

Geo-spatial Statistics with Globalland30

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**²International Society of Photogrammetry
and Remote Sensing (ISPRS)**

June 9, 2014, Beijing



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- 1. 43rd W-E Day's News**
- 2. Data and methodology**
- 3. Preliminary results**
- 4. Discussion and Outlook**

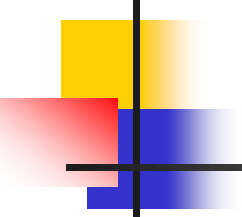
43rd World Environment Day

(June 5th 2014,世界环境日)

A Press release on **‘Global Ecological Environment Remote Sensing Monitoring’ Annual Report 2013**



Global Ecological Environment RS Monitoring' Annual Report 2013



- **Urban and rural construction land distribution between 2000 and 2010**
- **Terrestrial vegetation growth status**
- **Large land surface water area distribution**
- **Bulk grain and oil crops production situation**

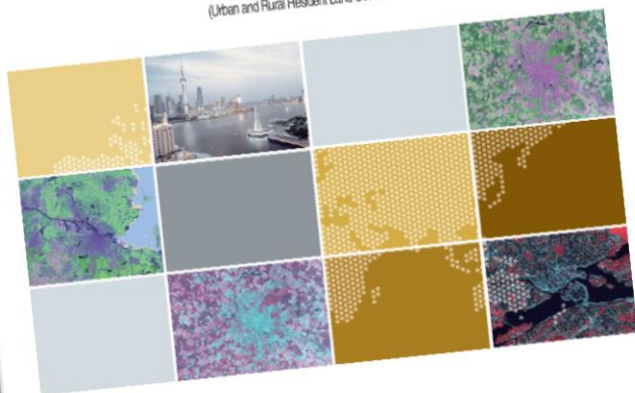
Urban and Rural Construction land distribution between 2000 and 2010

2013
年度报告

全球生态环境遥感监测
(城乡建设用地分布状况) 中文版
Global Ecosystem Remote Sensing Monitoring 2013 Annual Report
(Urban and Rural Resident Land Cover Distribution between 2000 - 2010)



2013
Report on Remote Sensing Monitoring of
Global Ecosystem and Environment
(Urban and Rural Resident Land Cover Distribution between 2000 - 2010)



English Briefing



Chinese Version

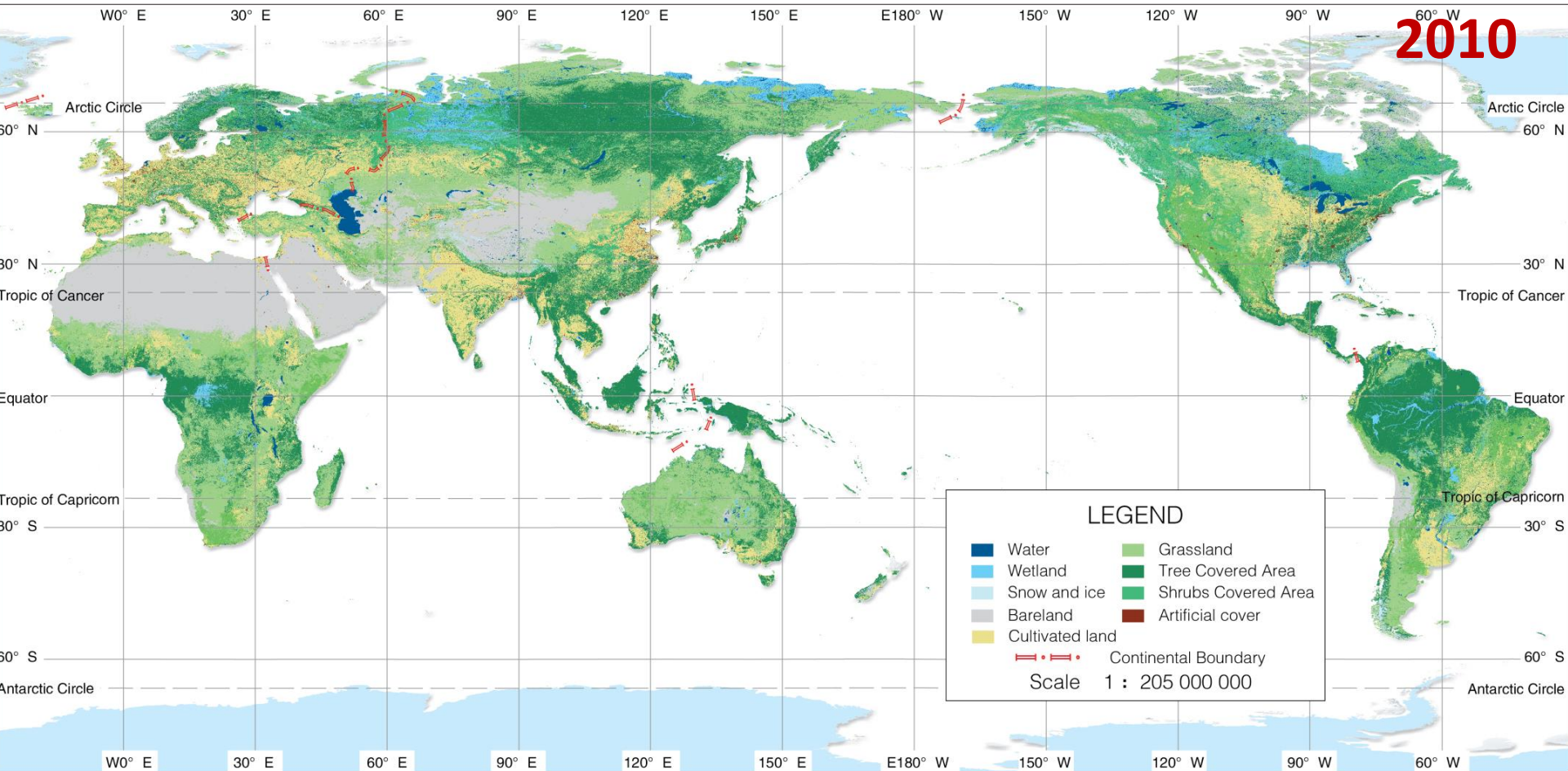


Some Highlights

- **The total area of the global urban and rural construction land in 2010 is 1.1875 Million km², which covers 0.88% of the total area of the global land surface!**
- **From 200-2010, total increase is 57,400km² with the variation rate of 5.08%. Asia has the highest Increase propotion, 43.55%, and Africa has14.81%**
- **USA and China are the largest and 2nd countries with respectively**

Globalland30

-First 30m Global Land Cover Data Set

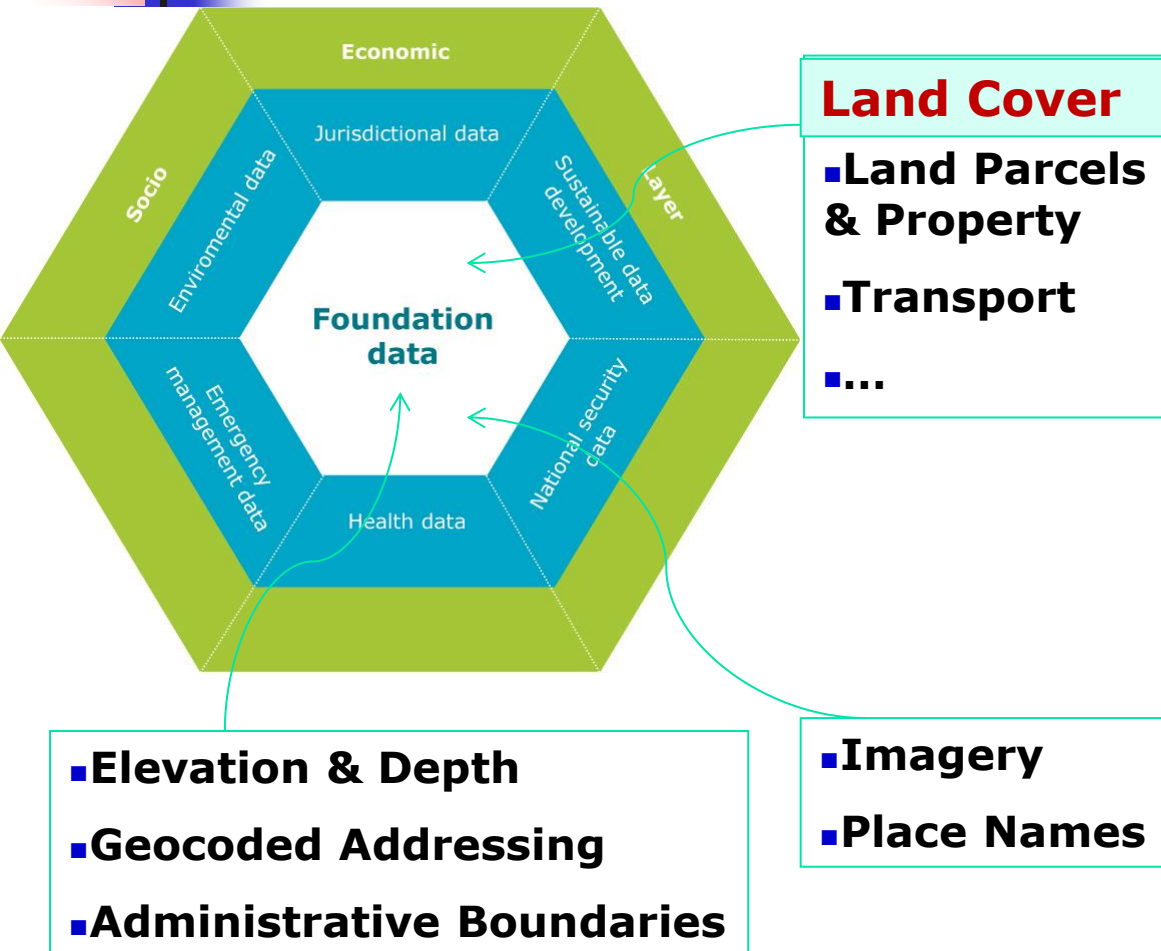




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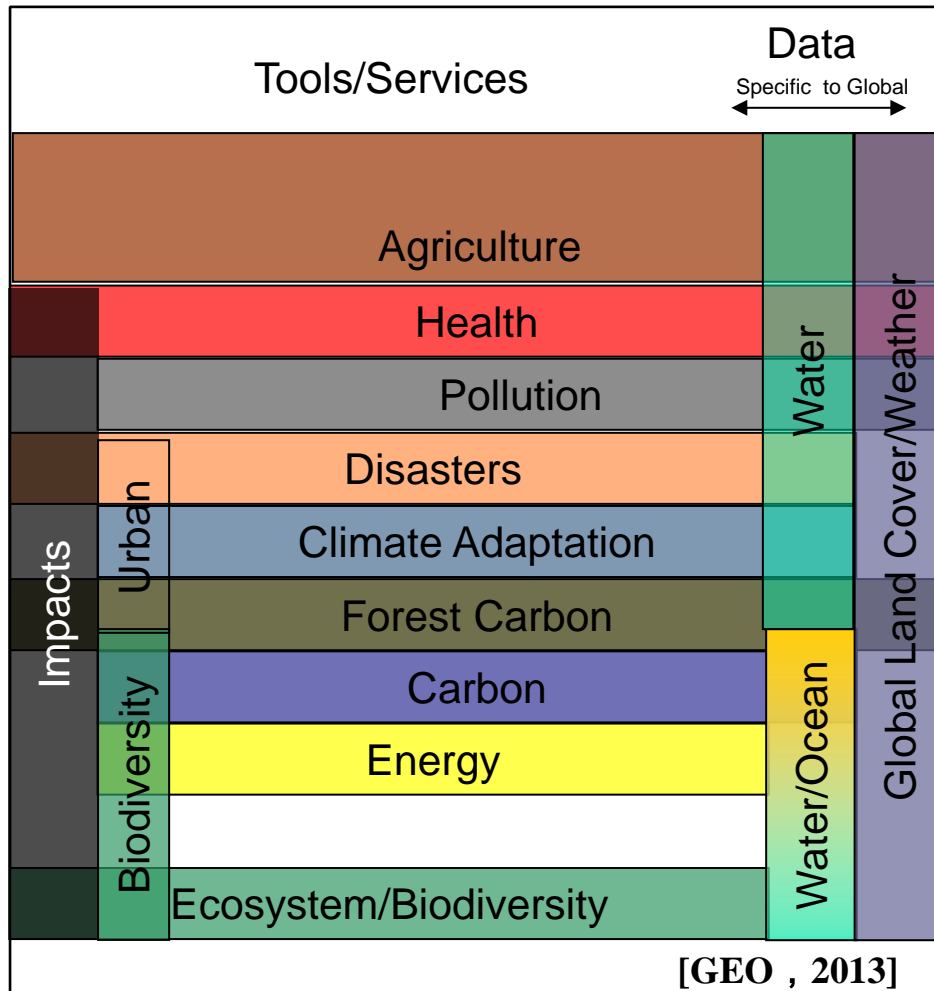
Geo-Spatial Data as Fundamental Ones



- Serving as authoritative and reliable spatial framework for socio-economic and other data

- Providing critical knowledge about spatial distribution and temporal changes of our planet and environment

2.1 Land Cover and Change Information



- Natural attributes /characteristics of a variety of material types covering the surface of the globe

- Requested by all the nine SBAs as identified by GEO

Land Cover Data Products

Level	Data Products	Spatial Resolution	Temporal Resolution
Global	USGS	1km	One year
	UMD	1km	One year
	BU	1km	One year
	GLC2000	1km	One year
	GLC2005	300m	One year
Regional	EU- Corine	1:100,000/ 100m	
National	USGS	30m	
	China	30m	
	Spain		
		...	

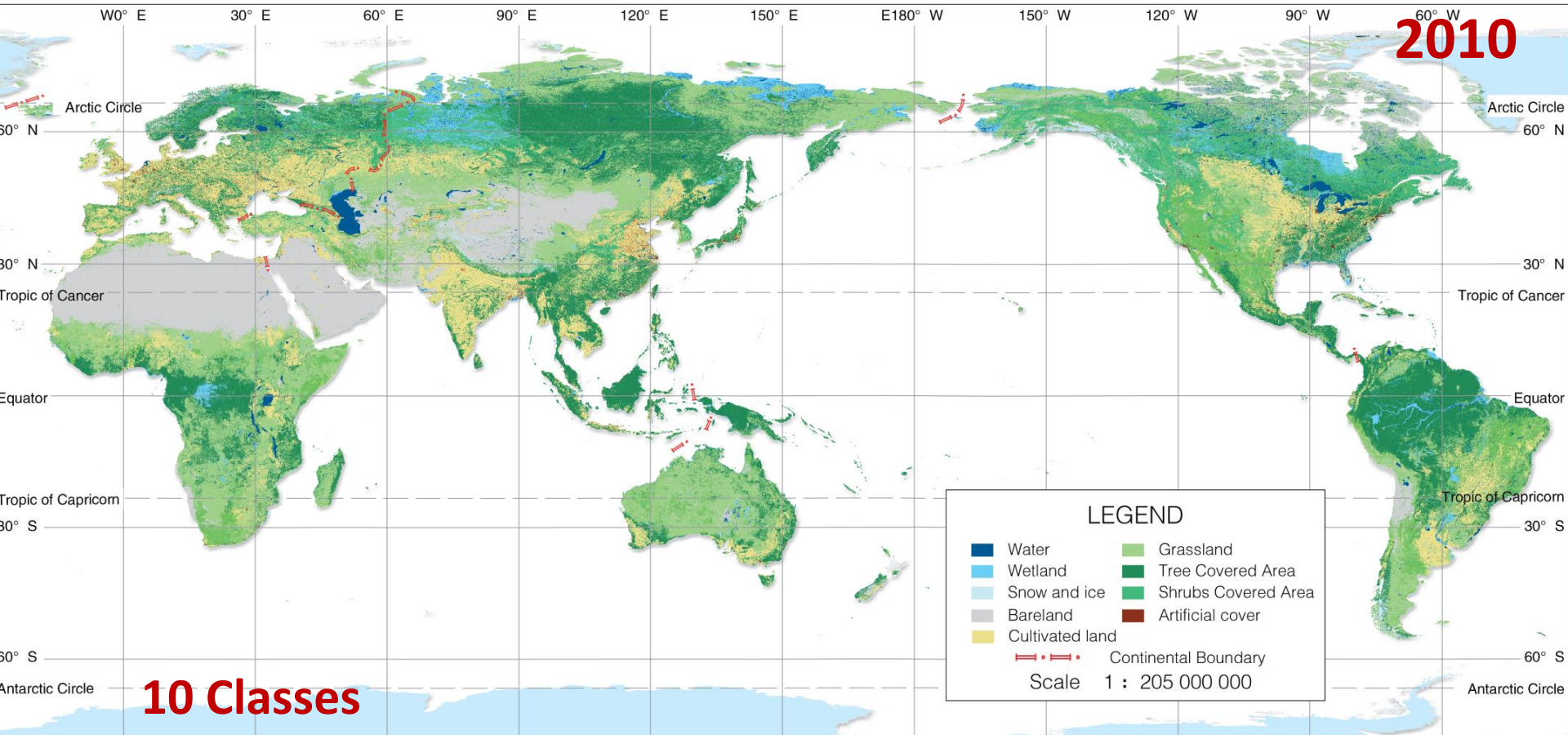
- Coarse spatial and temporal resolution
- Low spatial accuracy and consistency

Land Cover Data Products

Level	Data Products	Spatial Resolution	Temporal Resolution
Global	USGS	1km	One year
	UMD	1km	One year
	BU	1km	One year
	GLC2000	1km	One year
	GLC2005	300m	One year
	GlobalLand30	30m	2000/2010
Regional	EU- Corine	1:100,000/ 100m	
National	USGS	30m	
	China	30m	
	Spain		
	...		

- Fine resolution
- Two-time series
- Higher accuracy

GlobalLand30



Open Water, Wetland, Artificial Cover, Cropland, Forest, Shrubland, Grassland, Bare Land, Tundra, Perm.snow & Glac



Data Validation by international Colleagues

Summary of Overall Disagreement - Population only	
CORINE	1.97
Peng Gong All	17.25
Peng Gong Minus Cloud etc	16.04
MODIS Own Validation	0.17
MODIS Geo-Wiki Validation	37.99
GLC-2000 Own Validation	0.21
GLC-2000 Geo-Wiki Validation	32.68
GlobCover Own Validation	0.21
GlobCover Geo-Wiki Validation	25.48
GLC Chen Jun Geo-Wiki No Mixed	2.09
GLC Chen Jun Geo-Wiki No Mixed + High Confidence	1.98
GLC Chen Jun Geo-Wiki All + Mixed Pixels	2.64

•KTH, Sweden, (Prof. Yifang Ban) : **closer to CORINE**

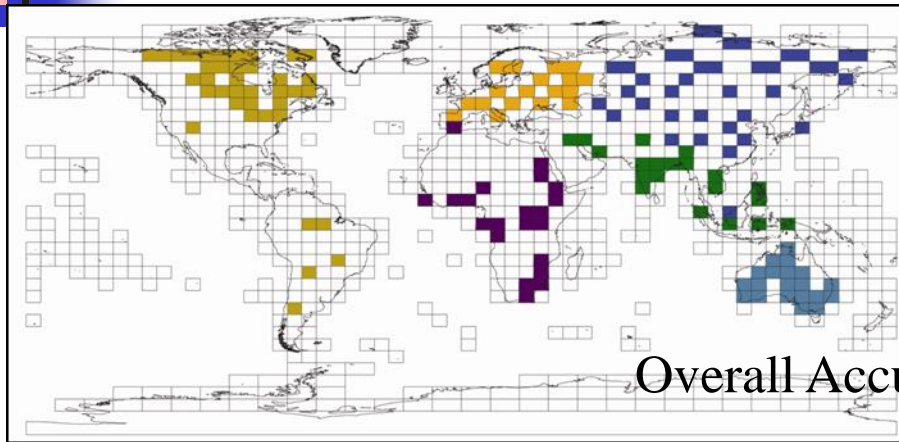
•Greece (Ioannis Manakos, Centre for R& Techn. Hellas ,CERTH): **87%**

•CAS (Chuang Liu): **85%**

•USGS (Zhiliang Zhu)

•Italy (Maria Antonia Brovelli)

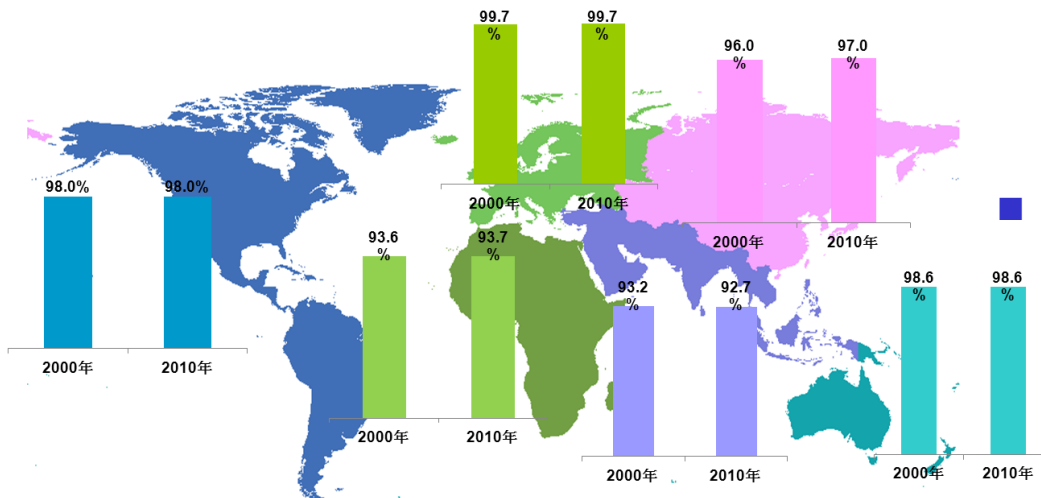
Preliminary Validation by 3rd Parties



- Three research institutes from China;
- Total samples: 139 map sheets (16%), free-collect sample points in each sheet

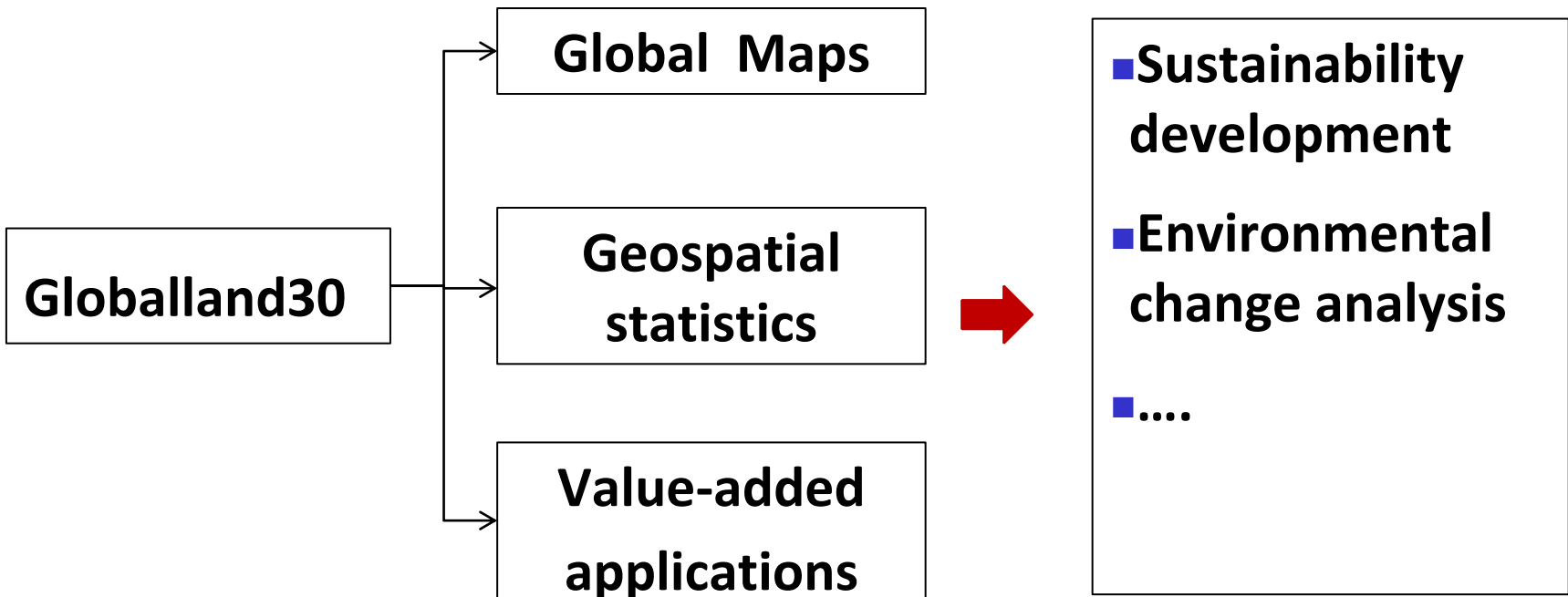
- 2010 Accuracy:
83.11% ± 0.18%

- 2000 Accuracy
75.33% ± 0.2%

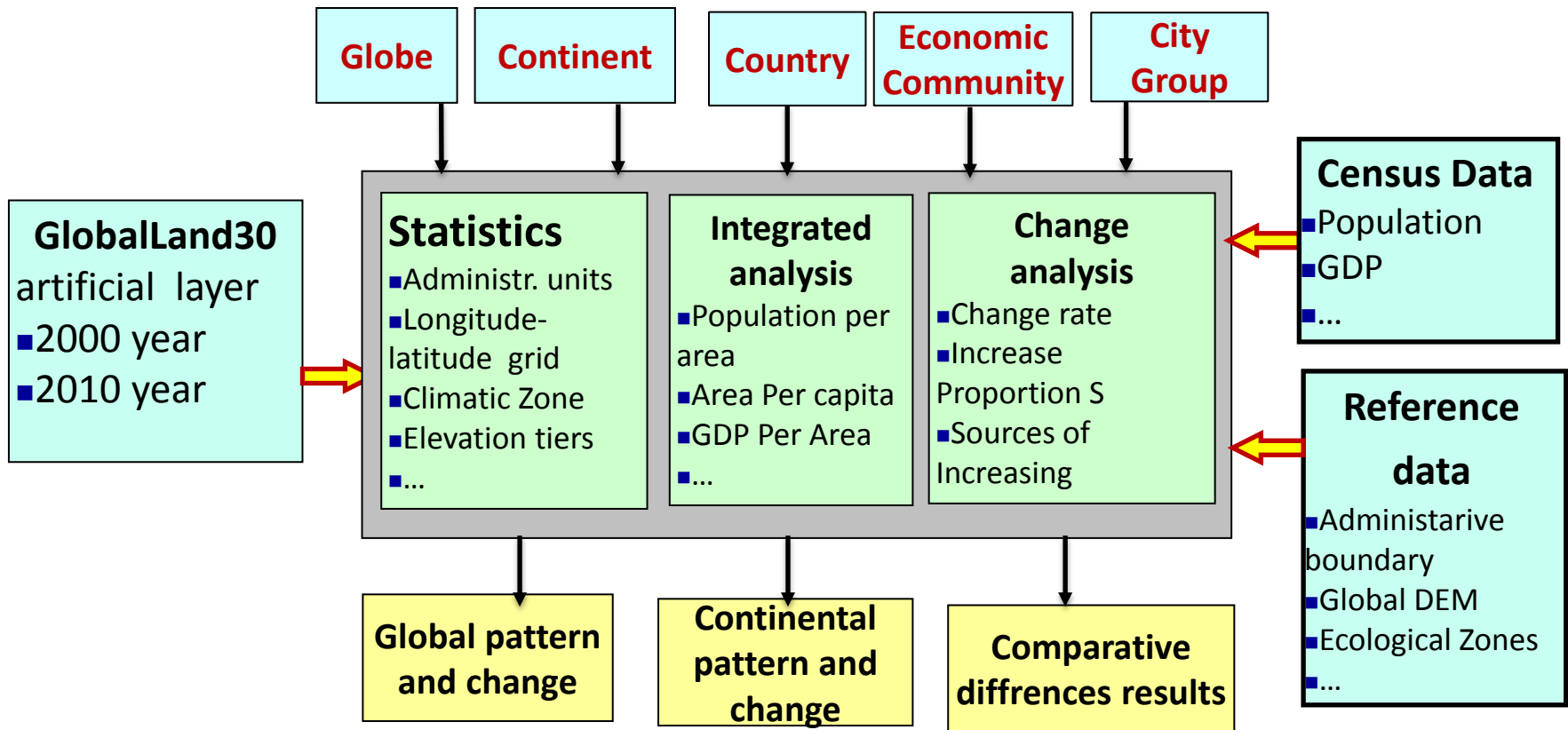




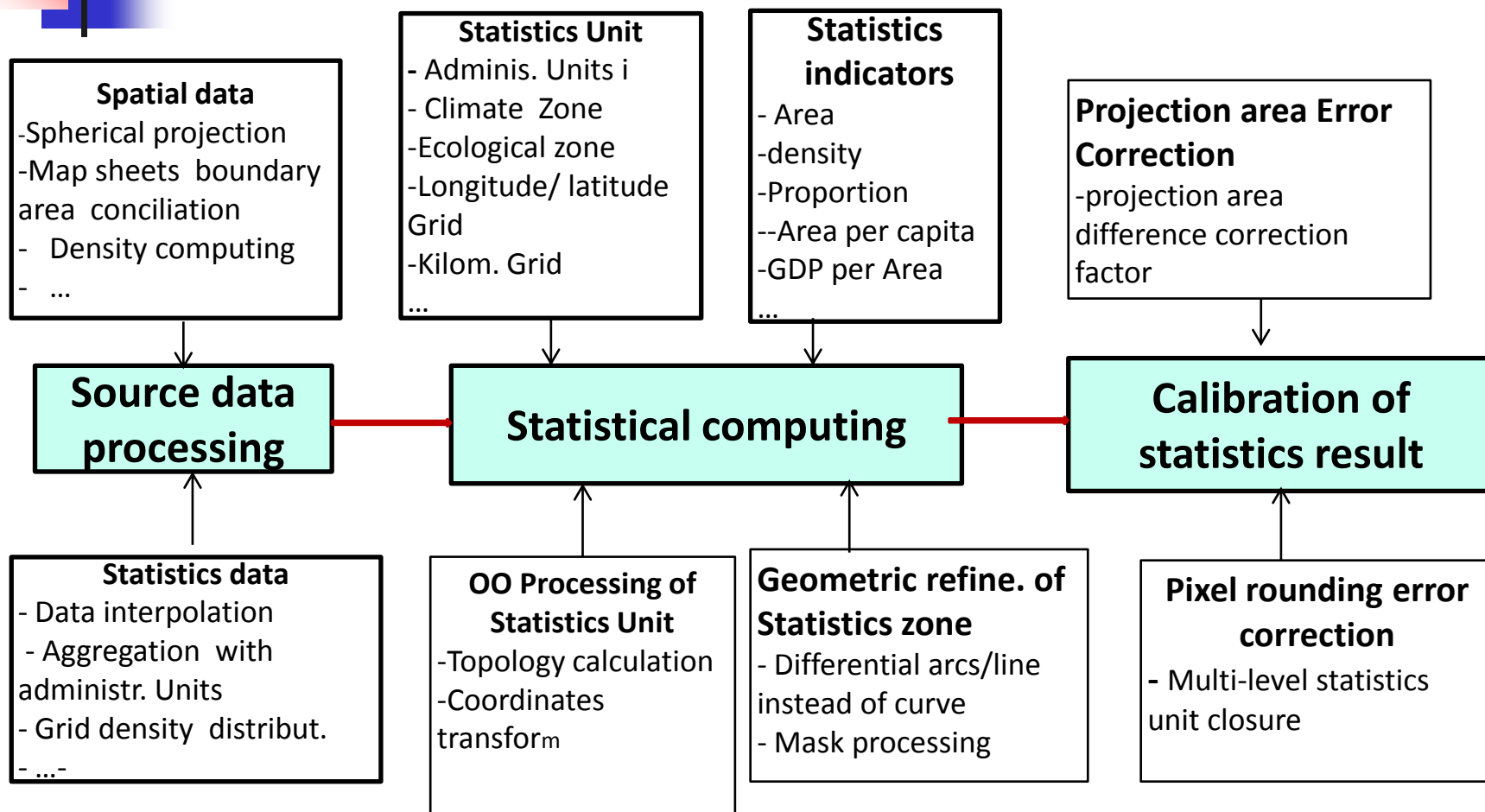
Globaland30's Applications



2.2 Integrating GLC and Census Data



Work Flow for Global Geo-spatial Computing and Analysis





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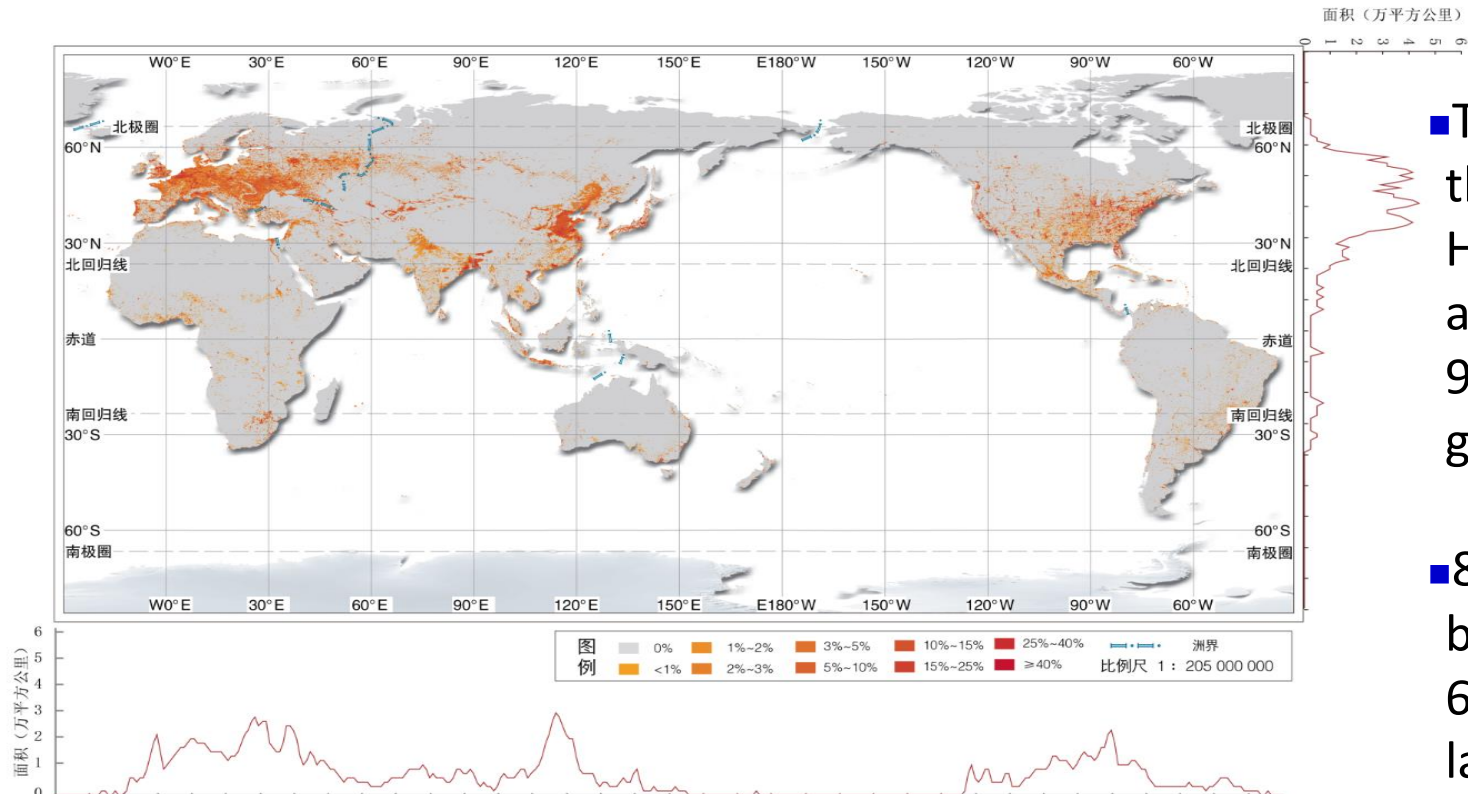
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3.1 Urban and Rural Construction Land Distribution in 2010

Region	2000		2010		Change		Increased Proportion (%)
	Area 1,000 km ²	(%)	Area 1,000 km ²	%	Area 1,000 km ²	%	
Global	1,130.1	100.0	1,187.5	100.00	57.4	5.08	100.00
Asia	389.1	34.43	414.1	34.87	25.0	6.43	43.55
Europe	318.5	28.18	324.2	27.30	5.7	1.79	9.93
Africa	69.7	6.16	78.2	6.59	8.5	12.20	14.81
N. American	277.9	24.59	292.8	24.66	14.9	5.36	25.96
S. American	58.0	5.13	60.4	5.09	2.4	4.14	4.18
Oceania	17.0	1.50	17.8	1.50	0.8	4.71	1.39

- Total area of the global urban and rural land in 2010 is 1.1875 Million km², which covers 0.88% of the total area of the global land surface
- Asia, Europe and North America, accounts for 86.83% of that of the global total.

Urban and Rural Land Cover in 2010 - Global Spatial Distribution



- The total area in the Northern Hemisphere accounts for 90.69% of the global total
- 82.28% locates between 20° ~ 60° north latitude.

- distributes mainly on the east and the west coasts of continents
- Higher concentration in the east coast of North America, and the west and east coast of the Eurasia .

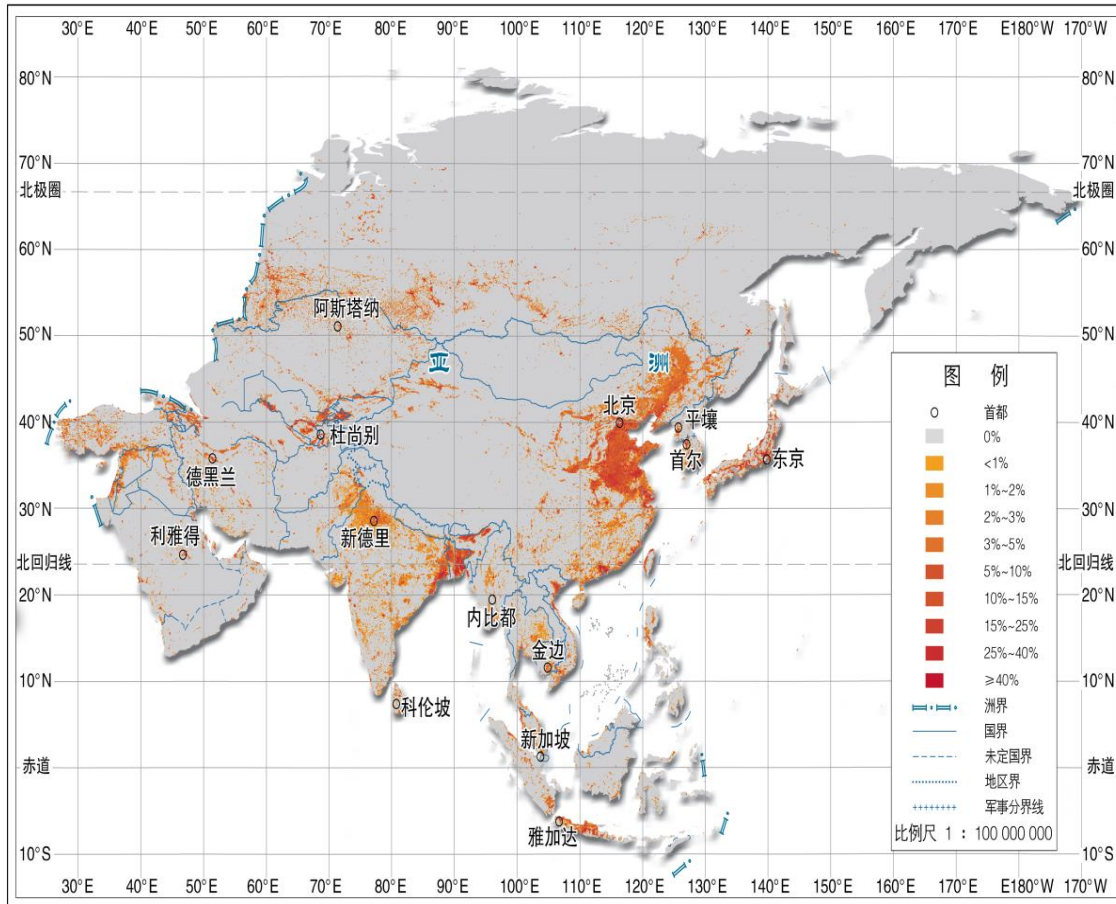
Urban and Rural Construction Land -Top Ten Countries, 2010

Country/ Region	Area in 2000 (10,000 km ²)	Area in 2010 (10,000 km ²)	Variatio n Rate (%)	Increase Proportion (%)
China	14.49	16.10	11.17	28.17
U.S.A	22.38	23.56	5.26	20.48
Russia	9.50	9.83	3.46	5.73
Mexico	2.32	2.50	7.87	3.18
India	4.90	4.99	1.79	1.53
Brazil	3.18	3.24	1.83	1.01
Japan	2.50	2.54	1.55	0.67
France	2.86	2.90	1.29	0.64
Germany	3.02	3.02	0.03	0.01
Ukraine	4.09	4.09	<0.01	<0.01

- USA and China are the largest and 2nd countries

- These 10 countries accounts for 61.26% of that of the global total.

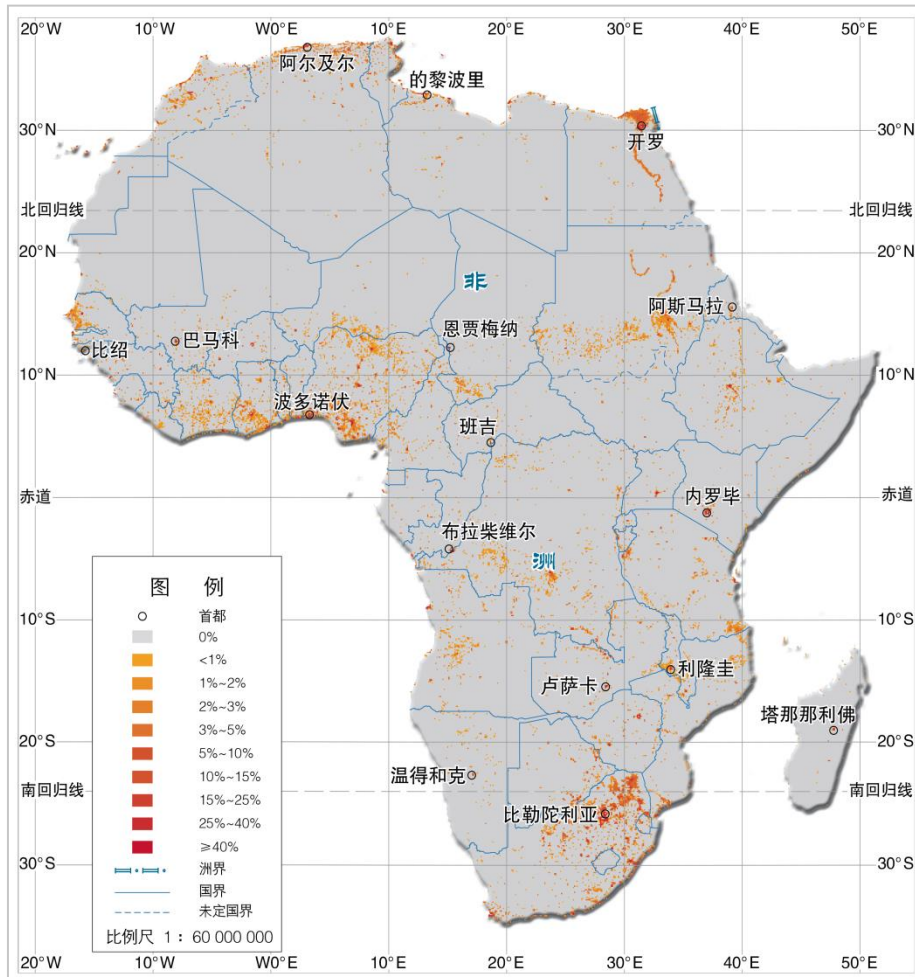
Asia



■ About 414,100 km² in 2010, accounting for 34.87% of the world, first in all continents, and uneven distribution of space.

■ Mainly distributed in the coastal zone in the east Asia, the Indian Ocean near the bay of Bengal and around the Caspian sea and Lake Issyk-Kul.

Africa



- About 78,200 km² in 2010, accounting for 6.59% of the world.
- Southern African region is the largest in urban and rural resident land in Africa, accounting for 33.09% of Africa total
- Eastern Africa only accounts for 8.20%.

3.2 Change between 2000 -2010

Region	2000		2010		Change		Increase Proportion (%)
	Area 1,000 km ²	(%)	Area 1,000 km ²	%	Area 1,000 km ²	%	
Global	1,130.1	100.0	1187.5	100.00	57.4	5.08	100.00
Asia	389.1	34.43	414.1	34.87	25.0	6.43	43.55
Europe	318.5	28.18	324.2	27.30	5.7	1.79	9.93
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S. American	58.0	5.13	60.4	5.09	2.4	4.14	4.18
Oceania	17.0	1.50	17.8	1.50	0.8	4.71	1.39

- Total increase: 57,400km² with the variation rate of 5.08%.
- Change rate: Africa has highest 12.20% , Asia has 6.43%
- Increase propotion: Asia is highest- 43.55%, Africa 14.81%

Change of the Ten Countries (2000-2010)

Country/ Region	Area in 2000 (10,000 km ²)	Area in 2010 (10,000 km ²)	Variation Rate (%)	Increase Proportion (%)
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Germany	3.02	3.02	0.03	0.01
Ukraine	4.09	4.09	<0.01	<0.01

■ China experienced the rapidly change in 11.17% and made the contribution 28.17% to that of the world

■ Germany and Ukraine remains very little change

■ China and USA account for almost half of the global total

3.3 Sources for Increased Urban and Rural Resident Land in Each Continent

		Asia	Europe	Africa	North America	South America	Oceania	Global
Arable land	Area(km ²)	17968.43	3457.04	2525.80	4074.99	666.82	179.34	28872.41
	Proportion (%)	72.01	60.43	29.47	27.26	27.91	20.86	50.26
Forest land	Area(km ²)	1756.84	416.31	1134.09	3859.18	376.62	185.92	7728.96
	Proportion (%)	7.04	7.28	13.23	25.82	15.76	21.62	13.46
Grassland	Area(km ²)	3749.71	643.80	3479.60	3093.45	755.19	344.52	12066.26
	Proportion (%)	15.03	11.25	40.59	20.69	31.61	40.07	21.01
Shrub	Area(km ²)	158.09	284.31	517.68	2563.72	306.59	82.71	3913.11
	Proportion (%)	0.63	4.97	6.04	17.15	12.83	9.62	6.81
Wet land	Area(km ²)	33.68	127.33	27.54	743.92	17.93	20.46	970.87
	Proportion (%)	0.13	2.23	0.32	4.98	0.75	2.38	1.69
Waters	Area(km ²)	2.21	609.83	39.98	241.20	26.11	24.19	943.52
	Proportion (%)	0.01	10.66	0.47	1.61	1.09	2.81	1.64
Bare land	Area(km ²)	1282.04	182.18	849.38	372.80	240.00	22.83	2949.24
	Proportion (%)	5.14	3.18	9.91	2.49	10.04	2.66	5.13
Sub-total	Area(km ²)	24951.00	5720.80	8574.07	14949.26	2389.26	859.97	57444.37
	Proportion (%)	43.44	9.96	14.93	26.02	4.16	1.50	100.00

3.4 Utilization Efficiency Analysis

Country	Population density (persons/km ²)			Per capita land area (m ² /person)			GDP/ km ² (US\$ mn/km ²)		
	2000	2010	Variation rate (%)	2000	2010	Variation rate (%)	2000	2010	Variation rate (%)
Global	5387	5776	7.23	185.64	173.13	-6.74	28.13	52.11	85.26
G8	1842	1852	0.53	542.9	540.01	-0.53	46.54	69.88	50.16
BRICs	8028	8293	3.30	124.56	120.58	-3.19	8.57	32.99	284.78
EU	2532	2576	1.74	394.95	388.20	-1.71	44.16	82.91	87.74
CELAC	5877	6343	7.93	170.16	157.66	-7.35	23.57	54.18	129.85
UNASUR	5521	5940	7.58	181.12	168.36	-7.05	23.60	54.84	132.41
S. Asia	18810	21663	15.17	53.16	46.16	-13.17	8.28	28.08	239.15
African Union	11063	12494	12.94	90.39	80.04	-11.46	7.11	19.46	173.81
ASEAN	13967	14986	7.30	71.60	66.73	-6.80	16.23	47.20	190.75
Arab League	8163	9333	14.33	122.50	107.15	-12.53	20.38	53.75	163.76
Northeast Asia	6654	6723	1.03	150.28	148.74	-1.02	175.88	217.60	23.72

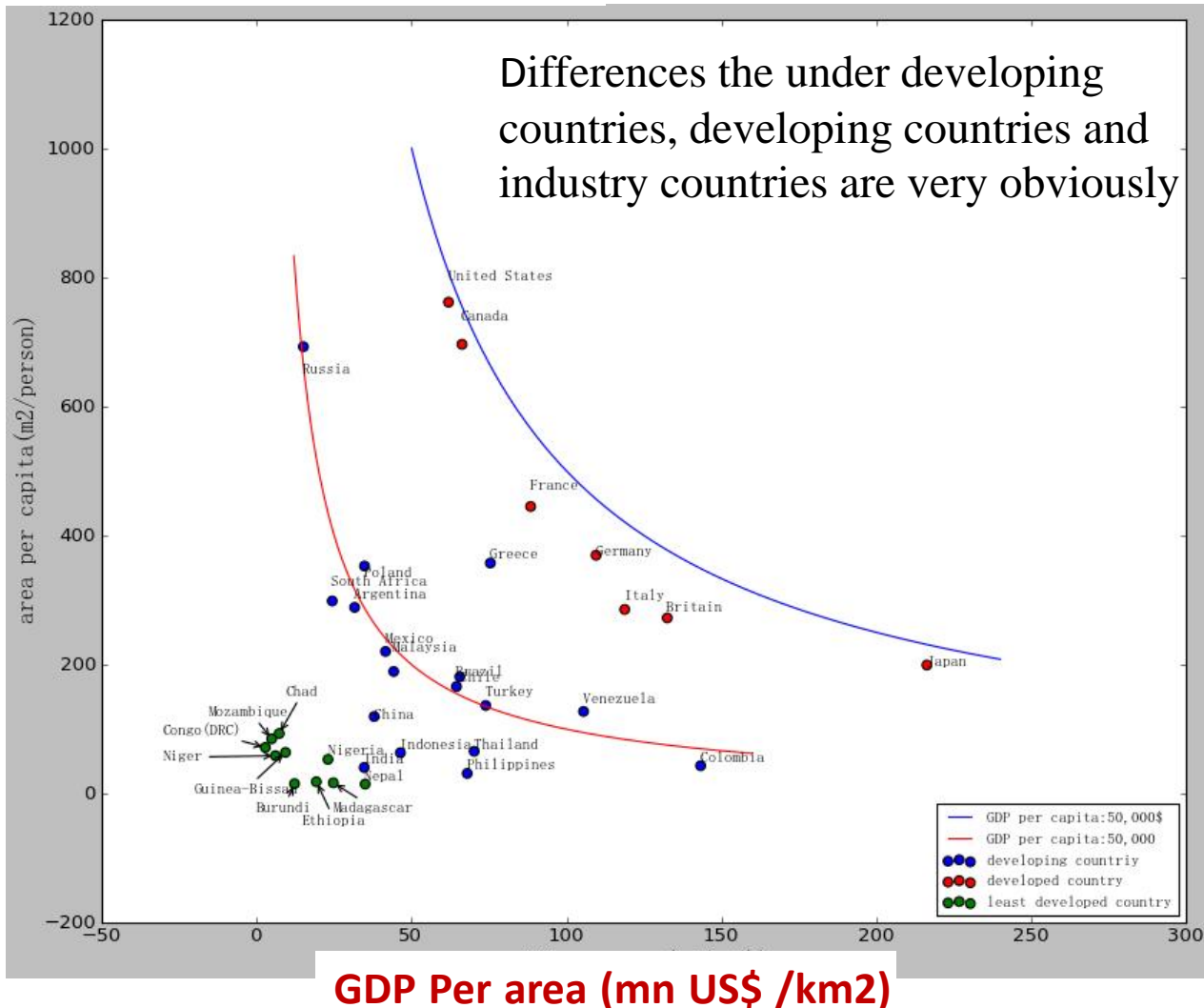
Utilization Efficiency- Change

Country	Population density (persons/km ²)			Per capita land area (m ² /person)			GDP/ km ² (US\$ mn/km ²)		
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Northeast Asia	6654	6723	1.03	150.28	148.74	-1.02	175.88	217.60	23.72

Utilization Efficiency

– Three Different Country Groups

Area Per Capita (m²/ Person)



- GDP in industry countries generally higher than US\$60mn/km², while lower than US\$35mn/km² in under developing countries
- Area per capita was five times more than that in under developing countries.



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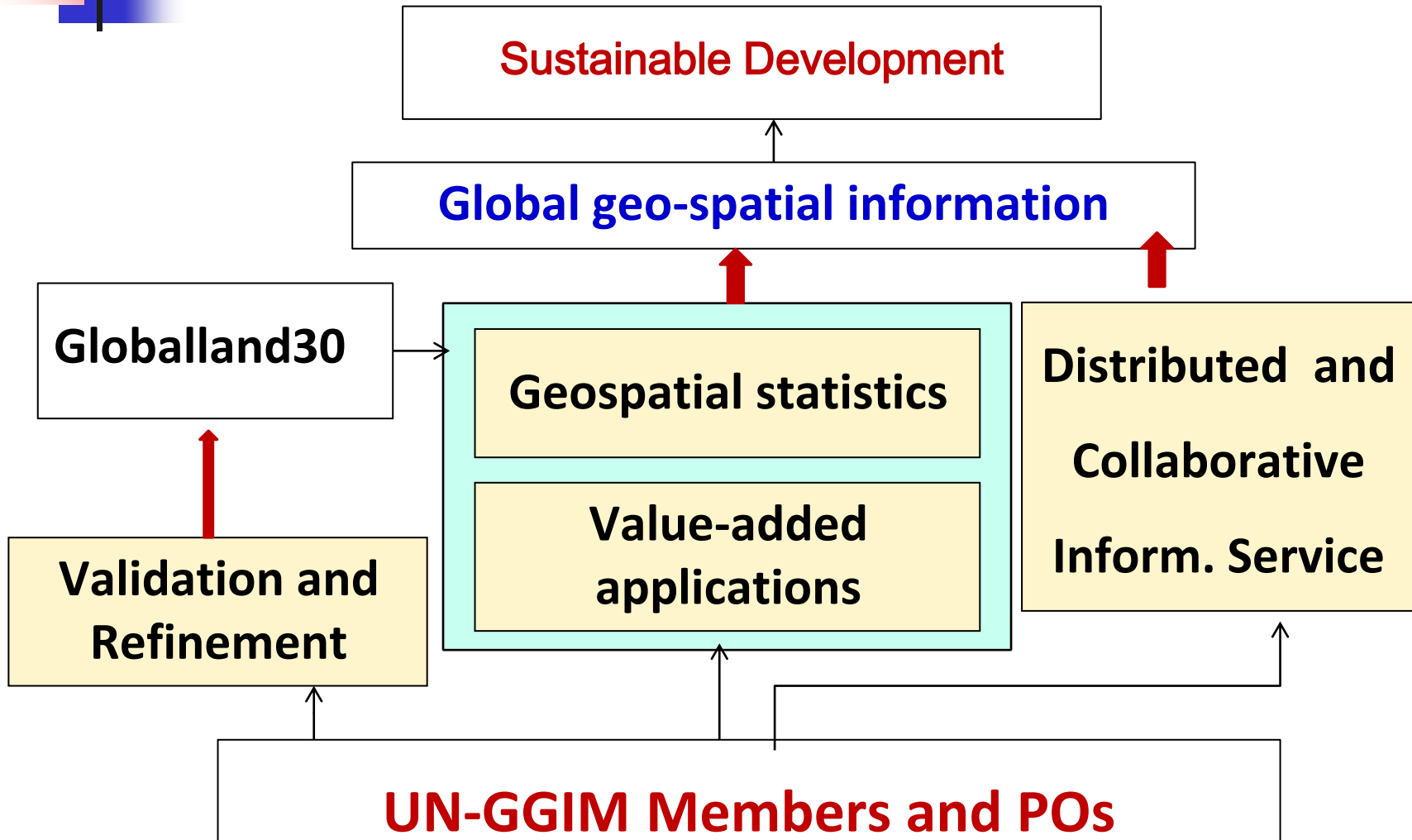
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4.1 Discussion

- **Globaland30 allows us to perform a global analysis about our planet and its change.**
- **A cross-disciplinary collaboration is needed to have in-depth analysis!**
- **30 m is good, but not enough! More detailed resolution will be needed for further smaller area analysis!**

4.2 Outlook





Geo-spatial Statistics with GlobalLand30!

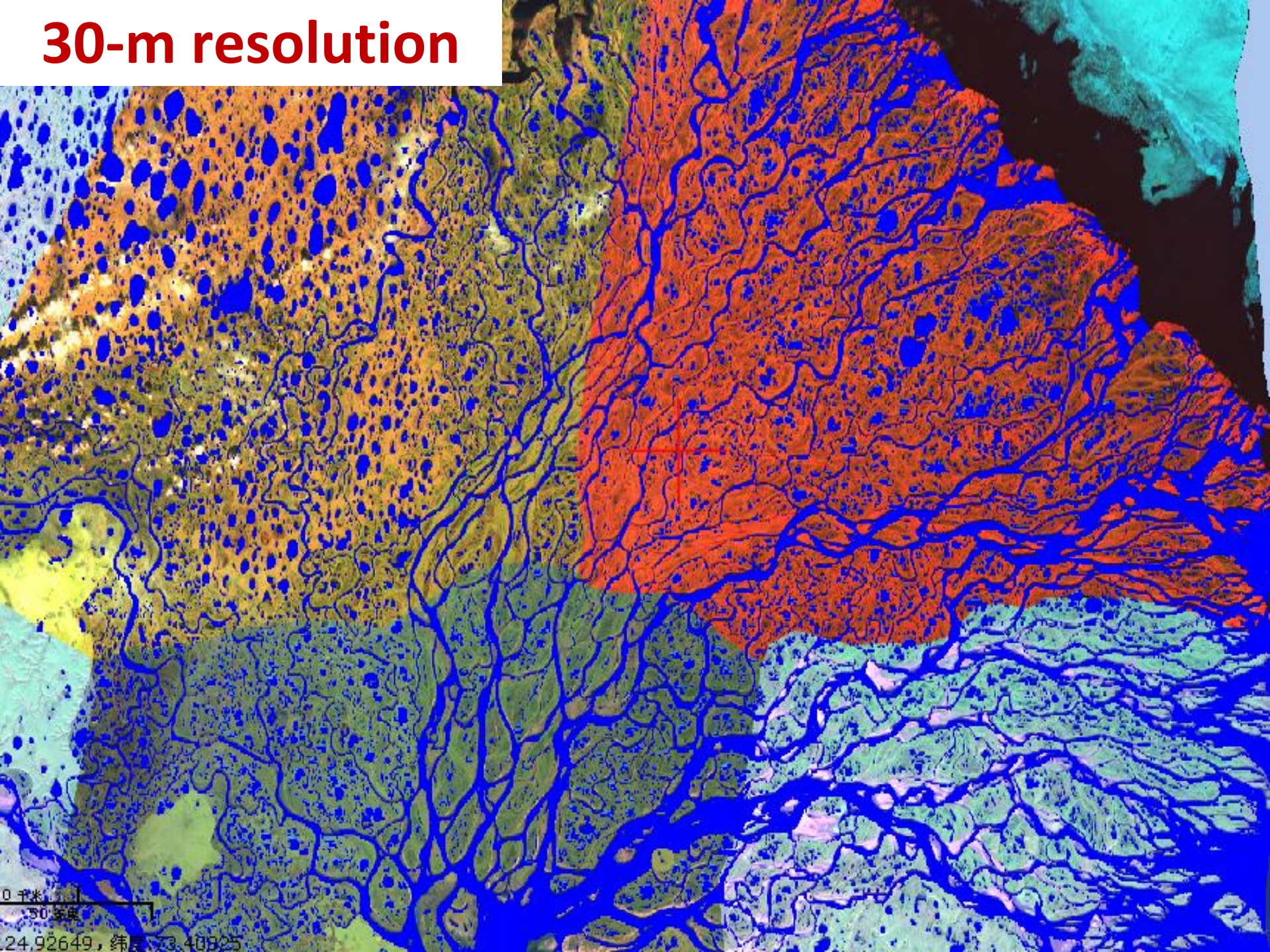
Chinese

www.globallandcover.com:5577

English:

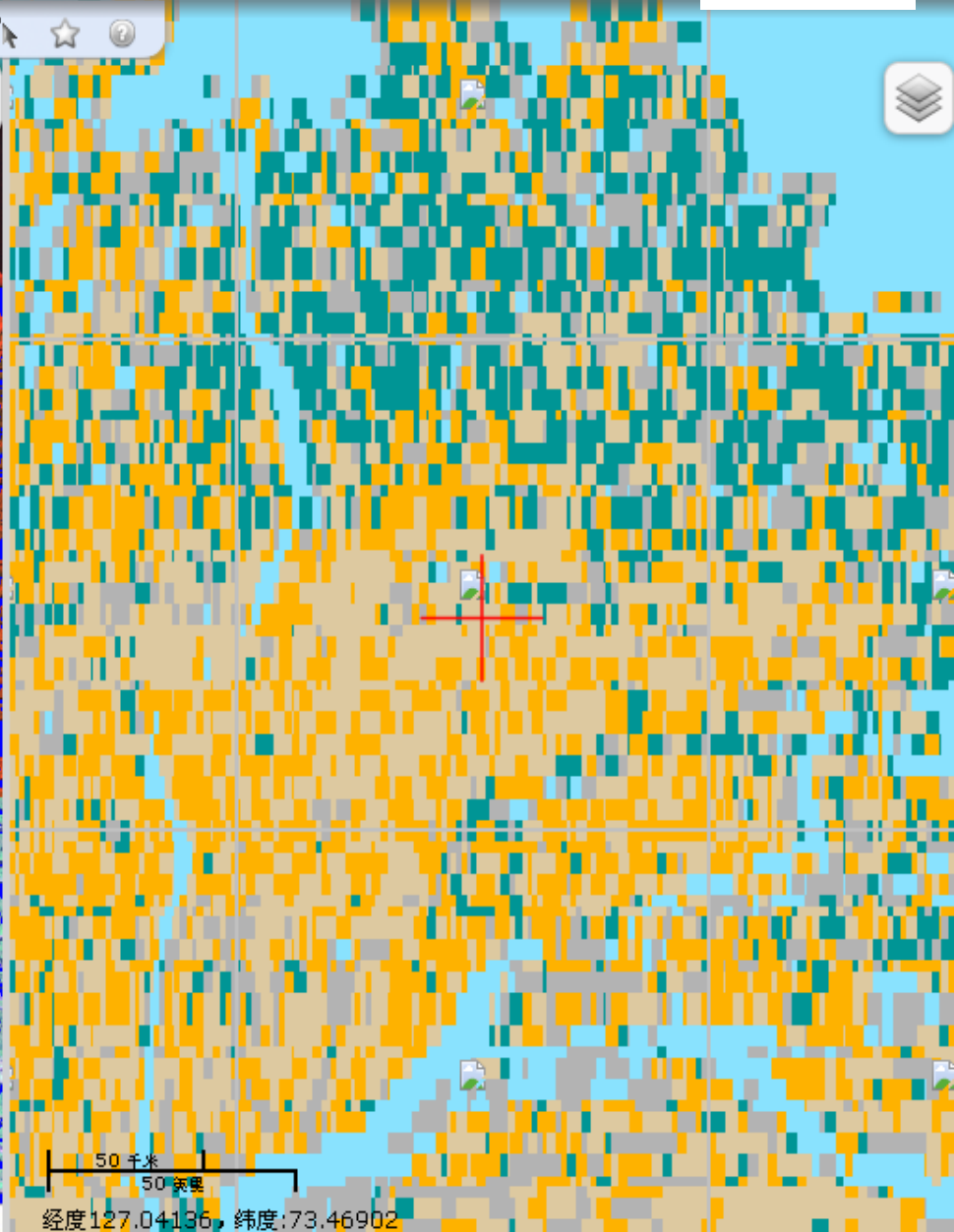
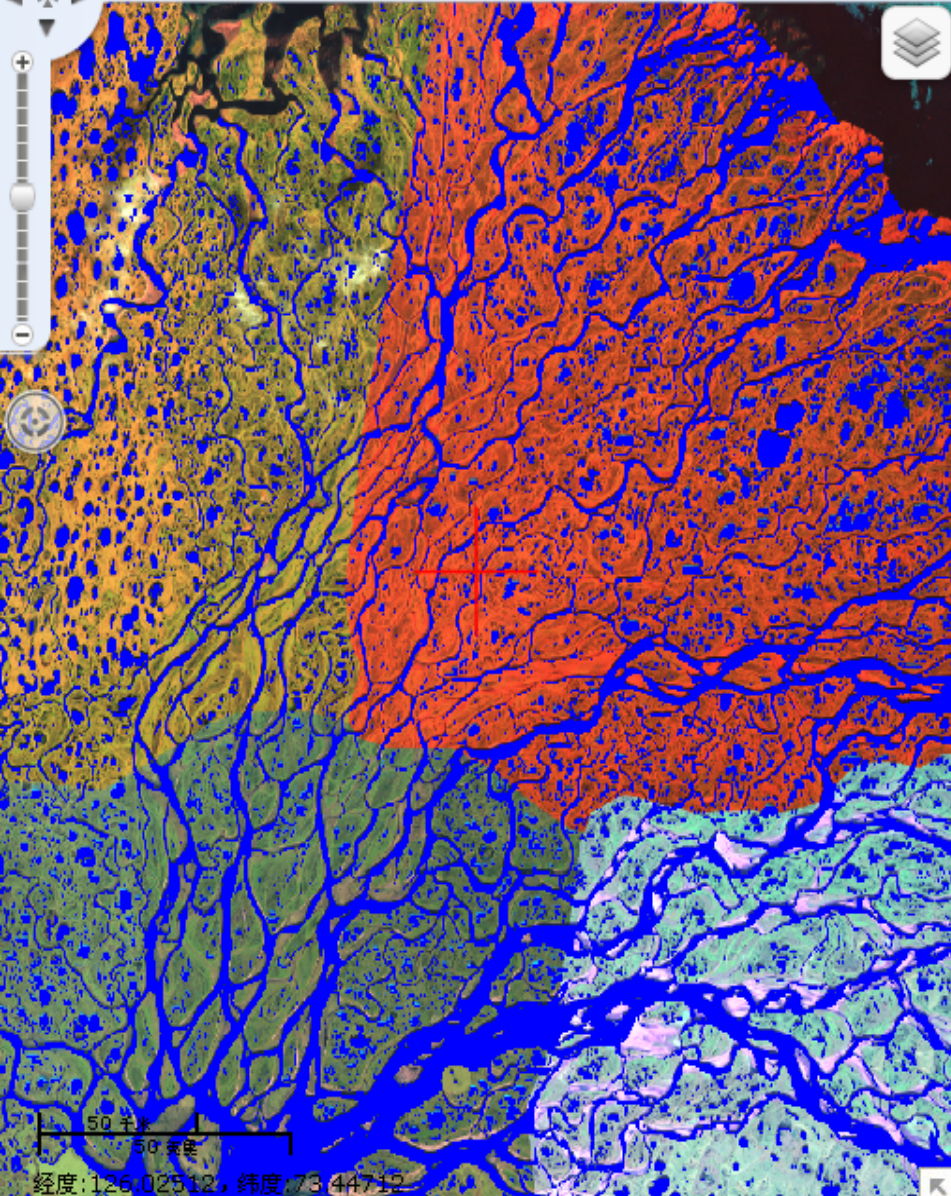
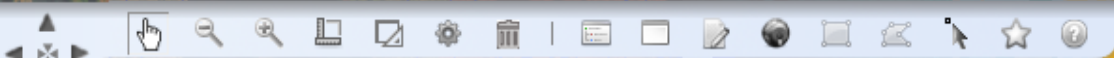
www.globallandcover.com:6688

30-m resolution



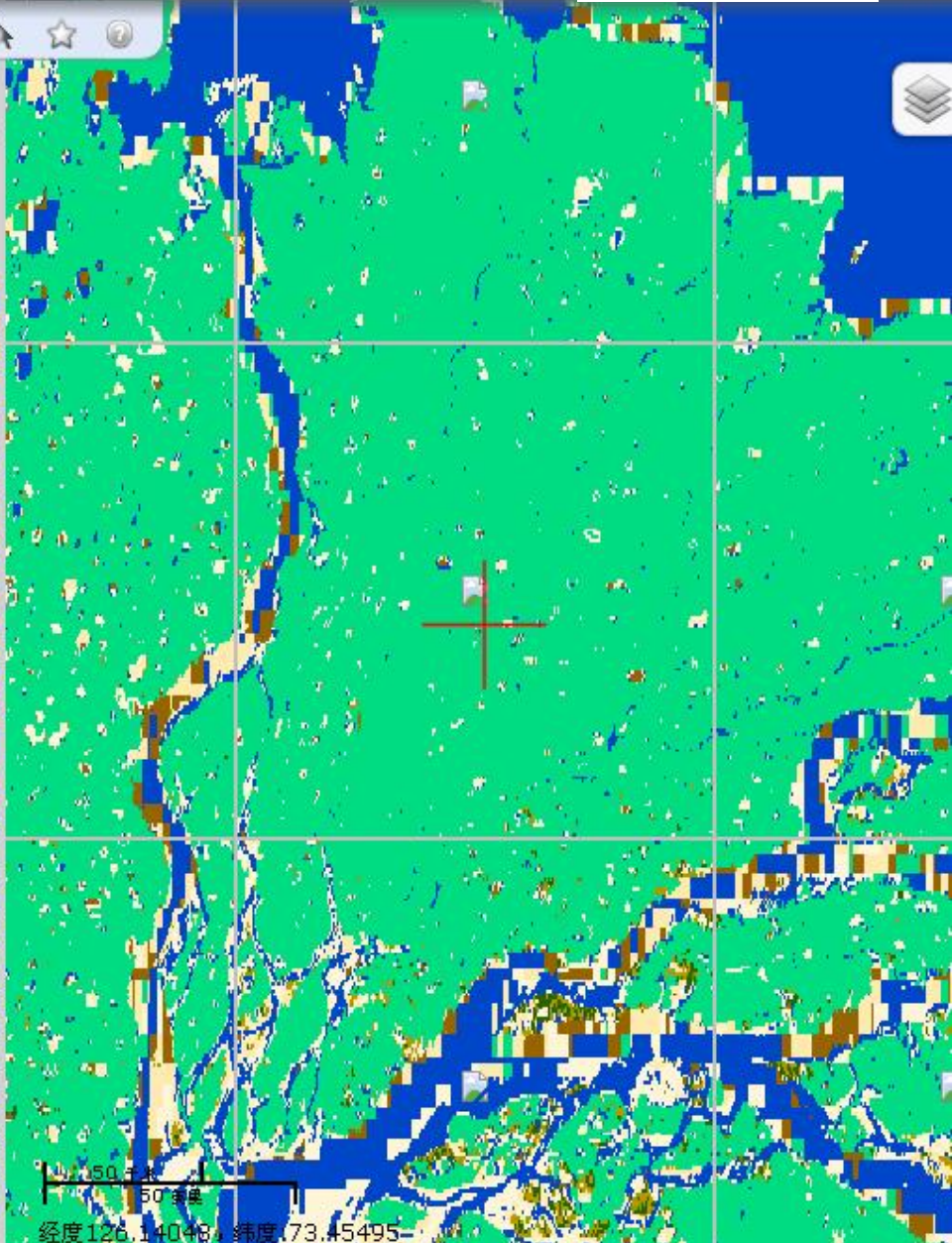
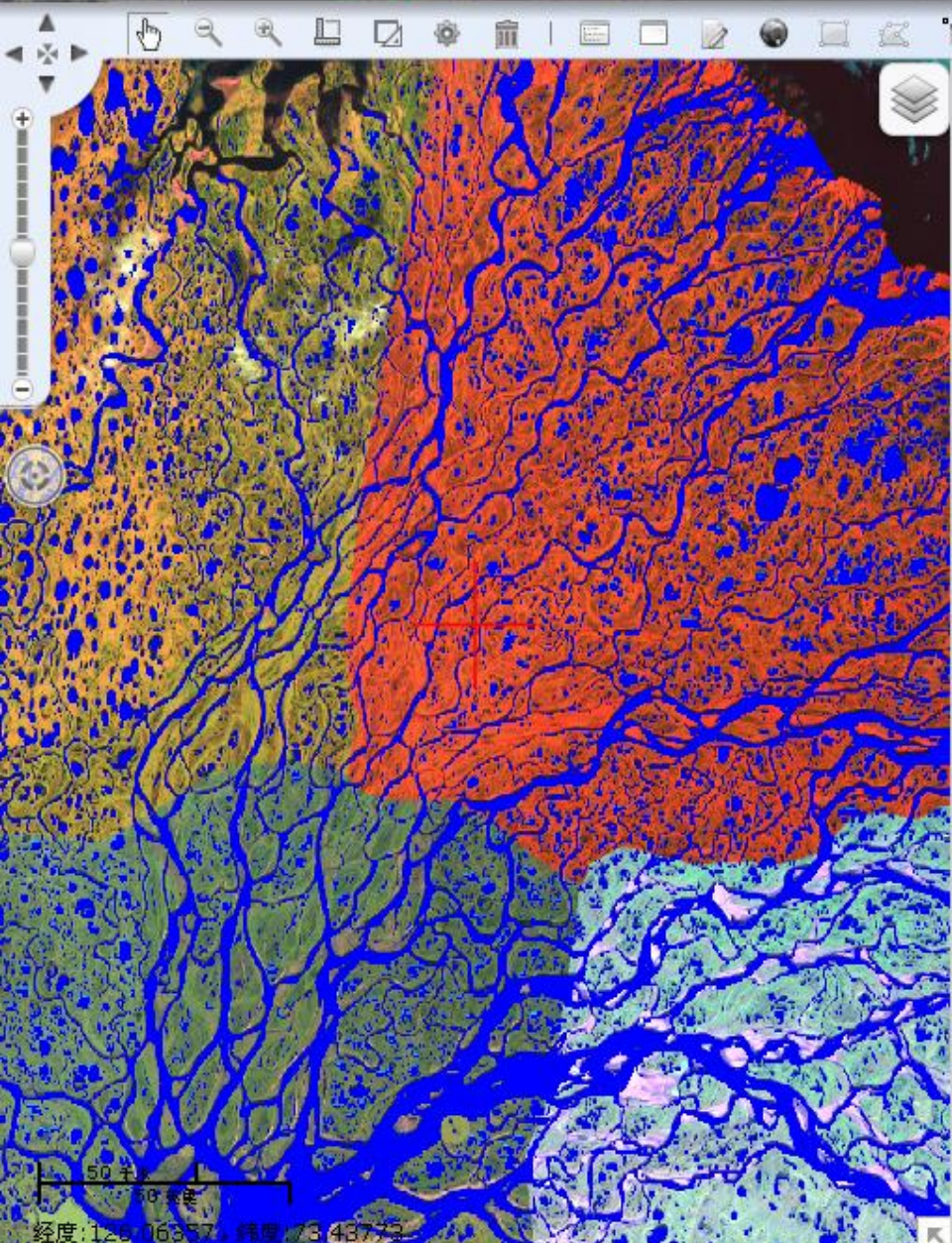
30m

1km

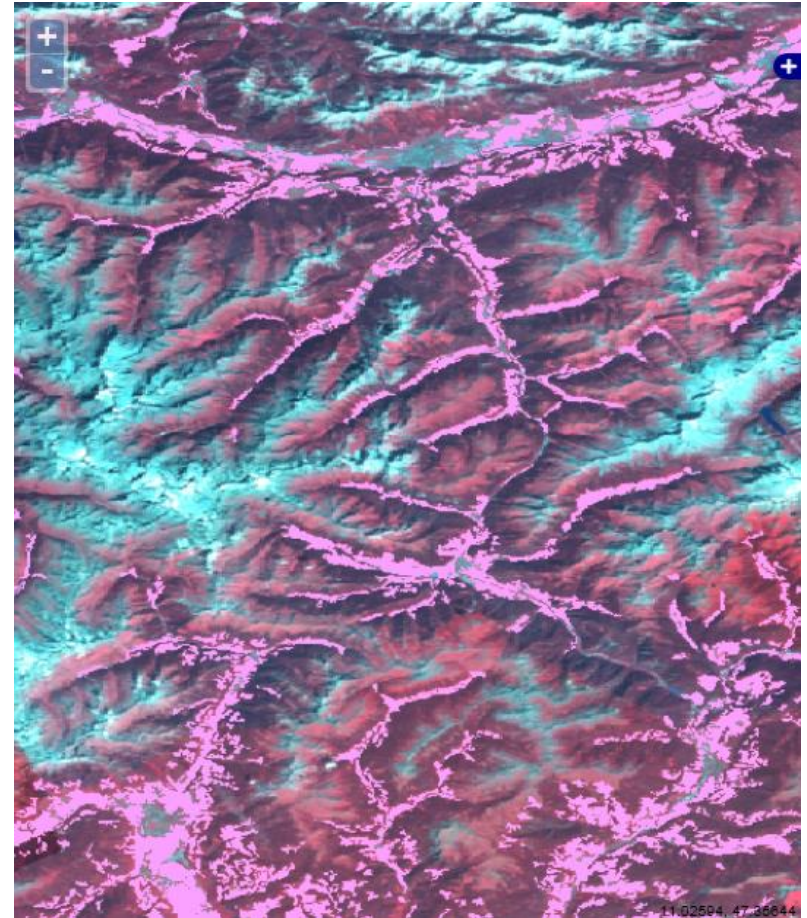
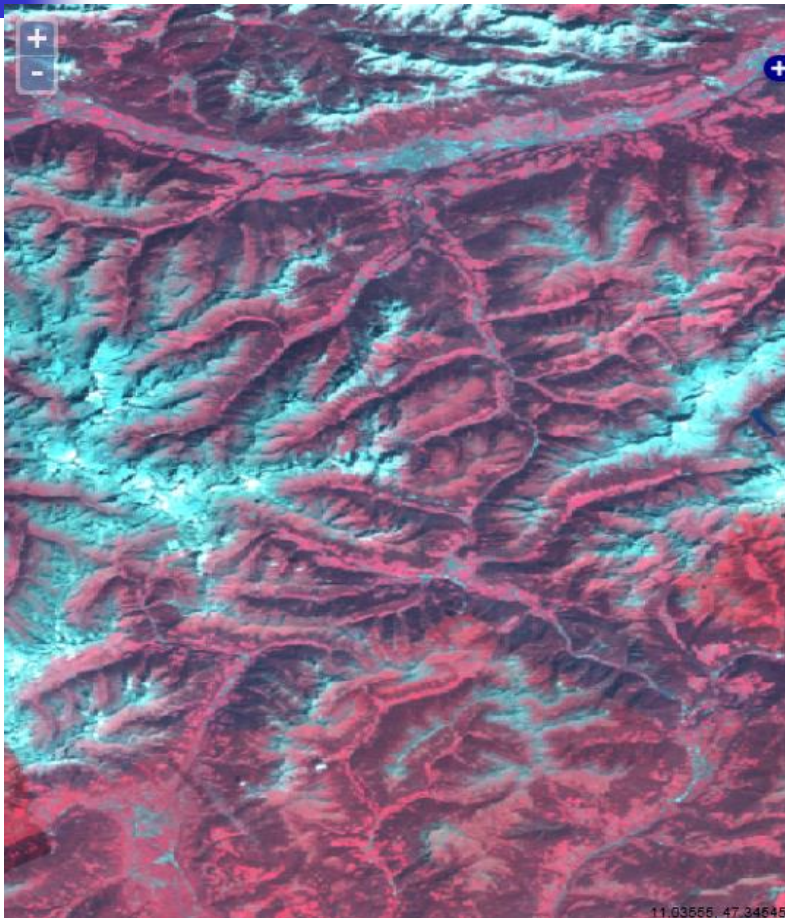


30m

300m



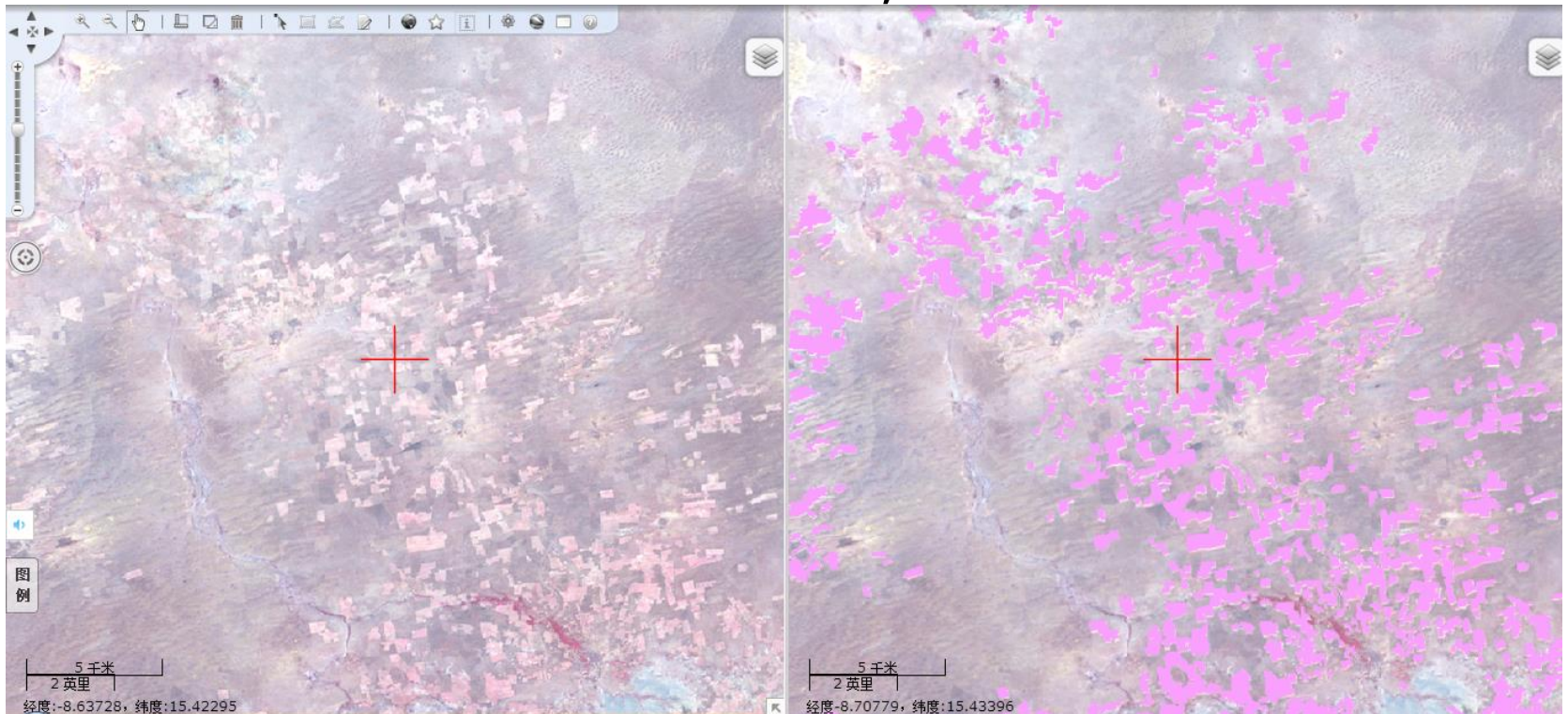
Cropland in Hilly area (Tyrol, Italy in 2010)



on both sides of the river canyon (46.959N, 11.380E)

Cropland in Arid Region (Koulikoro, Mali in 2000)

Coordinate: 15.433N, 8.707W



- **30m... permits detection of land change at the scale of most human activity [Loveland, 2010]**

Artificial Cover Change-Beijing

2000

20

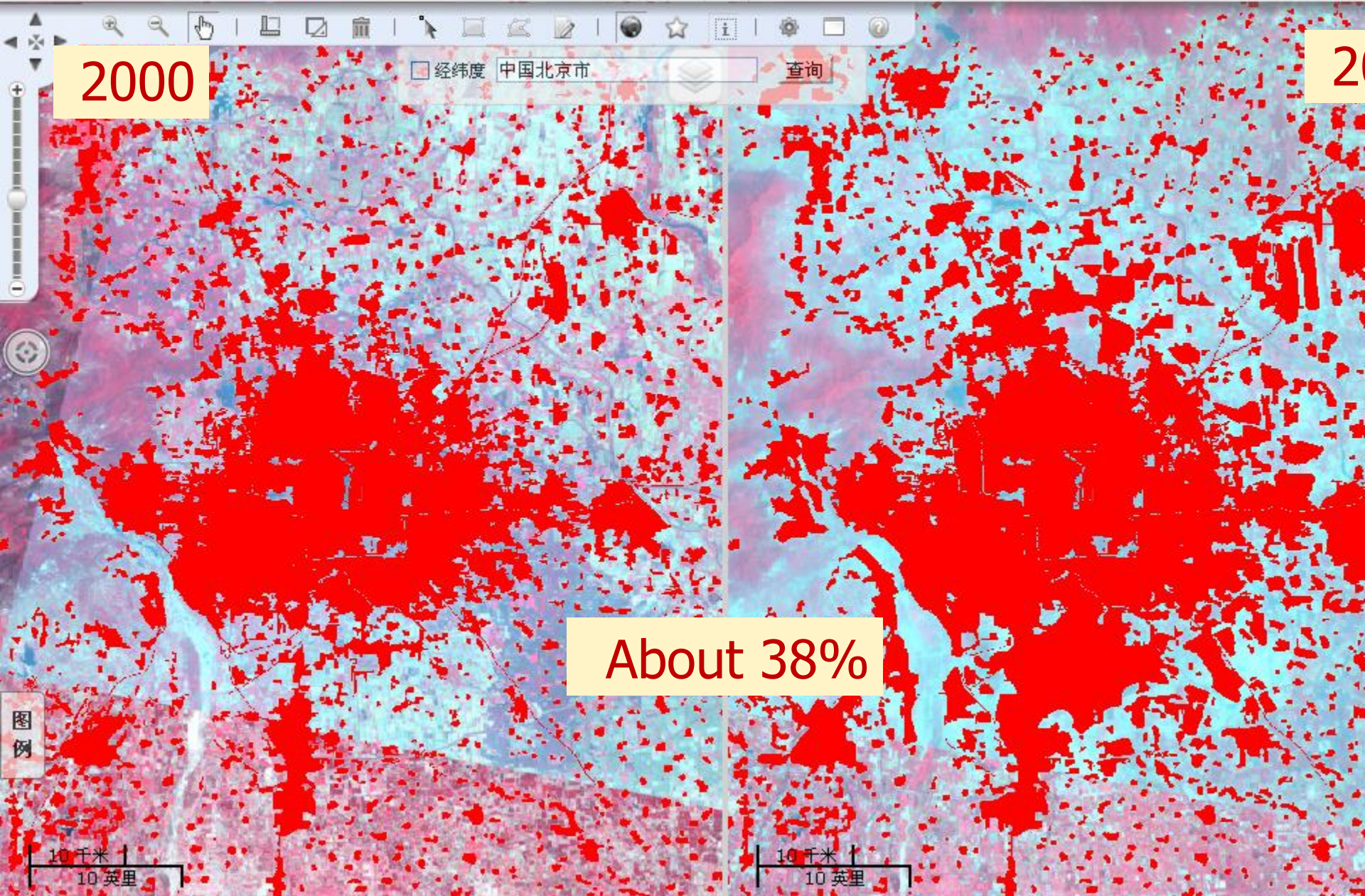
经纬度 中国北京市 查询

About 38%

图例

10 千米
10 英里

10 千米
10 英里



Artificial Cover Change- Hefei

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数据资料

成果检验

论坛

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您好 项目组

退出

2000

20

经纬度 中国安徽省合肥

查询

Almost 100%

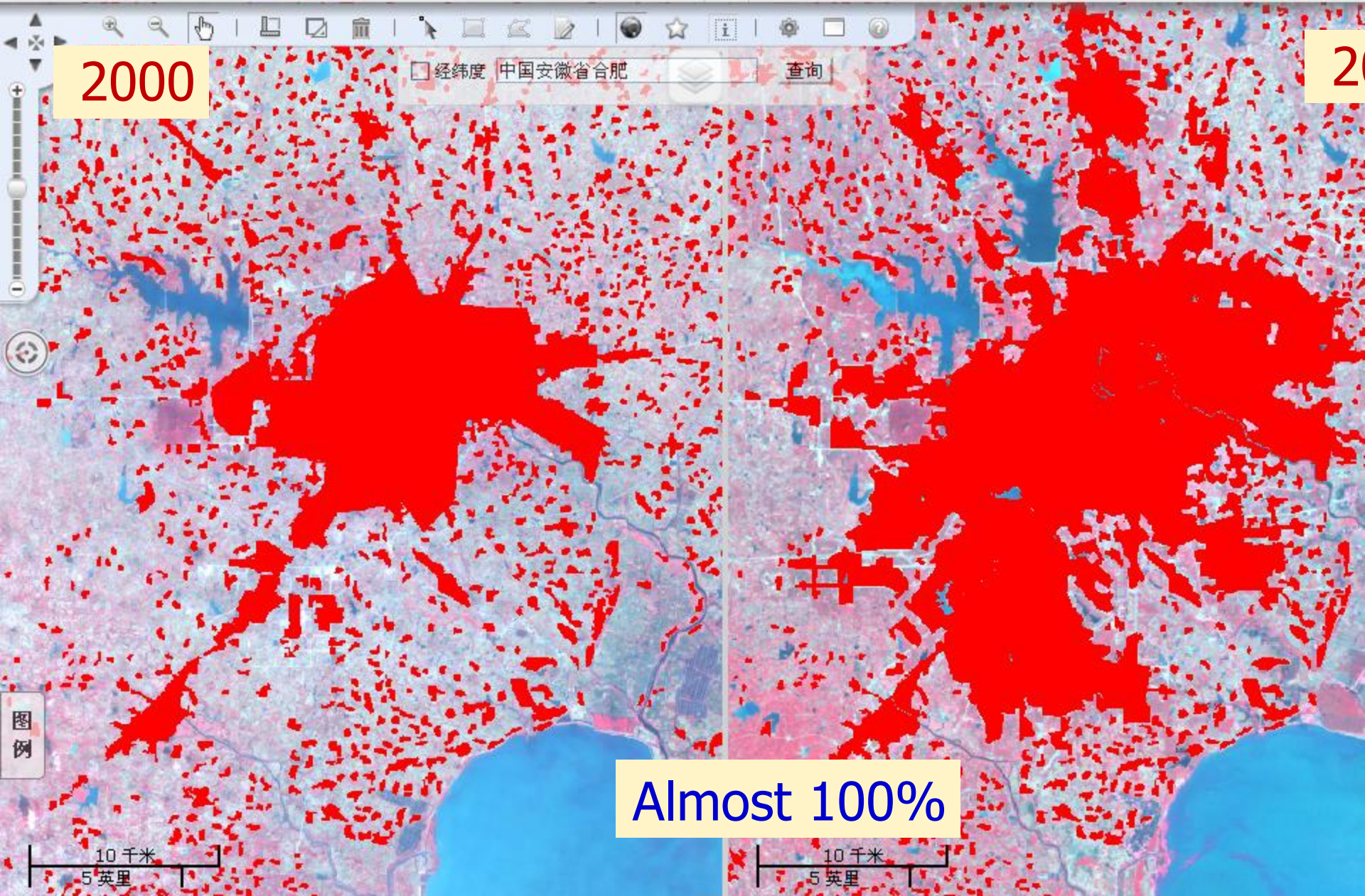
10千米

5英里

10千米

5英里

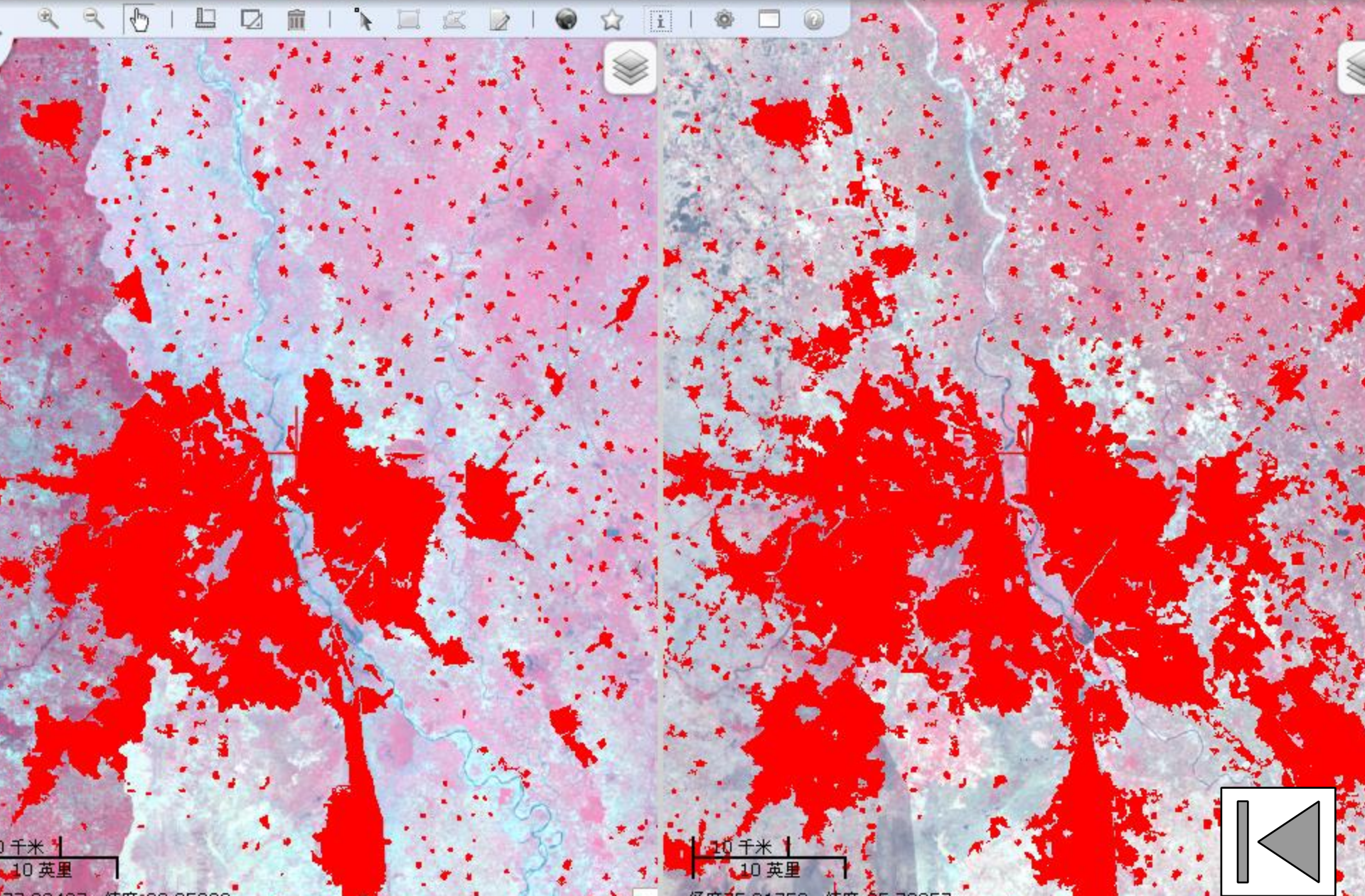
图例



Artificial Cover Change- New Deli

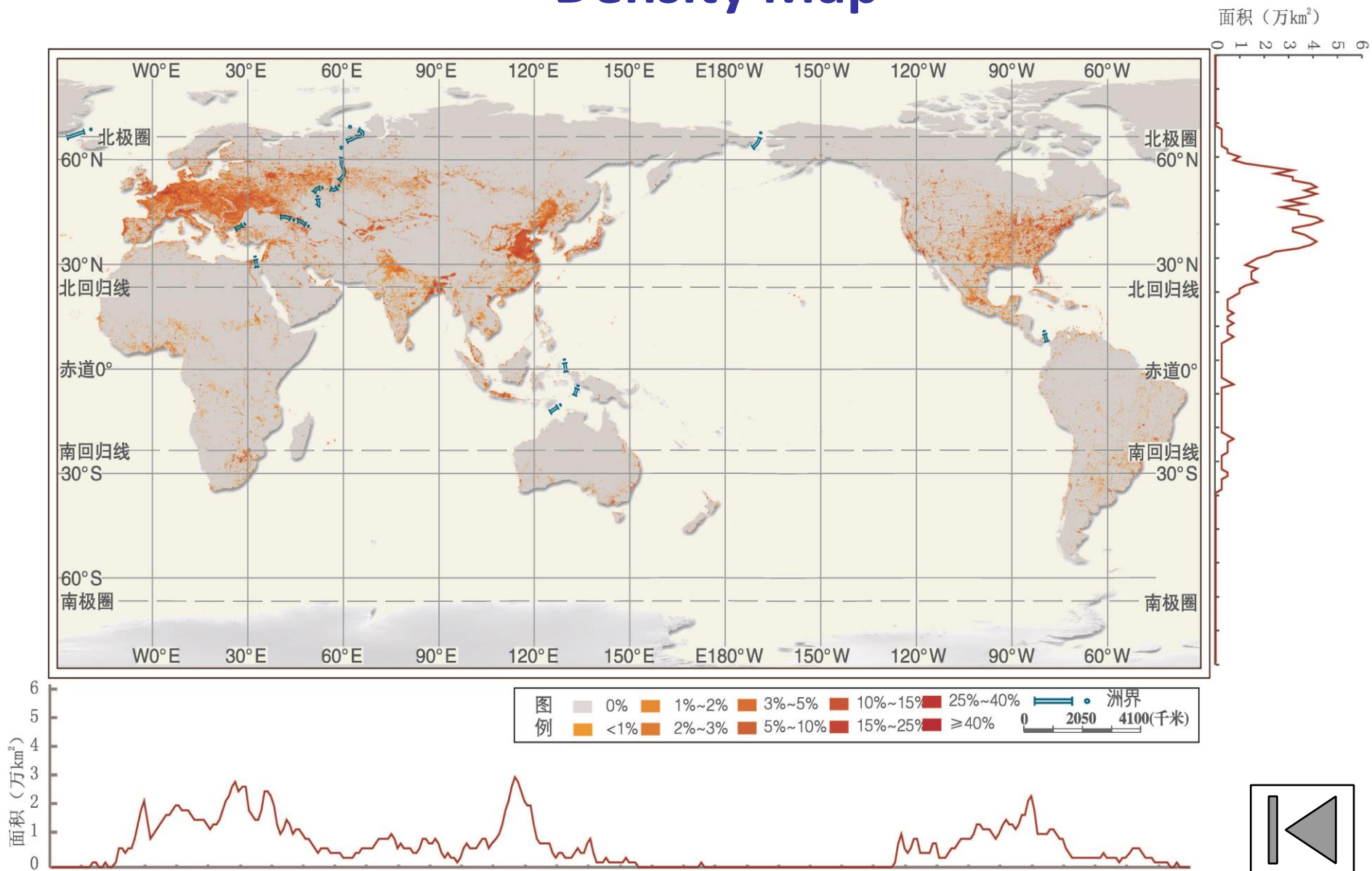
项目组

退出



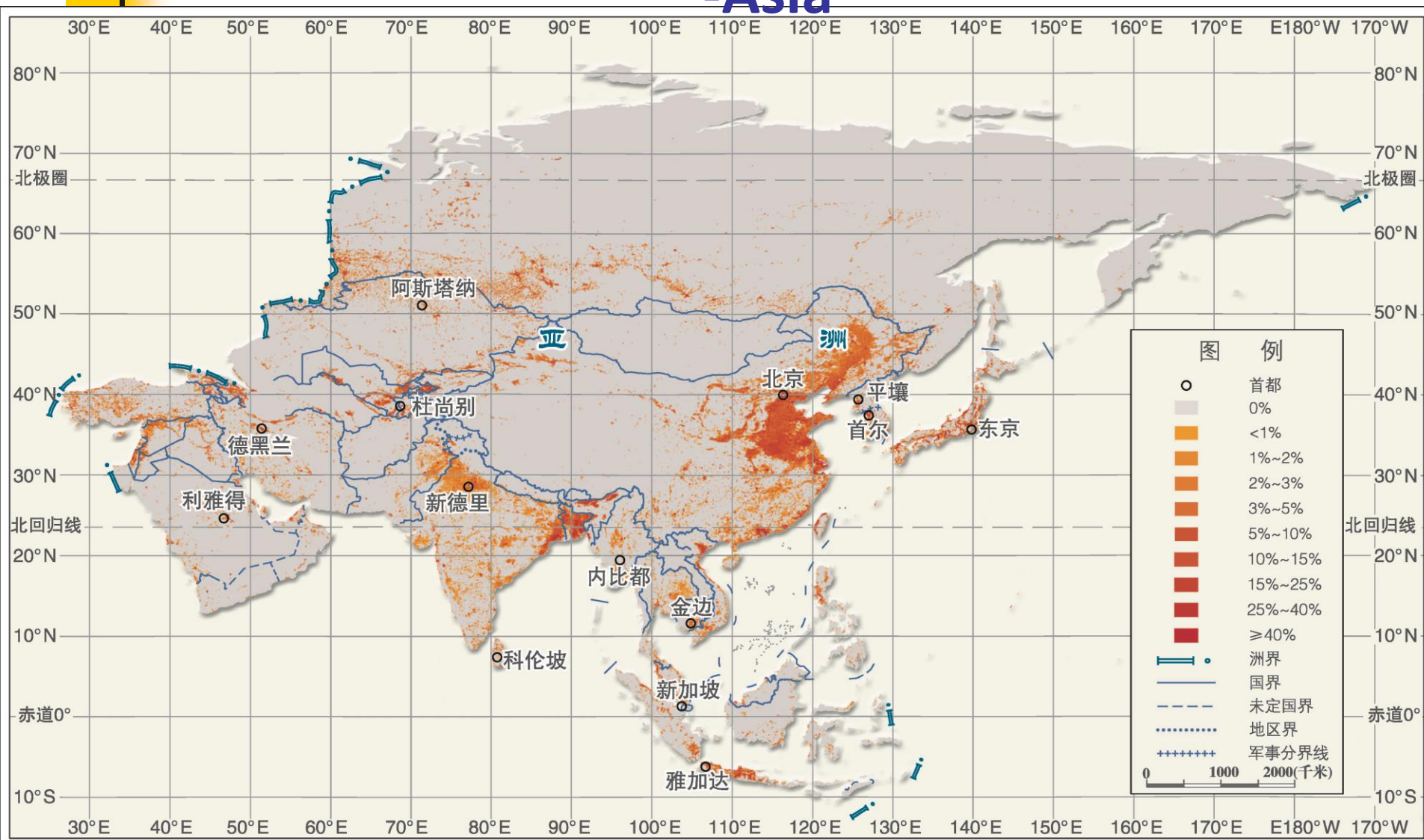
Urban and Rural Construction land-2010

- Density Map

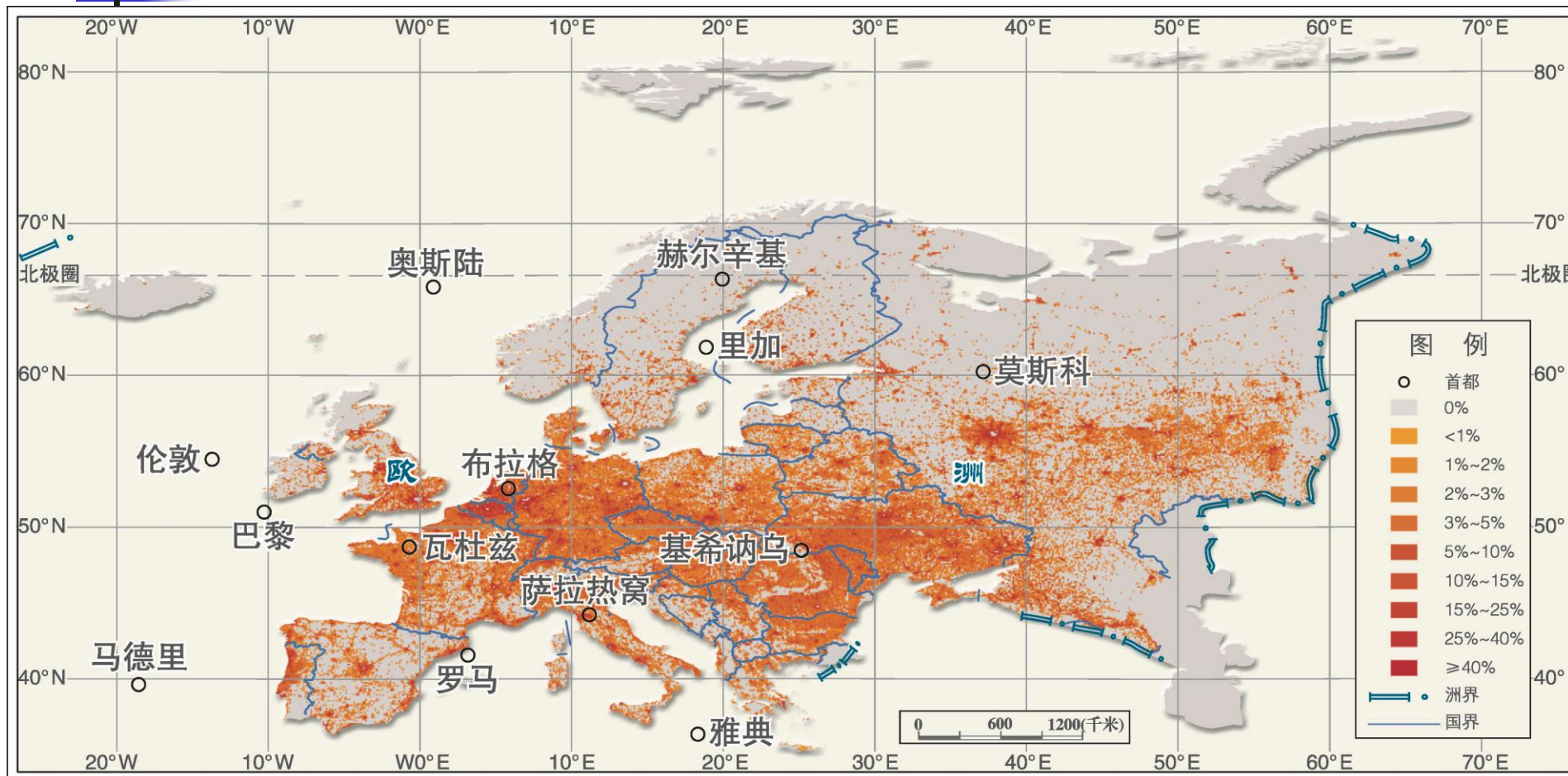


Urban and Rural Construction land

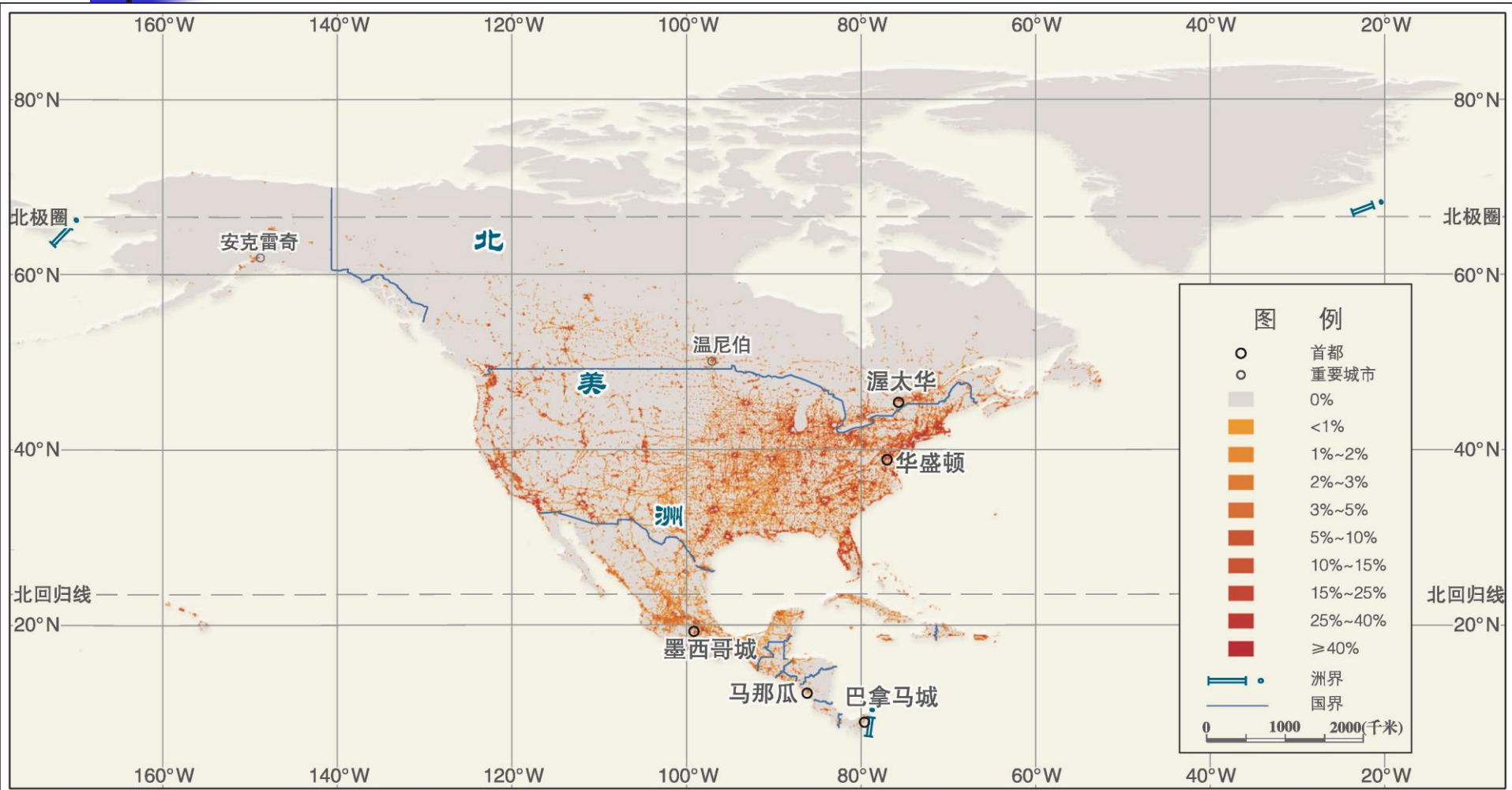
-Asia



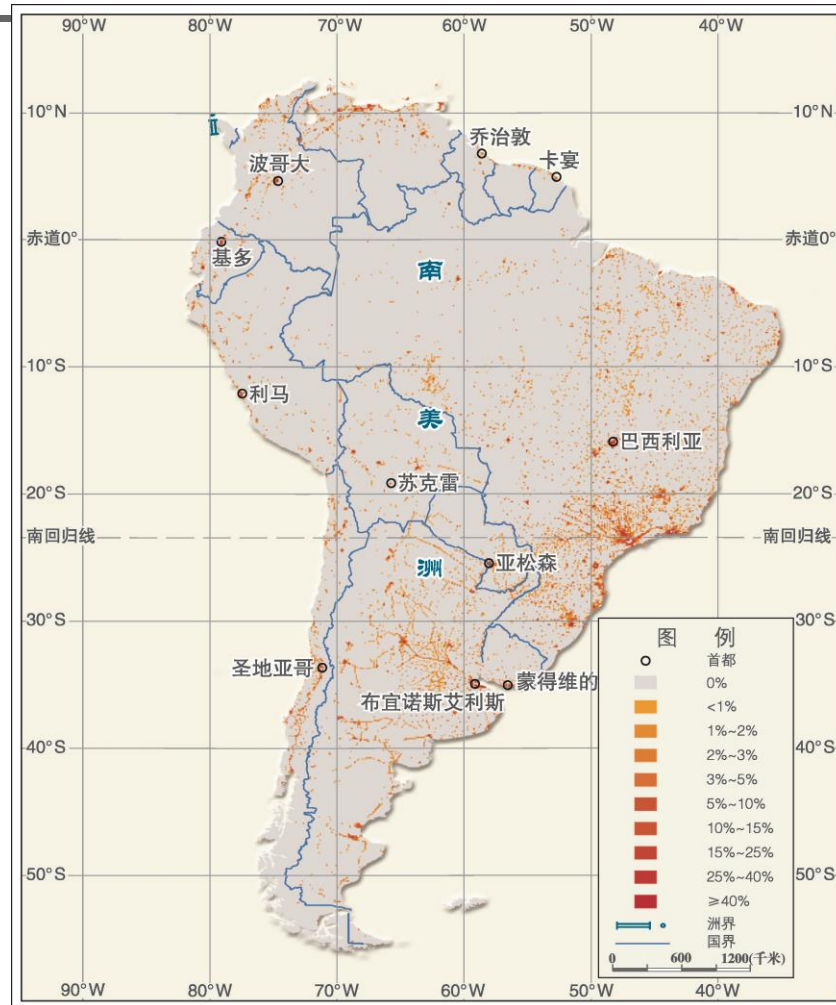
Urban and Rural Construction land - Europe



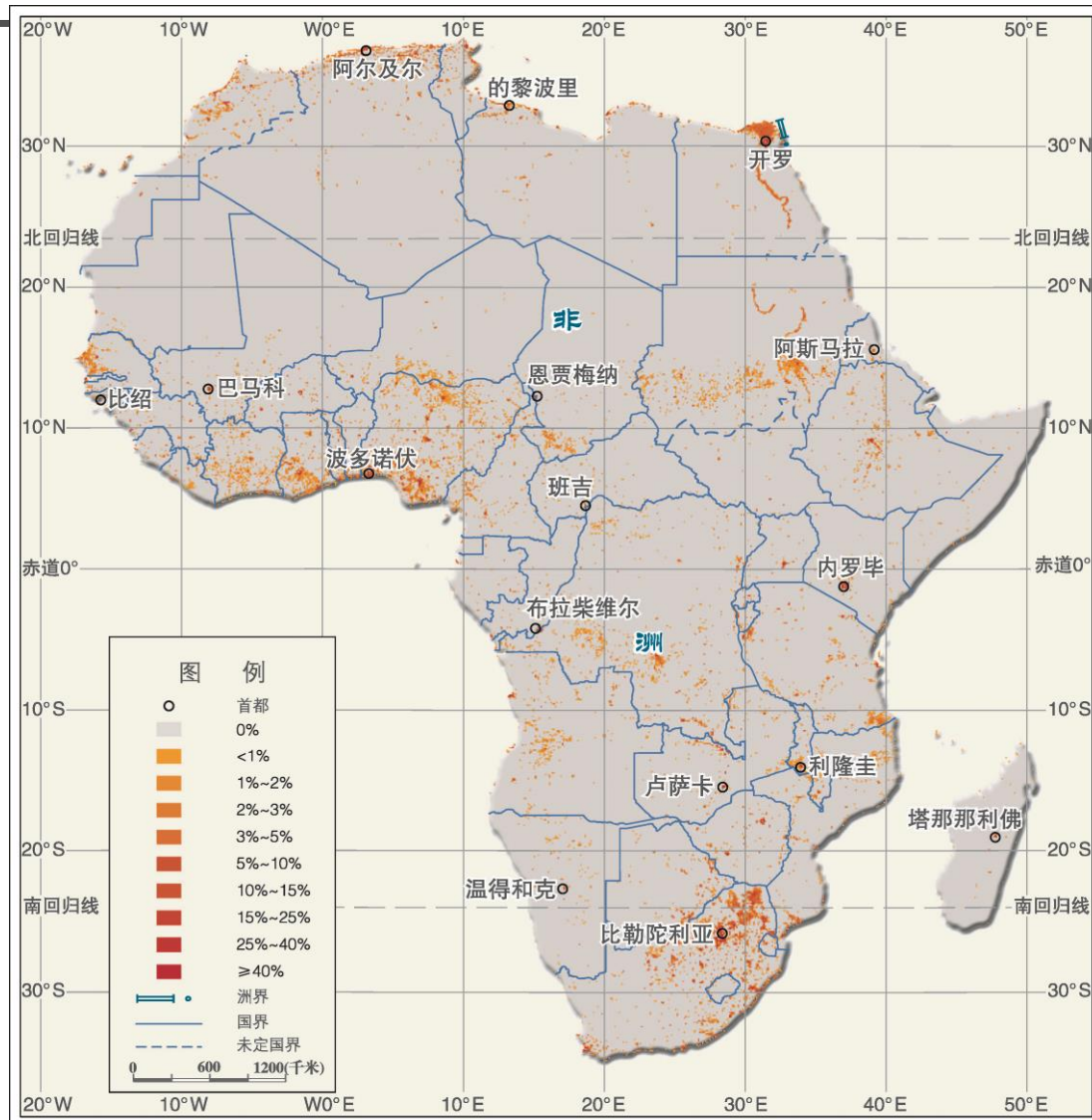
Urban and Rural Construction land - North America



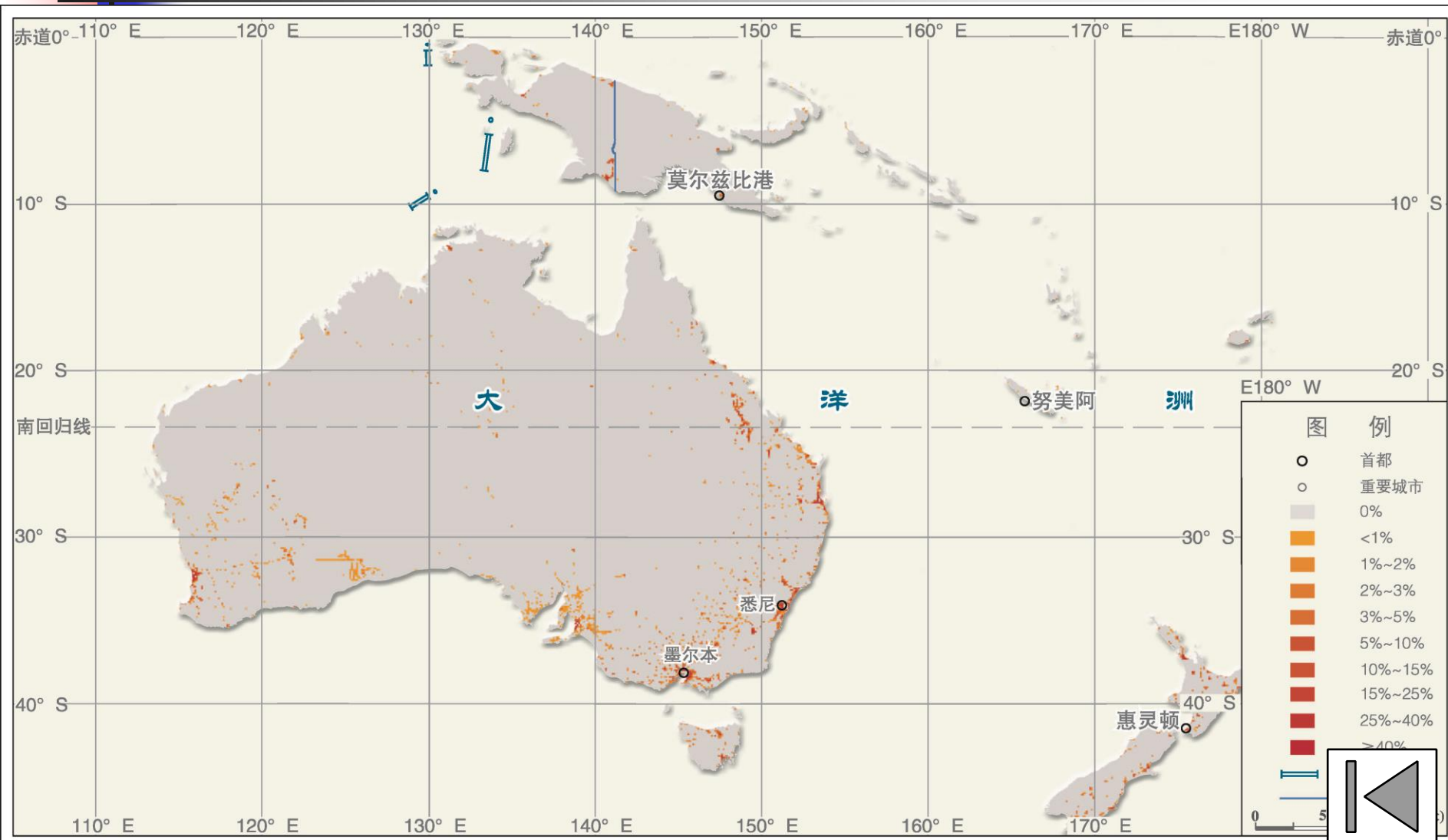
Urban and Rural Construction land - South America



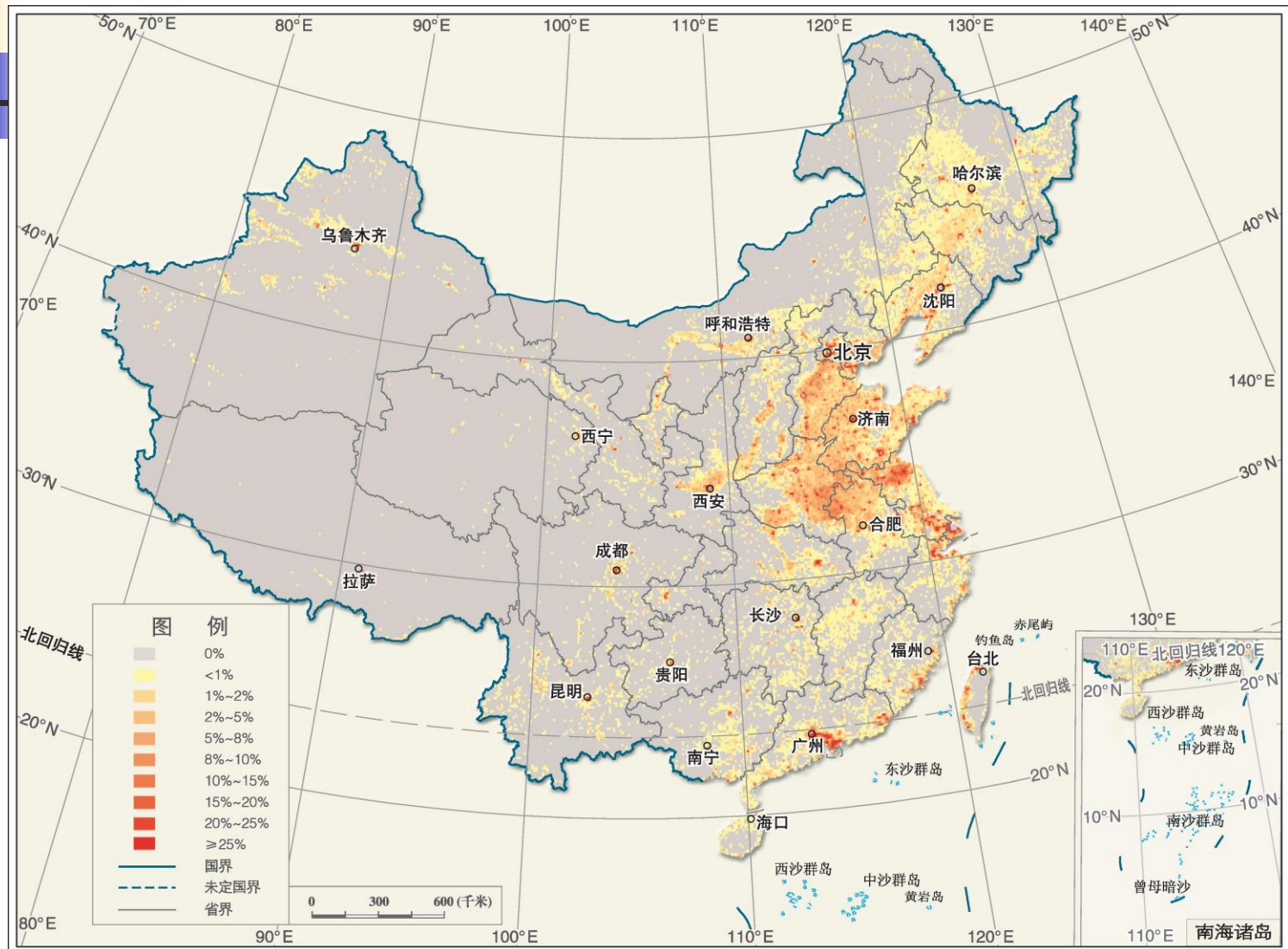
Urban and Rural Construction land - Africa



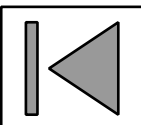
Urban and Rural Construction land - Oceania



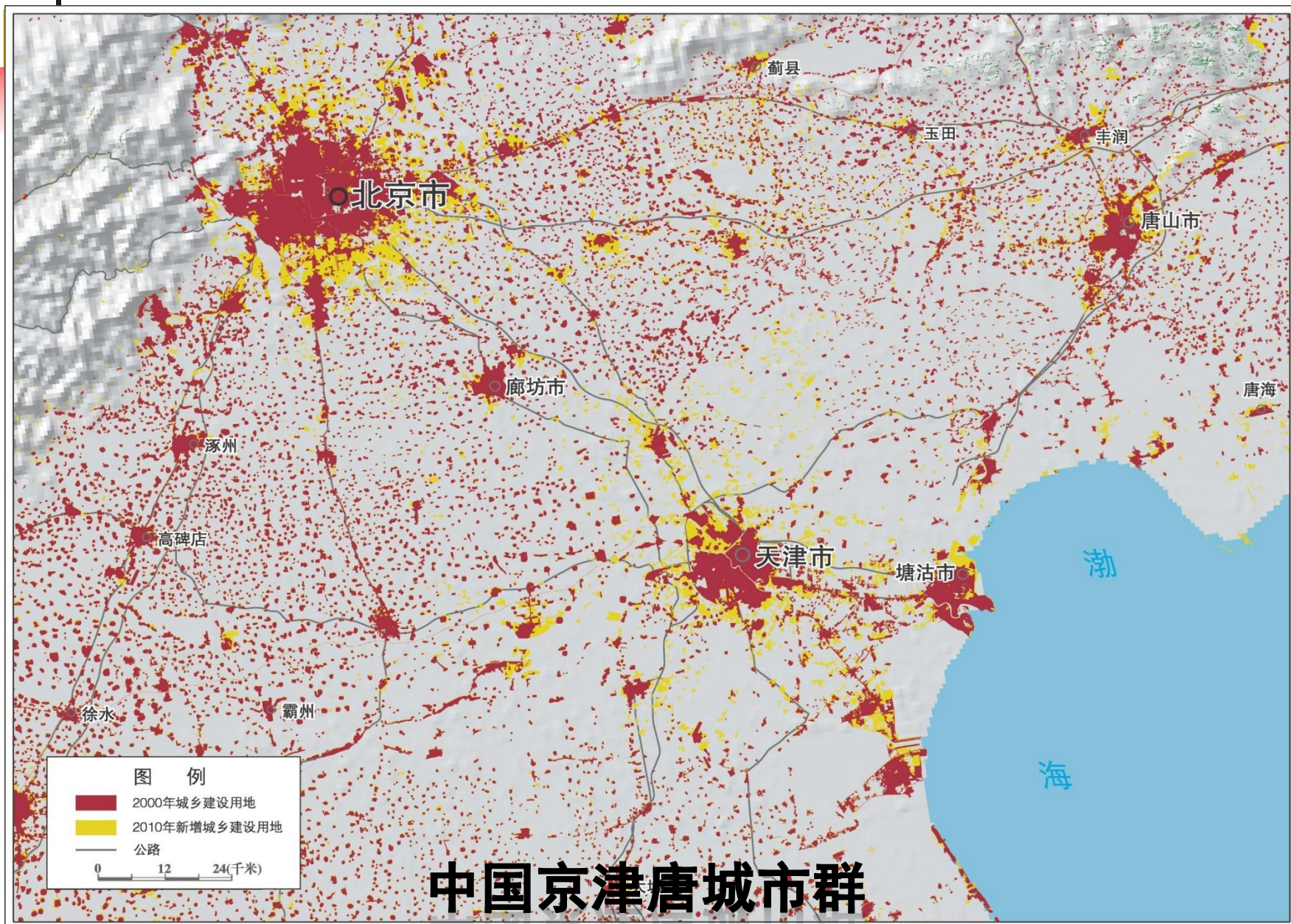
Urban and Rural Construction land



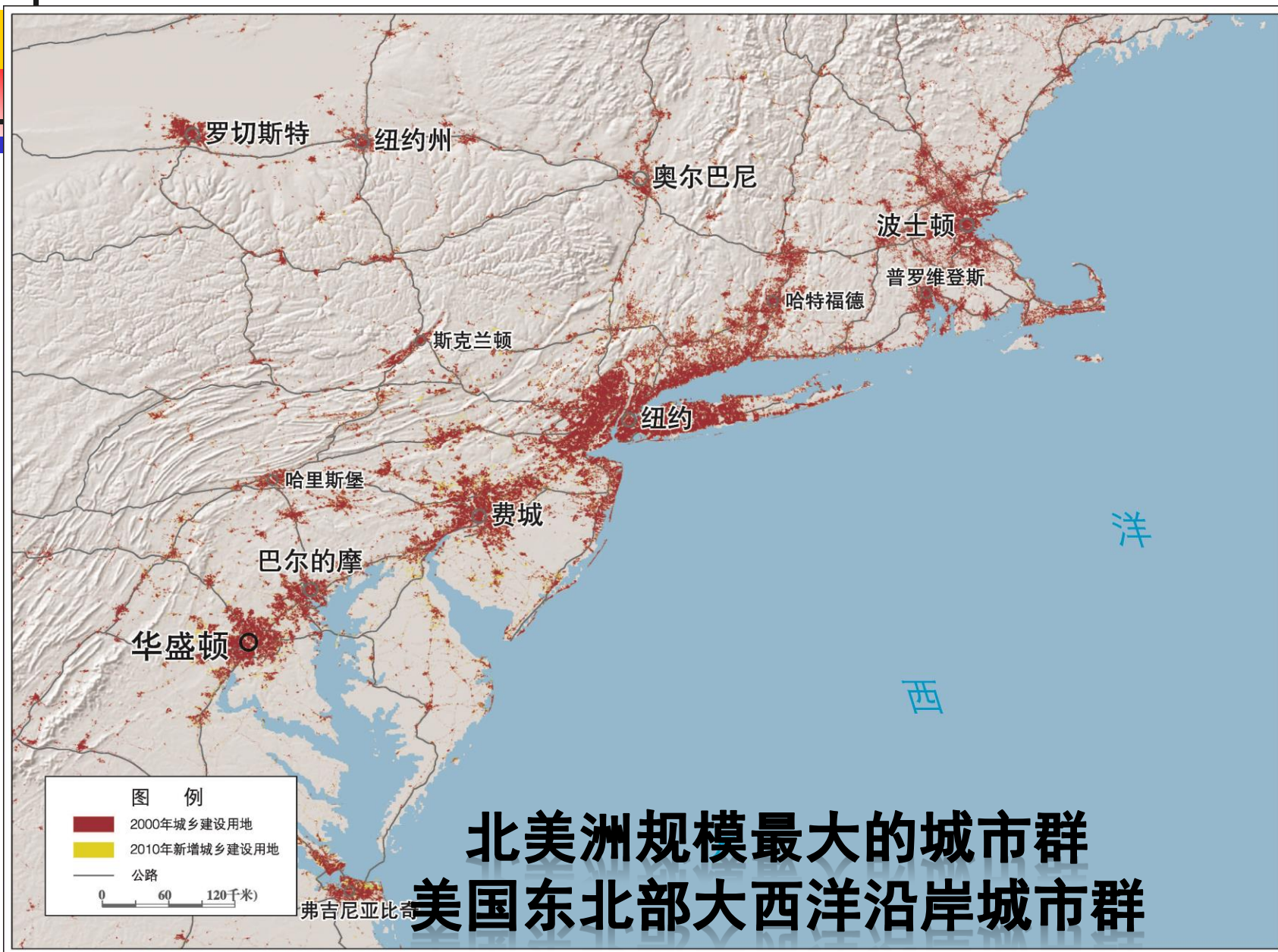
China, 2010



Urban and Rural Construction land



Urban and Rural Construction land



Urban and Rural Construction land

