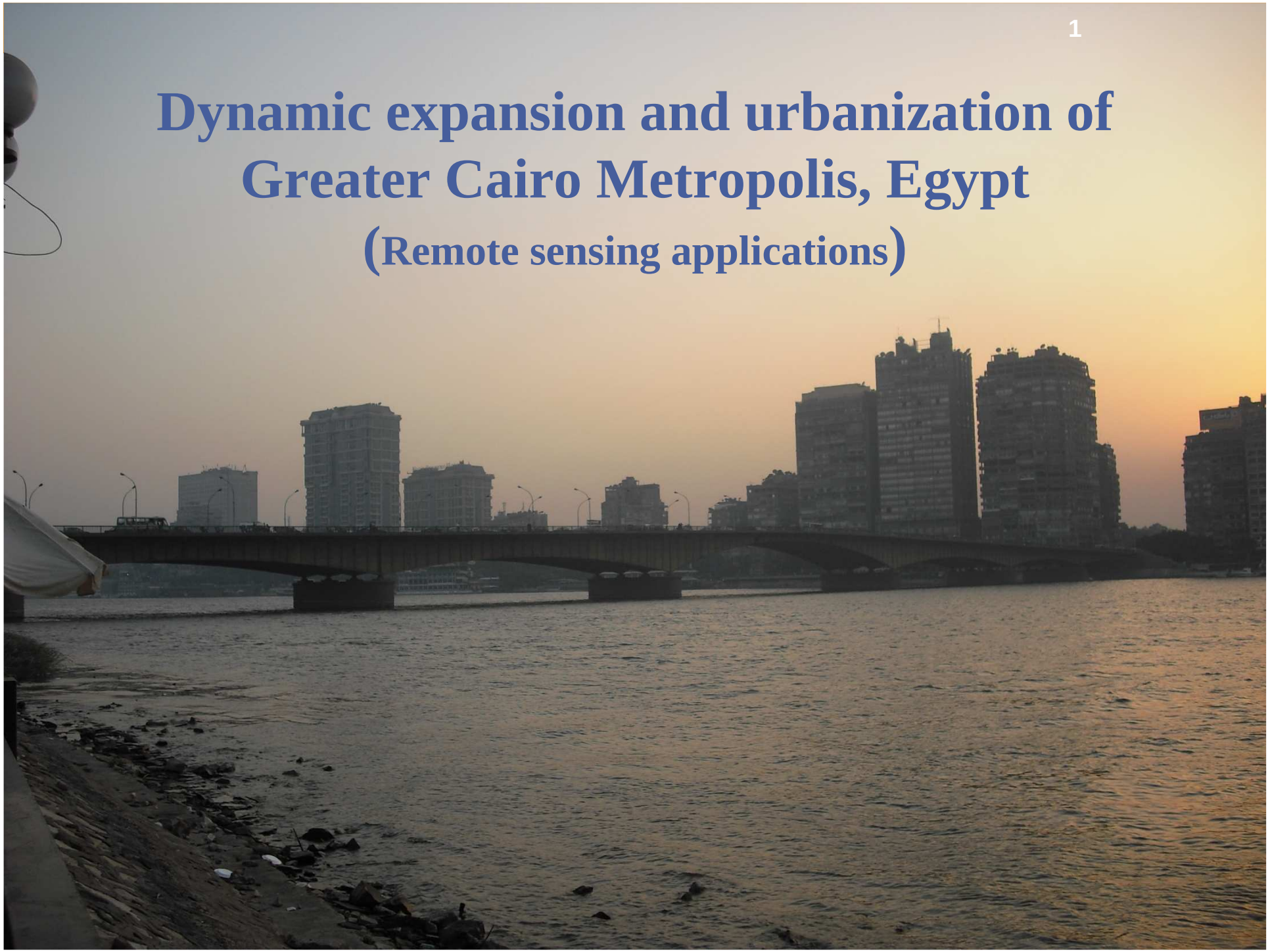
Dynamic expansion and urbanization of Greater Cairo Metropolis, Egypt

(Remote sensing applications)



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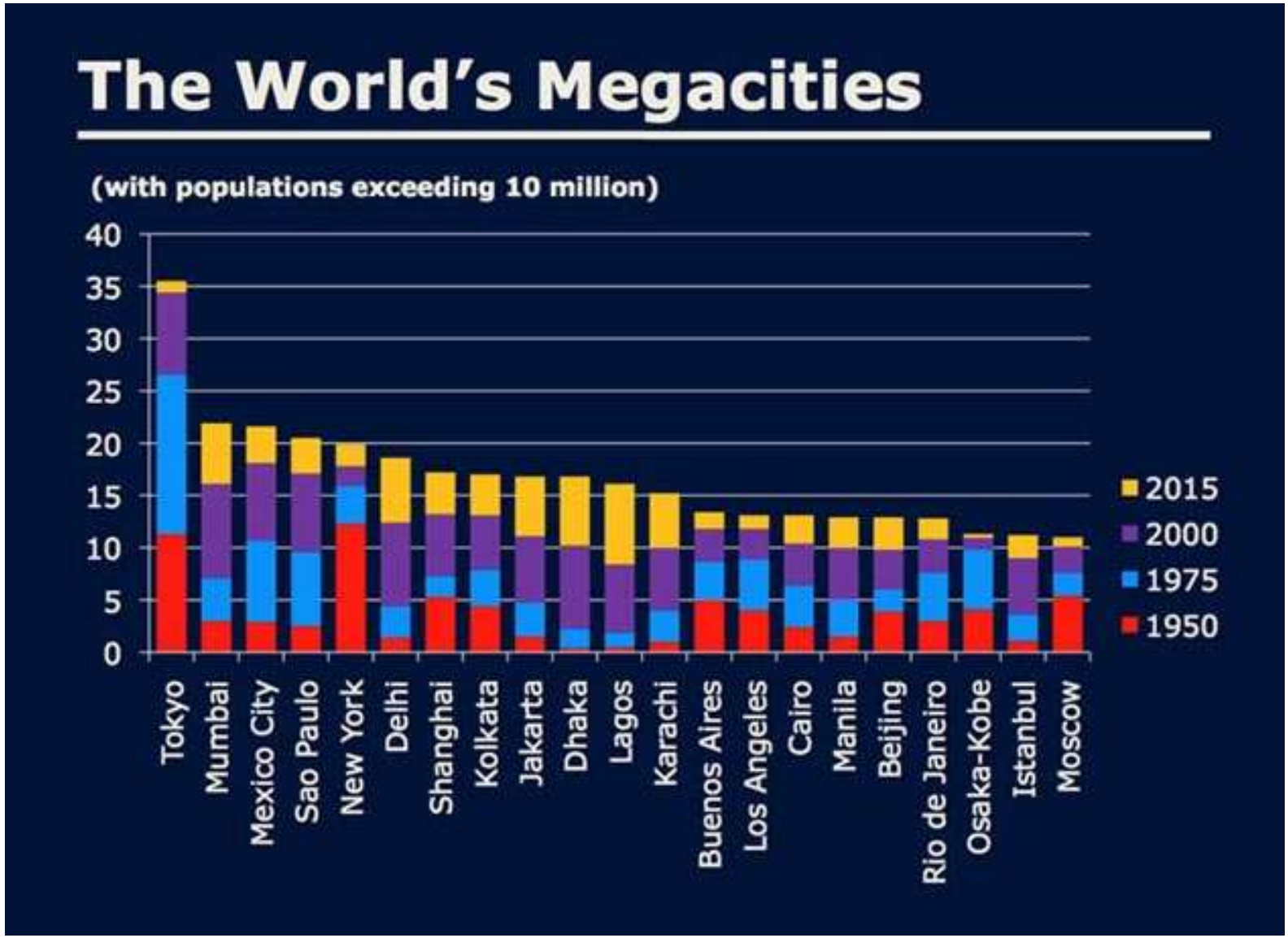
Introduction

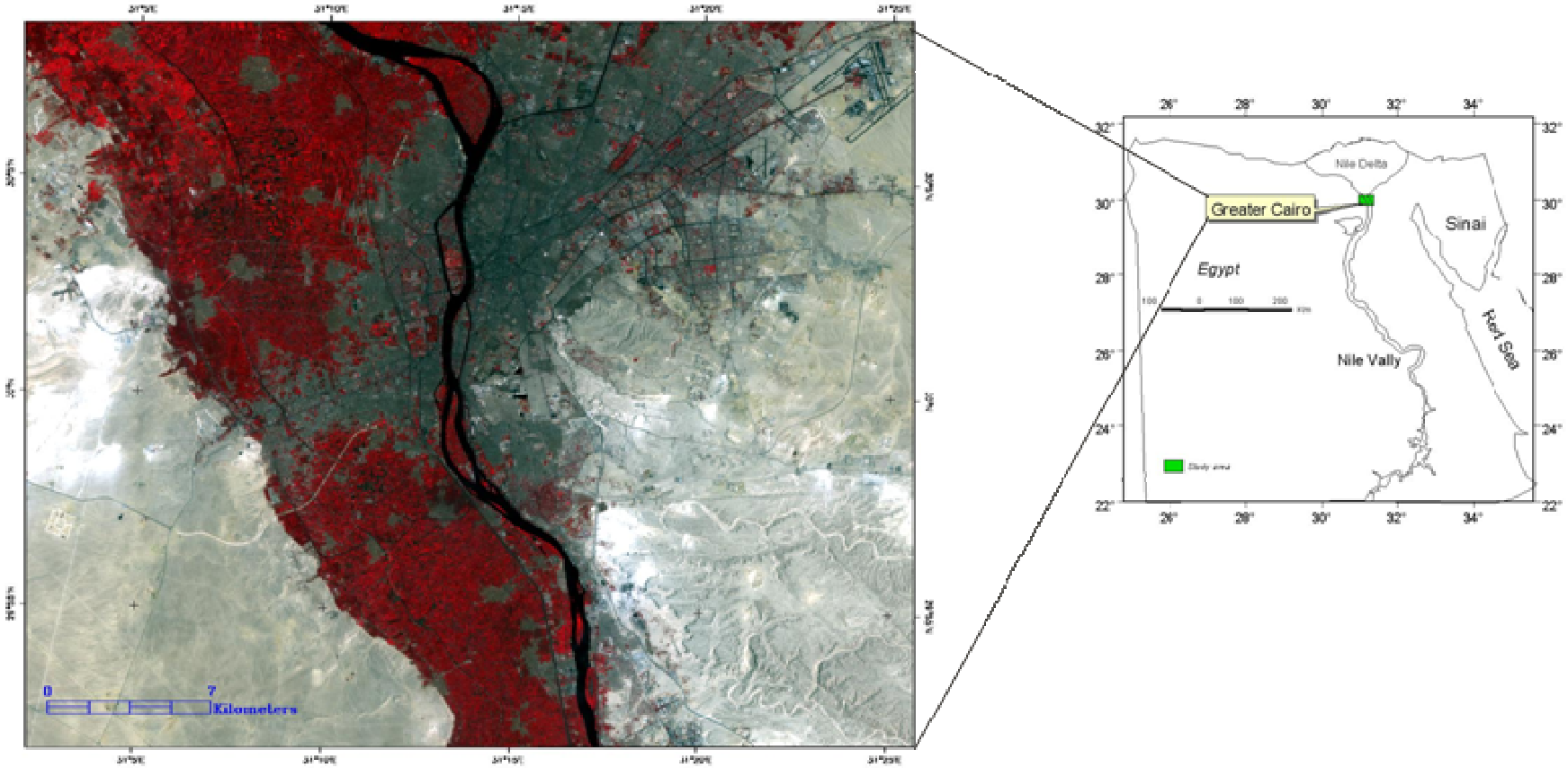


http://www.megacitiesproject.org/

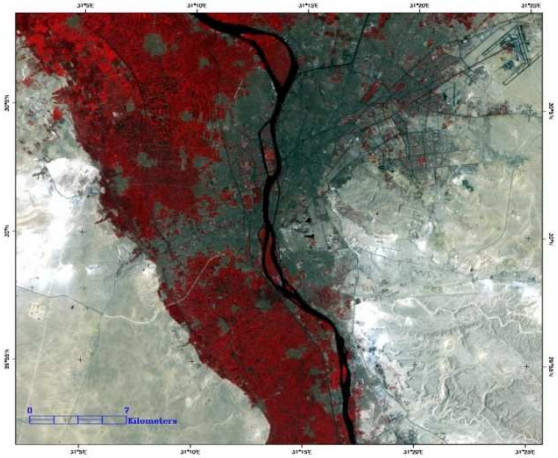
Problems:

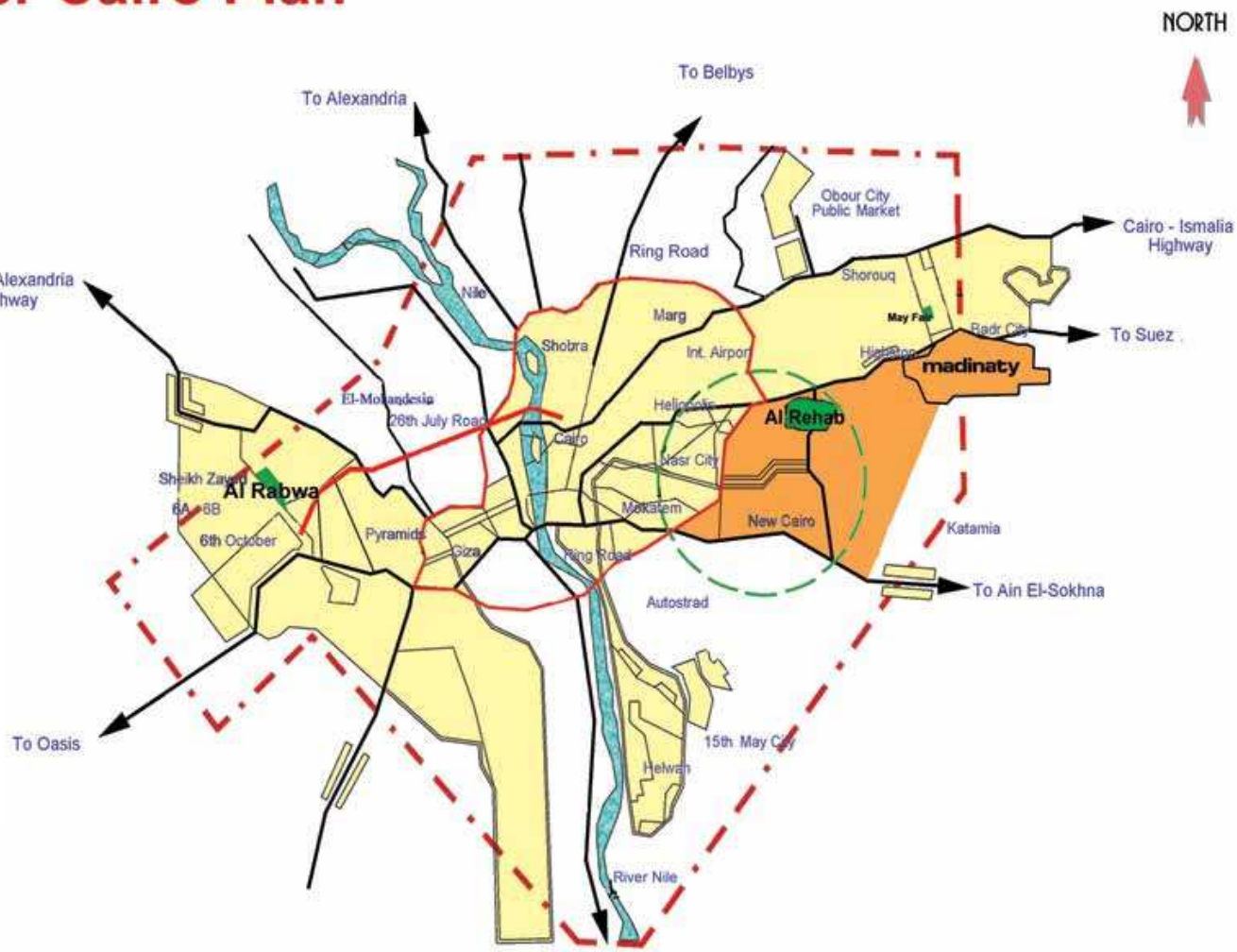
- Population growth
- Housing crisis
- Loss of fertile lands

Location Map of Greater Cairo

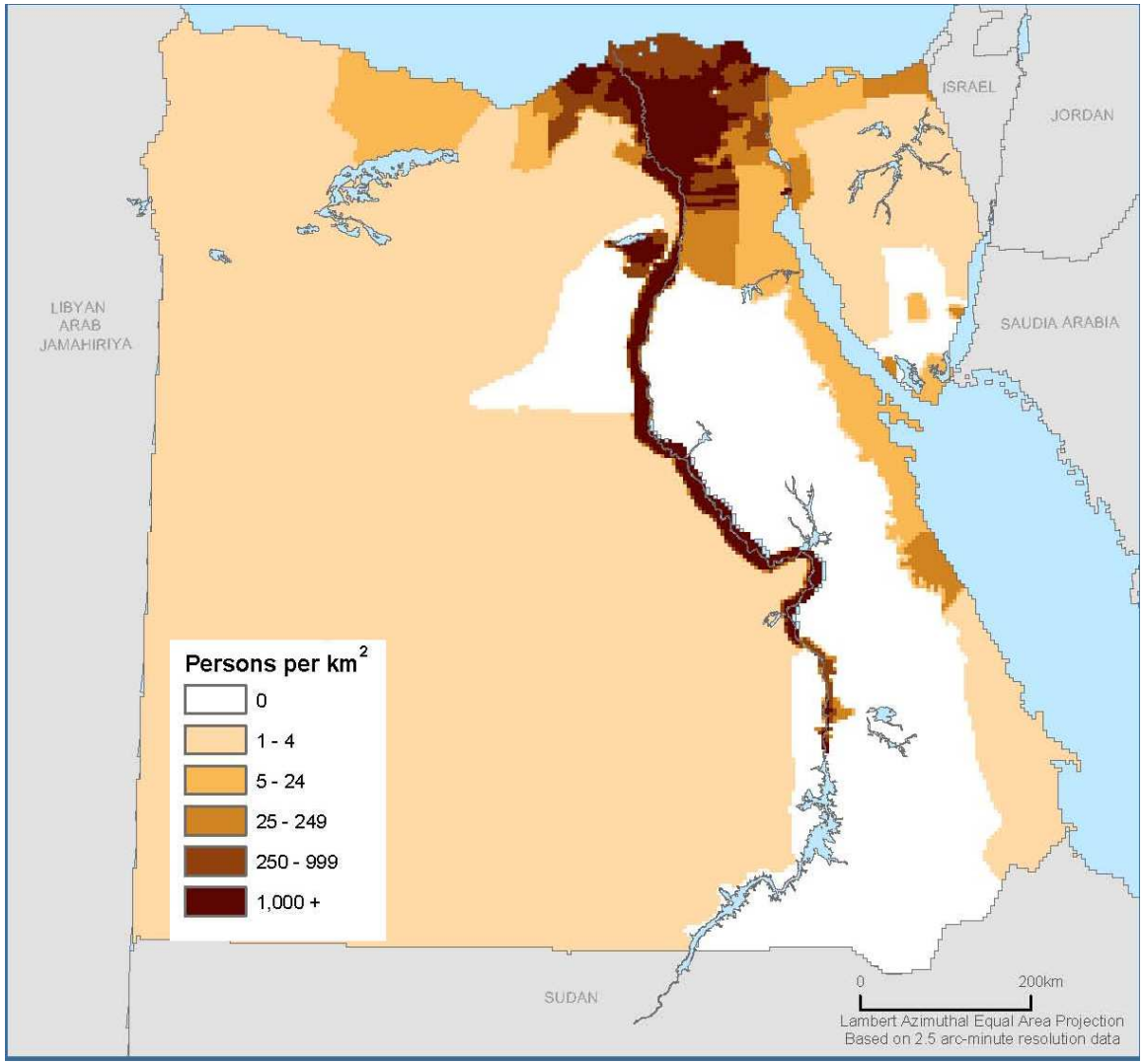


Greater Cairo Plan



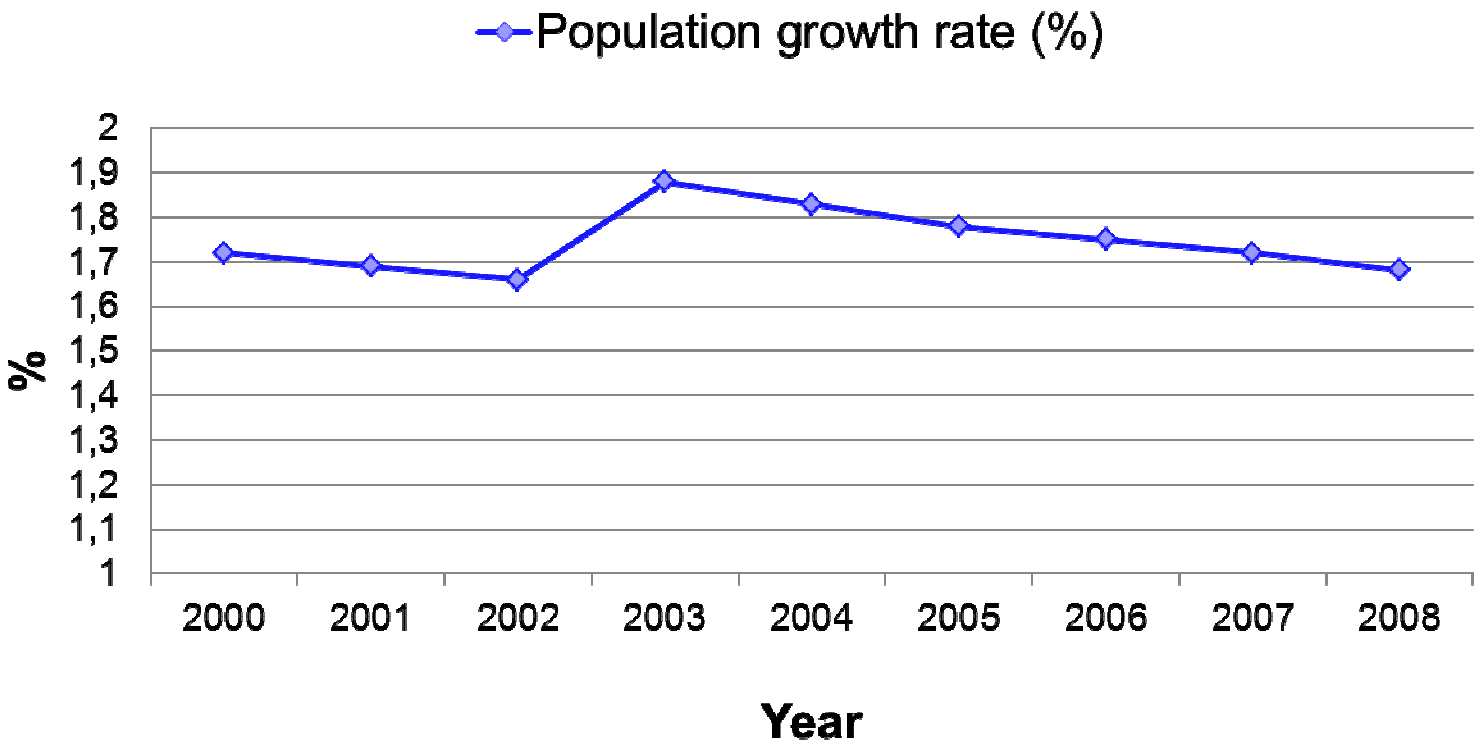


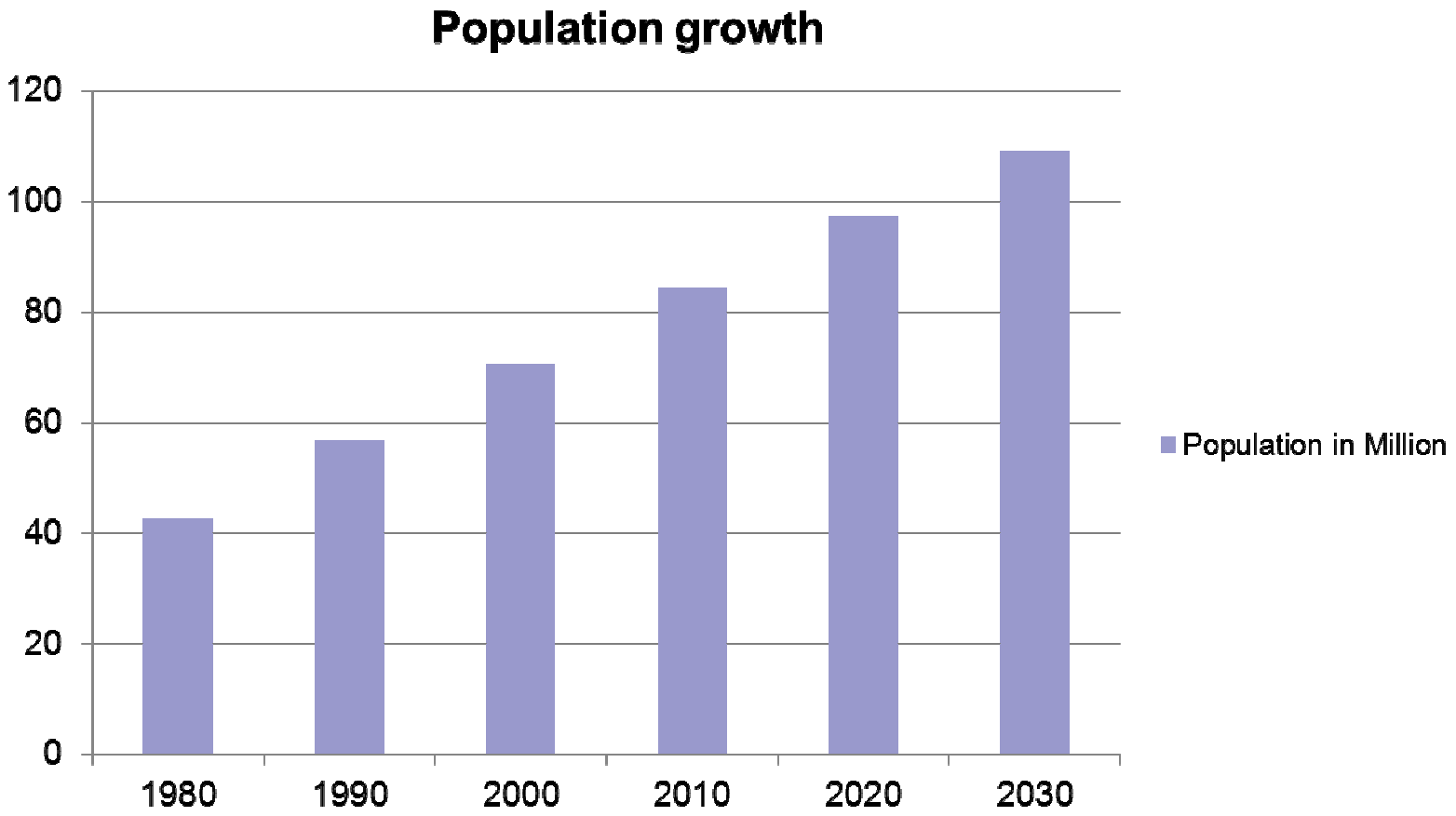
http://www.google.de/images?hl=de&client=firefox-a&hs=adc&rls=org.mozilla:de:official&q=greater%20cairo%20governance&um=1&ie=UTF-8&source=og&sa=N&tab=wi



Population Density Map of Egypt

http://sedac.ciesin.columbia.edu/gpw/global.jsp


Population growth rate (%)
%
2
1,9
1,8
1,7
1,6
1,5
1,4
1,3
1,2
1,1
1
2000
2001
2002
2003
2004
2005
2006
2007
2008
Year

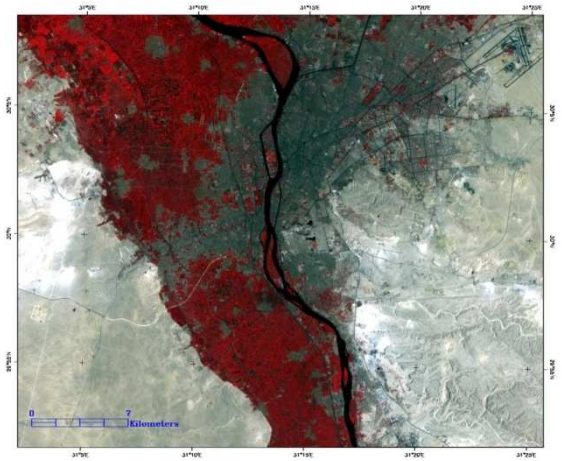

Population growth
120
100
80
60
40
20
0
1980
1990
2000
2010
2020
2030
Population in Million

Urbanization:

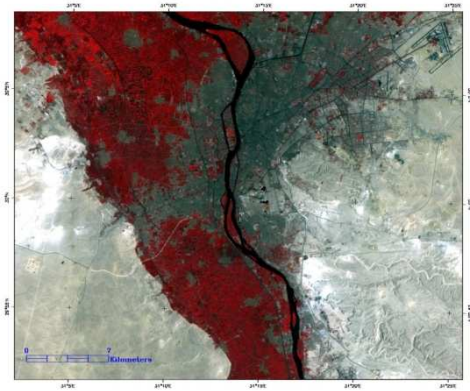
- Urbanization or urban drift is the ***physical growth*** of urban areas as a result of global change.

- Urbanization is also defined by the United Nations as movement of people from rural to urban areas with population growth equating to urban migration. The United Nations projected that half of the world's population would live in urban areas at the end of 2008.

Old and new Cairo



Loss of fertile land



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Objective:

- To show some of different remote sensing techniques to analyze the expansion of Greater Cairo

- Using different levels of classification based on the target and object (LU/LC and urban areas).

Materials and Method

Materials:

- Three Landsat TM & ETM images dates (path 176, row 39): 1984, 1990, and 2006 (the image of 1984 consider as the reference year for the other images).

- Multi-spectral spot mosaic acquired on 2006 has been chosen.

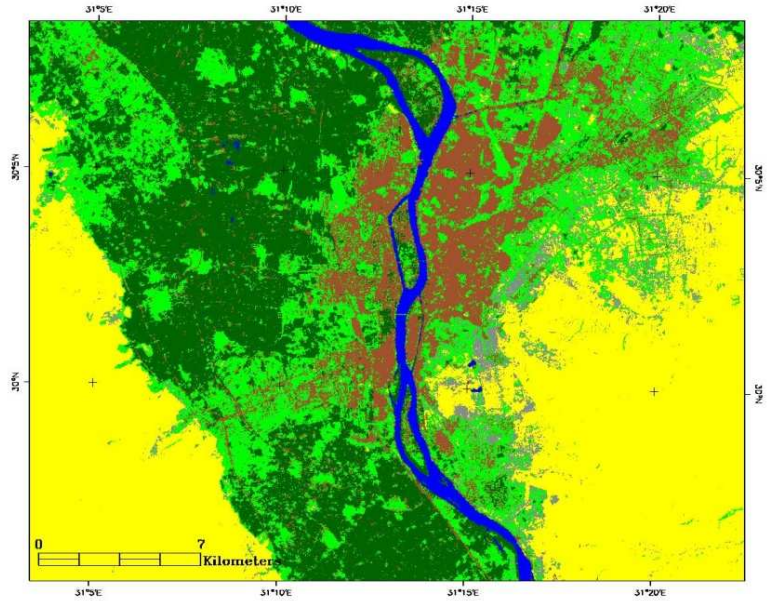
Method:

- Image processing
  (Enhancement)
- Pixel-based classification
  (First level of classification)
- Object-based classification
  (More levels of classification)
- Data management by GIS
  (Raster to Vector)

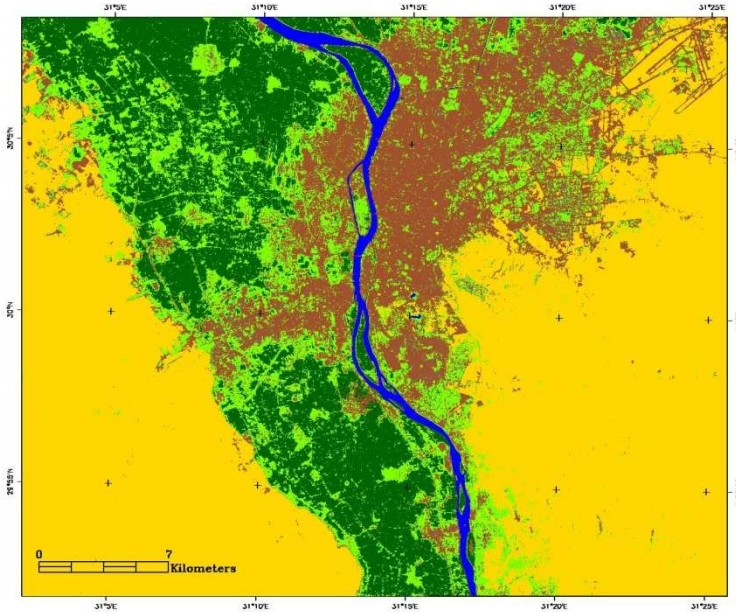
Results

Land cover-use change in Greater Cairo

Pixel-based classification

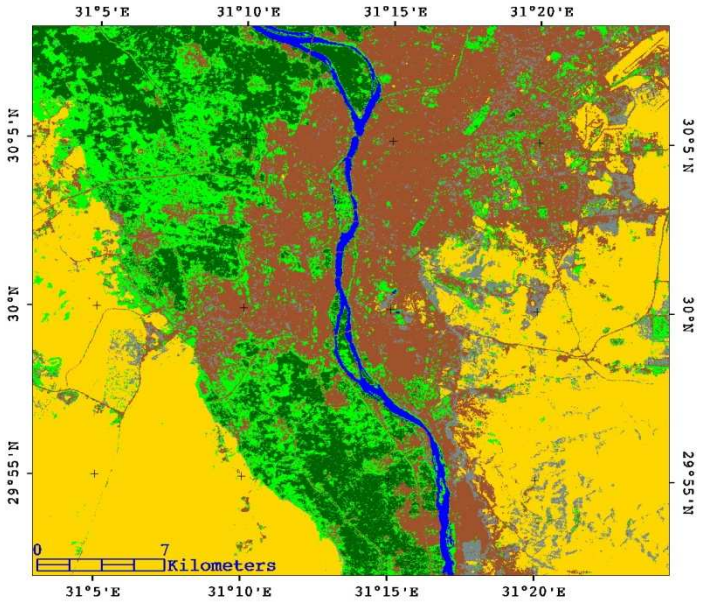


1984



1990

Urban area
Desert
Cultivated land
Bare Soil
Cultivated to Urban
Water



2006

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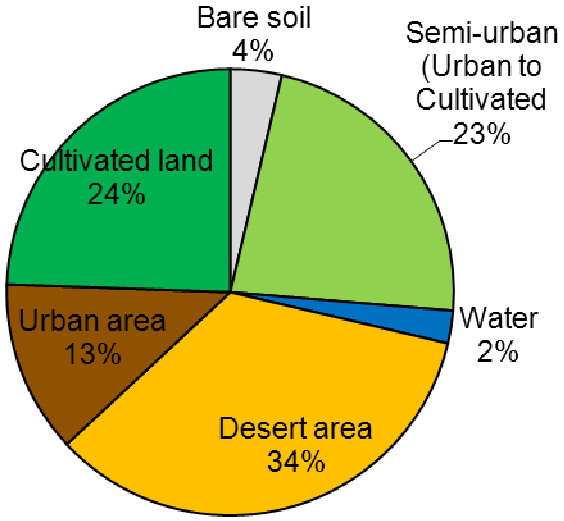
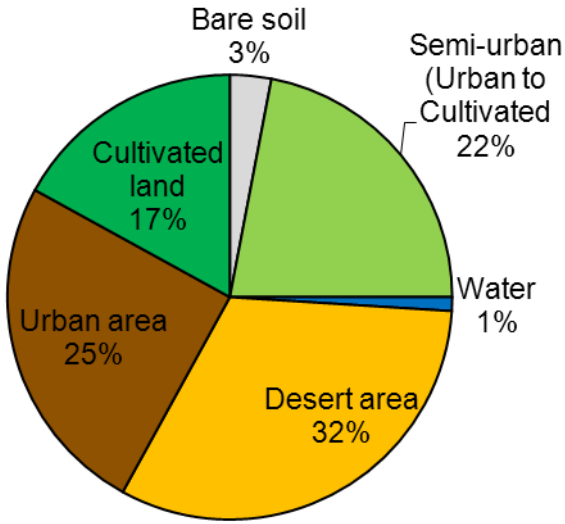
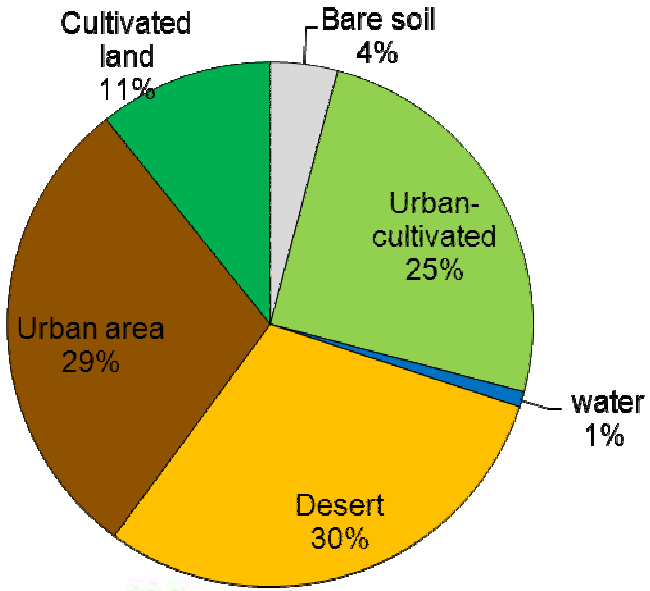
1984



1990

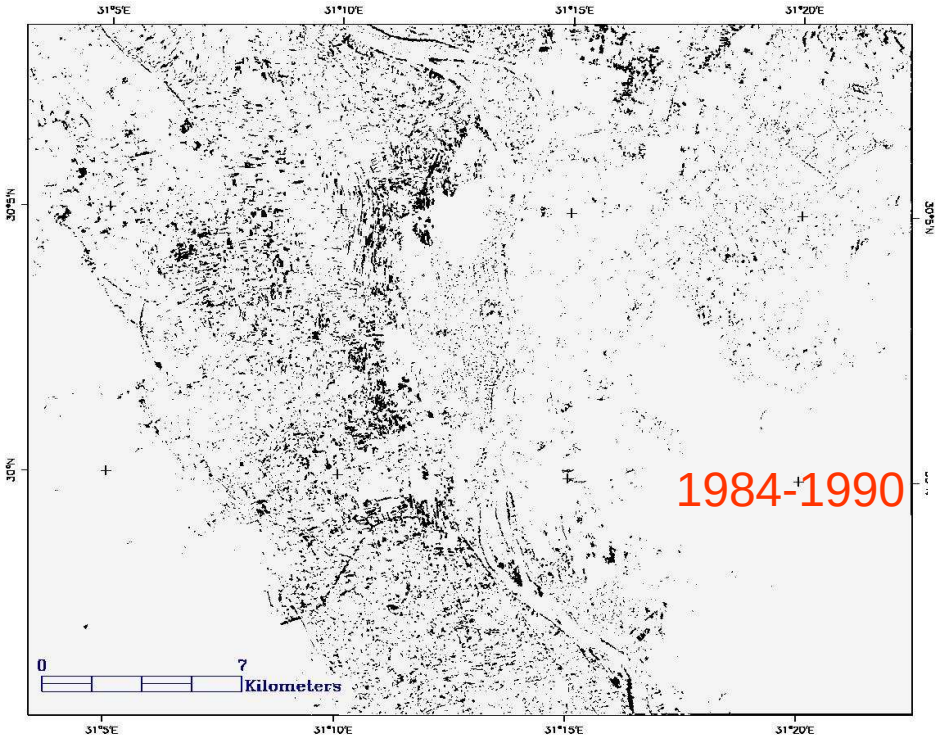


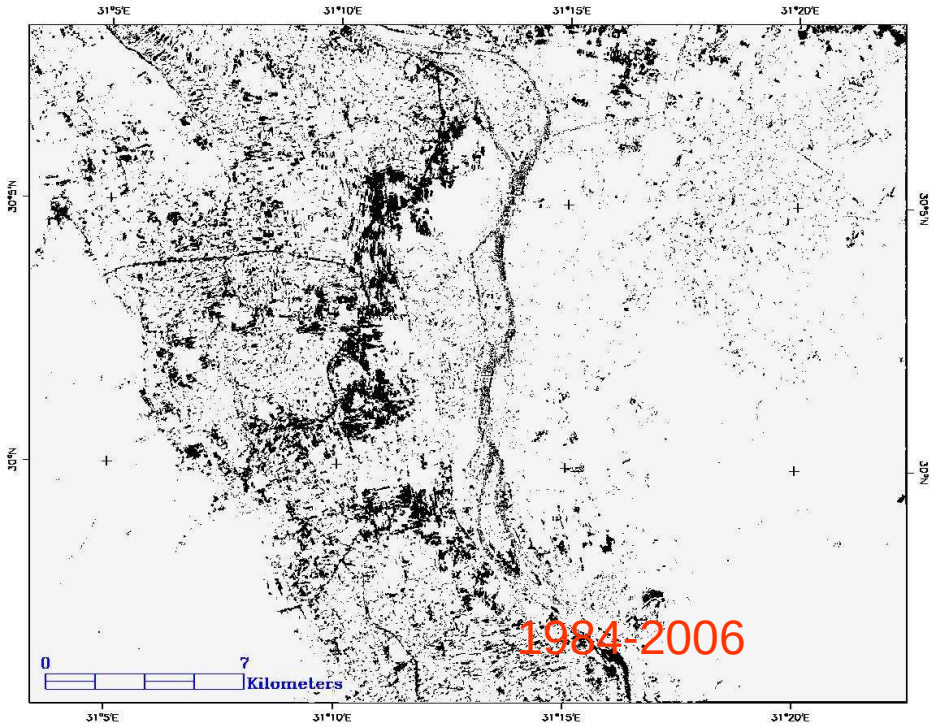
2006



21

The Normalization Difference Vegetation Index (NDVI)



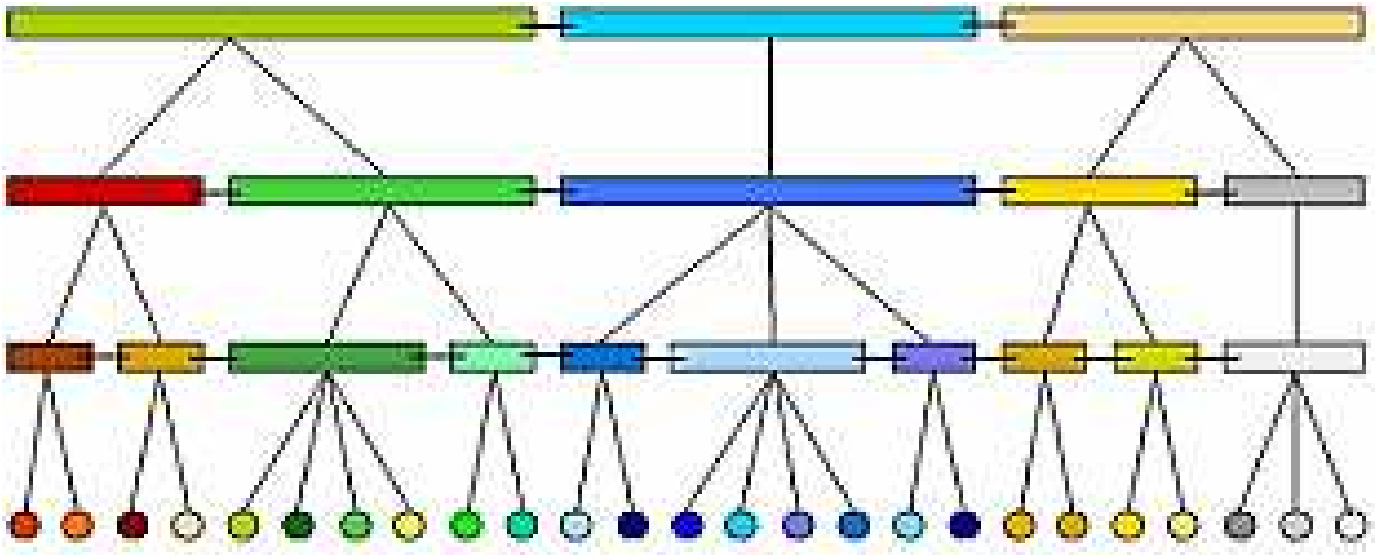


The degree of changes of cultivated land based on NDVI indices

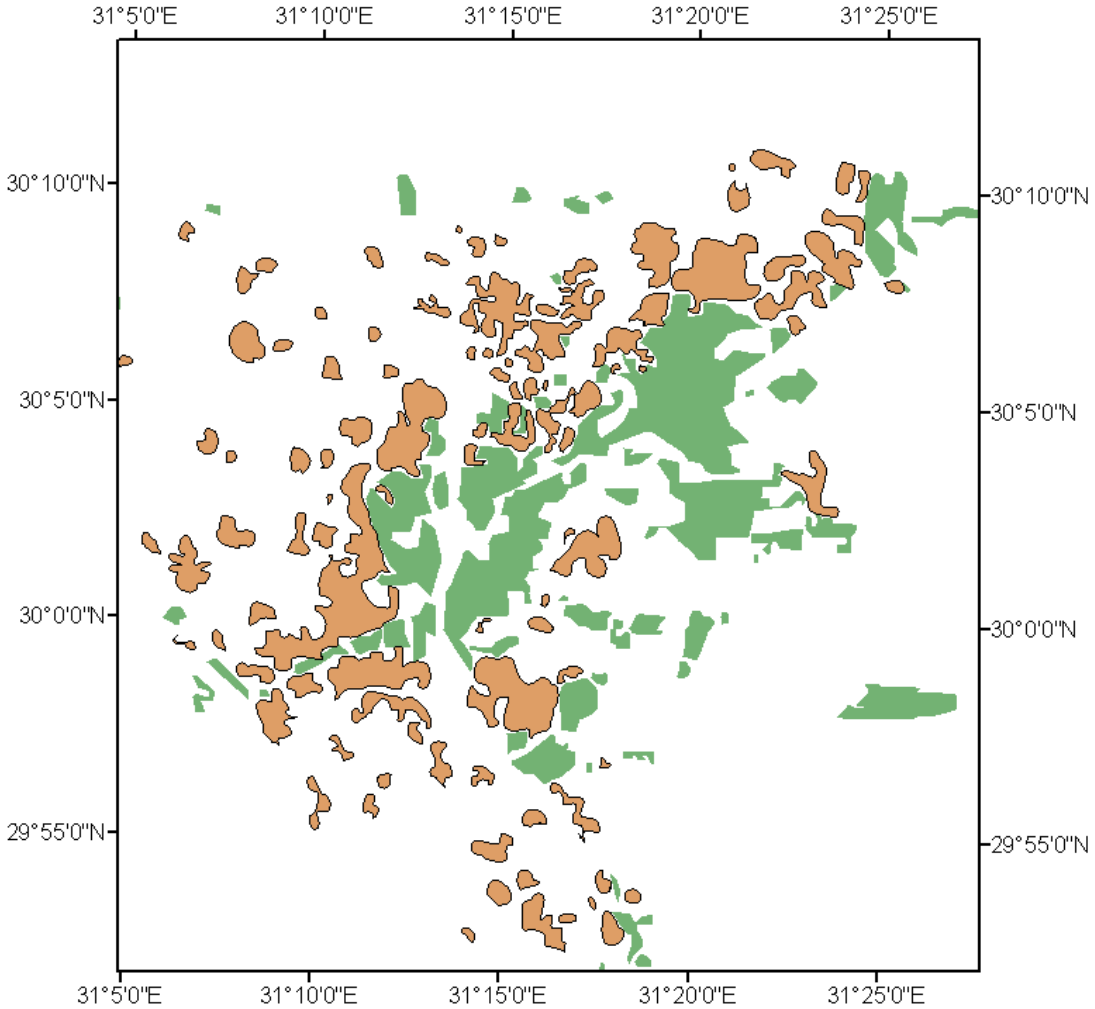
Note: **the dark area represents high degree of change**

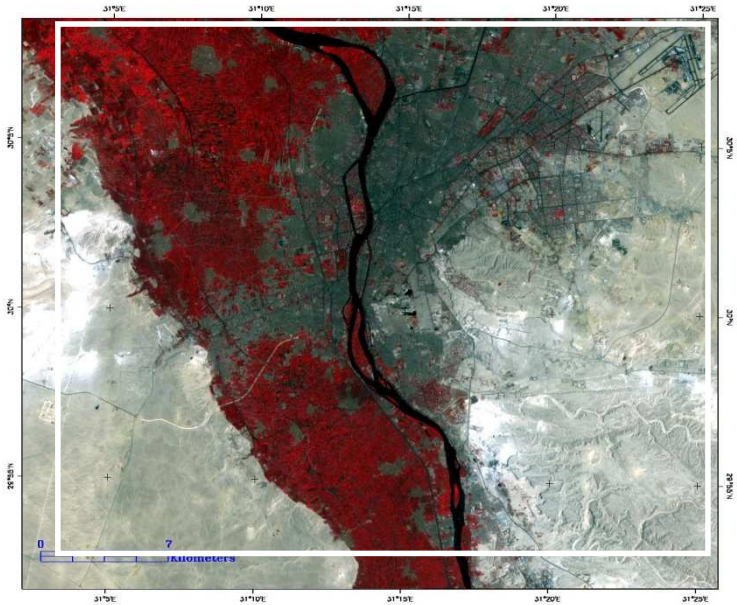
Object-based classification concept (Multiresolution segmentation)

- Hierarchical network of segments in different scale levels
- Choice of proper thresholds for homogeneity and heterogeneity criteria



* After eCognition / Definiens





Objects in the second level classification hierarchy were concerned to describe the formal and informal urbanization.

Legend

Formal building

informal building

N

0 1,5 3 6 9 12

Kilometers

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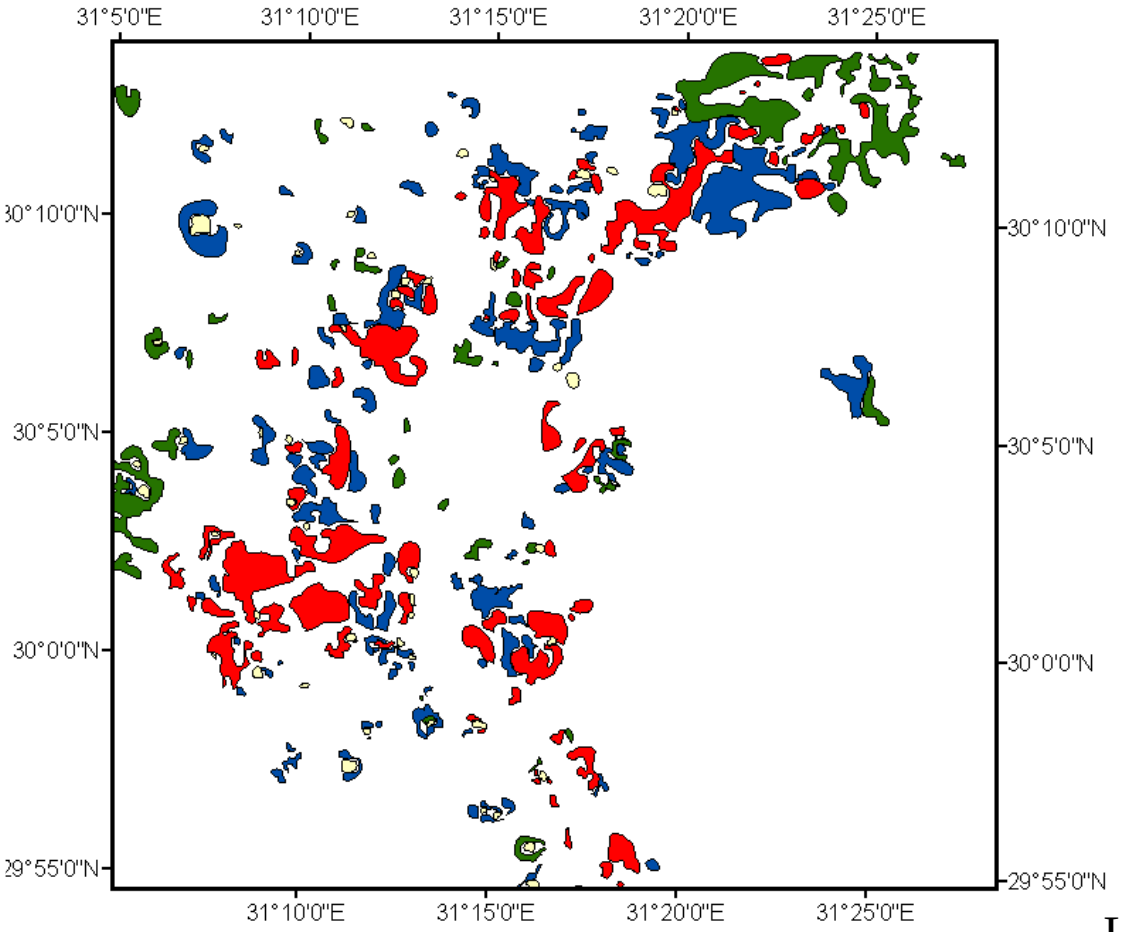

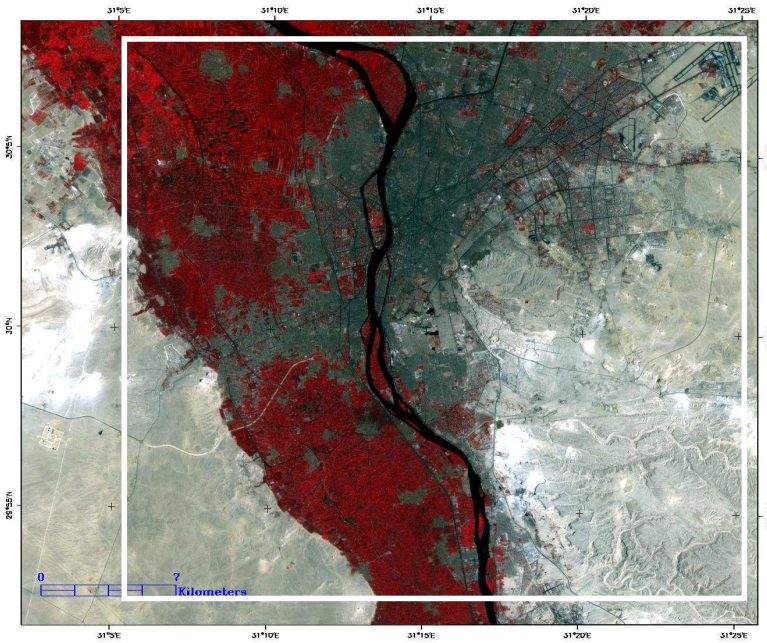

Legend

Informal_Classes

- Low Denisty
- Moderate Denisty
- High Denisty
- V.high Denisty

N

0 1,5 3 6 9 12

Kilometers

Level-2 is distinguished by four child classes.
These child classes are described as low, moderate, high, very high density of urbanization respectively

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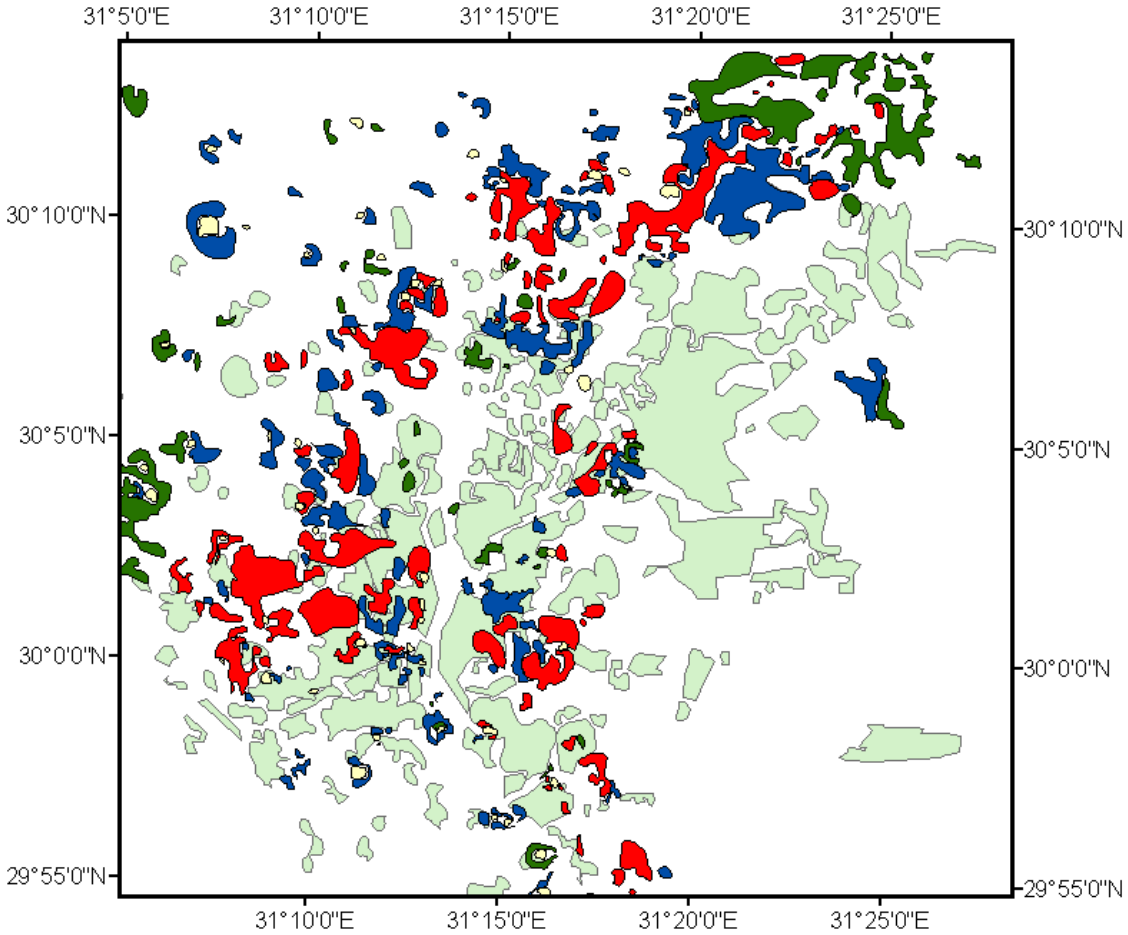

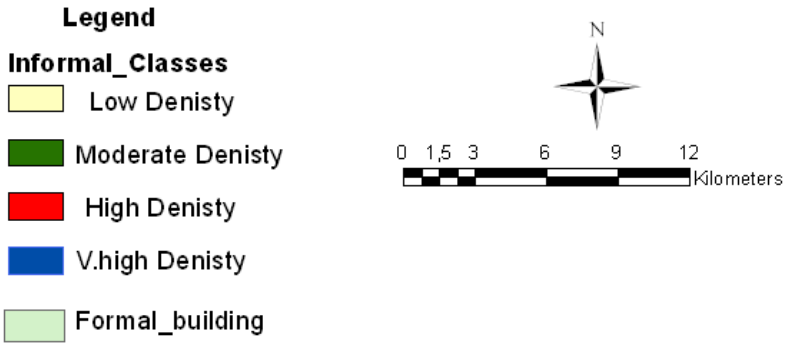

Combination map between different classes

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Outlook

- Pixel-based classification applied on Landsat TM and ETM+ time-series is useful for monitoring dynamics of megacities.

- Object-based classification deals more sufficiently with urban environment including formal and informal buildings.

- Very high image resolution is recommended for higher and higher levels of object-based segmentation and accuracy of classification.

- High densities of houses are not reflecting real population densities, due to the many houses are empty or partially empty.

Egypt is the promising country not a developing or third world country.