



# 辽宁中部城市群扩展与非 点源污染响应

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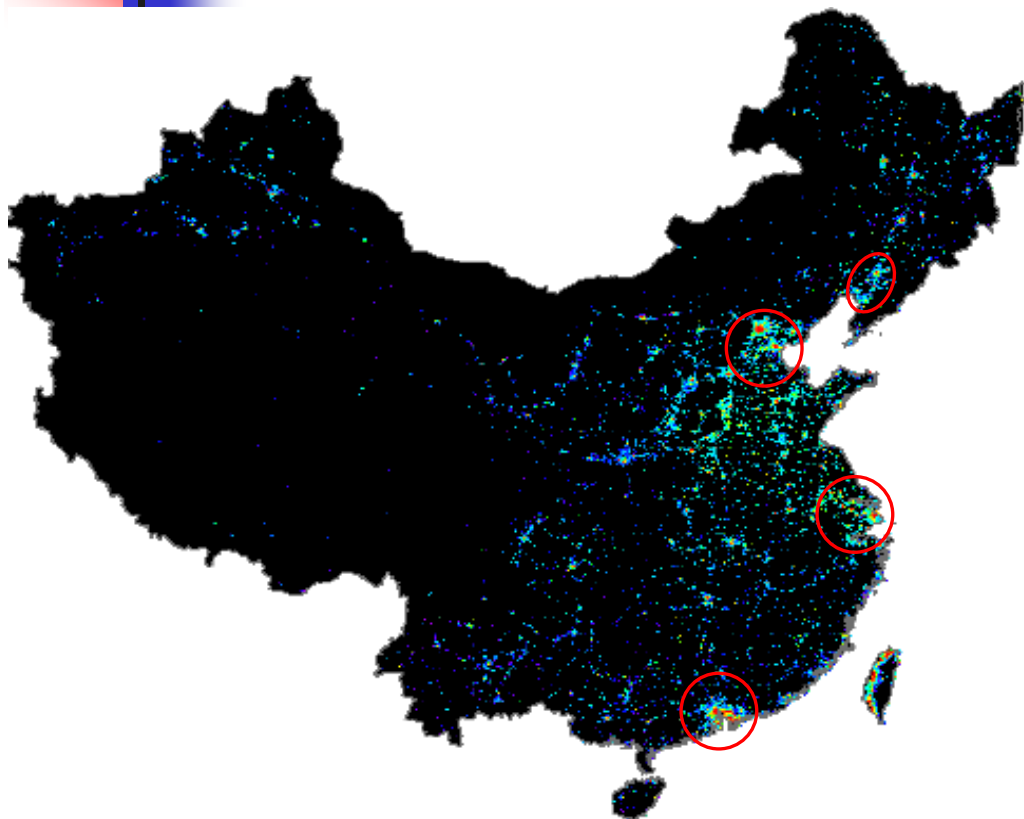
刘淼 胡远满

中国科学院沈阳应用生态研究所

景观生态室

2011.10

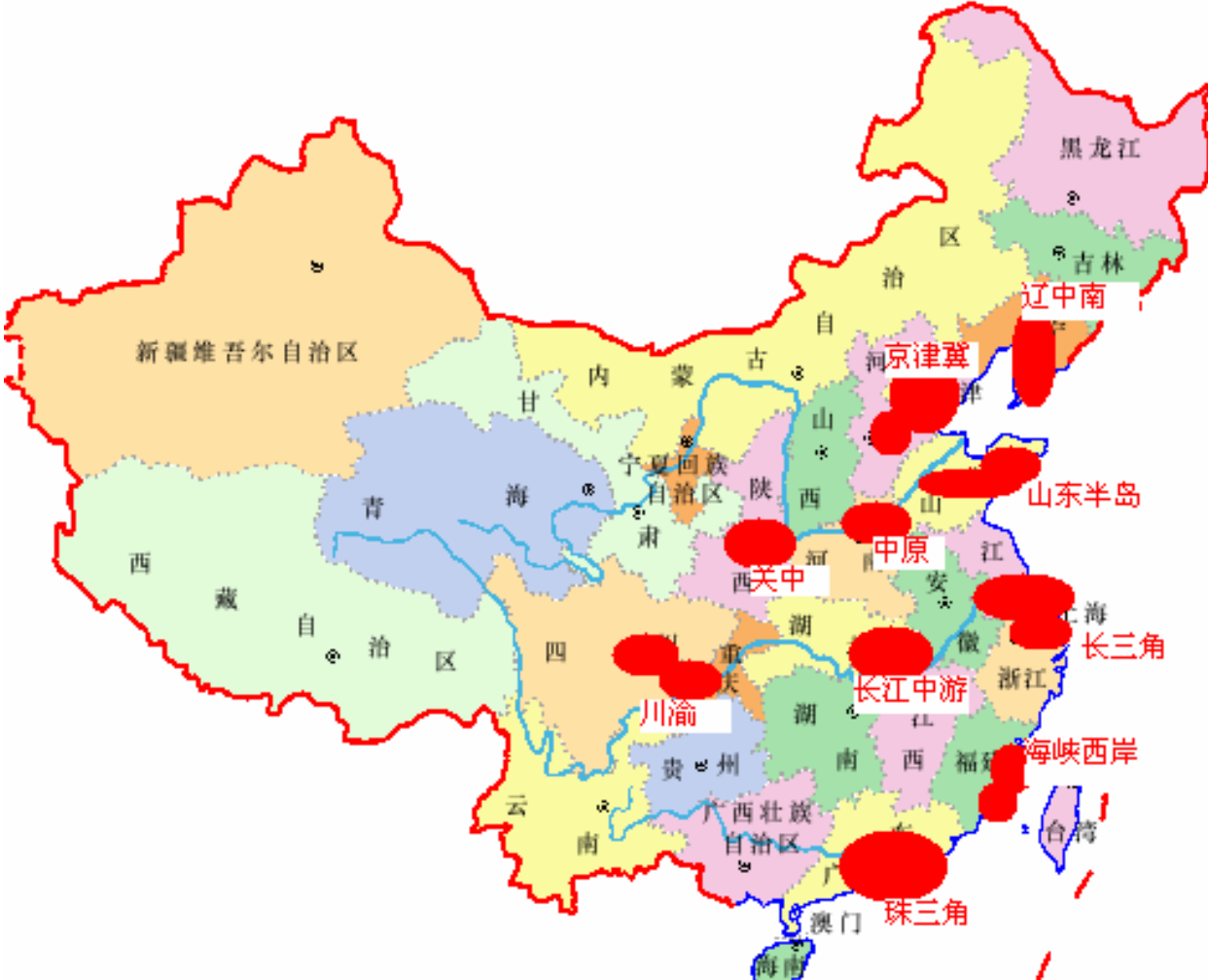
# 背景



- 城市化水平提高  
17.9% (1979) – 41.8% (2004)  
预测: 75% - (2050)
- 中国的城市化—影响21世纪人类发展进程的关键因素
- 城市群—中国城市发展的新阶段

1998年中国非辐射定标夜间灯光强度图(DMSP/OLS)

# 十大城市群



中国十大城市群

# 生态环境问题



农村城镇化



城市群扩张

土地利用/覆  
被变化

资源短缺

环境污染

生态破坏

GLOBAL  
I G B P  
CHANGE



IHDP



# 城市扩展生态影响

## 水污染

- 点源和非点源污染。
- 点源污染不断得到控制
- 城市扩展导致的土地利用变化直接影响非点源污染。



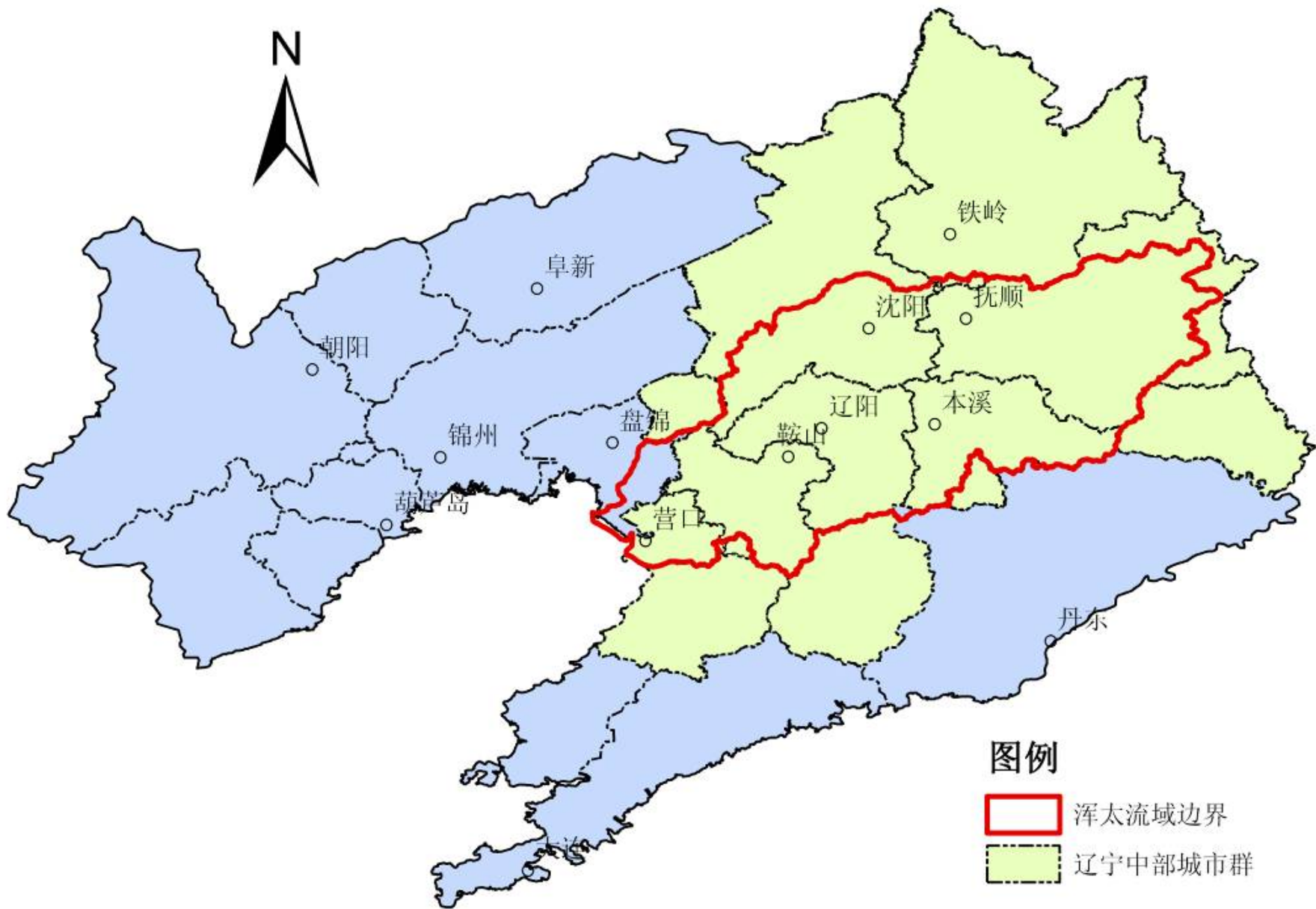


# 研究内容

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- 辽宁中部城市群扩展
- 辽宁中部城市群非点源污染

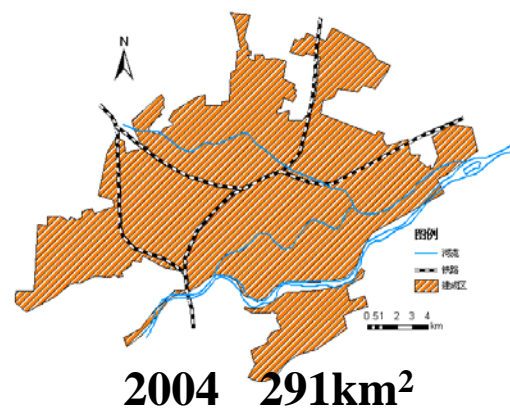
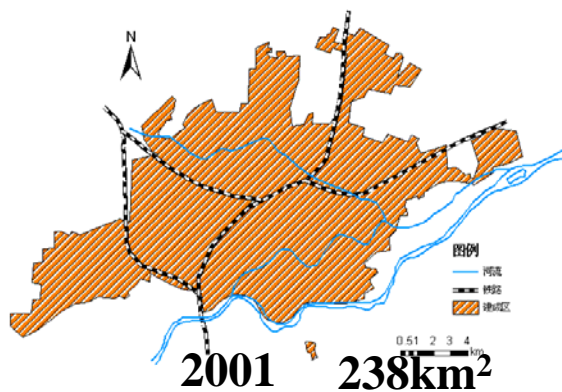
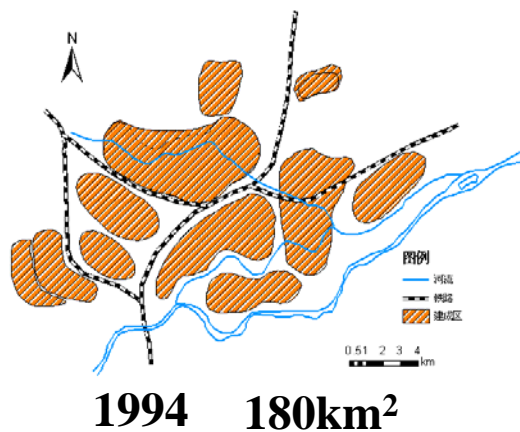
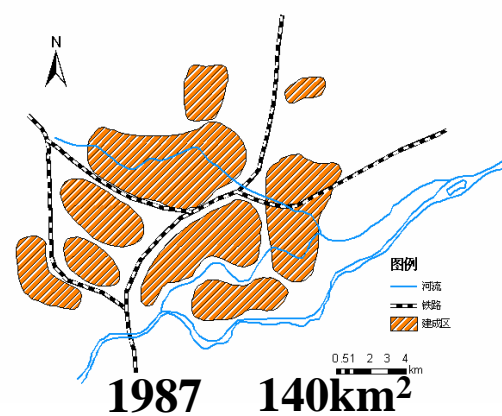
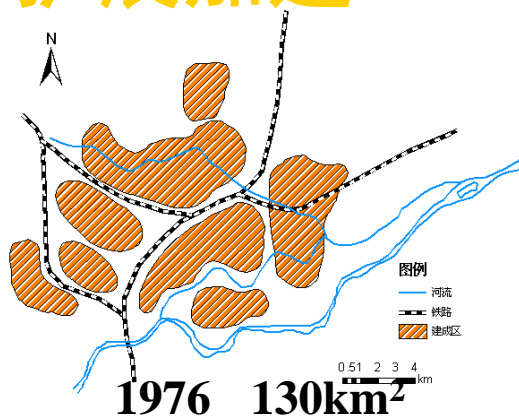
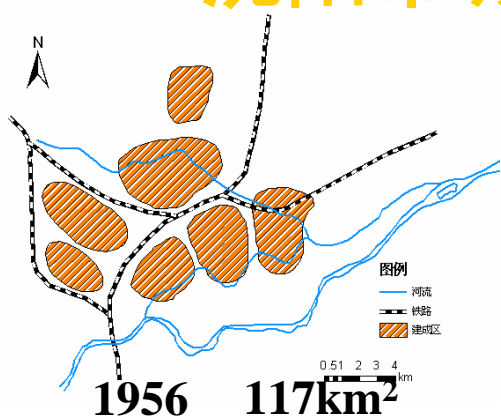




0 25 50 100 150 200  
Kilometers

# 辽宁中部城市群扩展

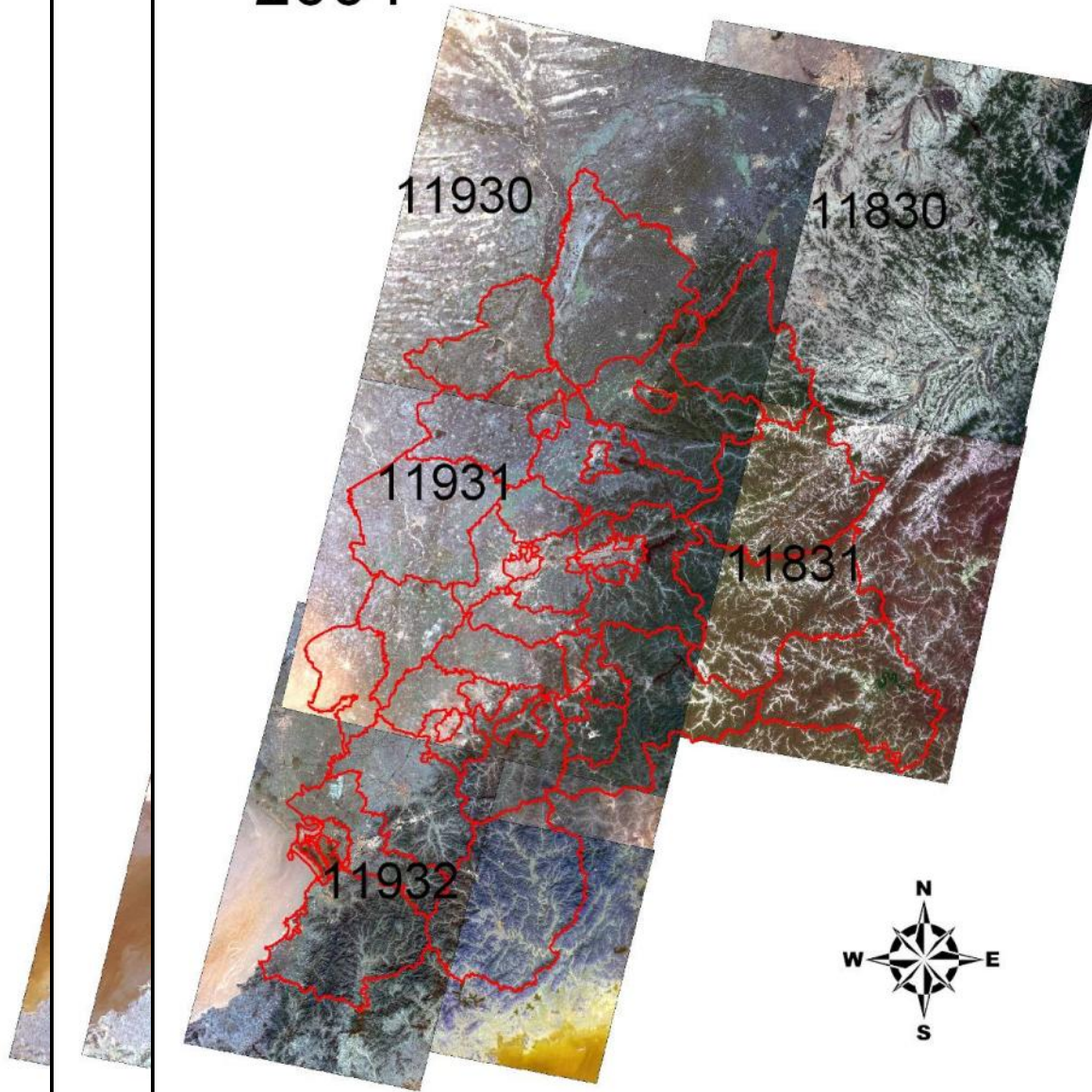
## 沈阳市城市扩展加速



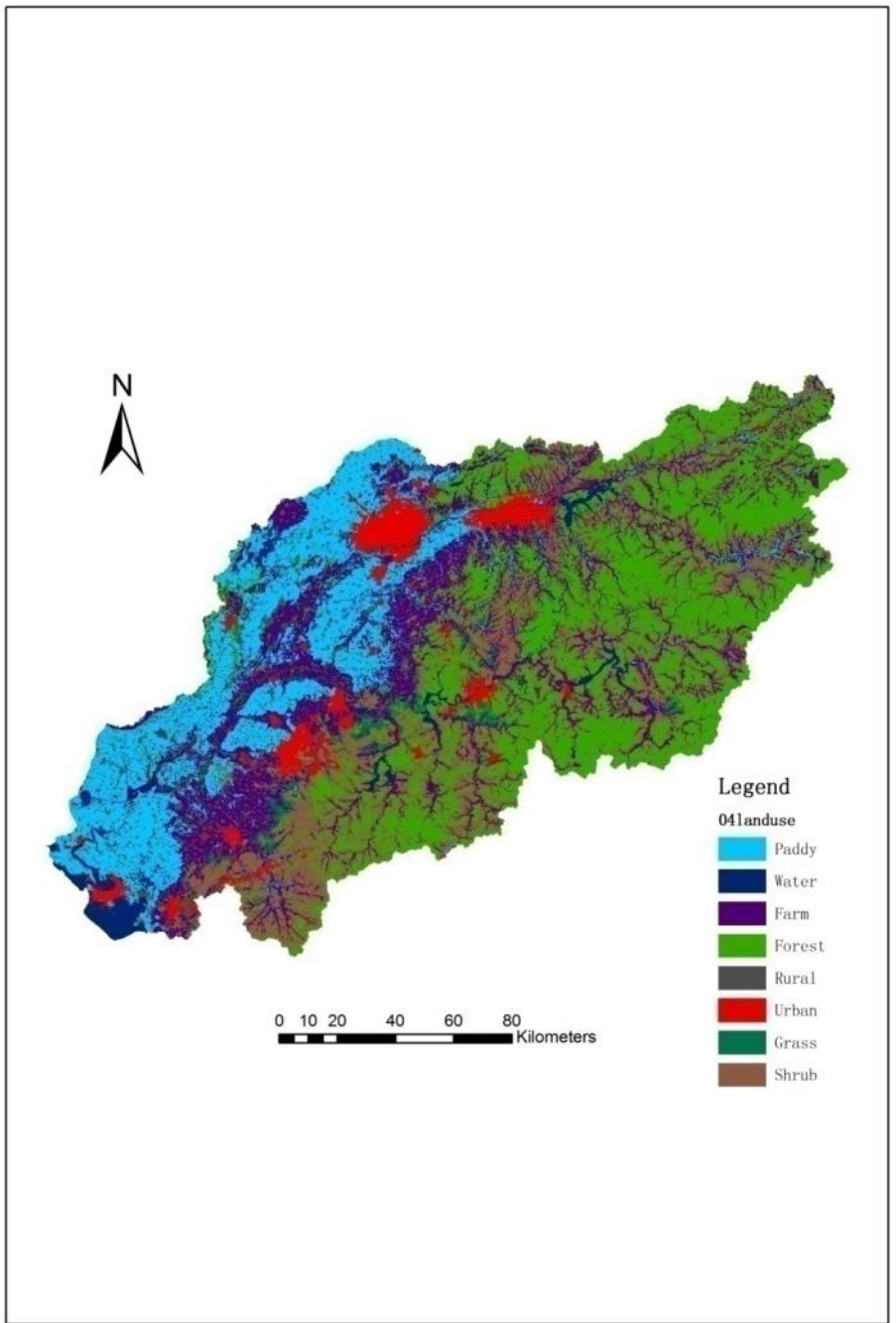
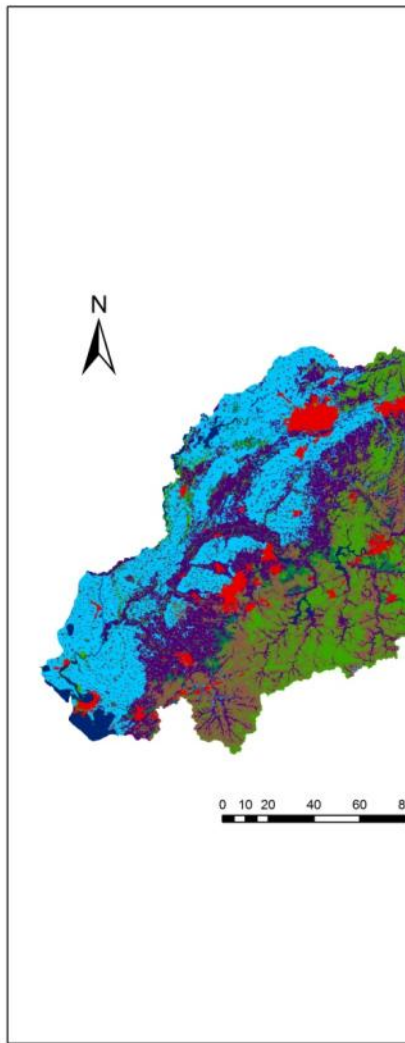
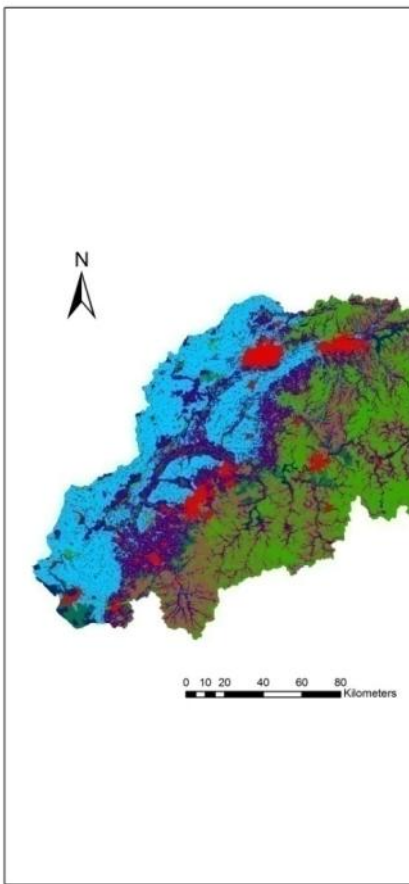
(李团胜, 1997; 李月辉, 2005)

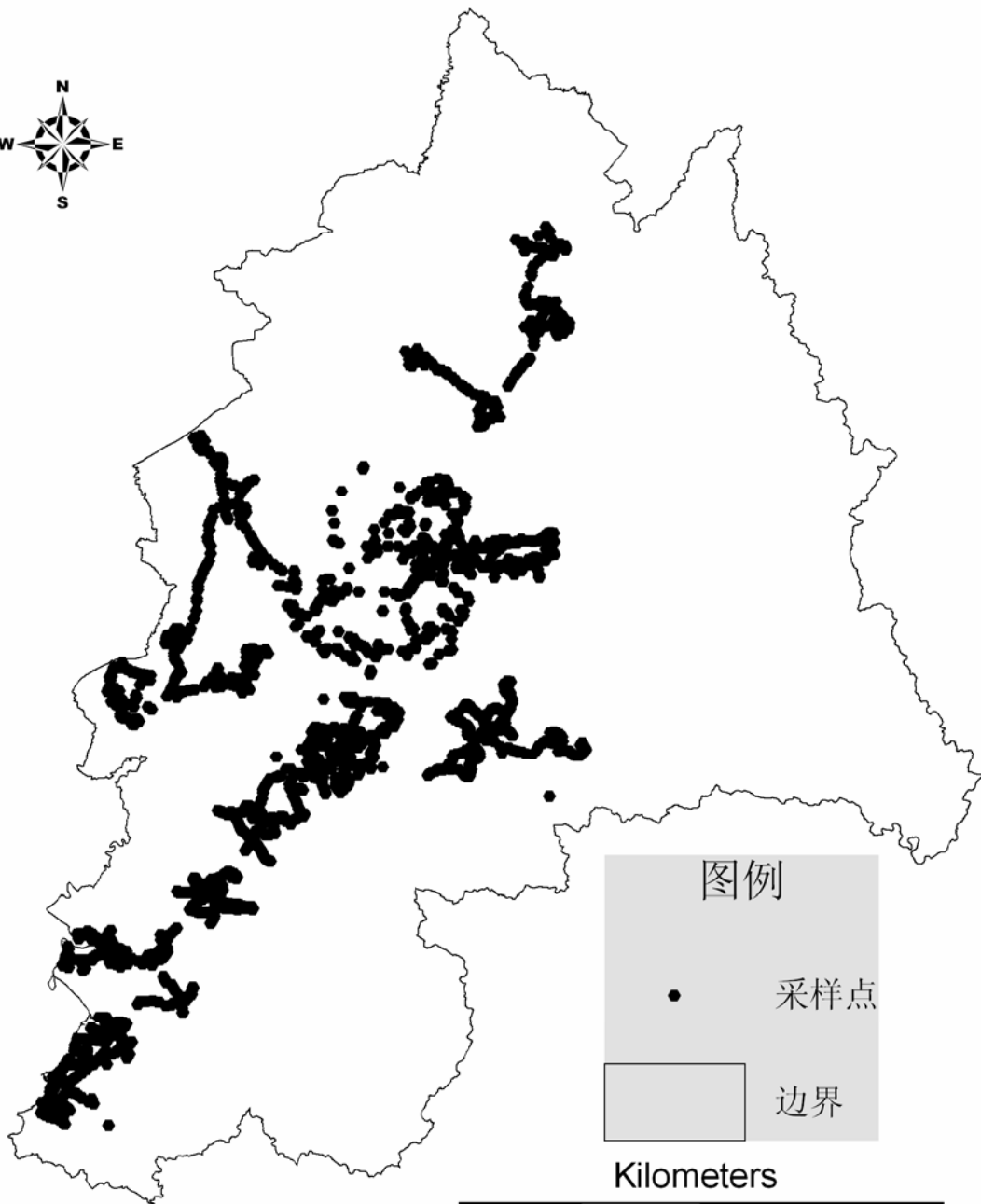


2004



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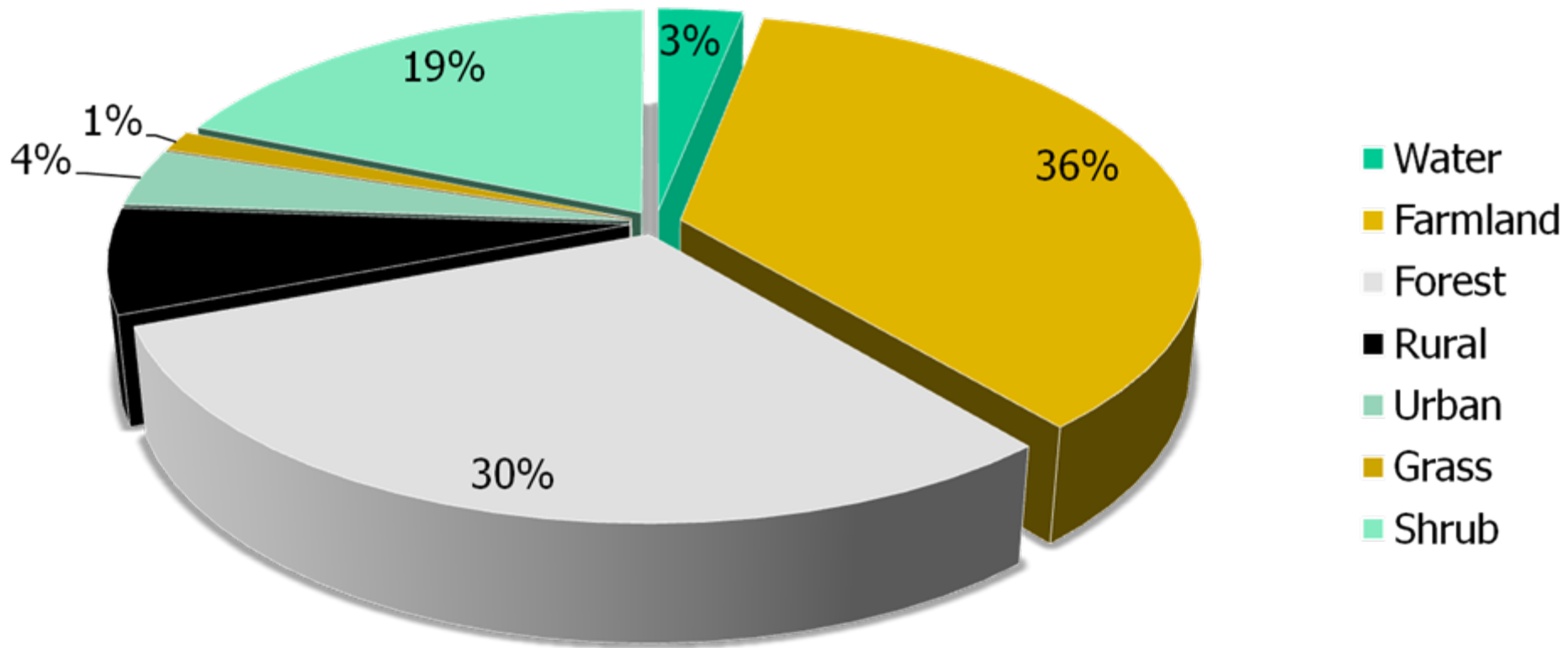


- GPS field survey point 2286

- Accuracy 92.2%, Kappa 91.7%

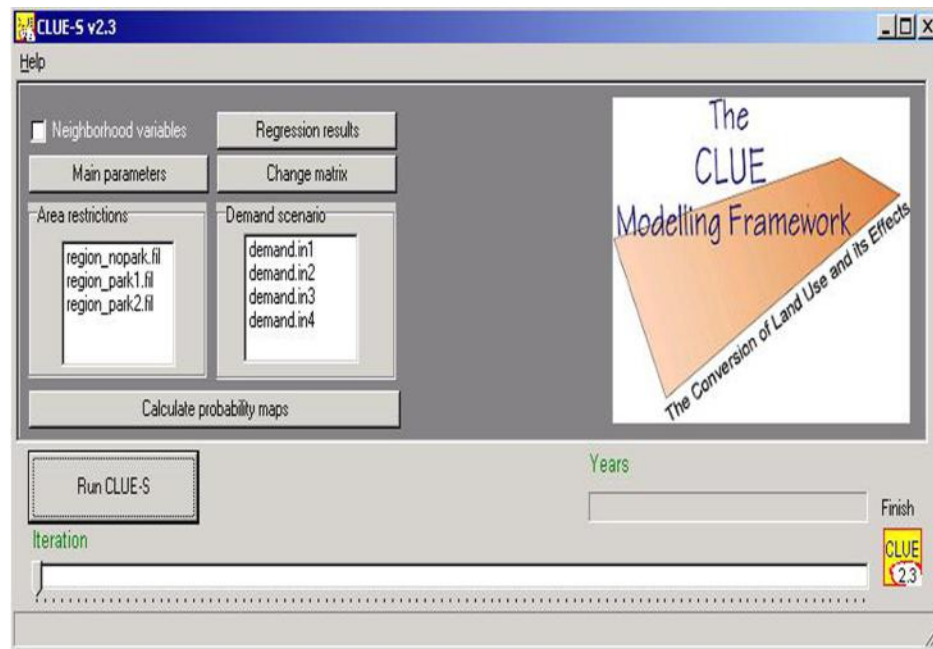
# Area percentage

2004



# 基于CLUE-S 土地利用变化模拟

- CLUE-S model
- 模拟时间段: 2004-2024
- 步长: 1 年
- 预案:
  - 历史预案: 基于历史趋势
  - 生态保护预案: 考虑“天然林保护工程”和“基本农田保护”
  - 城市规划预案: 参考辽宁省中部城市群发展规划







# 景观变化及驱动力分析

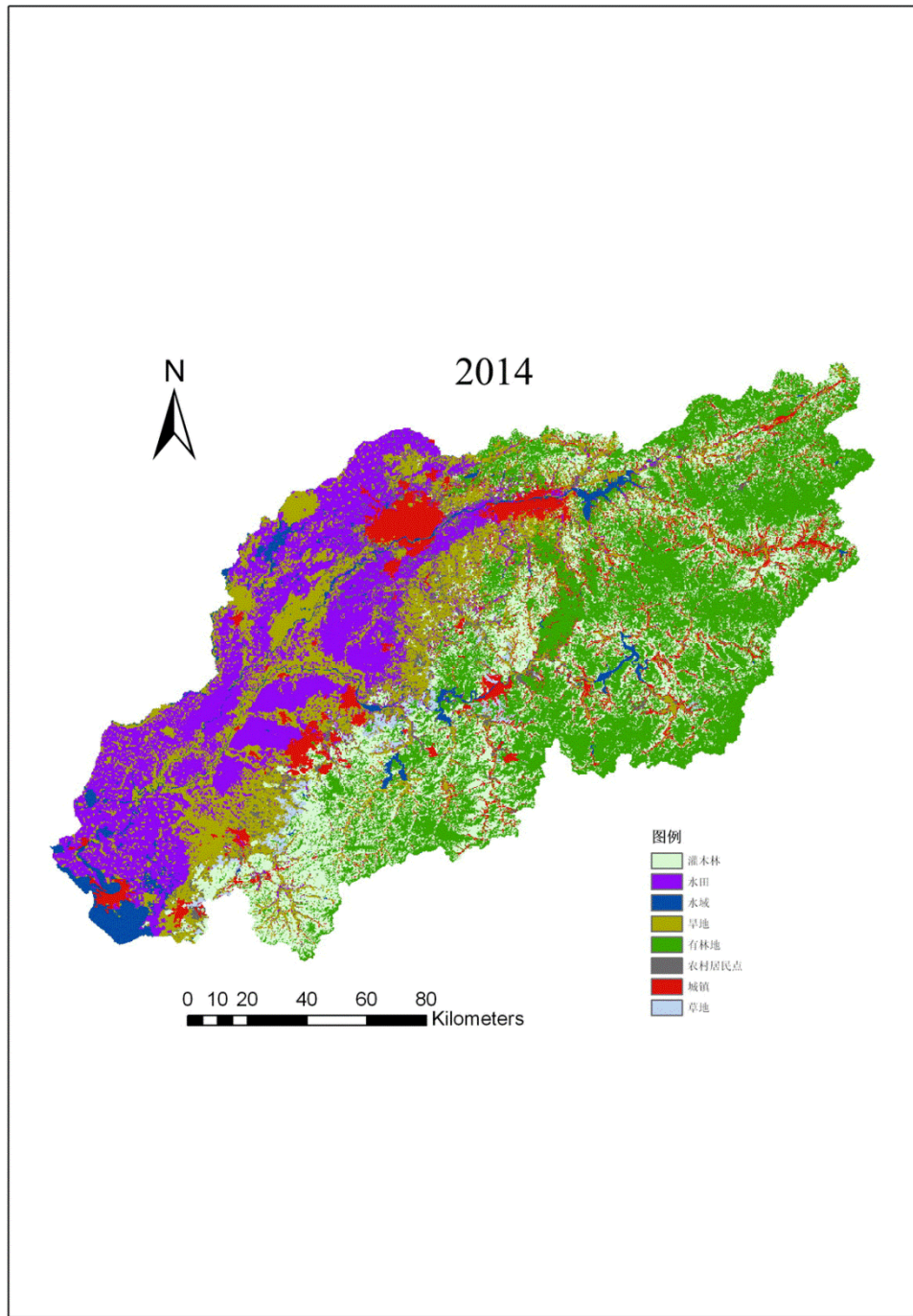
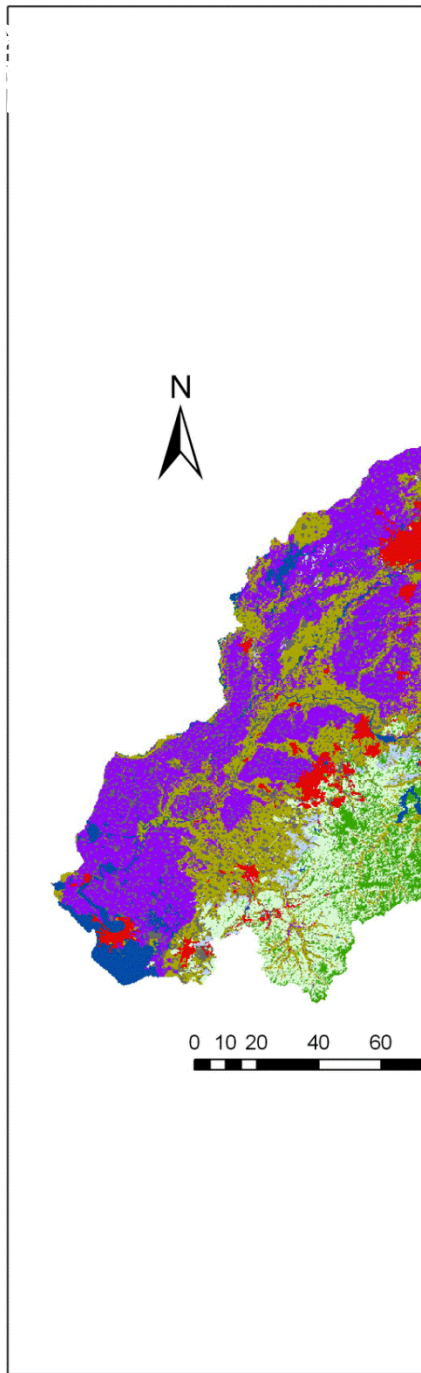
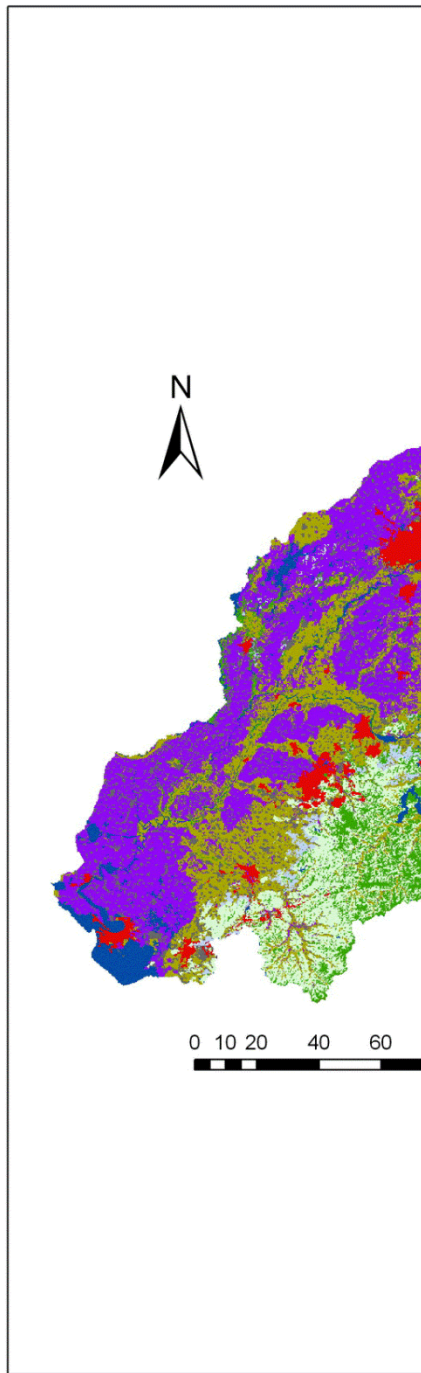
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## 景观转移矩阵分析法

分析结果作为景观变化的历史预案的基础

## 分析方法（Logistic回归）

选取地形、邻域（距离）、自然因子（气象，土壤）、社会经济因子（人口、农业人口等）等4类16中驱动因子进行Logistic回归分析，作为上述三种预案的基础。

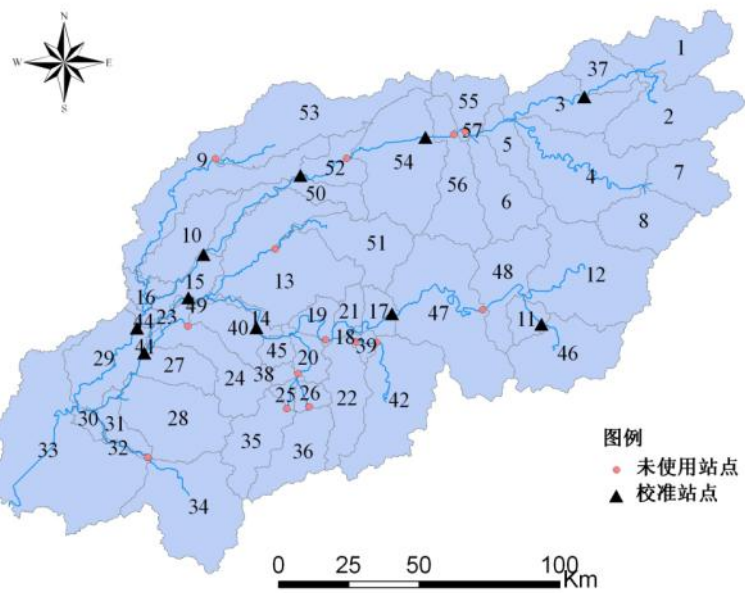
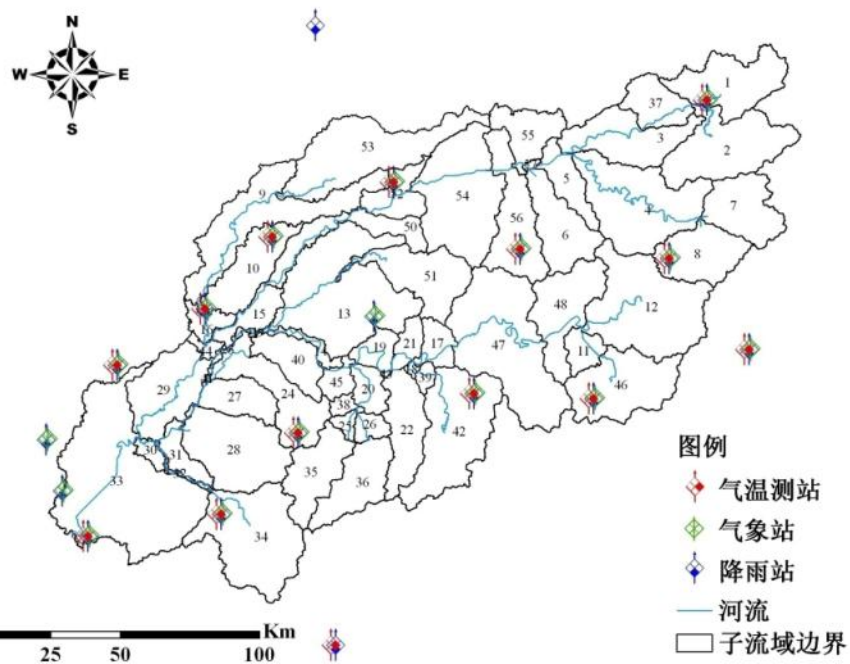
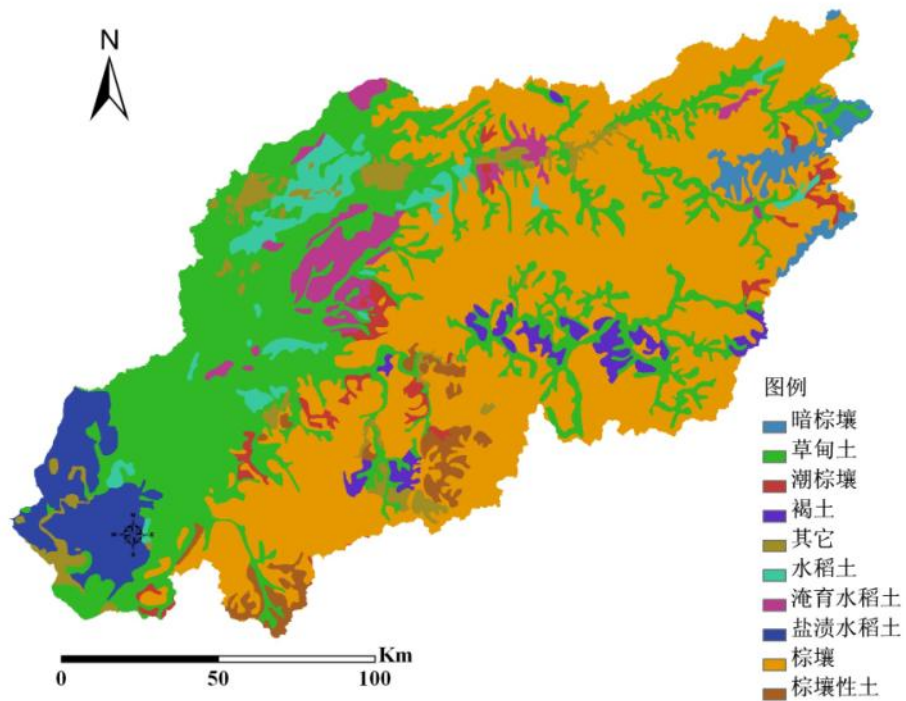
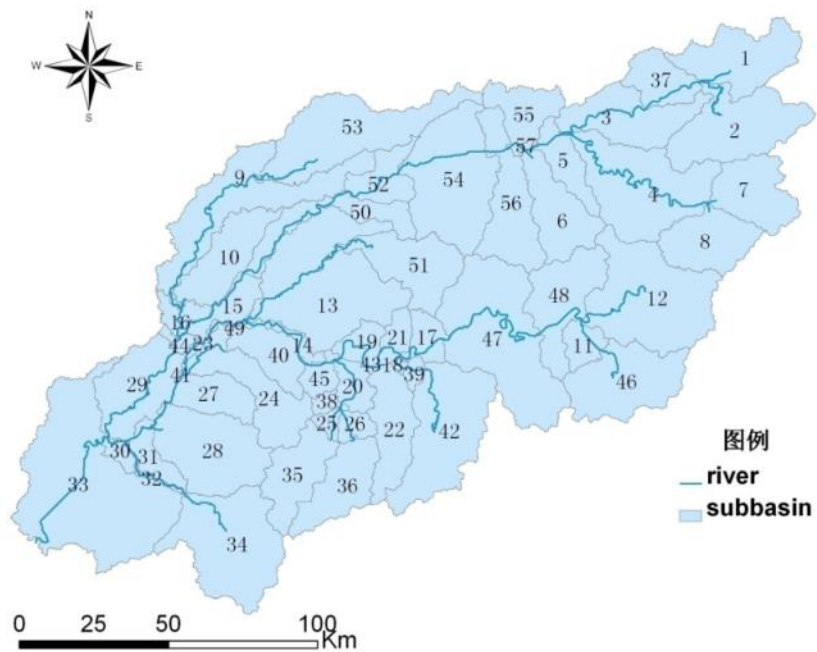


# 非点源污染模拟--AVSWAT2005

The screenshot displays the AVSWAT2005 software interface. The main window, titled "Watershed", shows a Digital Elevation Model (DEM) map of a watershed area, rendered in shades of orange and brown. A "Watershed Delineation" dialog box is open in the foreground, allowing for the configuration of watershed parameters. The dialog box includes the following sections:

- DEM Set Up:** Contains a "Dem grid" field with the path "d:\非点源污染\新建文件夹\temp1\moscc" and a "Properties" button. Below it are checkboxes for "Focusing watershed area option" and "Burn\_in option".
- Preprocessing of the Dem to remove sinks:** Includes an "Apply" button.
- Stream definition:** Features a "Threshold Area" field set to "0 [ha]", which corresponds to "Number of cells: 0". It also includes "Min:" and "Max:" fields and an "Apply" button.
- Outlet and inlet definition:** Includes a "Table:" field, "Add by table", "Inlet", and "Outlet" radio buttons, and "Add", "Remove", and "Redefine" buttons.
- Main watershed: outlet(s) selection and definition:** Includes "Whole Watershed outlet(s)" and "Calculation of subbasin parameters:" fields, along with "Select" and "Undo" buttons.
- Reservoirs:** Includes "Add" and "Remove" buttons.
- Bottom:** Displays "Current number of outlets/subbasins:" and "Help", "Minimize", and "Close" buttons.

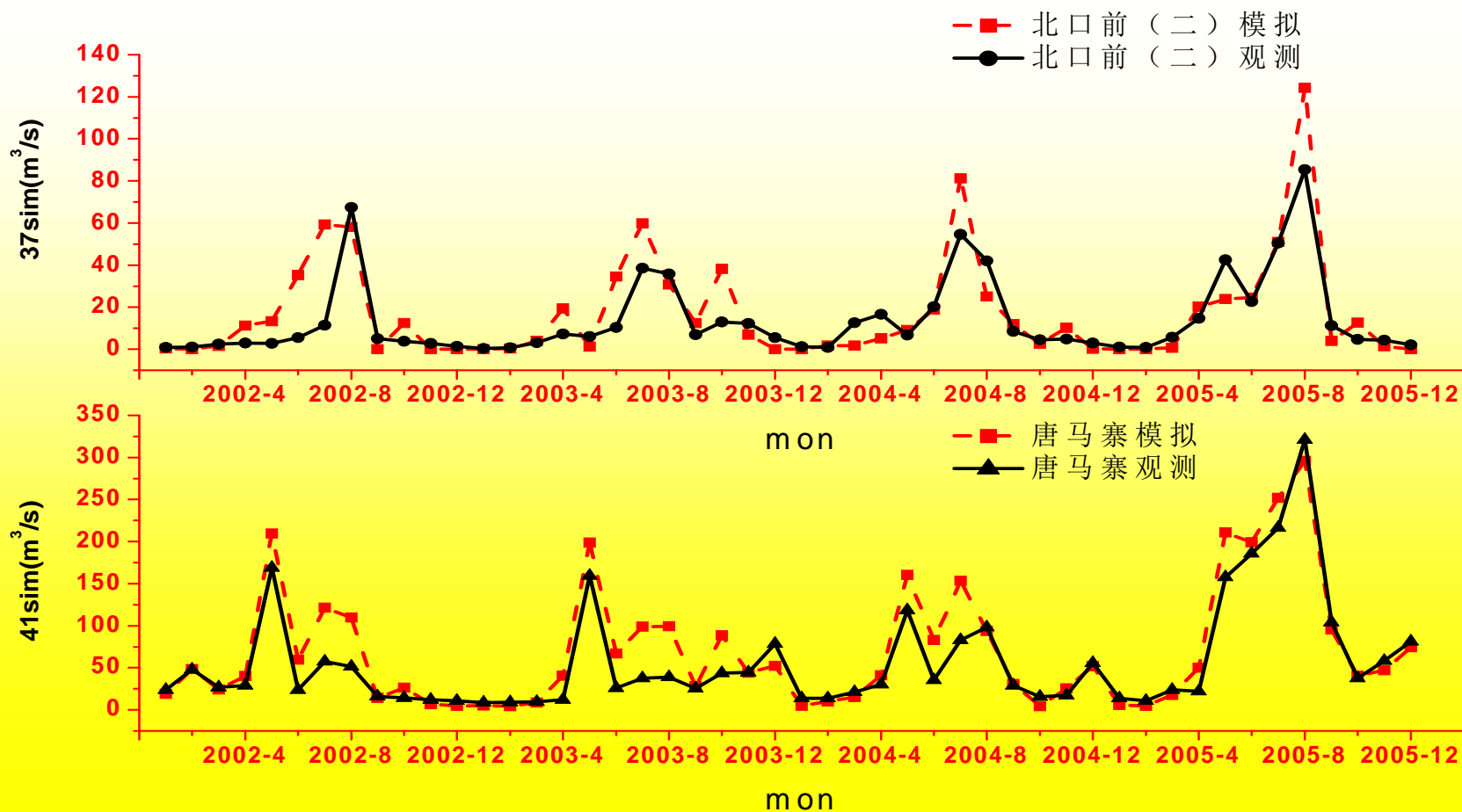
The software's status bar at the top right indicates a scale of 1:1,385,241 and coordinates 603,840.51 and 4,548,035.10. The left sidebar shows a legend for the DEM with various elevation ranges and their corresponding colors.





# 径流参数率定及验证结果

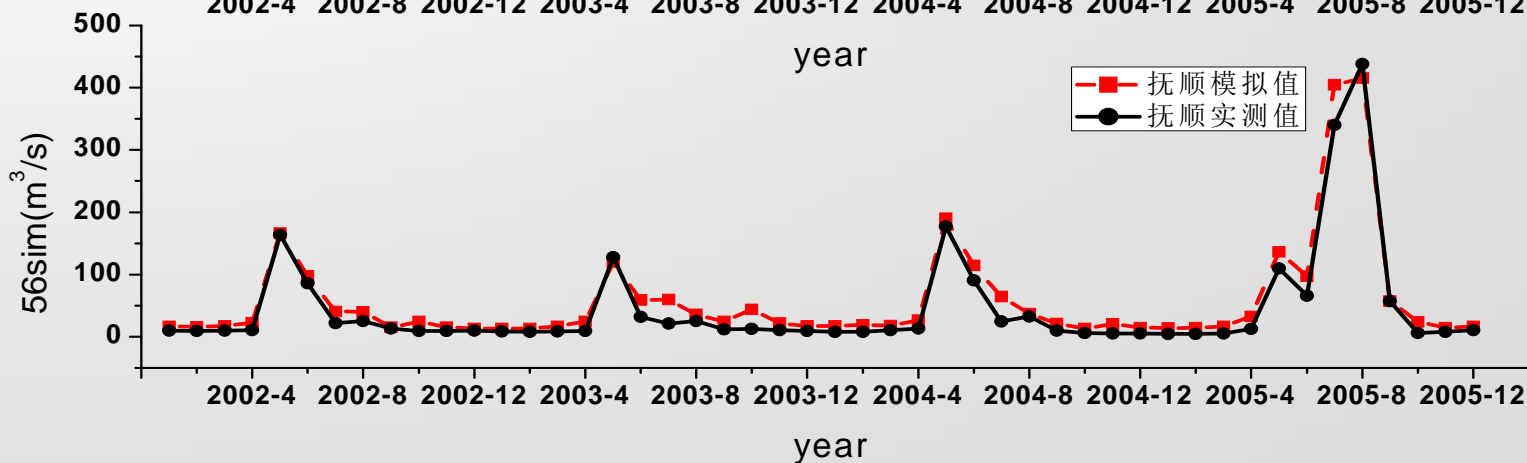
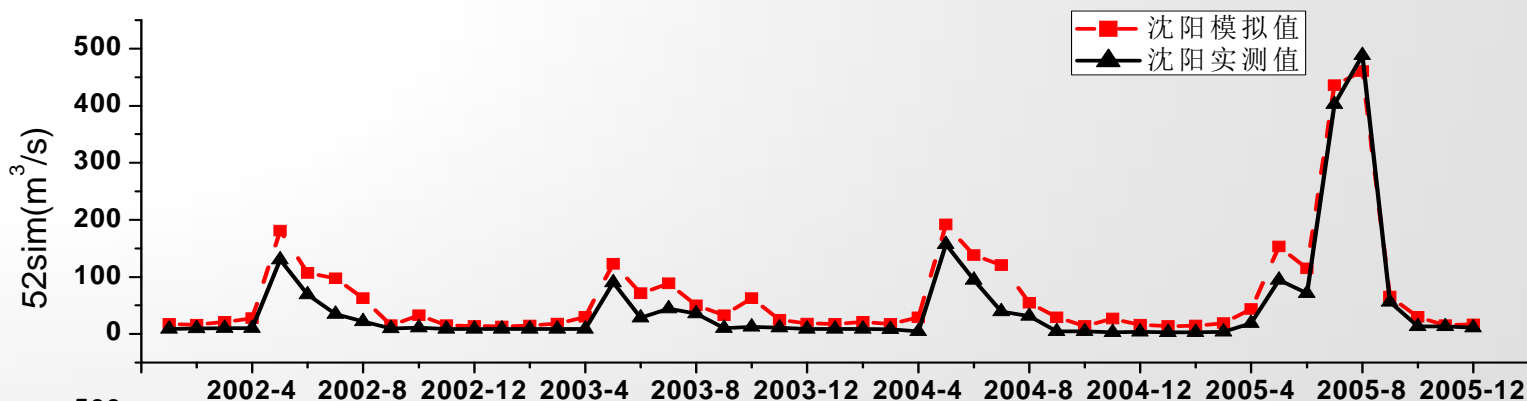
站点	模拟时期	$R^2$	$E_{NS}$
北口前	率定期 (2002-2003)	0.73	0.73
	验证期 (2004-2005)	0.75	0.71
唐马寨	率定期 (2002-2003)	0.87	0.79
	验证期 (2004-2005)	0.92	0.78





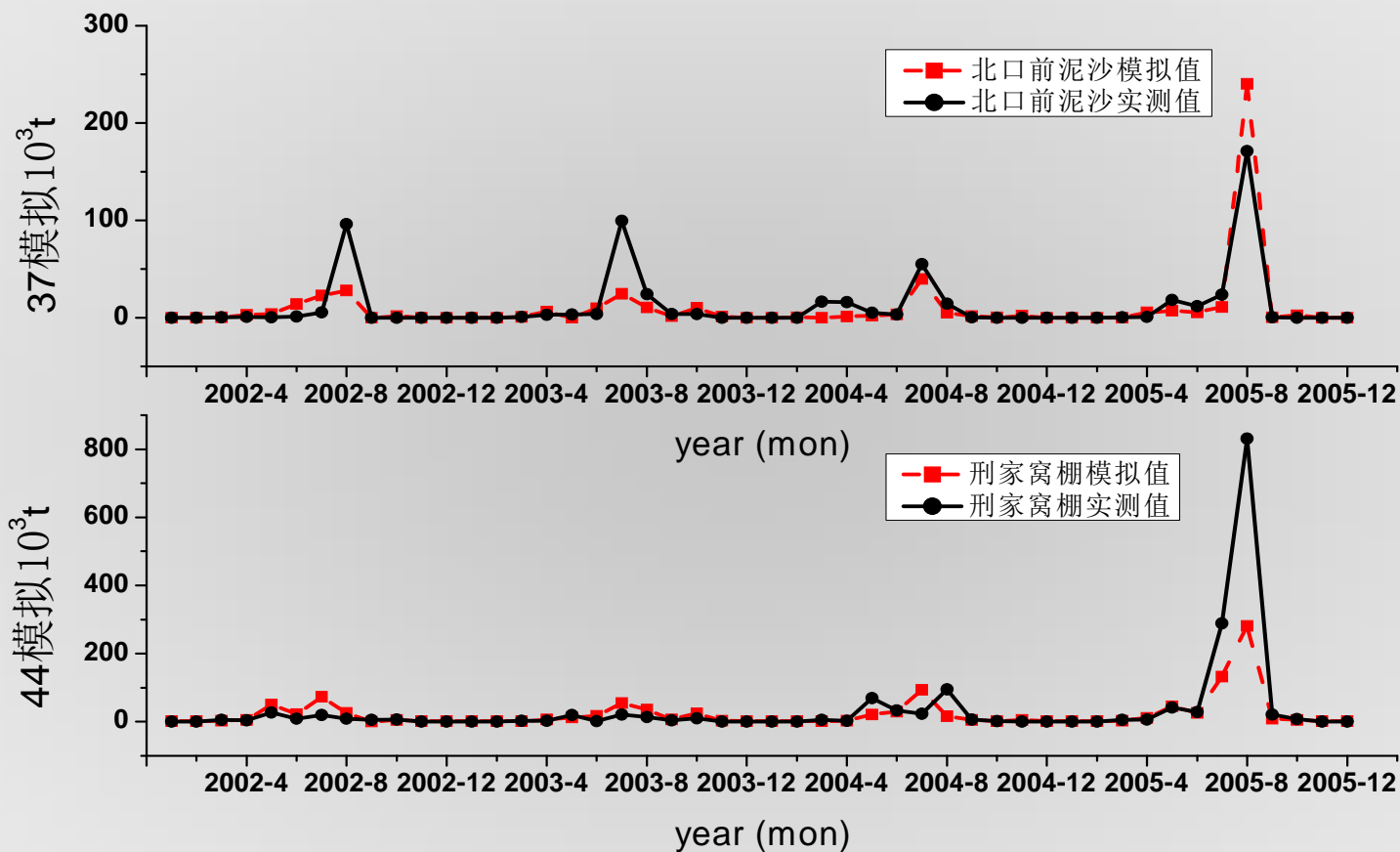
# 径流参数率定及验证结果

站点	模拟时期	$R^2$	$E_{NS}$
沈阳	率定期 (2002-2003)	0.96	0.90
	验证期 (2004-2005)	0.87	0.88
抚顺	率定期 (2002-2003)	0.98	0.95
	验证期 (2004-2005)	0.91	0.93

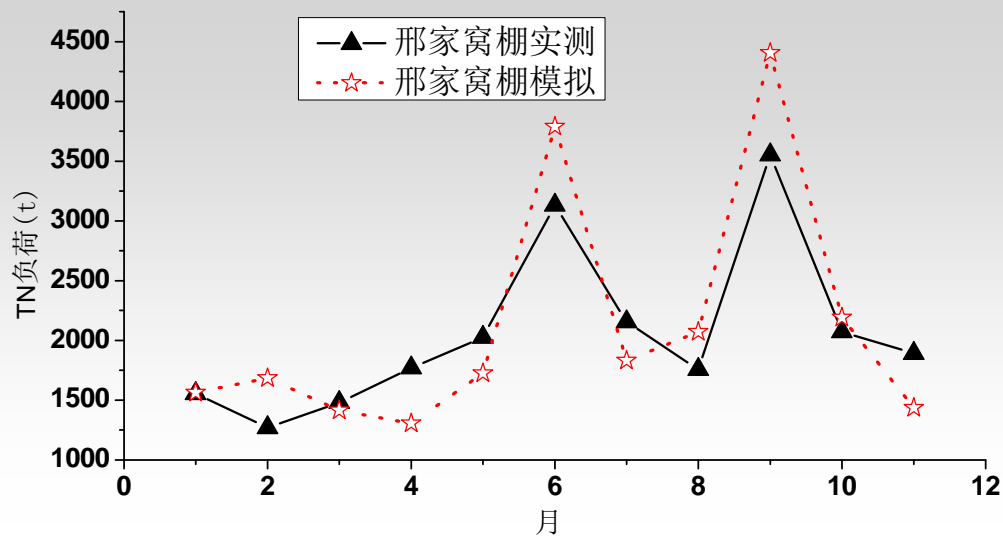


# 泥沙参数率定及验证结果

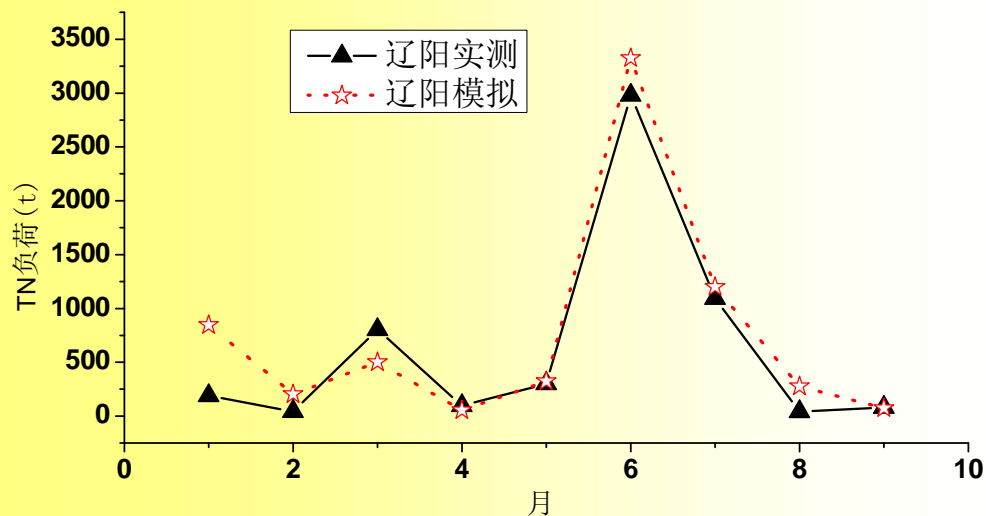
站点	模拟时期	$R^2$	$E_{NS}$
北口前	率定期 (2002-2003)	0.71	0.64
	验证期 (2004-2005)	0.69	0.65
邢家窝棚	率定期 (2002-2003)	0.84	0.53
	验证期 (2004-2005)	0.79	0.58



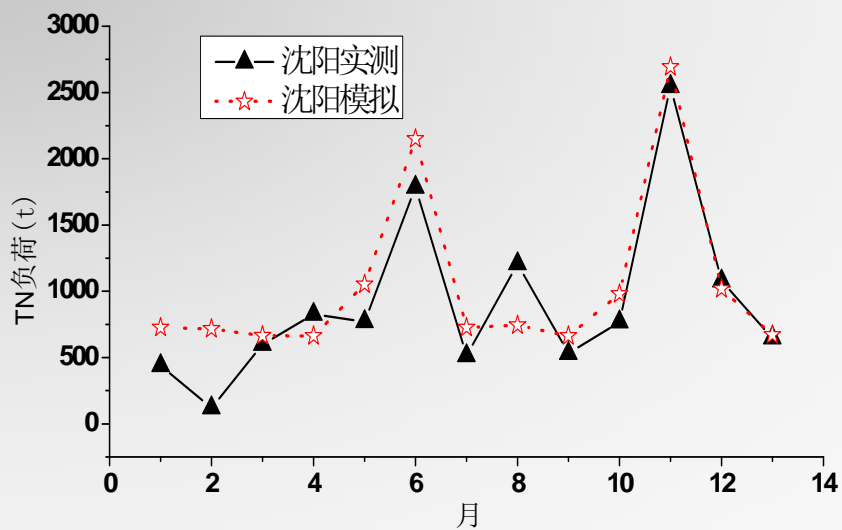
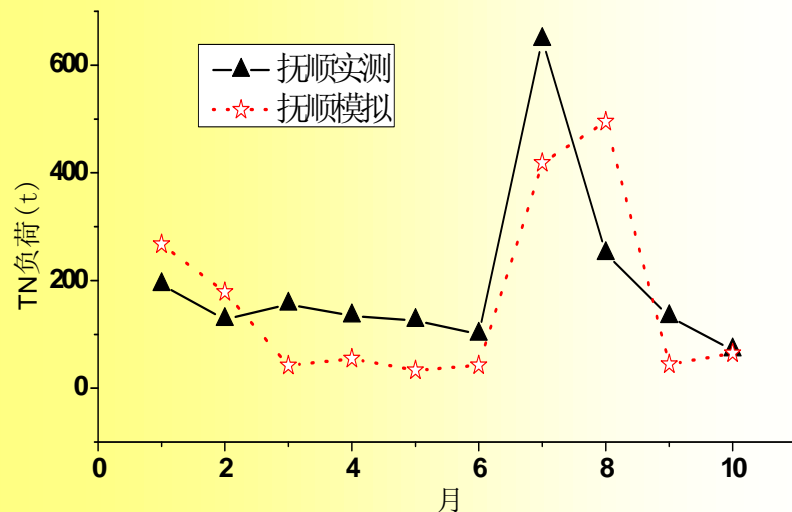
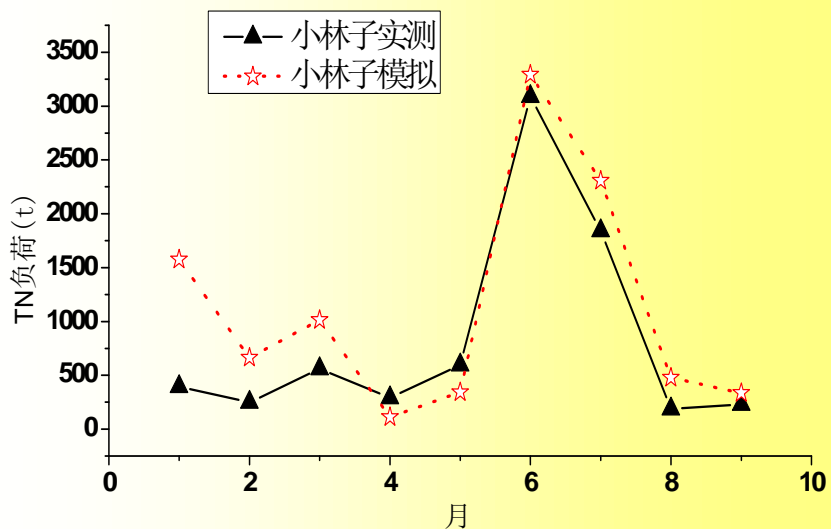
# TN参数率定及验证结果



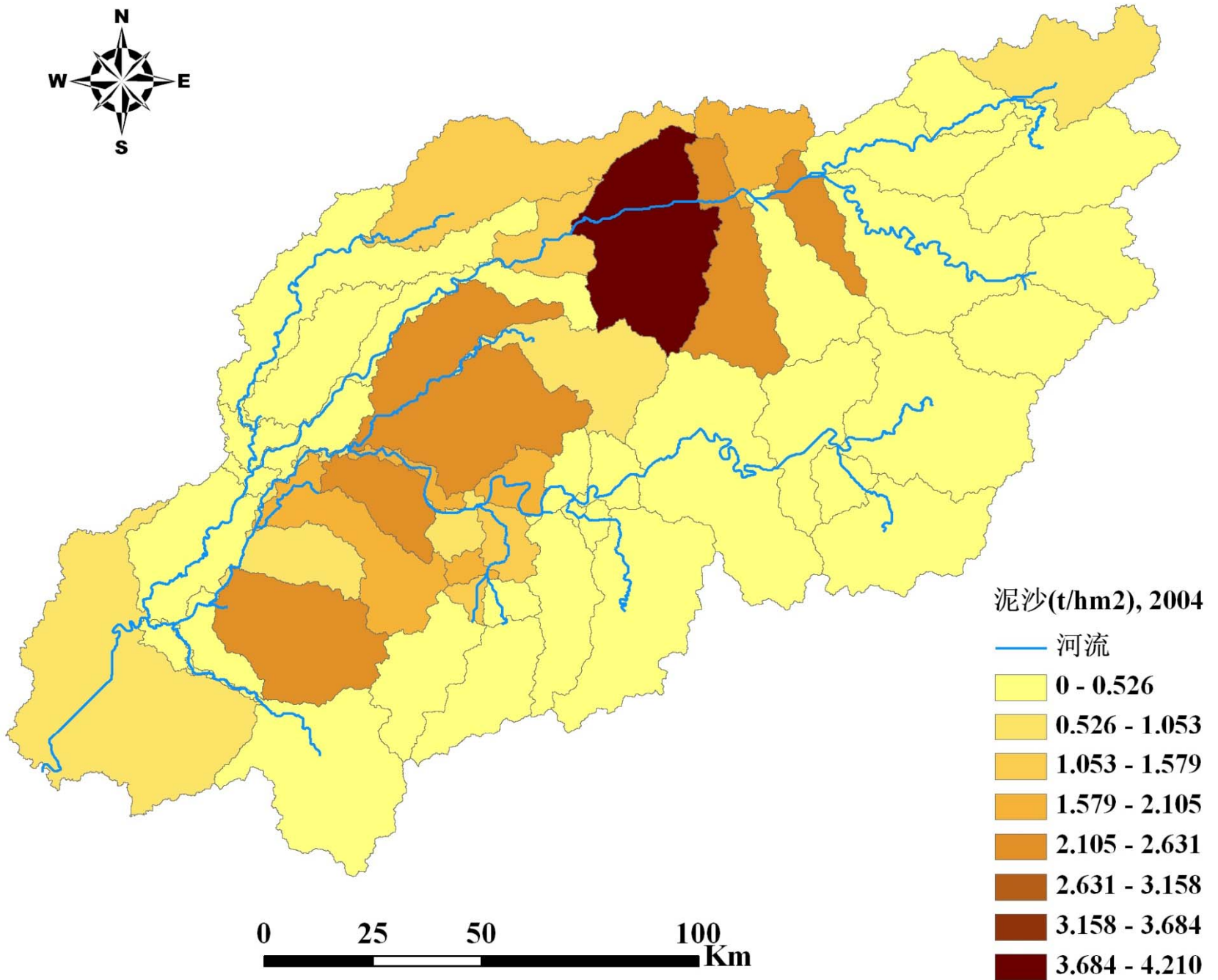
站点	模拟时期	TN	
		$R^2$	$E_{NS}$
邢家窝棚	率定期	0.87	0.57
	验证期	0.79	0.52
辽阳	率定期	0.93	0.90
	验证期	0.91	0.87



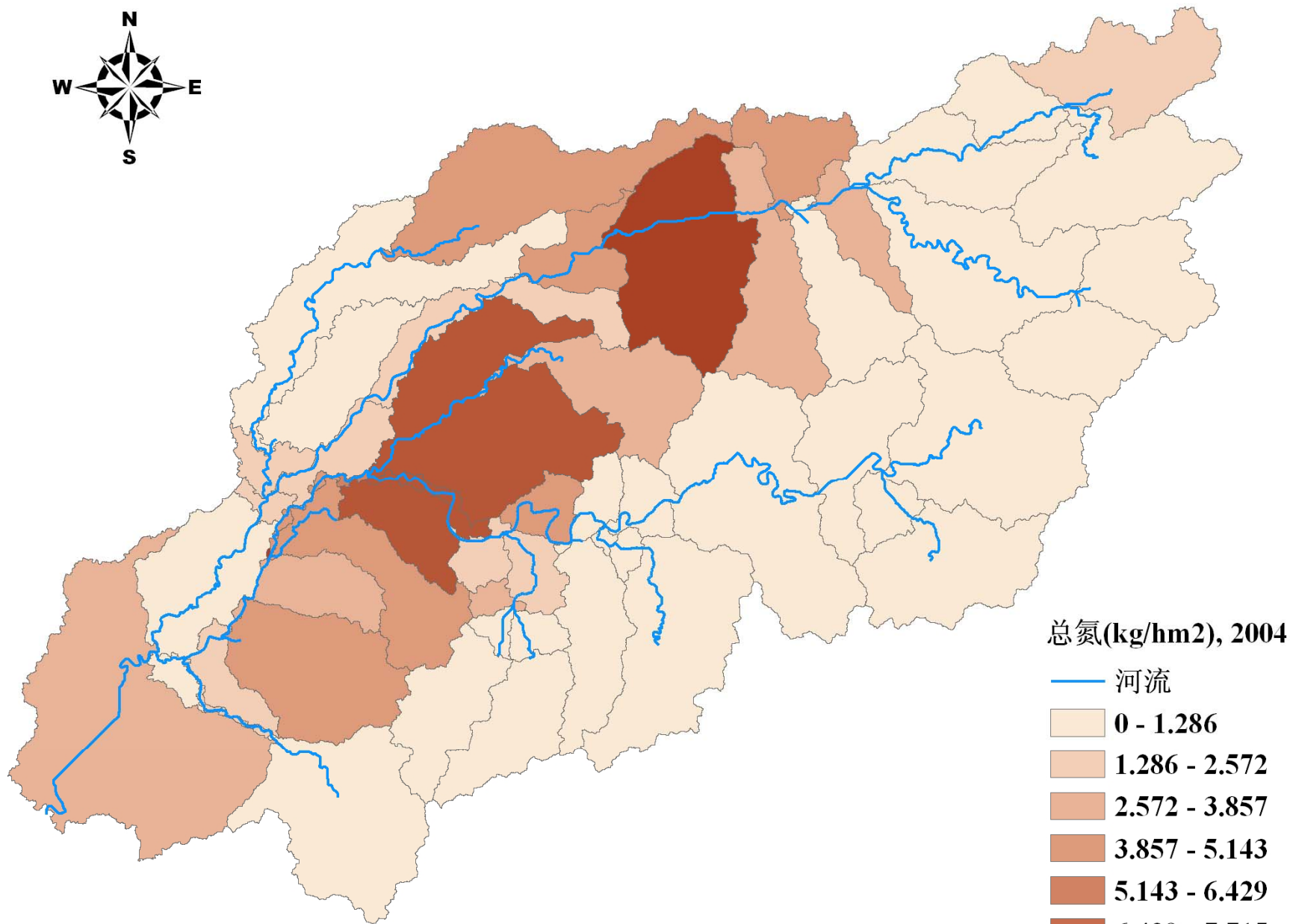
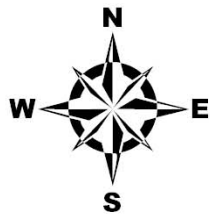
# TP参数率定及验证结果



站点	模拟时期	TP	
		$R^2$	$E_{NS}$
小林子	率定期	0.85	0.72
	验证期	0.86	0.69
沈阳	率定期	0.84	0.79
	验证期	0.72	0.59
抚顺	率定期	0.50	0.42
	验证期	0.54	0.46







总氮(kg/hm<sup>2</sup>), 2004

— 河流

0 - 1.286

1.286 - 2.572

2.572 - 3.857

3.857 - 5.143

5.143 - 6.429

6.429 - 7.715

7.715 - 9.000

9.000 - 10.286

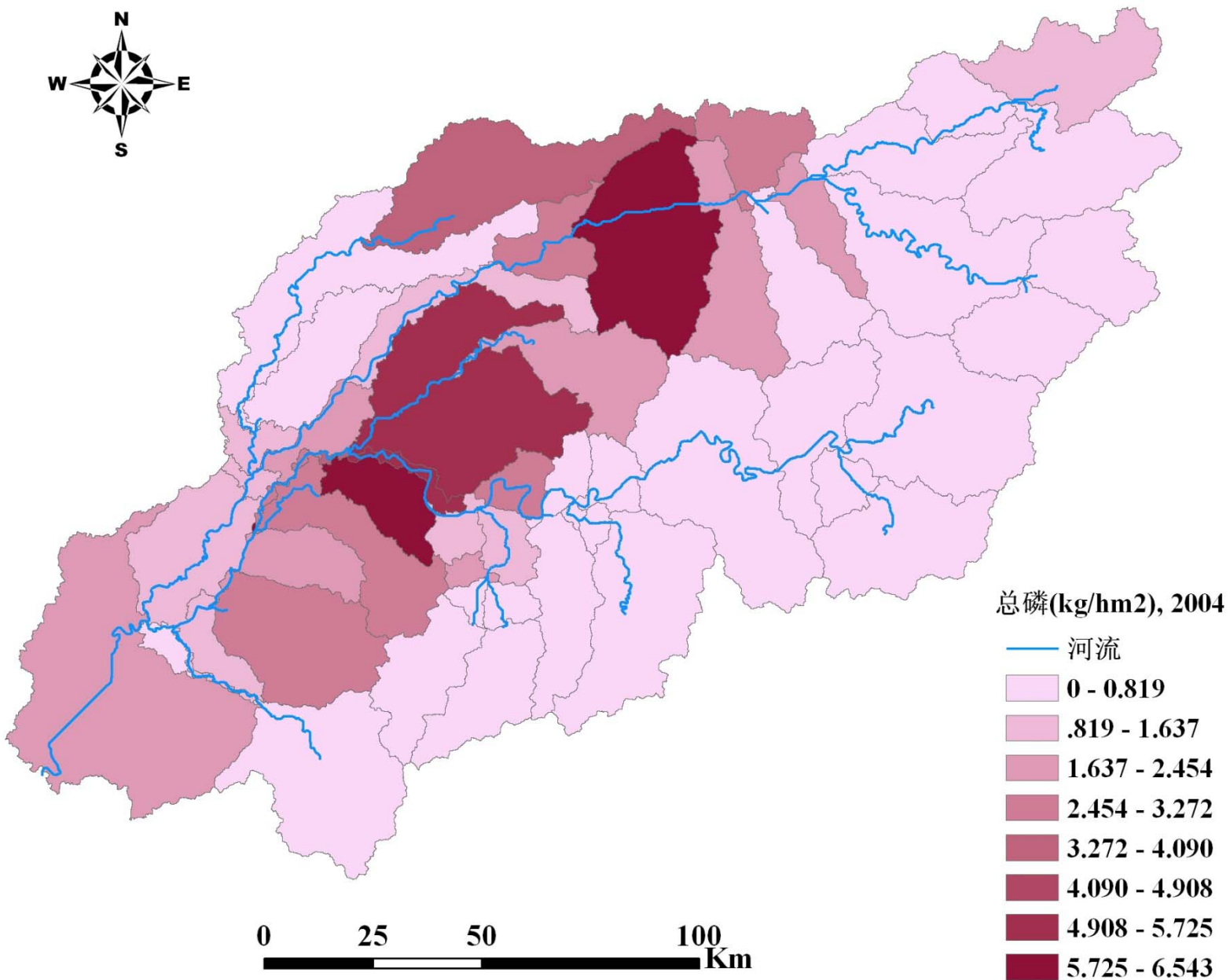
0

25

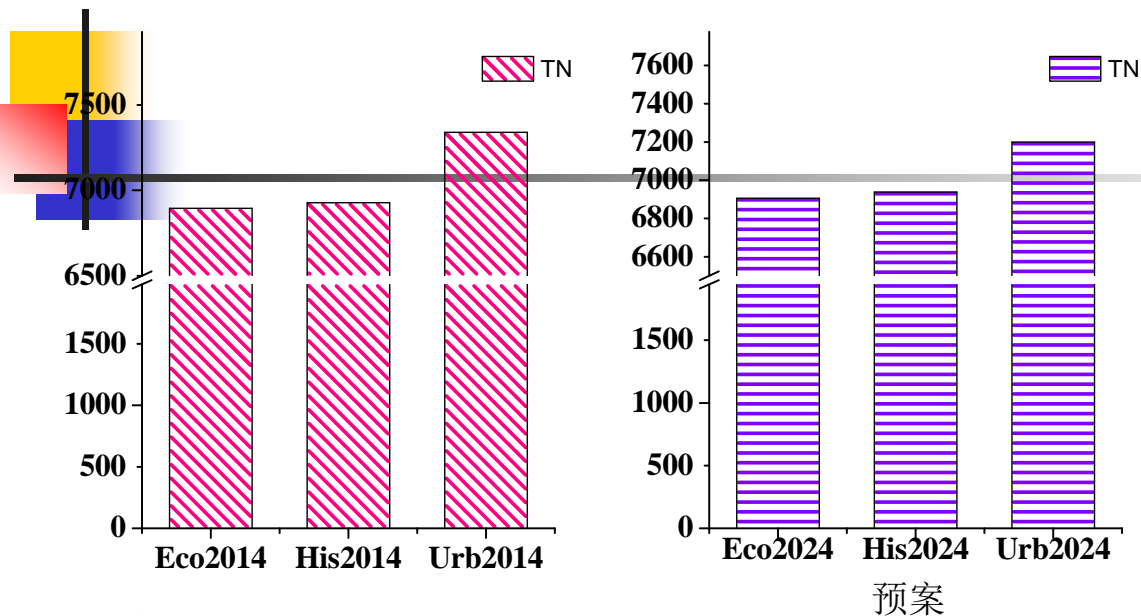
50

100

Km

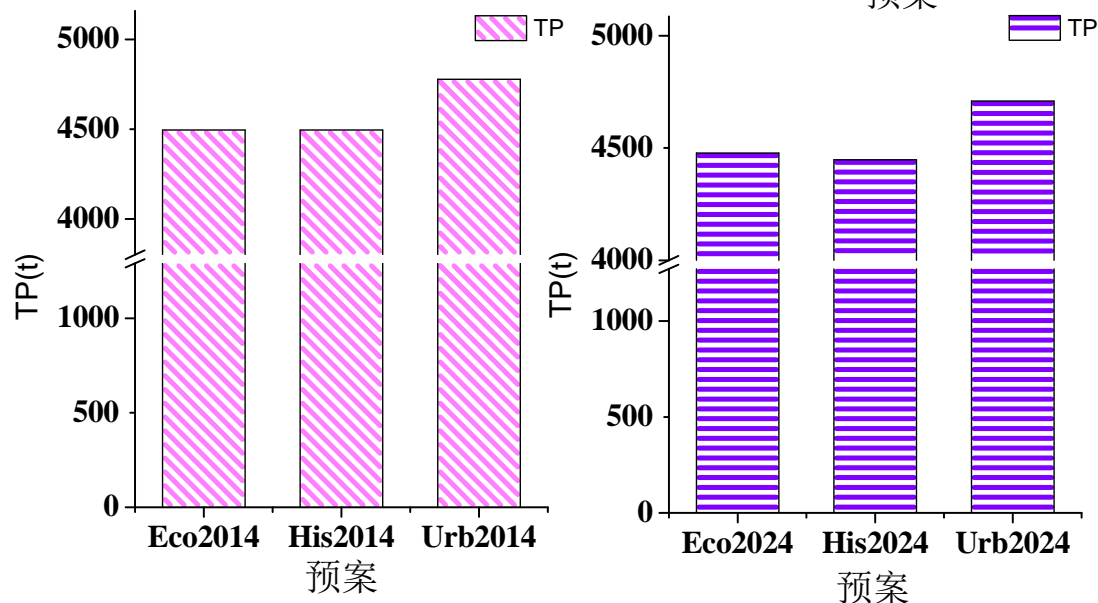


# 不同预案景观变化对非点源污染负荷的影响



2014年不同预案的排序为  
urb2014>his2014>eco  
2014,

2024年不同的预案排  
序为:  
urb2024>his2024>eco  
2024。



TP负荷2014年不同的  
预案排序为urb2014>  
his2014>eco2014,  
2024年不同的预案排  
序为:  
urb2024>his2024>  
eco2024。



# 结论

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- 非点源污染负荷贡献率从大到小的排序依次为旱地、水田、城镇及农村、林地、灌木地。
- 研究区内三种不同预案下，非点源污染负荷都有增加的趋势。生态预案下非点源污染负荷增加的程度是最低。表明“天然林保护工程”会降低非点源污染负荷增加的幅度。而城市扩张，会导致流域非点源污染的增加。



# 下一步工作

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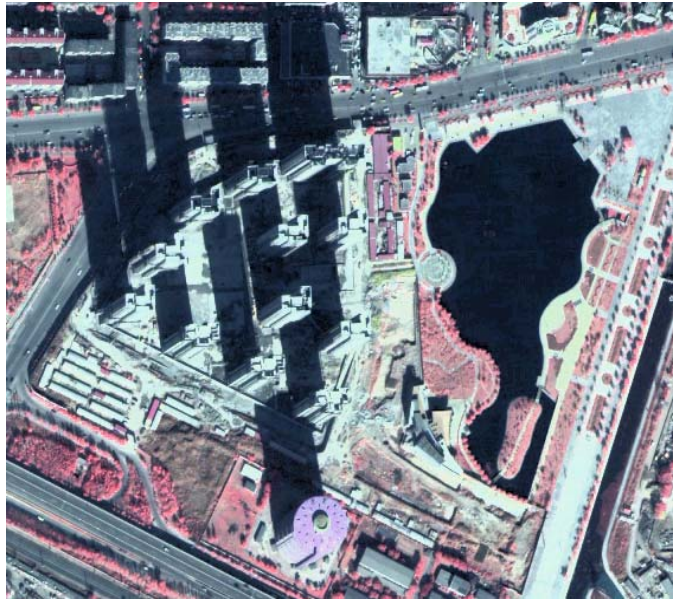
- 景观格局与非点源污染关系探讨
- 基于格局优化的经济的非点源控制方式
- 城市三维变化及环境效应



2002



2008



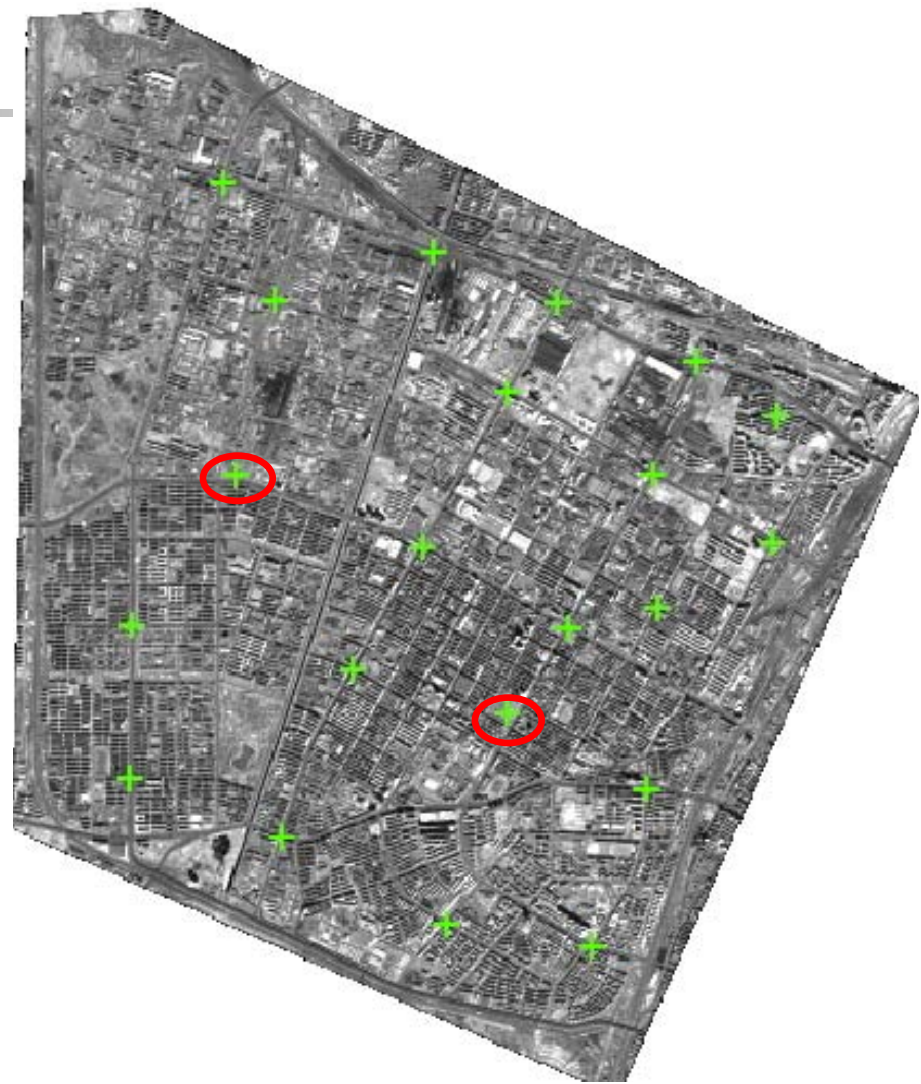


# 1、城市3D信息的提取

■ 数据：1997年沈阳市航片

(RMS为0.56像元，Arcgis中  
提取)，2002、2005、2008  
年铁西区Quickbird影像；  
RPB参数；1:1万DEM；21个  
实测GCPs。

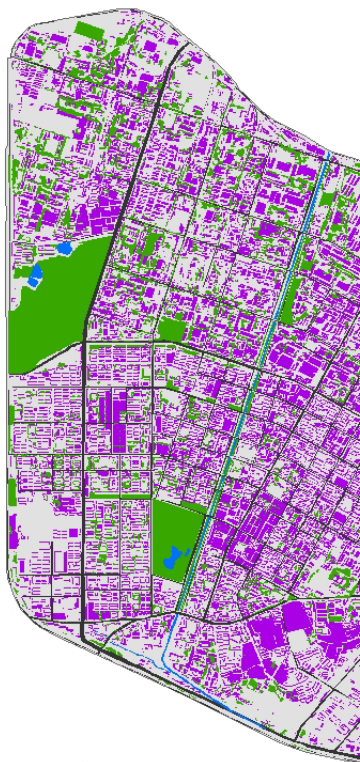
- 工具：Barista
- 方法：目视解译



# 2、城市景观变化的总体特征

## 1) 景观类型分类

(1990)



(2000)



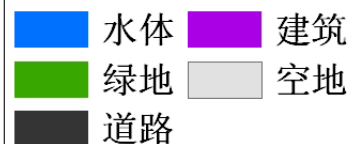
(2005)



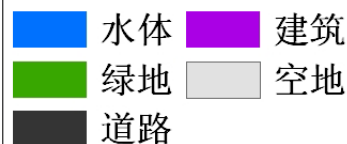
(2008)



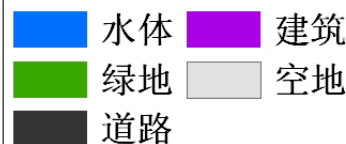
Legend



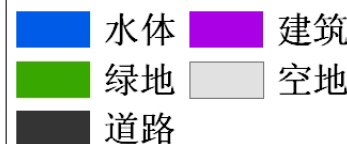
Legend



Legend



Legend



0 5001,000 2,000 Meters

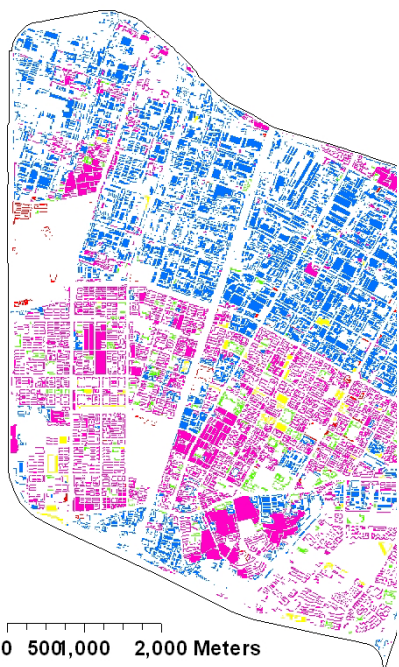


# 3.2、建筑类型的变化特征

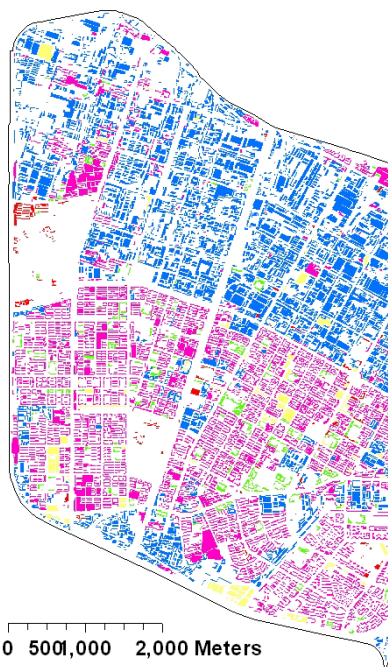
## 1) 不同使用类型建筑的变化

① 分类结果 (分类精度为86.3%)

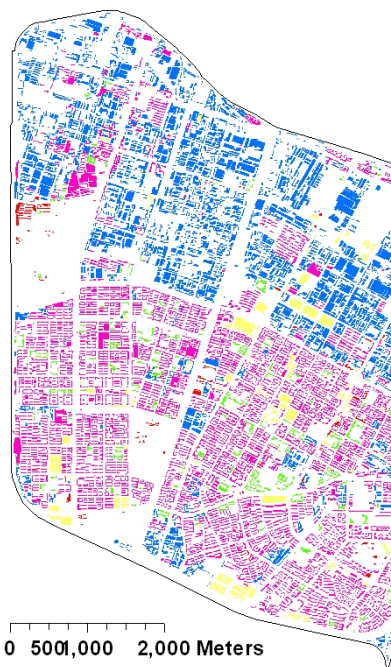
(1997)



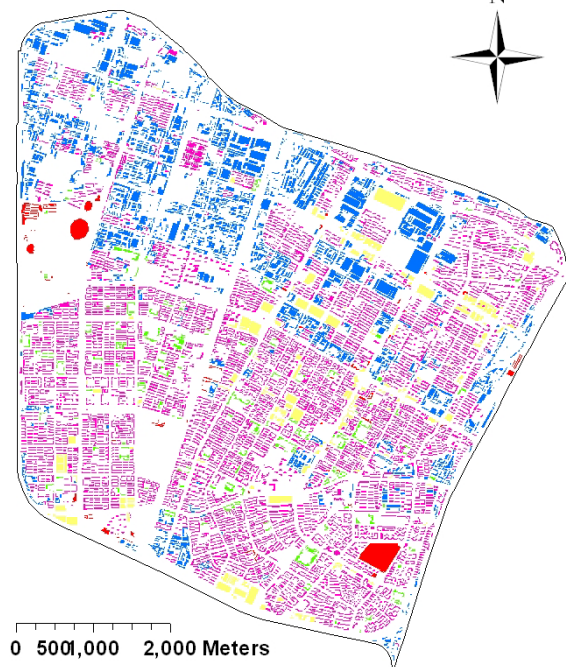
(2002)



(2005)



(2008)



Legend

居住建筑 商业建筑  
工业建筑 教育与医疗建筑

Legend

居住建筑 商业建筑  
工业建筑 教育与医疗建筑

Legend

居住建筑 商业建筑  
工业建筑 教育与医疗建筑

Legend

居住建筑 商业建筑 其它  
工业建筑 教育与医疗建筑 铁西区范围



# 三维变化环境效应

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- 水
- 气
- 重金属

An aerial photograph of a wide, braided river delta. The river channels are filled with brown, silty water and are separated by dark, rocky bars. The surrounding landscape is a mix of green grass and light-colored sediment. In the background, there are rugged, rocky mountains under a clear blue sky. A large, bold red text '谢谢!' is superimposed over the center of the image.

谢谢!