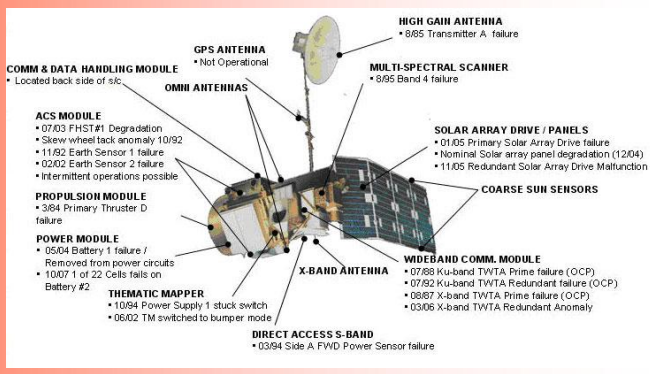
Multi-temporal NDVI change detection using Landsat 5 imagery



Brian Block

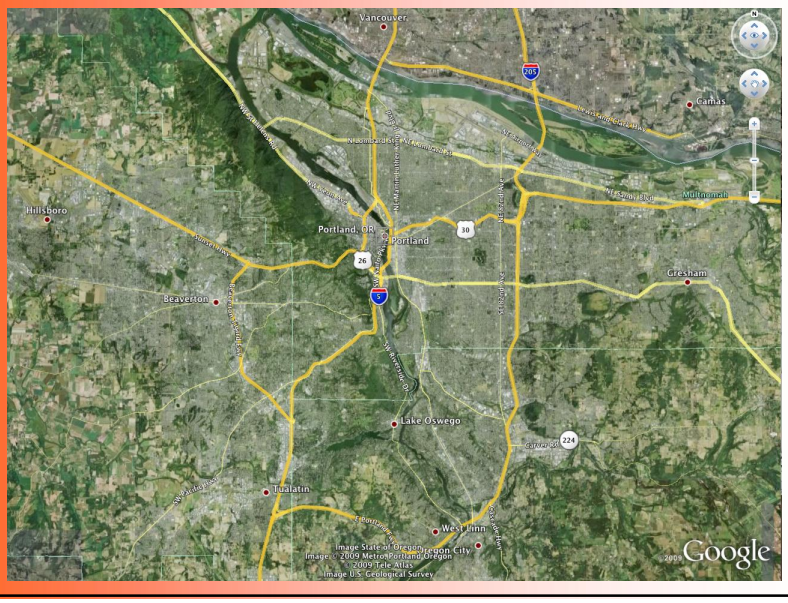
Geog 4/582

Satellite Image Class./Change Detection

Study:

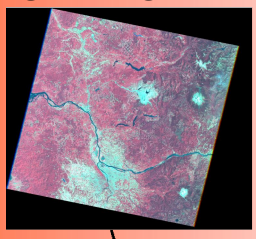
- Determine pattern of vegetative change in the Portland metro area using NDVI indices over a 20 year span.
- Select cloud free Landsat 5 images from similar dates in the late summer to control for seasonality and maximize detection of vegetation.
- Mask areas of image not of interest to study.
- Rescale NDVI into the byte data range (Rescaled NDVI = (NDVI *200)+50). Scaling the data into this range does not result in loss of information and enables use of 8-bit unsigned datasets.

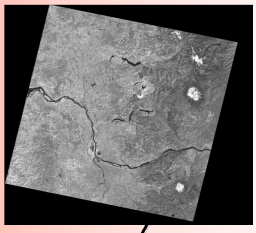
Study area: metro Portland, OR



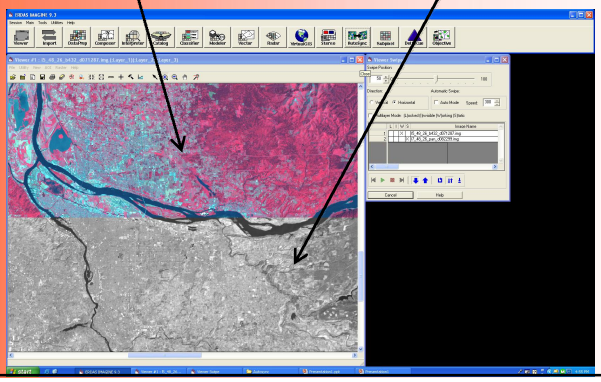
Swiping images to verify rectification.

Landsat 5
P: 46, R:28
RGB: (4,3,2)
30m res.

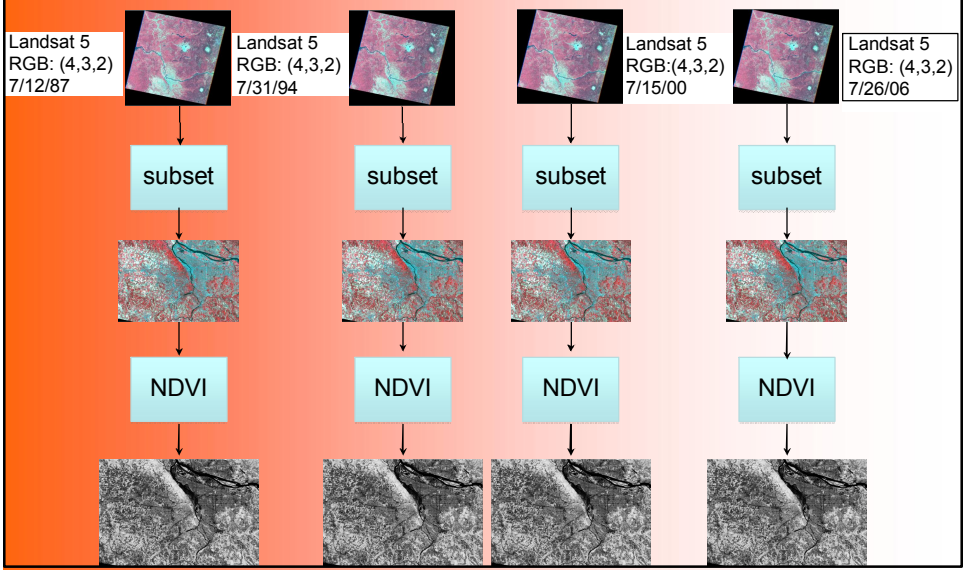




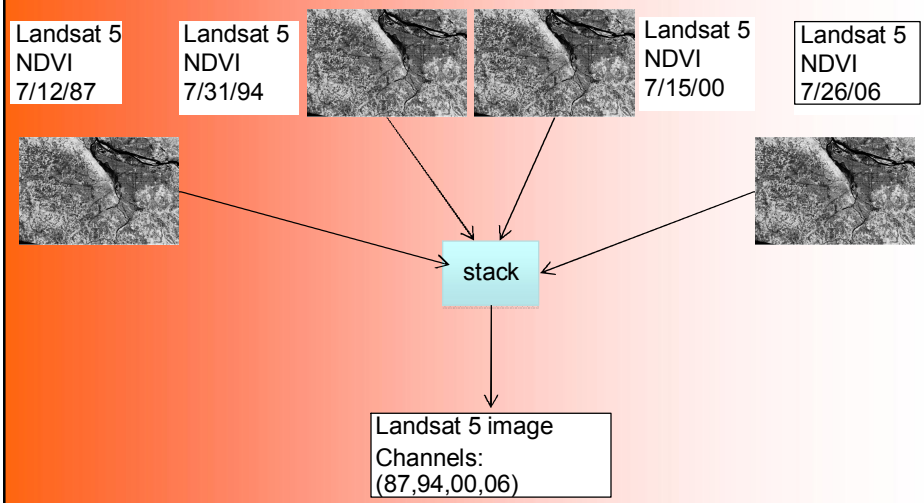
Landsat 7
P: 46, R:28
Panchromatic
15m res.



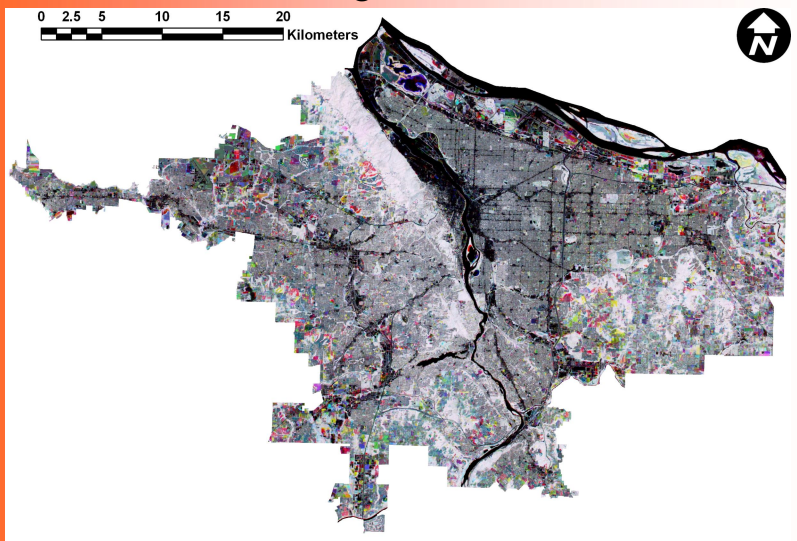
Initial process to calculate NDVI = (NIR-Red)/(NIR+Red)



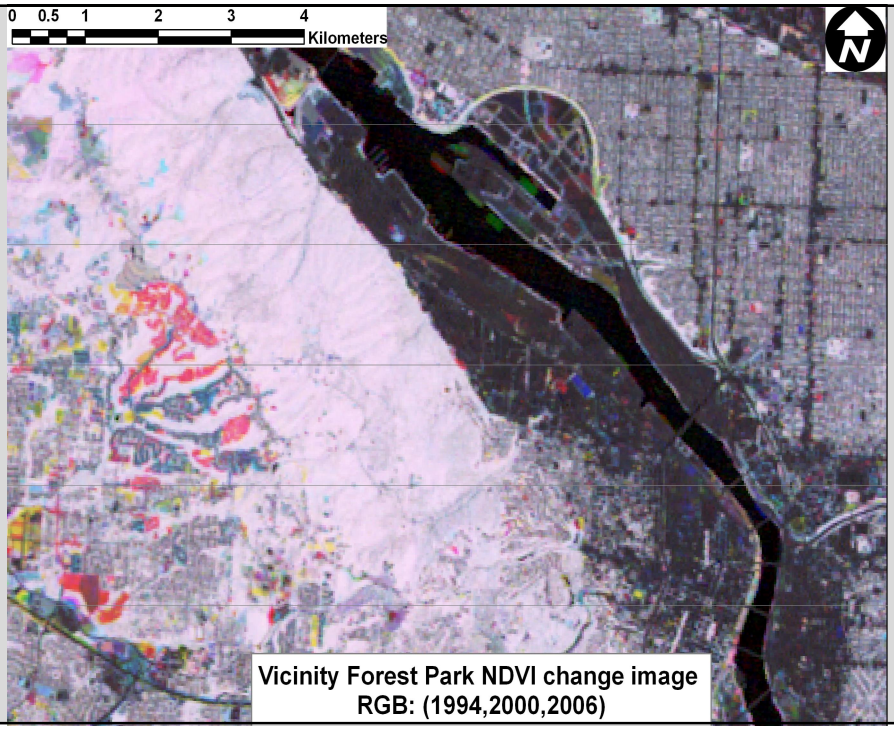
Merge NDVI images for all years to form a single image with 4 channels.



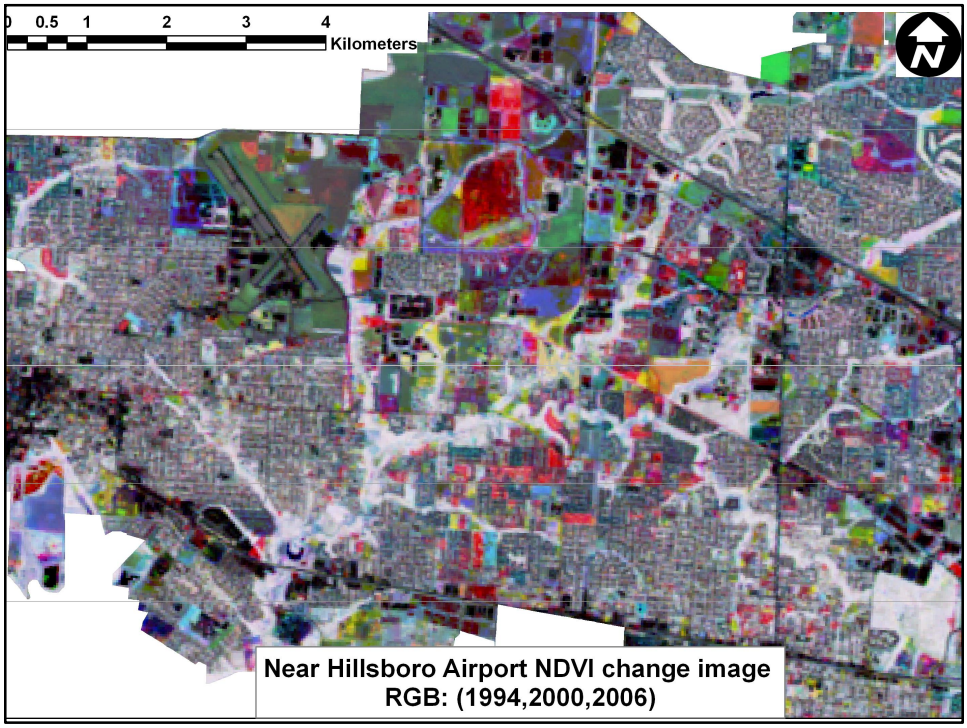
A comparison to ISODATA, the metro area with NDVI assigned to color bands.



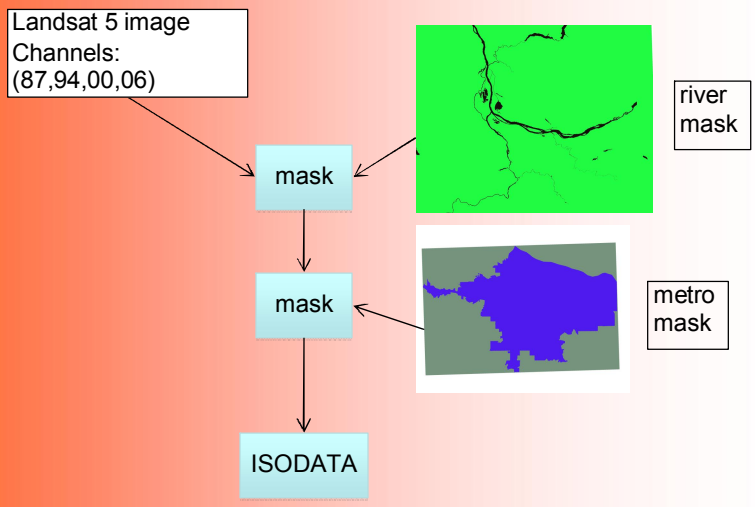
Portland metro NDVI change image
RGB: (1994,2000,2006)

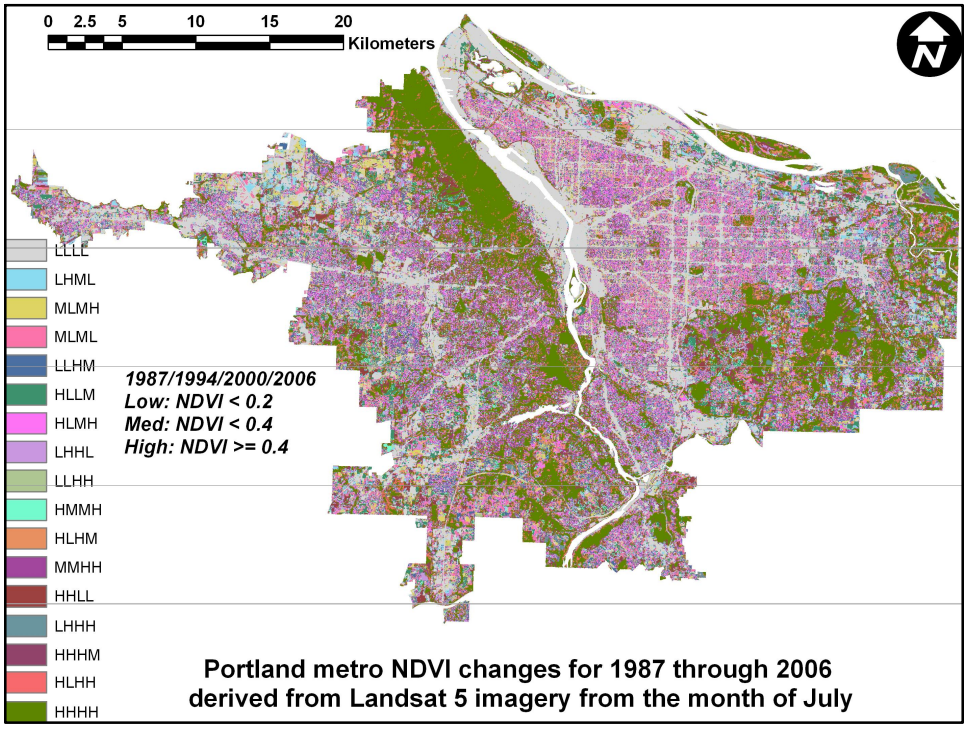


Vicinity Forest Park NDVI change image
RGB: (1994,2000,2006)

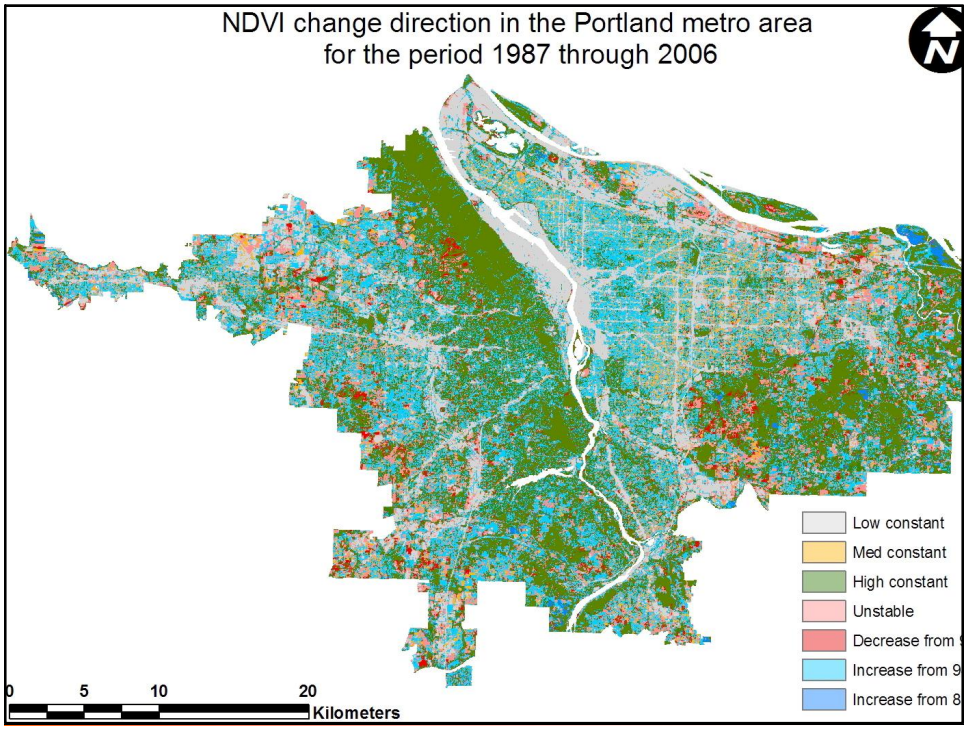


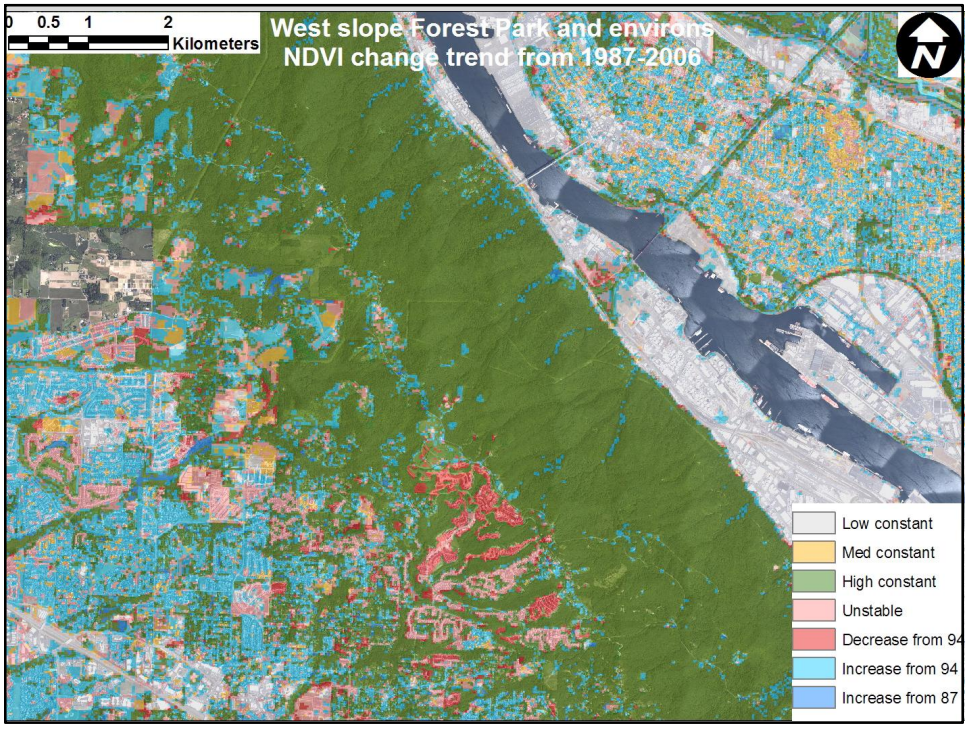
Eliminate data unnecessary to study and perform unsupervised classification.

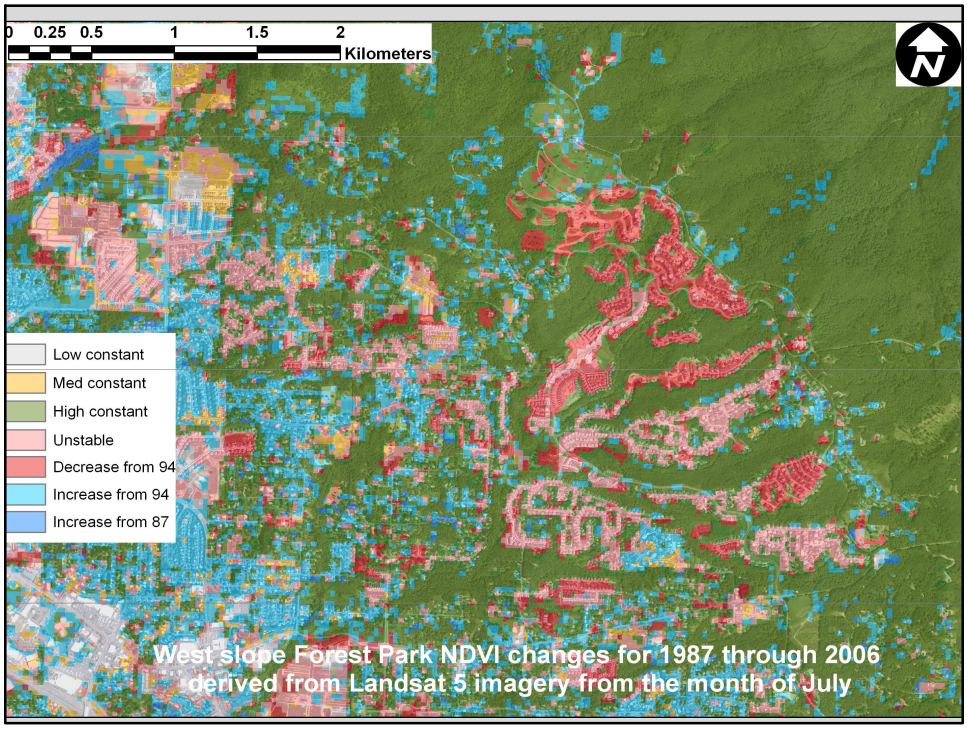


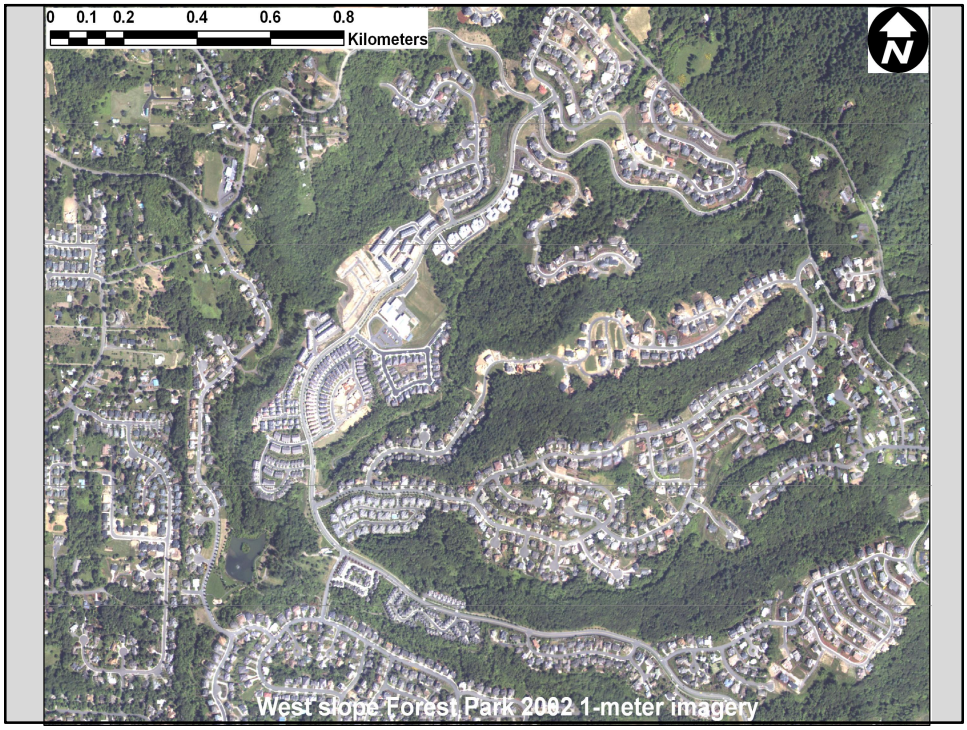


Portland metro NDVI changes for 1987 through 2006 derived from Landsat 5 imagery from the month of July

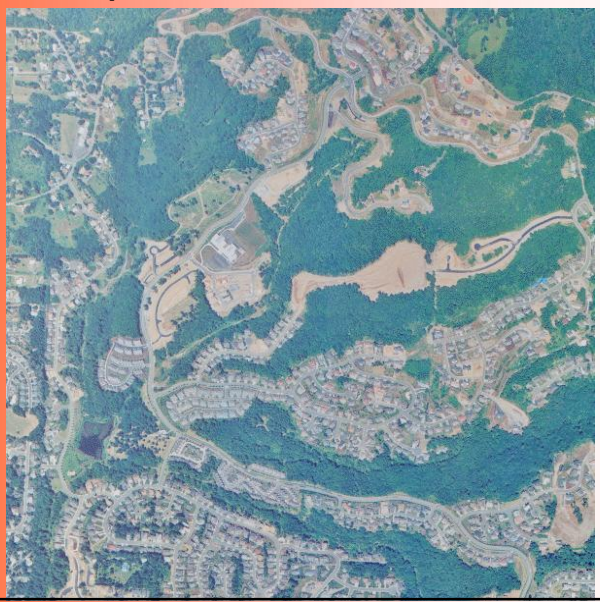


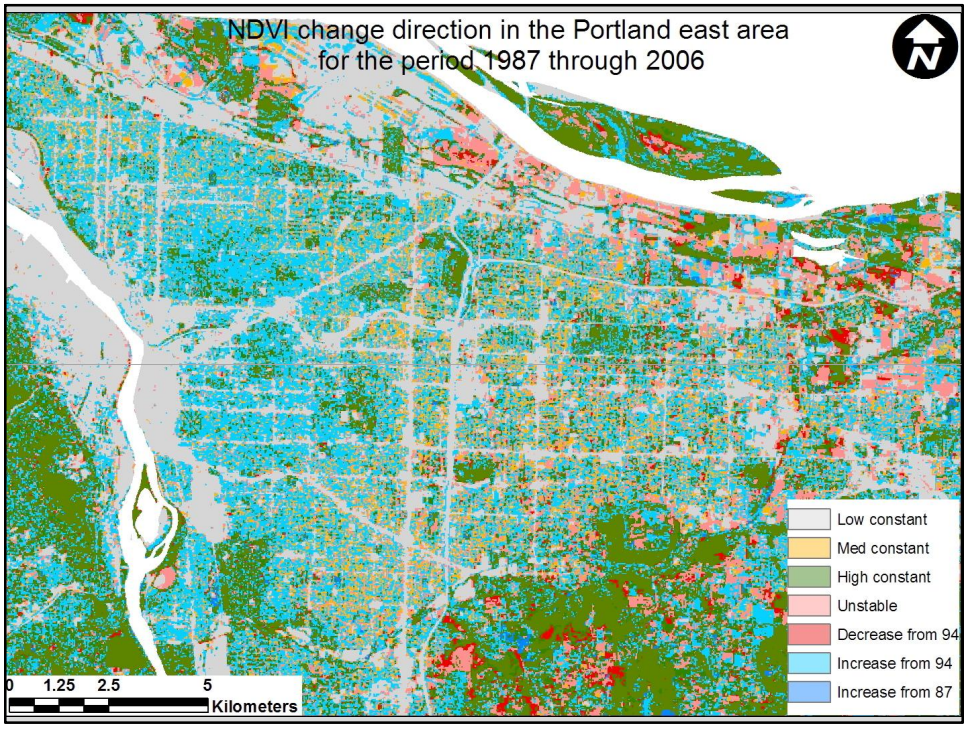

0 0.5 1 2
Kilometers
West slope Forest Park and environs
NDVI change trend from 1987-2006
N
Low constant
Med constant
High constant
Unstable
Decrease from 94
Increase from 94
Increase from 87


0 0.25 0.5 1 1.5 2
Kilometers
N
Low constant
Med constant
High constant
Unstable
Decrease from 94
Increase from 94
Increase from 87
West slope Forest Park NDVI changes for 1987 through 2006
derived from Landsat 5 imagery from the month of July

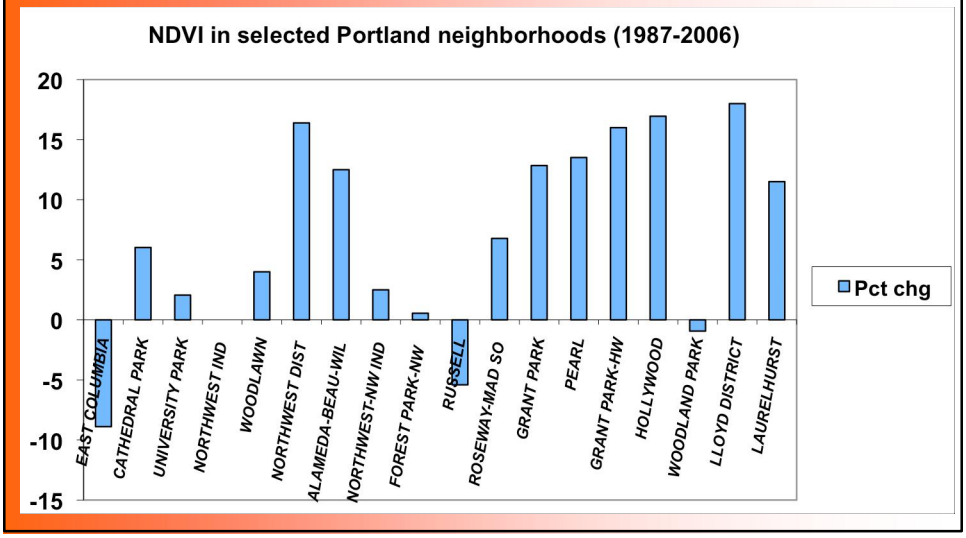


Ground truth: 10-meter true color Metro RLIS photo from 1999 -1N1W





Utilizing rescaled NDVI for statistics.



Conclusions:

- NDVI is an efficient method to measure vegetative change over time.
- More factors need to be taken into account for image selection, like droughts or variations in the timing of growing season.
- Even Landsat 30 meter resolution imagery was able to detect changes on a neighborhood scale.
- As expected growth is radiating outwards from the metro center, except for the Forest Park area.

References:

- Roderick, M., Smith, R.C.G. and Cridland, S.W. 1996, The precision of the NDVI from AVHRR observations, *Remote Sensing of Environment* 56: 57-65.