



International Forum in Taipei

Global Climatic Change and Eco-vulnerability Assessment on Estuary City: -- A Case of Shanghai

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Outline

1. Background: on global climatic change
 2. Objectives of Research
 3. Methodology
 4. Achievements & Countermeasures
- A Case of Shanghai



1. Background: on global climatic change

1.1 Some Highlights on Climatic Change

Climatic change is a key word of international politics and research hot in recent years:

- IPCC issued the fourth assessment report in 2007
- 2007's Nobel Peace Prize awarded for IPCC & Al' Gore
- Temperature increases continuously in 57 years in China
- China's National Development and Reform Committee issued that "State Strategies for climatic change" in June 2007, which was the first politic document for climatic change adaptation
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High impact of climatic change on the earth



The coastal areas in lower altitudes threatened by being drowned



Environmental Pollution

Flooding & Sea Level Rising

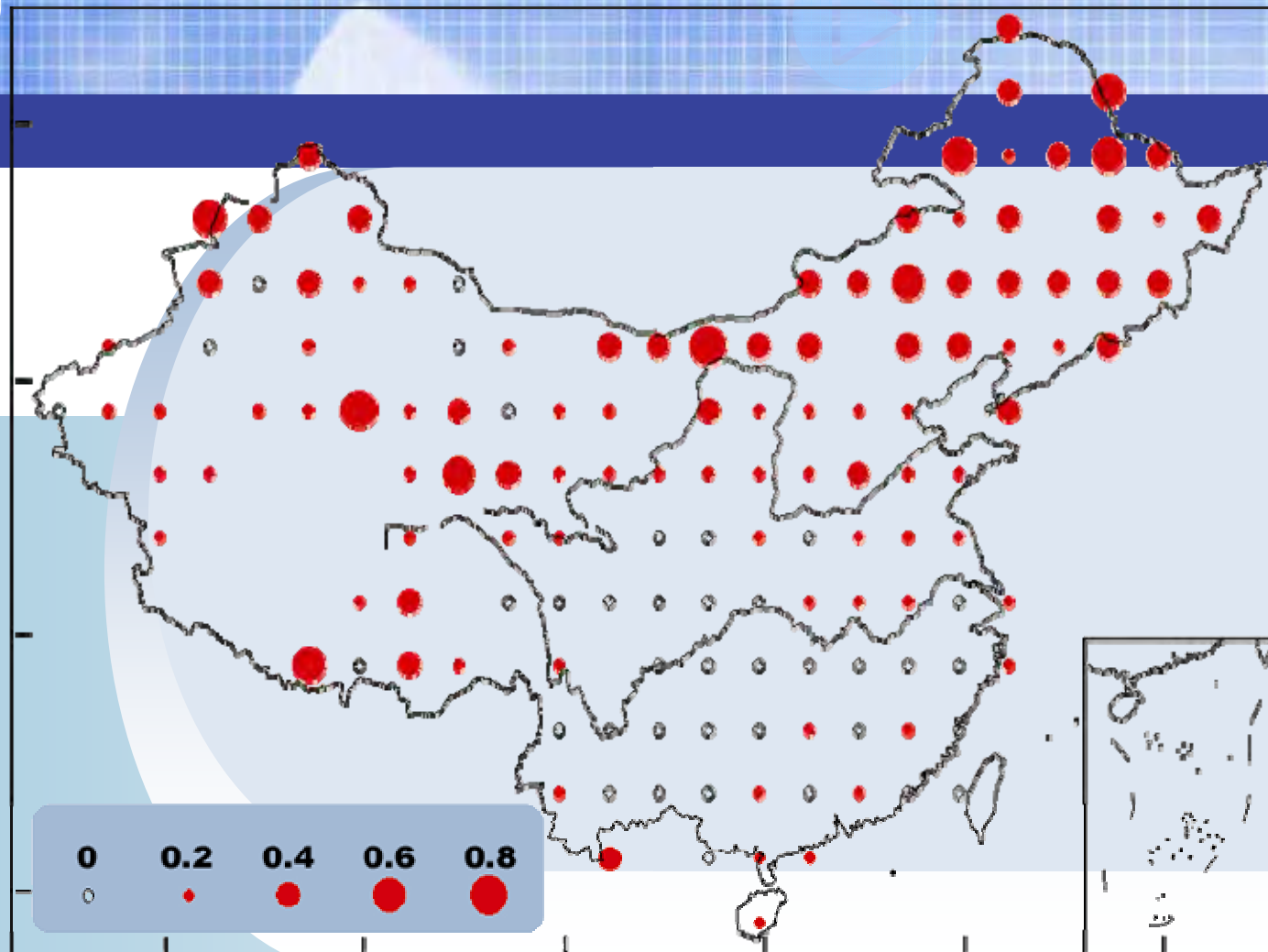
Eutrophication

Urban ecosystem degradation

Desertification



China: Temperature increases in recent 50 years





1.2 The position and action of different countries

EU

Strongly called for more radical emission reduction measures, quantified emission reductions.

USA, Japan, Australia, etc

Opposed to take immediate quantified emission reduction measures, insist on setting no reduction standard and making use of technology to take more relaxed measures.

Developing countries

Opposed to commitments of further emission reduction, do not want the emission reduction measures impede their own development.

Island countries

The international community should provide help to the island nations suffering from climate change as far as possible.

Petroleum export countries

Being low-pitched or against emission reduction.

China

Do not take mandatory or absolute emission reduction tasks before reaching a moderately developed country.

1.3 Why estuary city for this research ?

■ Some characteristics of the estuary city:



(1) A most sensitive segment of the delta, with an advantaged geographic position for developing

(2) An unique natural ecosystem, with abundant nutrients, rich biological productivity and varied eco-environment





2. Objectives of Research





Objectives of research : 211

- **Revealing 2 attributes:** Reveal the eco-system vulnerability and spatial distributing pattern through assessing its dynamics of climate change under global climate change.
- **Constructing 1 comprehensive assessment indexes system:** Assess the response of ecological environment and economic system to climate change of Shanghai and the potential impact to Shanghai could be caused by various climate changes scenarios based on information databases and evaluation index system.
- **Proposing 1 set countermeasure:** Provide for policy makers the preferential comprehensive countermeasures under different climate change scenarios, vulnerabilities or climate change exposures, as well as provide the public the appropriate knowledge of popular science.



3.Methodology

The current study of climate change vulnerability assessment is still a relatively new field of research. Despite the IPCC and UFCCC have formulated special research program directly against climate change assessment, the existing research extremely lack quantitative evaluation study .

Currently the related climate change vulnerability evaluation methods can be concluded into three types:

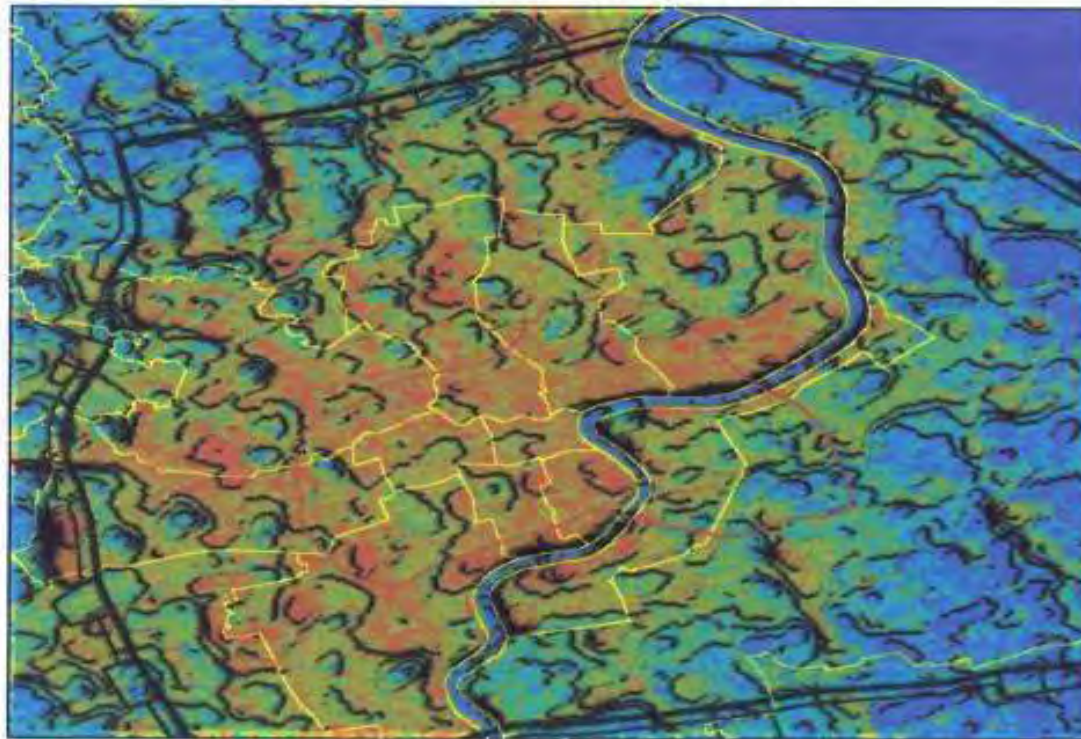
- 3S + Modeling**
- Index system evaluation**
- Contrast research**



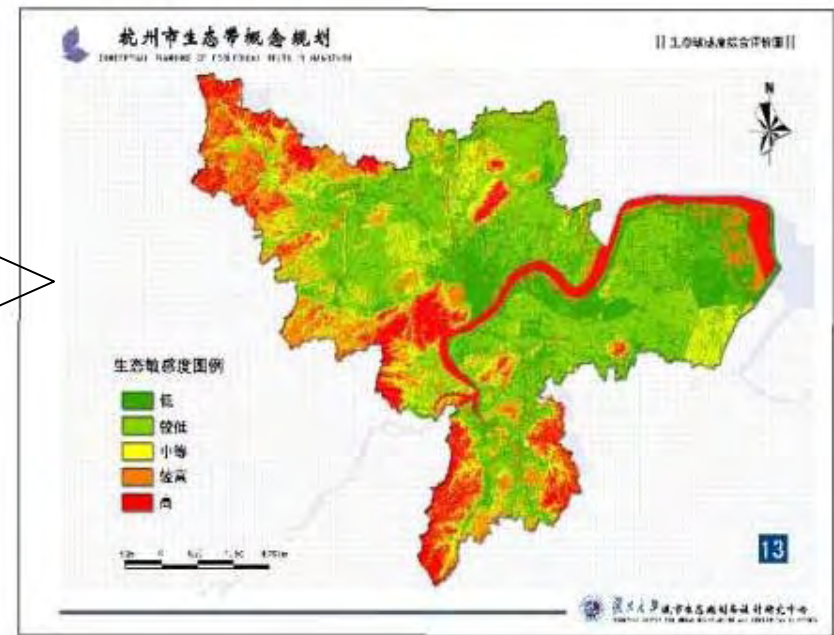
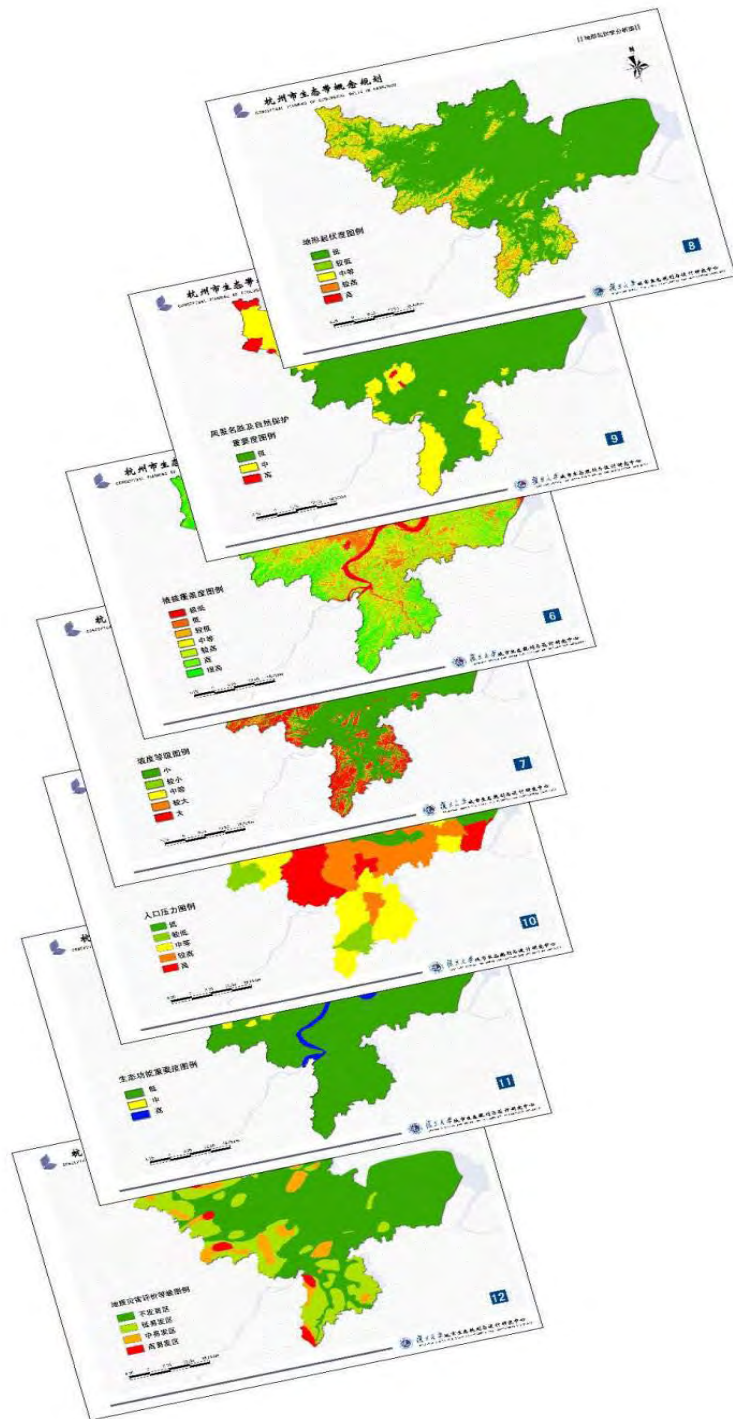
■ 3S techniques

上海市热场等级图

TM6 1998年8月4日



■ Mono-factor & multi-factors Mapping





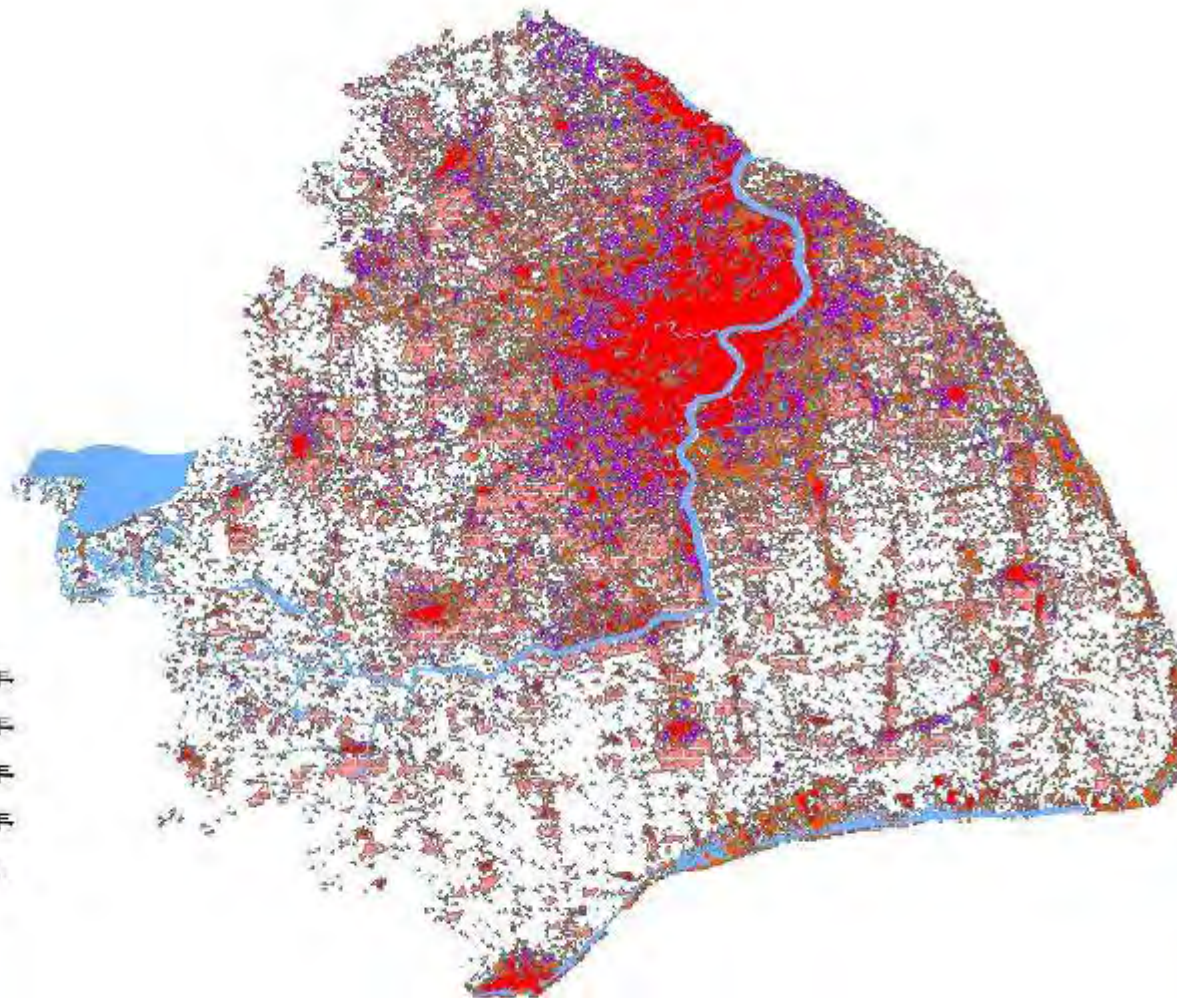
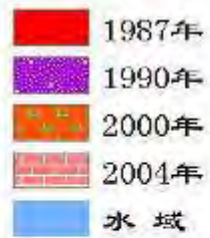
■ Monitoring & Field Investigation



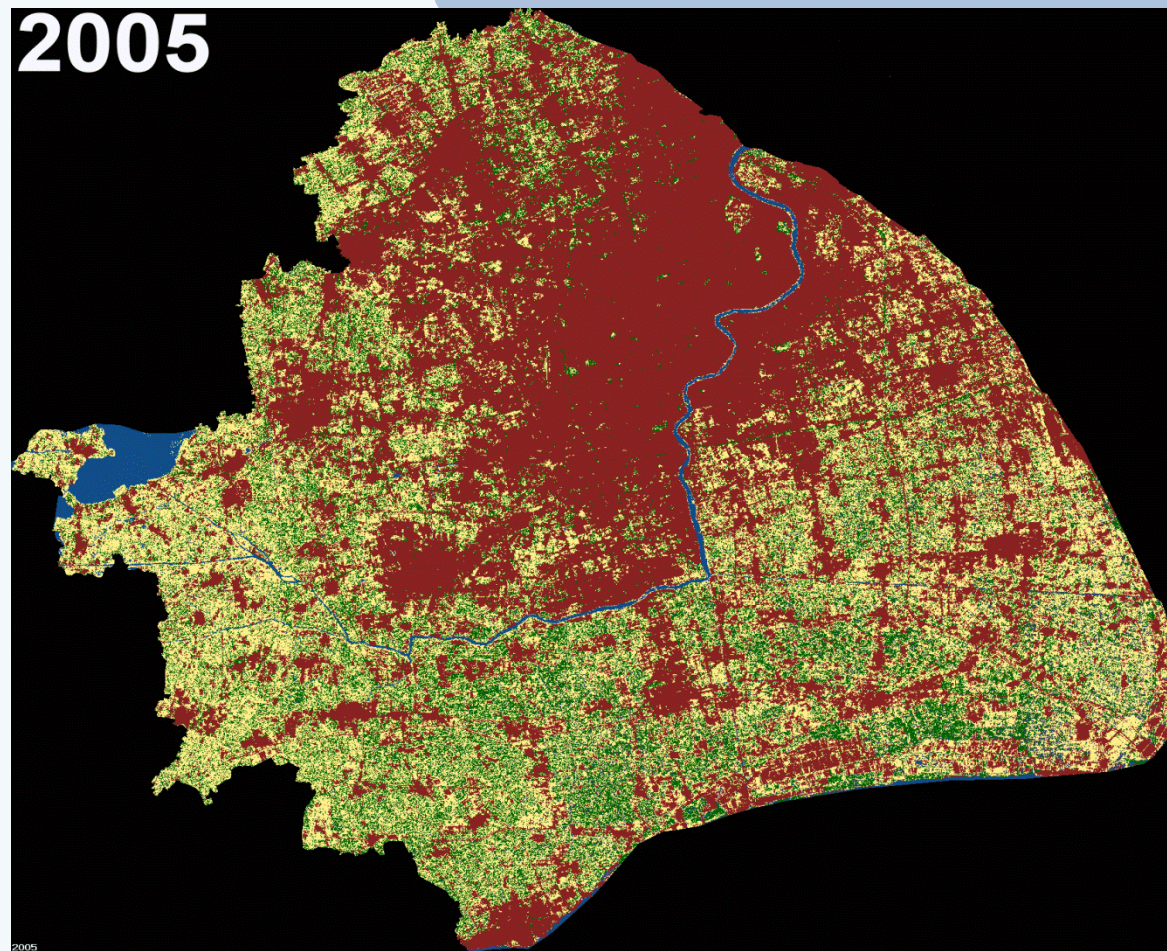


LUCC/CA/SD Modeling

图例



Forecasting by SLEUTH Modeling: 2005-2040 Shanghai land-use succession



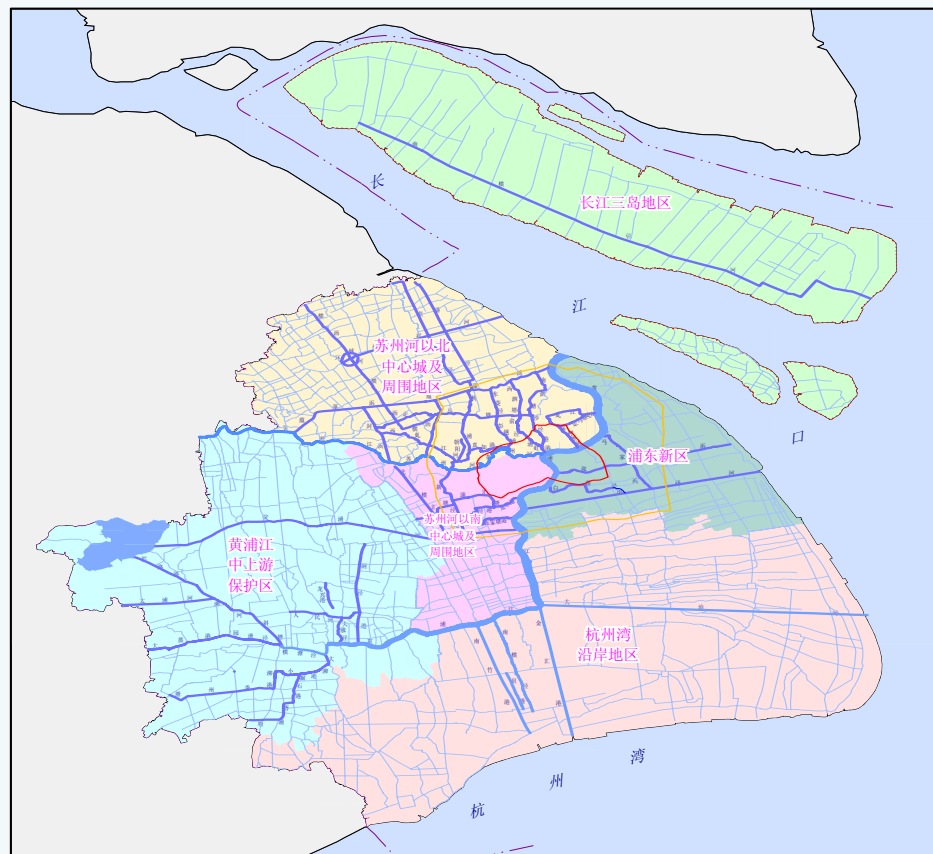
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Modeling analysis and forecast

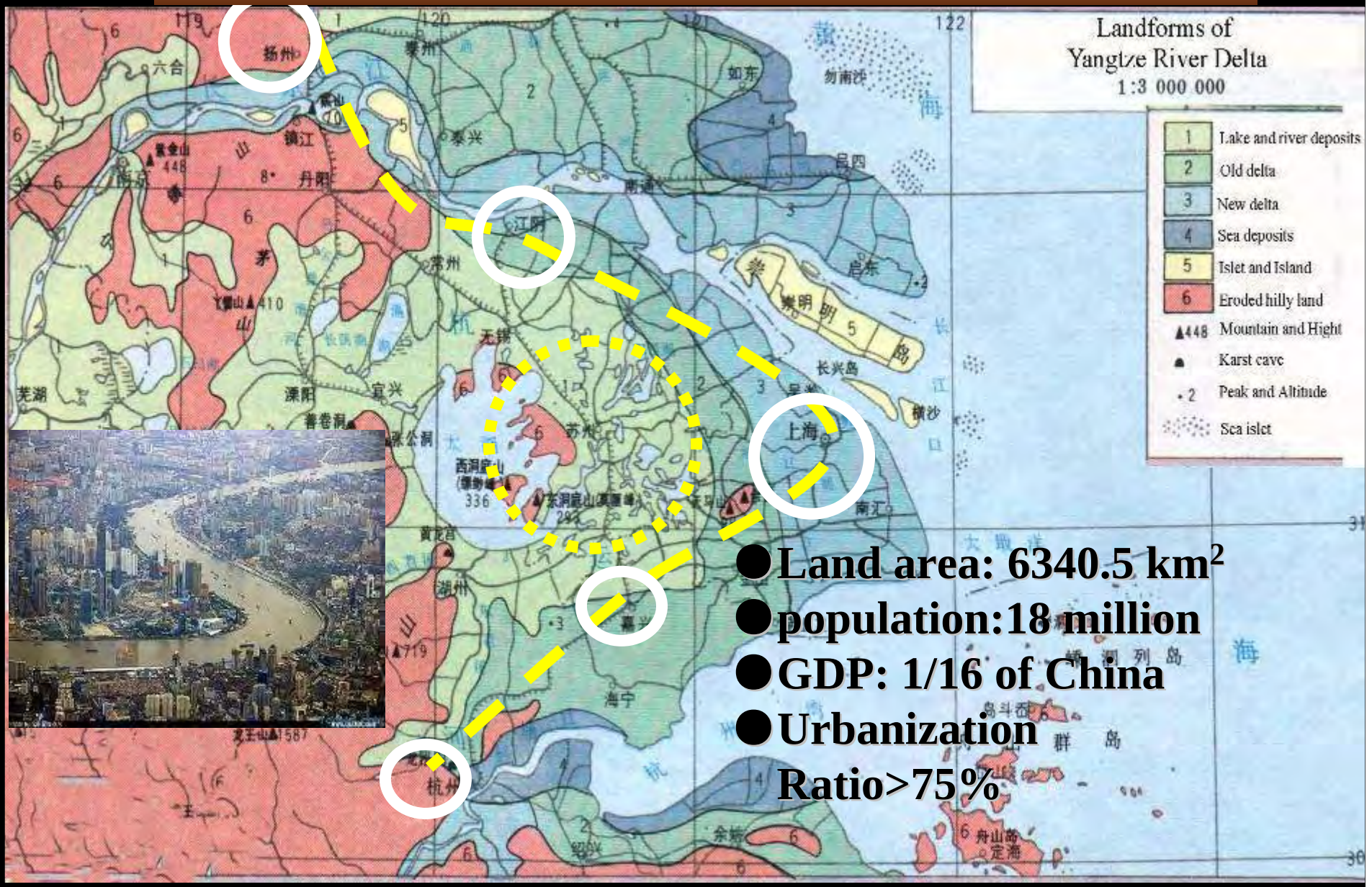


4. Achievements & Countermeasures

--- A Case of Shanghai



4.1 Some Characteristics of Shanghai



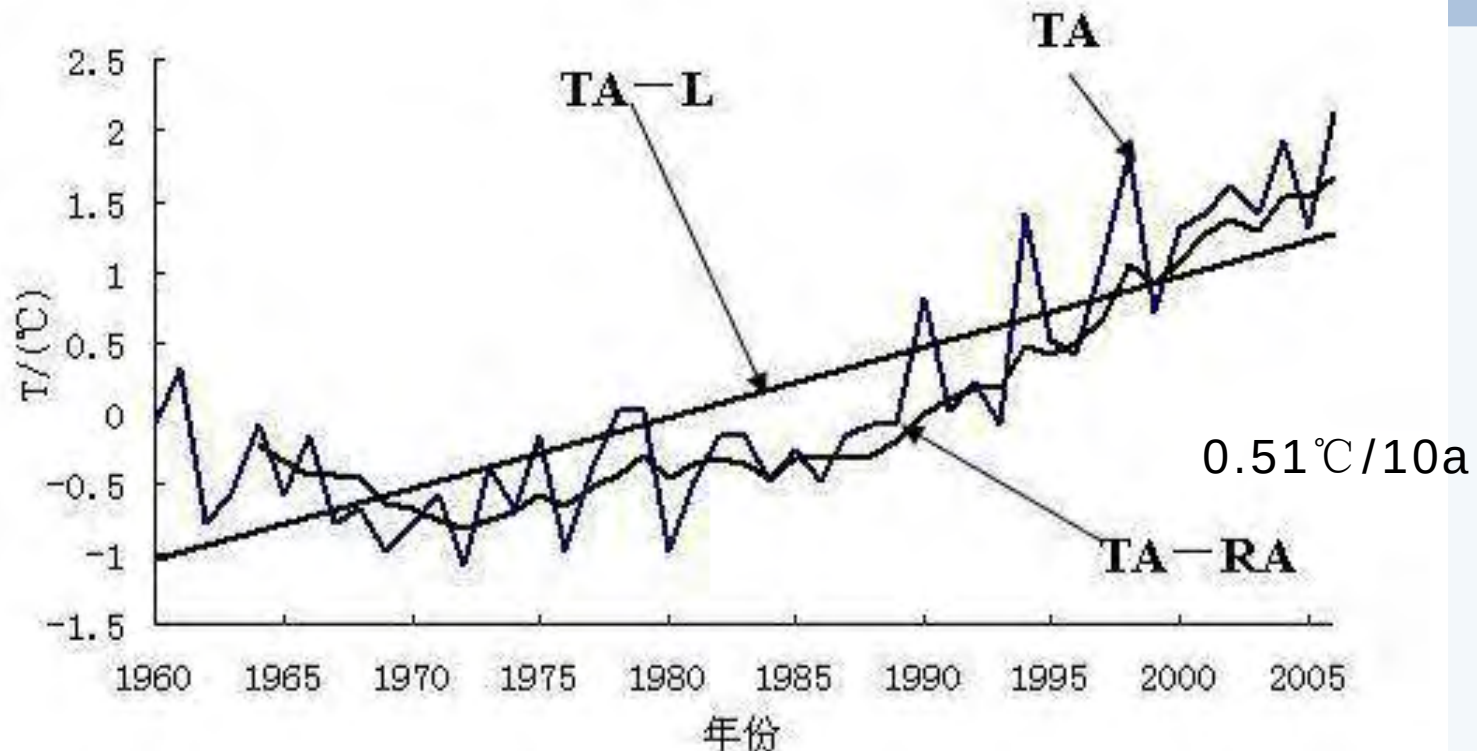
4.2 The dynamic tempo-spatial review during the last 50 years of Shanghai



- **Temperature variation**
- **Precipitation variation**
- **Urban wind field variation**
- **Urban extreme weather research**
- **The effects of Shanghai's urbanization on climate change**



● Urban annual mean temperature



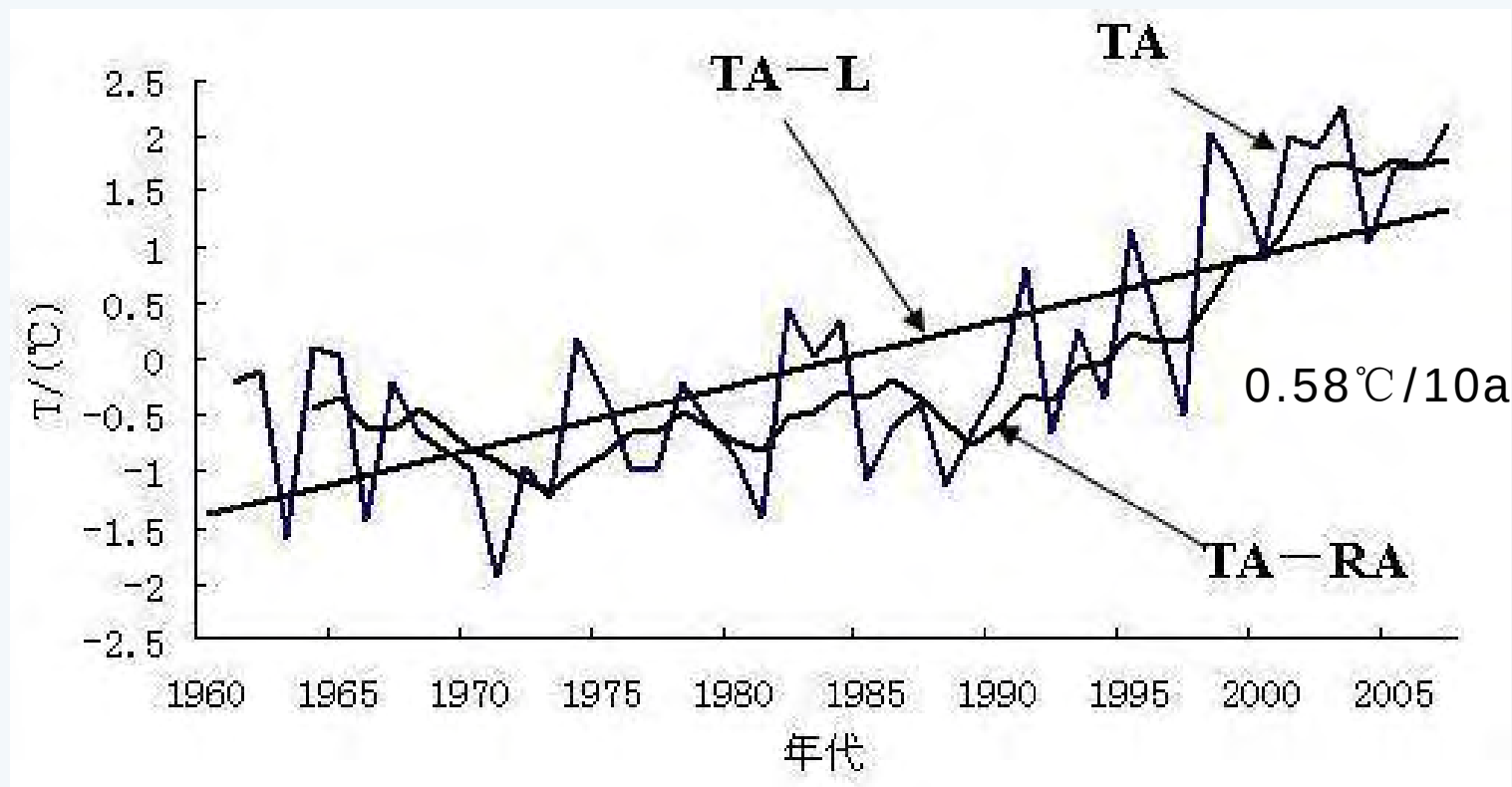
TA为上海徐家汇气象站1960—2006年平均气温距平曲线，
TA-L为气温距平线性回归曲线，TA-RA为气温距平5年滑动平均曲线

图 上海徐家汇气象站1960—2006年平均气温距平图

Fig. Annual mean temperature anomalies in Shanghai during 1960—2006



● Urban mean temperature in spring



TA为上海徐家汇气象站1960—2006年春季平均气温距平曲线，
TA-L为春季气温距平线性回归曲线，TA-RA为春季气温距平5年滑动平均曲线

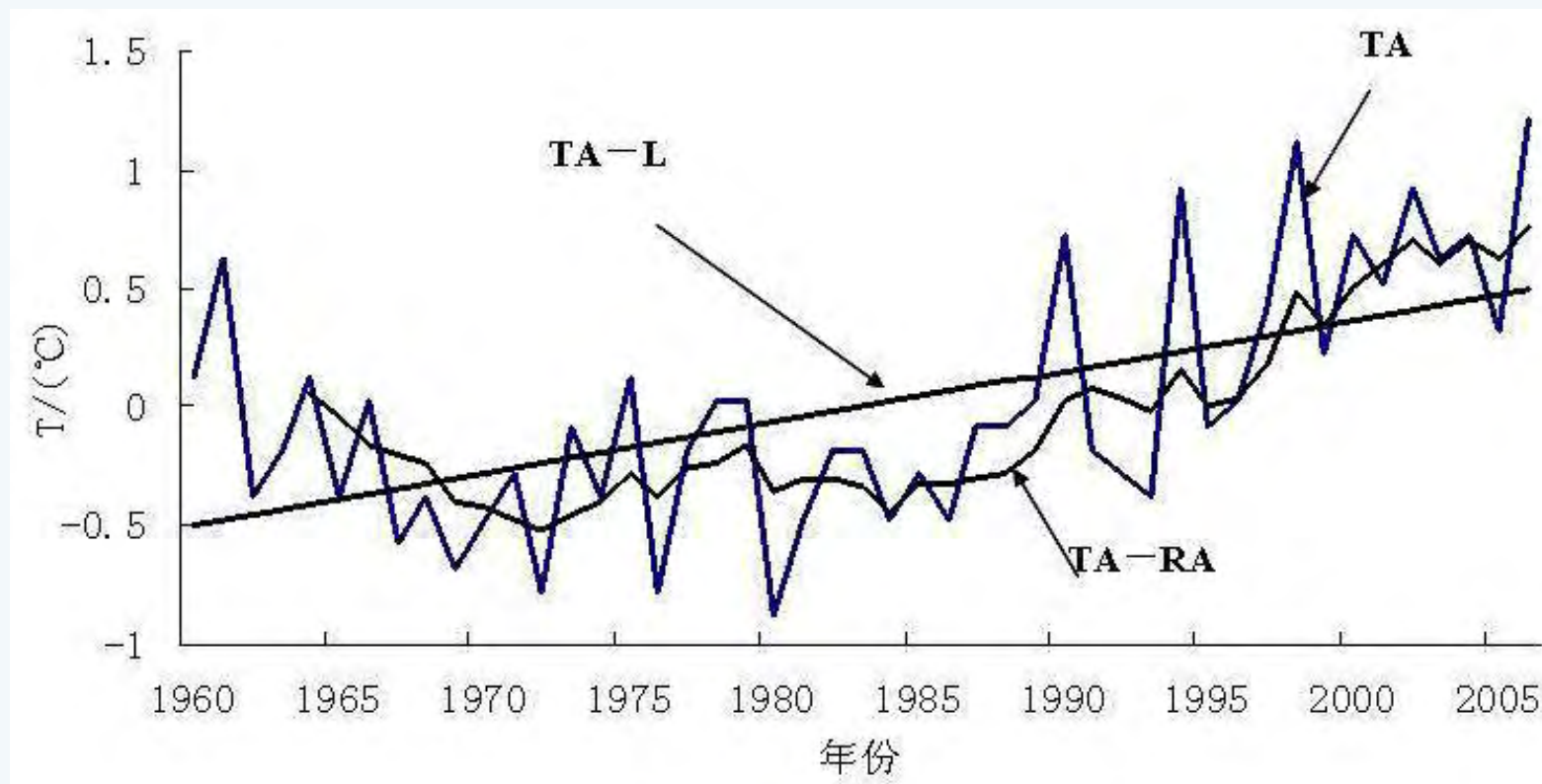


● Comparison with annual national mean temperature anomaly change rate

°C/10a				
各季和年平均	上海市区			全国气温变化倾向率
	1984年之前	1984年之后	气温变化倾向率	
春季	0.08	1.45	0.58	0.28
夏季	-0.13	0.88	0.35	0.15
秋季	-0.13	1.04	0.48	0.20
冬季	0.06	1.06	0.6	0.39
年平均	0.01	1.1	0.51	0.25



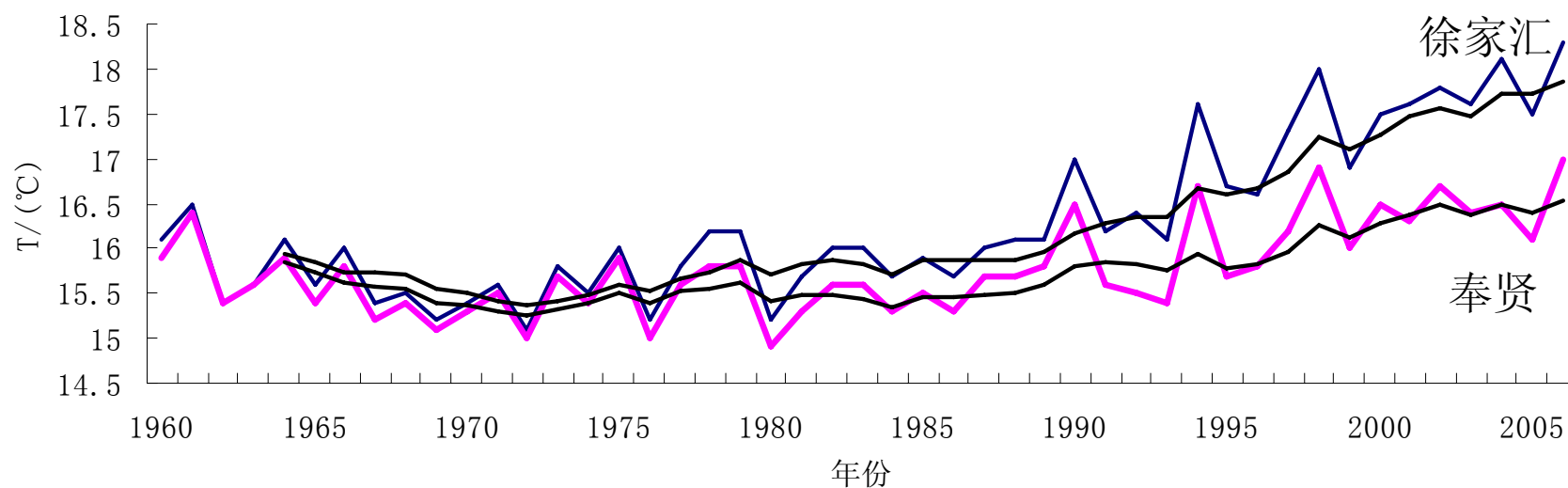
● Difference between urban and suburb area



TA为上海奉贤气象站1960—2006年平均气温距平曲线，
TA-L为气温距平线性回归曲线，TA-RA为气温距平5年滑动平均曲线



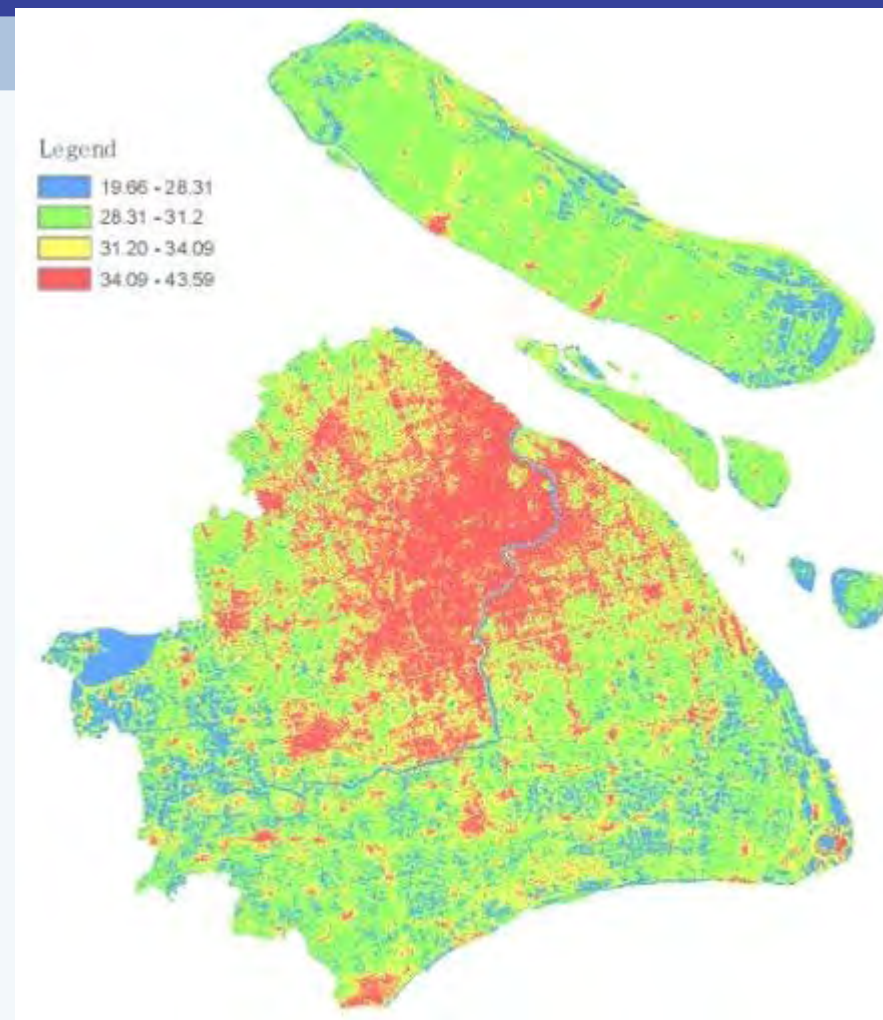
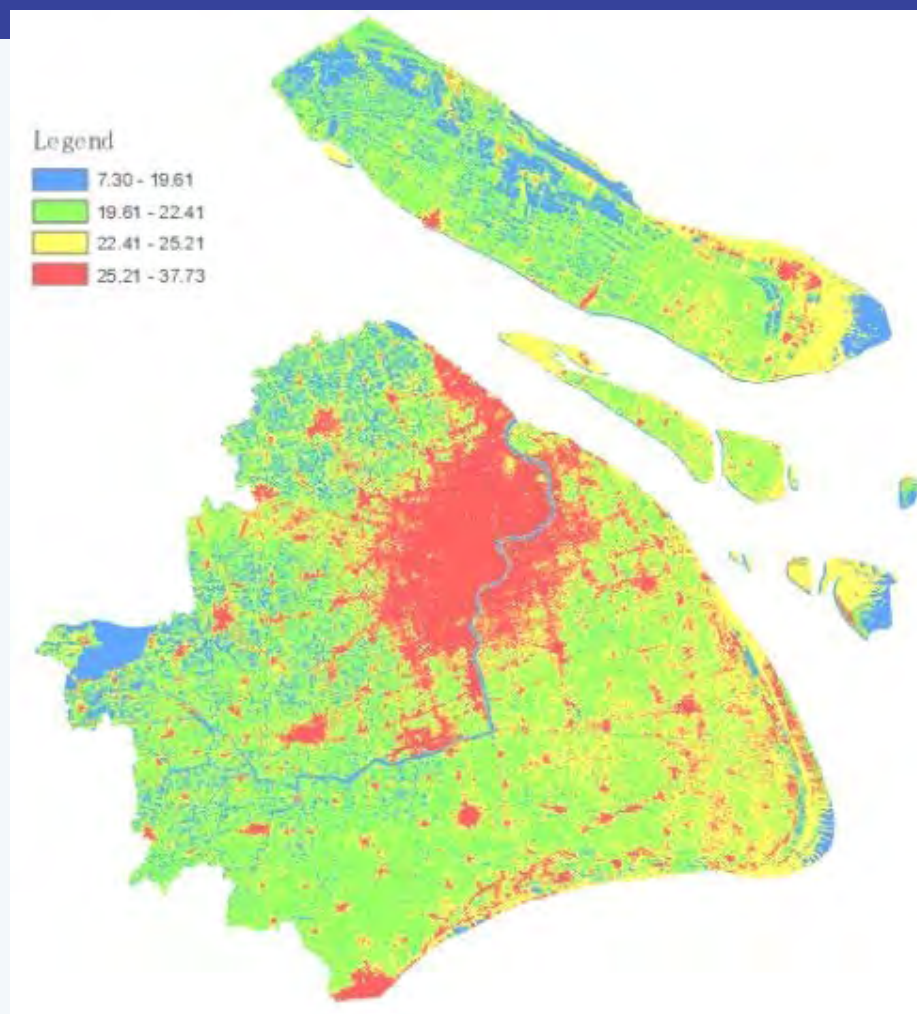
● Difference between urban and suburb area



	1960s	1970s	1980s	1990s	2000-2006
徐家汇平均气温 ($^\circ\text{C}$)	15.74	15.68	15.84	16.88	17.77
奉贤平均气温 ($^\circ\text{C}$)	15.61	15.5	15.47	16	16.5
城郊差别 (%)	0.83	1.16	2.39	5.50	7.70



● Distribution of Heat-Island in Shanghai in 1997 and 2004



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上海市1997年4月11日和2004年7月19日地表温度(单位: °C) 空间分布图

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● Principal conclusions

- The temperature data from 1960-2006 in Xu Jiahui station and Feng Xian station of Shanghai indicated that **there is a significant temperature increase from mid 1980s**, especially in winter and spring and also have a transition of temperature increase trend to summer and autumn.
- The mean temperature in urban and suburb **increase 0.51 °C and 0.22 °C every 10 years respectively**. There is a significant temperature difference between urban and suburb ($P < 0.01$).
- Urban heat island effect influenced by urbanization is increasingly serious.

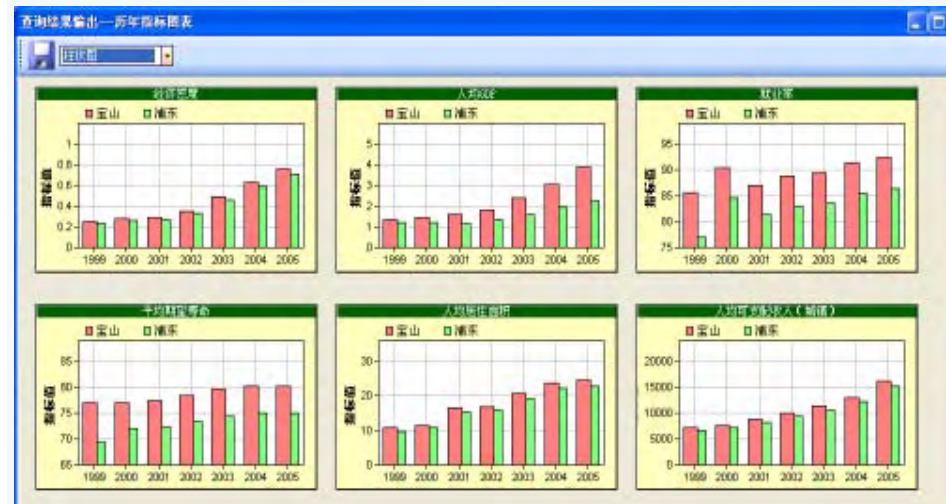
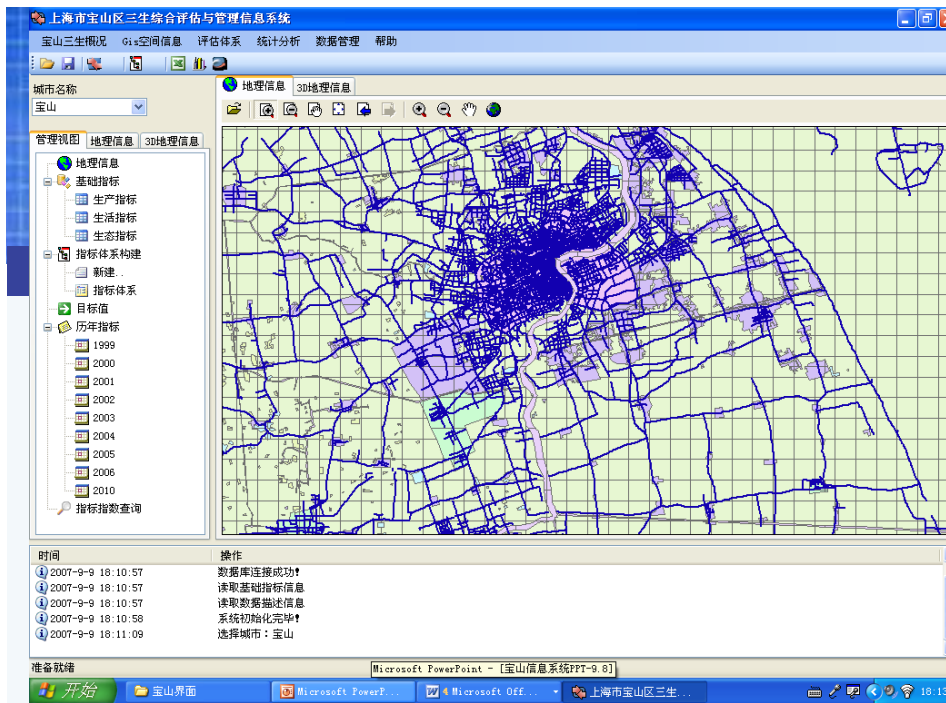
4.3 Index system for evaluating the eco-vulnerability of estuary city



- Home and abroad climate vulnerability index system research status
- Comprehensive index system establishment

Comprehensive index system establishment





Database

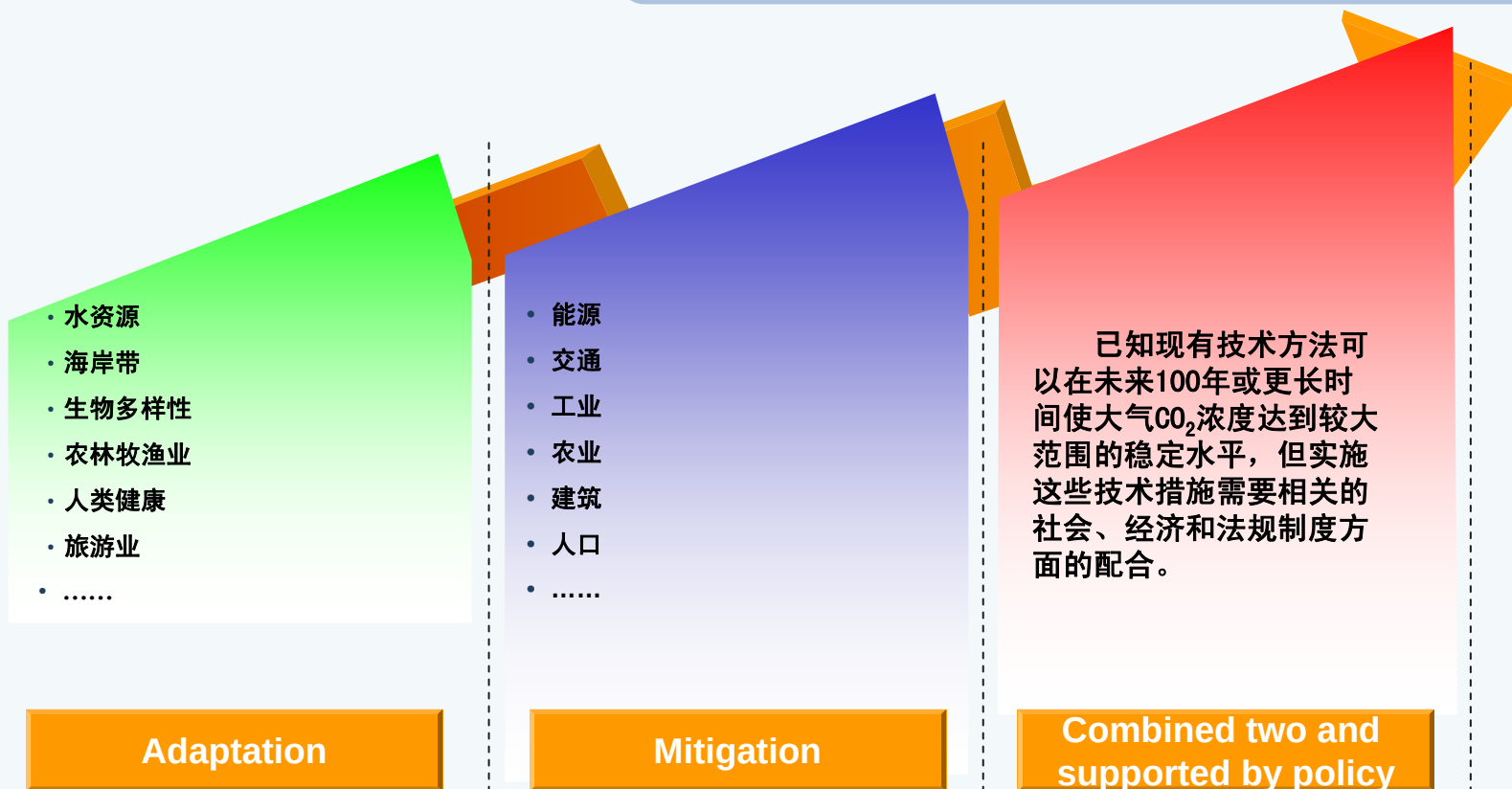
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Information system design





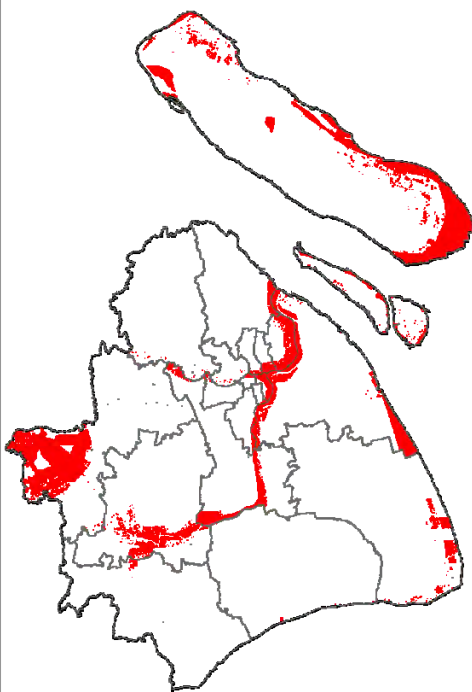
4.4 Countermeasures



一级脆弱区应对策略

一级脆弱区

447.66 km²



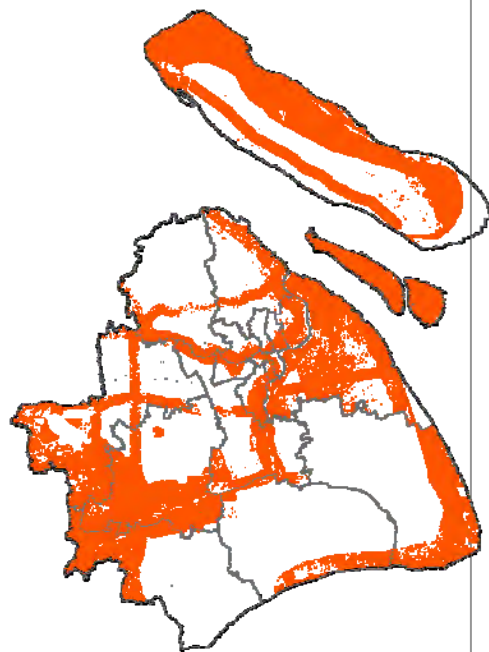
应对策略

- ①强化应对海平面升高的适应性对策。采取护坡与护滩相结合, 工程措施与生物措施相结合, 提高设计坡高标准, 加高加固海堤工程, 强化沿海地区应对海平面上升的防护对策。采取陆地河流与水库调水、以淡压咸等措施, 应对河口海水倒灌和咸潮上溯。
- ②加强海洋环境的监测和预警能力。增设沿海和岛屿的观测网点, 建设现代化观测系统, 提高对海洋环境的航空遥感、遥测能力, 提高应对海平面变化的监视监测能力。建立沿海潮灾预警和应急系统, 加强预警基础保障能力, 加强业务化预警系统能力和加强预警产品的制作与分发能力, 提高海洋灾害预警能力。
- ③严格控制滩涂围垦和填海。对围垦滩涂和围填海活动要科学论证, 依法审批。严禁围垦沿海沼泽草地、芦苇湿地。
- ④在崇明东滩自然保护区建立长期监测站点, 检测该区域的岸线变化, 自然环境和物种变化。
- ⑤适度控制东平国家森林公园和佘山国家森林公园的开放度, 减少人为干扰。
- ⑥提高水源地风险管理意识。
- ⑦构建水源地突发污染事故的有效防范体系, 切实降低突发事故发生的概率。建设和完善水源保护区水路运输管理系统, 有效防止船舶污染, 全面禁止在水源保护区水路运输危险品。建立水源安全预警制度, 定期发布饮用水源地水质监测信息。
- ⑧完善水源地突发污染事故应急预案, 提高安全防范和应对能力, 建设水污染事故应急处理物资储备中心, 提高应急处理处置能力。
- ⑨进一步开辟长江供水水源

二级脆弱区应对策略

二级脆弱区

1849.07 km²



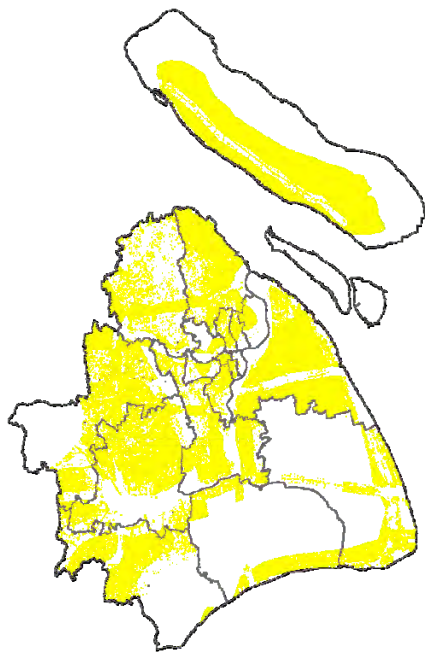
应对策略

- 建立合理的海岸带综合管理制度、综合决策机制以及行之有效的协调机制，及时处理海岸带开发和保护行动中出现的各种问题。建立综合管理示范区。
- 大力营造沿海防护林，建立一个多林种、多层次、多功能的防护林工程体系。
- 合理利用岸线资源。开展海岸调查评价，制定海岸利用和保护规划。深水岸线优先保证重要港口建设需要。
- 加强长江口通海航道综合整治和生态环境保护。
- 制定和完善海啸、风暴潮、赤潮及化学品泄漏、油泄漏、核泄漏、海难、工程设施损毁等应急预案。
- 提高沿海重大工程设施的防护标准，提高港口码头设计标高，调整排水口的底高。
- 建立应急预案。建立规范、高效的气象灾害应急体系，形成信息畅通、反应迅速、处置高效的应急处置机制，提高气象灾害应急处置能力，最大限度地减轻气象灾害及其造成的人员伤亡和财产损失，保障经济持续稳定发展和城市安全运行。

三级脆弱区应对策略

三级脆弱区

1660.11 km²



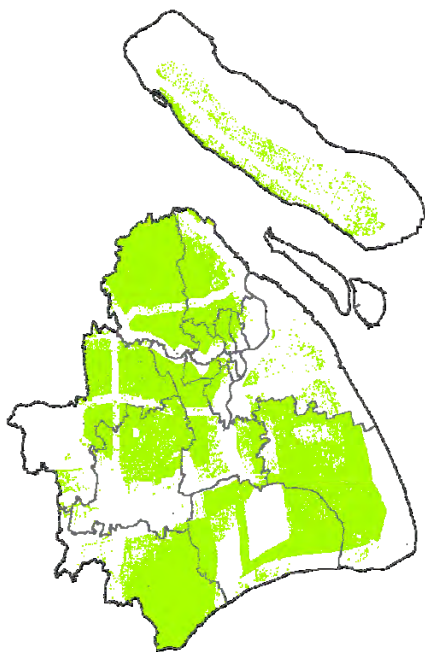
应对策略

- 建立完善的极端气候预警系统。组织成立一个专门的预警小组，负责上海地区的极端气候预报工作。电台、电视配合发布橙色、红色警报。
- 在工业区建立生态工业园，进行试点工程的建设，实现产业园的资源内循环，提高资源的利用效率。合理使用能源，做到能源循环利用，对于高耗能化工、炼钢、火电厂周围居住区使用冷却水作为采暖热源进行供暖。
- 鼓励使用清洁能源。改变能源结构，减少二氧化硫、二氧化碳的排放。应推出政策，对于不同的发电方式的电价做出调整。
- 进行产业结构的调整，由重工业转向轻工业，加大高新技术产业的投资和发展力度。
- 制定相应的法律并以此为基准确立相关工厂评估制度，对工厂实行评估及规定其减排尺度。关闭高耗能、高排放、高污染、违法排污的企业工厂，对未达成减排标准的单位予以适当罚款。

四、五级脆弱区应对策略

四级/五级脆弱区

2383.65 km²



应对策略

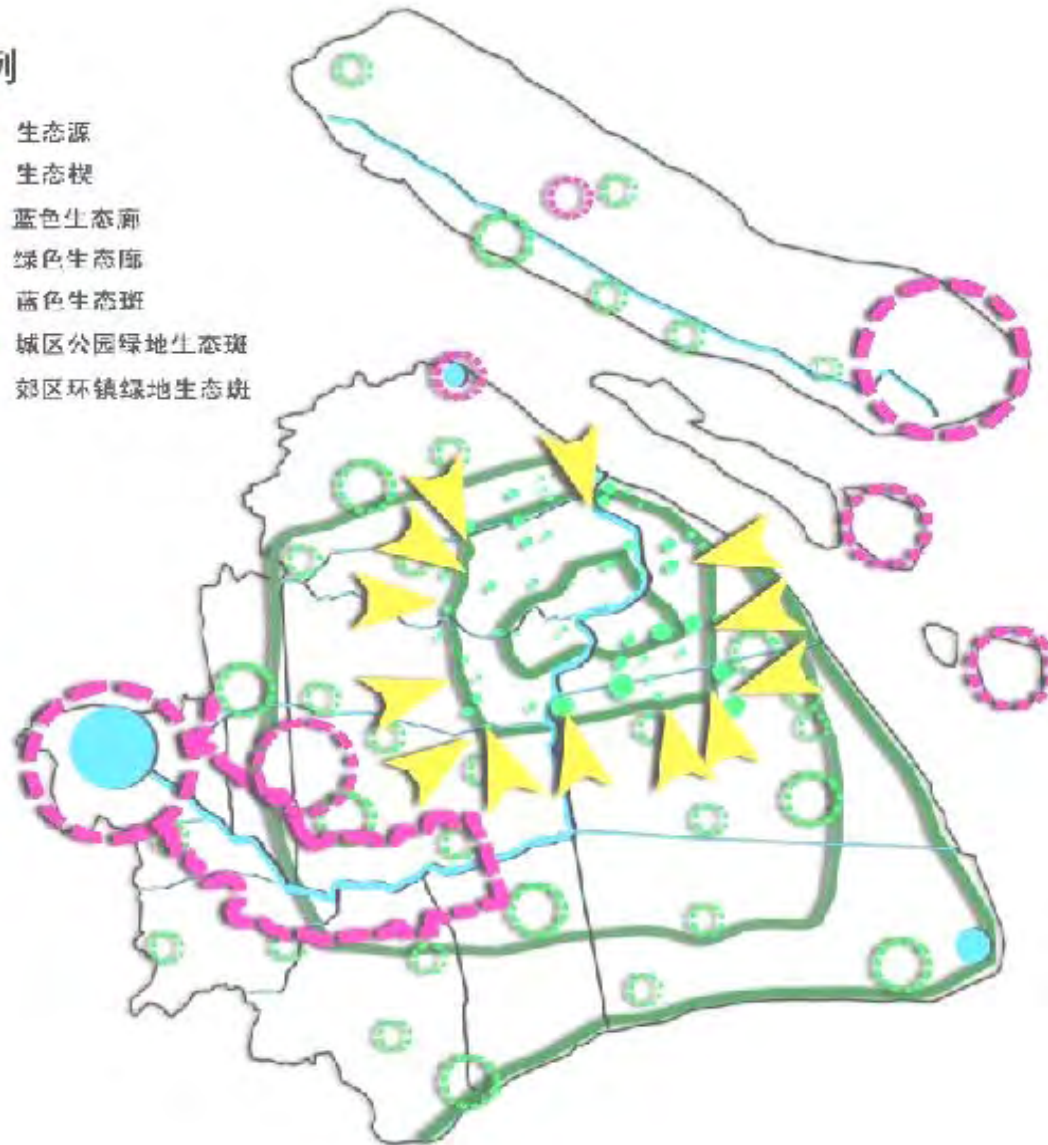
STRATEGY

- 进行产业结构的调整，加大生态农业建设
- 控制农药和化肥的施用；
- 推进城市森林建设，提升植被的碳汇功能；
- 进一步推广秸秆等的处理技术，促进能源结构向沼气为主发展。并选育低排放的高产水稻，研究及发展微生物技术，降低稻田甲烷排放强度。
- 协同发展“农家乐”生态旅游与生态系统保护。宣传教育改善其生态脆弱性的重要性，以应对气候变化的现状。

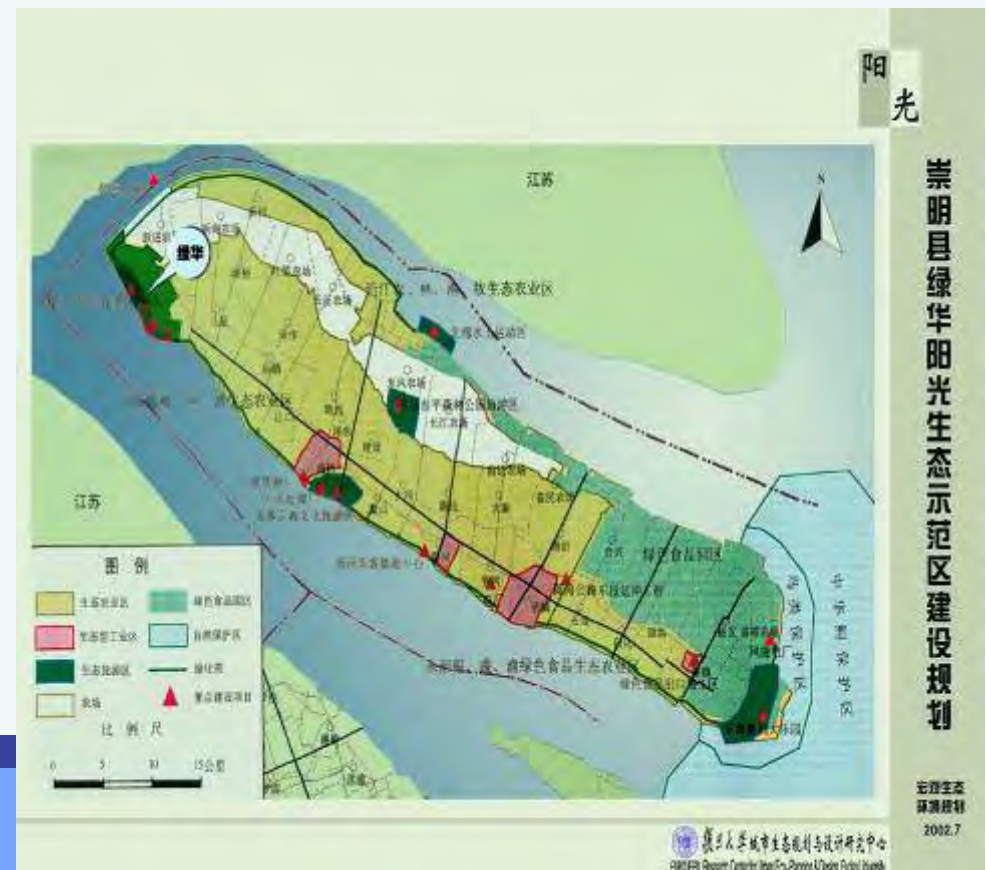
● Eco-planning for Eco-security Pattern in Shanghai

图例

- 生态源
- 生态楔
- 蓝色生态廊
- 绿色生态廊
- 蓝色生态斑
- 城区公园绿地生态斑
- 郊区环镇绿地生态斑



● Eco-planning for Chongming Island, Shanghai (2007)





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4.5 Next Plan for Research

- **The effects of urbanization in Shanghai on climate change**
- **Zoning for Vulnerability of Whole Shanghai**
- **Comparison with some estuaries in the world: the Netherlands, Germany and USA ---linked project development**

Thanks!

