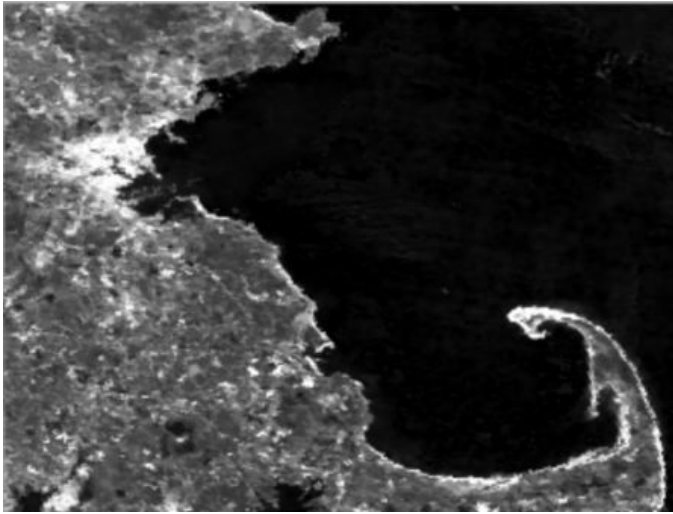


A satellite image of New England, USA, showing a large area of green vegetation. A prominent, winding river or waterway is visible, colored in a dark blue/purple hue, cutting through the green landscape. The terrain appears to be a mix of forested areas and open land. The overall image has a slightly grainy texture, characteristic of satellite data.

Measuring Vegetation Health Investigation Using Remote Sensing Data : Spatial Aspects

MODIS satellite image
of New England

MODIS 500 meter resolution



Landsat 30 meter resolution



The Earth Observing satellites have different **spatial** views of Earth depending on the instrumentation of the satellite and what it's purpose is. How many scenes an instrument can capture each orbit and how large it's Earth **footprint** is will tell us about **repeat-cycle** and image **resolution**.



IKONOS
1 meter
resolution
Fenway
Park

We will look at images with which you may be familiar around Boston, Massachusetts.

These images will be from three different satellites that are in orbit at least 250 miles above the earth. The satellite images have different **resolutions**. We will look at Fenway Park, Bunker Hill Monument, and Logan Airport.

IKONOS satellite image
September 6, 2000



Digital photograph
courtesy of BaseballPilgrimimages.com

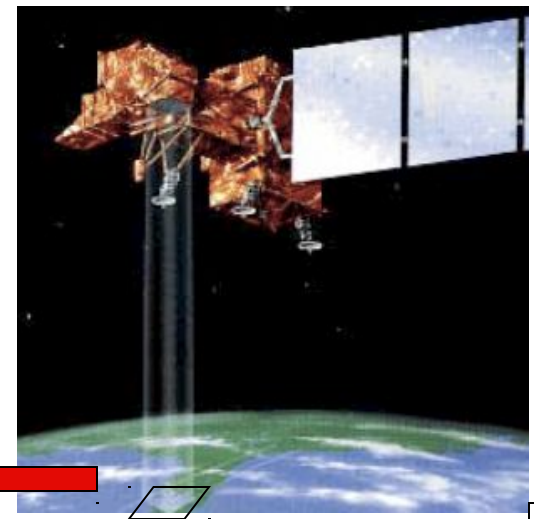
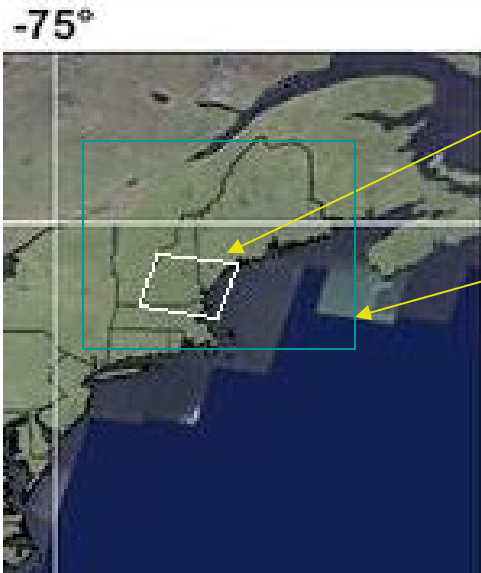
You will have an opportunity to zoom in and out of images.

Satellites have a **footprint**: the area on earth they cover for one scene.

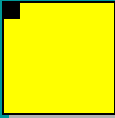
For **MODIS**, the footprint size is 10 degrees by 10 degrees, or about 1000 kilometers on a side. A MODIS footprint (blue box) is called a “tile”.

A **Landsat** footprint is 185 km on a side. (See the white outline)

About how many Landsat footprints are in a MODIS footprint?



Landsat footprint



The smallest data “point” of a satellite image is called a pixel. A pixel is the smallest piece of a footprint. The word was created from a shortening of “picture element”.

To scale, the blue outline represents one MODIS 500 m pixel, the yellow box would be one 30 m Landsat pixel, and the black square would be one 4m IKONOS pixel.

Repeat-cycle

It is important to know how frequently a satellite will look at the same geographic area on Earth so we can compare images that are taken at different times. Because the Earth rotates beneath the satellite, the orbit shifts every 100 minutes, and takes a “snapshot” of Earth below it several times an orbit. The repeat-cycle is how long it takes the satellite to be aligned over the same area again.

Satellite Instrument	Pixel Size	Footprint	Repeat cycle
MODIS	500 m	1000 km per side	2-3 days
Landsat	30 m	185 km per side	16 days
IKONOS	4 m	11 km approx	144 days



The blue outline contains a 500m x 500 m area on this IKONOS image. The blue box represents one MODIS pixel.

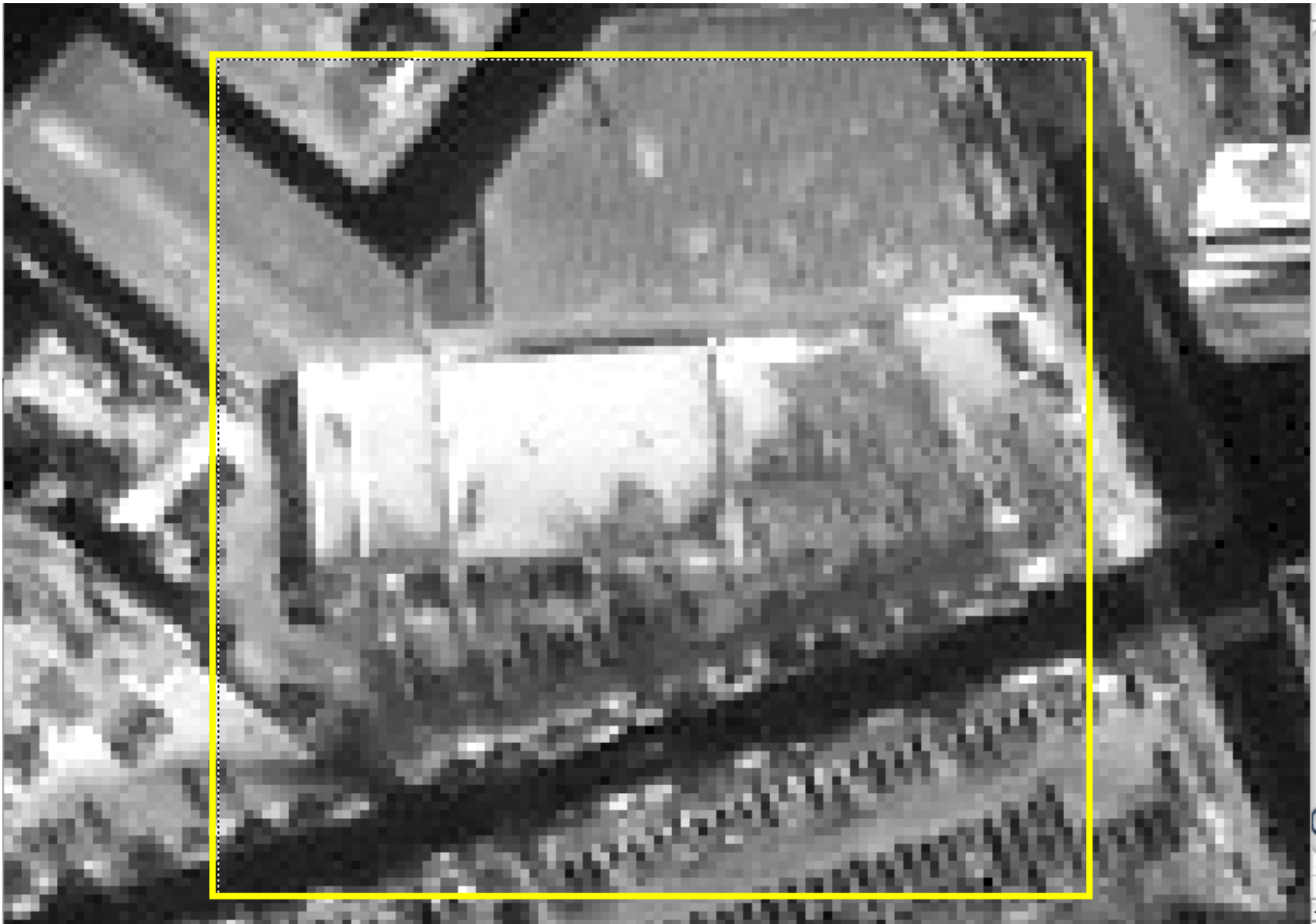


IKONOS
1 m
resolution
100 m box

How does
the yellow
box
compare
with the
distance
from home
to first
base?

100 m box zoomed until pixels appear on IKONOS image

The lower right corner has parked cars. About how long are they?



← St Lawrence River

← Lake Champlain

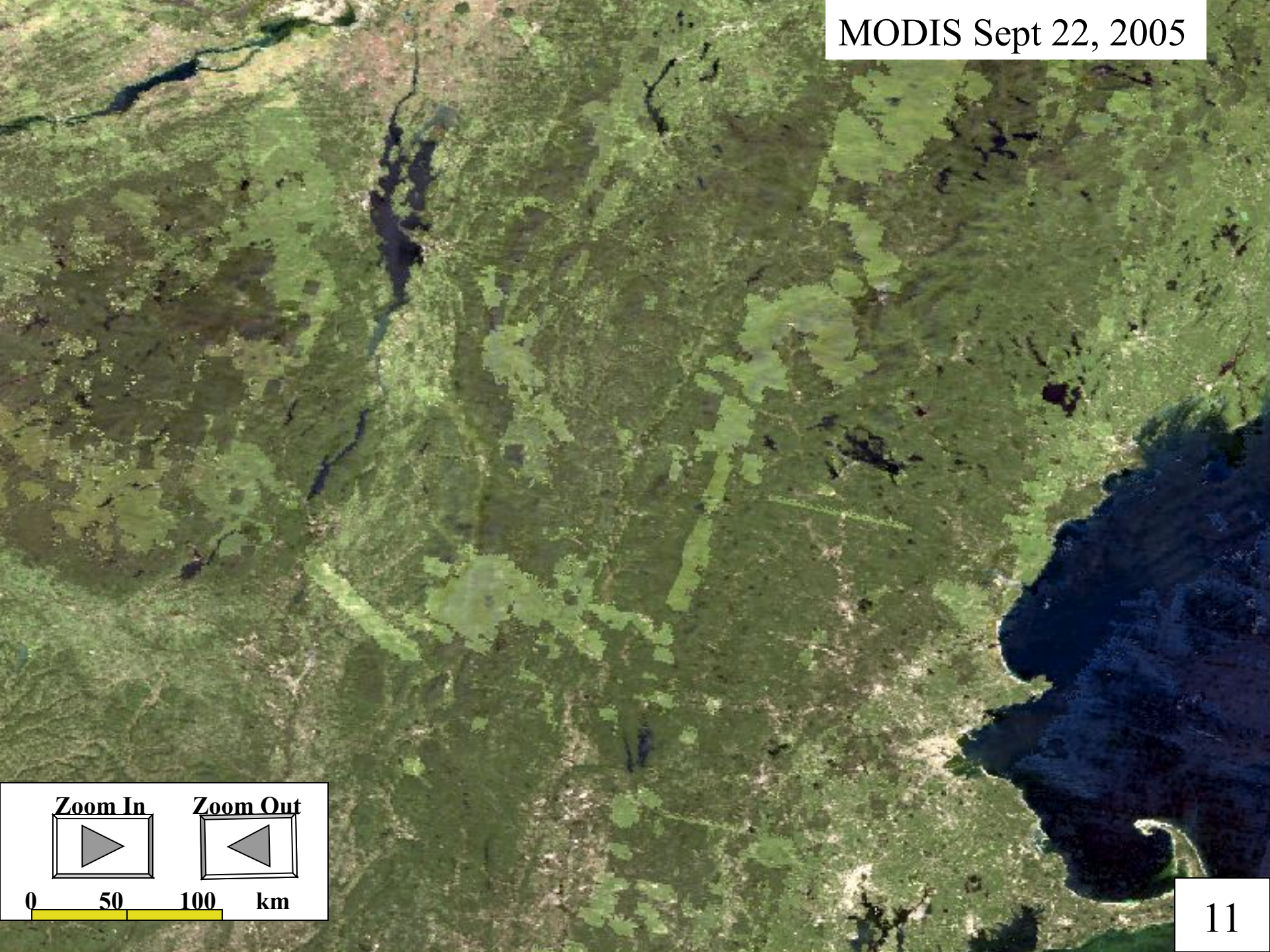
Do you see rivers or other geographic features on this slide?

→ Boston

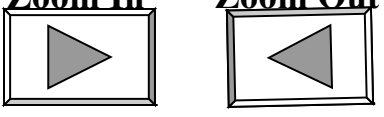
→ Cape Cod

Scale Zoom In

50 km



Zoom In **Zoom Out**

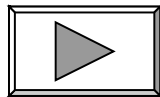


0 50 100 km

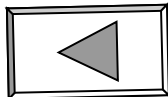
The complex block contains two icons: a right-pointing triangle labeled 'Zoom In' and a left-pointing triangle labeled 'Zoom Out'. Below these icons is a scale bar with markings at 0, 50, and 100 km.



Zoom In



Zoom Out



0 25 50 km



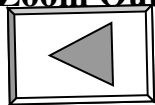
MODIS Sept 22, 2005



Zoom In



Zoom Out



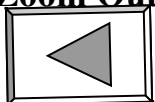
0 25 50 km



Zoom In



Zoom Out



0 30 60 km

You can start to see individual pixels and Boston appears “out of focus”.

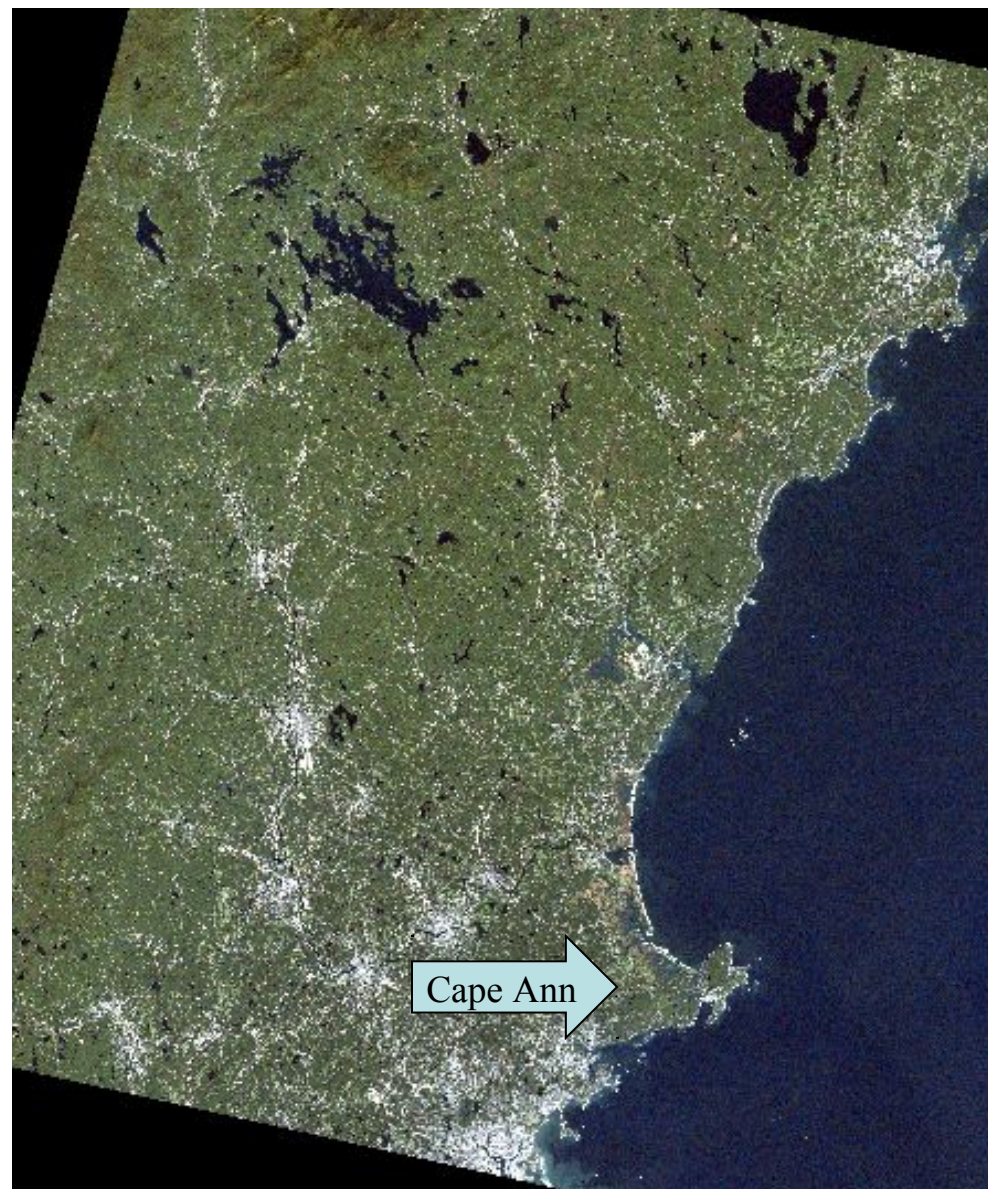


Next slide Zoom Out

0 15 30 km



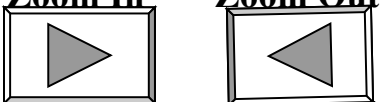
MODIS Sep 2005 500m resolution



Landsat ETM Sep 2000 30m resolution



Zoom In **Zoom Out**

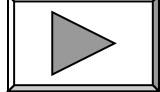
The Zoom In icon consists of a gray right-pointing triangle inside a white square with a black border. The Zoom Out icon consists of a gray left-pointing triangle inside a white square with a black border.

0 6 12 km

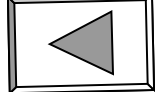
Landsat ETM+ September 27, 2000



Zoom In



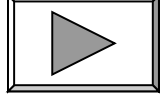
Zoom Out



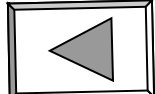
0 3 6 km



Zoom In



Zoom Out

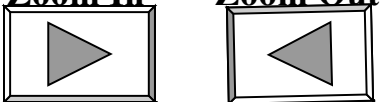


0 1.5 3

km



Zoom In **Zoom Out**

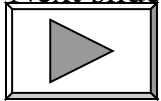


0 3 km

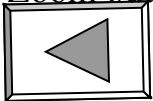
This block contains navigation and scale controls. It features two icons: a right-pointing triangle labeled "Zoom In" and a left-pointing triangle labeled "Zoom Out". Below these icons is a yellow scale bar with the number "0" at the left end and "3 km" at the right end.



Next slide



Zoom out



km

IKONOS images in spectral bands have 4 meter resolution.

IKONOS panchromatic band (appears black and white) is 1 meter resolution.

Here we will look at the **panchromatic** images to get the best resolution.



IKONOS

1m pixels

km 1 2 3



Landsat

30m pixels

These two images are about the same scale, but Landsat is at the limit of its resolution. You will see the difference in detail when you zoom the 1m IKONOS image.