城镇建设用地扩展类型的空间识别及其意义

吴志峰

广州大学 地理科学学院

广东省生态环境与土壤研究所

内容提要

1. 目的、意义
2. 数据及研究方法
3. 结果与分析
4. 结论与展望

1 研究目的、意义

1.1 研究背景

- 整个人类社会发展的历史就是一个人口聚落与城市发展的历史。
- 城市空间形态及其演化受到自然与经济社会发展制约与驱动，同时也对“人与自然”产生重大影响。
- 城市扩展是当前城市空间形态发展的主要趋势，尤其是在经济高速发展地区，城市扩展研究是地理学、生态学和城市规划等研究领域的热点问题之一。
- 城市建设用地的大规模扩张对区域土地资源承载力与生态安全形成了巨大压力。有效识别与定量评定城市建设用地扩展类型和空间格局是城市集约、节约用地的重要前提之一。

1.2 城市扩张研究的主要方向

格局过程

遥感、GIS

驱动力

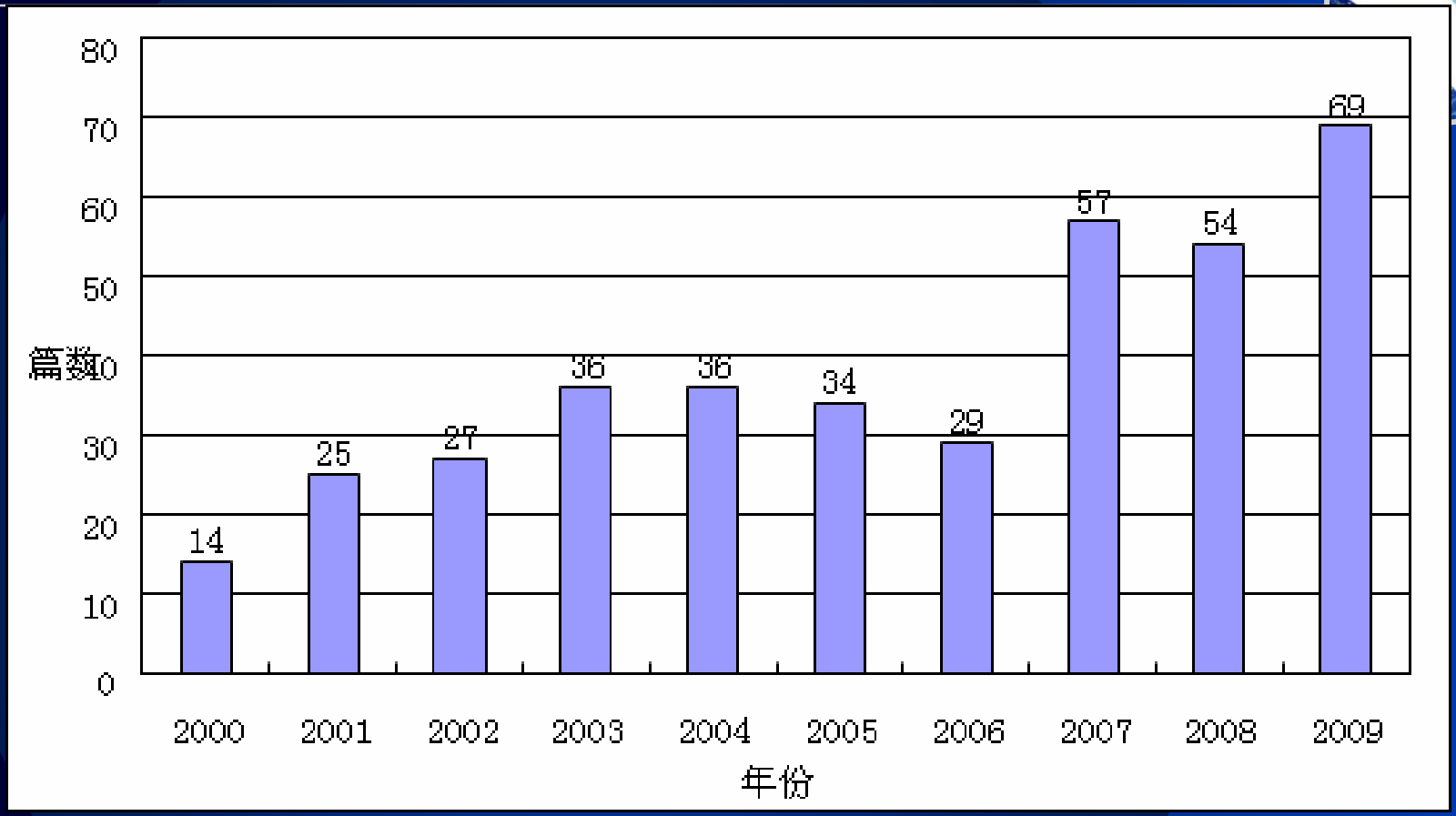
人文、社会

生态环境效应

热点、多学科

模拟预测

难点、应用



2000~2009年检索ISI标题中包含
“urban expansion”、“urban sprawl”或者“urban growth” 文献篇数

字段:国家/地区	记录数	% ，共 389	柱状图
USA	135	34.7044 %	
PEOPLES R CHINA	97	24.9357 %	
ENGLAND	19	4.8843 %	
INDIA	17	4.3702 %	
JAPAN	16	4.1131 %	
GERMANY	15	3.8560 %	
ITALY	15	3.8560 %	
CANADA	14	3.5990 %	
FRANCE	12	3.0848 %	
MEXICO	10	2.5707 %	

字段:来源出版物	记录数	% ，共 389	柱状图	将分析数据保存至文件
IEEE INTERNATIONAL SYMPOSIUM ON GEOSCIENCE AND REMOTE SENSING (IGARSS)	21	5.3985 %		
LANDSCAPE AND URBAN PLANNING	19	4.8843 %		
2009 JOINT URBAN REMOTE SENSING EVENT, VOLS 1-3	15	3.8560 %		
PROCEEDINGS OF THE SOCIETY OF PHOTO-OPTICAL INSTRUMENTATION ENGINEERS (SPIE)	10	2.5707 %		
INTERNATIONAL JOURNAL OF REMOTE SENSING	9	2.3136 %		
PHOTOGRAMMETRIC ENGINEERING AND REMOTE SENSING	8	2.0566 %		
REMOTE SENSING OF ENVIRONMENT	8	2.0566 %		
ANNALS OF HUMAN BIOLOGY	7	1.7995 %		
IGARSS 2005: IEEE INTERNATIONAL GEOSCIENCE AND REMOTE SENSING SYMPOSIUM, VOLS 1-8, PROCEEDINGS	7	1.7995 %		
AMERICAN JOURNAL OF AGRICULTURAL ECONOMICS	5	1.2853 %		

With millions of farmers each year moving to its burgeoning cities, China is searching for novel ways to expand urban areas while conserving natural resources

CHINA'S LIVING LABORATORY IN URBANIZA

CHONGMING ISLAND, CHINA—Standing in a sea of marsh grass at the eastern tip of Chongming Island, in the mouth of the Yangtze River, it's easy to forget that this wilderness lies within the boundaries of Shanghai municipality. Tidal mud flats, feeding grounds for migratory birds on the East Asian–Australasian Flyway, reach toward the East China Sea as far as the eye can see. A million shore birds pass through every year, including the endangered black-faced spoonbill. To the west, scattered sparsely across the 1041 square kilometers of Chongming, the world's largest alluvial island, are villages, paddies, and orchards.

Shanghai is about to burst another seam and spill onto this peaceful isle. A bridge-tunnel link scheduled for completion in 2009 will turn a torturous 3-hour car-and-ferry trip from downtown—just over the horizon to the south—into a 30-minute commute. And with well over 300,000 new residents each year swelling one of the world's biggest cities—Shanghai has more than 17 million inhabitants—development of Chongming's wide-open spaces is inevitable.

Shanghai is hoping to show that development can be environmentally responsible with the world's first "carbon neutral" city, in which carbon emissions would be completely offset by carbon absorption. Construction of Dongtan Eco-city will begin early this year on land adjacent to Chongming's wetlands. Dongtan's backers hope it will offer a new model that contrasts with China's haphazard urbanization of the past 2 decades. Some planners familiar with practices here, however, wonder if Dongtan's ambitious aims can be fully realized.

Dongtan is one of a half-dozen or so eco-cities on the drawing boards as Chinese leaders cope with one of the fastest urbanization rates in the world. The leadership now realizes that unchecked urban sprawl threatens the country's environment and security, says Niu Wenyuan, chief scientist of China's sustainable development strategy program and a counselor of the State Council. As a result, he says, the country is striving for three "zero net-growth rates": the population by 2020, urban energy consumption by 2035, and urban ecological degradation by 2050. "We still have a long way to go," Niu said at the first Xiamen International Forum on Urban Environment in Xiamen, China, last November.

This may be China's last chance to get urbanization right, says Qiu
minister of construction. "If
the wrong [urbanization] mod
will [impact] the entire world."

Much of the developing w
izing rapidly, but China's s
make the stakes here higher.
670 cities, up from 69 in 19
1980. According to United N
tics, China has 15 of the world
growing cities with a popula
lion or more (based on popu
between 1950 and 2000); Ind
list, has eight. China has 89
population of a million or mo
States has 37 and India 32.

The government estimate
China's population now lives
that figure does not include
ers registered as residing in
they are included, "China's
tion rate is already around 50
Wei, an urban economics
Tsinghua University in Beiji
some 60% of the populatio
cities, according to governm
Each year, about 12 million
to cities, Niu says: "The big

Published by AAAS

国际上对中国城市化与农地流失持续关注

Landsat reveals China's farmland reserves, but they're vanishing fast

Sir—We have compared the official estimates of agricultural land and rates of agricultural land conversion with those derived from Landsat thematic mapper satellite images for 10 counties in the Pearl River Delta, which is one of the fastest-developing regions in China. Ground-based field assessments verify the high accuracy of our techniques in estimating the area of agricultural land and its change through time[1,2].

Our results indicate that there is significantly more agricultural land than reported in official statistics[3]. Although this under-reporting is well documented[4], particularly using coarse resolution (1-km) satellite data sets[5], our study is the first to use high-resolution satellite imagery to quantify this bias.

Satellite-derived estimates of total agricultural area in the ten counties for 1990 is 6,724 km^2—this is 115% greater than the 3,119 km^2 reported in government yearbooks (Fig. 1a). Similarly, satellite-derived estimates for the total area of agricultural land converted to other uses between 1990 and 1996 is about 11% greater than the 789 km^2 reported in statistical yearbooks (Fig. 1b).

One interesting effect is that while the satellite-based method estimates more overall conversion of agricultural land, the fraction of the agricultural land converted is smaller than official estimates.

With the world's largest population and one of the fastest-growing economies, China's ability to feed itself has important domestic and international implications. Agricultural self-sufficiency is a concern because economic development is rapidly converting China's small per-capita stock of agricultural land to other uses[6,7]. Analyses of the severity of this problem are based largely on official statistics for the stock of agricultural land and its rate of conversion, but these statistics may be biased by institutional factors.

Starting with the Great Leap Forward in 1958, Chinese farmers have had strong incentives to understate the extent of their agricultural land. Grain quotas were based on agricultural acreage, so understating agricultural area reduced the quota a farmer was expected to provide.

Although this production quota has been eliminated, farmers still have incentives to understate their agricultural land. A 1985 moratorium in the region limited the amount of agricultural land converted for other uses. This directive, together with a desire to evade taxes on land leased for commercial purposes, causes farmers to understate the area of agricultural land that has been converted to other uses.

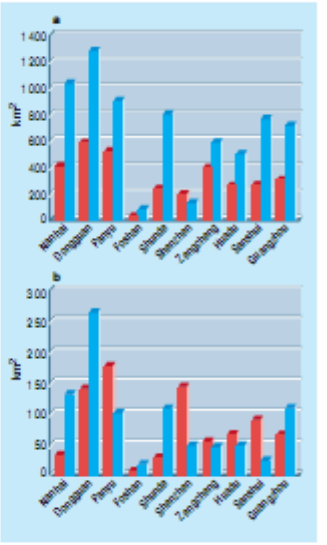


Figure 1a, Estimates of agricultural land in 10 counties of the Pearl River Delta, 1990, derived from satellite imagery (blue) and official yearbooks (red). **b,** Estimates of agricultural land conversion from 1990 to 1996 in 10 counties of the Pearl River Delta, derived from satellite imagery (blue) and official yearbooks (red).

Despite this under-reporting, we are not suggesting that the satellite-derived estimates are unbiased. Remote-sensing estimates may overestimate the amount of agricultural land because the resolution of the imagery (30 × 30 m) is too coarse to differentiate among small irrigation ditches, dirt paths and the other types of land use that co-exist with agriculture. Moreover, remote-sensing and government classification regimes of agricultural land may differ.

Our conclusion that there is more agricultural land than reported does not eliminate concern about the loss of agricultural land associated with rapid rates of economic development. Indeed, our results indicate that more agricultural land is being converted than reported.

Our results do, however, indicate that analysts must exercise caution when they use official statistics of agricultural land area and rates of loss to assess future rates of agricultural production in China.

Karen C. Seto, Robert K. Kaufmann, Curtis E. Woodcock

Department of Geography, Boston University, 675 Commonwealth Avenue, Room 141E, Boston, Massachusetts 02215, USA

1. Seto, K. C. *et al. Int. J. Remote Sensing* (submitted).
2. Kaufmann, R. K. & Seto, K. C. *Agriculture, Ecosystems and*

1.3 具体研究目标

- 建立一种在空间上有效识别城市建设用地扩张类型简便方法。
- 在遥感与GIS技术支持下，对研究区1979～2005年间不同阶段的城市建设用地扩展类型进行定量空间识别 。
- 探讨城市化水平和交通条件等因素对城市建设用地扩展类型的影响。

2 数据与研究方法

2.1 研究区域

2.2 数据源

- 东莞市DEM数据；
- 美国陆地卫星Landsat TM/MSS图像，行列号为122/44：
  - 1979年10月19日获取的MSS图像
  - 1990年10月13日获取的TM图像
  - 1995年12月30日获取的TM图像
  - 2000年09月14日获取的TM图像
  - 2005年11月23日获取的TM数据
- 东莞市行政区划图、土地利用现状图；
- 其他数据：主要包括经济、人口等统计数据。

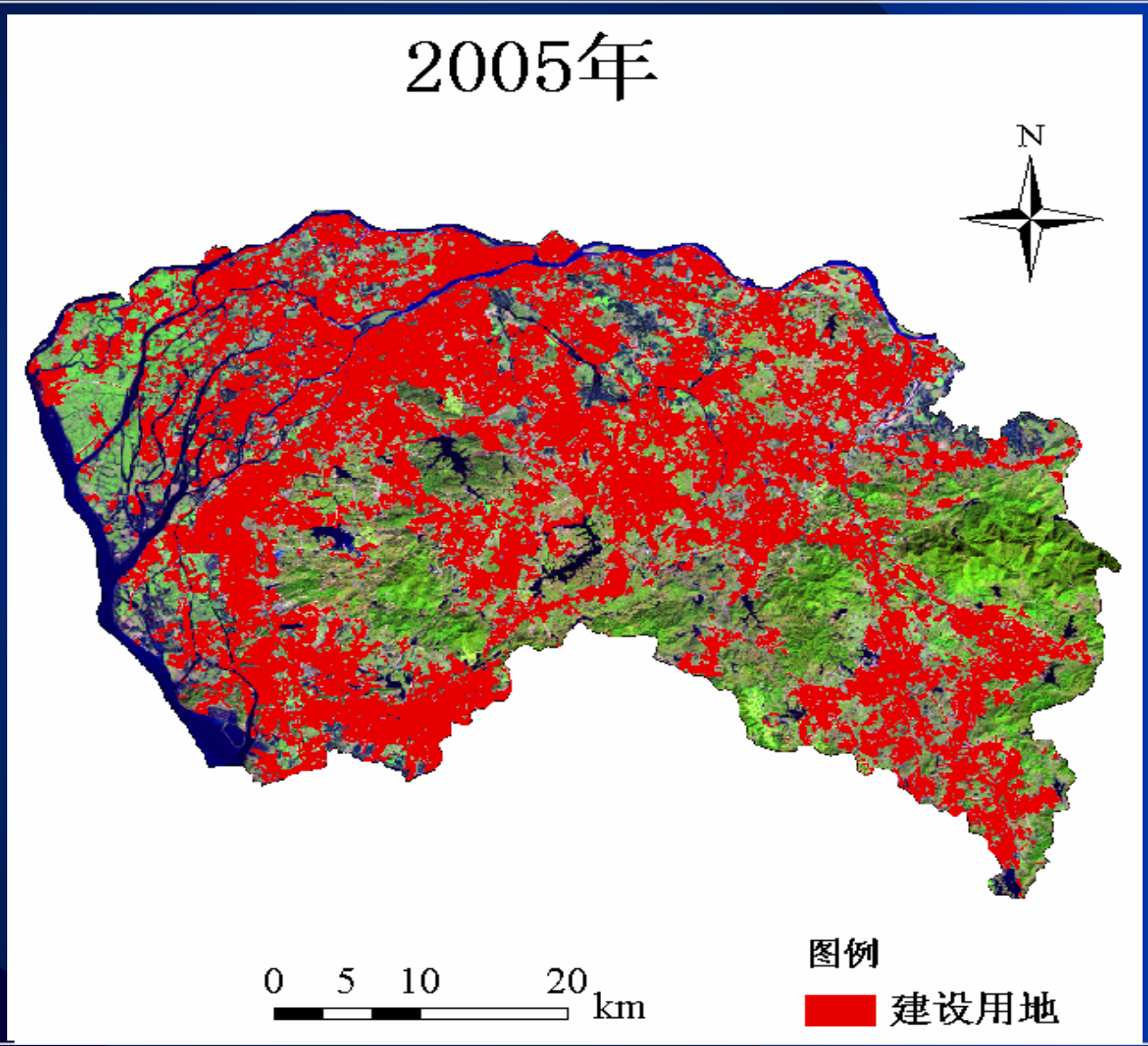
2.3 研究方法

- GIS与遥感：作为数据获取、处理及空间分析的主要技术手段与工具；
- 空间拓扑运算方法：基于地理实体间的拓扑空间关系，通过空间拓扑运算的方法识别出三种建设用地扩展类型；
- 其它方法：结合时间序列分析、统计分析方法，定量分析城镇建设用地扩展的时空规律及扩展过程。

建设用地遥感分类结果的精度评估

土地利用类型	1979 年	1990 年	1995 年	2000 年	2005 年
建设用地	0.91	0.95	0.92	0.94	0.92
耕地	0.71	0.82	0.78	0.80	0.83
总体精度	0.75	0.79	0.81	0.91	0.84

各年份城镇建设用地分类结果图



城镇建设用地扩展类型识别方法

Clementini *et al*，1993

城镇建设用地扩展类型识别方法

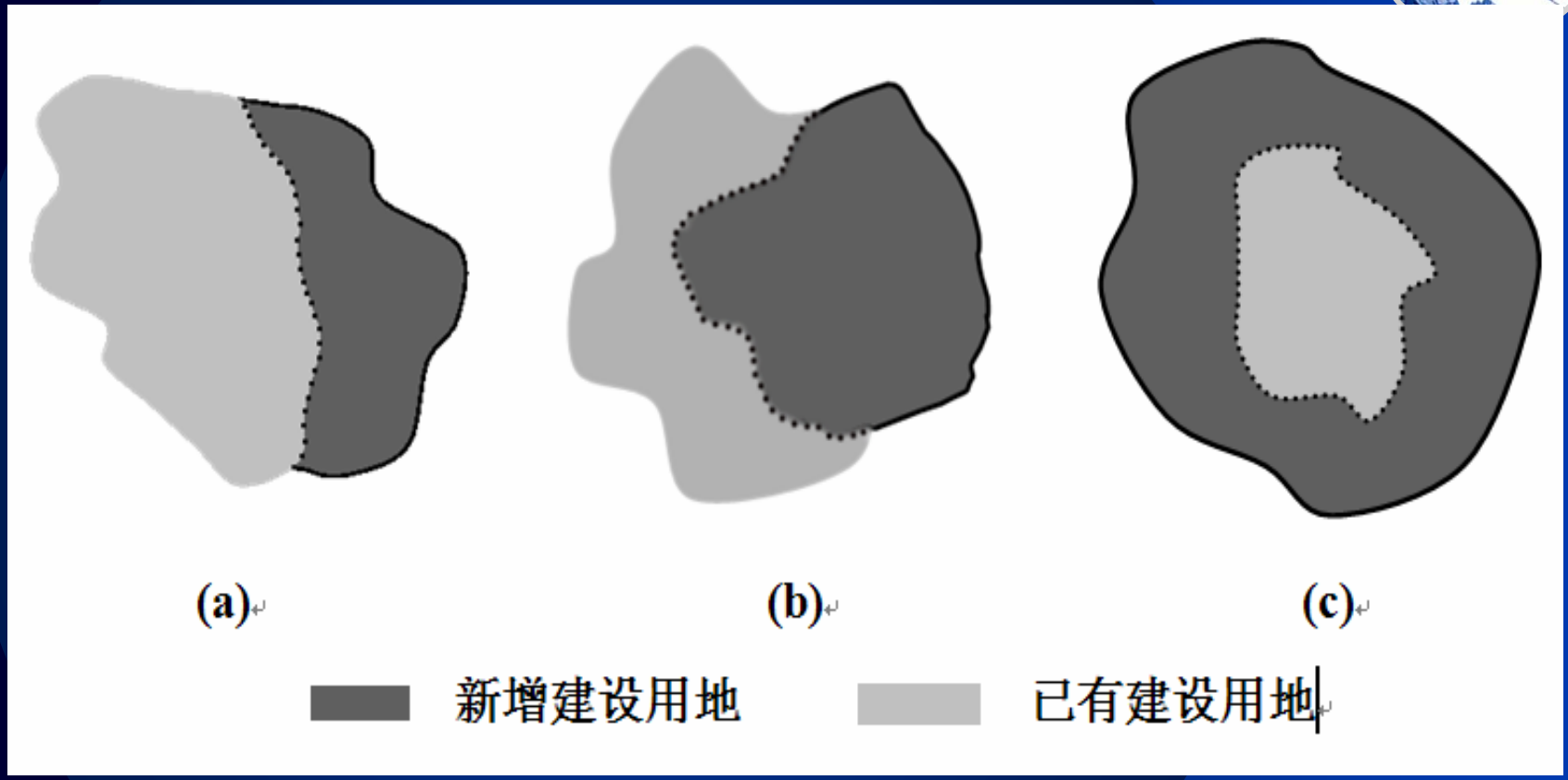
$$S = L_c / P$$

***Lc*：** 新增建设用地斑块和已有建设用地斑块之间公共边界的长度；

***P*：** 新增建设用地斑块的周长。

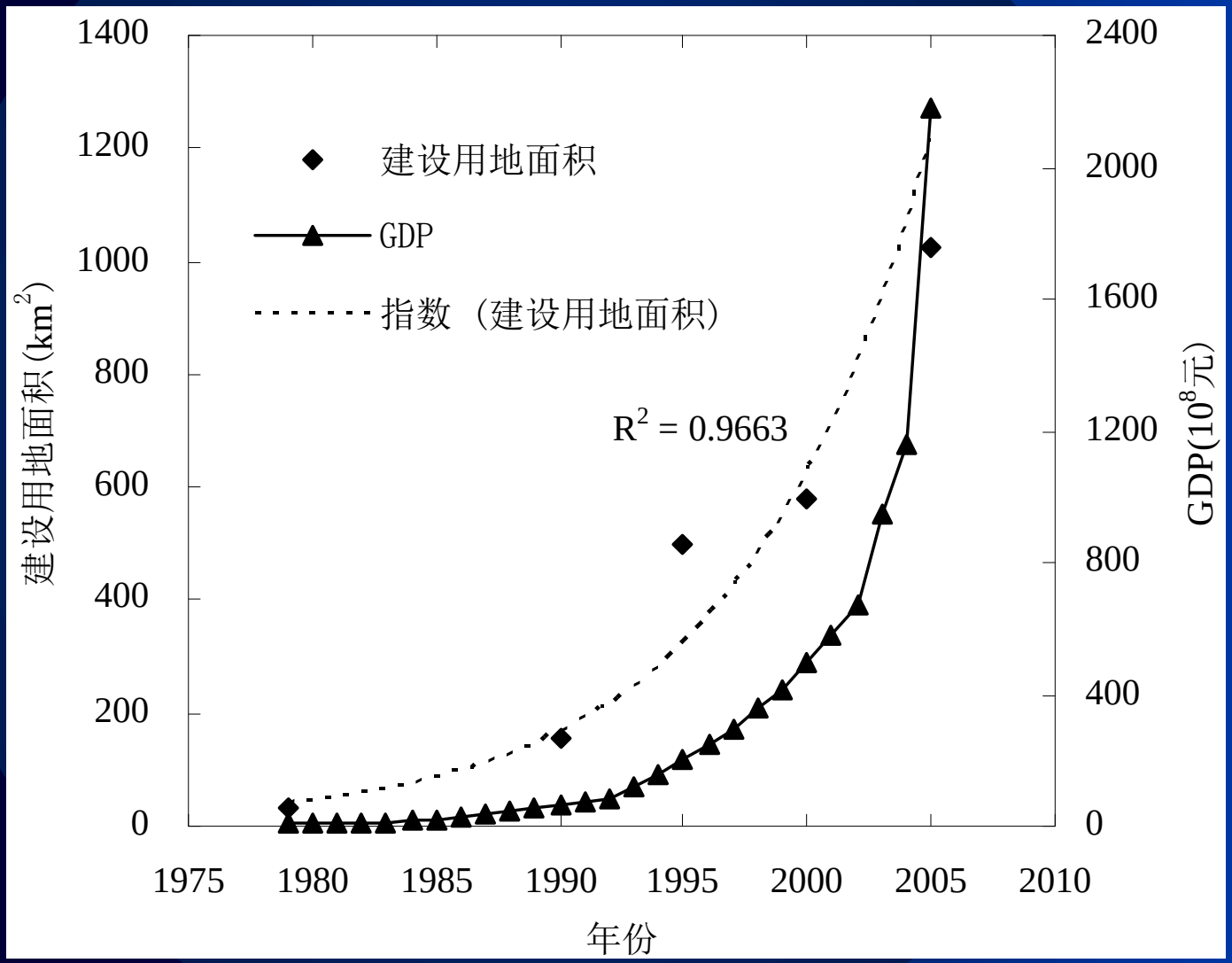
- 比值S =0，为跳跃式扩展；
- 0< S <0.5，为外延型扩展；
- 比值$S \geqslant 0.5$，为填充式扩展。

城镇建设用地空间扩展类型示意图

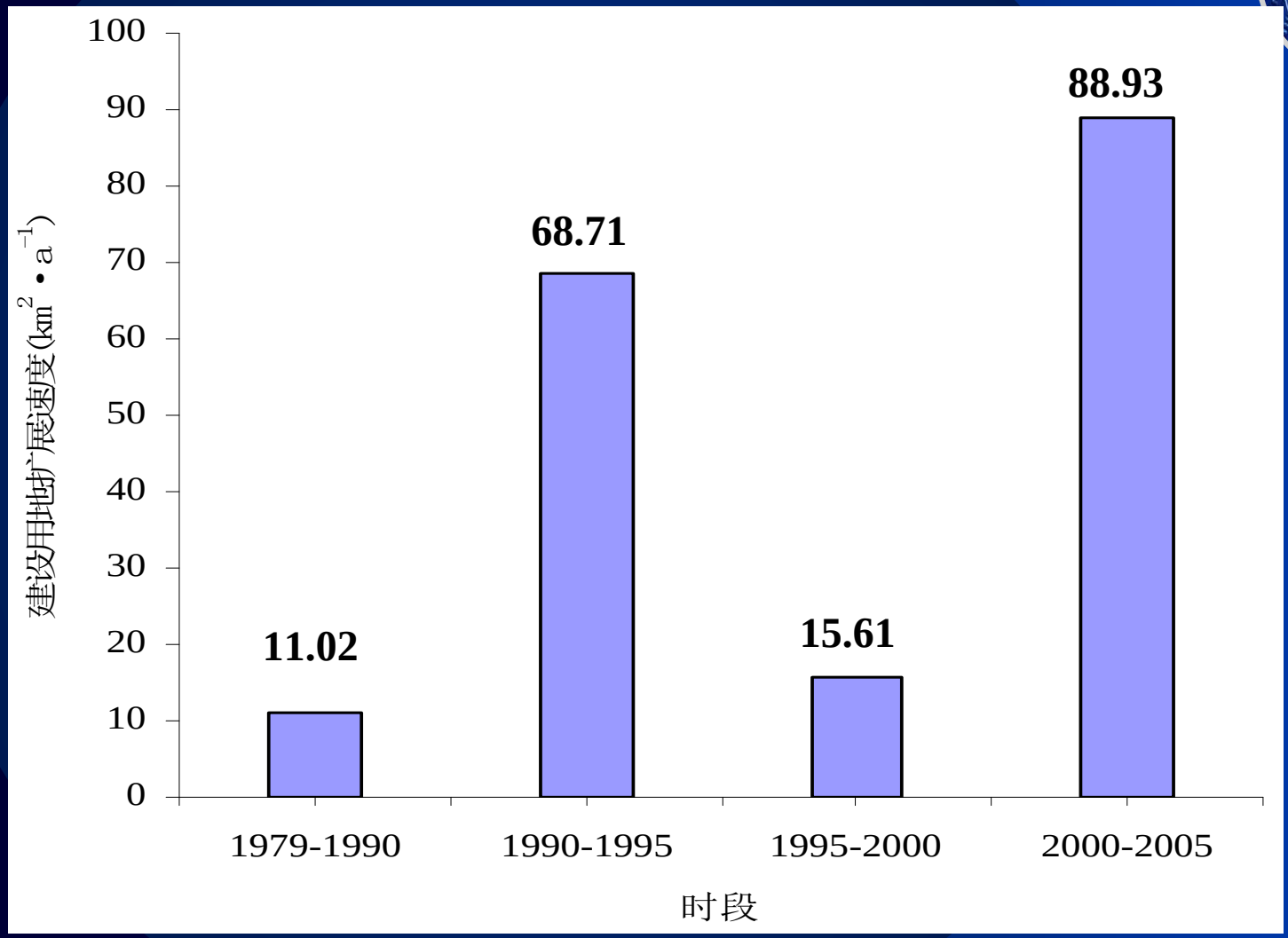


3 结果与分析

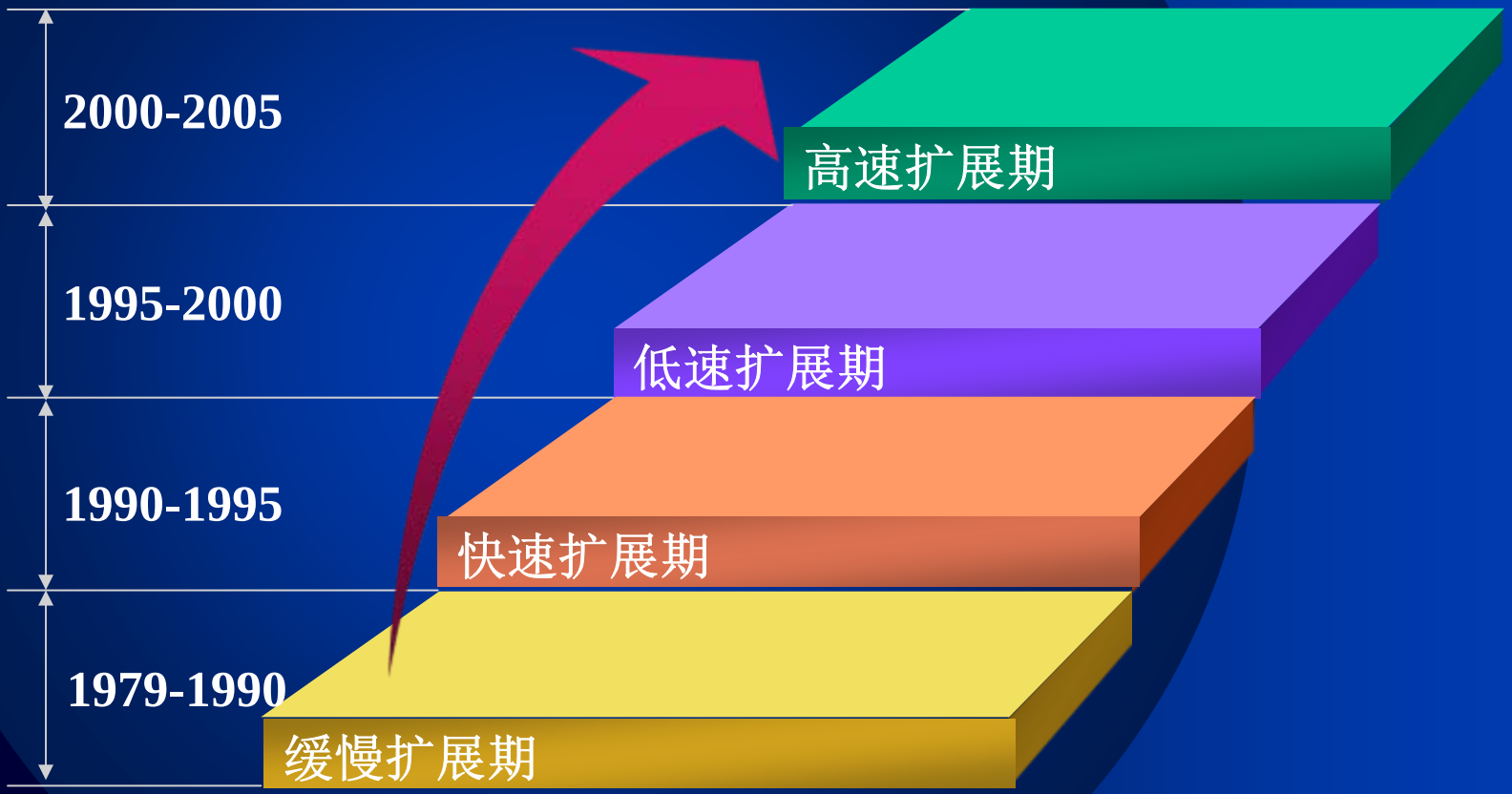
东莞市城镇建设用地面积及GDP变化



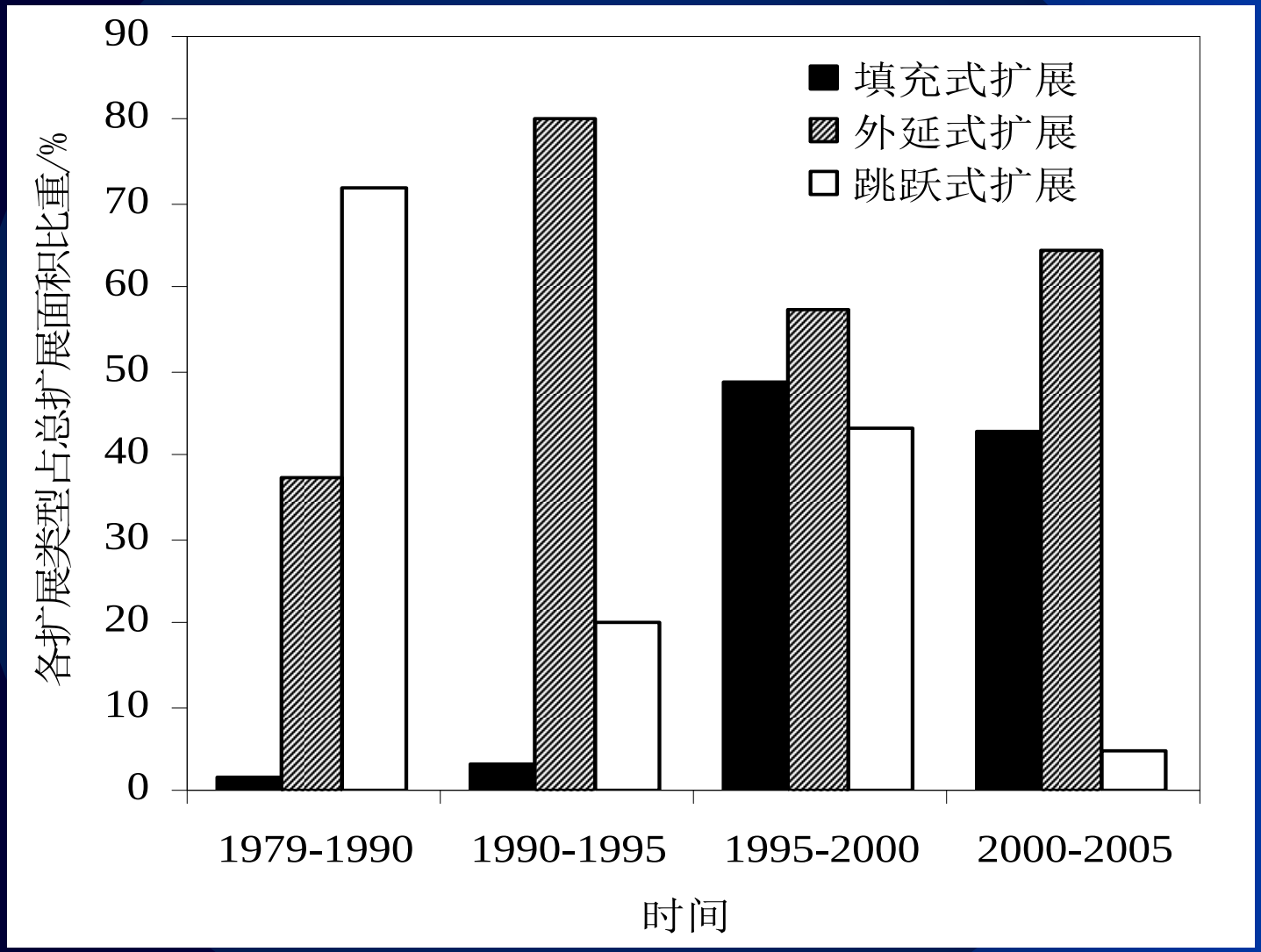
各时段城镇建设用地扩展速度



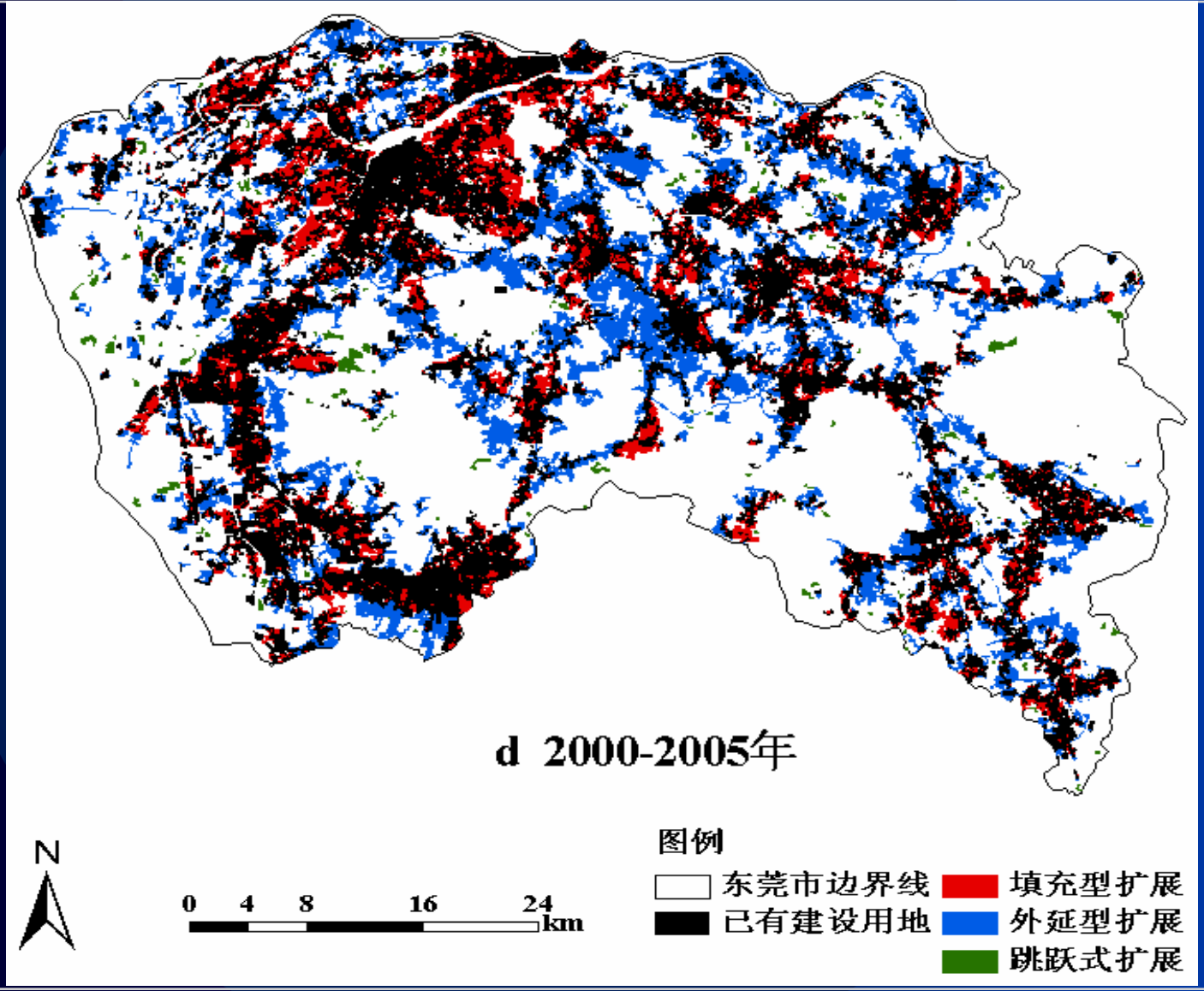
城镇建设用地扩展的阶段性特征



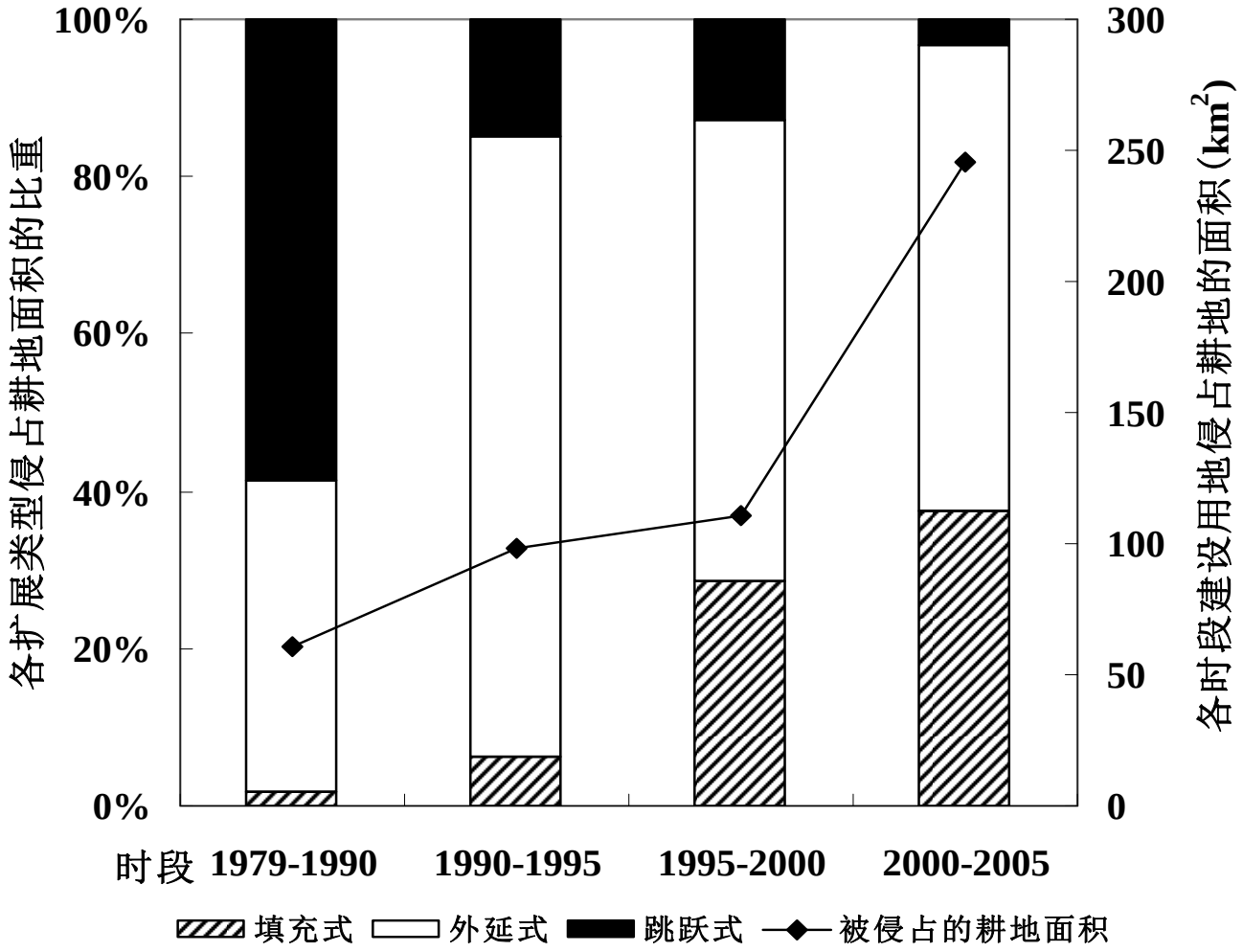
各时段内三种扩展类型占扩展总面积比重



城镇建设用地扩展类型的时空演变特征



各时段建设用地侵占耕地的面积及各扩展类型侵占耕地面积的比例



4 结论与展望

结论 1

- 1979-2005年间，东莞市建设用地扩展类型的变化反映出该市的扩张经历了“跳跃式分散-外延式集聚-混合式扩散-外延式集聚”的一般过程；早期以跳跃式扩展占主导地位；后期，在严格土地管理政策、制度以及城市地域空间限制的影响下，跳跃式扩展比例下降而填充式扩展比例增大。

结论 2

- 从空间分布上看，东莞市建设用地扩展交通引导效应十分明显。这种效应主要体现在建设用地扩展的交通轴线导向性突出，城镇建设用地沿高速公路、国道、铁路等主要交通干线，从呈多中心向外围，逐渐形成块状组团状扩展。

结论 3

- 跳跃式的扩展类型是侵占耕地的主导因素。在整个研究时期内，跳跃式扩展类型和填充式扩展类型所侵占的耕地面积变化趋势相反，跳跃式扩展类型致使城镇用地结构分散，为填充式扩展类型的产生提供了可能性。

珠三角传统农业景观与现代城市化景观

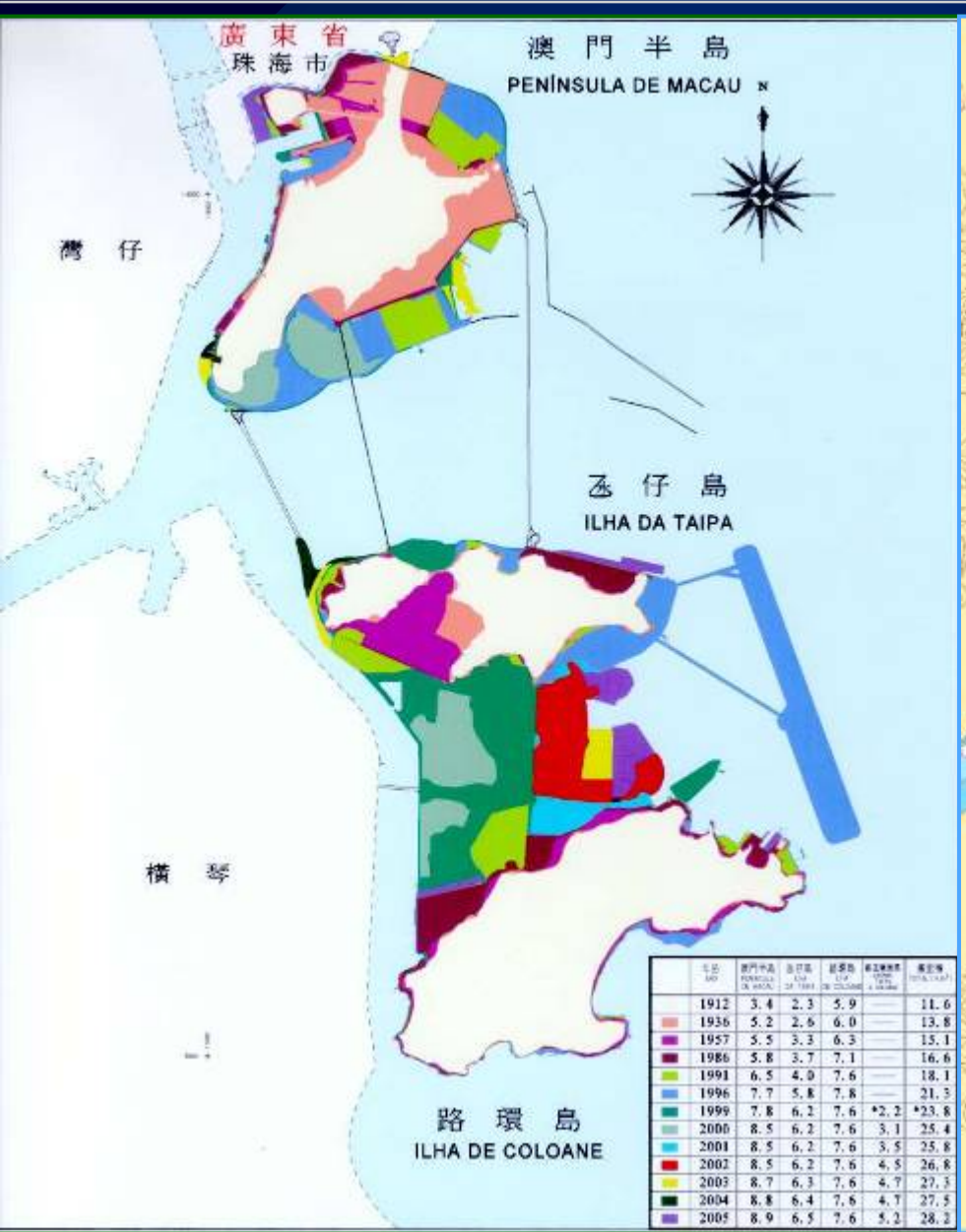
桑基鱼塘(Sang Ji Yu Tang)

Traditional agricultural landscape: dike-pond wetland

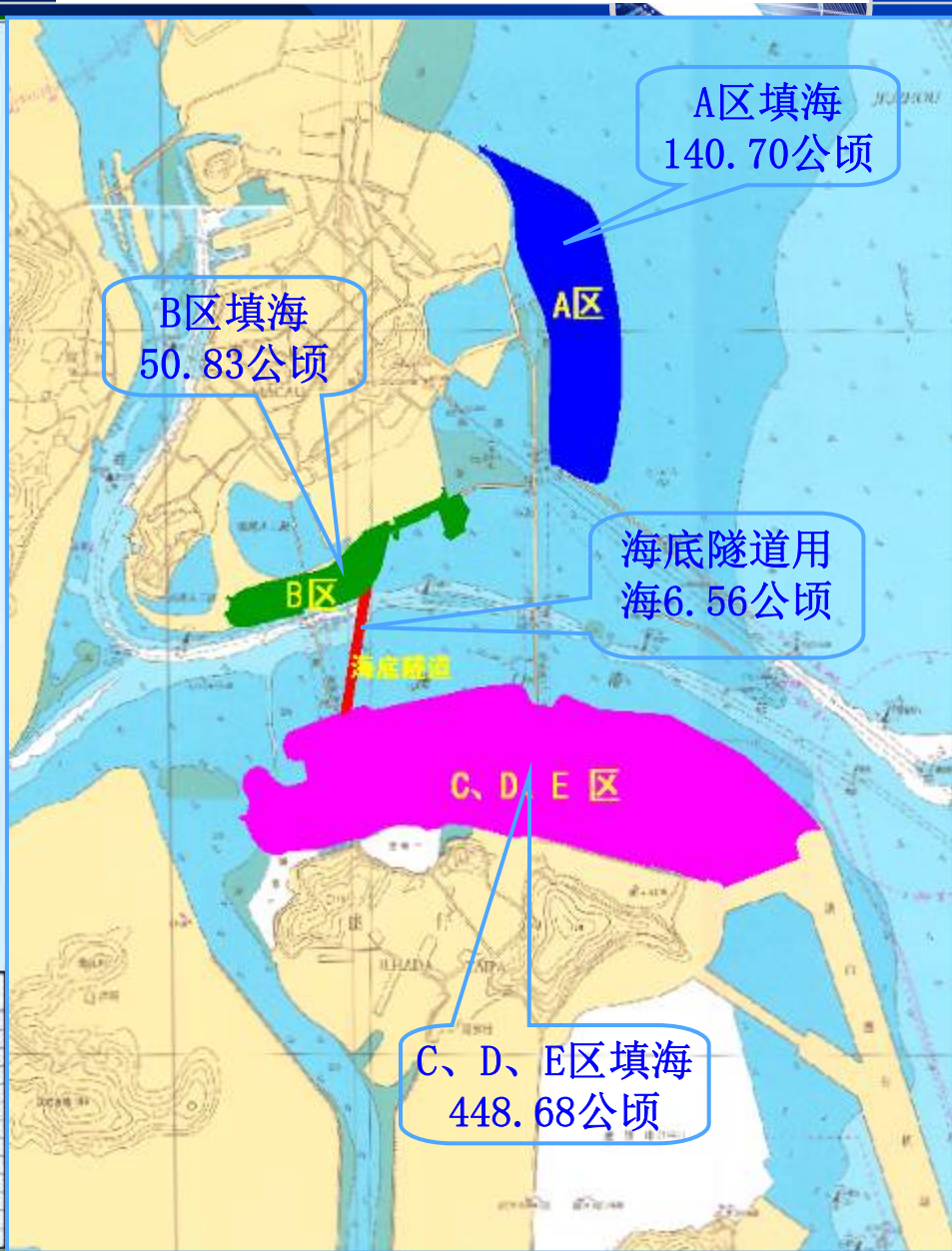
Fast speed urbanization landspcape

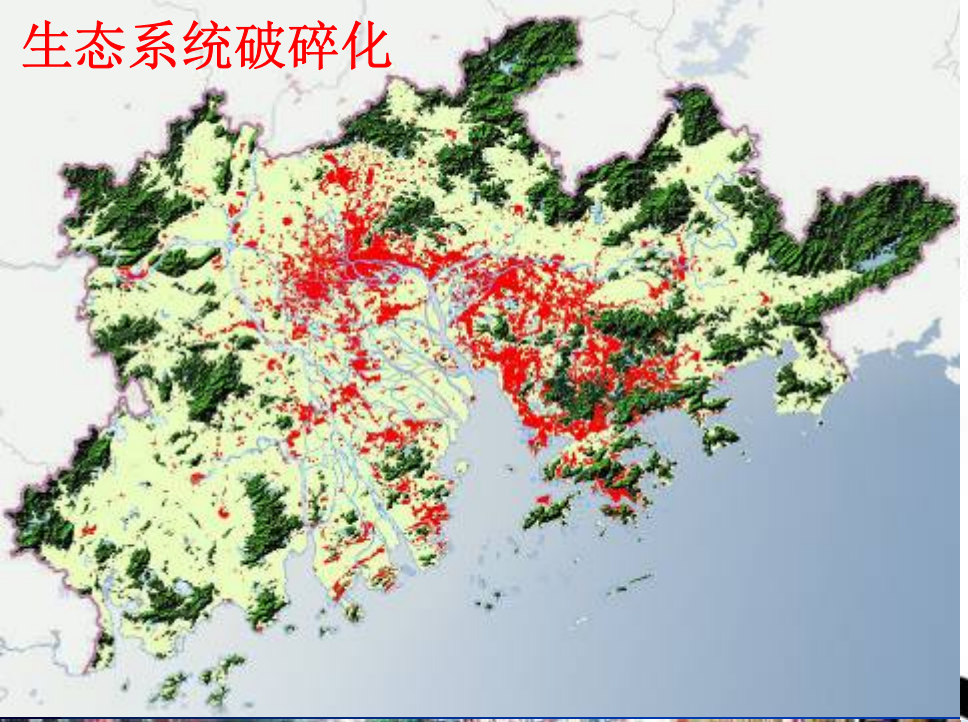
城市扩张向海洋进军

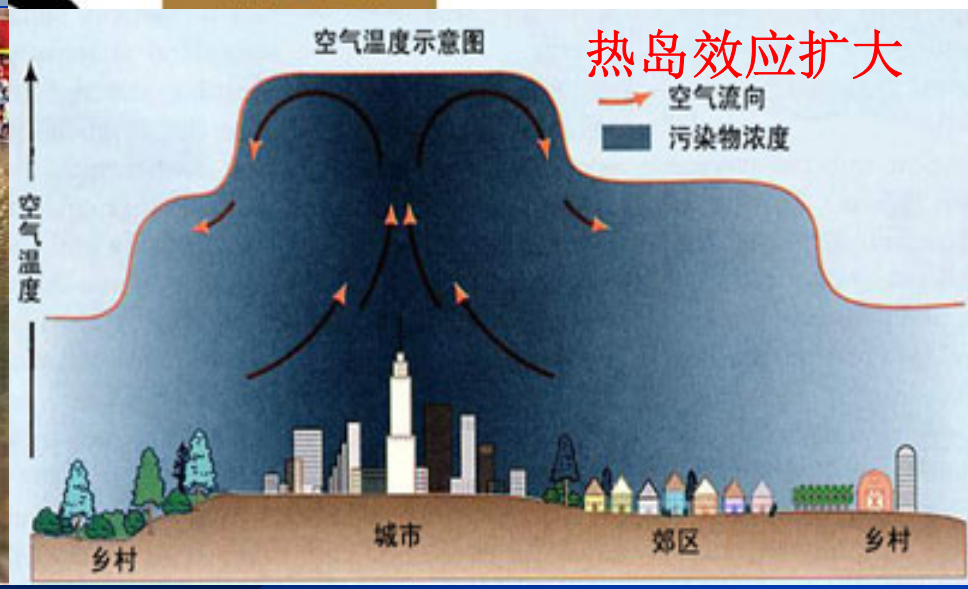
即将进行的5个新填海区块所需的填海物料总量为5625万m^3，其中砂土填料为4555万m^3，石质填料为1070万m^3。



	1912	3.4	2.3	5.9		11.6
	1936	5.2	2.6	6.0		13.8
	1957	5.5	3.3	6.3		15.1
	1986	5.8	3.7	7.1		16.6
	1991	6.5	4.0	7.6		18.1
	1996	7.7	5.8	7.8		21.3
	1999	7.8	6.2	7.6	*2.2	*23.8
	2000	8.5	6.2	7.6	3.1	25.4
	2001	8.5	6.2	7.6	3.5	25.8
	2002	8.5	6.2	7.6	4.5	26.8
	2003	8.7	6.3	7.6	4.7	27.3
	2004	8.8	6.4	7.6	4.7	27.5
	2005	8.9	6.5	7.6	5.2	28.2







城市快速扩张的造成负面效应

城市不透水地面的大量增加，对城市防洪造成了严重压力

城市扩张的“第三维度”

我国当前的城市建筑普遍缺乏生态理念，盲目追求所谓现代的外表形象和夸张的表现手法。忽视建筑的文化传承、节能环保以及与周边环境的自然和谐。

上：大面积的玻璃幕墙
右：夸张耗费能源而不实用的结构

Thank You !

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