HTT20
P05

Modeling Land Use and Land Cover Dynamic Changes in Tianjin City

WANG Ruci

Division of Spatial Information Science, Faculty of Life and Environmental Science

University of Tsukuba, Japan

Email: <warucy0720@yahoo.co.jp>

Introduction

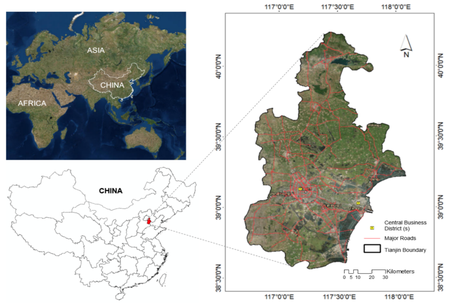

Fig.1: Location of the study area.

- Urban areas have been expanding rapidly in the world, especially in developing countries. With this rapid urban growth, several environmental and social problems have appeared.
- Better understanding of land use and land cover (LULC) change will facilitate urban planning and constrain these potential problems.
- As one of the four municipalities in China, Tianjin has experienced rapid urbanization and such trend is expected to continue. Relying on remote sensing (RS) and geographical information system (GIS) tools, this study investigates LULC change in Tianjin city.

Materials and Methods

Data

- Landsat 5 TM (1995), Landsat 7 ETM+ (2005) and Landsat 8 OLI (2015) from USGS. All imageries chosen were cloud free and in the same season.
- Administrative boundary shape file.

Pre-processing

- No geometric and radiometric correction (already done by USGS)
- Mosaicking, Clipping, projecting, geo-referencing etc.

Classification

- Training sample selection and creating signatures.
- Maximum (supervised) classification applied using ENVI 5.2 software.

Modeling

The Model

- Cellular Automata (CA) model and Markov Model were used for modeling future LULC in 2015, 2025 and 2035.
- CA model was applied using IDRISI Software (Version 17.02).

Variables

- Distance to roads.
- Distance to subways.
- Distance to bus stations.
- Distance to CBDs.
- Distance to markets.
- DEM
- Slope

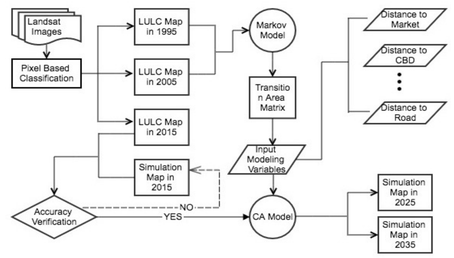

Fig.2: Process of simulation in urbanization modeling.

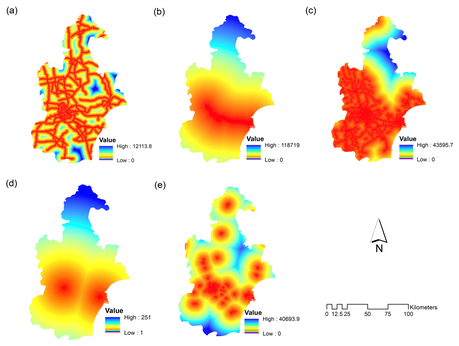

Fig.3: Spatial patterns of five variables: (**a**) distance to roads; (**b**) distance to subways; (**c**) distance to the capital bus stations; (**d**) distance to CBDs; (**e**) distance to markets.

Results

LULC Modeling

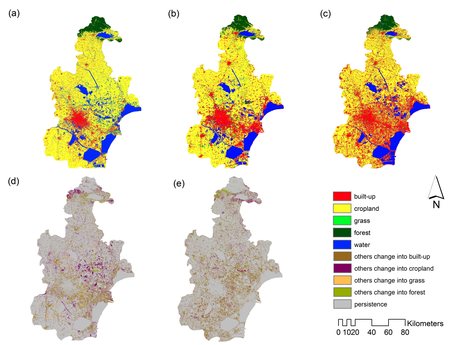

Fig.4: Land use and land cover (LULC) in 1995 (**a**), 2005(**b**), 2015(**c**), change map from 1995–2005 (**d**), and change map 2005–2015 (**e**).

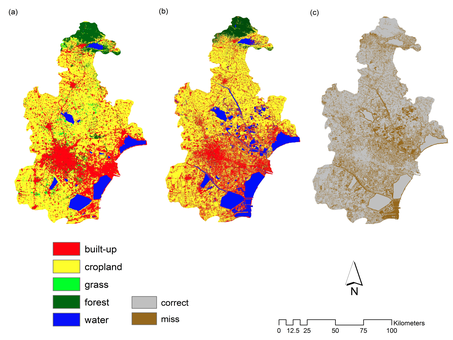

Fig.5: Actual map in 2015 (**a**), simulation map in 2015 (**b**), and error map (**c**).

Table1: LULC classification statistics.

LULC Class	1995		2005		2015	
	Area (Km^2)	%	Area (Km^2)	%	Area (Km^2)	%
Built-up	1537.92	13.52	2021.7532	17.78	2747.11	24.15
Cropland	7632.16	67.1	7267.6775	63.90	6652.69	58.49
Grass	247.84	2.17	320.0716	2.81	216.76	1.91
Forest	451.76	3.97	355.5	3.13	394.7	3.47
Water	1504.8	13.23	1408.6578	12.39	1362.48	11.98
Total	11374	100	11374	100	11374	100

Table2: The rate of change for LULC.

LULC Type	Area Change (km^2)		Annual LULC Change Rate (%)	
	1995-2005	2005-2015	1995-2005	2005-2015
Built-up	483.83	725.36	3.15	3.59
Cropland	-364.48	-614.99	-0.48	-0.85
Grass	72.23	-103.31	2.91	-3.23
Forest	-96.26	39.20	-2.13	-0.06
Water	-96.14	-46.18	-0.64	0.00

Markov transition probability matrix

Table3: Matrix in LULC, 1995–2005 (%).

LULC in 1995	LULC in 2005				
	Built-up	Cropland	Grass	Forest	Water
Built-up	83.22	14.55	1.60	0.31	0.33
Cropland	12.98	84.59	0.84	0.10	1.50
Grass	4.81	9.10	75.60	1.48	9.01
Forest	1.15	16.46	1.03	79.60	1.76
Water	0.80	23.02	0.88	1.56	73.74

Table4: Matrix in LULC, 2005–2015 (%).

LULC in 2005	LULC in 2015				
	Built-up	Cropland	Grass	Forest	Water
Built-up	81.44	15.50	0.32	0.77	1.98
Cropland	14.72	82.48	0.34	0.88	1.58
Grass	1.03	38.54	56.79	2.84	0.79
Forest	2.74	17.22	0.19	78.62	1.23
Water	1.23	11.40	0.22	1.89	85.25

Model Validation

- FoM: 14.73%
- K-histogram: 0.83
- K-location: 0.86
- K-simulation: 0.51

```
Image Similarity / Association Data
-----------------------------------

   Chi Square =32088660.00000
           df =          16
      P-Level =      0.0000
   Cramer's V =      0.5761
        Kappa =      0.7229
```

Simulation

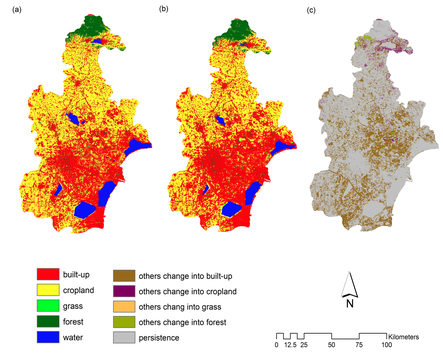

Fig.6: Simulation LULC in 2025 (**a**) and in 2035 (**b**), and change map 2025–2035(**c**).

Conclusion

- 14.55% of built-up areas were changed into cropland from 2005 to 2015. It is because per capita cultivated land size in China is less than 40% of the world average.
- From the simulation map in 2025 and 2035, the major roads and subways in the study area will have an enormous influence on urban growth in the near future.
- The analysis contributes to the understanding of the development process in the Tianjin area, which will facilitate future planning, as well as constraining the potential negative consequences brought about by future LULC changes.