

To Observe the Earth and Visualize the Future: One School's Story

John D. Moore

Albert Einstein Distinguished Educator
Fellow

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Burlington County Institute of Technology, Medford, New Jersey

- Four-year Comprehensive Vocational - Technical School Grades 9-12
- County school open to all residents
- Geospatial Technologies Career Major



Timeline of Events

- 1994 GLOBE Briefing in Washington DC
- 1995 GLOBE Teacher Training Workshop
- 1998 GLE I Helsinki Finland
- 1999 Croatia Land Cover Symposium
- 2002 GLE II Croatia
- 2003 Intergraph International “Educational Best Practices Award”
- 2004 Intergraph International “Educational Best Practices Award”

Timeline of Events

- 2004 GLOBE Denmark Exchange
- 2005 NJ GLOBE Partner
- 2008 NJEA NJ Classroom Close-up Feature
- 2009 Burlington County College NASA STEM Education Grant
- 2009-2010 Einstein Fellow: NSF Directorate of Geosciences

School to School Collaborations

- Digital Earth: GIS
- WeatherWatchers: Observing the Earth System
- IPY: Climate and Land Cover Study

IEEE Geoscience and Remote Sensing Society

- Toronto, Canada
- Toulouse, France
- Anchorage, Alaska

Satellite and Education Conference

- West Chester, PA
- Cal-State LA
- MYSPACE Project(s)

SPACE-EARTH : EARTH-SPACE

“SEES” Model

Students now have the ability to
examine a geo-referenced location from the
top-down and bottom-up

Space to Earth:Earth to Space “SEES” Model

- Examines a geo-referenced *location* from the top-down and bottom-up
- Fosters Geospatial Thinking
- Identifies geo-referenced data points/sources
- Incorporates Real-time Data

Identifying Sources of Real Time Data and Imagery

- National Aeronautics and Space Administration
- National Oceanic and Atmospheric Administration
- United States Geological Survey
- Environmental Protection Agency
- Digital Library for Earth Systems Education
- GLOBE Program
- Others

Geographic Information Systems (GIS)

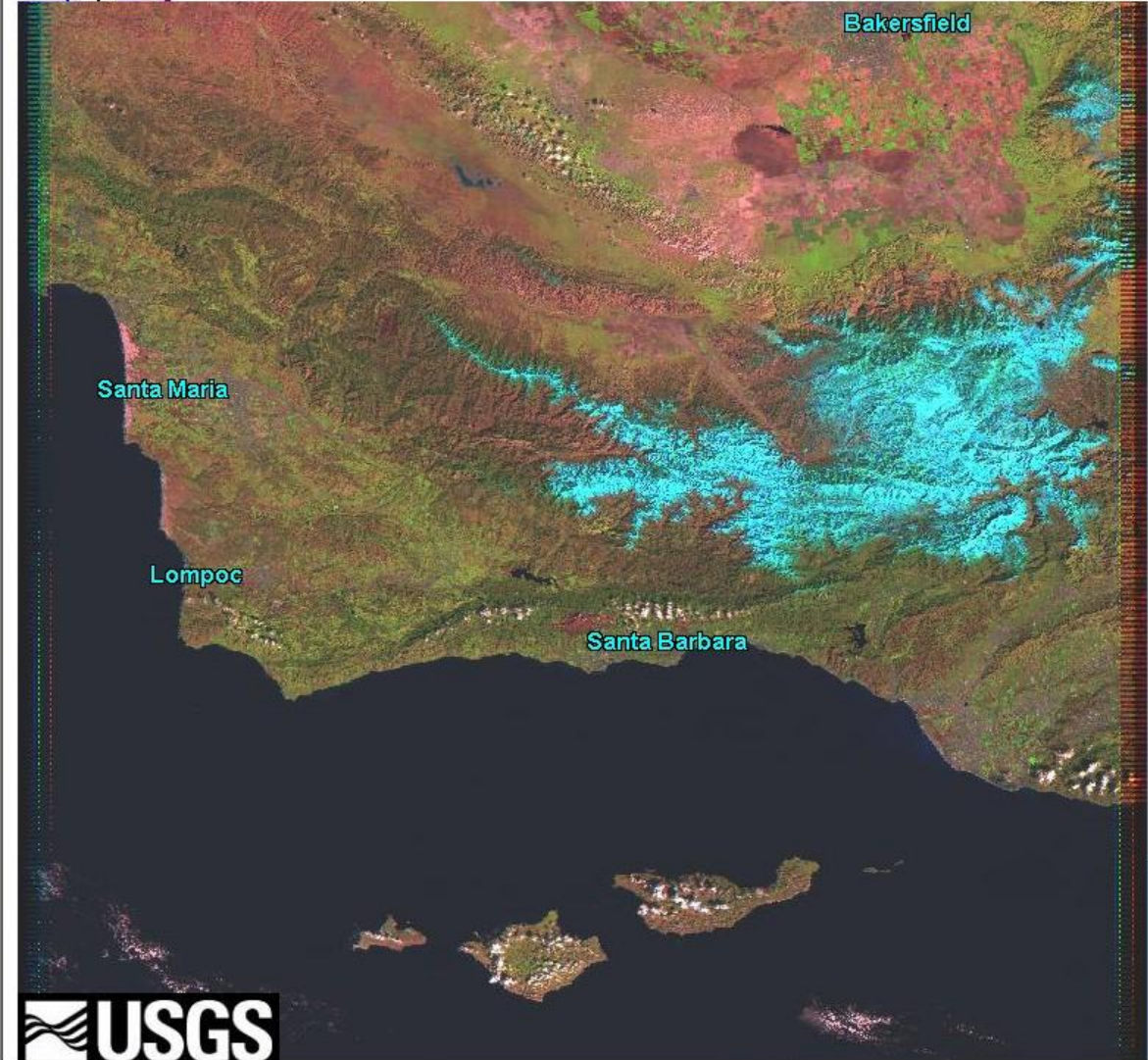
- Visual representation of Data Sets
- Layers (Themes)
- Geo-referencing (GPS)
- Analyze (Query) Geospatial Data
- Geospatial Thinking



USGS Home
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EarthNow! Landsat Image Viewer

[Help](#) | [FAQ](#)



EarthNow! Landsat Image Viewer

Now Showing: Landsat 5
Live Broadcast
Acquired: 1:20pm 18-Feb

Satellites

View: All
Types: All

- KOREASAT 2
- KOREASAT 3
- LANDSAT 5**
- LANDSAT 7
- LEASAT 5
- LES 9
- LMI-1
- LO-19
- LUCH 1
- MABUHAY
- MAQSAT B
- MAQSAT H
- MARISAT 2

Sat. Info: Info. displayed in browser.

JTrack - 3D
View Satellite Options
18 Feb 2009 18:28:21 GMT

LANDSAT 5

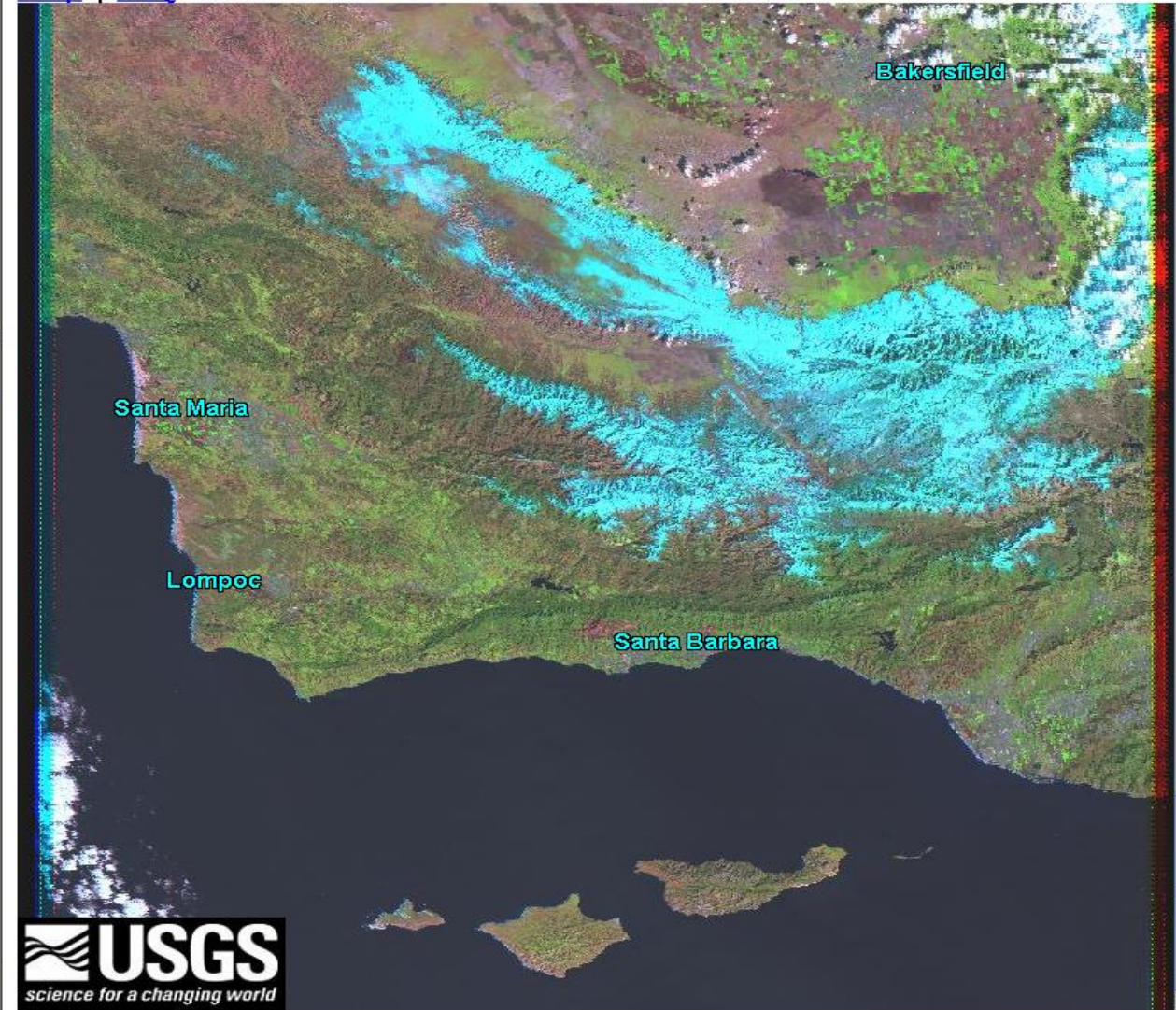
LANDSAT 5	
Latitude	6.0
Longitude	-126.0
Altitude (km)	703.8
Velocity (km/s)	7.504
Period	1:38:49
Inclination	98.25





EarthNow! Landsat Image Viewer

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EarthNow! Landsat Image Viewer

**Now Showing: Landsat 7
Live Broadcast
Acquired: 1:24pm 10-Feb**

Landsat 7 scenes over the U.S. with less than 20% cloud cover are available for download within 24 hours of acquisition at <http://glovis.usgs.gov>.

Landsat satellites have been acquiring images of the Earth's land surface since 1972. Currently there are more than 2 million Landsat images in the National Satellite Land Remote Sensing Data Archive. For more information about Landsat visit <http://Mandsat.usgs.gov>.

Acquired at the U.S. Geological Survey Center for Earth Resources Observation and Science (EROS), Sioux Falls, SD



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EarthNow! Landsat Image Viewer



Now Showing: Landsat 7
Live Broadcast
Acquired: 1:18pm 19-Feb

Satellites [X]

View: All [v]

Types: All [v]

- KOMPSAT
- KOREASAT 2
- KOREASAT 3
- LANDSAT 5
- LANDSAT 7**
- LEASAT 5
- LES 9
- LMI-1
- LO-19
- LUCH 1

Sat. Info. Info. displayed in browser.

Java Applet Window

LANDSAT 7 [X]

Latitude	15.7
Longitude	-123.0
Altitude (km)	704.6
Velocity (km/s)	7.504
Period	1:38:48
Inclination	98.22

Java Applet Window

JTrack - 3D [X]

View Satellite Options

19 Feb 2009 18:23:29 GMT



Java Applet Window

Navigate to MYNASA DATA

mynasadata.larc.nasa.gov



Mentoring and inquiry using NASA Data on Atmospheric and earth science for Teachers and Amateurs

Select the “Live Access Server” (Armstrong Edition)

- Weekly Sea Surface Temperature (MCSST)
- Plot to **GOOGLE EARTH**





NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

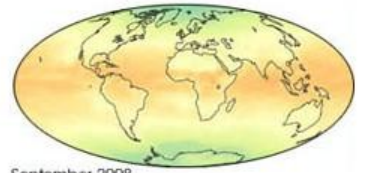
+ Visit NASA.gov
+ Visit the ASDC Home Page

Search:

all words
 any words
 exact phrase



- +ABOUT MY NASA DATA
- +DATA ACCESS
- +LESSON PLANS
- +COMPUTER TOOLS
- +SCIENCE FOCUS



September 2008
Seasonal Changes in Global Net Radiation. Click image for details.

For Citizen Scientists

FEATURES



Science Basics
 Visit some of the new links added to the Weather/Climate section.
[+ Science Basics Page](#)
 Create your own Microsets!
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Click here to see where our team members will be next!

- + Freedom of Information Act
- + The President's Management Agenda
- + Privacy Policy and Important Notices



Curator: Penny Oots
 NASA Responsible Official:
 Dr. Lin Chambers
 + Contact Us
 Last updated: 12/30/2008 12:31:36

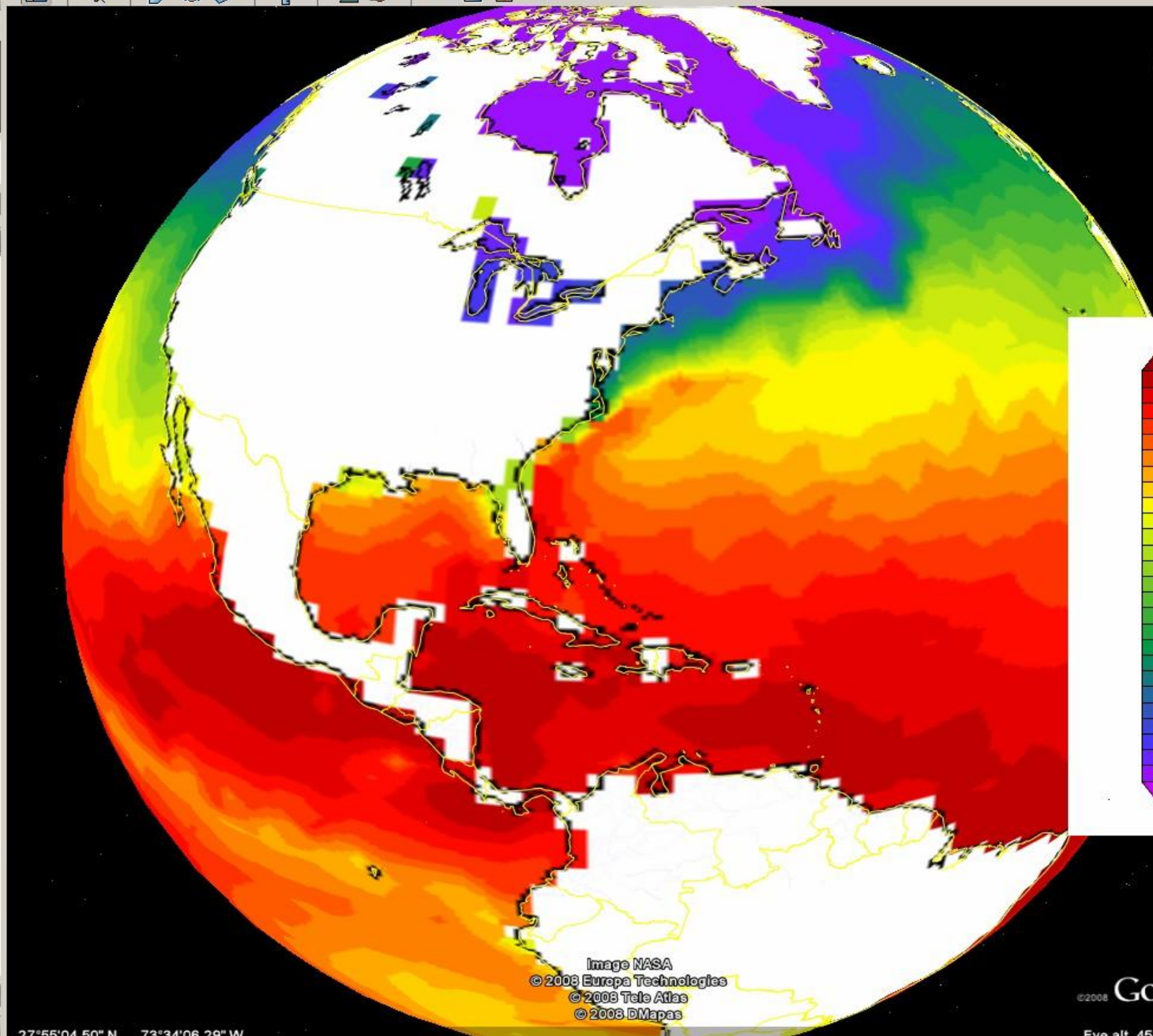
Search

Fly To Find Businesses Directions

Fly to e.g., Hotels near JFK

Places Add Content

- Snow Water Equivalent
24-Hour Change Ending
2008-11-18 06
- Average Snowpack Temp
24-Hour Average Ending
2008-11-18 06
- Snow Melt
24-Hour Total Ending
2008-11-18 05
- Surface Sublimation / Con
24-Hour Total Ending
2008-11-18 05
- Blowing Snow Sublimator
24-Hour Total Ending
2008-11-18 05
- NWS Radar Images
- NWS Radar Animation of ...
- Active Deployments
COOL Slocum Glider Fleet
- Glider ru23
- CLAVRx 12/09/2008
- False Color Imagery
- Ocean Temperature
Degrees Celsius
- Marine Protected Areas
- ETOPO1 Ice Surface
- Daily MODIS Satellite Images
Composite of daily MODIS
TERRA subsets. Built and
- Blue Marble Next Gen...
- Temporary Places
- mcsst_k10_1dayperwk: wat
static overlay
- Plot
- Grid Points



Navigation controls including a compass, a hand icon for panning, and a vertical zoom slider with '+' and '-' buttons.

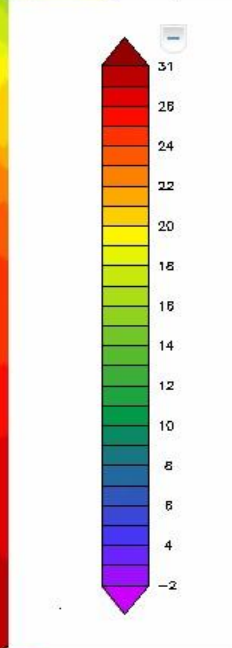


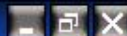
Image NASA
© 2008 Europa Technologies
© 2008 Tele Atlas
© 2008 BMapas

27°55'04.50" N 73°34'06.29" W

Access National Data Buoy Center Data

- Select Station **44004**
- Plot to Google Earth by entering Lat/Long
- Notice Station has *moved*
- Plot *new* location of Station 44004





Address <http://www.ndbc.noaa.gov/>

Go Links >>



National Data Buoy Center

Center of Excellence in Marine Technology



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Station ID Search



Station List

Observations

- Recent
- Historical
- Obs Search
- NOAA Obs
- APEX
- CSI
- DART

Station Status

- Maintenance
- Platform Status

Ship Observations

- VOS Program
- Ship Obs Report

About NDBC

Dial-A-Buoy

Publications

- Annual Report
- Sea Worthy

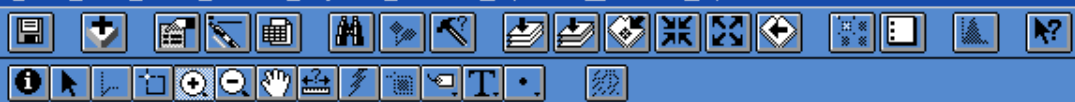
Science Education

Recent Data | Historical Data | Observations Search | NOAA Marine Observations | APEX | NOAA Coastal Storms Initiative | DART

Not All Stations Depicted are Operated by the National Data Buoy Center.



[About Bobby Approval](#)

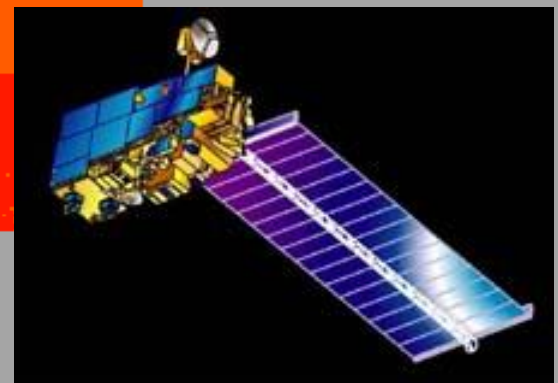
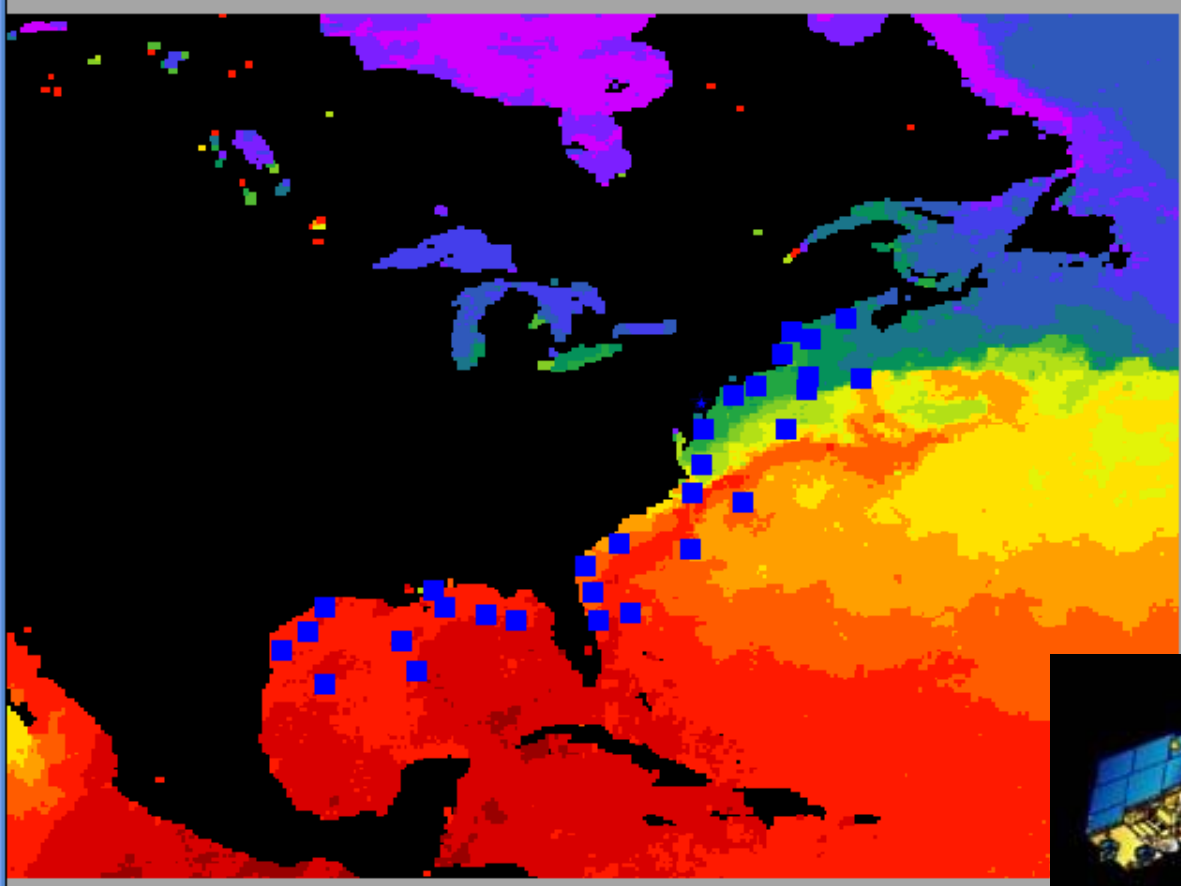


Scale 1: 40,992,328

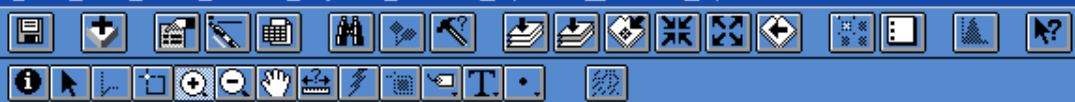
-89.67
45.50

North America

- 5-26-03 bouys
- Moored Bouys
- BCIT
- Pond
- Hurricane 5-26-03
- Hurricane 5-28-03
- Hurricane 5-30-03
- 5-26-03
- 5-28-03
- 5-30-03



Origin: (-103.83, 4.54) dg Extent: (4,861.50, 4,009.90) mi Area: 19,494,097.59 sq mi

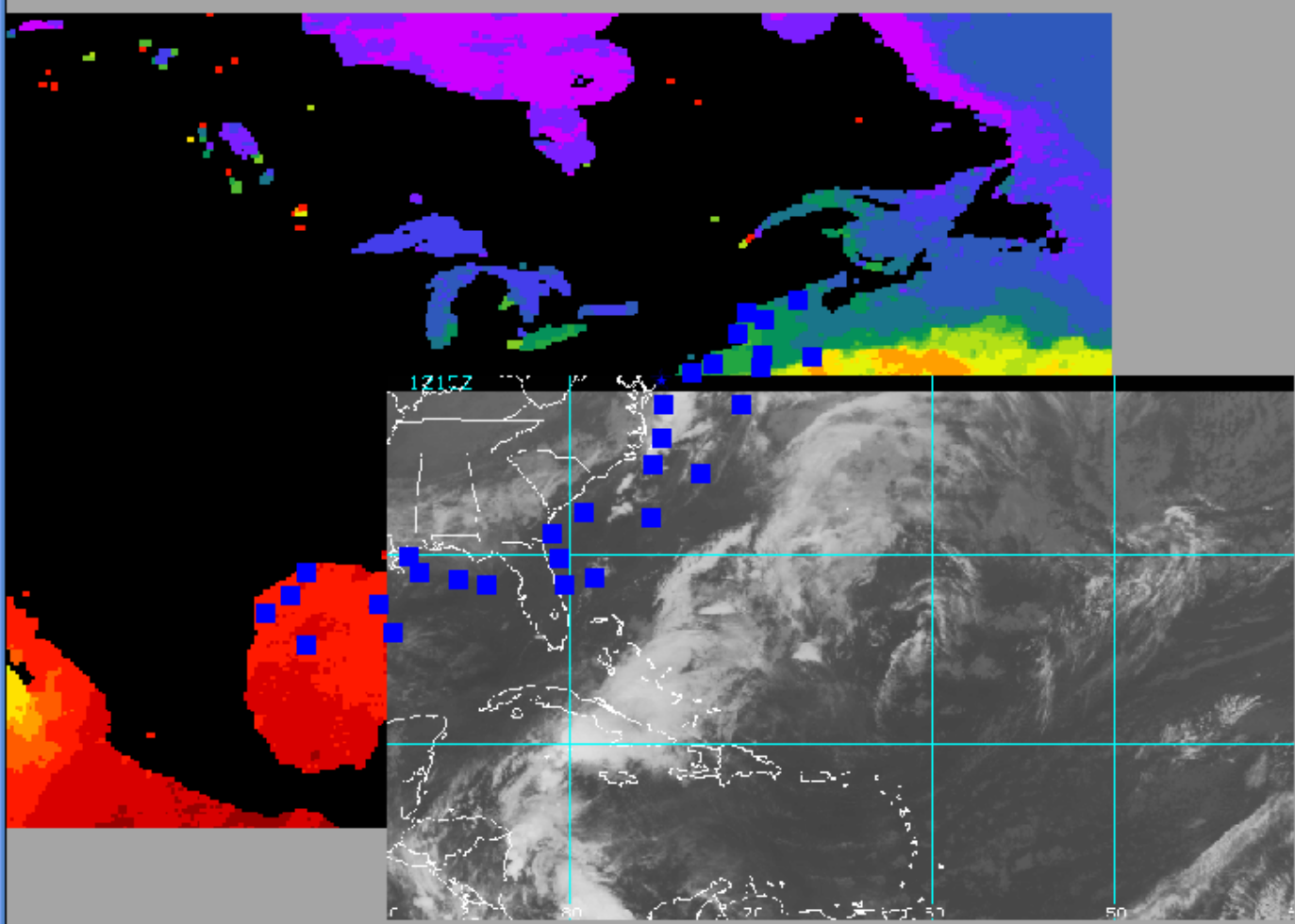


Scale 1: 40,992,328

-110.06
38.97

North America

- 5-26-03 bouys
- Moored Bouys
- BCIT
- Pond
- Hurricane 5-26-03
- Hurricane 5-28-03
- Hurricane 5-30-03
- 5-26-03
- 5-28-03
- 5-30-03



Origin: (-103.83, 4.54) dg Extent: (4,861.50, 4,009.90) mi Area: 19,494,097.59 sq mi

Conducting Data Comparisons

- Determine the SST from NASA “Space” Data
- Determine the SST from NOAA “Earth” Data



Scale 1: 4,870,051

-77.02
35.41

North America

5-26-03 bouys

Moored Bouys

BCIT

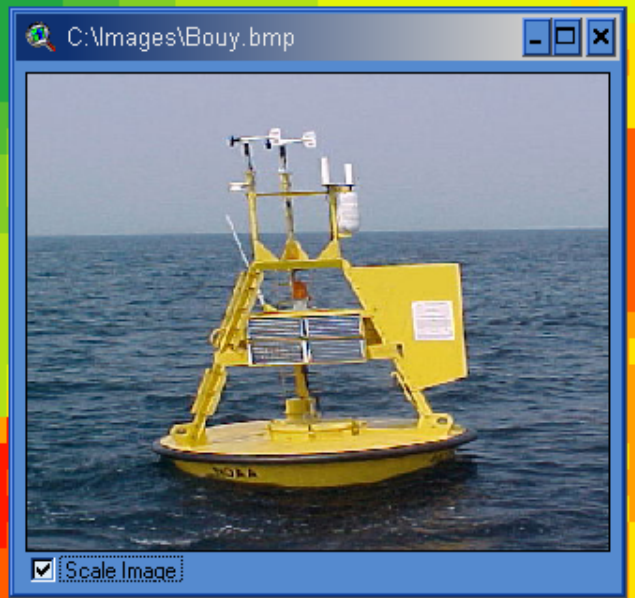
Pond

Identify Results

1: 5-26-03 bouys - 110

Dpd	11
Apd	MM
Mwd	MM
Baro	1010.2
Atmp	13
Wtmp	11.1
Dewp	12.9
Vis	MM
Ptdy	-0.4

Clear Clear All



Using Google Earth

- Using the “Measuring Tool”, calculate the distance of the “drift”



Search

Fly To Find Businesses Directions

Fly to e.g., Hotels near JFK

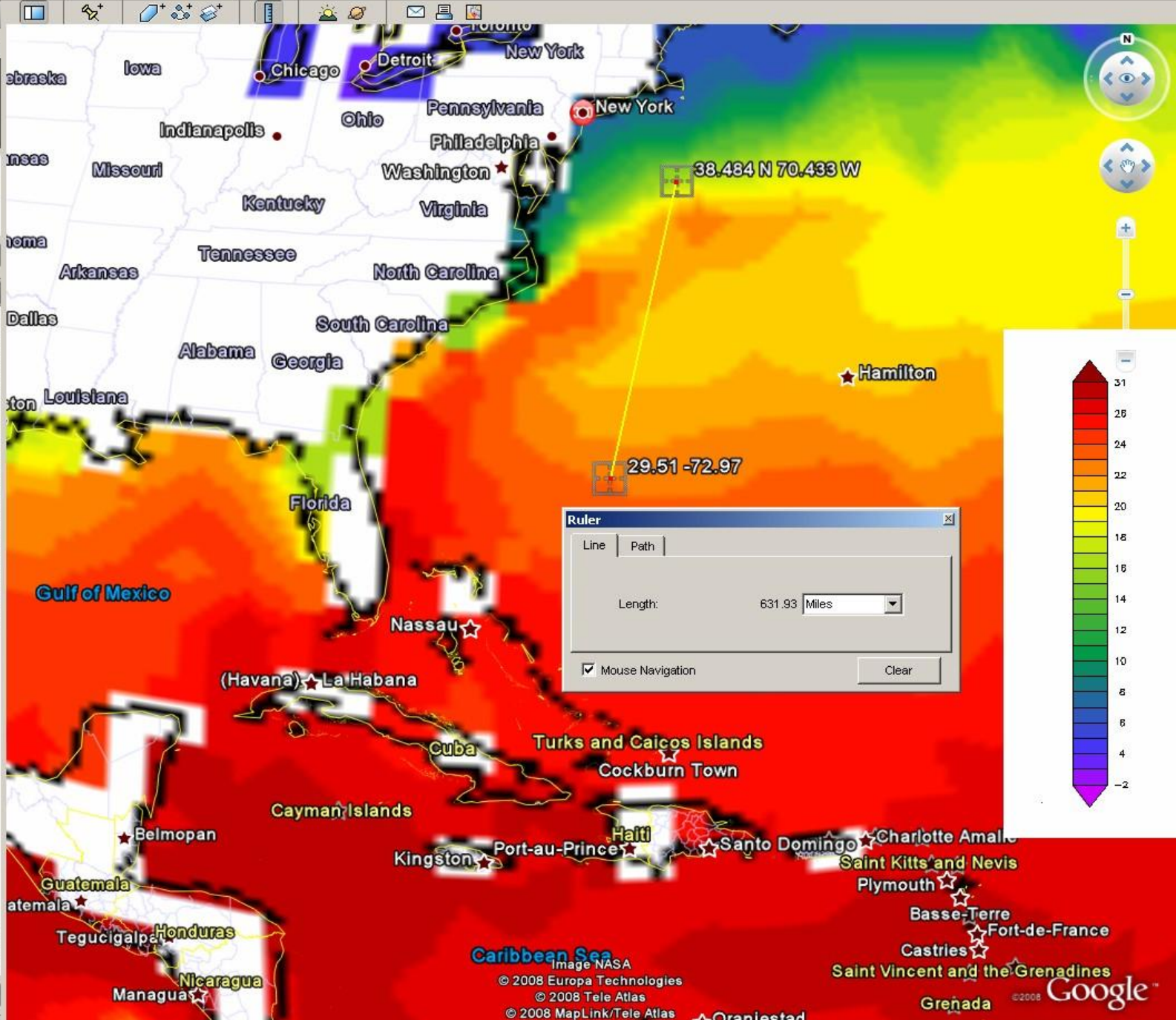
29.51 -72.97

29.51 -72.97

38.484 N 70.433 W

Places Add Content

- Snow Density 2008-11-18 06
- Snow Water Equivalent 24-Hour Change Ending 2008-11-18 06
- Average Snowpack Temp 24-Hour Average Ending 2008-11-18 06
- Snow Melt 24-Hour Total Ending 2008-11-18 05
- Surface Sublimation / Con 24-Hour Total Ending 2008-11-18 05
- Blowing Snow Sublimator 24-Hour Total Ending 2008-11-18 05
- MWS Radar Images
- MWS Radar Animation of ...
- Active Deployments
- COOL Slocum Glider Fleet
- Glider ru23
- CLAVRx 12/09/2008
- False Color Imagery
- Ocean Temperature Degrees Celsius
- Marine Protected Areas
- ETOPO1 Ice Surface
- Daily MODIS Satellite Images Composite of daily MODIS TERRA subsets. Built and
- Blue Marble Next Gen...
- Temporary Places
- mcsst_k10_1dayperwk: wa static overlay



Ruler

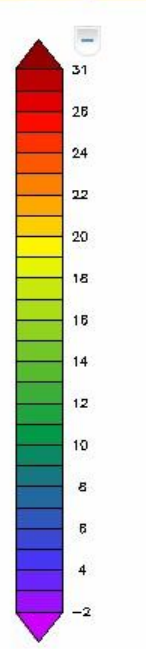
Line Path

Length: 631.93 Miles

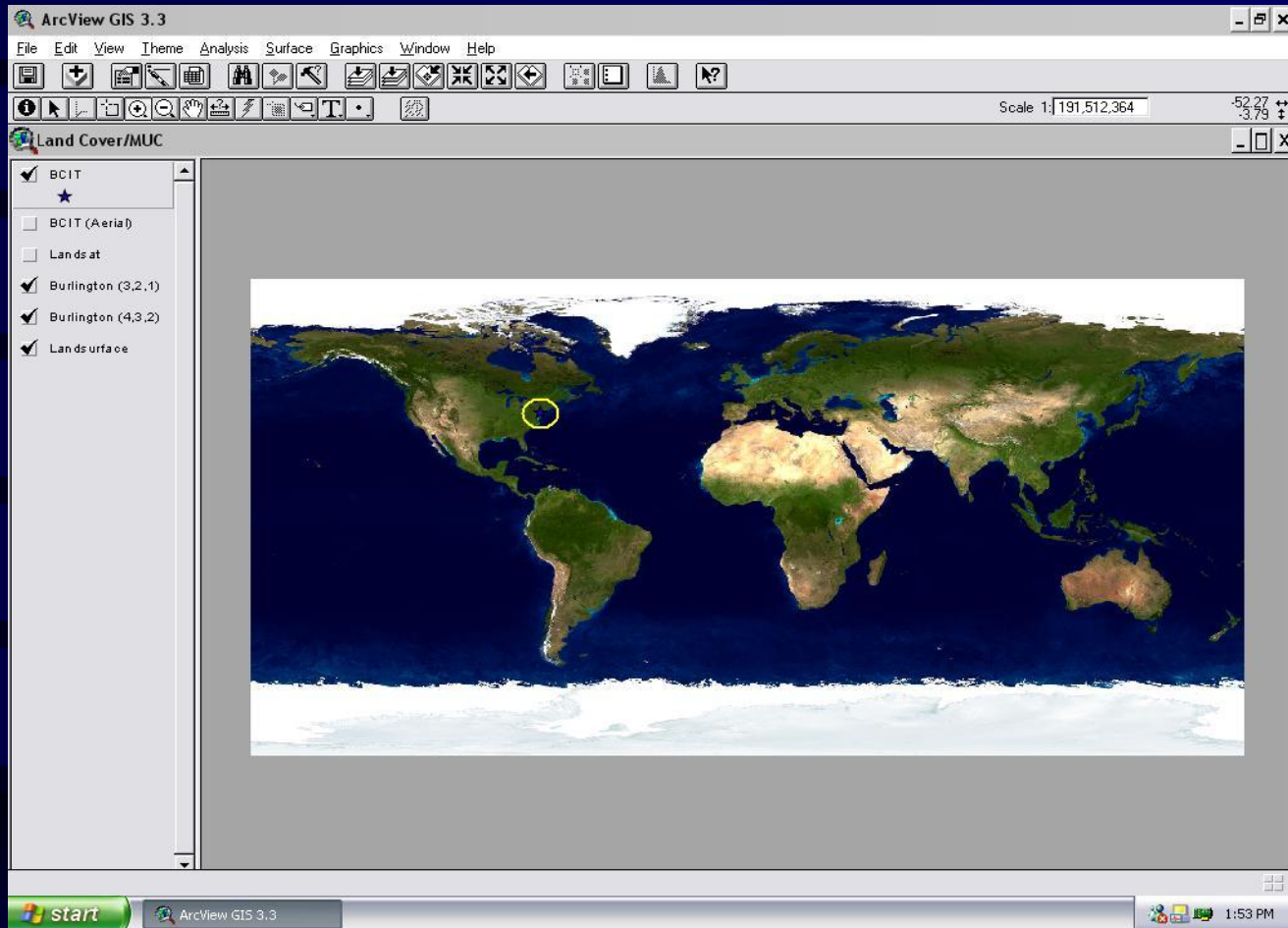
Mouse Navigation

Clear

Navigation controls including a compass, a hand icon for panning, and a vertical zoom slider.

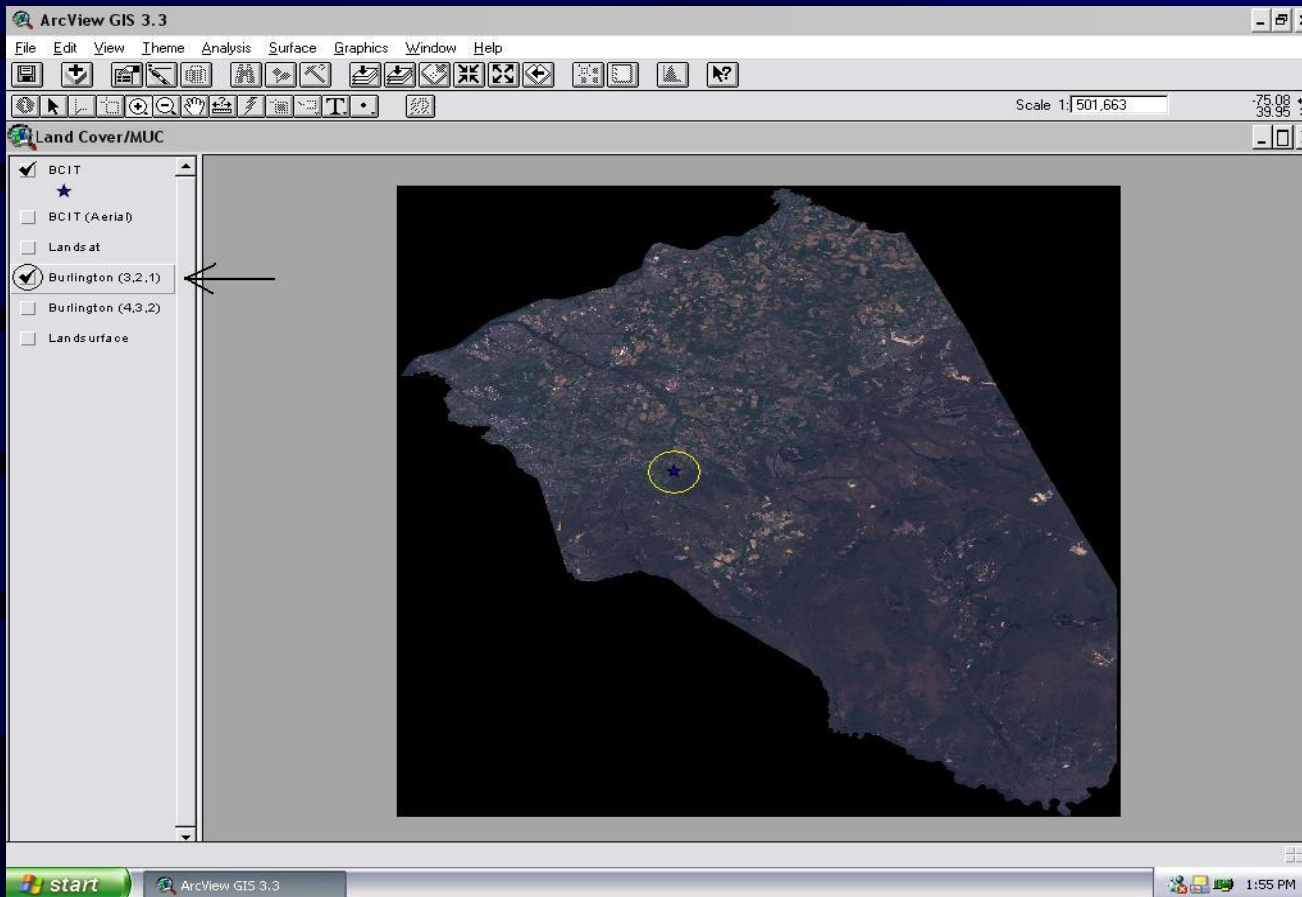


World Land Cover as Viewed from SPACE



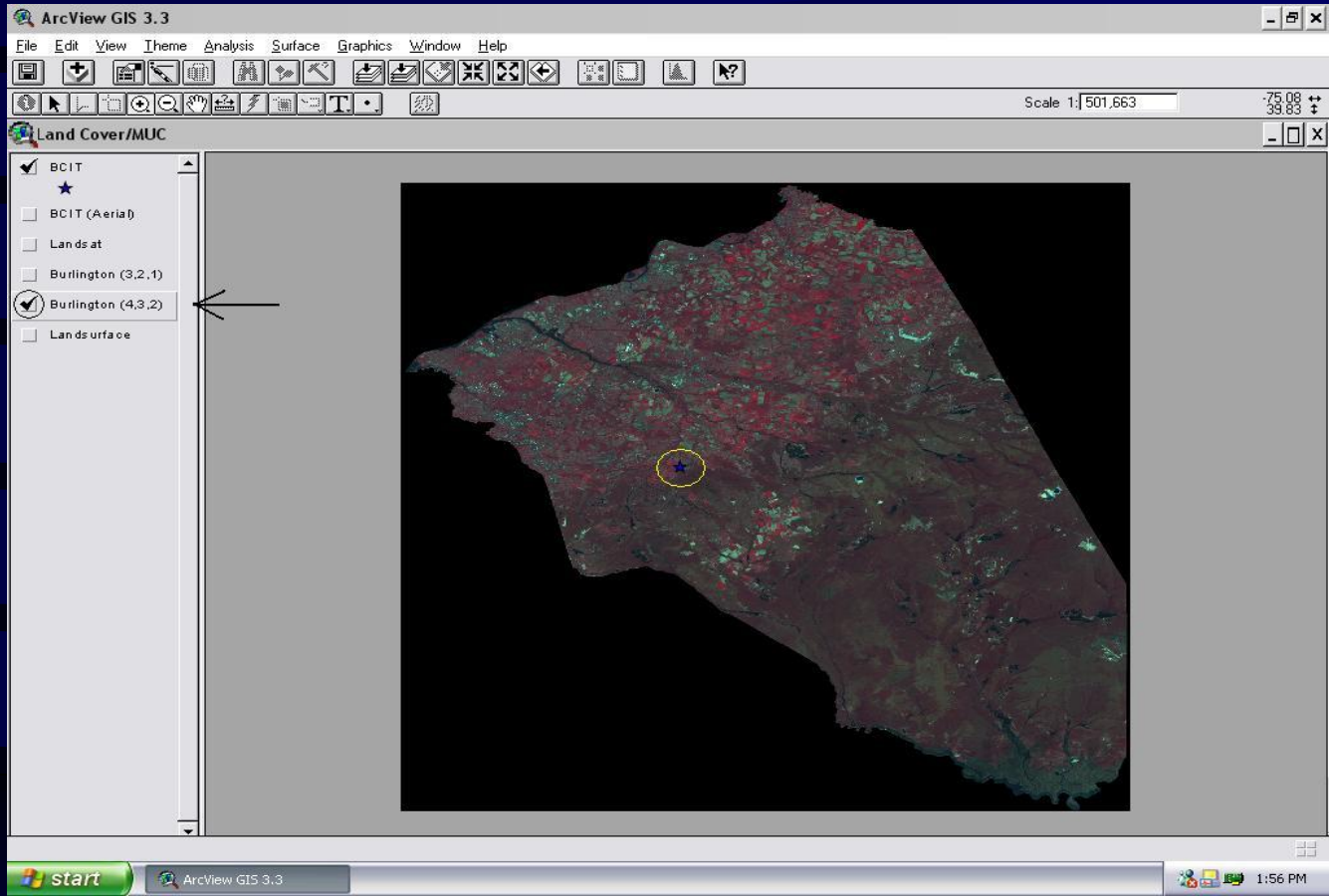
This **SPACE** image from the NASA Earth Observatory shows global land cover. Notice that BCIT is geo-referenced (yellow circle), showing rather green land cover, signifying vegetation.

LANDSAT Image Bands 3-2-1 (Fig. 8)



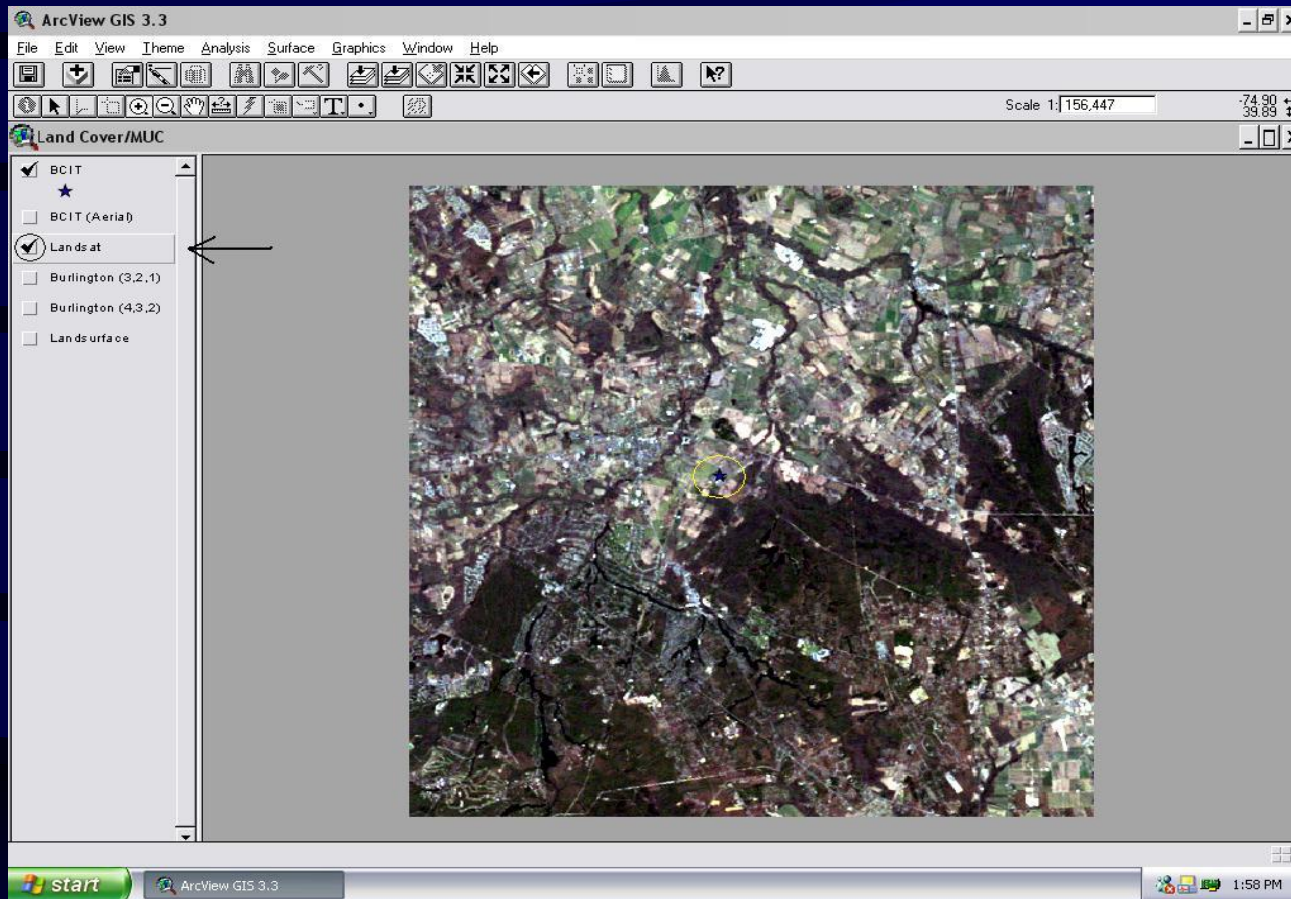
This image from **SPACE** is a visible image. Notice the theme is checked for a LandSat with bands 3-2-1. Once again, BCIT is starred and circle for quick geo-referencing.

LANDSAT Image 4-3-2 (Fig.9)



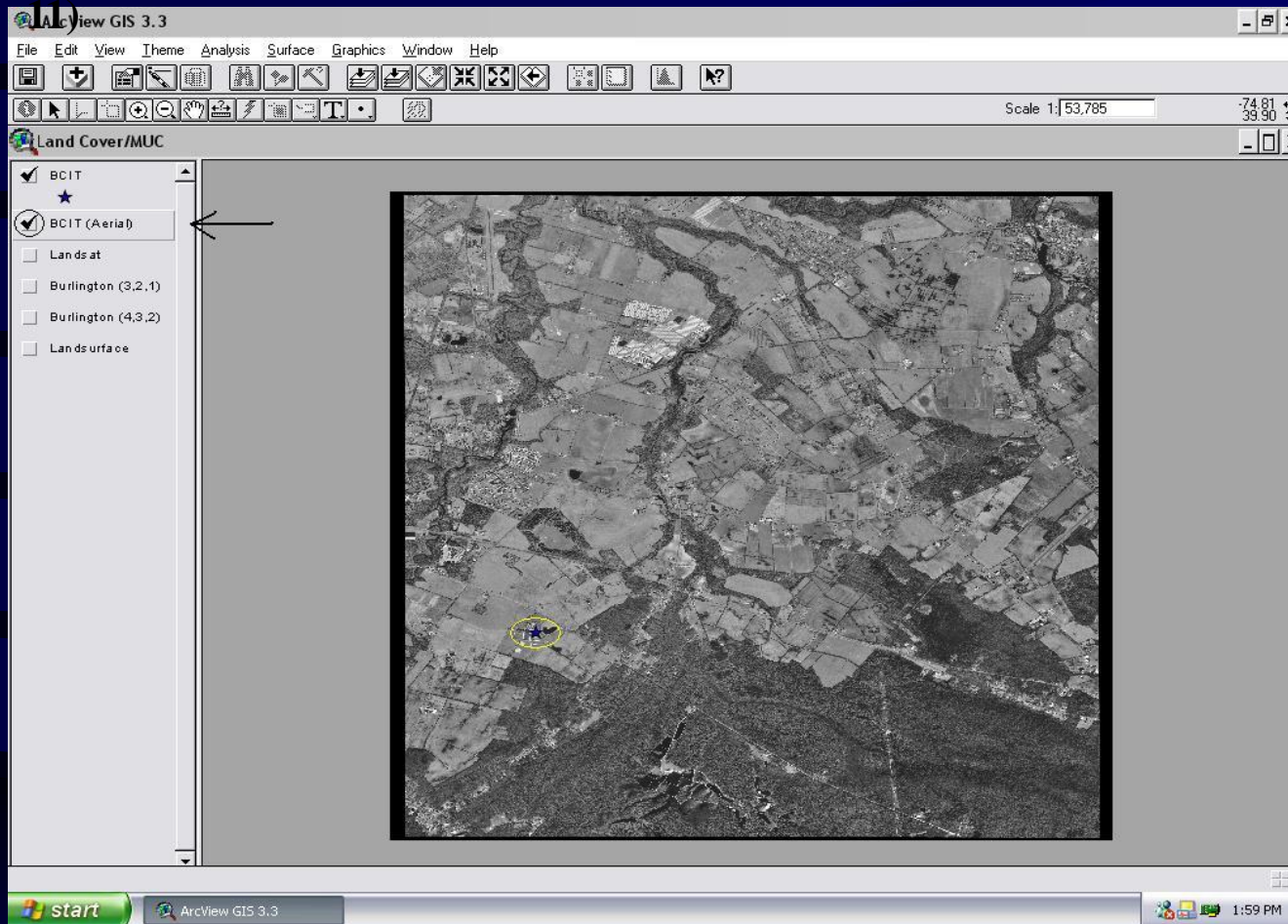
Unlike the previously image that has only bands 3-2-1, this 4-3-2 band image highlights vegetation. Notice the deep reds and greens are now displayed in the BCIT area signifying mixed development and vegetative land cover.

LANDSAT 3-2-1: A Closer View (Fig. 10)



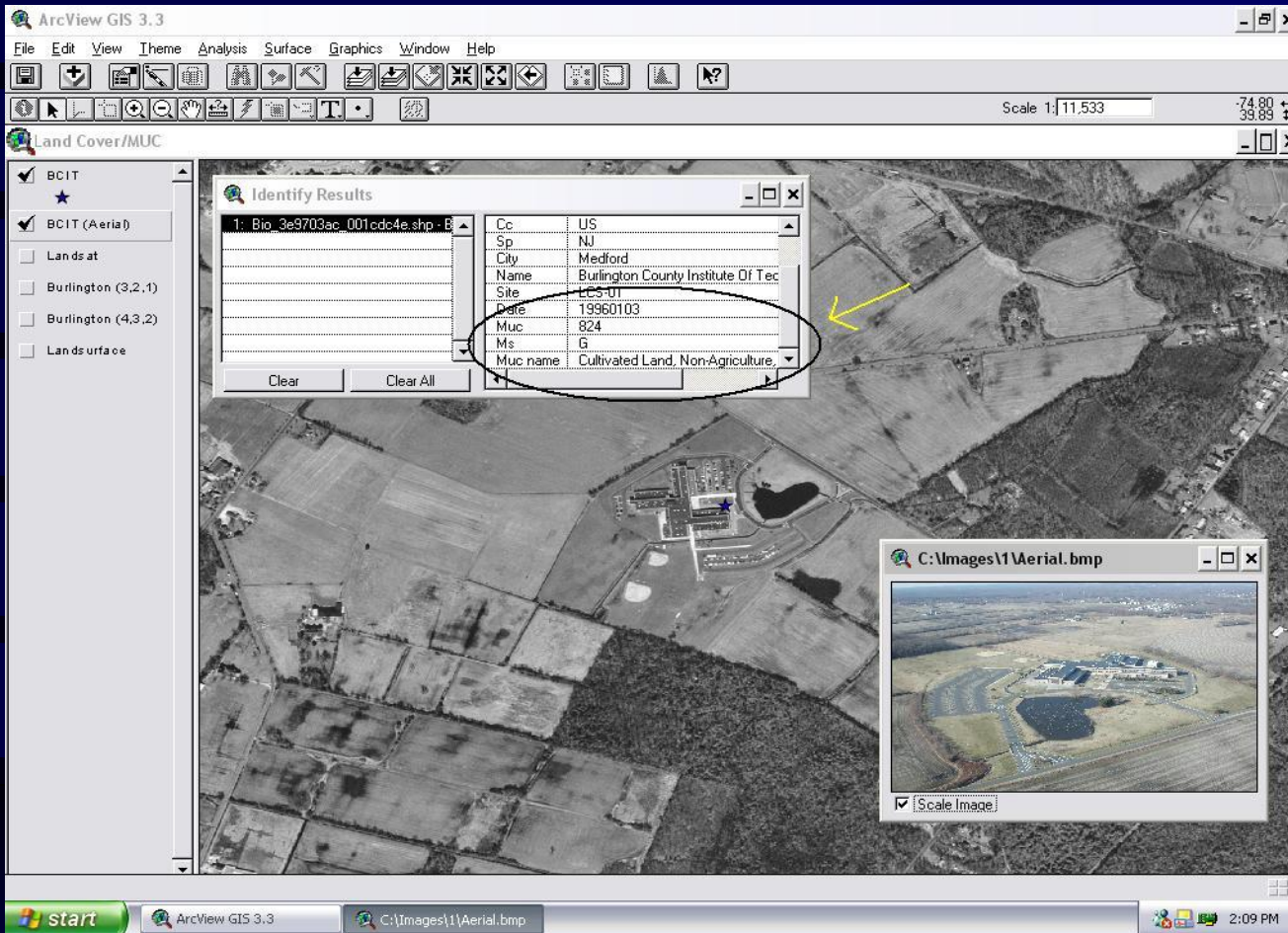
BCIT can now be easily located and compared to the surrounding environment. Notice the considerable open space and suburban sprawl. BCIT is on the edge!

Aerial Photograph: A Higher Resolution (Fig. 11)



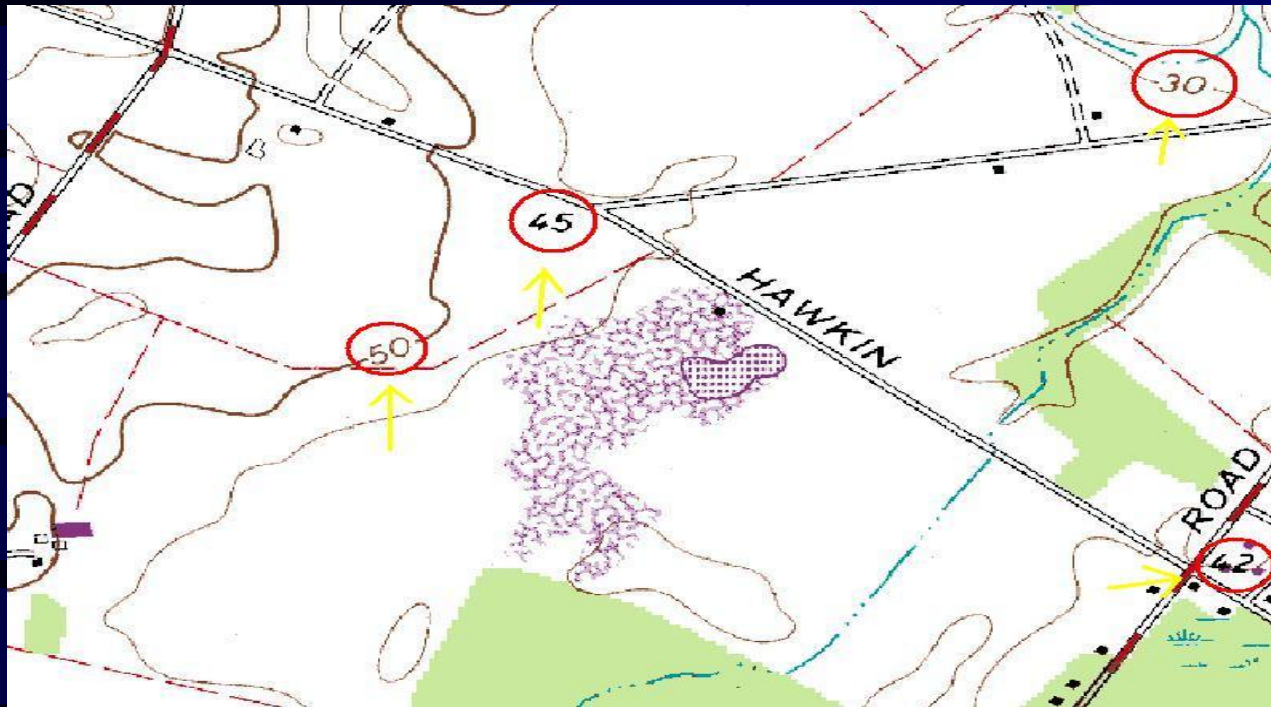
BCIT and the surrounding land cover can now more easily be seen due to the higher resolution available through aerial photography. The land cover observations continue to support each other. Also notice, the BCIT Aerial theme is now checked (displayed).

GIS Land Cover Synopsis (Fig. 12)



This GIS representation demonstrates a consistent view of the BCIT land cover. An aerial image, digital aerial photograph, clearly depicts what the region looks like. The displayed attribute table shows the GLOBE data, i.e. MUC 824, cultivated land, non-agriculture.

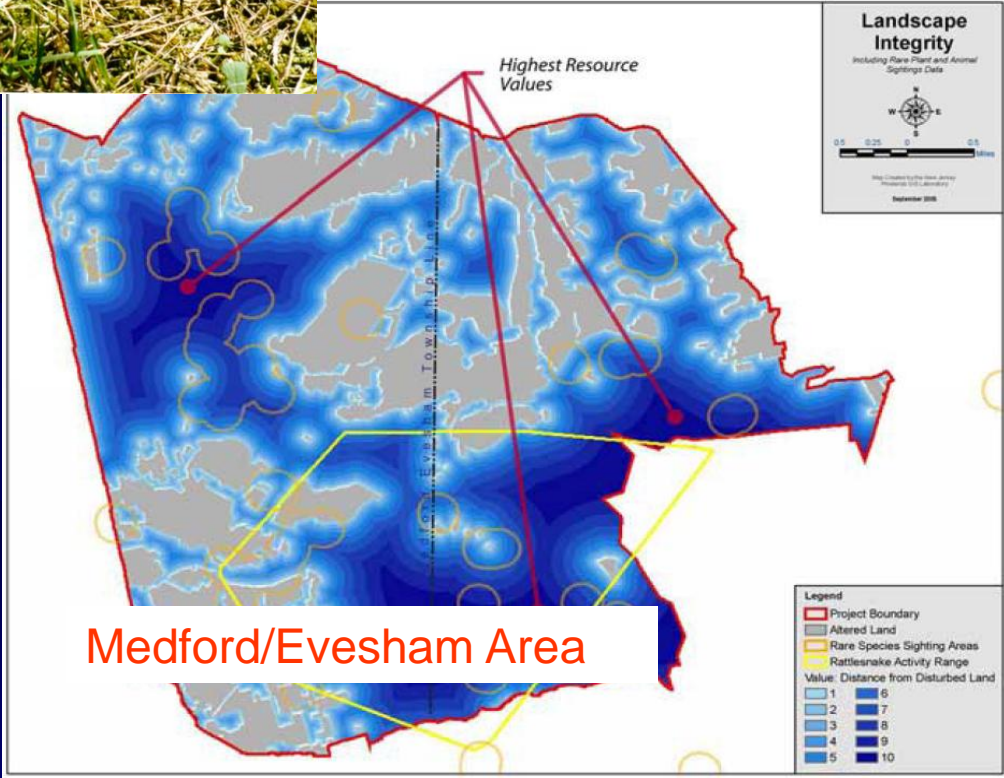
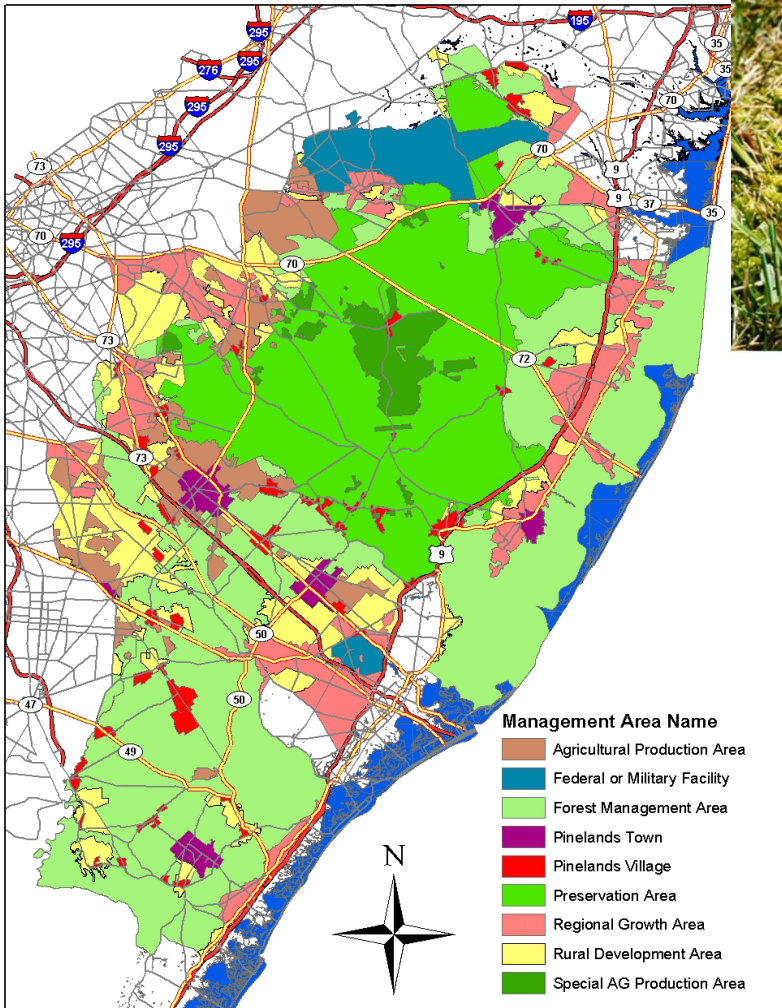
DATA SUMMARY: Part 3 Elevation 2m Topographic Image (Fig. 13)



This image is a USGS topographic map of the BCIT (Medford, NJ) area. Notice the numbers circled in red and pointed to by a yellow area. These numbers represent elevation in feet for that point. GLOBE default value of elevation for BCIT is 17m. That number translates to about 55ft. Thus the 55ft elevation falls within the number range of the outside numbers. Now we can use the equation ($A=B$, $B=C$, and thus $A=C$) where A equals the elevation of the school, B equals the topographic image provided by the USGS, and C (see next page) would equal the digital elevation map from the same source USGS.

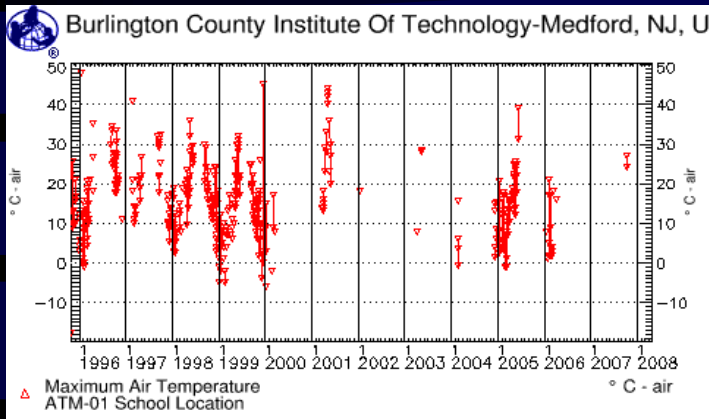
Endangered Species

Pinelands Management Area



MONITORING LOCAL ENVIRONMENTAL CHANGE ...

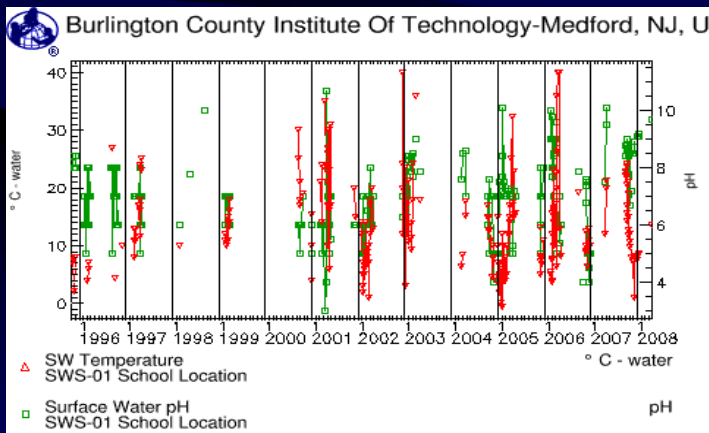
GLOBE DATA from Burlington County Institute of Technology



GLOBE Graphs*

Monitoring Air Temperature

Changing Temps impact Green-up/down



Changing Land-Use may alter runoff. The Pinelands are pH sensitive

ArcView GIS 3.3

File Edit View Theme Analysis Surface Graphics Window Help

Scale 1:11,533

74.80
39.89

Land Cover/MUC

BCIT

BCIT (Aerial)

Identify Results

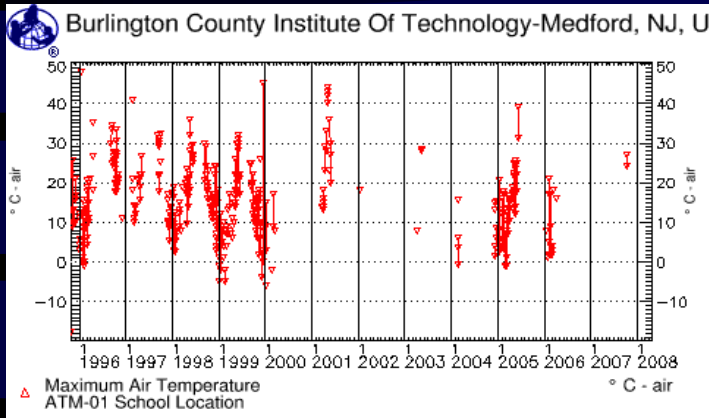
Cc	US
Sp	NJ
City	Medford
Name	Burlington County Institute Of Tec
Site	195-11
Date	19960103
Muc	824
Ms	G
Muc name	Cultivated Land, Non-Agriculture

C:\Images\1\Aerial.bmp

Using Satellite Imagery and Aerial Photography to document Land-Use change. How much change can occur before the MUC changes?

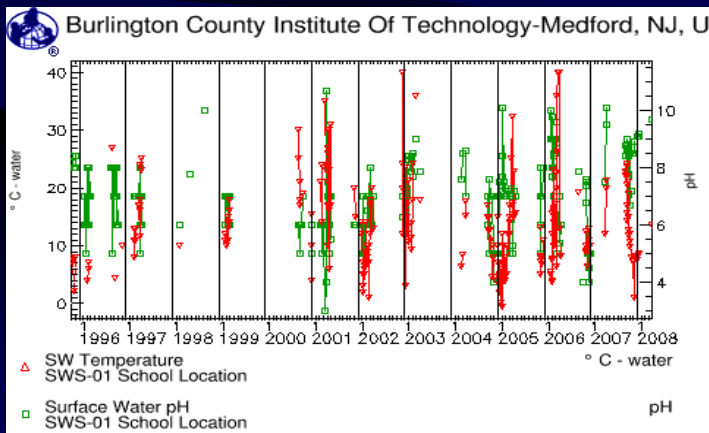
MONITORING LOCAL ENVIRONMENTAL CHANGE ...

GLOBE DATA from Burlington County Institute of Technology



Monitoring Air Temperature

Changing Temps impact Green-up/down



Changing Land-Use may alter runoff. The Pinelands are pH sensitive

ArcView GIS 3.3

File Edit View Theme Analysis Surface Graphics Window Help

Scale 1:11,533

Land Cover/MUC

Identify Results

Cc	US
Sp	NJ
City	Medford
Name	Burlington County Institute Of Tec
Site	1995-011
Date	19960103
Muc	824
Ms	G
Muc name	Cultivated Land, Non-Agriculture

C:\Images\1\Aerial.bmp

start ArcView GIS 3.3 C:\Images\1\Aerial.bmp 2:09 PM

Using GIS to monitor environmental change. How much change can occur before the MUC changes?

Conclusions

- Incorporation of Satellite Imagery, Real-Time Data, Remote Sensing Technology, and Computer Visualizations in the K-12 classroom lead to true inquiry
- Earth *Systems* Education demonstrates the interrelationships of the Geosciences
- Incorporation of GeoSpatial Technologies in student learning fosters Geospatial Thinking
- What's next? Opportunities for International Project Based Learning