基于人口守恒定律的东北地区收缩城市资源优化配置研究

刘洁
东北林业大学





依托项目

1 青年基金

应对内涝灾害城市系统抗灾力测度模型及其动态演化机制研究

2 教育部人文社科

应对内涝灾害城市系统抗灾力形成机制及其动态演化过程研究

3 中国博士后科学基金

基于内涝灾害恢复力理论的城市道路交通网络优化决策

4 其他参与项目

长江流域城市洪水灾害易损性动态演进机理及其预警模型研究

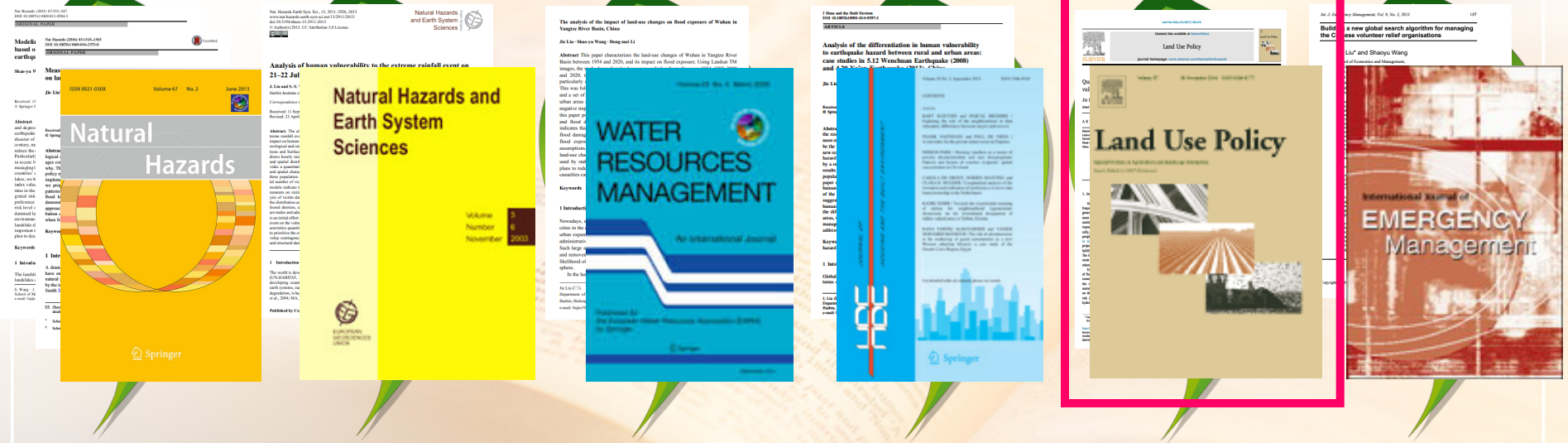
灾害应急能力综合评价指标的耦合关系及其模型研究

基于区域综合风险测度的城市公共安全系统规划研究

震损水库及堰塞湖风险评估与处置关键技术研究

研究成果

近5年代表性学术成果(SCI\SSCI\EI源期刊)



研究背景

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Quantifying land-use change impacts on the dynamic evolution of flood vulnerability

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ABSTRACT

Recently, dramatic flood disasters have occurred incrementally in several regions of the world. Land-use change as one of the main affecting factors becomes a key component in flood risk management. This study strives to deal with quantifying how changes in land use to affect the dynamic evolution of flood vulnerability. The floodplains of Wuhan, which are located in the Yangtze River Basin, have been selected as an example. In this paper, we use GIS to gather different historical geometric data as sources of land-use information. By proposing the Simpsons-dominance index and location index to analyze the characteristics of land-use changes, and building a quantitative model to measure flood vulnerability, a series of flood vulnerability maps demonstrate differential flood vulnerability of floodplains of Wuhan in three inundation scenarios and four historical periods. Finally, the non-parametric correlation is used to reveal the interactive effect of land use and flood vulnerability. Based on this study, comprehensive flood disaster management strategies for land-use planning are proposed for government decision-makers to reduce the flood vulnerability of Wuhan in future.

1. Introduction

On a global scale, flood disasters have increased dramatically in frequency and intensity over the past decades. Climate changes which generate more extreme precipitation patterns are the driving force. But more importantly, the rapidly urbanizing developments of floodplain catchments cause population and capital to become increasingly exposed and vulnerable to flood disasters (Munich Re, 2006). Historically, floodplain management has been transferred from 'keeping the people away from the river' to 'learning to live with floods' (Green et al., 2000). From an engineering perspective, many protection projects (e.g. dams, dikes, drains and reservoirs buildings) are built to fulfill the society's requirement for safe and floodplain development. The hypothesis of this is that these protection projects can completely resist floods, but this is just another way to push the damage somewhere else or postpone it for another time.

Urbanization and urban expansion which induces the development of floodplains is inevitable. This raises the question that how we can counterpoise the development issues and the flood risks to maximize the net-benefits of floodplains, at the same time, to ensure the sustainable development (APFM, 2007). So numerous studies are focus on dealing with the relationship between land-use changes and flood risk (Schilling et al., 2010): (1) Some scientists have investigated hydrological models to evaluate the impact of land-use changes on the rainfall-runoff regime (Wheather and Evans, 2009; Chang and Franczyk, 2008), flood peak (Hollis, 1975; Zhang and Zhu, 2011), magnitude (Mahe et al., 2005) and frequent (Petrow and Merz, 2009); (2) Some researches have emphasized that the vegetative cover changes cause greater flood risk, particularly the effects of the deforestation on peak-flows (Brown et al., 2005; Tao et al., 2011), flood runoff discharge (Turner et al., 2002; Costa et al., 2003), flood magnitude and frequency (Blöschl et al., 2007; Lin et al., 2009). Most of these studies above have concentrated on the adoption of technological and physical measures to analyze the interaction between land-use changes and flood risk. Unfortunately, not more attention has been given to analyze the impact of land-use changes on flood risk from a social perspective. Vulnerability as the key element of flood risk, reflects the intrinsic characteristic of the hazards' receptors. It is the root cause of the uneven distribution of flood risk in different regions. Much of recent literature on disaster science uses the concept of vulnerability to illustrate which areas are vulnerable to what and why. These researches suggest that vulnerability "zooms" the effect of flood hazards (Annan, 1999). Over the past two decades, the concept of vulnerability has changed constantly, which has formed several research branches to define, evaluate, and measure flood vulnerability: (1) some researchers have argued the component factors of flood vulnerability, including exposure (e.g. Turner et al., 2003; Thieken et al., 2005), sensitivity (e.g. Kienberger, 2012; Miceli et al., 2008), and resilience (e.g. Birkmann

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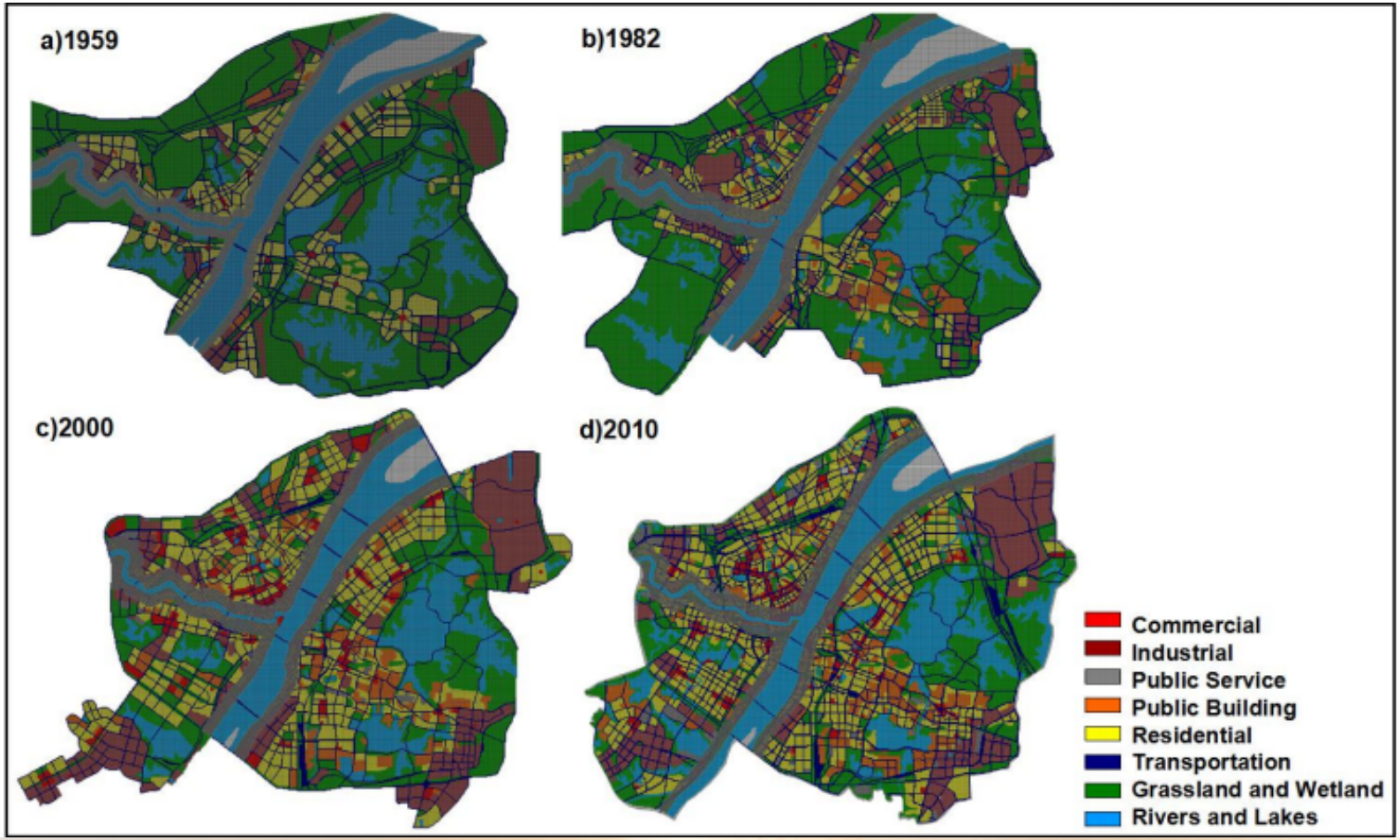
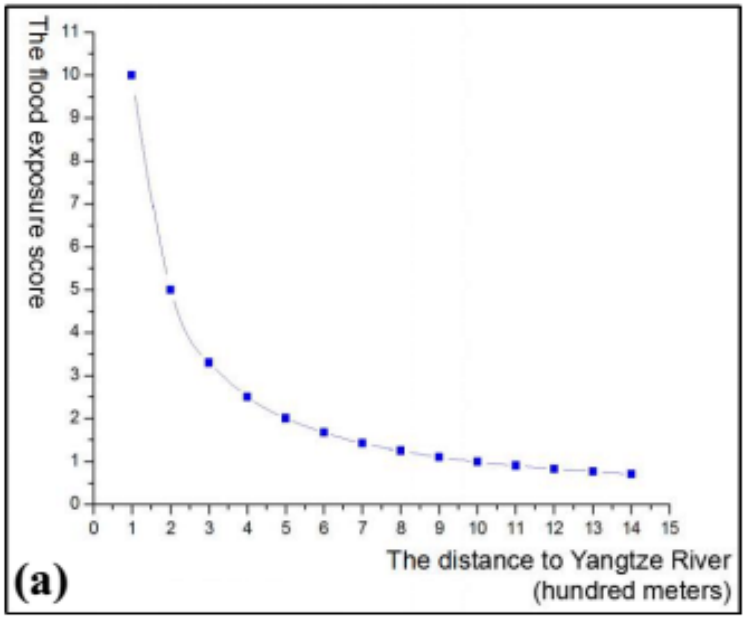
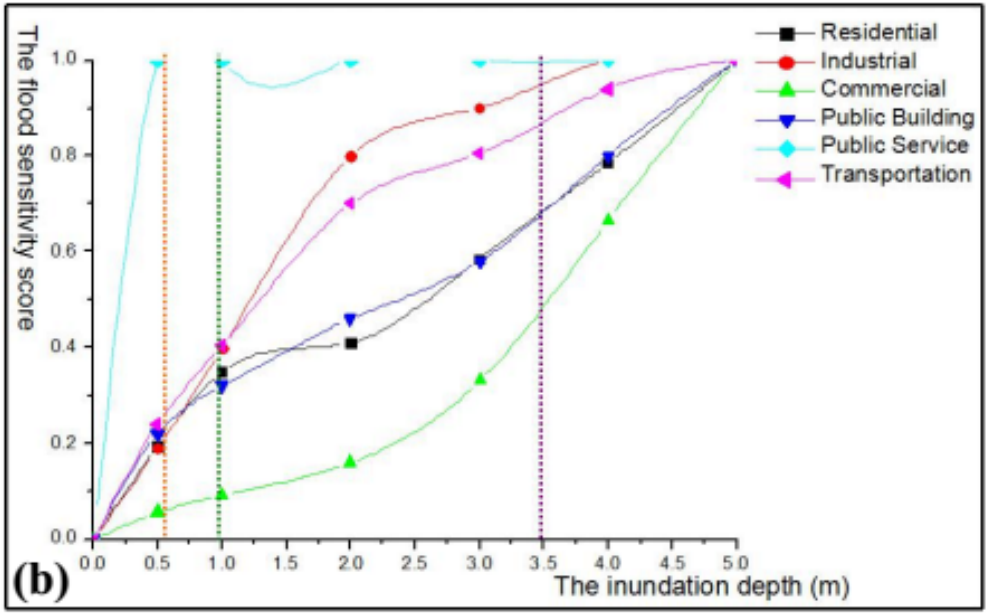
研究背景



The digital maps of Wuhan in four historical periods

研究背景

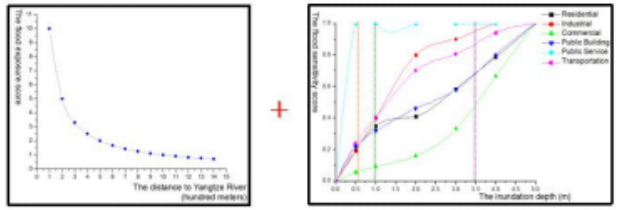




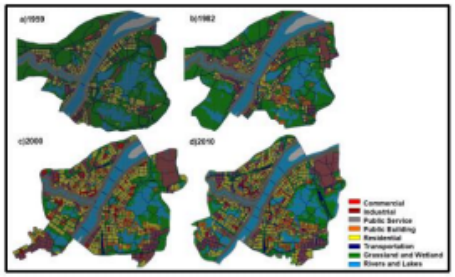
The flood exposure (a) and sensitivity scores(b) of the floodplains of Wuhan

研究背景

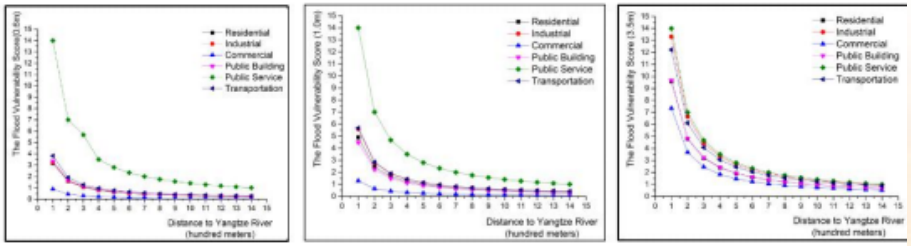
The forming process of flood vulnerability maps of the floodplains of Wuhan



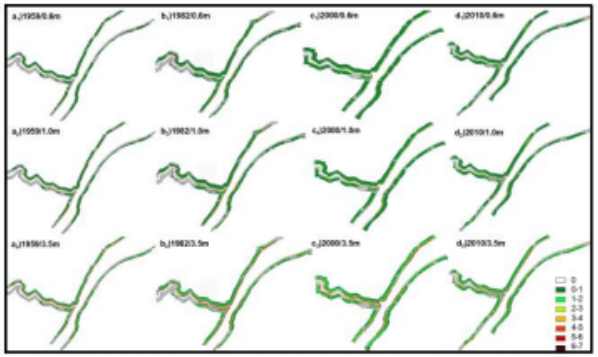
The Flood Exposure Score The Flood Sensitivity Score



The Digital Maps of Floodplains



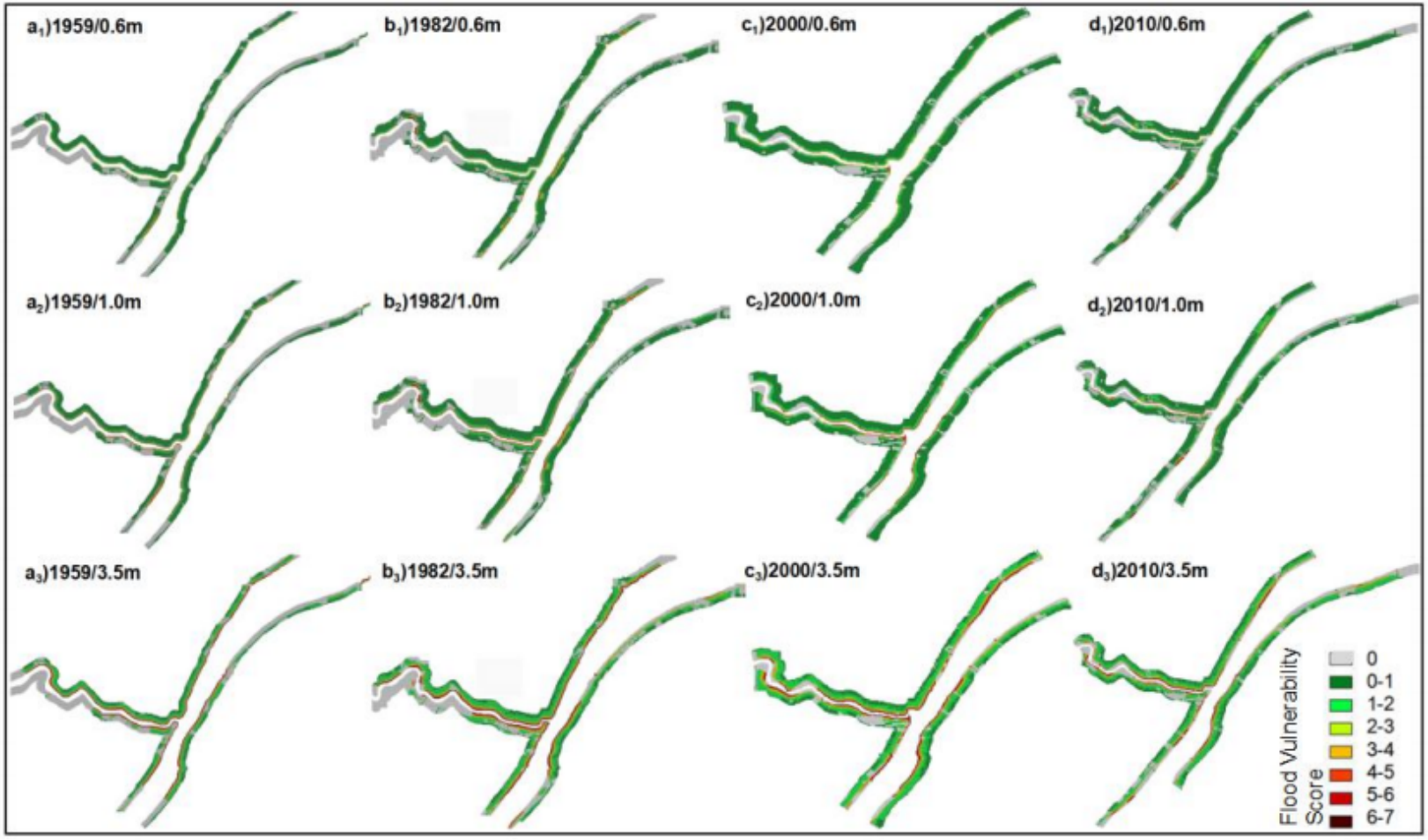
The Flood Vulneraability Score



The Flood Vulnerability Maps

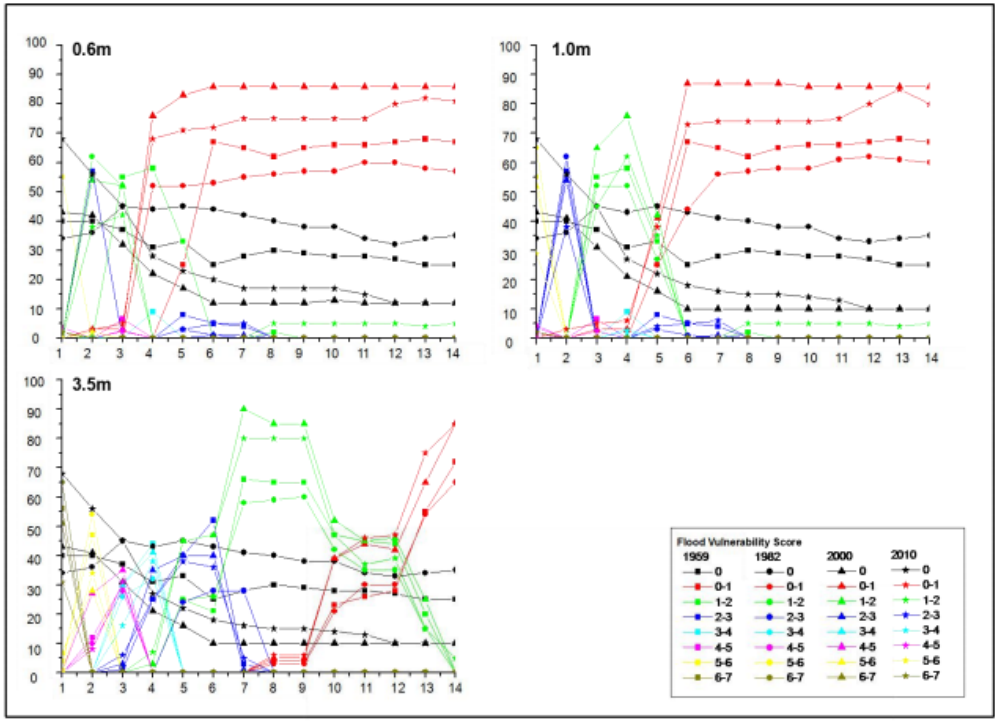
研究背景

研究成果之一

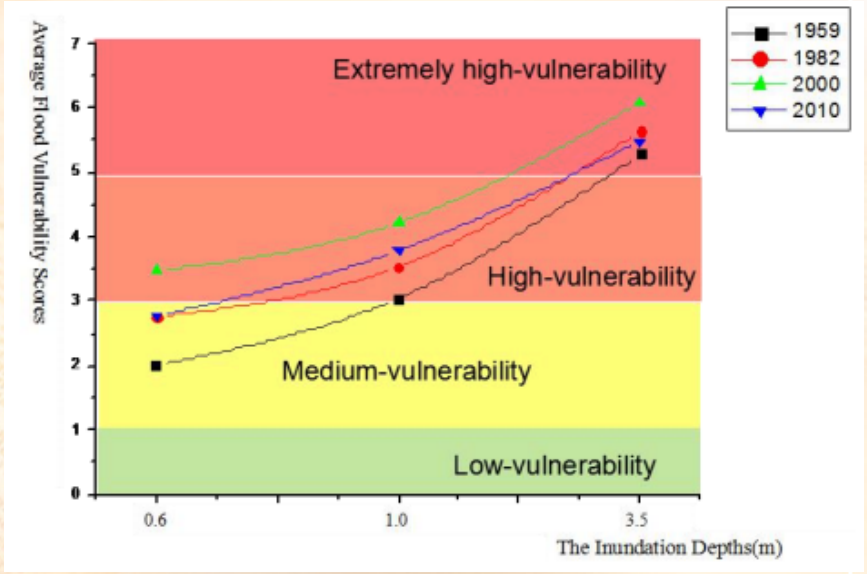


The flood vulnerability maps of floodplains of Wuhan in three inundation scenarios and four historical periods

研究背景



The distribution ratio of flood vulnerability scores



The distribution of average flood vulnerability scores

研究背景

Table 1

Spearman's rank correlation coefficient between land use and flood vulnerability

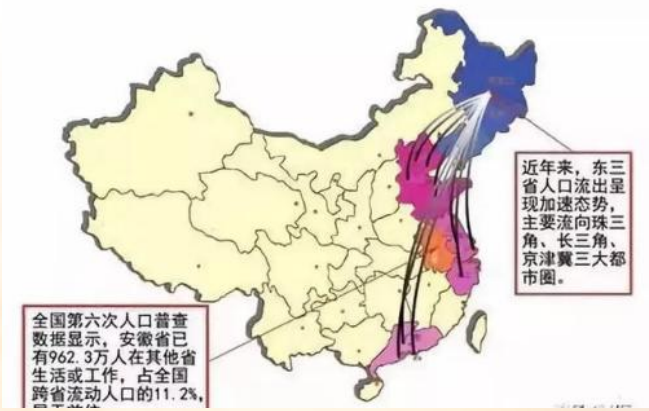
Percentage of land-use categories	Spearman’ s rho	The average flood vulnerability scores		
		0.6m	1.0m	3.5m
Residential	Correlation Coefficient	1.000**	1.000**	0.800
	Sig. (2-tailed)	-	-	0.200
Industrial	Correlation Coefficient	0.200	0.200	0.400
	Sig. (2-tailed)	0.800	0.800	0.600
Commercial	Correlation Coefficient	0.600	0.600	0
	Sig. (2-tailed)	0.400	0.400	1.000
Public building	Correlation Coefficient	1.000**	1.000**	0.800
	Sig. (2-tailed)	-	-	0.200
Public service	Correlation Coefficient	0.400	0.400	0.800
	Sig. (2-tailed)	0.600	0.600	0.200
Transportation	Correlation Coefficient	0.400	0.400	0.800
	Sig. (2-tailed)	0.600	0.600	0.200
Grassland and wetland	Correlation Coefficient	-0.800	-0.800	-0.400
	Sig. (2-tailed)	0.200	0.200	0.600
Rivers and lakes	Correlation Coefficient	-0.600	-0.600	0.000
	Sig. (2-tailed)	0.400	0.400	1.000

*Correlation is significant at 0.05 level (2-tailed)

**Correlation is significant at 0.01 level (2-tailed)

研究背景


东三省和全国人口增量对比柱状图
900
800
700
600
500
400
300
200
100
0
-100
644
826
774
761
768
892
681
673
672
641
644
669
668
710
680
809
23
19
14
14
14
60
35
22
33
48
-11
29
3
0
-19
-30
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016


近年来，东三省人口流出呈现加速态势，主要流向珠三角、长三角、京津冀三大都市圈。
全国第六次人口普查数据显示，安徽省已有962.3万人在其他省生活或工作，占全国跨省流动人口的11.2%，


东三省人口自然变化率情况
8.00%
7.00%
6.00%
5.00%
4.00%
3.00%
2.00%
1.00%
0.00%
-1.00%
辽宁
吉林
黑龙江
1996年
5.96%
6.93%
7.35%
2005年
0.97%
2.57%
2.67%
2015年
-0.42%
0.34%
-0.60%
1996年 2005年 2015年

静态守恒与动态守恒概念

*静态守恒*以城市*人口下限量*为基本前提，其主要与*常住人口*密不可分，分析个体对土地资源、住房资源、交通资源、食品资源、医疗资源、生态资源及通讯资源的*动态倾向性*，达到资源优化目的，确定城市收缩的最小规模。

*动态守恒*则以城市*流动人口*为主要研究方向，基于各个城市都有人口下限的基础上，如果将全国看作是一个*封闭系统*的话，这些流动人口在各个城市穿梭，他们所需要的土地资源、住房资源、交通资源、食品资源、医疗资源、生态资源及通讯资源又构成了一个*伴随地理位置变化*的动态资源守恒，涉及到城市扩张或收缩的规模、功能和资源的准备。

东三省案例分析

表 2-2 哈尔滨市历年城镇居民家庭人均年消费性支出构成情况统计(2009-2016)(消费性支出=100)

单位:%

指标	2009 年	2010 年	2011 年	2012 年	2013 年	2014 年	2015	2016
消费性支出	100	100	100	100	100	100	100	100
食品烟酒	34.5	34.6	35.3	34.7	33.7	32.8	32.7	32.6
食品	25.8	26	26.3	25.5	24.3	23.4	23.1	22.5
谷物	2.8	2.8	3.1	3.3	3.1	3	2.8	2.5
薯类	0.4	0.4	0.4	0.5	0.4			
豆类	0.5	0.4	0.4	0.4	0.4			
食用油	1.3	1.3	1.1	1.1	1			
蔬菜和食用菌	3.8	3.8	3.8	3.4	3.3			
肉类	6.4	6.5	6.3	6.2	5.8			
禽类	0.8	0.8	0.9	0.9	0.9			
水产品	1.9	1.9	2	2	1.9			
蛋类	0.9	0.9	0.9	0.9	0.8			
奶类	1.6	1.6	1.6	1.5	1.5			
干鲜瓜果类	3.4	3.4	3.6	3.4	3.3			
糖果糕点类	1.2	1.1	1.2	1.1	1.1			
其他食品	1	0.9	0.9	0.8	0.8			
饮料	0.8	0.8	0.8	0.7	0.7			
烟酒	2.3	2.3	2.2	2.3	2.2			
饮食服务	5.6	5.6	5.9	6.2	6.5			
衣着	14.3	14	14.1	13.8	13.2			
居住	10.2	10.6	11.1	12.3	11.7			
生活用品及服务	7.8	8.2	7.6	6.7	6.1			
交通通信	8.7	9.2	9.7	10.3	11.8			
交通	3	3.3	3.9	4.9	6.6			
通信	5.7	6	5.8	5.4	5.1			
教育文化娱乐	12.4	11.5	10.7	10.7	11.4			
教育	8.4	7.1	5.9	5.4	5.3			
文化娱乐	4	4.4	4.8	5.3	6.2			
医疗保健	8.9	8.5	8	7.9	8			
其他用品和服务	3.1	3.2	3.5	3.7	4.1			
其他用品	1.9	2	2.6	2.7	2.9			

表 2-1 哈尔滨市历年城镇居民家庭人均年消费性支出情况统计(2009-2016)

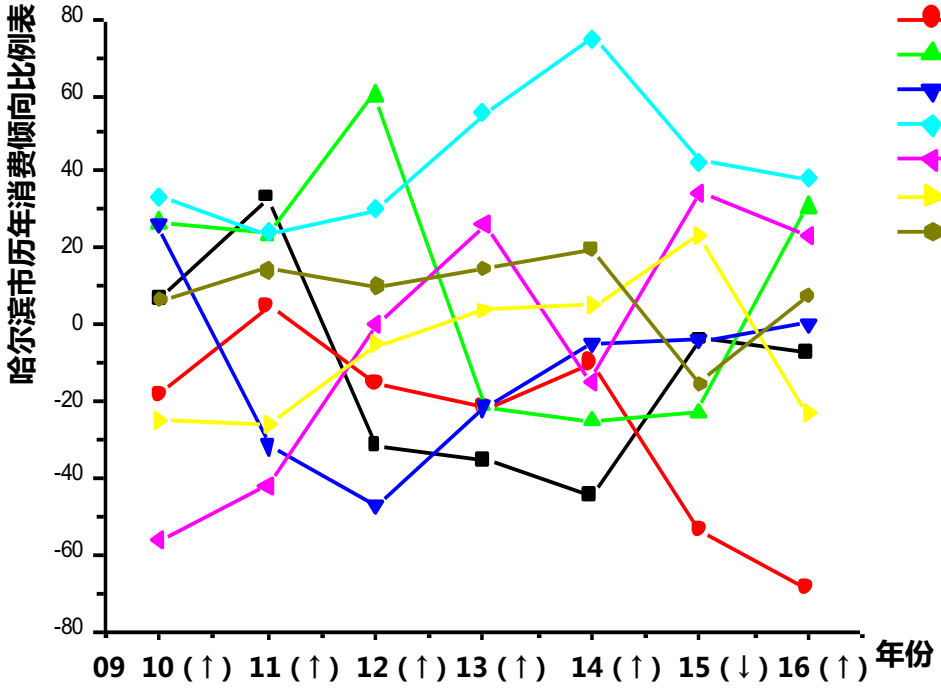
单位:元

指标	2009 年	2010 年	2011 年	2012 年	2013 年	2014 年	2015 年	2016 年
消费性支出	12578.1	14589.5	17032.7	18614.6	20331.8	21638.5	22961.7	2430.1
食品支出	4354.1	5147.4	5915.5	6277.8	6668.8	7043.9	7508.6	7938.9
食品	3264.1	3840.1	4335.2	4524.1	4759.5	4981.8	5293.3	5480.6
谷物	353.5	448.2	562.8	570.4	613.3	637.1	641.7	599.4
薯类	47.6	60.7	78	80.3	89.4	91.2	95.9	97.1
豆类	56.1	62.9	69.5	73.8	78.1	82.		
食用油	160.5	165.4	179.6	193.2	202.8	210.		
蔬菜和食用菌	482	556.1	587.1	612	665.5	689.		
肉类	819.2	920	1054.8	1085.7	1128.4	1164		
禽类	101.5	138.4	159.7	160.3	167.4	176.		
水产品	241.6	289.2	338.4	358.4	369.9	384.		
蛋类	113.1	135.7	148.8	156	162.4	178.		
奶类	203.8	229.4	261.2	273.6	275.9	300.		
干鲜瓜果类	423.9	531.8	571.3	610.5	632.1	672.		
糖果糕点类	142.7	173.6	184.2	200.6	211.9	221.		
饮料	118.6	128.7	139.8	149.3	162.3	172.		
烟酒	100.3	121	127.1	132.5	137.9	143.		
饮食服务	287.7	324.5	389.3	413.7	429.9	453		
	702	861.8	1063.9	1207.5	1341.6	1456		
衣着	1765.4	2058.9	2342.9	2463.1	2643.1	2748		
居住	1331.2	1622.3	2090.3	2178.8	2277.2	2424		
生活用品及服务	1034.8	1102.9	1136.7	1131	1219.9	1307		
交通和通讯	1159.8	1418	1753.1	2190.4	2704.1	2952		
交通	409.7	574.5	829.6	1233.1	1718.7	1902		
通信	750.1	843.5	923.5	957.3	985.3	1050		
教育文化娱乐	1451.2	1565.4	1823.1	2130.4	2256.8	2432		
教育	897.4	861.4	916.7	980	1030.5	1080		
文化娱乐	553.8	704	906.4	1150.4	1226.3	1352		
医疗保健	1074.5	1161.7	1339.6	1481	1646.9	181		
其他用品和服务	407.1	512.9	631.5	762.2	914.9	911.		
其他用品	247	375.4	461.4	548.7	609.3	590.		

表 2-3 哈尔滨市 2008-2016 年总人口数据

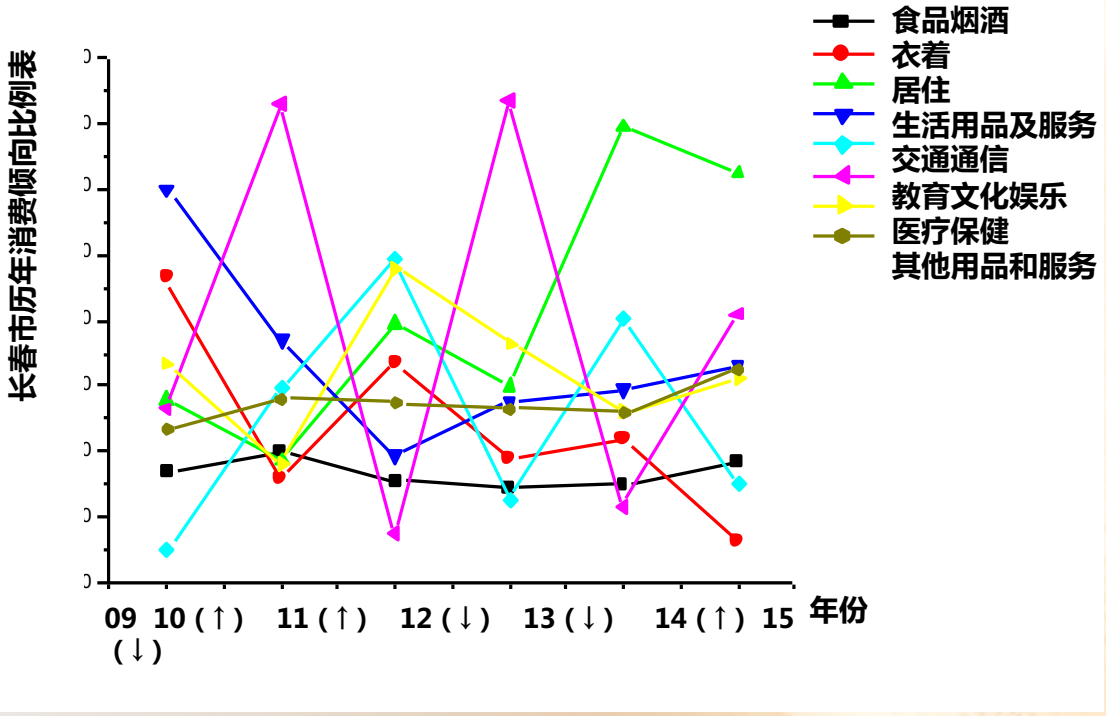
指标	单位	2008 年	2009 年	2010 年	2011 年	2012 年	2013 年	2014 年	2015 年	2016 年
总户数	户	3295192	3397029	3470403	3666459	3722326	3810790	3893041	3870758	3855027
年末总人口	人	9898578	9915892	9920216	9932679	9935115	9952122	9872856	9613743	9620522
按农业和非农业分										
非农业人口	人	4769481	4770108	4757729	4764517	4789343	4807990	4813044	4643374	4677540
农业人口	人	5129097	5145784	5162487	5168162	5145772	5144132	5059812	4970369	4942982
按性别分										
男	人	5002473	5026200	5009482	5006215	5015177	5002755	4959695	4834524	4835169
女	人	4896105	4889692	4910734	4926464	4919938	4949367	4913161	4779219	4785353
性别比(女性=100)		102.2	102.8	102	102	101.9	101.1	100.9	101.2	101
市区人口	人	4751298	4746801	4717945	4715198	4713574	4736326	4737636	5487193	5510644
辖县(市)人口	人	5147280	5169091	5202271	5217481	5221541	5215796	5135220	4126550	4109878
迁入人口	人	98546	99730	104216	97815	115085	92812	86774		
市区	人	71109	73427	74361	69348	73382	65655	63809		
县(市)	人	27437	26303	29855	28467	41703	27157	22965		
迁出人口	人	134956	145261	150941	119172	116287	104909	157536		
市区	人	95709	108833	108846	79591	76684	58133	67477		
县(市)	人	39247	36428	42095	39581	39603	46776	90059		
出生人口	人	95187	83991	85984	82262	86353	82525	85358		
人口出生率	‰	9.6	8.5	8.7	8.3	8.7	8.3	8.6		
死亡人口	人	44755	43107	54110	55709	91763	54447	80513		
人口死亡率	‰	4.5	4.4	5.5	5.6	9.2	5.5	8.2		
自然增长人口	人	50432	40884	31874	26553	-5410	28078	4845		
人口自然增长率	‰	5.1	4.1	3.2	2.7	-0.5	2.8	0.4	-0.17	2.3

东三省案例分析



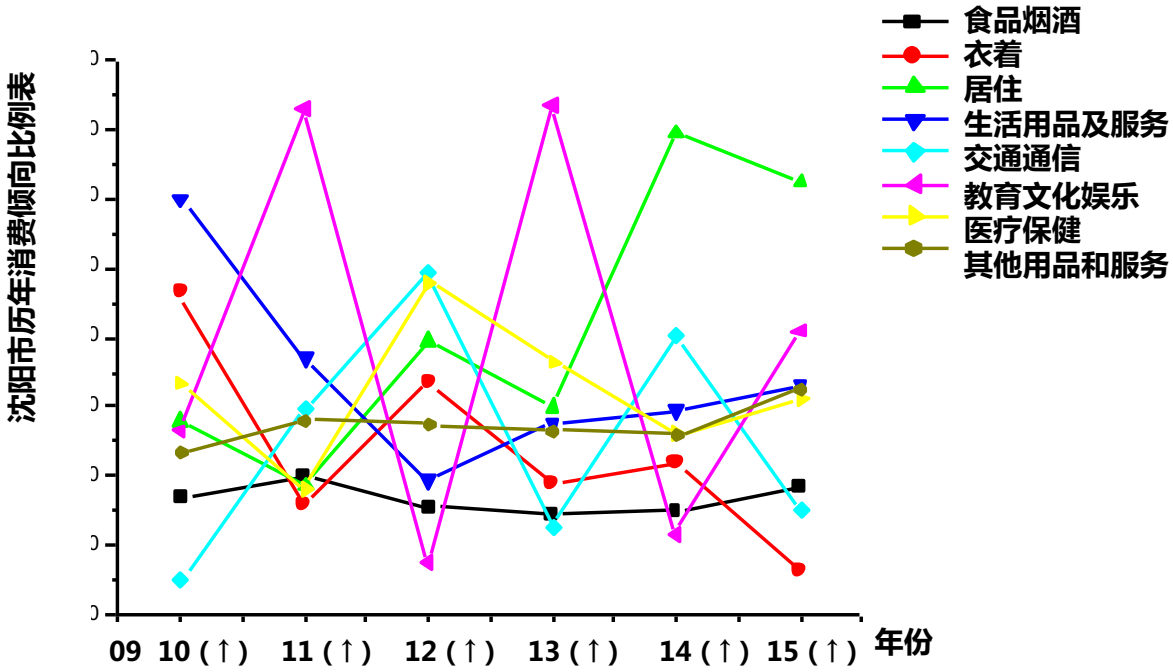
哈尔滨市2014-2015的变化过程中，***食品烟酒、衣着、居住、生活用品及服务、其他用品和服务***均表现出***负倾向***行为，即这些资源需求性下降，其中，资源需求下降***最为显著***的是***衣着资源***；另一方面可以看到***交通通信、教育文化娱乐和医疗保健***均表现出***正倾向***行为，即这些资源的需求性上升，但交通通信在与上一年占比的对比中发现，其并未在整个消费倾向行为中继续扩大对资源的占有，反而***教育文化娱乐资源***的需求量***显著上升***，因此，市场应快速驻进与教育相关的产品才不至于出现供不应求的低效市场。

东三省案例分析



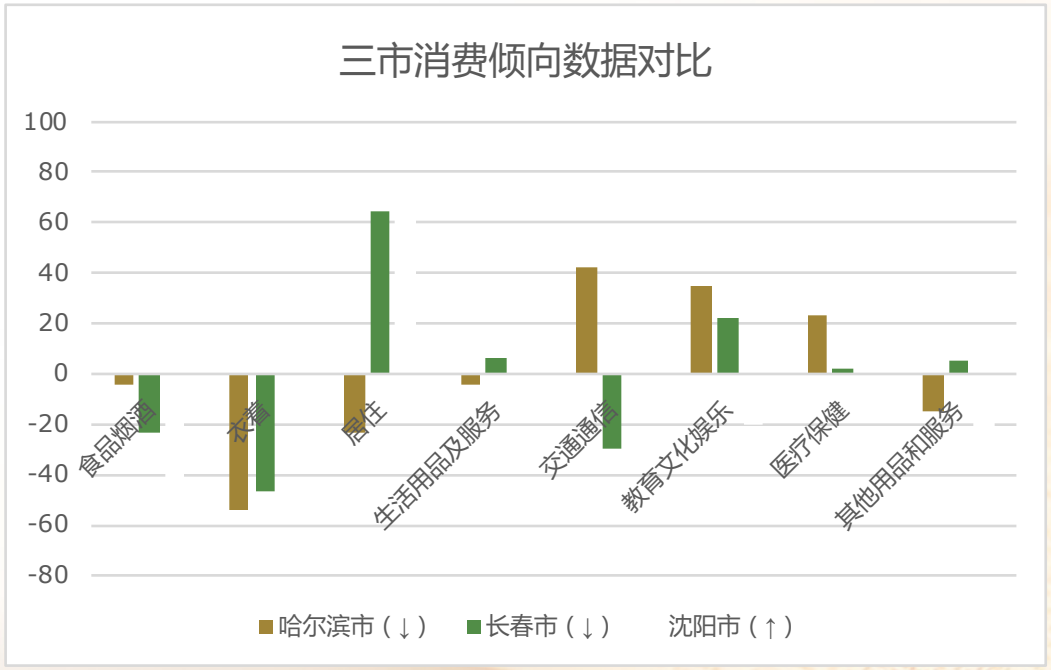
长春市2014-2015的变化过程中，**食品烟酒、衣着和医疗保健**均表现出**负倾向**行为，其中，资源需求下降较为明显的有**衣着和医疗保健**，医疗保健从正倾向转为负倾向，即由需求性扩张资源转为需求性收缩性资源。此外衣着需求下降幅度同比上年扩大；另一方面可以看到**居住、生活用品及服务、交通通信、教育文化娱乐、其他用品和服务**均表现出**正倾向**行为，即这些资源的需求性上升，**交通通信**的需求量**显著上升**，从负倾向性资源转变为正倾向性资源，因此，市场短期内对交通的需求会快速上升，这种需求的体现可能是上下车人流的拥挤、也有可能是人均购车数量的增多，由此引发的生态问题，能源供应问题均需快速的在市场内得到较为合理的引导。

东三省案例分析



沈阳市2014-2015的变化过程中，食品烟酒、衣着、交通通信、教育文化娱乐、其他用品和服务均表现出***负倾向***行为，即这些资源需求性下降，其中，资源需求下降较为显著的是***食品烟酒和教育文化娱乐***，居民对它们的需求从正倾向性消费急剧地转变为负倾向性消费；另一方面可以看到***居住、生活用品及服务、医疗保健***均表现出正倾向行为，即这些资源的需求性上升，尤其是***居住资源***的市场会出现供不应求的现状。

东三省案例分析



教育文化娱乐和医疗保健两项指标上哈尔滨市和长春市在基于人口减少方面具有同向的消费倾向行为，而基于人口增长的沈阳市则表现为与其相反的消费倾向行为，由此反映出当城市人口密度下降、资源一定时，人们倾向处于马斯洛层次需求的非第一层次的需求，即对**生理的需求关注度降低**，而会在**非必需品的关注度提高**；哈尔滨市和长春市对**食品烟酒**的需求下降程度低于沈阳市的需求度；哈尔滨市和长春市对**衣着**的需求下降明显，并明显高于沈阳市；在居住、生活用品及服务、交通通信方面哈尔滨和长春市并未表现出相同的倾向，也未与沈阳市形成具体的对比。

Thank You !

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