From Growth to Health
Urban Sustainability Challenges in China

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1. About Me and My Special Experiences

2. China’s Achievements in Urbanization

3. China’s Challenges in Urban Sustainability
   ① Macroscale limits to growth
   ② The negative lock-in effects
   ③ The emerging health challenges

4. Efforts to Address these Challenges

5. Summary and Implications
My Circle: Zhangzhou-Beijing-New Haven-Xiamen

Source: Google Map
19 Years in Rural China

- **1996-2000.** Studied as a high-school student in a county.

Lack of paved roads, high-rise buildings, TVs, cars, refrigerators, …

Eager to Become Urban Inhabitants!
2000-2010. Studied at Tsinghua School of Environment, Beijing.

Beijing was quickly “Urbanized” from traditional to modern style
Most Americans live in cities like New Haven, rather than Manhattan.
Many Chinese cities were built into Manhattan style cities in ≈10 years.
Unlike my contemporaries in Yale, my parents, or my kid

I belong to a special generation of rural Chinese, who had the dream of entering cities when being a teenager, and this dream did gradually come true while we were growing up.
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1978-2018 was a period when China needed and had growth!

China’s urbanization since 1978 was driven by and also drove the GROWTH of almost everything: GDP, cities, city sizes, infrastructures, urban inhabitants...
Build up ≈600 Cities and Significantly Expand them

Source: atlasofurbanexpansion.org

Data source: envicloud.cn
Equip and Connect Cities with Modern Infrastructure

Public Transportation in Xiamen

High-Speed Railway System

Source: Xu and Huang, Transportation Research Part A, 2019

http://www.sohu.com/a/247707096_414894

http://www.xmgdjt.net/
Enable Chinese to Earn Modern Life Styles in 3-5 Decades

The proportion of Chinese living in cities increased from 18% to 59%.
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Macroscale limits to growth
The growth is approaching a plateau due to several national-scale limits
Almost all people, economic activities, and cities exist in only ≈40% of China’s land area east to the famous *Hu Huanyong* line.
The Ecological-Geographical Limit: Hu-Huanyong Line

DiDi 24-hour Footprint Heat Map Aug 09, 2017

Source: Didi Global
The Population Limit 1: Aging

Population projection 2050

China

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<thead>
<tr>
<th>Age group</th>
<th>Male</th>
<th>Female</th>
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<tbody>
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<td>90 - 100</td>
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Total: 1,301,627,048

India

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<th>Age group</th>
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Total: 1,656,553,632

Data source: US Census Bureau IDB
Visualization by @aronstrangberg
The Population Limit 2: Regional Population Loss

40% of cities in China are losing population.

Data Source: China Urban Construction Statistical Yearbook, 2010-2016 & Netease
The Resources-Environmental Limit

China is producing over 50% of global cement, iron, aluminum...
The negative lock-in effects
The growth in the last 3-4 decades have resulted in significant Negative Lock-In Effects that have to be addressed in the coming decades.
Locked-In 1: Over/Unnecessary Expansion of Urban Land Use
Locked-In 1: Over/Unnecessary Expansion of Urban Land Use

Locked-In 2: Inappropriate Design of Infrastructure

Urban surfaces are over cemented, resulting in flooding and the break of biogeochemical cycles in urban and peri-urban areas!

http://www.sohu.com/a/235760212_286880
http://www.gov.cn/jrzg/2010-10/06/content_1716212.htm
Locked-In 3: The Improper Choice of Transportation Systems

Pursue for Cars + High Density + Lack of Parking Space

Passenger Cars in total: Million Unit
Passenger Cars per capita: Unit

Beijing-Passenger Car
- PC
- ABS.

[Diagram showing the increase in passenger cars from 1980 to 2016]

The emerging health challenges

New challenges to health of both cities themselves and people living in cities are emerging because cities have reached an unprecedented scale and brought new lifeways.
New Challenge 1: The Coming Surge of Solid Wastes

Modelled EOL Products (Millions)

- 电视机  Televisions
- 空调  Air Conditioners
- 电冰箱  Refrigerators
- 洗衣机  Washing Machines
- 私家车  Passenger Cars
Outline

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## Typical Efforts for Addressing Challenges: “XXXX City”

Each Ministry has its incentive to build “XXXX City”

<table>
<thead>
<tr>
<th>Time</th>
<th>XXXX City</th>
<th>The Challenges to Address</th>
<th>The Leading Ministry</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>Sanitary City</td>
<td>Environmental and health issues</td>
<td>National Health Commission</td>
</tr>
<tr>
<td>2000</td>
<td>Garden City</td>
<td>Landscape and livability</td>
<td>Housing and Construction Ministry</td>
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<tr>
<td>2004</td>
<td>Forestry City</td>
<td>Ecosystem and livability</td>
<td>Forestry Agency</td>
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<tr>
<td>2008</td>
<td>Low-Carbon City</td>
<td>Carbon mitigation</td>
<td>Development and Reform Commission</td>
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<tr>
<td>2010</td>
<td>Circular Economy City</td>
<td>Resources efficiencies and wastes</td>
<td>Development and Reform Commission</td>
</tr>
<tr>
<td>2012</td>
<td>Smart City</td>
<td>The application of IOTs and Its in urban management</td>
<td>Housing and Construction Ministry Science and Technology Ministry</td>
</tr>
<tr>
<td>2017</td>
<td>Resilient City</td>
<td>Adaptation of disasters</td>
<td>Emergency Management Ministry</td>
</tr>
<tr>
<td>2017</td>
<td>Sponge City</td>
<td>Urban flooding</td>
<td>Housing and Construction Ministry</td>
</tr>
<tr>
<td>2019</td>
<td>Zero-Waste City</td>
<td>Solid wastes management</td>
<td>Ecology and Environment Ministry</td>
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The Joint Efforts to Promoting Circular Economy in China

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Efforts to Address these Challenges

Summary and Implications
1. China’s solution to the lack of urbanization during 1978-2010s was **GROWTH**, which has been pretty effective.

2. The growth may be approaching a plateau and has resulted in significant negative lock-in effects.

3. New challenges, especially in **HEALTH**, are emerging with cities growing to unprecedented big scales and bringing new lifestyles to people.
A Plausible Metaphor?

Average body weight: Kg

Age: Years

中国居民膳食营养素参考摄入量（2001版）. https://www.ftchinese.com/tag/%E5%8A%9F%E5%A4%AB%E7%86%8A%E7%8C%AB
Thanks!

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Urban Data Platform: http://uree.org