



IUEMS

A CAS product for

# Mapping Urban Ecosystem Services

online

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© Intelligent Urban Ecosystem Management System

# Which kind of visualization meets the needs of URBAN ECOLOGY?

Calculate **EASILY**

Understand **EASILY**

Decision-making outputs



Analytical results



































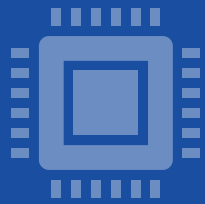
Monitoring data



- Ecosystem components
- Science popularization
- Stakeholder participation
- + Ecosystem phenomena
- + Scientific research
- + Scientists
- + Ecosystem forecasting
- + Scientific research
- + Scientists

# The modules of IUEMS (Intelligent Urban Ecosystem Management System)

 Heat mitigation	 Climate adjustment	 Water purification	 Noise Abatement	 Gross Ecosystem Product	 Eco-asset Index	 Coupled-Ecosystem Index	 Eco-services tradeoff
 Storm runoff regulation	 Sedimentation retention	 Non-point pollution retention	 Mental health	 Human activity boundary	 Population distribution	 Runoff analysis	 Raster data resolution booster
 Carbon Sequestration (NPP)	 Carbon Sequestration (Annal difference)	 Carbon Sequestration (Coefficient)	 Air Purification	 Geo-data reprojection	 Zonal Statistic	 Geo-data Clip	 Raster resample
 Coastline protection	 Animal habitat	 Daily recreation	 Runoff retention	 Zonal assignment	 Excel to raster	 Landscape premium	 Landscape tourism



Calculating

- Monitoring data & analysis
- 3D visualization
- Big data



Drawing



Decision making

# Upload & calculate your data visually

## Data uploader

## GIS layers manager

The screenshot displays the Urban Ecosystem Analysis System (UEAS) interface. The main window is titled "model4" and contains a "Data uploader" panel on the left and a "GIS layers manager" panel on the right. The central area shows a map with a grid overlay and a blue shaded region. The "Data uploader" panel includes input settings (研究区边界面矢量, 样本正方形核心区边长, 样本环形缓冲区半径) and output settings (所有核心区网格文件, 有效核心区网格文件, 有效缓冲区网格文件). The "GIS layers manager" panel lists various layers such as dem\_rs10.tif, AT\_prj1.tif, 裁剪文件.shp, 新土地利用文件.tif, 缓冲区文件.shp, 模拟无生态空间温度.t, 模拟真实温度.tif, and 没有建筑物温度.tif. The "Processing monitor" panel at the bottom right shows a progress log for the grid calculation and clipping process.

**运行信息**

2020/01/15 11:08:32:	90%
2020/01/15 11:08:32:	91%
2020/01/15 11:08:32:	92%
2020/01/15 11:08:32:	93%
2020/01/15 11:08:32:	94%
2020/01/15 11:08:32:	95%
2020/01/15 11:08:32:	96%
2020/01/15 11:08:32:	97%
2020/01/15 11:08:32:	98%
2020/01/15 11:08:32:	100%
网格化计算完成!	
开始裁剪文件...	
2020-01-15 11:08:32:	0%
2020-01-15 11:08:33:	1%

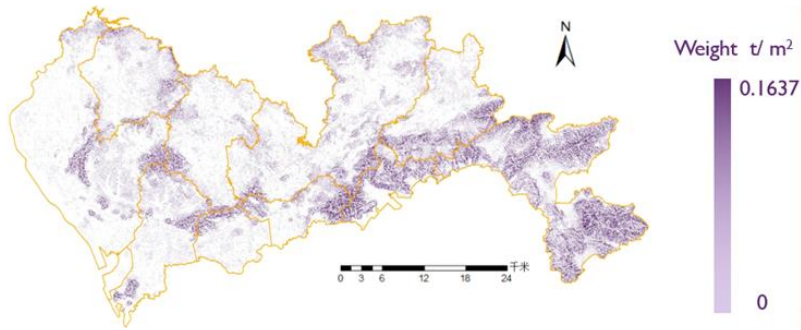
Click to run/stop

Real-time visualization

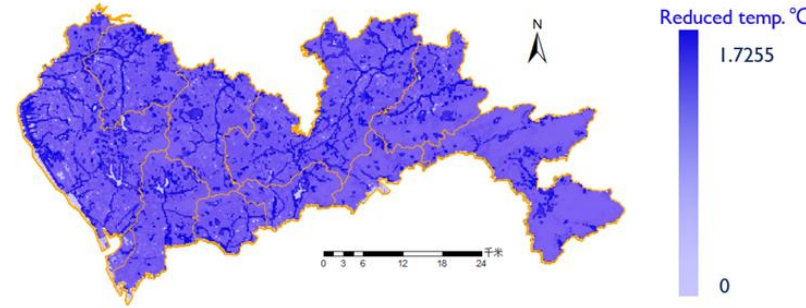
Processing monitor



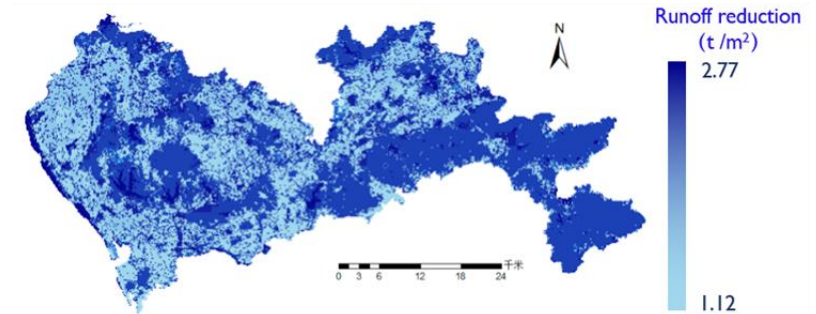
**Sedimentation retention**  
2.82 million t soil in total



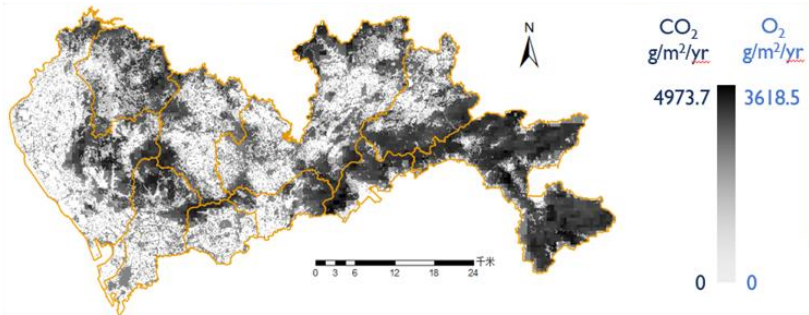
**Heat mitigation**  
Cooling 1.99 °C in average



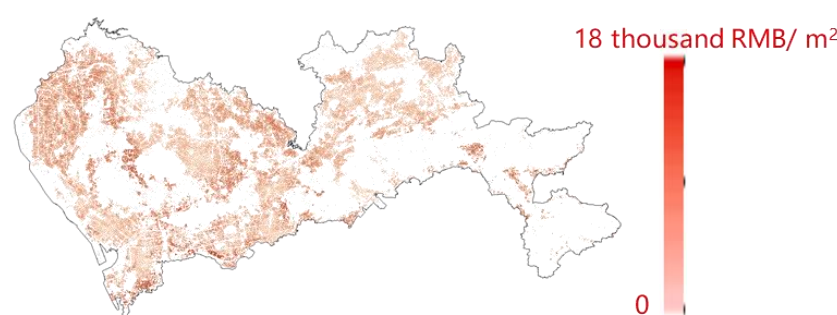
**Storm runoff regulation**  
Reduce 662 million t runoff in total



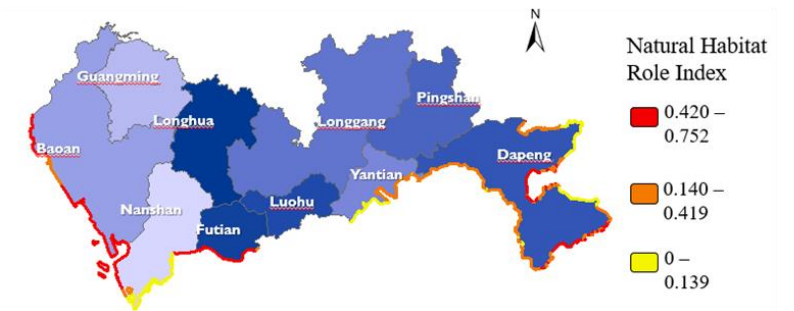
**Carbon sequestration**  
Sequesterate 300 thousand t CO<sub>2</sub>  
Release 220 thousand t O<sub>2</sub> in total

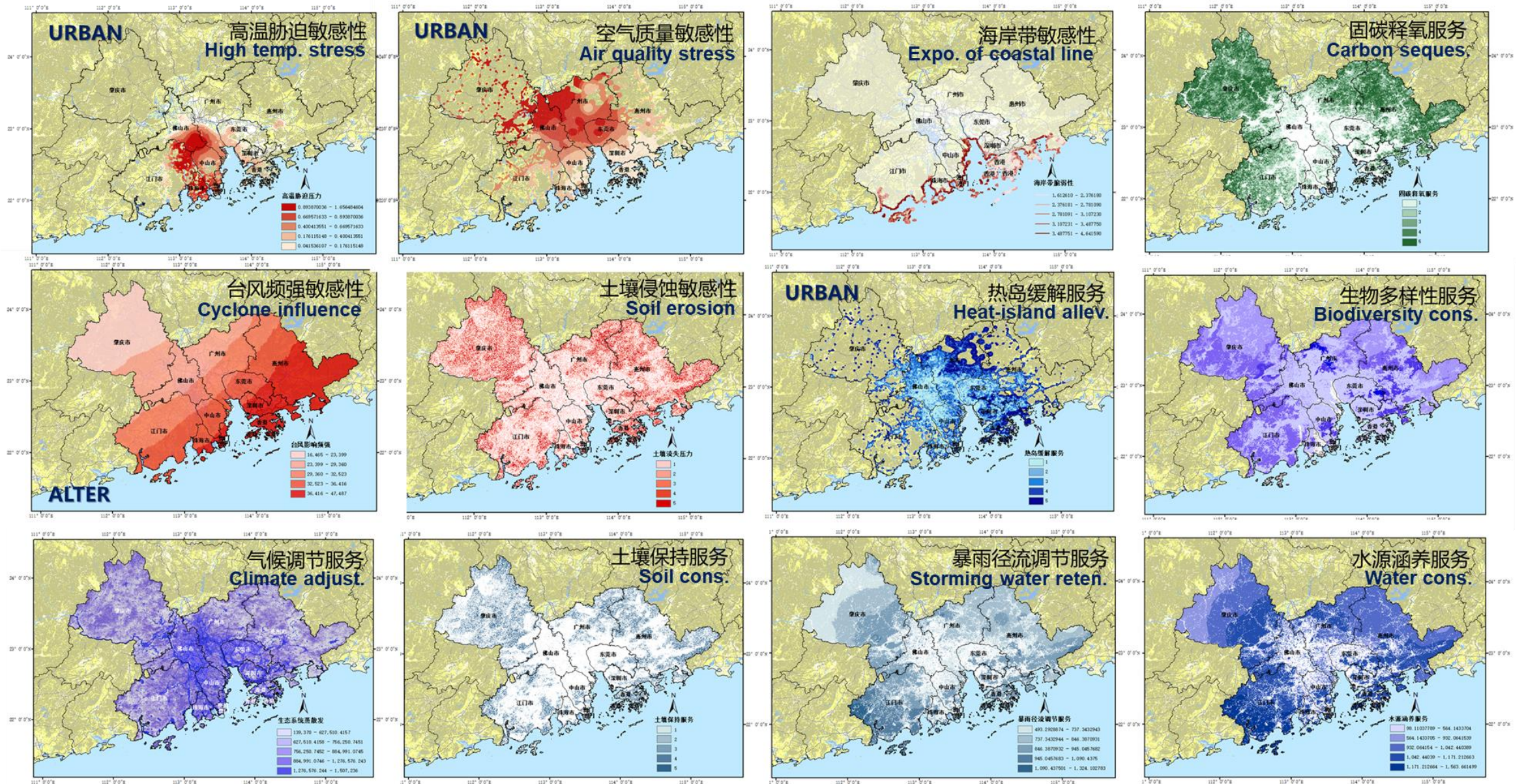


**Real estate landscape premium**  
Reduce 16 billion t RMB in total

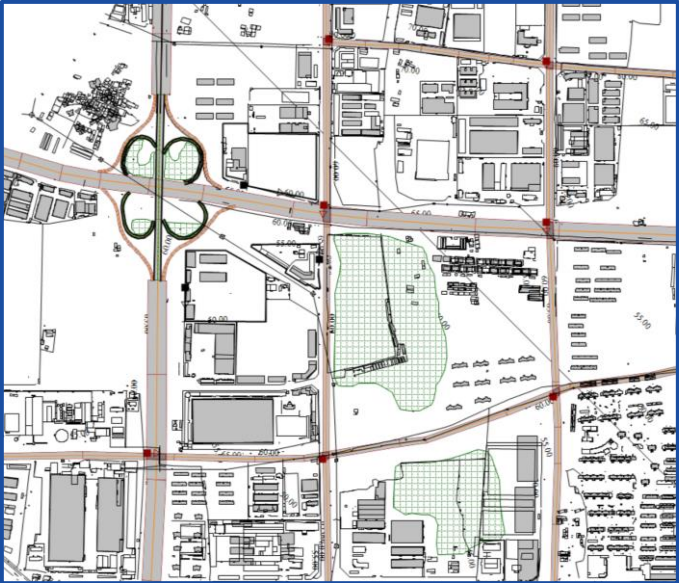
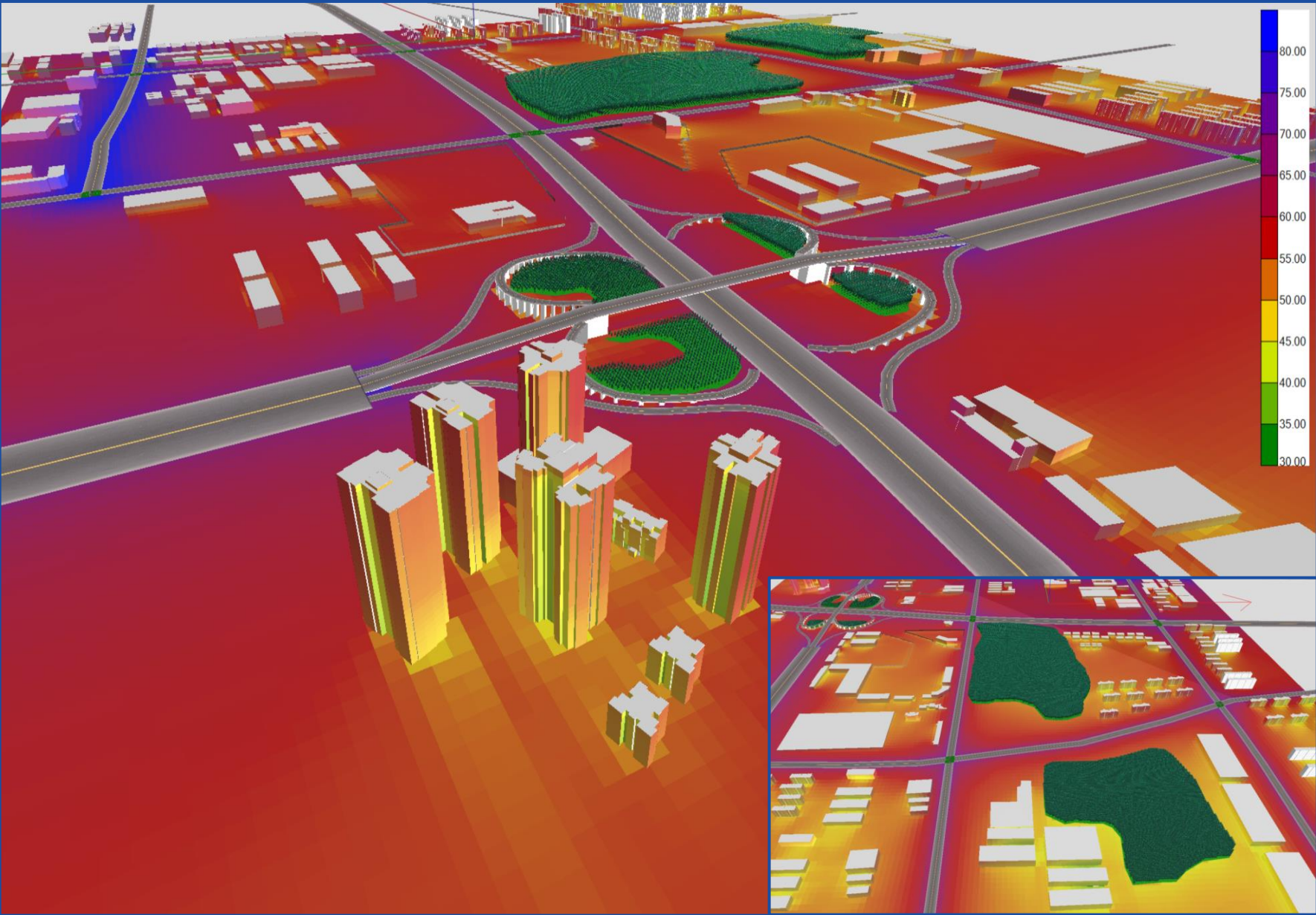


**Coastline protection**  
Protect 38%(88.9 km) coastline



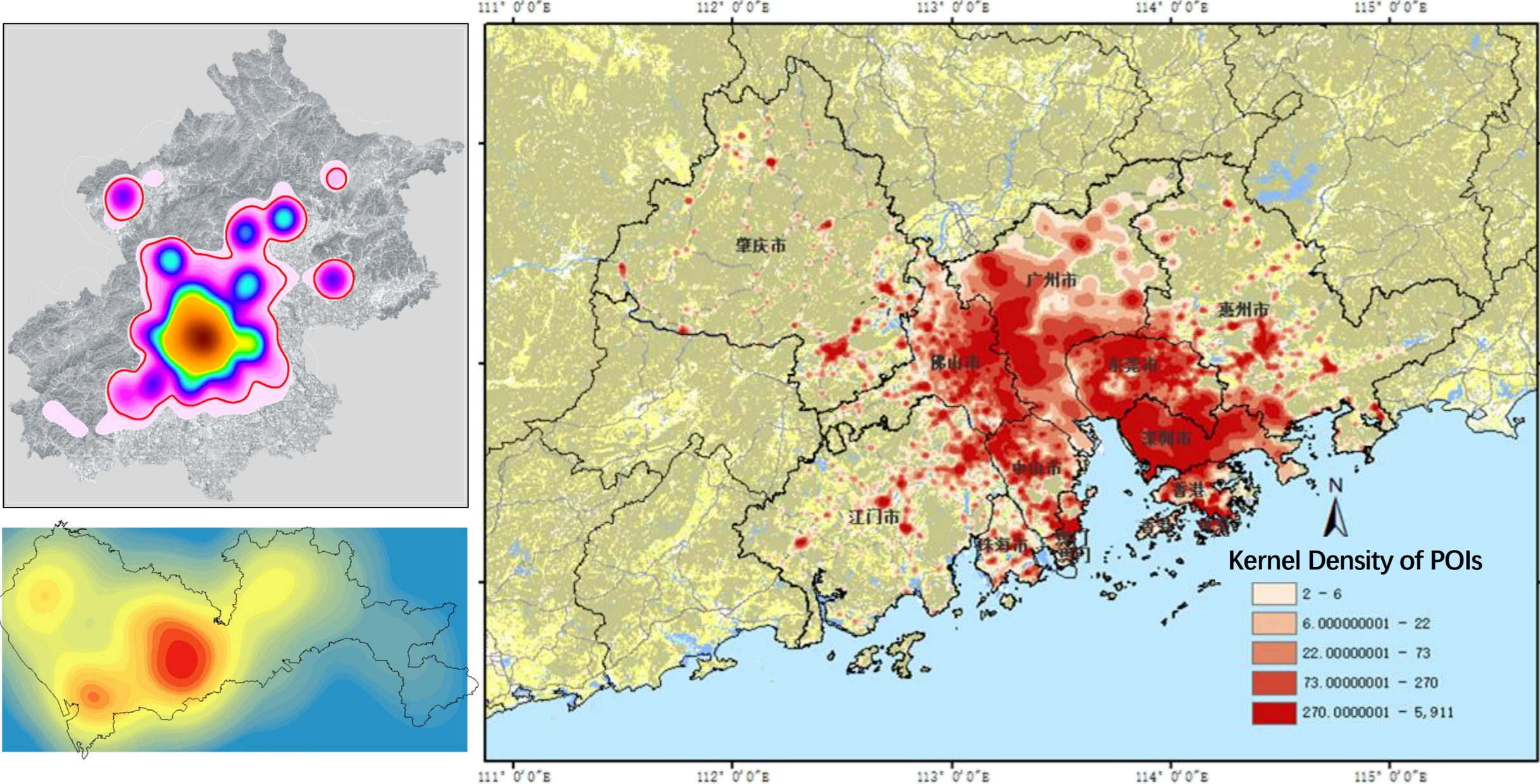


# 3D visualization: Noise abatement map (under $\beta$ -testing)



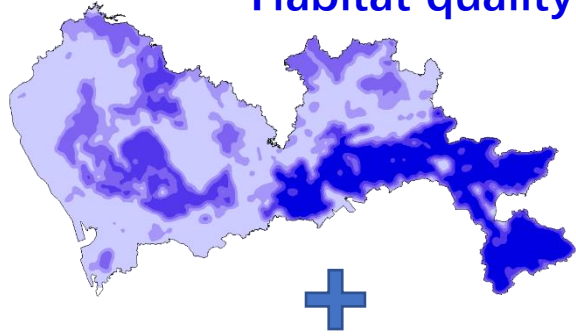


# Big data analysis: Demarcating the urban boundaries of human activity

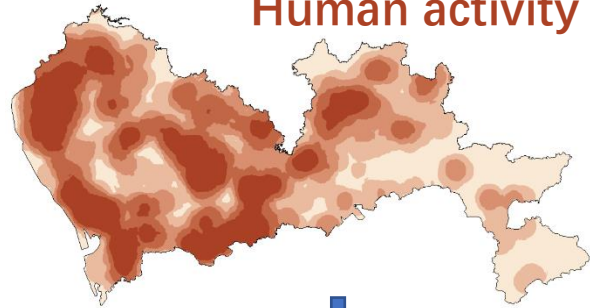


# Big data analysis: Human-bat contact probability map (under $\beta$ -testing)

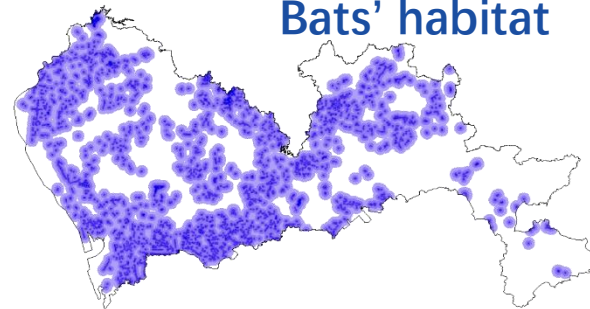
Habitat quality



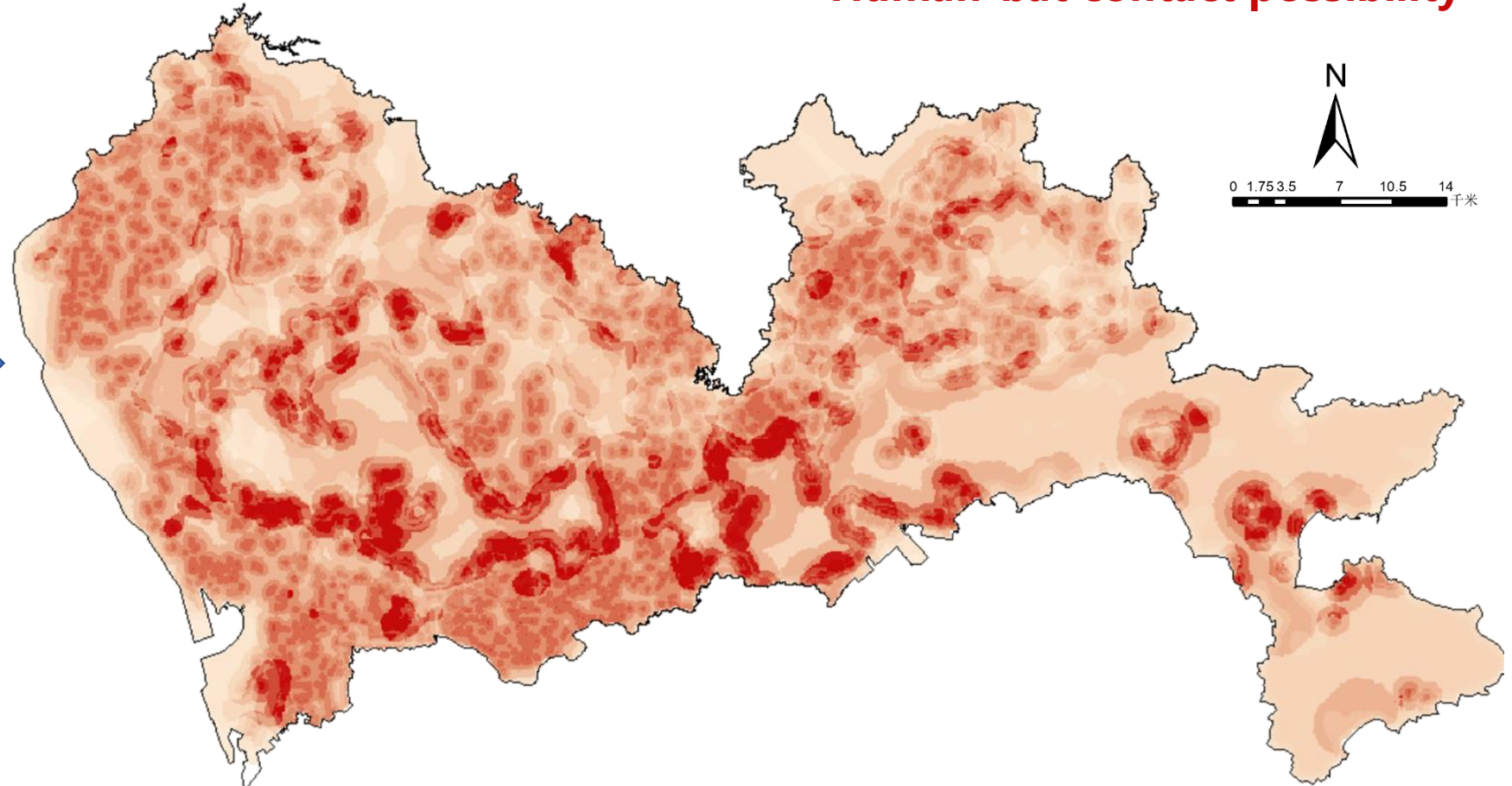
Human activity



Bats' habitat

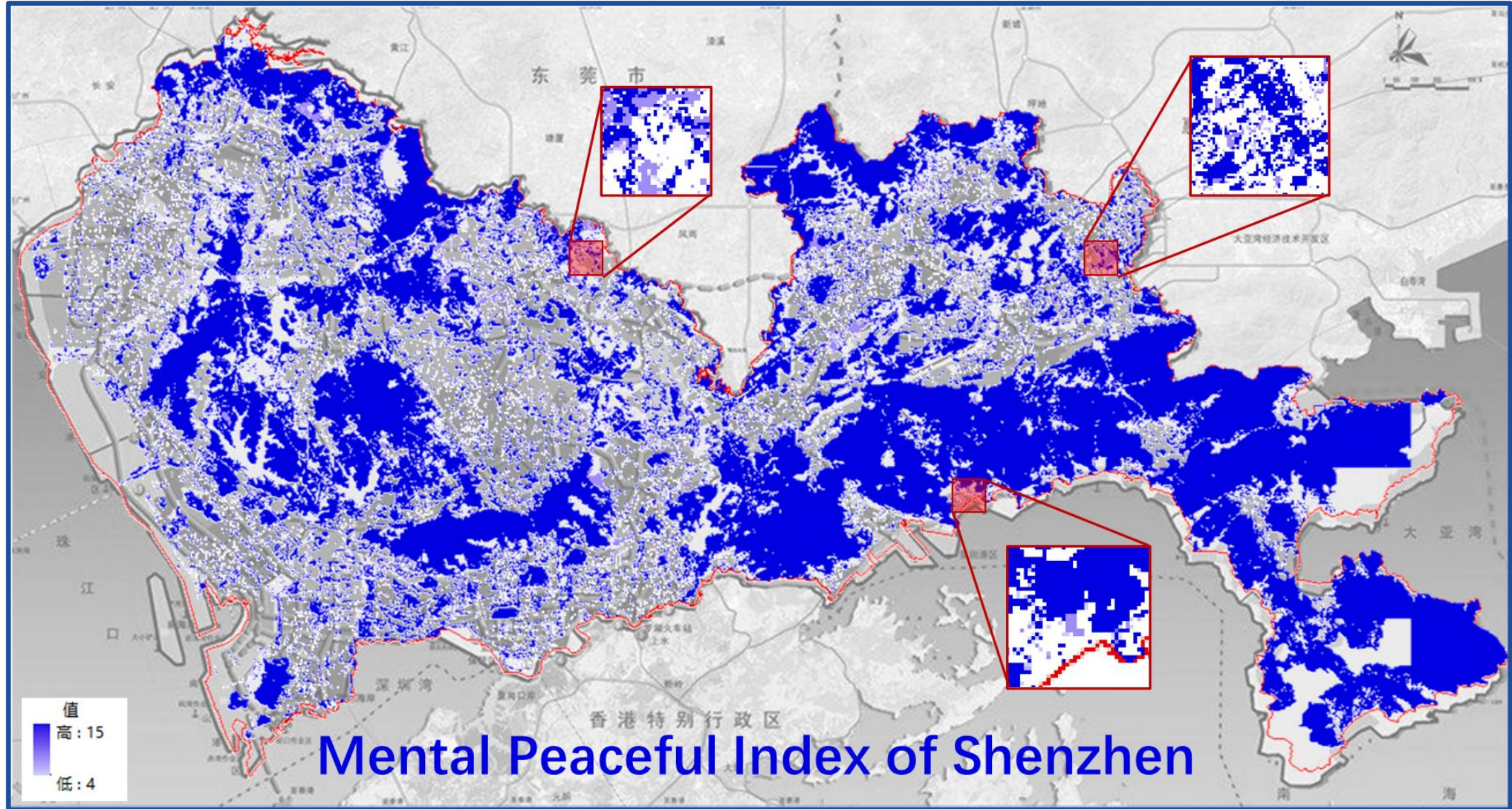


Human-bat contact possibility

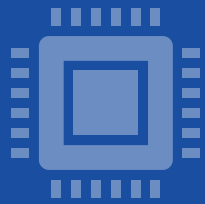


# Big data analysis: Ecosystem mental health service (under $\beta$ -test)

## Electroencephalogram(EEG) test for various vegetation cluster structures



Mental Peaceful Index of Shenzhen



Calculating



Drawing



Decision making

- for engineers
- for managers

# Output with customized layout

## Drawing for engineer

The screenshot displays the Urban Ecosystem Analysis System (UEAS) interface. The main window shows a map of a region with a pink color palette overlaid. The left sidebar contains configuration options for the map, including layer names, boundary colors, and legend settings. The right sidebar shows a layer management window with a list of layers: worldMap, maskLayer, SZ\_Boundary\_3857.shp, and sut.tif. A red arrow points to the color palette in the left sidebar, another red arrow points to the legend in the map area, and a third red arrow points to the layer management window. A blue arrow points to the map area.

城市生态分析系统 UEAS  
Urban Ecosystem Analysis System

TEST0514

简单配色展示

行政区图层:  
SZ\_Boundary\_3857.shp

行政区边界线颜色:

行政区图层边界线宽度:  
1

蒙版颜色:

蒙版透明度:  
0.5

需要配置的图层:  
sut.tif

数据字段:

渲染方式:  
渐变色

数据分级:  
等间距

分级数量:  
10

图例小数点保留位数:  
2

颜色:

图层管理

- 图层
- worldMap
- maskLayer
- SZ\_Boundary\_3857.shp
- sut.tif

22.58 - 24.00

24.00 - 25.42

25.42 - 26.84

26.84 - 28.26

28.26 - 29.68

29.68 - 31.10

31.10 - 32.52

32.52 - 33.94

33.94 - 35.36

35.36 - 36.78

沙田镇 东莞市 樟木头 新圩镇 沙田镇 北碚 长安镇 塘厦镇 惠阳区 惠阳区 上水 Sheung Shui 大埔区 Tai Po District 新界 New Territories 馬鞍山 Ma On Shan 屯門 Tuen Mun

IUEMS2020

Add the background geo-info,

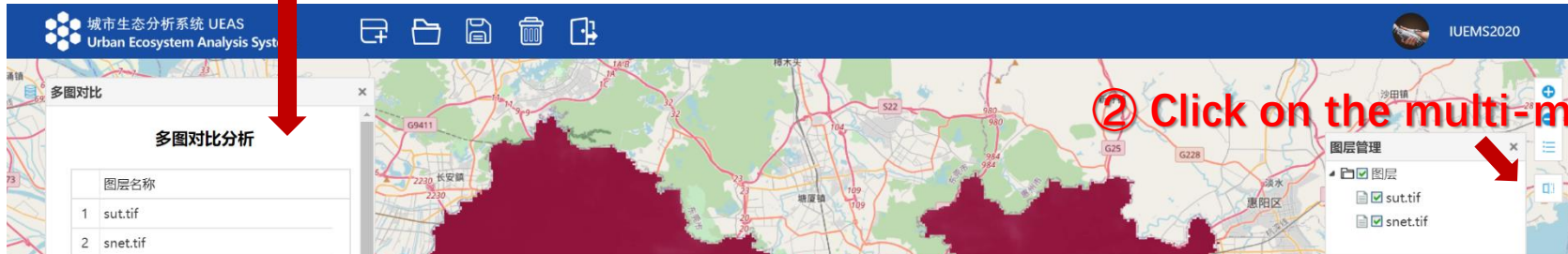
Change the size and legend

Select the color pallet

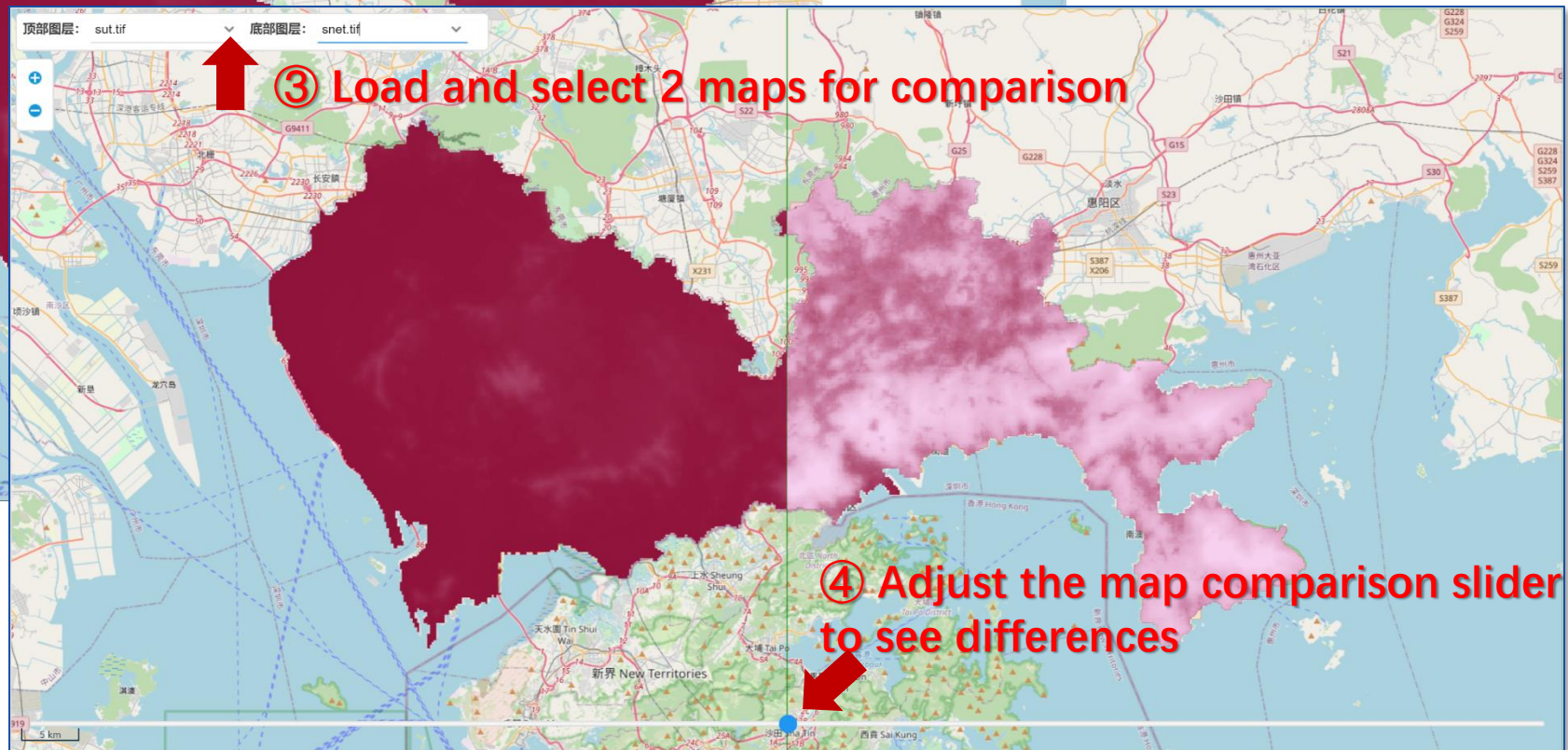
# Output for scenario comparison

## Drawing for decision maker

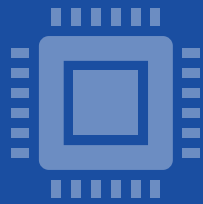
① Load 2 or more maps (different land-use scenarios) and then choose the color scheme



② Click on the multi-map selection button



④ Adjust the map comparison slider to see differences



Calculating



Drawing

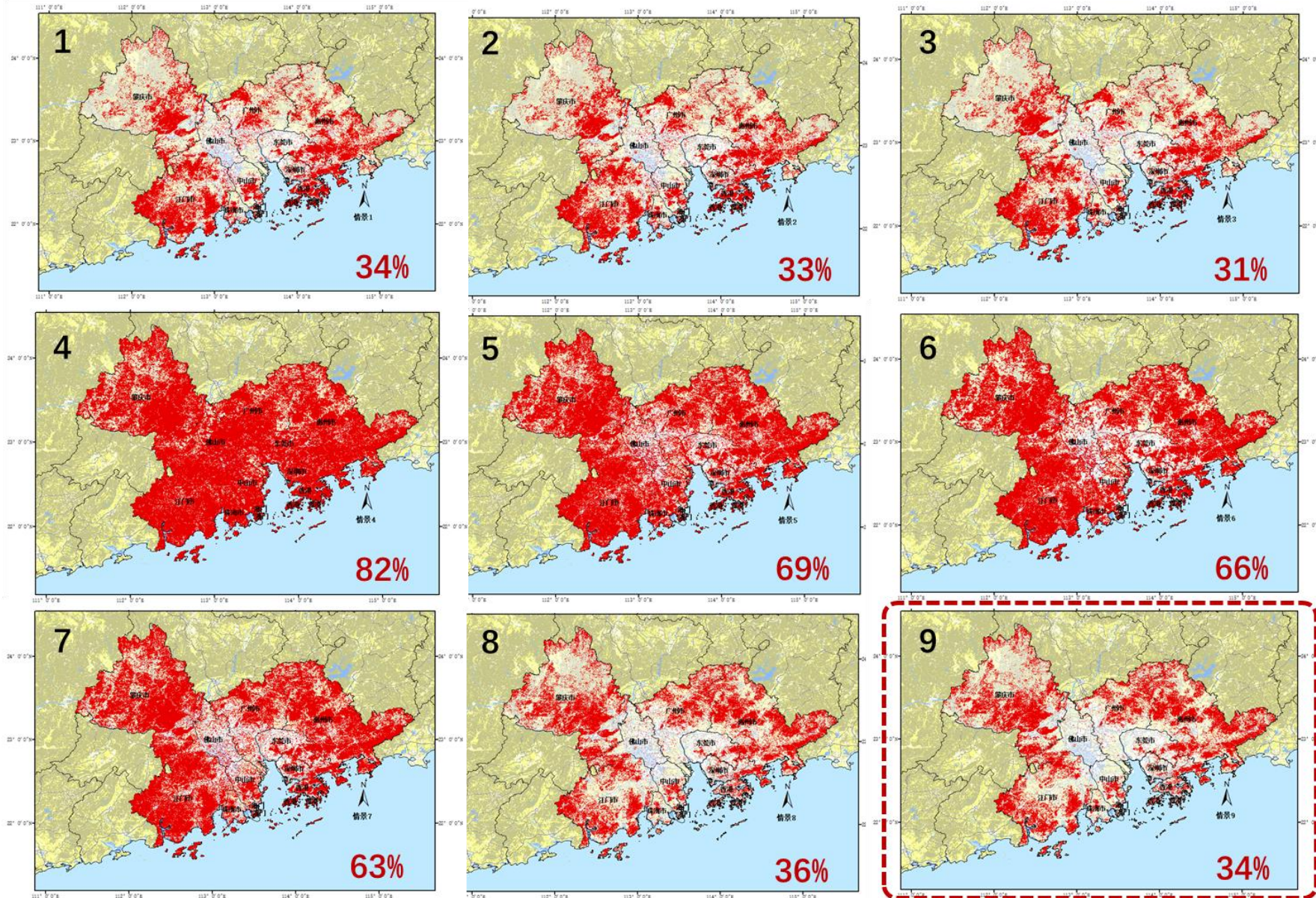


Decision making

- Marginal benefit analysis
- Scenario comparisons
- One-click version for government

# Software platform application – Selecting ecological protection spaces for optimal benefits

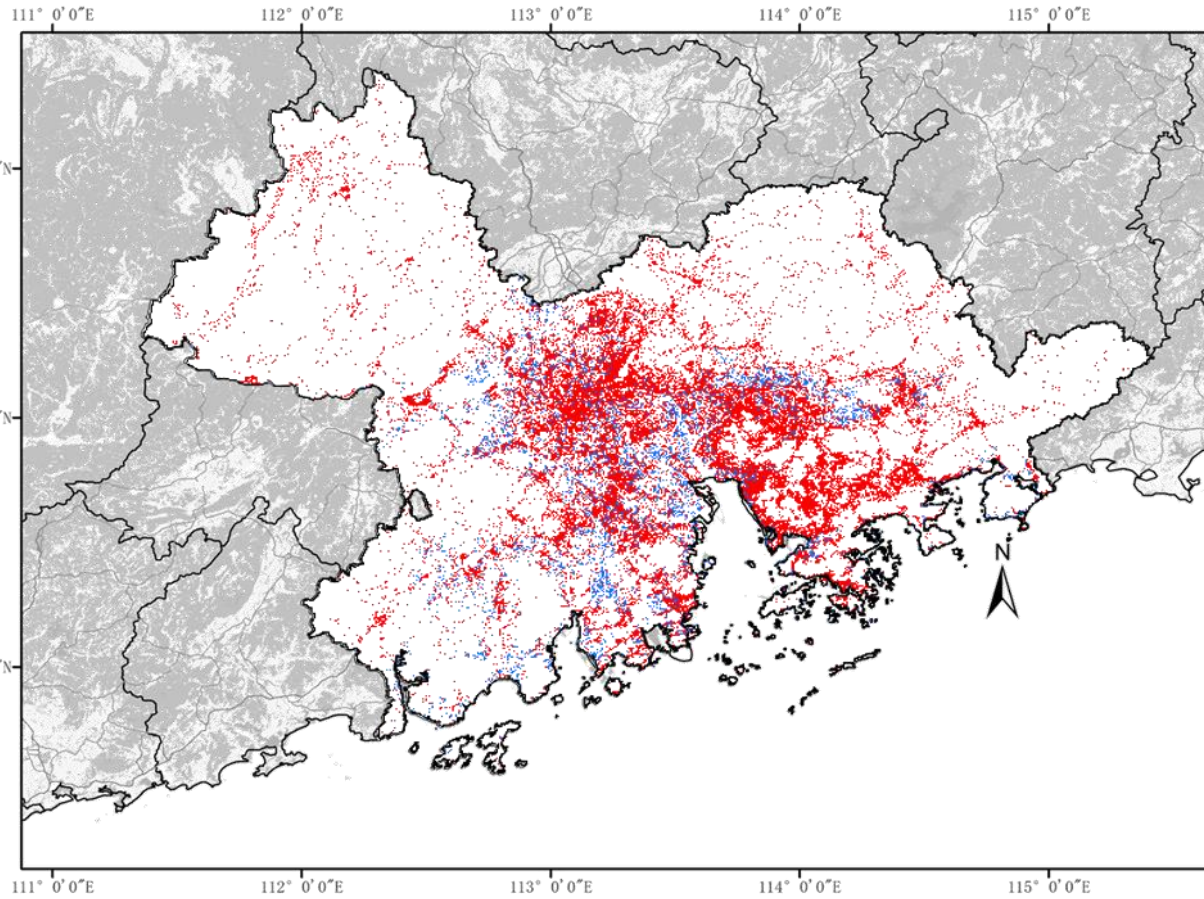
Scenarios	Description
<u>Scen. 1</u>	<b>Intersection of each ES's first 30% part (cumulative)</b>
<u>Scen. 2</u>	First 30% of ES (cumulative) take out built-up area, <b>Take out patch &lt; 1 ha</b>
<u>Scen. 3</u>	First 30% of ES (cumulative) take out built-up area, <b>Take out least important 5%</b>
<u>Scen. 4</u>	<b>First 50% of ES (cumulative)</b>
<u>Scen. 5</u>	First 50% of ES (cumulative) take out built-up area, <b>Take out patch &lt; 1 ha</b>
<u>Scen. 6</u>	First 50% of ES (cumulative) c take out built-up area, <b>Take out least important 5%</b>
<u>Scen. 7</u>	First 50% of ES (cumulative) <b>2 ESs elasticity &gt; 1</b> take out built-up area, Take out patch < 1 ha.
<u>Scen. 8</u>	First 50% of ES (cumulative) <b>3 ESs elasticity &gt; 1</b> take out built-up area, Take out patch < 1 ha.
<u>Scen. 9</u>	First 50% of ES (cumulative) <b>3 ESs elasticity &gt; 1</b> take out built-up area, <b>Take out least important 5%</b>





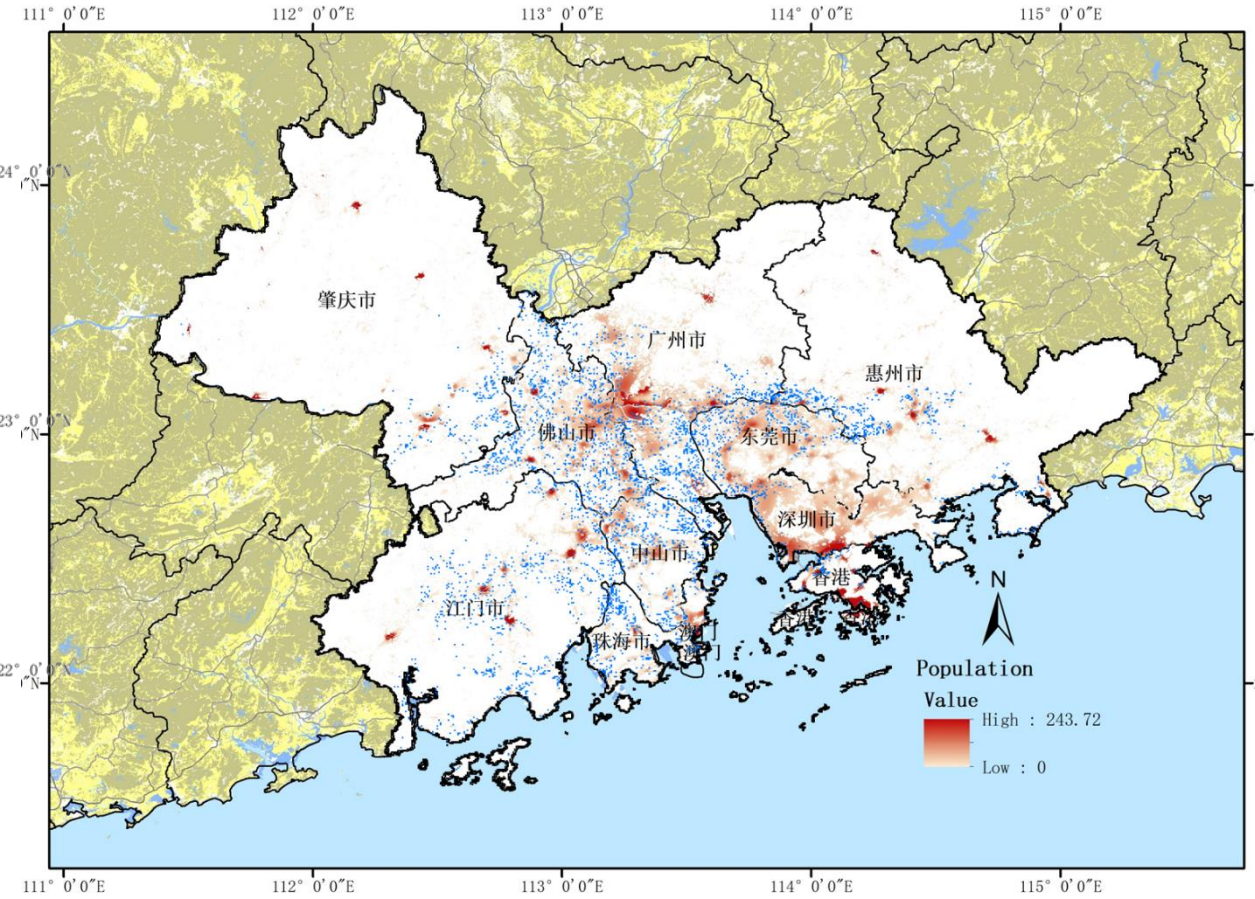
# Software platform application – Assessing ecological engineering benefits

Scenario: Under a 120-mm rainfall situation, 48-mm depth of runoff could be reduced through a nature-based solution.



Save:

**Flood-covered built-up area: 2.8 thousand km<sup>2</sup>**  
(Total built-up area: 9.1 thousand km<sup>2</sup>)



Save:

**Flood-affected population: 20.2 million**  
(Total population: 68 million)

# One-Click version for government use

IUEMS (政府版)  
Modeling for a sustainable world

深圳model4

1. 模块选择 — 2. 数据分配 — 3. 生成数据单表 — 4. 开始计算

热岛效应缓解  
Heat-island relieving  
功能量 价值量

减少泥沙淤积  
Reduce silting  
功能量 价值量

固碳释氧(NPP)  
Carbon sequestration  
Oxygen release  
功能量 价值量

气候调节(温度)  
Climate maintain  
功能量 价值量

水源涵养  
Water conservation  
功能量 价值量

空气净化(合规)  
Air purification  
功能量 价值量

水体自净(合规)  
Water purification  
功能量 价值量

径流分析  
Runoff analysis  
功能量

下一步

# Select

# 1

IUEMS (政府版)  
Modeling for a sustainable world

深圳model4

1. 模块选择 ✓ — 2. 数据分配 ✓ — 3. 生成数据单表 — 4. 开始计算

办公区  
网址: http://119.3103473125849hfjknacjnfelowhfocnklrv,d=Blngf 用户名: dept1 密码: password 完成度: 3/5

统计局  
网址: http://119.3103473125849hfjknacjnfelowhfocnklrv,d=Blngf 用户名: dept1 密码: password 完成度: 4/5

上一步 下一步

# Upload

IUEMS (政府版)  
Modeling for a sustainable world

深圳model4

1. 模块选择 ✓ — 2. 数据分配 ✓ — 3. 生成数据单表 ✓ — 4. 开始计算

热岛效应缓解  
Heat-island relieving  
距结果约: 4/9

气候调节(温度)  
Climate maintain  
距结果约: 9/9

水源涵养  
Water conservation  
距结果约: 5/10

空气净化(合规)  
Air purification  
距结果约: 9/6

水体自净(合规)  
Water purification  
距结果约: 5/6

暴雨径流调节  
Storming runoff retention  
距结果约: 5/6

人口集聚区识别  
Identify urban boundary  
距结果约: 5/6

人口空间分布估计  
Population distribution  
距结果约: 5/6

开始运算 查看结果 生成报告

上一步 下一步

# 2

# Assign

# 4

# Click



## Applications & Practices

- Beijing ecosystem restoration performance evaluation
- Macao ecological protection zoning
- Shenzhen GEP (Gross Ecosystem Product) evaluation
- Guangdong-Hongkong- Macao bay area ecosystem restoration plan
- JTP (Joint test platform) with InVEST (Stanford University) team
- WWF (World Wildlife Fund) training for urban research



## Authorship & Partnership

<p>中国科学院 生态环境研究中心</p> <p><b>Founder RCEES, CAS</b></p>	WWF <span>U</span>	復旦大學 FUDAN UNIVERSITY <span>U</span>	西南大學 SOUTHWEST UNIVERSITY <span>U</span>	中国科学院 华南植物园 South China Botanical Garden, Chinese Academy of Sciences <span>U</span>	南京農業大學 Nanjing Agricultural University <span>U</span>	深圳市 生态环境局 <span>G</span>
	華東師範大學 EAST CHINA NORMAL UNIVERSITY <span>U</span>	北京工業大學 BEIJING UNIVERSITY OF TECHNOLOGY <span>U</span>	深圳市 环境科学研究院 <span>C</span>	濟南大學 <span>U</span>	The Nature Conservancy <span>C</span> Protecting nature. Preserving life. 大自然保护协会	重慶大學 <span>U</span>
	北京市城市规划设计研究院 Beijing Municipal Institute of City Planning & Design <span>C</span>	SAES 上海市环境科学研究院 Shanghai Academy of Environmental Sciences <span>C</span>	UPDIS Urban Planning & Design Institute of Research <span>C</span>	河南財經政法大學 HENAN UNIVERSITY OF ECONOMICS AND LAW <span>U</span>	廣東省 環境科學研究院 <span>C</span>	THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY 香港科技大學 <span>U</span>

11 U: university & research institute 7 C: consulting companies & NGOs 1 G: government

Thanks  
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