

2nd StatGIS conference: 12.11.2014

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RS Research for Social Sciences



INVESTMENTS IN EDUCATION DEVELOPMENT

REMOTE SENSING AND THE SOCIAL SCIENCES

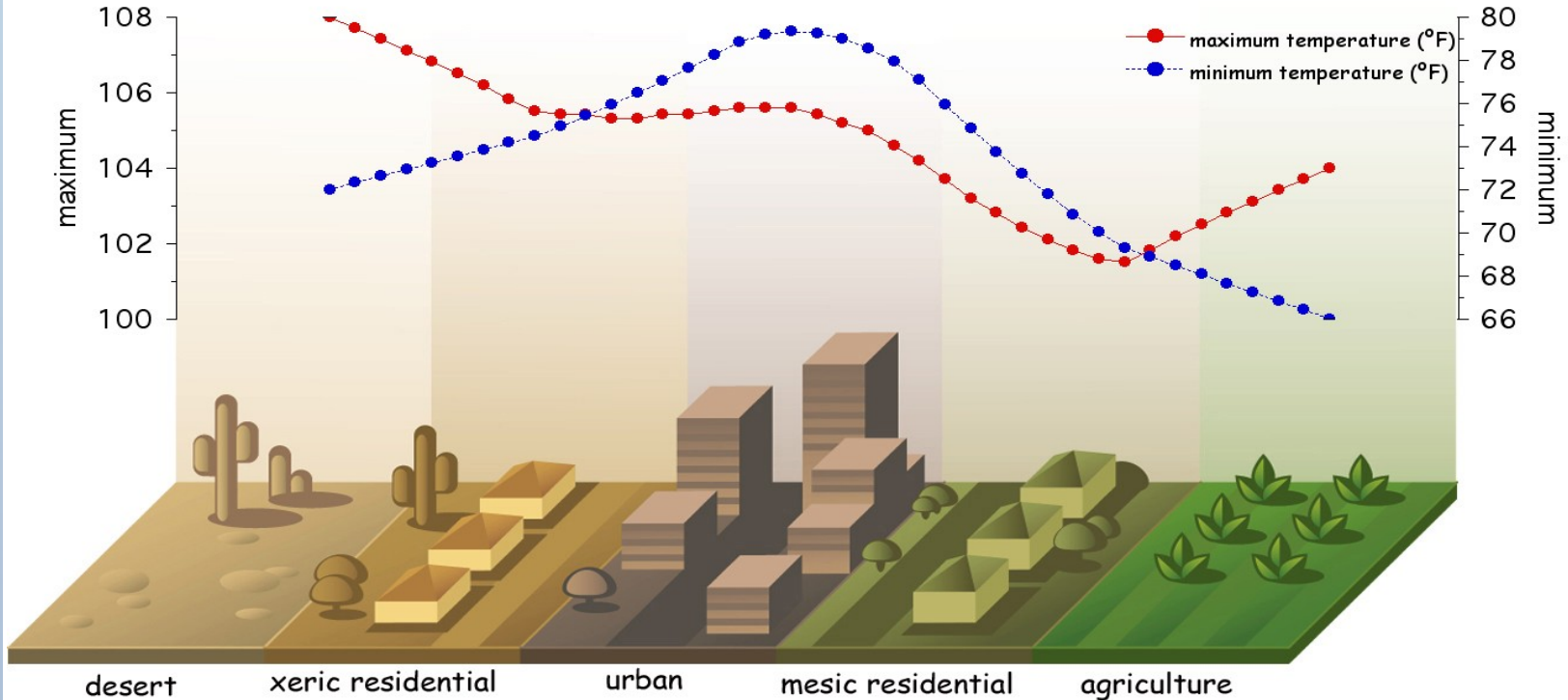
- CONTRIBUTION OF REMOTE SENSING TO SOCIAL SCIENCE RESEARCH
- SCALE
- DATA INTEGRATION
- INTERDISCIPLINARY RESEARCH
- CONFIDENTIALITY

APPLICATIONS IN THE SOCIAL SCIENCES

- DEMOGRAPHY
 - Estimating Population Size and Quality of Life
 - Studies of Population Dynamics
- HUMAN HEALTH AND EPIDEMIOLOGY
 - Mapping Risk Environments
 - Challenges and Opportunities for Early Warning Systems
- ARCHAEOLOGY AND ANTHROPOLOGY
 - Archaeological Research
 - Anthropological Research and Land Use Studies
- INTERNATIONAL RELATIONS, LAW AND POLICY
 - International Diplomacy and Arms Control Verification
 - Agricultural Monitoring and Famine Early Warning
 - Environmental Treaties
- LAND-USE CHANGE AND SUSTAINABILITY TRAJECTORIES
 - Land Use Change
 - Sustainability Trajectories

- *Identification and Delineation of Urban Areas*
- *Classification of Urban*
- *Measuring and Monitoring Physical Properties of Urban Areas Analysis of Physical Characteristics and Demographic/Socioeconomic Patterns*
- *Monitoring Urban Growth*

Urban Heat Island



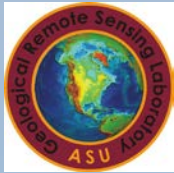
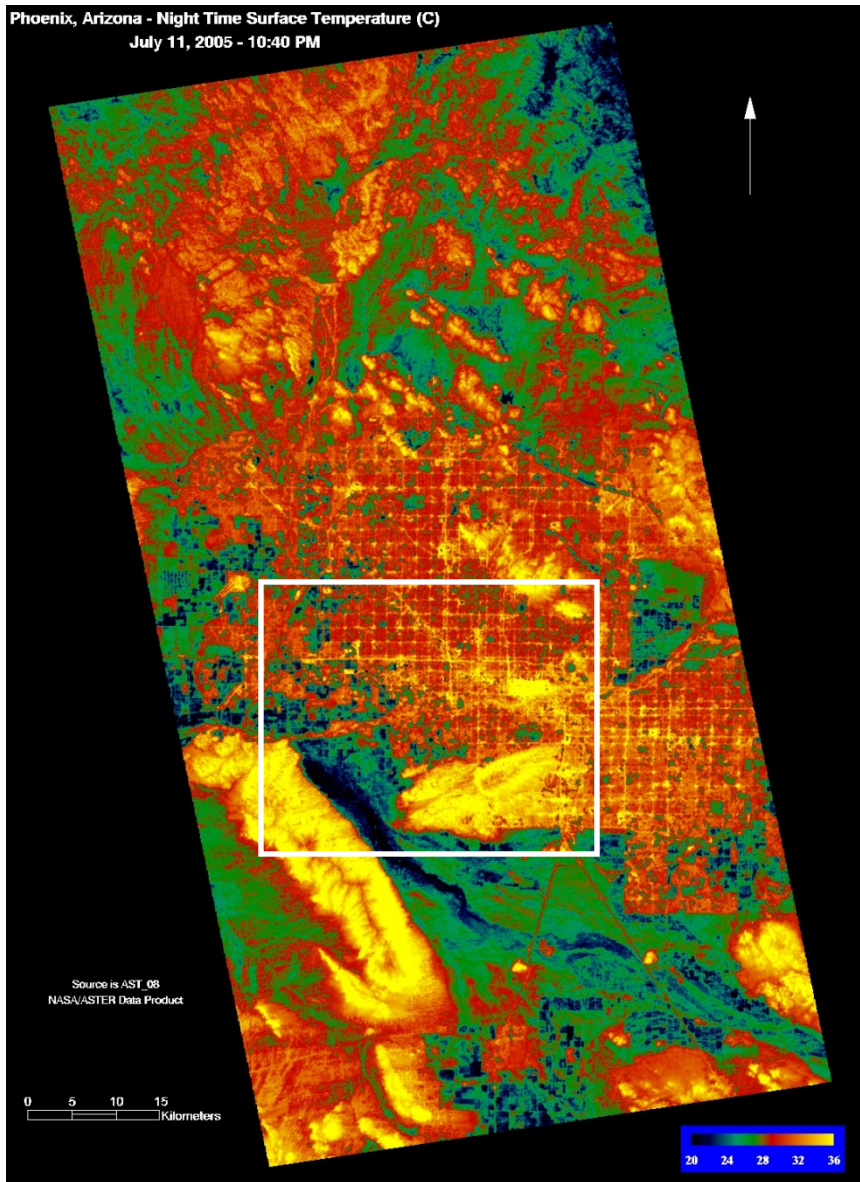
The heat island is a nighttime phenomenon in semi-arid regions. Residential and agricultural irrigation mitigate the heat island during the day.

ASTER Phoenix Nighttime Surface Temperature

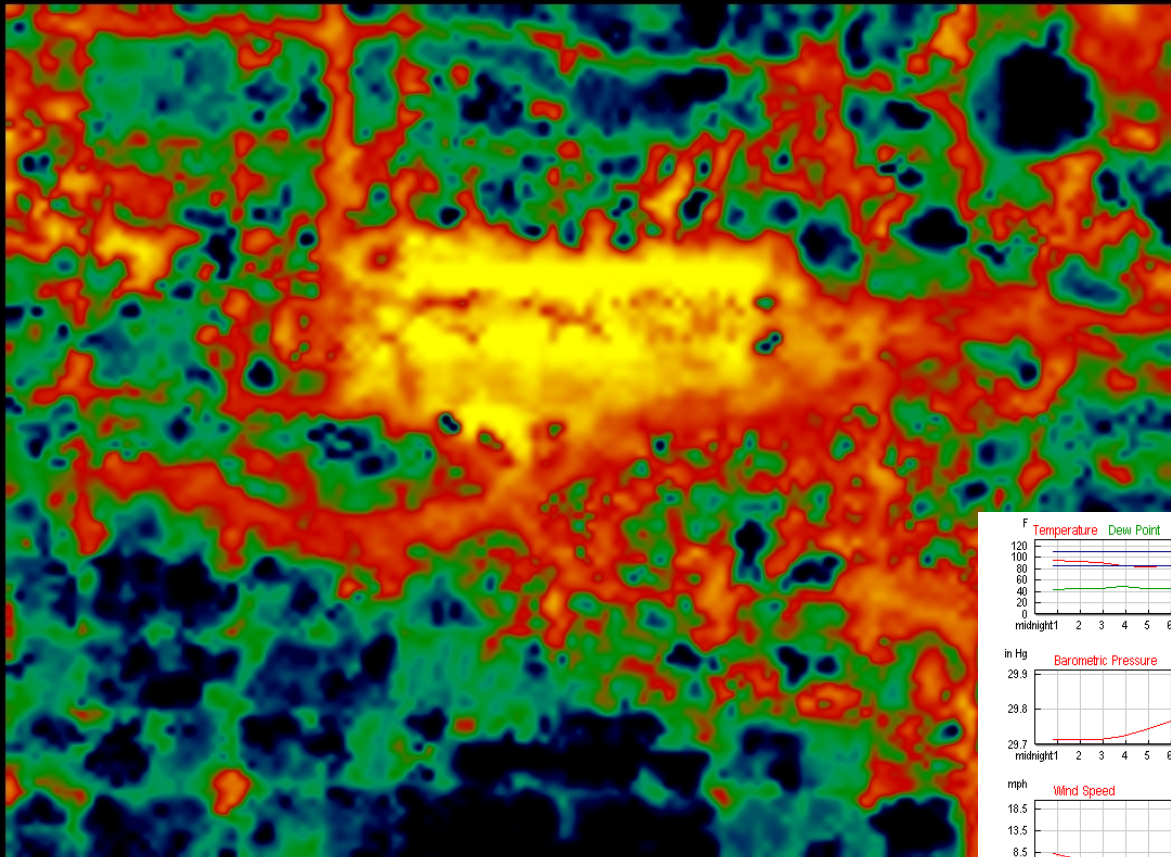
**NWS Data
July 11, 2005**

Max Daytime
Temperature
43 °C / 111 °F

<u>Time</u>	<u>Temperature</u>
10:51 PM	98.1 °F / 36.7 °C



Phoenix Sky Harbor - Surface Temperature (C) July 11, 2005 - 10:40 PM



NWS Data July 11, 2005

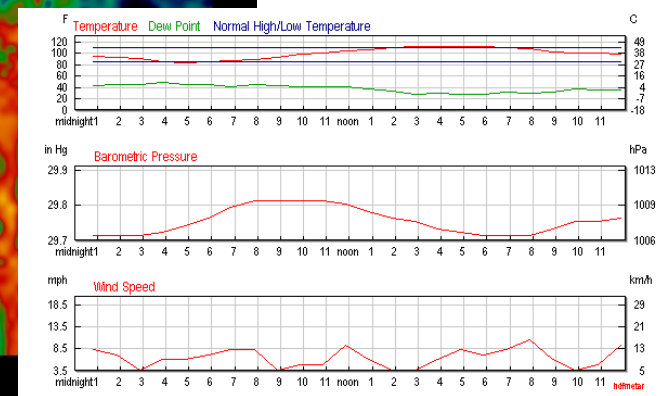
Max Daytime
Temperature
43 °C / 111 °F

Time (MST) Temperature

10:51 PM 98.1 °F /
 36.7 °C

Dew Point Humidity

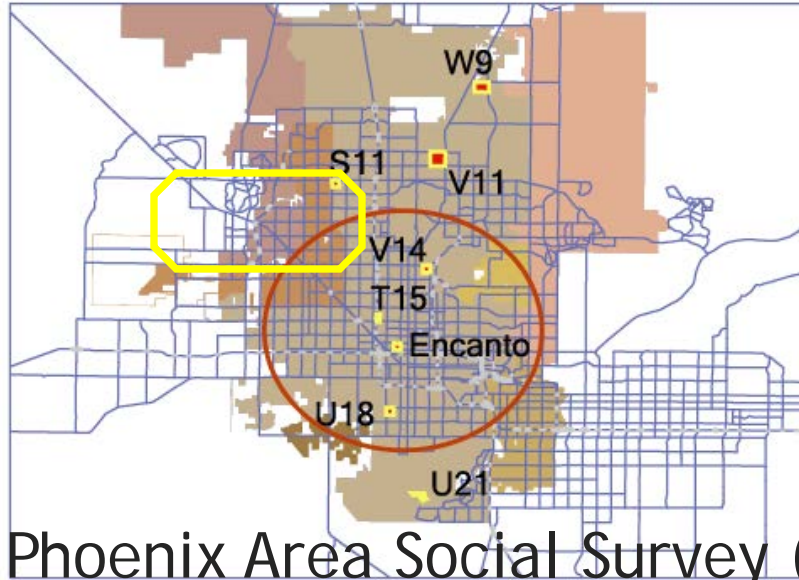
33.1 °F / 10%
0.6 °C



AST_08 - NASA/ASTER



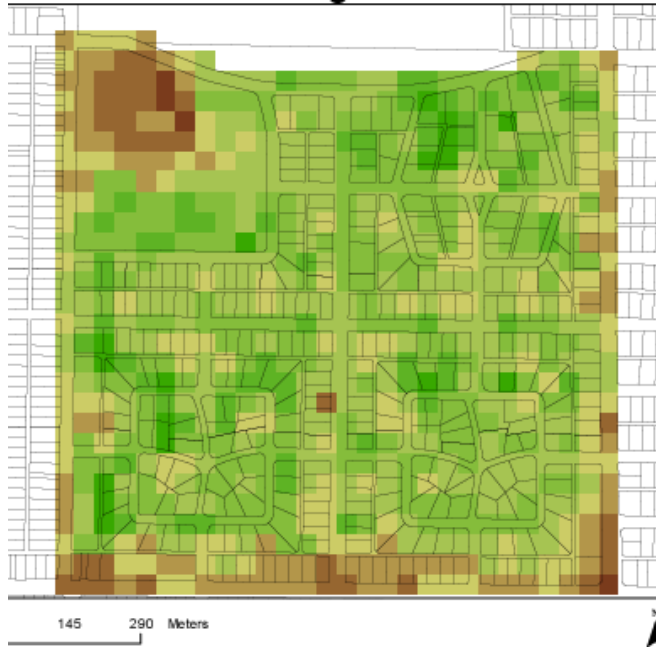
Study of Heat in Phoenix Neighborhoods



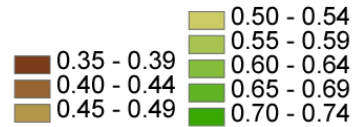
Phoenix Area Social Survey (PASS) Neighborhoods

	Social Capital	Population	% Hispanic	Median HH Income	%Home Owners	%Edu College+	Mean Age
U21	3.3	4,345	6	107,230	97	24	34
ENCANTO	3.5	981	23	77,404	74	42	38
V11	3.0	2,553	7	59,375	93	5	37
S11	3.1	1,185	11	55,417	79	3	33
V14	3.2	1,481	17	43,245	33	11	36
U18	2.9	1,995	87	32,625	77	0	25
T15	2.4	2,024	77	25,785	6	1	23

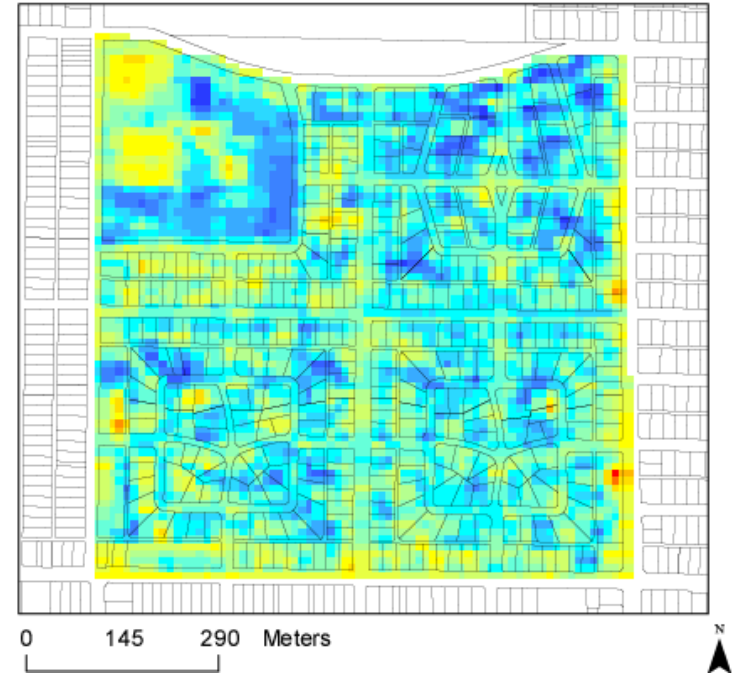
Encanto Vegetation Index



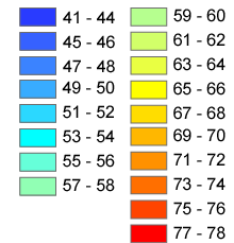
SAVI Derived from 2000 Landsat



Encanto Surface Temperature

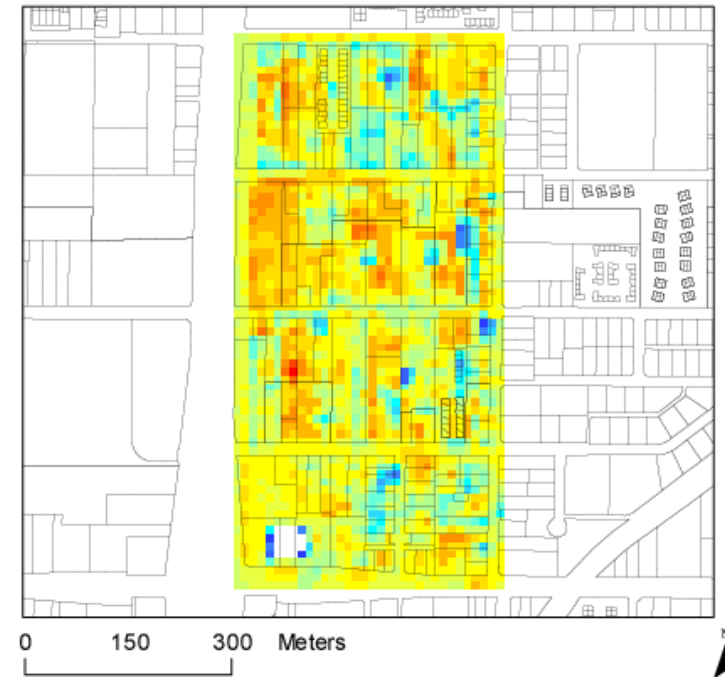
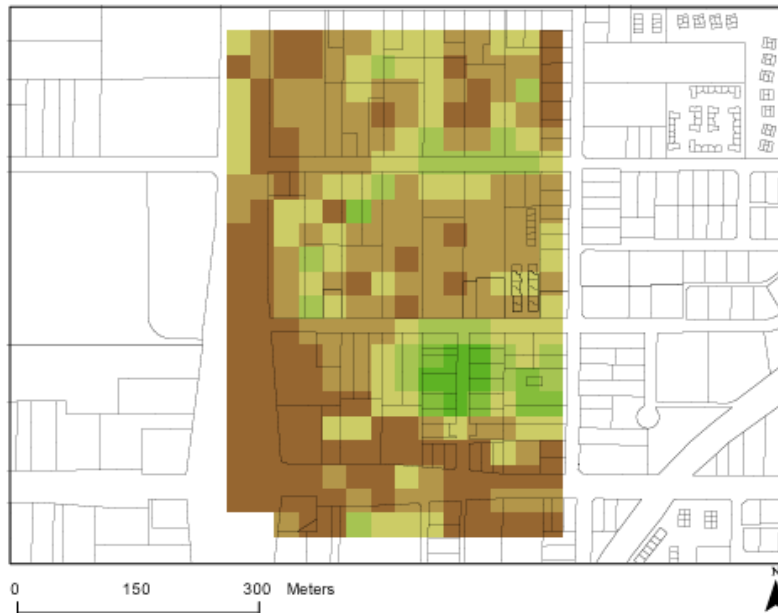


Surface Temperature in C

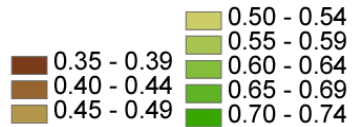


T15 Vegetation Index

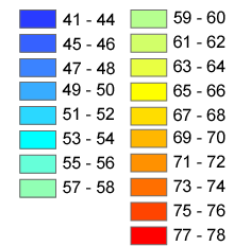
T15 Surface Temperature



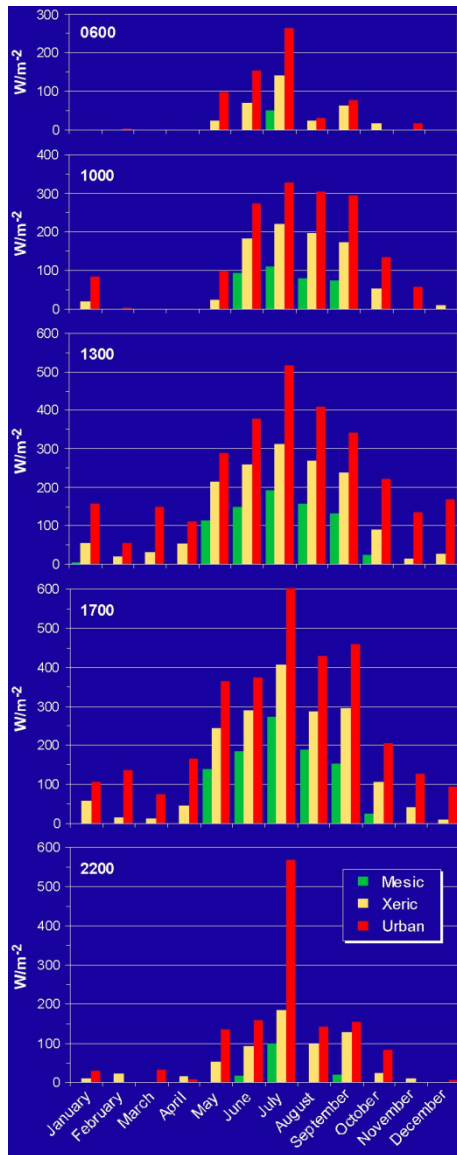
SAVI Derived from 2000 Landsat



Surface Temperature in C



Human Comfort



Urban residential or
“zeroscape”



Mesic residential

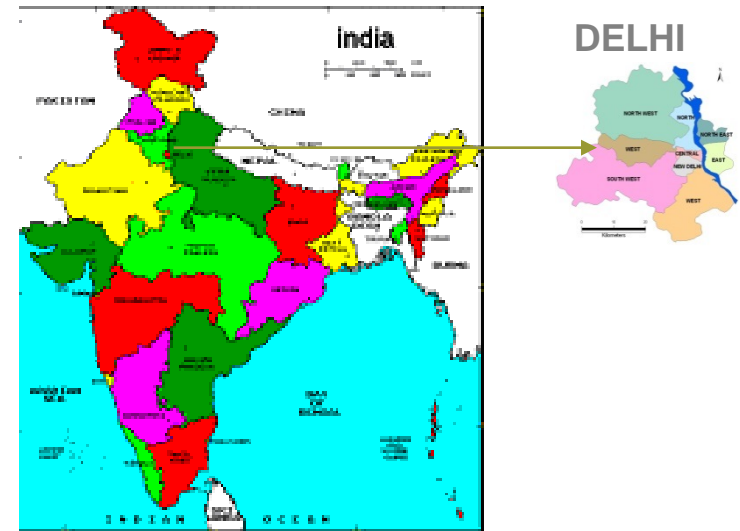


Xeric residential



Case study Delhi/India

- Capital city of India
- It spreads over an area of 1,463 km²
- Total population ca. 15 million in 2011 (Census of India 2011)
- The climate is semi-arid with maximum rainfall is - July (296 mm),
- The hottest months are May and June with mercury levels touching 48°C, whereas,
- The lowest falls to 4°C at the end of Dec.- Jan.



Delhi - Growth of slums

Migrants account for 50% increase in population every year.

Jhuggi/Jhopadis (Slum) 12,749 in 1951 to

Now >600 000 (0.6 million)



JJ Clusters on the bank of Yamuna River

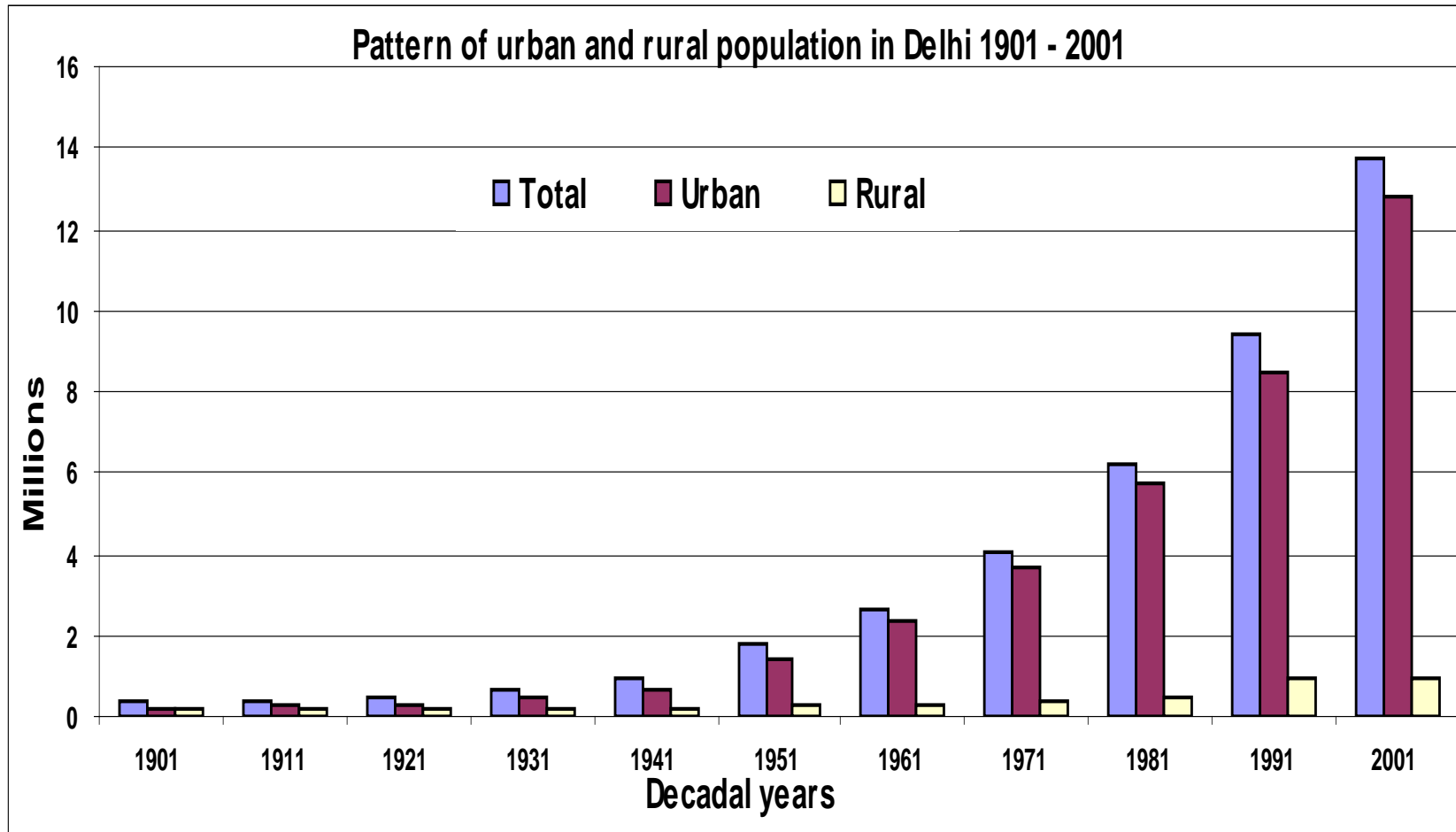


Fig. 5

Since 1951, the population of Delhi has been increasing at an average rate of **46%** per decade

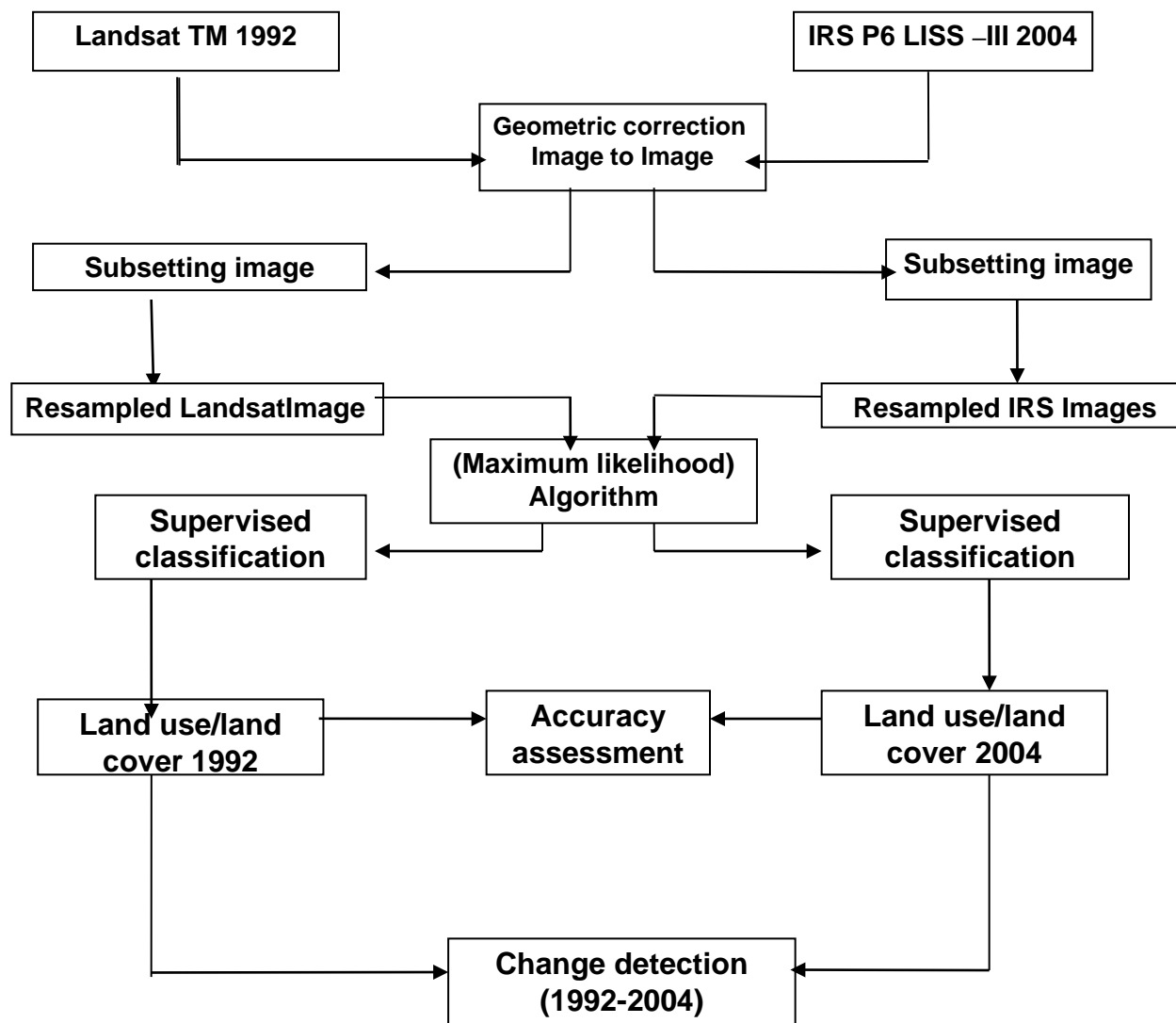
Delhi's population in **rural areas**

1901 Census - **47.4%**

1951 Census - 17.60%

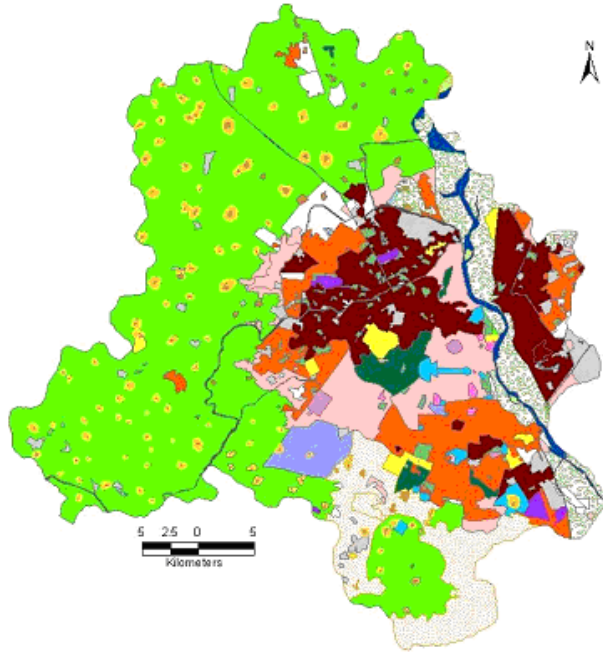
2001 Census - **7%**

Methodology for land use/land cover & change detection

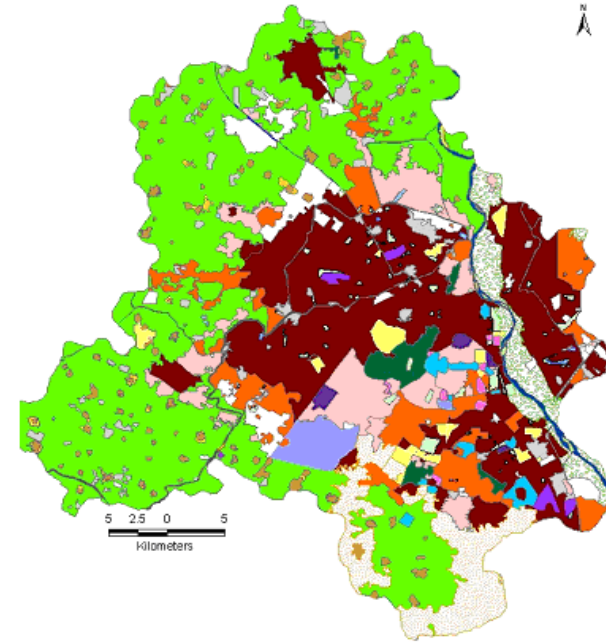


Case study Delhi - LC/LU classification

1992

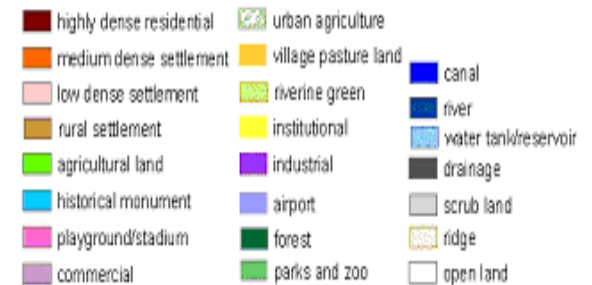


2004










The broad land use classes have been taken from **Landsat TM data**.

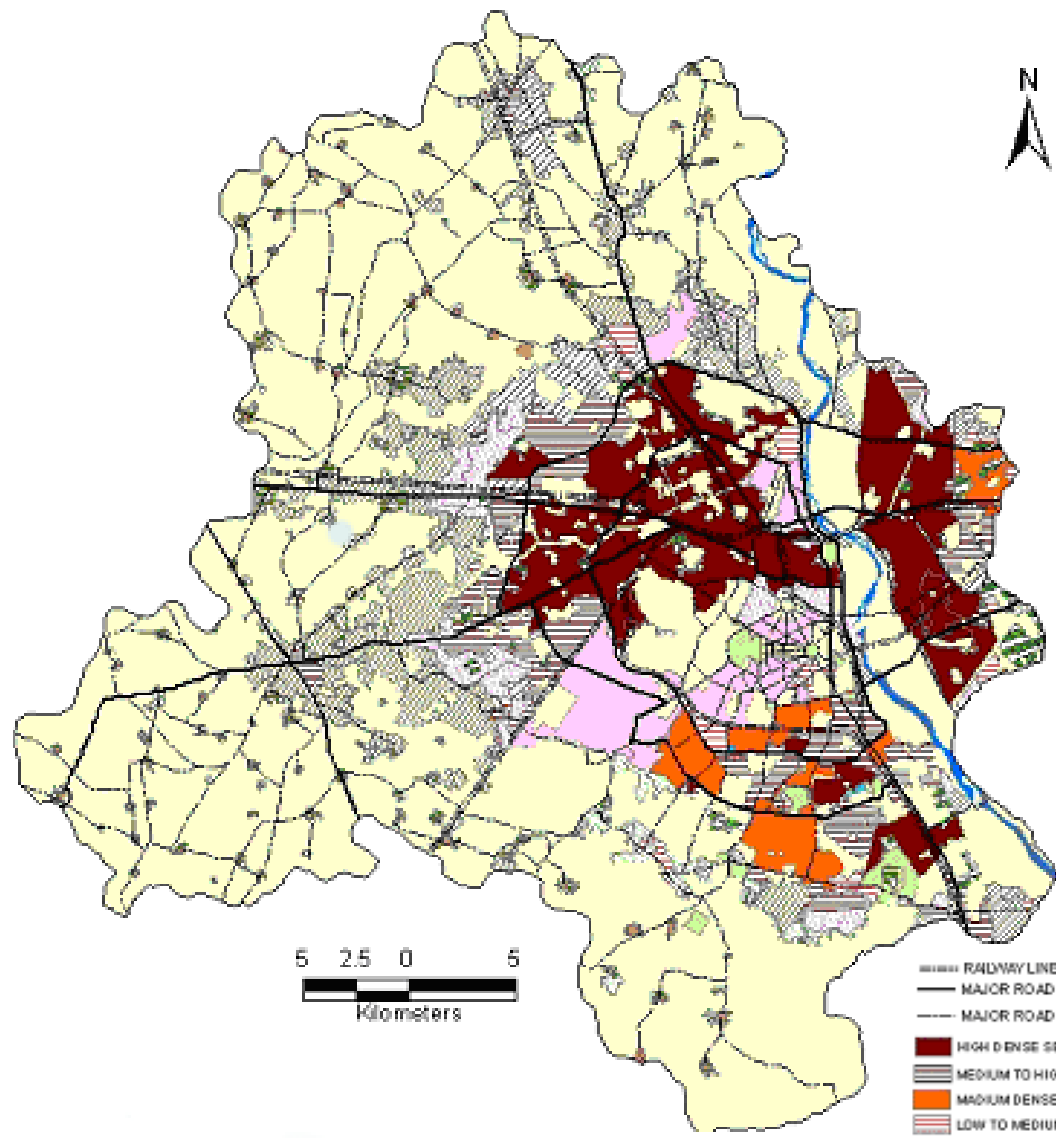
The detail land use classes have been done from **IRS-P-6 Liss III**.



Land use/land cover change detection (1992-2004)

Land use/land cover	1992		2004	
	Area (Hect.)	Area (%)	Area (Hect.)	Area (%)
Highly dense residential	15,348.87	10.39	34,123.04	22.95
Medium dense residential 	12,039.75	8.15	10,706.75	7.20
Low dense residential	10,661.80	7.22	10,324.30	6.94
Rural settlement 	1,457.07	0.99	2,773.80	1.87
Airport	2,261.67	1.53	2,160.02	1.45
Institutional	1,718.19	1.16	1,951.32	1.31
Agricultural land 	65,114.21	44.89	54,152.63	36.94
Scrub land 	3,521.43	2.52	3,615.58	2.43
Forest 	2,331.06	1.58	2,127.34	1.43
Ridge 	9,874.87	6.69	8,211.81	5.52
Urban agriculture 	8,102.82	5.49	4,755.28	3.20
Open land	3,507.95	2.38	5,338.12	3.72

RESIDENTIAL LANDUSE TRANSFORMATION (1992- 2004)



5 2.5 0 5
Kilometers

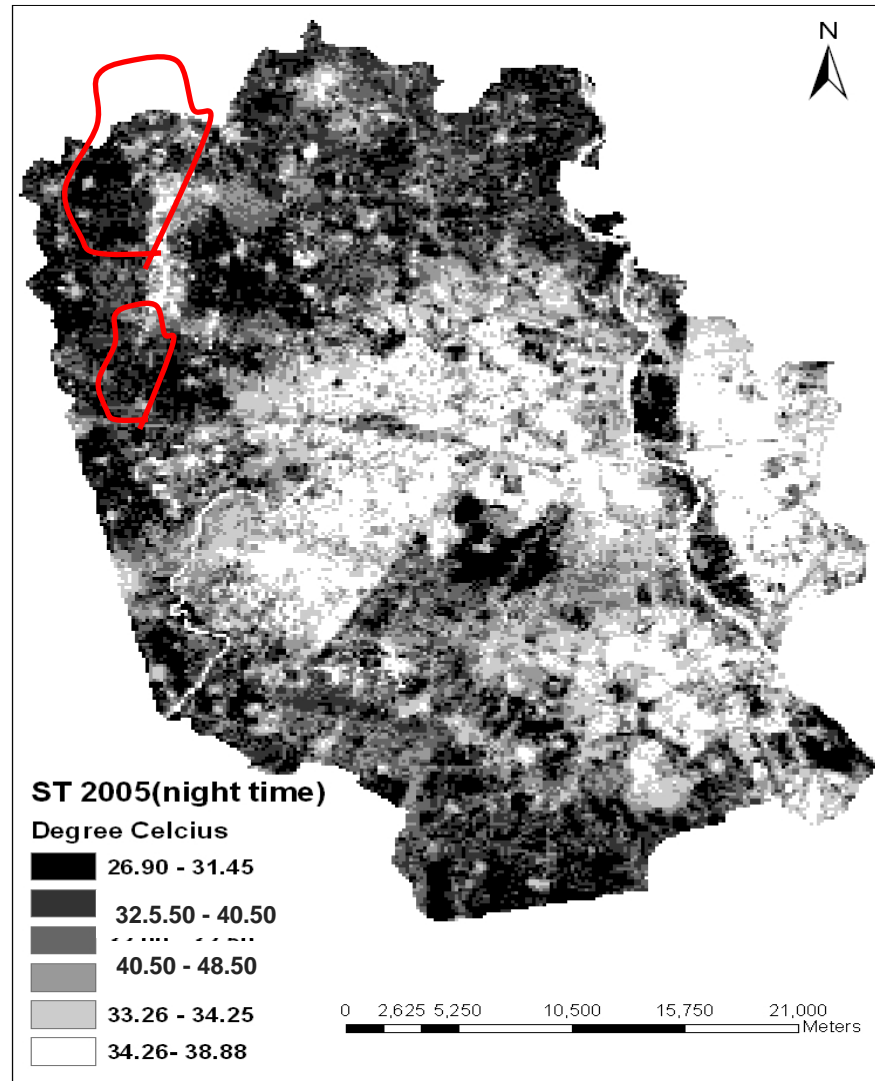
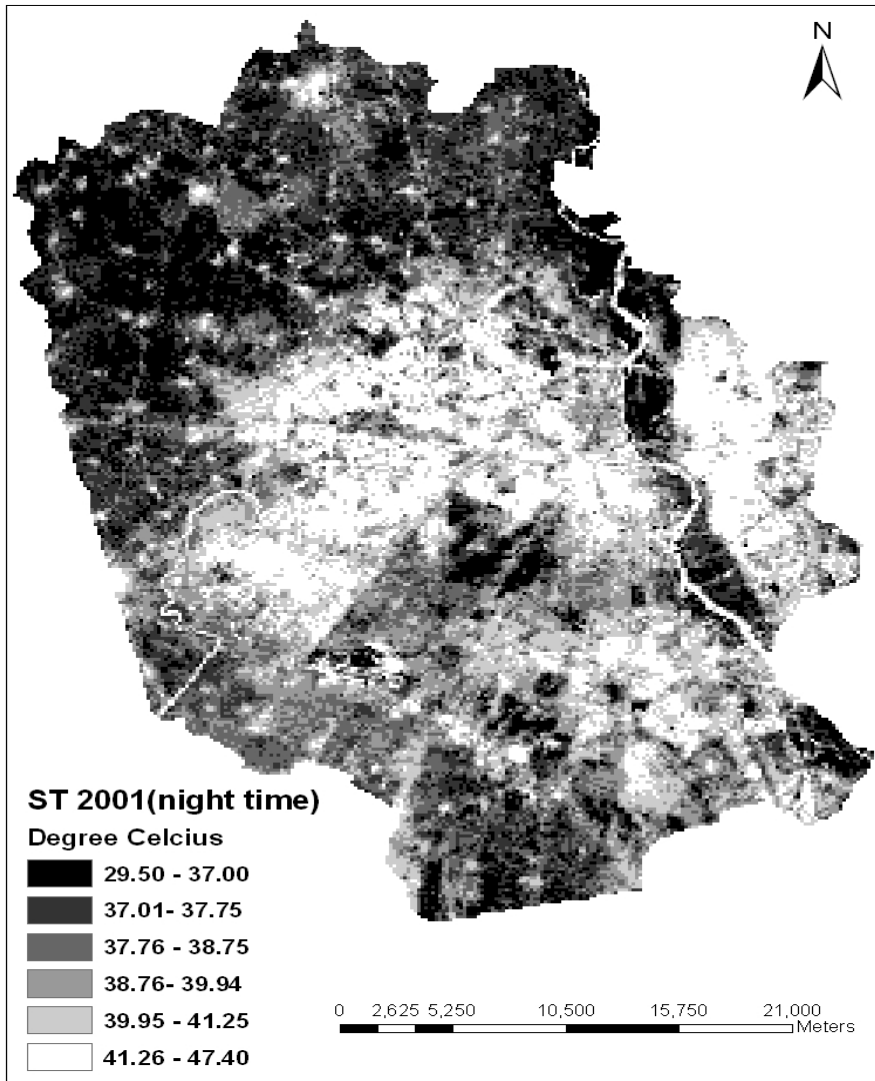
- RAILWAY LINE
- MAJOR ROAD
- MAJOR ROAD
- HIGH DENSE SETTLEMENT
- MEDIUM TO HIGH DENSE SETT
- MEDIUM DENSE SETTLEMENT
- LOW TO MEDIUM DENSE SETT
- LOW DENSE SETTLEMENT
- LOW TO HIGH DENSE
- RURAL SETTLEMENT
- RURAL TO HIGH DENSE SETT
- RURAL TO MEDIUM DENSE
- RURAL TO LOW DENSE SETT
- AGRI TO RESIDENTIAL
- RIDGE TO RESIDENTIAL
- PASTURE LD TO RESIDENTIAL
- SCRUB TO RESIDENTIAL
- OPEN LD TO RESIDENTIAL
- RIVER
- RESI IN HISTORICAL MONUMENT
- OTHERS



**Urban expansion on
productive lands**

**Encroachment of built
up area on productive
agricultural lands**





**Fig. Spatial distribution of surface temperature from ASTER data,
7th Oct. 2001 & 2nd Oct. 2005**

Surface temperature assessment

Comparison of satellite derived surface temperature with field measurement

Features	*In the field Observation on 3 rd Oct 2005 (21.30 to 23.00 local time) in °C	Satellite observation		UTM Coordinates (m)
		ASTER of 07 th Oct 2001 (22.35 local time) in °C	ASTER of 02 nd Oct 2005 (22.35 local time) in °C	
Vegetation 1	28.50	29.64	31.10	718935/3159479
Vegetation 2	29.00	30.25	31.30	719570/3169243
Vegetation 3	29.30	30.67	31.47	718365/3167032
Vegetation 4	28.00	28.95	30.20	717613/3160398
Average	28.70	29.88	31.02	-
Bare soil	28.50	30.88	31.35	700395/3158756
Concrete 1 (URBAN)	30.10	31.90	32.96	719871/3168740
Concrete 2 (URBAN)	28.30	31.42	32.34	717811/3169012

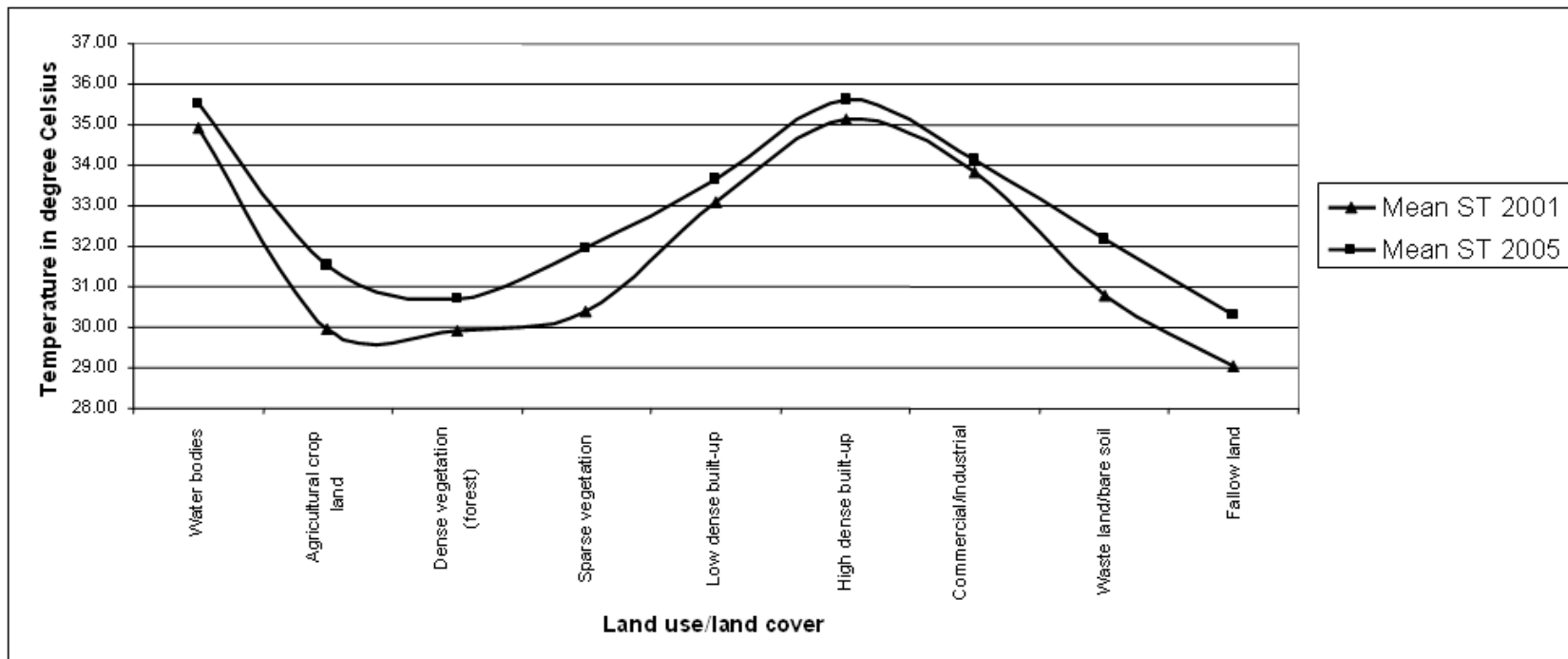


Fig. Mean surface temperature of different Land use/land cover of ASTER, 2 Oct. 2005 & 7 Oct, 2001

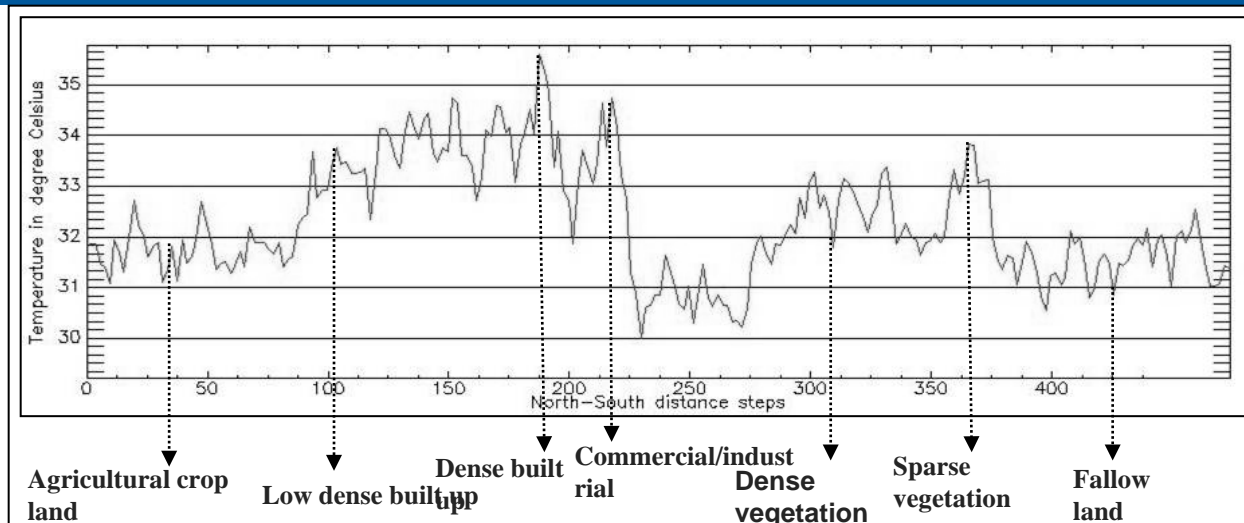


Fig. Surface temperature profile along N-S transect for night time image of ASTER, 2 Oct, 2005

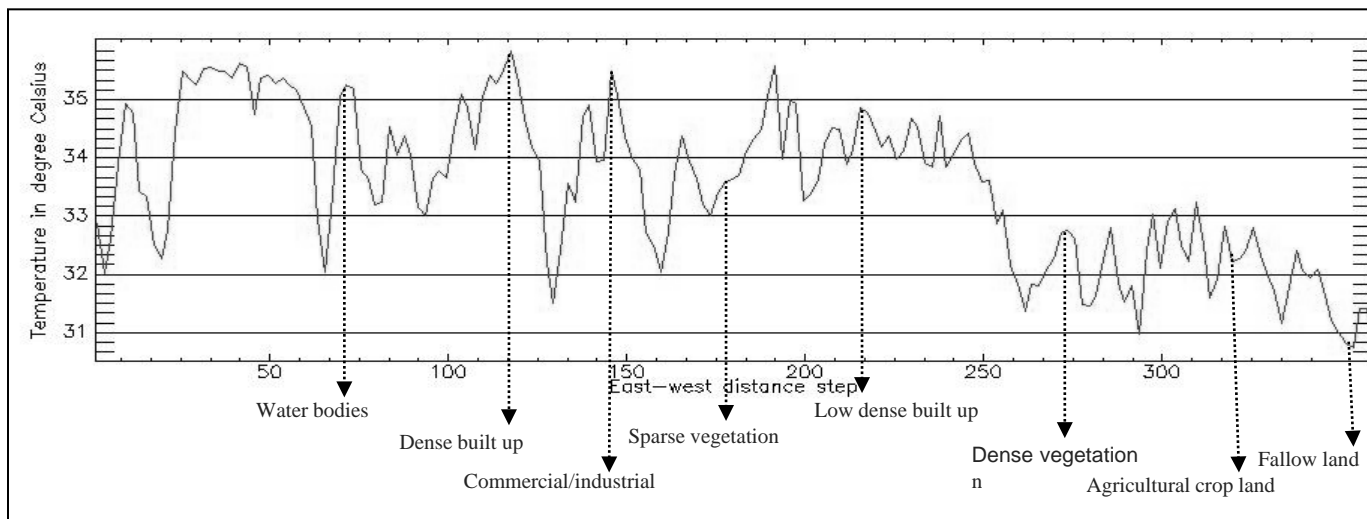
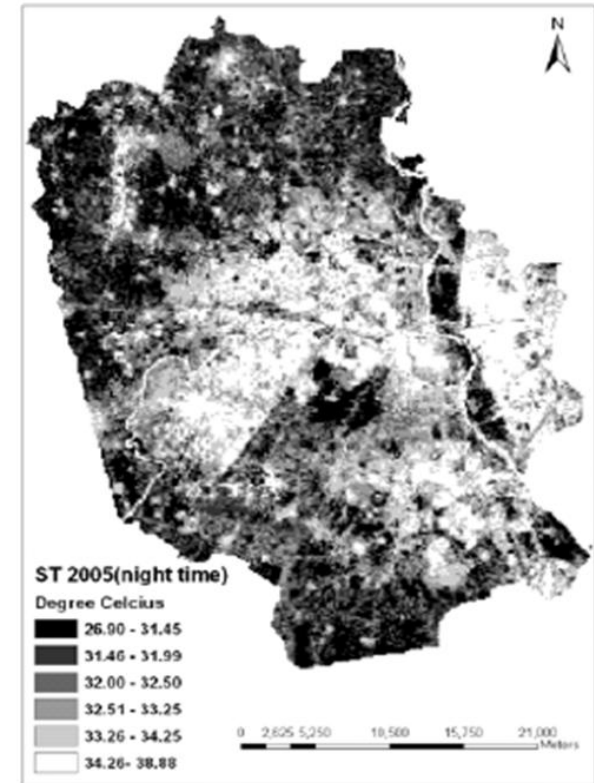
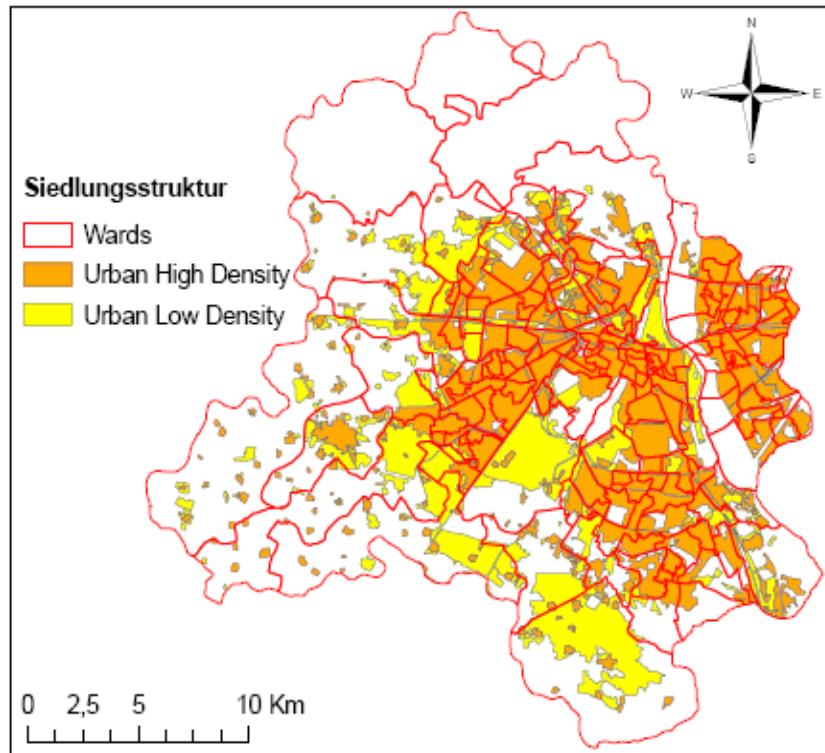
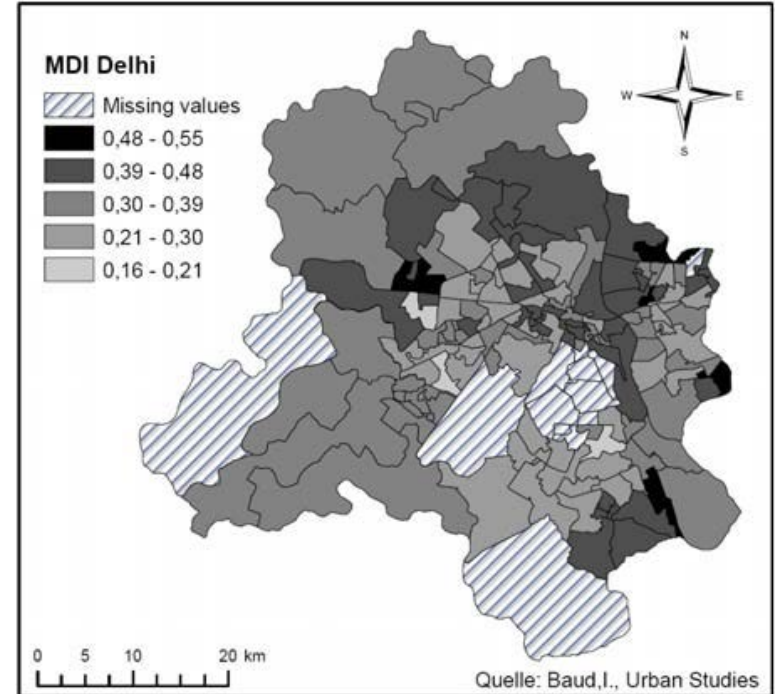
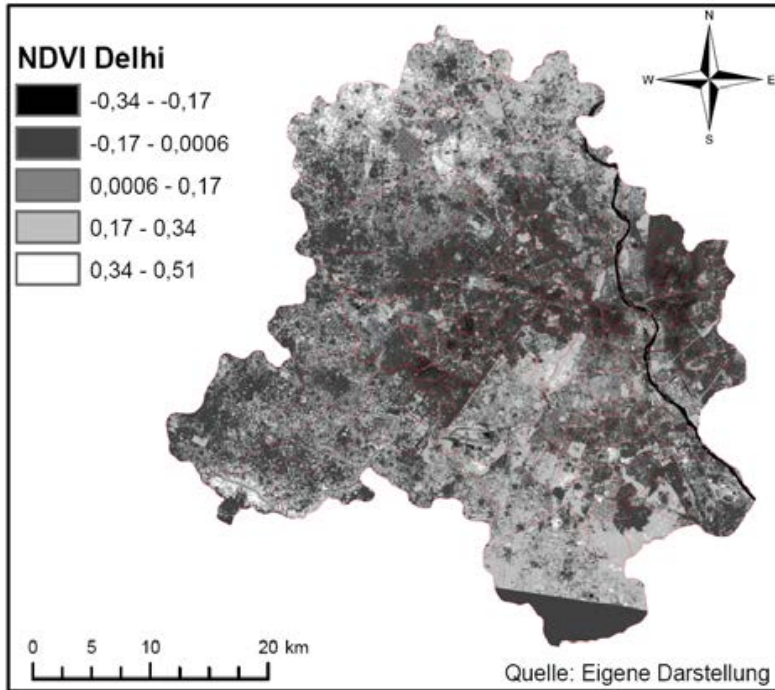


Fig. Surface temperature profile along E-W transect for night time image of ASTER, 2 Oct, 2005

Thermal Infrared / Night-time temperatures and Mapped Settlement structure

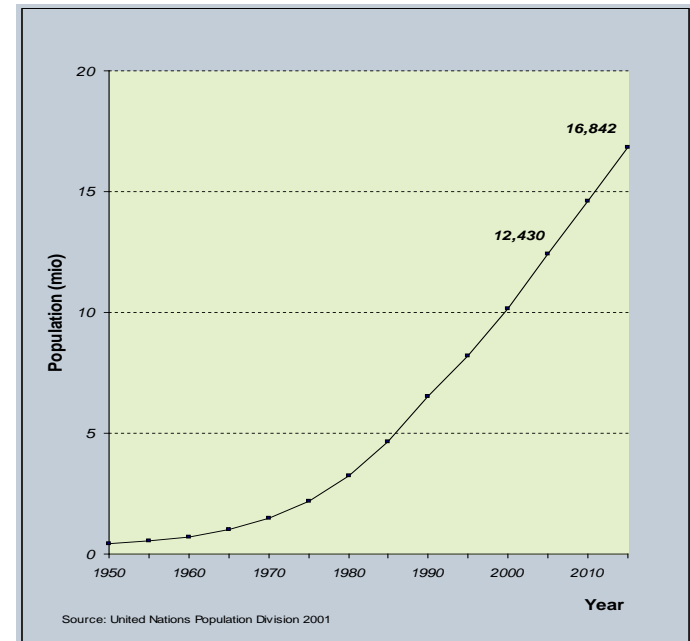


Case study Delhi - NDVI / Multiple Deprivation Index (Physical, Social, Economic Indicators)



Case study Dhaka

- one of the fastest growing megacities
- 12,5 Mio. inhabitants
- 3,4 Mio inhabitants are slum dwellers
- 34.000 inh. / km² (Berlin 3800 inh. / km²)

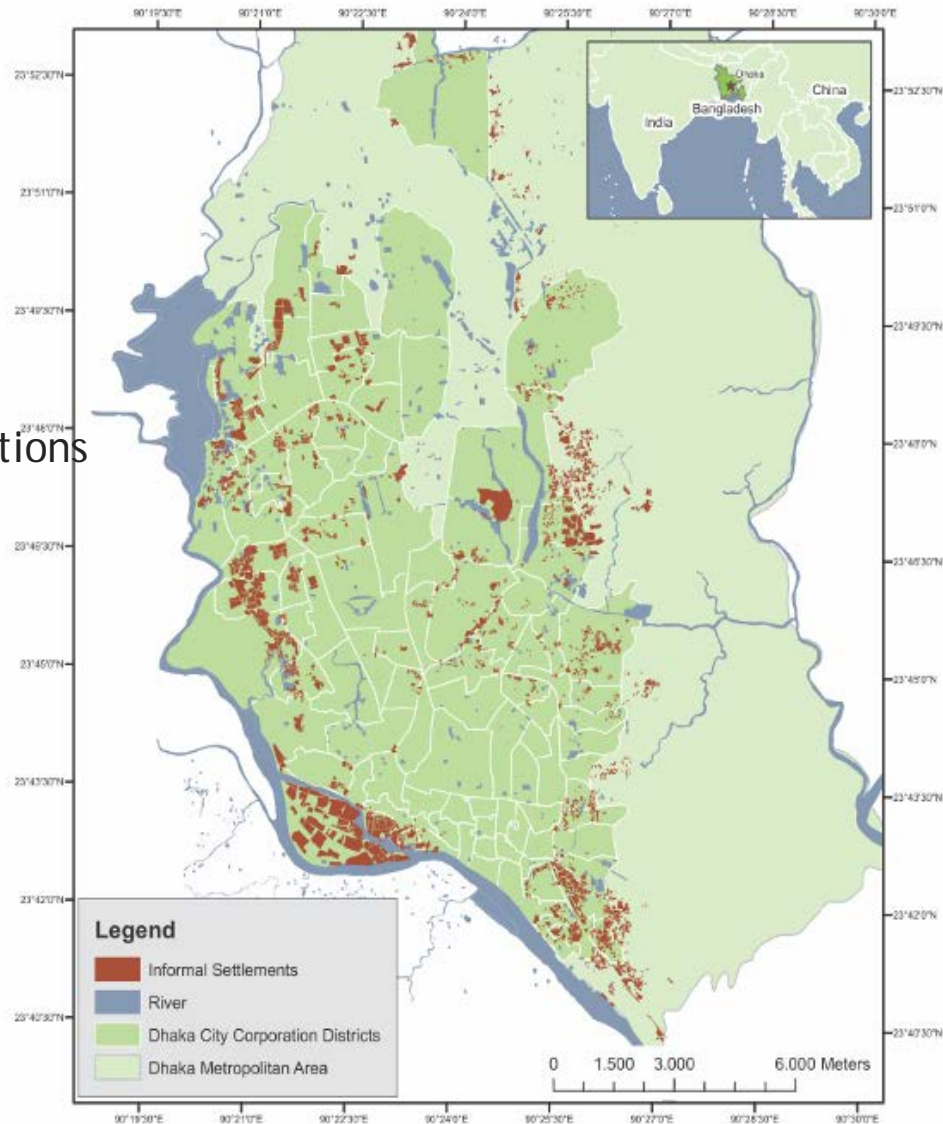


Dhaka

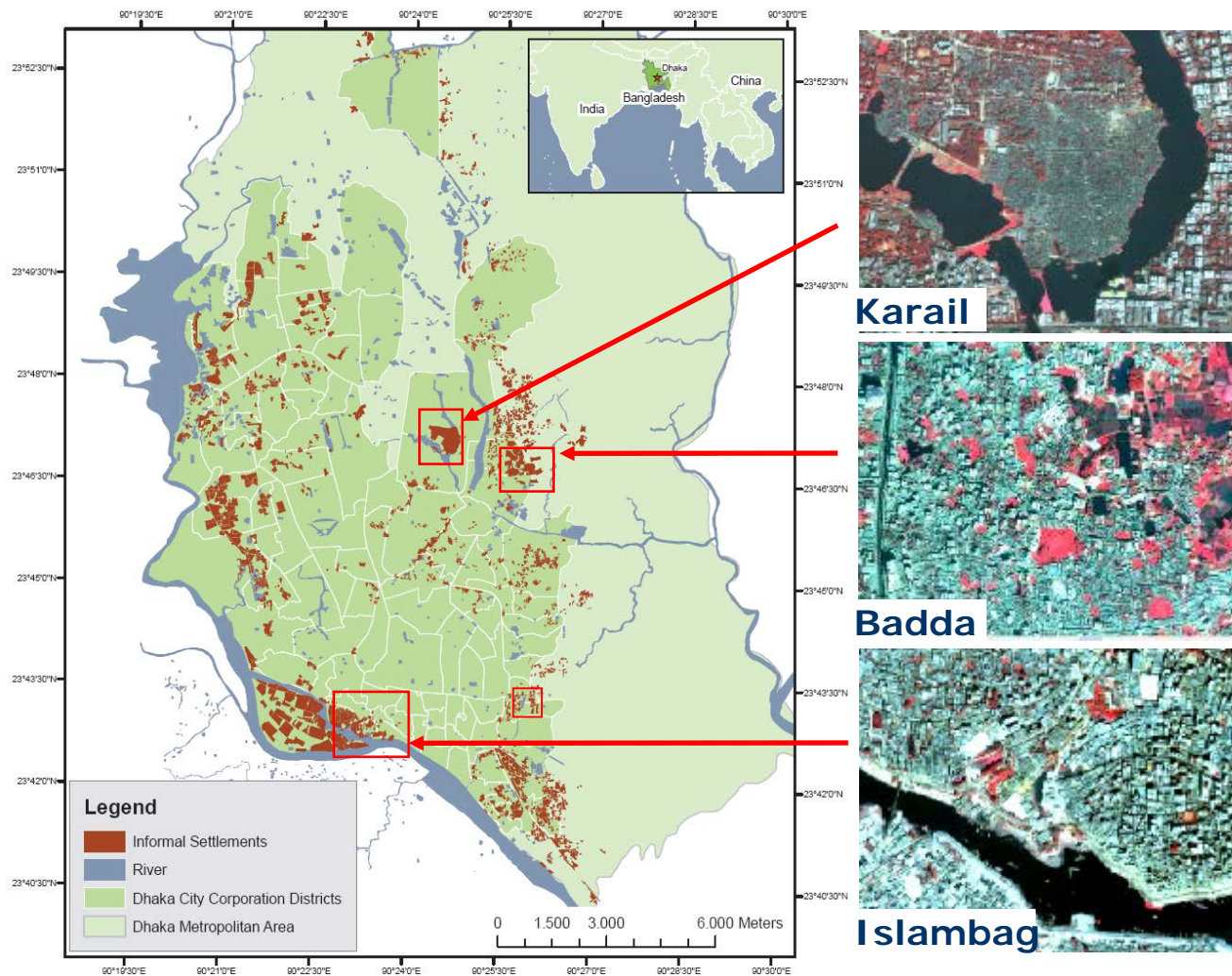
3,4 Mio. slum dwellers

They mostly have:

- no access to clean water
- no access to clean sanitary installations
- no sufficient shelter
- no permanent housing
- no property rights



Case study areas in Dhaka



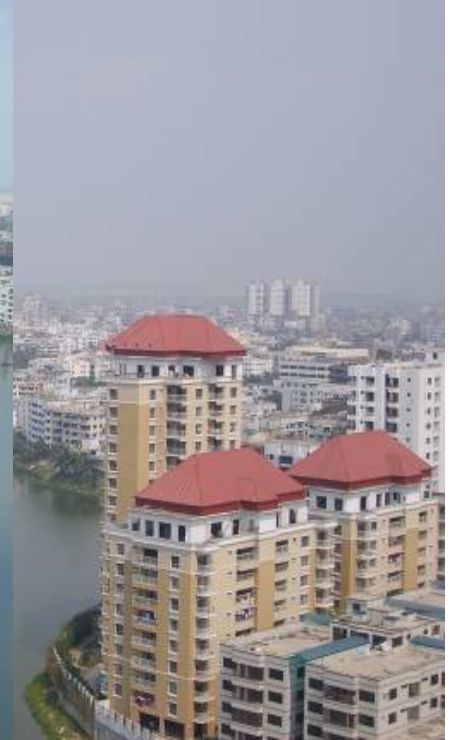
Four case study areas:

N = 3300
mapped housing
structures

N = 660
Interviewed
households

Quickbird data 2006

„Bustee Karail“,
with 100.000
inhabitants
the biggest slum in
Dhaka







In: Netzband, M., Banzhaf, E.,
Hoefler, R. and Hannemann, K.
(2009): Identifying the poor in
cities - How can remote sensing
help to profile slums in fast
growing cities and megacities? In:
IHDP Update 01/2009.

Data Acknowledgement:
,Dhaka-INNOVATE' (DFG-SPP),
Humboldt-University

Study area in central Dhaka

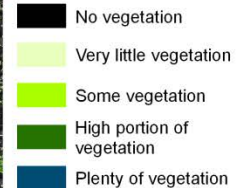


Land use / land cover
classification



Vegetation Index

Normalized Difference
Vegetation Index (NDVI)



Input dataset

Quickbird 2006/01/22
multispectral: 2.4 m
panchromatic: 0.6 m
band combination:
near-infrared - red - green

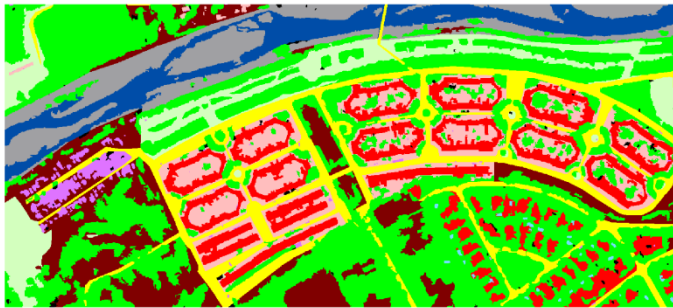


Study area in Lo Barnechea - Santiago de Chile



Urban structure types

- Marginal area / informal settlement
- Social housing
- Detached house, courtyard and swimmingpool
- Public building
- Open space / green space
- River
- Road



Basic classes

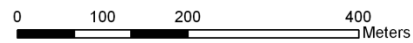
- Shanty
- Residential building
- Shed / garage
- Unpaved public space
- Road
- Swimming pool
- Riverbed
- Vegetation
- Bare soil
- River
- Shadow



Input dataset

Quickbird 2006/12/19
 multispectral: 2.4 m
 panchromatic: 0.6 m
 band combination:
 near-infrared - red - green

image analysis procedure





Thanks for your attention !