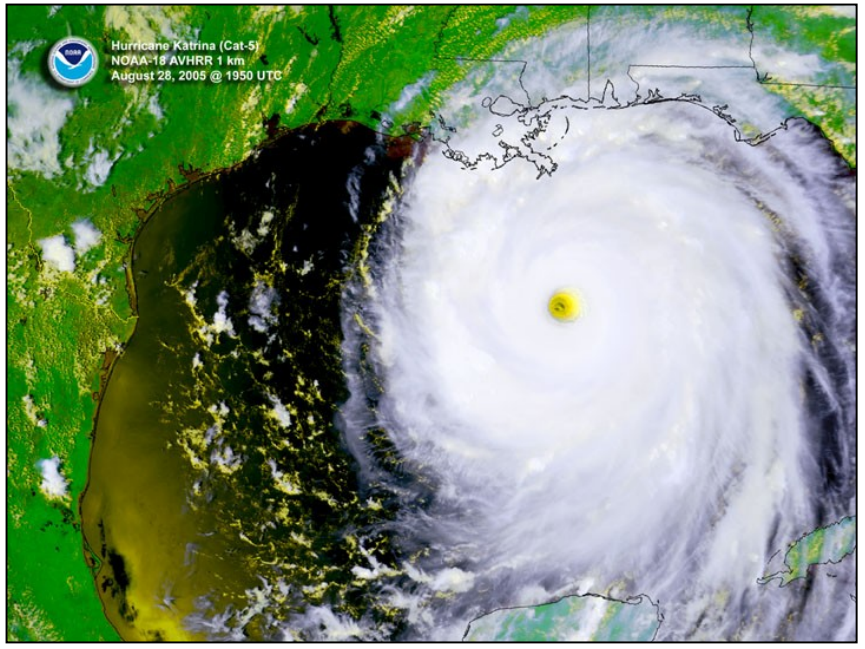
Weather and Climate Data

- Instantaneous data on local, regional conditions
- Longer-term climatological summaries
- Changes in mean, variance



source: U.S. Forest Service

Weather Monitoring

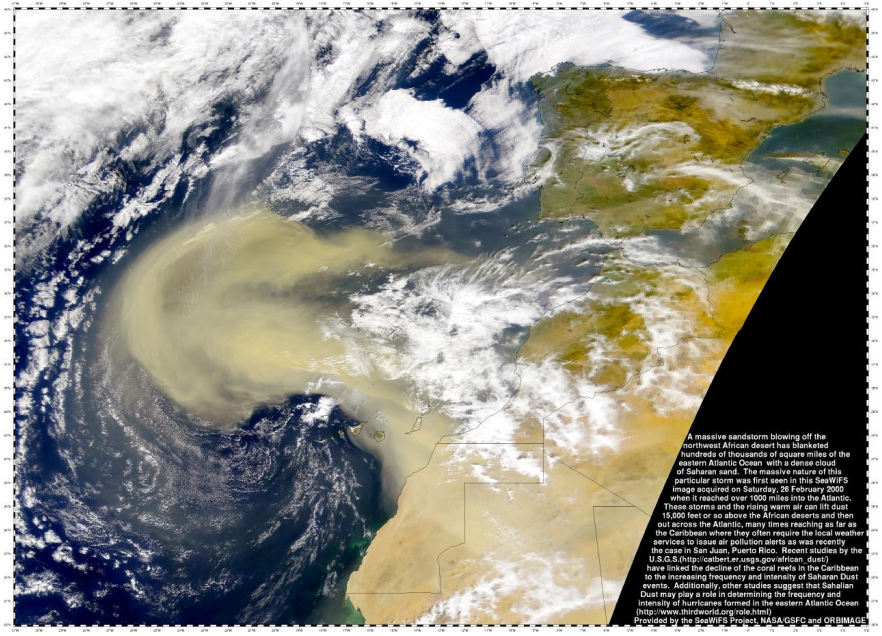


http://www1.ncdc.noaa.gov/pub/data/images/hurr-katrina-20050828-n18rgb.jpg

https://www.youtube.com/watch?v=84Nc7e7pqw4

Hurricane Katrina

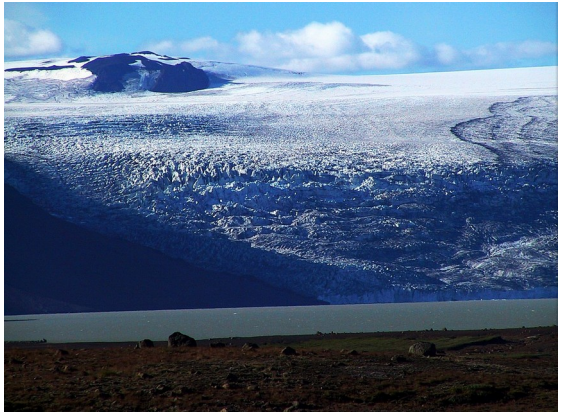
Source: http://seawifs.gsfc.nasa.gov/SEAWIFS/IMAGES/Africa/
S2000057133341.L1A_HDUN_CAN.SaharanDust Storm.small.jpg



African Dust storm

Aquatic Ecosystems

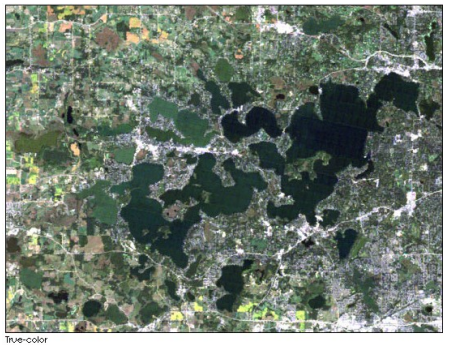
Source: NOAA



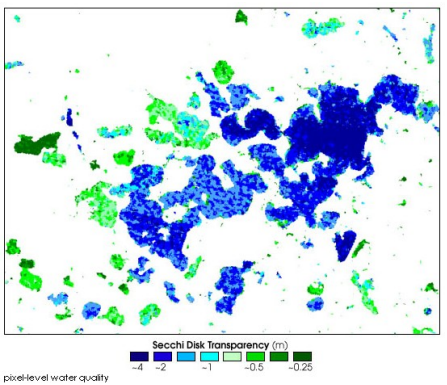
Source: Harri Eliasson

- Runoff
- Flooding
- Water quality
- Water body extent
- River flow rates
- Wetlands mapping
- Water surface elevation and depth
- Ocean color
- Coral reef mapping
- Benthic habitat
- Oil spill monitoring

Hydrology



Source: NASA



Source: NASA

Hydrologic Modeling:

- Watershed geometry
- Drainage network
- Empirical Equations
  Annual runoff, Flood peak, Low flow

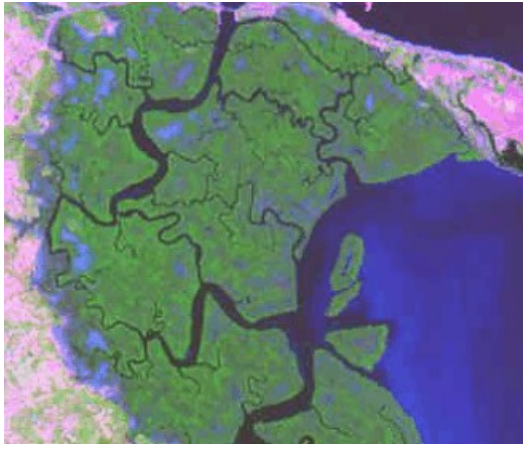
Runoff Modeling:

- Land use
- Soil moisture
- Topography

Water Quality:

- Suspended sediments
- Estimate chlorophyll
- Temperature
- Turbidity
- Eutrophication

Wetlands



Source: NASA

Source: The Nature Conservancy

Understanding of wetland habitat linkages and the complex habitat needs of wetland species

Input on identification, classification and inventory, ecological studies, hydrologic studies, and monitoring change

Flooding

- Compare imagery from before a flood event and at different stages as it peaks and recedes.
- Overlaying GIS layers provides information about the areas that have been inundated.
- Map extent of flooded forests

Pre- flood

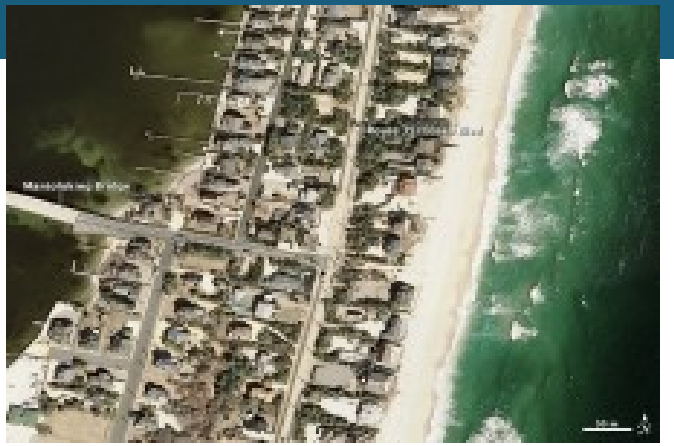
Peak-flood

Source: NASA/Goddard Space Flight Center

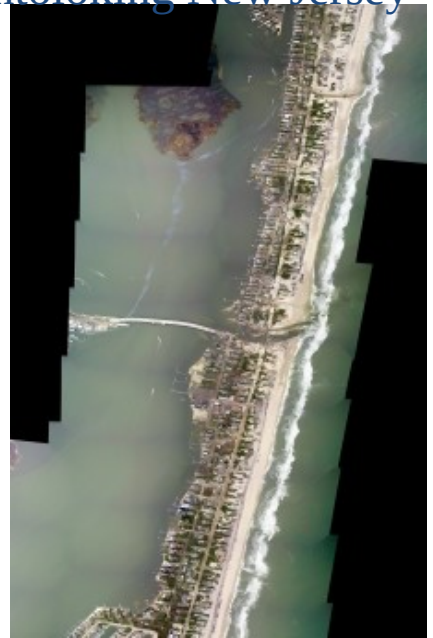
Confluence of Mississippi and Missouri Rivers
During Flood of 1993

Weather after-effects

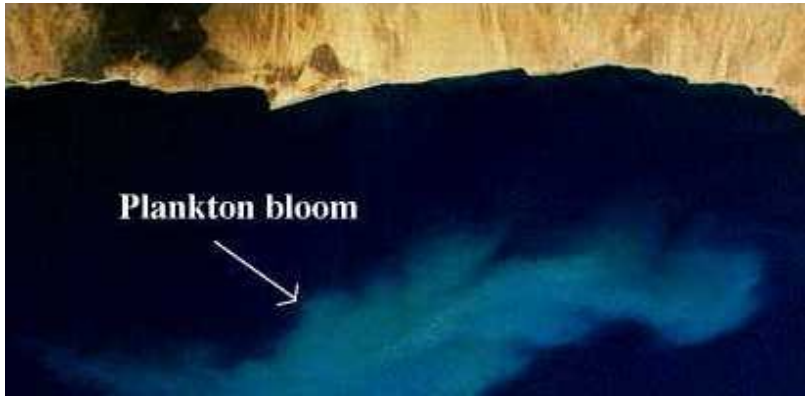
Hurricane Sandy, Monday October 29



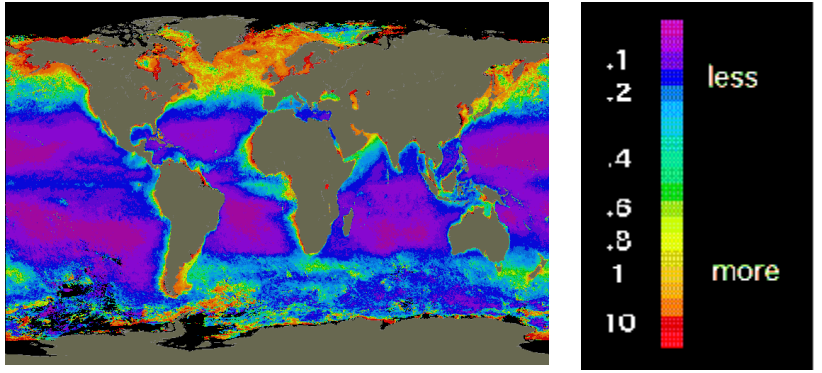
Mantoloking New Jersey



Monitoring Ocean Color



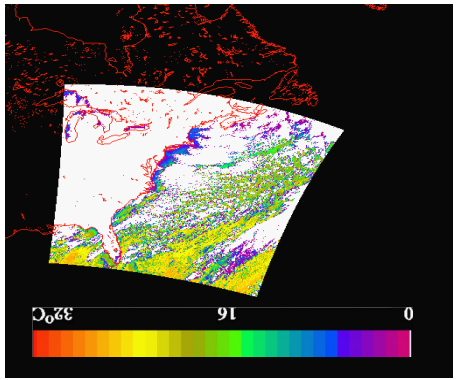
Source: NASA



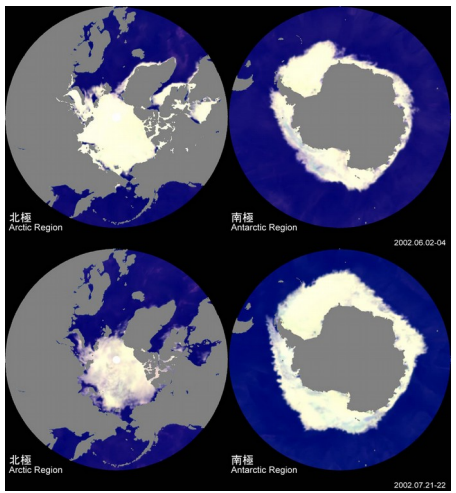
Source: NASA

- Surges in phytoplankton appear as sudden bright blooms in satellite images
- In contrast, relatively low fluorescence indicates a healthy area and appears darker
- Primary productivity can be measured by determining the amount of light absorbed by phytoplankton chlorophyll
- Sensors detect variations in the intensity of light, called ocean color, at the ocean surface
- Specific bands detect chlorophyll absorption

Sea Surface Temperature and Sea Ice



Source: NOAA



Source: NASA

SST

Thermal infrared (TIR) observations

- Measure thermal infrared radiance from sea surface in two different wavelengths
- Calculate "brightness temperatures"
- Convert calibrated radiances to temperatures

Sea Ice

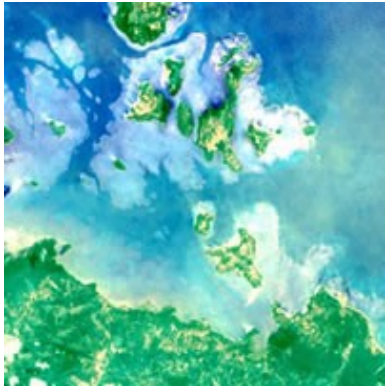
Passive Microwave Sensors

- Salinity
- Surface roughness
- Surface wetness of ice

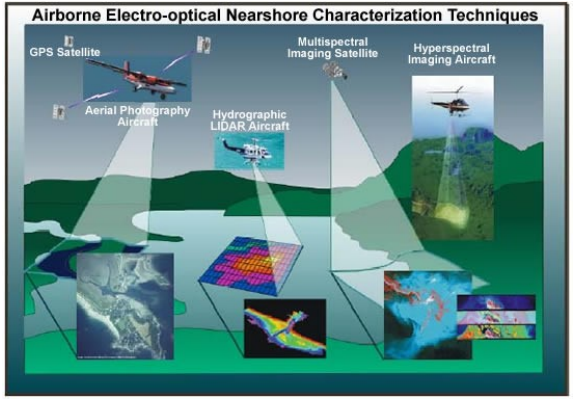
Uses:

- Locate, monitor, and evaluate sea ice movement

Monitoring Benthic Habitats



Source: NASA, JPL



Source: Science Applications International Corporation

Challenges

Imagery must penetrate the water and capture the seafloor

Techniques

High-resolution optical satellite images

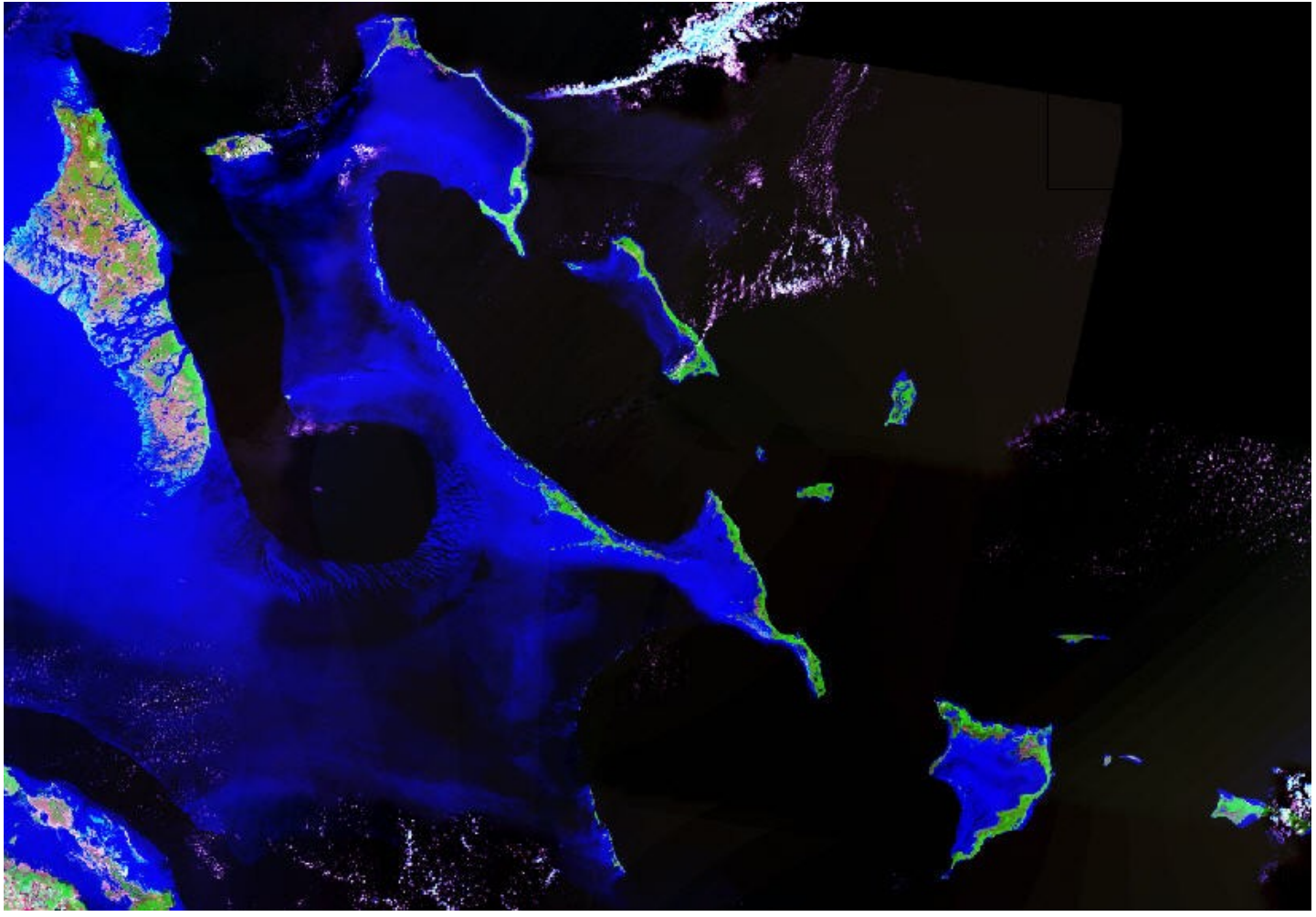
Digital aerial photographs

Active microwave images

Optical (video, still cameras, lasers)

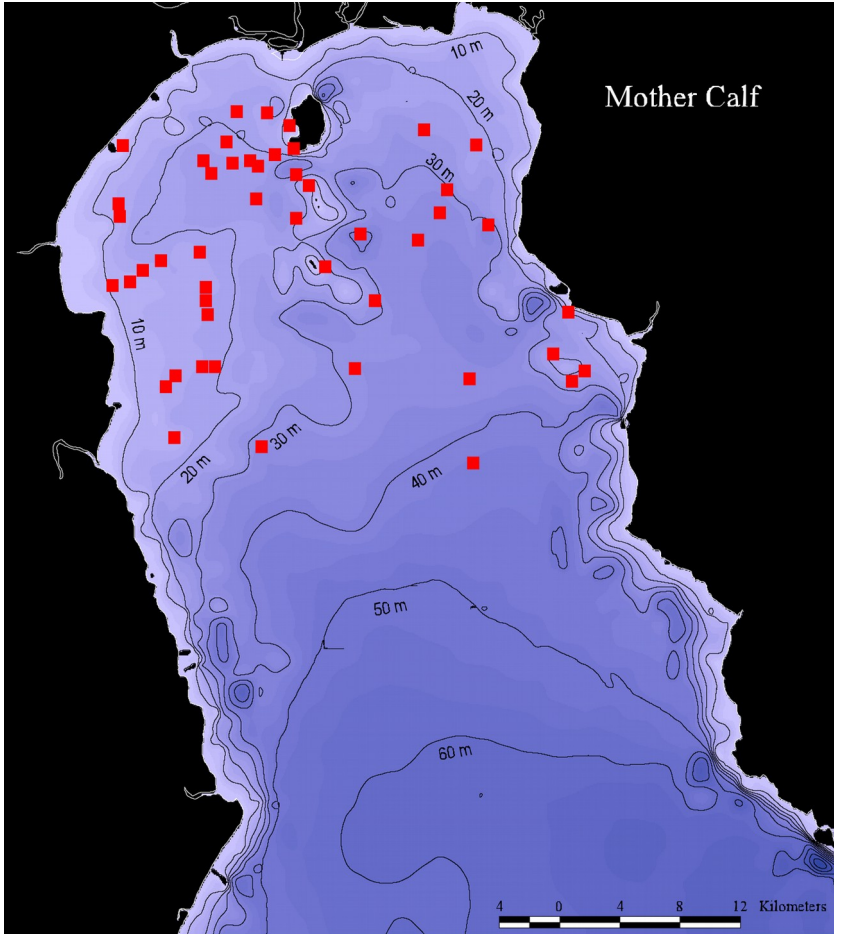
Physical (shipboard acoustic surveys)

LIDAR – narrow high frequency laser beam from aircraft : *When the laser beam hits the water, part of the energy is reflected off the surface and the rest travels through the water column and reflects off the seafloor. The sensor records the time it takes for the reflected signals from the surface and seafloor to return to the aircraft. The water depth is calculated from the time difference between the returns.*

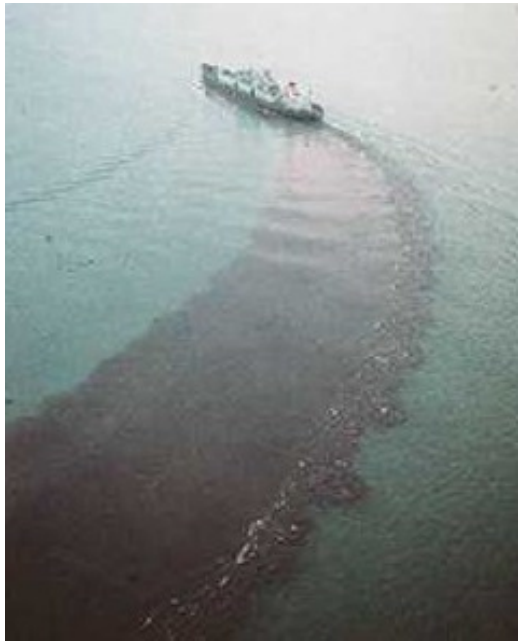


Cetacean habitat use

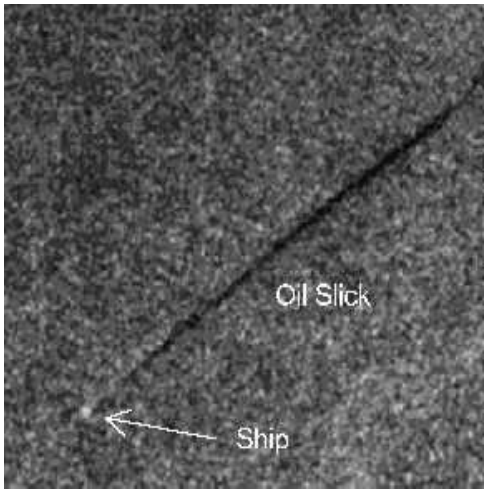
- Assess habitat use and population distribution.
- For example, Mother/calf significantly distributed within and around 20m isobath.
- Areas where come into contact with human interests.
- Individual positions linked into database.
- Superimpose different data layers (AVHRR, SeaWhiffs & TOPEX).

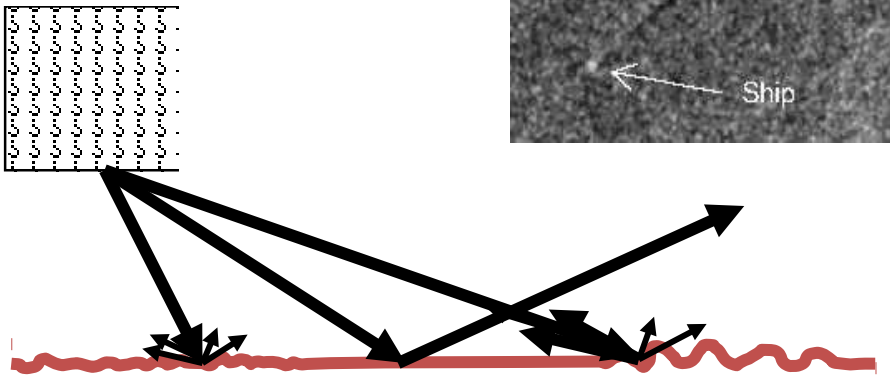


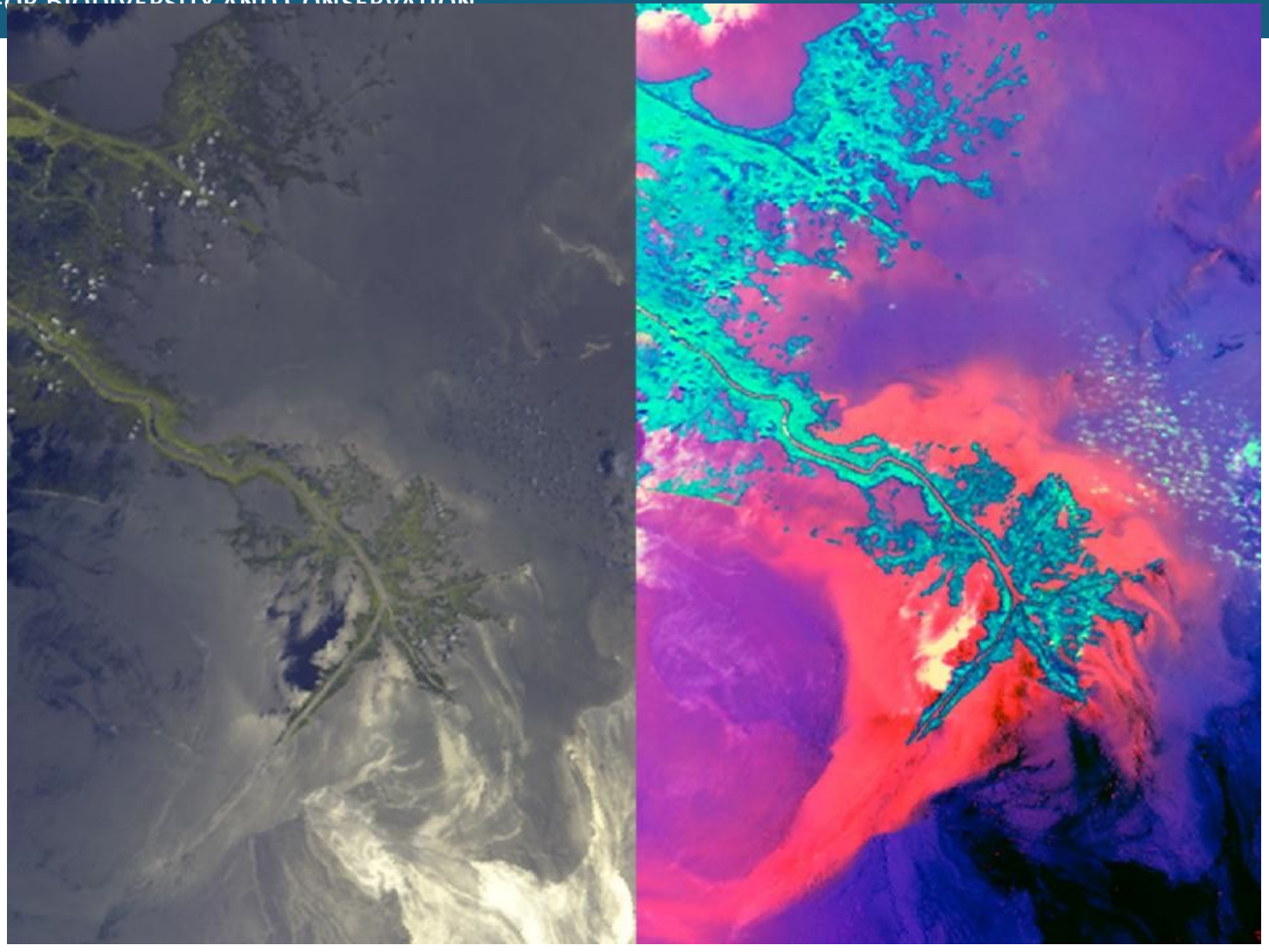
Oil spill detection, mapping and monitoring



© Greenpeace







Fire Mapping and Prediction

Source: U.S. Forest Service

Source: U.S. Forest Service

During Fire Goals:

- Detection
- Behavior
- Monitoring
- Prediction

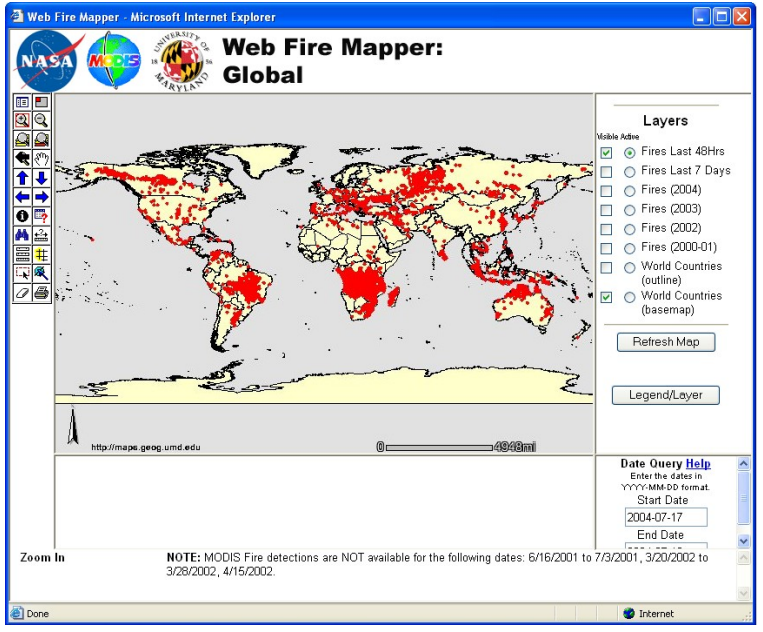
Post-Fire Goals:

- Assessment
- Burn severity
- Mapping
- Rehabilitation

Fire behavior dependent on:

- Fuel
- Weather
- Topographic Factors

Fire Monitoring



Source: NASA

Frequent wide area coverage of satellite remote sensing provides:

- Location
- Frequency
- Spatial distribution

Source: National Weather Service, Sioux Falls

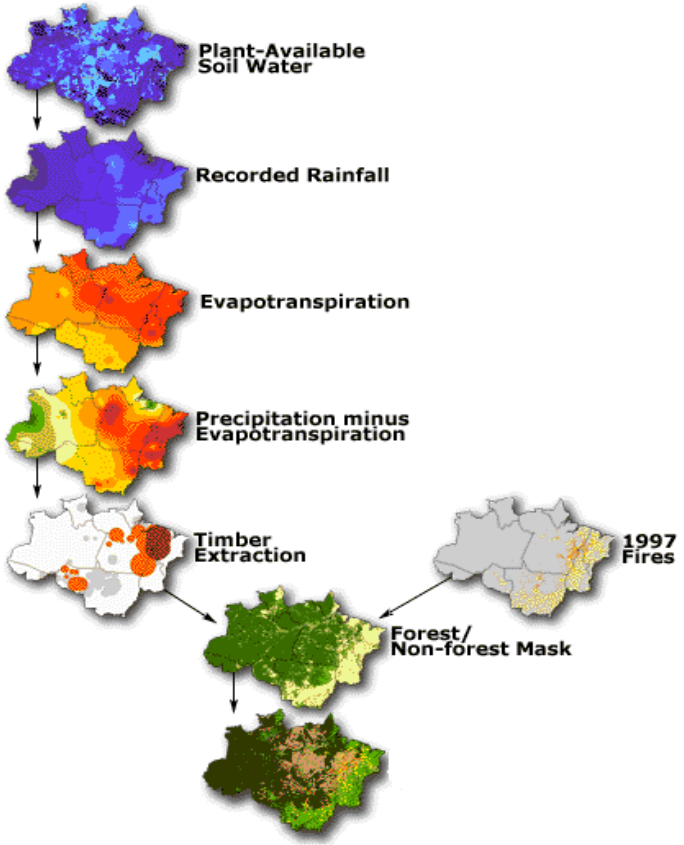
Fire Phases

- Active
- Smoldering

MODIS

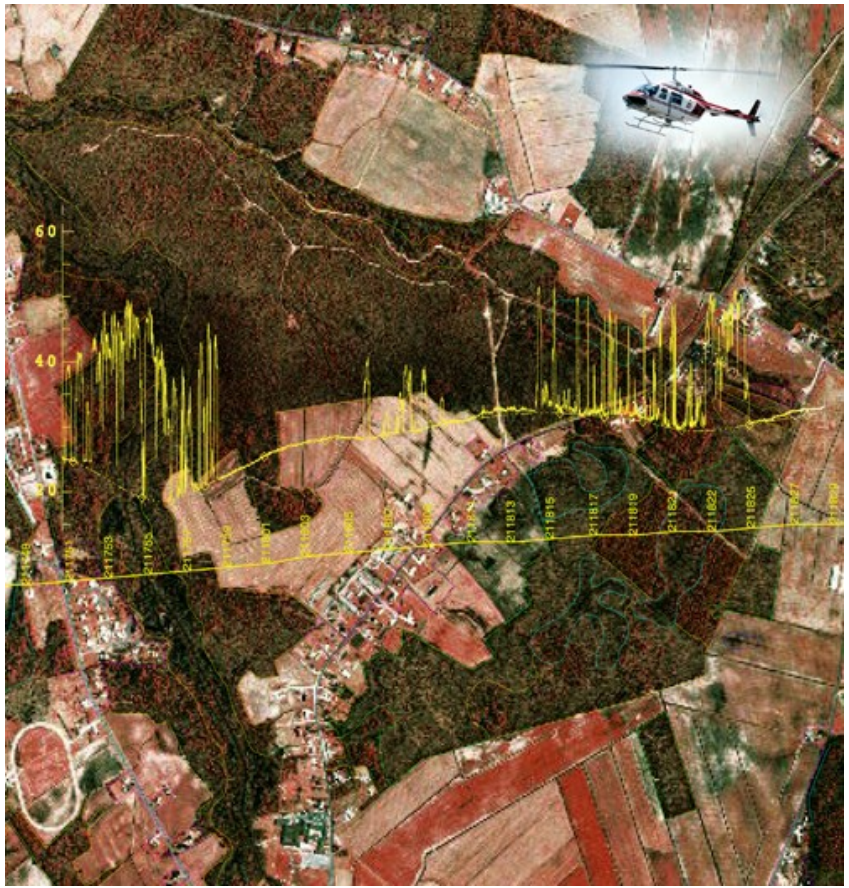
- Detects flaming and smoldering
- Near real-time monitoring capability

Areas of Fire Risk



Source: http://www.ipam.org.br/fogo/ppt-peten.htm

- Forestry



Source: Ross Nelson, NASA Goddard Space flight Center

Tree height

Volume

Stand density

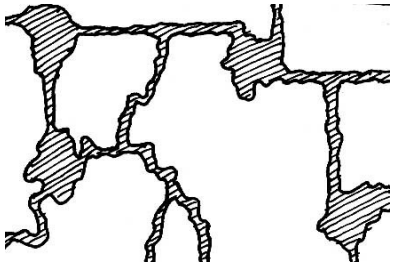
Biomass

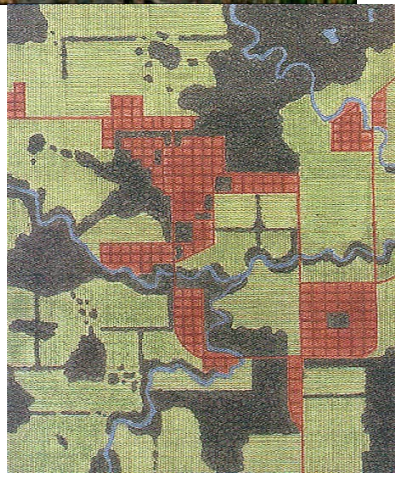
Leaf area index

Structure

Forest Health

Landscapes





Source: University of Idaho

Land Use Land Cover Change (LULCC)

- Repeated inventories of land use and land cover from space
- Simulation of processes (land conversion and use) taking place on the ground

Landscape ecology

- Spatial patterns of landscapes can be observed and documented to model landscape metrics and indicators.

Patches and Landscapes

Patch: land cover is continuous, invariant

Landscape: mosaic of patches of two or more land-cover types

As Resolution Increases, Landscapes Appear More "Patchy"

Level I: 15 broad ecological regions

Level II: 52 ecological regions

source: U.S. Environmental Protection Agency

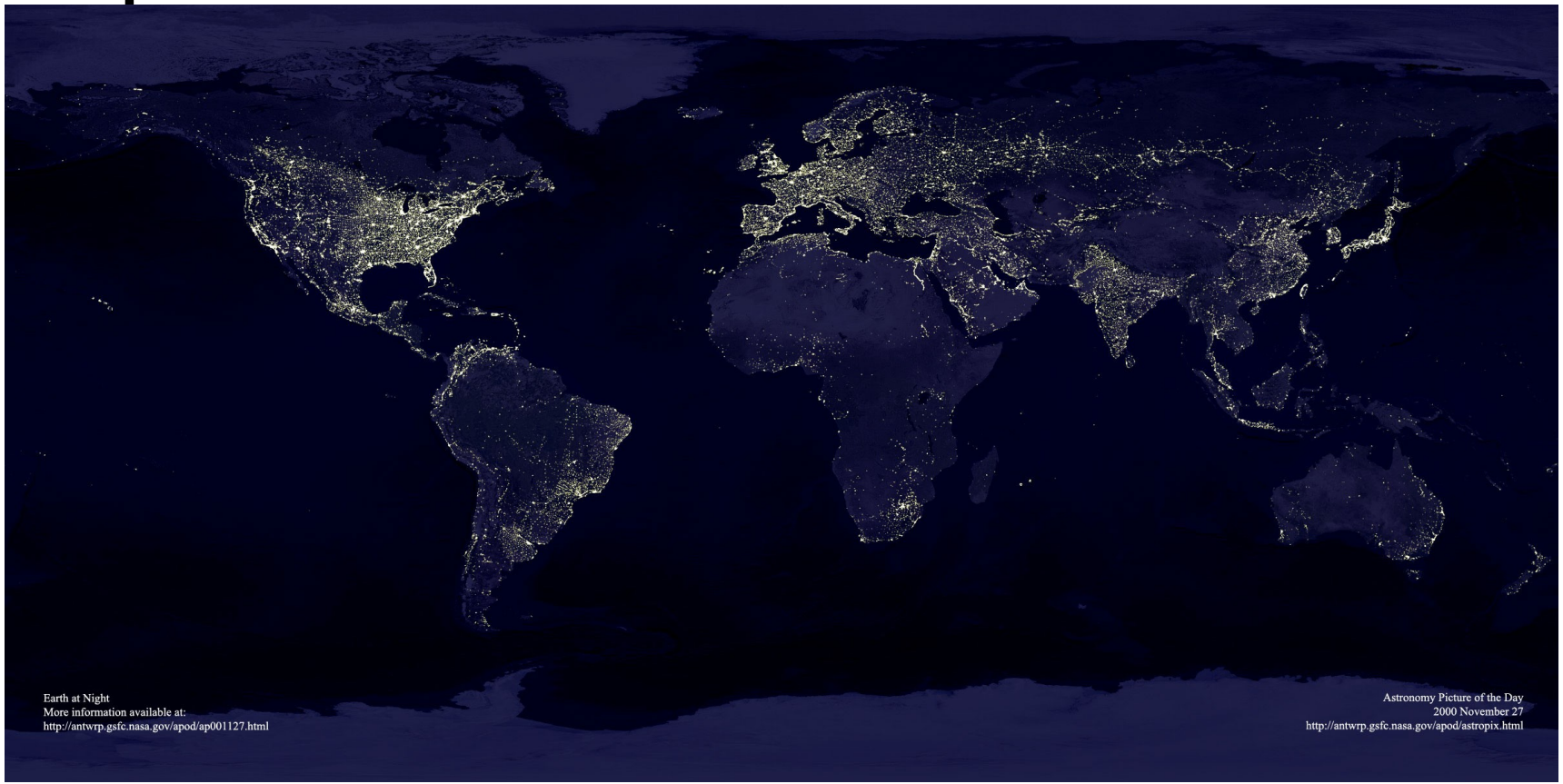
Advantages of RS and GIS

- Cost-effective method of monitoring land cover and use
- Allow monitoring of global processes
- Can observe remote areas
- Enable the integration of many different types of data
- Encourage better information management
- Facilitate historical comparisons
- Create a clear and striking visual product
- Develop and compare options for future land use

Limitations of RS and GIS

- Cost of satellite images, software and equipment
- Cloud cover
- Error in data interpretation
- Satellite coverage
- Lack of visible light
- Large data storage needs
- Limited historical data
- Lack of good species data

Population distributions



Nighttime lights - November 27, 2000

http://antwrp.gsfc.nasa.gov/apod/image/0011/earthlights2_dmsp_big.jpg