

Portland's Urban Growth Boundary and Lessons for Shanghai and
Suzhou-Wuxi-Changzhou Urban Agglomeration, China

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Abstract

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It is well known that China is undergoing a rapid urbanization, and the excessive urban expansion is encroaching on its arable land and threatening the food security. In 2014, the Chinese government required 14 pilot cities to draw urban growth boundaries (UGBs) to control urban sprawl and preserve farmland. In contrast to the new containment strategy for China, more than 100 cities and counties have adopted some form of UGBs in the United States to manage their urban growth. This thesis studies the Portland region's UGB, one of the most famous and successful examples of a UGB in the United States, to provide lessons for China in implementing its UGBs. This research chooses the Shanghai and Suzhou-Wuxi-Changzhou (SWC) urban agglomeration as the study area to specifically discuss how Chinese cities and regions can learn from Portland.

After forty years of implementation, Portland's UGB has been proven to be an effective tool for managing urban growth and preserving farmland. Lessons learned from the review of Portland's experience that are applicable to the study area in China, include: 1) UGBs should be a regional program that serves an entire metropolitan area, not just a single city; 2) UGBs do not work in

isolation, but it requires the support of other related containment policies; and 3) UGBs are more than simple boundaries they also play a role in shaping growth patterns. This thesis qualitatively and quantitatively analyzes urban expansion and farmland loss in Shanghai and SWC region. Based on the causes of urban sprawl and institutional characteristics of this region combined with lessons learned from Portland, this thesis develops several recommendations for the implementation of UGBs in the study area, including: 1) the need for regional cooperation in the area to manage provincial urban growth; 2) a full-coverage and multi-level UGB system should be established to serve this area; and 3) UGBs as new planning tools should be consistent with Chinese existing planning system. It is worth cautioning that powerful and practical regional planning for the region will not be possible if real cooperation among the region's cities cannot be achieved.

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LIST OF ABBREVIATIONS

CRAG: Columbia Region Association of Governments
DLCD: Department of Land Conservation and Development
ECCA: Expanded central city area
EFU: Exclusive farm use
GDP: Gross Domestic Product
ISA: Inner-suburban area
JBS: Jiangsu Bureau of Statistics
LCDC: Land Conservation and Development Commission
LUBA: Land Use Board Appeals
MHURD: Ministry of Housing and Urban-Rural Development
MLR: Ministry of Land and Resources
NBSC: National Bureau of Statistics of China
NDRC: National Development and Reform Commission
OSA: Outer-suburban area
PND: Pudong New District
RPA: Regional Planning Agency
SBS: Shanghai Bureau of Statistics
SWC: Suzhou-Wuxi-Changzhou
TCPA: Traditional city proper area
UEC Conference: Urban Economic Coordination Conference
UGB: Urban Growth Boundary
USA: Urban Service Area
YRD: Yangtze River Delta

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Chapter 1 Introduction

1.1 Background

China is undergoing an urbanization process unprecedented in human history (Song & Ding, 2007). By the end of 2015 over 770 million Chinese, 56.1% of the total population, now live in urban areas and it is projected that China's urbanization rate will reach 70% by 2030 (Sun, 2016; UNDP China & IUES, 2013). Since the initiation of the Reform and Opening-Up policy (改革开放) in 1978, when the urbanization rate was only 17.9%, China has been experiencing a rapid urban development and economic growth. The urban population first exceeded that of rural areas in 2011, thus marking the transformation from a rural China into an urbanized one. Further, urban areas are still increasing by a rate of about 20 million formerly rural inhabitants each year (UNDP China & IUES, 2013).

Rapid urbanization is an inevitable result of pursuing economic development. In 1978, when economic reforms were first launched, there were only 13 cities with a population of over one million ("China's Urbanization Review," 2004). After over 30 years of development, China has created more than 100 large cities with populations of over one million and 15 megacities with populations of more than ten million (OECD, 2015). In the meantime, the rapid geographic expansion of urban areas brought many problems: traffic congestion; air pollution; encroachment on farmland, the squander and pollution of land resources; and the high costs of urban infrastructure and services. As the urbanization proceeds, agricultural land is being consumed by relentless urban expansion. The threat posed to food security by urban sprawl is now the most important concern of the Chinese government because "China must feed a fifth of the world's population with about 7% of its arable land" (Kaiman, 2015).

Since Lester Brown's article asked "Who Will Feed China" in 1994, the concern of China's capability to feed its massive population has risen domestically and internationally (Cui & Kattumuri, 2010; Huang et al., 2015). China's rapid urbanization attracts masses of rural labor migrating into cities for higher incomes, and this migration further leads to the expansion of

urban areas that exacerbates the reduction of farmland and losses for peasants. The shrinkage of arable land and farm labor threatens the domestic food supply. According to national land use surveys, from 1997 to 2008 China lost 12.3 million hectares of arable land, of which 20% was attributed to urban expansion (Cui & Kattumuri, 2010). Besides, the most productive land is always near cities because of the long-term farming practices around cities in history. In order to protect farmland and secure the food supply, the Chinese government proposed a “1.8 billion mu (120 million hectares) Farmland Red Line” policy in 2006, which proclaimed that 120 million ha of arable land would be strictly protected without compromise. However, as the unstoppable pace of urbanization continues, the loss of farmland appears to have become inevitable, and people are beginning to question whether this security line can be maintained (Lu & Huang, 2010).

In order to enhance China’s stringent farmland protection policy and curb excessive urban expansion, the Ministry of Land and Resources (MLR, 国土资源部) and the Ministry of Housing and Urban-Rural Development (MHURD, 住房和城乡建设部) announced a program to formulate urban growth boundaries (UGBs) around the following 14 major Chinese cities in 2014 (“14 Cities,” 2015): Beijing, Shanghai, Shenyang, Nanjing, Suzhou, Hangzhou, Xiamen, Zhengzhou, Wuhan, Guangzhou, Shenzhen, Chengdu, Xi'an, and Guiyang. Over the next two to three years, the central government wants to expand the list to include 600 cities.

Urban growth boundaries have proved to be effective tools in controlling urban sprawl and preserve farmland in the United States. As early as 1958, the United States established its first urban growth boundary around the city of Lexington, Kentucky, to limit urban expansion (Anderson, 1999). So far, more than 100 cities and counties have adopted some form of urban growth boundary in the United States to manage growth (Staley et al., 1999). Oregon was the first state to implement a statewide urban growth boundary policy in 1979, and its Portland metropolitan area’s UGB has become a notable case study for analyzing and learning about the experience of establishing and managing UGB in the world (Jun, 2004).

Portland’s UGB was proposed in 1977 as part of the requirements of Oregon’s statewide

land-use planning laws and was finally established in 1979. Parts of three counties, twenty-four cities, and more than sixty special service districts around the Portland region are included inside the boundary (“Urban Growth Boundary,” 2016). A regional agency, Metro, was created to manage this regional urban growth boundary. After 40 years of implementation, the urban growth boundary in the Portland metropolitan area has achieved its goals of preserving farmland and separating urban and rural uses. However these 40 years have also revealed problems with UGBs as well, such as increases in housing prices and decreases in housing affordability. Since the goals of both China’s and Portland’s UGBs are to prevent urban sprawl and preserve agricultural land, the strategies and experience from Portland can provide lessons for China’s implementation of UGBs.

This thesis takes Shanghai and Suzhou-Wuxi-Changzhou (SWC) urban agglomeration as the study area to illustrate how UGB and Portland’s urban growth management policies can be transferred and applied to the Chinese context. This study area is one of the most developed regions in China, and it is therefore a good representation of China’s rapid urban expansion and rural contraction. By focusing on this area, the thesis will provide suggestions learned from Portland for Chinese cities and metropolitan areas to implement UGBs and establish inter-city cooperation to achieve regional growth management and farmland preservation goals.

1.2 Purpose and Structure of Thesis

This thesis examines the mechanisms behind Portland’s UGB and provides suggestions for Shanghai and SWC region to formulate its own UGB system. The research questions of the thesis are:

- 1) What makes Portland’s Urban Growth Boundary work?
- 2) What are the effects of the UGB policy? (What goals and intended outcomes of this policy have been achieved? What pitfalls and unintended consequences have occurred in the meantime?)

- 3) What is the development and land-use status quo in Shanghai and SWC metropolitan areas?
- 4) What lessons can Shanghai and SWC region and even the whole nation learn from Portland's experience based on China's own characteristics and context?

This thesis is primarily a qualitative research project except the use of some quantitative evidence to show urban sprawl and farmland loss in the study area of China. Through the review of Portland's history of formulating and managing a UGB, this thesis summarizes lessons that are valuable from Portland's experience and that can be a reference for China. The thesis then examines the urbanization and land use status quo in Shanghai and SWC region, and analyzes why it is necessary to formulate a UGB for this area. Finally, based on the regional characteristics and China's political and institutional environment, the thesis provides suggestions for the establishment of UGBs in the study area combined with lessons learned from Portland.

The thesis is divided into five chapters and the main content of each chapter is as follows.

Chapter 1 provides a general background of the research topic and purpose. It is well known that China is undergoing a rapid urbanization, and in 2014, the Chinese central government required 14 cities to establish UGBs to control their urban sprawl and preserve farmland. Against this background, this thesis (1) uses one of the United States' most famous UGB examples, Portland, Oregon, to summarize lessons for China, and (2) uses one of China's most developed regions, the Shanghai and Suzhou-Wuxi-Changzhou urban agglomeration, as the study area to discuss how experience from Portland might be applied to China.

Chapter 2 provides a literature review that summarizes previous studies about the causes and characteristics of urban sprawl in both the United States and China. United States urban containment policies (specifically urban growth boundaries, urban service areas, and greenbelts) are then reviewed; and existing Chinese containment policies ("Three Districts and Four Lines" and "Three Boundaries and Four Districts") are also discussed. Finally, some of urban growth

boundary studies conducted by Chinese scholars are also introduced.

Chapter 3 reviews the history of the Portland region UGB . Rapid urbanization in the 1970s triggered the initiation of Oregon's land use planning legislation, and as part of the requirement of the law, UGBs were established across the state. In the Portland region, a regional agency, Metro, was created to formulate and manage the region's UGB. In this chapter, the mechanisms behind the UGB, such as the land reserves, UGB expansions, and public involvement are introduced. The criticism and effects of Portland's UGB are also discussed. Then, based on the review of the UGB in Portland, the chapter summarizes several lessons that are valuable for Shanghai and SWC to learn.

Chapter 4 describes the Chinese study area: the Shanghai and SWC urban agglomeration. It starts with an introduction about the urbanization, economy, and land use in the Yangtze River Delta, China, and then introduces the study area. The chapter then provides a detailed description of the urban sprawl and land-use changes in Shanghai and SWC, and underlines the necessity and urgency of establishing UGBs to control urban expansion in this region. Finally, according to the institutional features of this region, some recommendations for the establishment of UGBs are provided.

Serving as a conclusion, Chapter 5 summarizes the lessons learned from Portland. Most importantly, Portland's UGB is a regional planning tool that serves the entire metropolitan area, not just a single city. Further, it does not work in isolation, rather it requires the support of other policies.

Based on Portland's experience and the Chinese study area's own characteristics, Chapter 5 suggests the establishment of a full-coverage and multi-level UGB system to manage regional urban growth. This UGB system will require regional cooperation that can be achieved through vertical and horizontal political approaches. However, these recommendations just provide theoretical and possible solutions for the study area to overcome its institutional barriers and

achieve regional growth management. Yet if real cooperation among cities cannot be achieved, any effective regional planning will be difficult to promote.

Chapter 2 Literature Review

2.1 Urban Sprawl

There is much debate and many definitions about urban sprawl in the United States. It is hard to give an exact and universally accepted definition for urban sprawl because of its extensive controversy and complicated measurements. Mills (1999) and Brueckner (2000) defined urban sprawl as the excessive spatial growth of the built environment from central city to the suburbs. The Merriam-Webster dictionary defines the term “urban sprawl” as “the spreading of urban developments (as houses and shopping centers) on undeveloped land near a city” (urban sprawl in *Merriam-Webster.com*, 2016). Others describe urban sprawl as unplanned and uncontrolled single, land-use patterns that do not have a functional mix use of uses and which appear as low density, scattered, leapfrog, and ribbon or strip development (Ewing, 1994; Nelson & Duncan, 1995). McDonald (1997) embraced the spirit of previous definitions in their characterization of sprawl: 1) low-density development that uses a lot of land; 2) geographic separation of essential places such as offices, homes and schools; and 3) high dependence on automobile for travel. Generally speaking, urban sprawl is an urban land-use pattern with features of low-density development, automobile dependence, dispersion, and other environmental and social effects (Ewing et al., 2002).

Urban sprawl is usually considered to have various negative effects, and that’s why urban containment policies are proposed to curb this phenomenon. Some negative effects of urban sprawl are summarized as below:

-Increased public expenditure. Communities have to pay for the extension of roads, sewers and other public infrastructure because of urban sprawl.

-Increased traffic. The decentralization of jobs and an imbalance between jobs and housing causes people to travel more on roads and increases noise and air pollution.

-Loss of agricultural and environmental resources. Urban development into rural areas consumes

farmlands. Environmentally sensitive areas may also be affected.

-Increased cost and difficulty of providing public transportation. Public transit cannot always keep up with the pace of urban expansion, and many suburban communities do not have access to public transportation.

-Decline of central cities. Because of scattered employment and housing, central areas lose population and employment. People living and working in new suburban neighborhoods reduces the activity of traditional central areas.

Urban sprawl and decentralization can be traced back to 1900s in the United States, when immigrants were able to afford to move out of dense central city neighborhoods (Bruegmann, 2005). After World War I, the suburbanization continued and cities expanded rapidly. Compared to urban sprawl in Europe, people who chose to live outside the inner city were usually middle- and high-income families. Suburbs were valued for their environmental quality and larger residential spaces and the high demand for such places fueled the spatial expansion process.

Some other factors, such as the low mortgage interest rates, new highway construction, low-density zoning codes, and large-lot residential zoning were also considered to promote development shift from urban central areas to the suburbs (Woo, 2007). Different from the view of political causes, others argue that urban sprawl is the result of residential preference (Richardson & Gordon, 2001). Though many efforts have been done to revitalize central cities and attract people to live and work in urban areas, there has not been much success in preventing urban sprawl (Nelson et al., 2004). Therefore Woo (2007) argued that urban containment policies that directly limit the spatial growth of cities is an effective way to prevent urban sprawl.

Mieszkowski and Mills (1993) summarized two theories of the causes of urban sprawl in the United States. One is the “natural evolution” theory, which believes the urban sprawl is a natural phenomenon. The increase of population and income, improvements of transportation, consumer choices and the competition for non-residential uses all lead the sprawl of urban area. The second theory is called “flight from blight,” which attributes the suburbanization to high crime rates,

low-performing public schools, and the large presence of poor and minorities in the central cities. High-income households' desire to avoid the blight of inner cities promotes suburbanization.

Some scholars define urban sprawl in many Chinese cities as a pattern of “pancake-making” (摊大饼) that cities blindly expand to occupy surrounding arable land (Deng & Huang, 2006). Jiang et al. (2007) argued that urban sprawl in China is the rapid, low-efficient and disorderly growth of non-agricultural land towards peripheral areas. Wang (2012) pointed out that urban sprawl in China is composed of two parts: 1) urban decentralization; and 2) urban renewal. Urban decentralization refers to the creation of new development areas in suburbs. Population and industries are encouraged to resettle in the new developed areas to reach the effect of de-densification, which means the original rural areas will be built up and urbanized. Urban renewal is the process of transforming “urbanized villages” (mixed-use areas that are located downtown or on outskirts of major cities but defined as non-urban land) to urban built-up areas. Infrastructure in these districts will be updated or demolished for redevelopment, and original residents are usually required to relocate to other places.

Compared to sprawl patterns in the U.S., China's rapid urban expansion is mainly driven by institutional and political factors (Wang et al., 2015; Xiao, 2014; Li, 2013). By law, urban land belongs to the state and rural land belongs to rural collectives. Thus, land in China is classified as urban or rural based on *who owns it* not *how it is used* (Xiao & Zhao, 2015). The ownership of urban land allows local governments to use and allocate urban land within their jurisdictions with great autonomy. In addition, the Constitution grants local governments to expropriate the use rights of rural land for the reason of “public interest” (Xiao, 2014). The definition of public interest is very vague but includes such interests as transportation infrastructure, national defense, and government facilities. This vagueness of the definition leaves loopholes for authorities to expropriate land discretionarily. Local governments can sell land use rights to developers to gain substantial revenues, and this has become a main source of fiscal revenues for local governments since the late 1990s. Consequently, the enormous revenues induce local governments to get more land and lease it out (Xiao, 2014). They expropriate rural land for “public interest” and then convert it to urban uses. Then, the rent-seeking process results in rapid urbanization and massive

farmland loss. However, this has caused intense conflicts between peasants and local government because compensation to farmers is very low compared to governments' selling price and the land's actual market value.

Besides gaining revenue, another reason for local governments' desires for urban expansion is because of expenses are lower in rural areas. In order to redevelop the existing urban land, governments have to pay current land users and compensate residents for their resettlement. Compared to the compensation for peasants, the payment for urban residents is much higher (Lichtenberg & Ding, 2006). The statistics show that 60% to 80% of the government revenue from land sales is used to relocate former residents (拆迁户). It is also more expensive to develop new infrastructure on the previously developed land than development on rural land. Though the urban development of rural land is not without roadblocks. The process of land acquisition and resettlement as well as tenants' dissatisfaction with their compensation causes confrontations with governments, leads to social conflicts, and ultimately slows down the process of urbanization.

In addition to the government's role other factors contributing to Chinese urban sprawl include: an increasing urban populations; rising levels of automobile ownership; and a booming real estate market. Behind these factors is industrialization, one of the major driving forces of urban sprawl in China. Since the economic reform in 1978, many industrial and high-tech development zones have been established in suburbs to attract investment and promote local economic growth. The increased labor in these districts stimulates the development of housing. Therefore, the combination of industrial and residential development in suburban areas contributes to the rapid urban sprawl in China (Li, 2013). Some academics also demonstrate that China's urban sprawl is a path-dependent trajectory resulting from the legacy of socialist political and planning systems (Gao et al., 2015; Wei & Dennis, 2012; Lin, 2006). Gao et al. (2015) argued that China's urban expansion is a complex process driven by multiple forces at multiple scales (local, regional, and global).

Urban sprawl in the United States is the consequence of market forces, public policies, and

population suburbanization (Li, 2013). In contrast, sprawl in China is mainly driven by local governments' desires for fiscal revenues and economic development, and the rapid industrialization in the suburban areas. Urban sprawl in the U.S. is characterized as low-density suburban development, while sprawl in China is marked by fragmented and discontinuous development on urban fringes (Li, 2013). The causes and patterns of urban sprawl in the U.S. and China are significantly different. So the solutions of controlling urban sprawl should consider their different characters and the application of US's experience in China has to take care of Chinese own context.

2.2 Urban Containment in the United States

Urban containment is a growth management policy that jurisdictions use to limit development outside a designated boundary and encourage infill development and other redevelopment strategies inside the boundary. Urban containment policies aim to meet development needs, while supporting the goals of encouraging compact development, preserving open spaces, and enhancing the quality of life. By implementing a variety of administrative tools, communities can achieve the management of location, character, intensity, and timing of growth (Aytur et al., 2008; Nelson, 2004).

Within the urban containment boundaries, compact development is encouraged, usually with minimum density requirements. Beyond the boundaries, urban development, especially high-density development, is discouraged or prohibited, and public services are often restricted (Nelson & Dawkins, 2004).

Besides the basic goals of preserving farmland and open space and maximizing the efficient use of urban land, Knaap and Nelson (1992), and Nelson and Duncan (1995) also noted that local government should consider providing sufficient land within the boundaries to meet the needs of housing, employment, industry and other urban land uses for a planning period. Otherwise, insufficient land supply may cause excessive housing pressure and even legal challenges (Nelson

& Dawkins, 2004).

Urban containment is not a new idea in America. As early as in the 1950s, Lexington, Kentucky, established an urban growth boundary to control the expanding urban area and protect farms surrounding the city. Gradually, more and more states and local governments have come to realize the issue of urban sprawl and the importance to take action to address it. In half a century, more than 100 cities or metropolitan areas in America have adopted or recommended some form of containment policies to protect the agricultural uses (Staley et al., 1999). States like Oregon, Washington and Florida have adopted statewide legislation to manage urban growth (Table 1). States like California do not have legislation that mandates the adoption of growth management, but local municipalities and communities can adopt UGBs themselves. In the San Francisco Bay area, more than 15 cities have adopted UGBs (Anderson, 1999).

Table 1. States adopted growth management and farmland preservation initiatives

States Adopted Growth Management and Farmland Preservation Initiatives	
1970s	Hawaii, Oregon, Vermont
1980s	Florida, Georgia, Kentucky, Maine, New Jersey, Rhode Island
1990s	Colorado, Delaware, Indiana, Iowa, Maryland, Michigan, Minnesota, Ohio, Pennsylvania, Tennessee, Washington

Source: Staley, 1999

Urban containment is not only a set of land-use regulations, but a broader array of tools and factors, including land ownership, transportation and infrastructure policies, market patterns, and topographical conditions (Pendall et al., 2002). This thesis only focuses on physical containment policies and does not deal with the broader context of urban containment.

2.2.1 Urban Growth Boundary

An urban growth boundary (UGB) is a line drawn to separate urban from rural areas, with lands

outside the boundary not allowed or discouraged to have new urban development (Woo & Guldmann, 2011; Staley et al., 1999). Because UGBs directly limit urban growth beyond the urban areas, they are considered to be a ‘strong’ containment policy (Nelson & Dawkins, 2004).

The advantages of a UGB include promoting the revitalization of urban central areas; supporting infill, compact, and transit-oriented development patterns; improving the efficient use of public facilities; protecting farmlands, wildlife habitats, and other environmentally sensitive spaces; and preserving a community’s identity by preventing it from merging with other neighboring communities (Anderson, 1999).

However, there are also negative side effects coming along with the implementation of this policy. Debate and skepticism about the effectiveness of UGBs have emerged. Staley et al. (1999) argued that by reducing the supply of developable land, housing and land prices increase, and the housing affordability would be reduced. Some studies suggest that UGBs push new development outside of boundaries because they raise housing prices and land values without achieving goals of limiting development inside the boundaries (Richardson & Gordon, 2001; Levine, 1999). The increased population density within a controlled area causes more vehicle miles travelled (Rodriguez et al., 2006).

In terms of the stringent implementation, states like Oregon and Washington have mandatory legislation that require their metropolitan areas to establish urban growth boundaries, while some other states like California, Maryland and Florida have voluntary requirements that encourage the adoption of growth boundaries (Anderson, 1999).

The table below summarizes some of the states that have the UGB policy:

Table 2. States have the UGB policy

State	Authority	State-level Involvement
Oregon	Statewide legislation adopted in 1973.	Moderate
Washington	Washington Growth Management Act adopted in 1991.	Limited
Florida	Local Government Comprehensive Planning and Land Development Regulation Act adopted in 1993.	Moderate
Maryland	Maryland Smart Growth Act adopted in 1996.	Low to moderate
California	None.	Limited

Source: Anderson, 1999

2.2.2 Urban Service Area

Urban service areas (USAs) are another important policy tools used to contain urban sprawl in the United States. This policy is similar to an urban growth boundary that draws a line around the urban area, however it delineates the area beyond which a local government will not support public infrastructure. Compared to an urban growth boundary, the urban service area is a loose containment policy, because development is actually not prohibited outside the USA. Developers can create new developments outside the service area, but these new developments will lack public infrastructure (Woo & Guldmann, 2011).

Not only do they limit geographical growth, USAs also take into consideration financial issues. Staley et al. (1999) pointed out that USAs are determined by the expenses local governments pay for roads, sewer and other public infrastructure. Beyond a certain range, the cost of extending public services is not effective for the local government. Then, within that range is the area that the government is willing to provide services. However, if efficiency improved, the service area can expand. As Woo and Guldmann (2011) stated, an UGB is explicitly used to limit the spatial growth, while an USA links infrastructure with urban sprawl to minimize the costs of providing services by creating a service boundary.

Minneapolis-St. Paul is one of the best-known metropolitan areas that has an urban service area boundary that restricts the provision of public services. The Metropolitan Council was established to manage urban issues in this region, such as the provision of public sewers and highways, the forecasting of regional housing and employment, and the regulation of environmental protection. All the municipalities in the metropolitan service area can expand their service areas if they follow the Council's criteria and regional policies (Woo, 2007).

Other cities or regions establish the similar USA system include: the City of San Diego and the County of Santa Clara in California; and Orange, Seminole and Manatee Counties in Florida. Maryland's Priority Funding Areas is also a similar system, which provides state funding for existing municipalities and areas designated by local governments to support new growth such as enterprise zones, neighborhood revitalization areas, heritage areas and existing industrial land (Priority Funding Areas, n.d.).

2.2.3 Greenbelt

Another important urban containment policy is the greenbelt. One of the oldest greenbelt examples can be traced back to the 7th century in the Muslim holy city, Medina, which established a 12-mile green belt around the city with trees in the strip that could not be removed (Hedstrom, 2012). In 1580, a three-mile wide green belt was created around the city of London to prevent new construction near the city, though it was actually designed for stopping the spread of plague (Ackroyd, 2001). These are early attempts to control urban sprawl by constructing buffer strips to curb new urban development, and they also become prototypes for the modern version of this urban containment tool.

A greenbelt is a strip of land around a city or metropolitan area where urban development is prohibited or severely restricted (Amati & Yokohari, 2004). One of the pioneers of greenbelt strategies, is the United Kingdom, which uses them widely to control its urban growth. In 1935, the Metropolitan Greenbelt around the city of London was first proposed, and after an 80-year

development period, the green belt has significantly extended and now covers over 60 different districts where it controls urban sprawl and safeguards the countryside from encroachment (Parsons & Schuyler, 2002). In Asia, South Korea has had greenbelt policies since 1971 (Bae, 1998). For the three decades, every city was surrounded by greenbelts, but it was relaxed in small and medium cities in 1997 (Bae & Jun, 2003). The effects of the Green Belt policy were mixed. The open space preservation was accomplished with a firm Green Belt policy, but decreased housing affordability, increased commuting costs, and leap frogging satellite town developments were unavoidable, especially around the megacity of Seoul (Benston & Youn, 2006).

In the United States, only a few communities have the same greenbelt system as in the United Kingdom and South Korea. A notable example is Boulder, Colorado, which is surrounded by a greenbelt.

In 1959, the City of Boulder approved an amendment to establish a “Blue Line” around the city to prohibit the extension of water and sewer services above 5,750 feet elevation (Pendall et al., 2002). This was intended to preserve the mountains along the west border of the city and save the costs of providing public infrastructure (Pendall et al., 2002). In 1967, the residents of Boulder agreed to use 0.4% of the city’s sales tax to purchase open space, which preserved a ring of 45,000 acres of land near the city (Hedstrom, 2012). In 1978, Boulder City and Boulder County together developed a joint comprehensive plan adopting a service area boundary limits the provision of urban services and facilities beyond the boundary (Pendall et al., 2002).

Boulder’s containment policy successfully curbs urban sprawl and protects open space. However, it also raised housing prices and created satellite communities beyond the city limit, which are the unintentional effects of the greenbelt strategy.

2.3 Urban Containment in China

2.3.1 Existing Containment Policies in China

National containment policies in China can be traced back to 1986 when the Land Management Law was enacted. This law prescribed strict regulations to protect farmland and manage urban development. Since then, farmland protection has become an important theme of China's land policies. The State Council promulgated the new Basic Farmland Protection Regulations (《基本农田保护条例》) in 1999, which required governments at all levels to designate basic farmland protection districts. Further, farmland within the districts could not be converted to any non-agricultural uses without permission. In the same year, the Amendment to the Land Management Law (《中华人民共和国土地管理法(修订草案)》) stressed that, "implement special protection against arable land, strictly limit conversion of arable land to construction land, and limit the total construction land" ("Instruction of the Land Management Act (Amendment)," 1988). In 2003, the Third Plenary Session of the Sixteenth Central Committee of the Communist Party of China (中共十六届三中全会) indicated that China would implement the most stringent farmland protection system in the world to ensure food security.

The Land Management Law sets up a land quota system to control the conversion of farmland into construction land, i.e. land allowed to build structures. The quotas of farmland conversion are allocated through the administrative hierarchy: state, province, city, county, and township (OECD, 2013). The higher-level authority sets an annual upper limit on the amount of arable land that its sub-levels can convert to urban and rural construction uses (Xiao & Zhao, 2015; Tan et al., 2011). The conversion quota for each city is based on its existing urban land area, economic scale and predicted land needs over a period of planning horizon (Wang et al., 2009). So the annual quota plan decides localities' amounts of arable land that should be preserved and the amounts of construction land that will be allowed.

There are two specific approaches that Chinese government uses to preserve arable land and provide developable land: 'total cultivated land dynamic balance' (耕地总量动态平衡) and 'cultivated land requisition-compensation balance' (耕地占补平衡). At the provincial level, the State Council requires that there should be no net loss of cultivated land within each of province

or municipality, and any conversion of farmland more than 35 ha and conversion of any other land more than 70 ha must be approved by the State Council (Lichtenberg & Ding, 2008). If the total amount of farmland is reduced, the provincial government will reclaim the same quality and amount of land as compensation for the reduced land. This is the cultivated land dynamic balance policy required for each provincial government. On the other hand, within each of the provinces, the farmland converted for development has to be balanced by new farmland somewhere else, or developers have to pay for government for farmland exploitation (Ding, 2003). The remedied new farmland can come from land consolidation (the integration and consolidation of fragmented small plots), land reclamation (the remediation of polluted or developed land back to arable land), and land cultivation (the development of unused land to be suitable for cultivation). Thus, theoretically, the total amount of arable land in each province will not decline, while accommodating local urban development needs.

However, as driven by economic growth promotion interests, local governments may expropriate high-production rural land for industrial and commercial uses; as long as they just replace it with low-quality agricultural land. The increased power of local governments in the wake of the 1978 economic reform gives local governments new opportunities to use both legal and illegal means to occupy or convert rural land at urban fringes while underreporting the actual farmland conversion despite the strict farmland protection policies. The lack of regulation and supervision needed to guide the expansion of residential and industrial uses on to farmland also makes current land protection policies ineffective. The conflicts between growth management and requirements for development moderate the effectiveness of implementing urban containment policies in China (Zhao, 2011).

In addition to the land management policies, other urban and land-use planning tools must be developed to regulate and limit urban expansion with the goal of protecting resource land.

There are two main spatial planning systems in China: urban and rural planning, overseen by the MHURD, and land use planning, overseen by the MLR. Urban and rural planning includes city, township and village planning, and it intends to define the size and structure of a city, town or

village and to determine the spatial distribution and form of development within a city, town or village (Yeh & Wu, 1999). Land use planning focuses on the allocation of land resources for built and un-built uses, and it formulates guidelines for the development, remediation, and preservation of un-built land, especially for farmland and forests (“An Overview,” 2016).

In 2008, the Urban and Rural Planning Law (2008) (《中华人民共和国城乡规划法》(2008)) required cities to identify the scope of construction area, and forbids the establishment of development districts and new urban areas outside of designated construction areas. The law also proposed the “Three Districts and Four Lines” (“三区四线”) spatial management system control urban construction areas and protect natural environment (see Table 3 and Figure 1). National Comprehensive Land Use Planning Outline (2006-2020) (《全国土地利用总体规划纲要(2006-2020)》) also established a similar spatial management system from the perspective of land use, which is called “Three Boundaries and Four Districts” (“三界四区”) (See Table 4 and Figure 2).

Table 3. Definitions of the “Three Districts and Four Lines” in urban and rural planning

Name	Definition
<i>Three Districts</i>	
Prohibited Construction Area	Prime farmland, first-level water source protection area, disaster-prone area etc., that prohibit any urban constructions
Restricted Construction Area	Second-level water source protection area, low disaster-prone area, non-core area of nature reserve etc., that limit but not prohibit urban constructions
Suitable for Construction Area	Urban construction allowed area
<i>Four Lines</i>	
Blue Line	Borderlines of urban surface water
Green Line	Borderlines of urban green space
Yellow Line	Borderlines of urban essential infrastructure
Purple Line	Borderlines of historical preservation district

Source: Measures of Formulating City Planning (《城市规划编制办法》), 2005

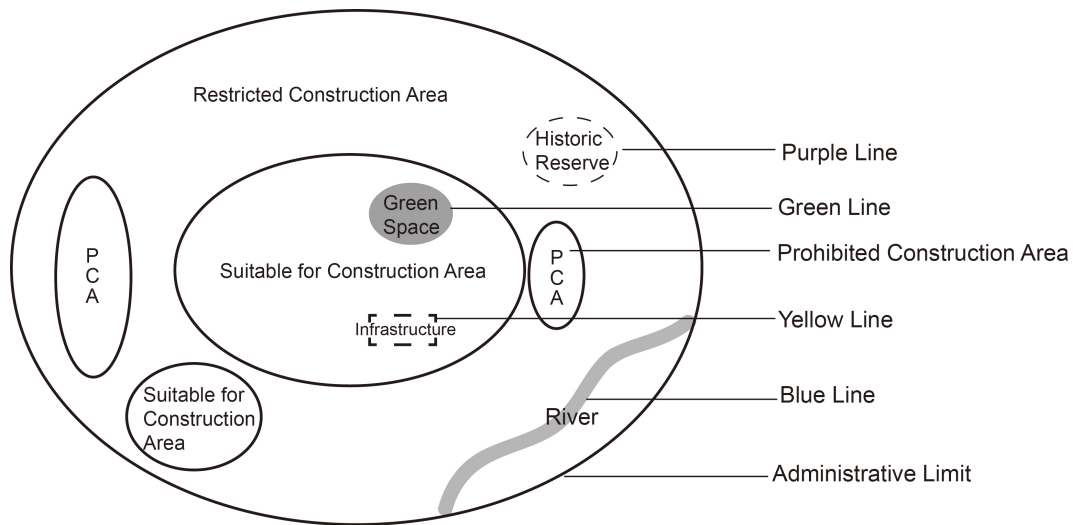


Figure 1. “Three Districts and Four Lines”

Source: Author

Table 4. Definitions of the “Three Boundaries and Four Districts” in land use planning

Name	Definition
<i>Four Districts</i>	
Construction Allowed Area	Designated urban construction area in a certain planning horizon
Conditional Construction Area	The area that supplies available land for urban development beyond the construction allowed area in case of need
Prohibited Construction Area	Nature reserve, historic reserve, etc., that prohibit any urban constructions
Restricted Construction Area	Area beyond the three areas above while within the administrative limit of a city
<i>Three Boundaries</i>	
Construction Boundary	The border of construction allowed area
Extension Boundary	The border of conditional construction area
Prohibited Construction Boundary	The border of prohibited construction area

Source: What is the Three Boundaries and Four Districts?, 2013

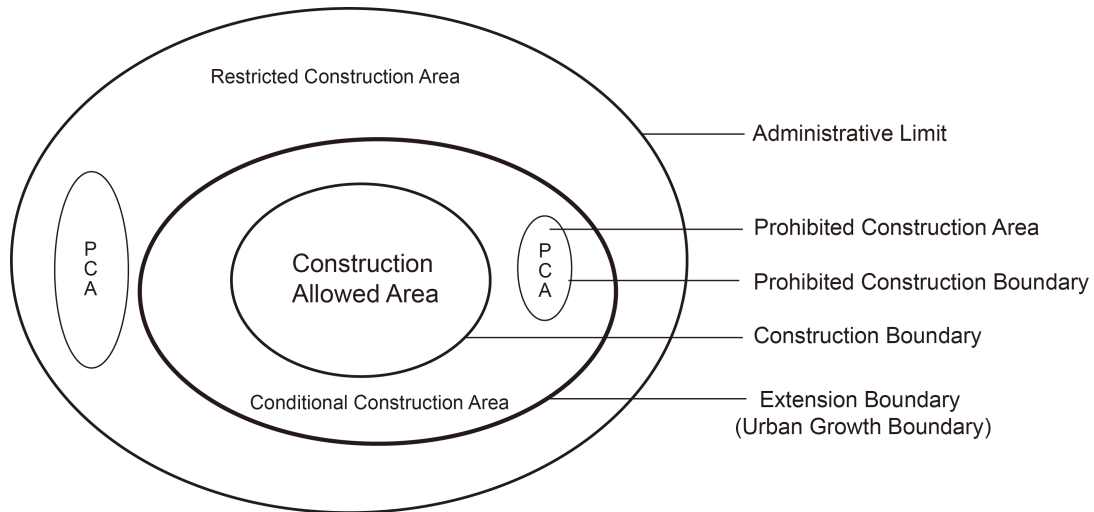


Figure 2. “Three Boundaries and Four Districts”

Source: Author

Though there is some overlap between the two sets of spatial management systems, they are formulated and managed by two different departments, the MLR and the MHURD. Thus conflicts and ineffectiveness are unavoidable during the implementation. This is why the Chinese government is seeking new policy tools and trying to unify the systems.

2.3.2 Urban Growth Boundary Studies in China

The concept of urban growth boundaries is not unfamiliar in China. There has been much literature discussing the measures of delimiting and implementing UGBs in China, and understanding United States’ UGB policies is their main learning object. Actually, the Measures of Formulating City Planning (2006) (《城市规划编制办法》(2006)) and the Urban and Rural Planning Law (2008) both required local planning agencies to formulate UGBs in their preparation of urban master planning (Shen & Qin, 2013). However, this was just an encouragement for cities to do relevant research of UGBs; there was still no instruction and legal basis for the implementation of UGBs. UGB was more than a research topic and not a planning policy at that time.

There is much debate about the nature of UGB policy and its application in the Chinese context

among Chinese academics and policy-makers. Existing literature or studies mainly focus on the definitions of UGBs, methods of designating UGBs, and discussions of America's experience. Lv and Xu (2010) thought that a UGB is an urban planning boundary for a city in a certain period and under the certain economic conditions. Duan et al. (2009) defined the UGB as a boundary between urban construction and non-construction lands. They also stated UGBs are technical and political measures used to control urban sprawl. Instead of simply defining a UGB as a line separating urban from rural areas to curb urban sprawl, Wang and Cheng (2010) further divided UGB into two types: the ultimate UGB and the flexible UGB (see Figure 3). The ultimate UGB delimits the maximum urban extent, and the area beyond the boundary can never be urbanized. The flexible UGB is a dynamic boundary, and it can be revised based on the needs of urban development in a certain planning period (Wang, 2013).

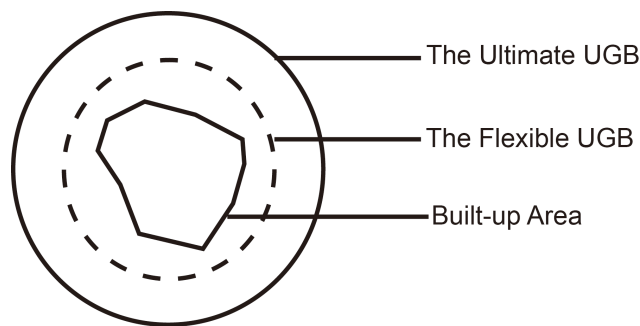


Figure 3. A simple illustration of the rigid UGB and the elastic UGB

Source: Author

Besides the discussion of the definition and nature of UGB policies, many researchers also have concerns about how UGBs can integrate with the existing spatial planning systems in China (Hu, 2014; Wang & Li, 2014). As introduced above, the National Comprehensive Land Use Plan (2006-2020) has required all Chinese cities to delimit the Construction Allowed Area and Prohibited Construction Area for each planning horizon, which is the existing Chinese form of controlling urban sprawl and preserving agricultural lands. Hu (2014) thought that UGBs could be consistent with the border of conditional construction areas, because the UGB and extension boundary both intend to identify the total available buildable land in a certain planning horizon (see Figure 2). And the construction boundary could be a flexible UGB, which could be adjusted

if the construction allowed area really needs expansion.

The discussion on methods for formulating UGBs is also a hot research topic. Yu et al. (2005) and Zhu et al. (2009) both proposed to identify the ecological sensitive areas and basic farmland within a city limit first, and then decide the area that can be used for urban construction. The border of the urban construction area becomes the UGB for the city. This method is called “land ecological suitability evaluation”. Other academics like Long et al. (2009) used the method of predicting urban land growth to delimit urban growth boundaries. Cellular Automaton (CA) modeling is a common approach used to simulate and predict urban growth and provide decision-making basis. Yang et al. (2010) proposed to combine the methods of land ecological suitability evaluation and urban growth prediction to delimit UGBs. Considering the importance of environmental protection and food security in China, I think the priority of protecting environment and farmland is a more appropriate approach of formulating UGBs in China.

2.4 Summary

Urban sprawl has become a nationwide problem both in the United States and China. There are a lot of debates about the nature and definitions of urban sprawl, but they share some common characteristics. Urban sprawl is a low-density land-use pattern that allows urban development to spread into rural areas which can lead to a series of environmental and social problems.

The United States has been concerned about this issue for a long time and has taken containment actions to prevent the problem from further aggravating. Urban growth boundary policy is one of the most common growth management tools used to curb urban sprawl. It is considered an effective way to limit urban expansion while encouraging compact development. For example, Oregon and Washington adopted mandatory legislation to establish UGBs in their metropolitan areas since 1973 and 1991 respectively. The other two containment tools are urban service areas and greenbelts. Local governments use urban service areas to limit urban sprawl by prohibiting the provision of public infrastructure beyond certain regions. In addition to the purpose of

limiting urban sprawl, urban service area policy also considers the issue of cost efficiency, because the extension of public services will also increase local financial burdens. The implementation of greenbelts is an old and international tool designed to control urban spatial expansion and prevent conurbanization. Boulder, Colorado, is one of notable case in the United States where this tool has been applied to manage urban growth. Abroad, London, UK, and Seoul, South Korea, represent additional examples.

Urban containment tools are not unfamiliar in China. There have been strict land policies such as the “land quota system” and the “cultivated land dynamic balance” to preserve farmland, and planning regulations such as “Three Districts and Four Lines” and “Four Districts and Three Boundaries” systems to manage urban and rural construction as well as to protect environment. However, the ineffectiveness of implementing containment policies and the huge demand for urban development weaken the goals of protecting farmland and curbing urban sprawl as expected. As for the urban growth boundary, it almost just remains on the paper now. Urban and land-use planning laws mention the concept of UGBs, but they do not provide specific guidance for the formulation and implementation of a UGB. In academia, there has been a lot of literature discussing UGBs. The nature and definitions of UGBs, the measures of formulating UGBs, and the feasibility of applying UGBs in the Chinese context are the main research focuses. Scholars have also explored America’s experience and proposed methods and plans for implementing UGBs in Chinese cities. But these are just theoretical analyses, very few local governments in China have had the chance to apply UGBs in reality.

What the Chinese scholars neglect in their discussions of America’s experience is that UGBs are effective when they are applied to an entire metropolitan area, including multiple cities and jurisdictions, rather than when they are implemented by an individual city or cities within the region. In the Portland region, the scope of the UGB is not limited in the City of Portland, but instead covers 24 cities and more than 60 special service districts. It is a regional planning tool that combines multiple policies to better manage regional urban growth. Instead of discussing how a Chinese *city* can learn from Portland, this thesis focuses on how a Chinese *region* can learn from such a regional strategy to control urban sprawl and protect farmland. One of the most

successful examples of UGB implementation in the United States, Portland, and one of the most developed urban agglomerations in China, Shanghai and SWC region, provide two cases for discussing the transferability and applicability of American-style UGB policies in a Chinese context.

Chapter 3. Portland's Urban Growth Boundary

3.1 Background and History

Because 24 cities, include the City of Portland, and more than 60 special districts fall inside the Portland UGB, the term 'Portland UGB' is used in this thesis synonymously with the terms 'Greater Portland' and the 'Portland Metropolitan Area'.



Figure 4. Location map of Portland metropolitan area

Source: Christensen, 2015b

Metropolitan Portland is located in the Willamette Valley east of the Pacific Ocean. The Willamette Valley is a fertile agricultural area, lying in the northwest of Oregon State (see Figure 5). The Valley stretches about 150 miles north to south and 40 miles east to west. It covers only 8% of Oregon's territory, but nearly 70% of the state's population lives in this region (Loy et al., 2001). The historic recurring floods in this region has enriched the soil and made it a livable

place for plants and humans. It produces about 40% of the state's agricultural goods and becomes an important source of the state income (Nelson, 1992). In the 19th century, the valley was mainly inhabited by a branch of the Native American Kalapuya tribe. But in the early 1830s, about 90% of the tribe died from an epidemic (Hunn & Selam, 1999). Then, new European settlers moved into this area and timber industry developed. The area adjacent to the Columbia River gradually became the urban center of this region (Hedstrom, 2012).



Figure 5. Willamette Valley

Source: Willamette Valley, n.d.

From the 1960s onward, the whole United States experienced a rapid urban expansion process. With the completion of the Interstate Highways, people chose to move to the periphery of urban areas, and suburbanization along with decentralization became a national trend. Over this period, the national urban population increased 21% and urban land increased approximately 9,000 acres (Knaap & Nelson, 1992). Oregon was not immune to these development trends, especially in its traditional urban center, the northern Willamette Valley region. Many immigrants from California and other states moved into the cities situated in the valley and settled down (Knaap &

Nelson, 1992). The population growth led the expansion of urban uses. The local governments and residents saw the sprawl and realized if the development was left uncontrolled, the region's farmland, timber, and scenery would be encroached upon and destroyed. Further, local agricultural productivity would decline and the pristine environment would cease to exist.

As a response to the concerns of urban sprawl and its threat to agriculture, a conference titled, "The Willamette Valley-What Is our Future in Land Use?" was held in 1967 to discuss the proposal of the State's first mandatory planning legislation, Senate Bill 10 (SB 10) (Abbott et al., 1994). Under the support of Governor Tom McCall, SB 10 was passed in 1969. It required all cities and counties to prepare comprehensive land-use plans and zoning ordinances to manage local land uses. However, this bill was ineffective, because it was not mandatory for implementation and it did not provide sufficient funding, technical assistance, or political incentives for local governments to execute (Dempsey & Plantinga, 2013). Many cities and counties just neglected to follow this requirement.

A new proposal, after the revision of loopholes and weaknesses in SB 10, developed by Senator Hector Macpherson, a dairy farmer from Linn County, and Governor McCall was submitted for discussion. In May 1973, McCall, Macpherson, along with a coalition of farmers and urban, environmental and agricultural interests strongly supported an improved and more comprehensive bill, that was then adopted by legislature as Senate Bill 100 (SB 100) (Abbott et al., 1994). This bill became the base of Oregon's land use regulation system. It also created two important agencies, the Land Conservation and the Development Commission (LCDC) and the Department of Land Conservation and Development (DLCD). The LCDC is composed of seven members elected from city or county officials and it is responsible for developing statewide land-use planning goals and overseeing local compliance with state goals. The DLCD was required to provide staff support and planning programs for the LCDC. 14 statewide planning goals were developed in 1974 and another 5 goals were added in December 1975 by the LCDC. The 19 goals are listed as follows (see a summary of these planning goals in the Appendix A):

Table 5. Oregon statewide planning goals

Oregon Statewide Planning Goals	
1. Citizen Involvement	11. Public Facilities and Services
2. Land Use Planning	12. Transportation
3. Agricultural Lands	13. Energy
4. Forest Lands	14. Urbanization
5. Open Spaces, Scenic and Historic Areas and Natural Resources	15. Willamette Greenway
6. Air, Water and Land Resources Quality	16. Estuarine Resources
7. Areas Subject to Natural Disasters and Hazards	17. Coastal Shorelands
8. Recreation Needs	18. Beaches and Dunes
9. Economy of The State	19. Ocean Resources
10. Housing	

Source: Statewide Planning Goals, n.d.

As required by Oregon’s legislation and in order to get state financial support, local communities’ plans must be consistent with the statewide plans. Local land use decisions should be made with the participation of both local and state governments. This ensures communities’ individual planning goals will be coordinated with the state goals (Duncan, 2012).

3.2 Establishment of the Urban Growth Boundary

Goal 14 Urbanization requires cities “to provide for an orderly and efficient transition from rural to urban land use, to accommodate urban population and urban employment inside urban growth boundaries, to ensure efficient use of land, and to provide for livable communities” (see the full text of the Goal 14 Urbanization in the Appendix B). The idea clearly identified in the goal is that cities and counties have to establish UGBs and development should be limited within the boundaries, and lands beyond the UGBs should not be urbanized. In addition, the area within the UGB should provide sufficient land for community development.

Under the Oregon’s planning system, local governments have to submit their UGB proposal to the LCDC with approval contingent on the statewide planning goals. The top-down enforcement device and the land-use planning consistency between state and local governments ensure the efficiency and effectiveness in the implementation of all Oregon UGBs.

In 1977, the regional planning agency, the Columbia Region Association of Governments (CRAG) (1966-1978), proposed a UGB plan for the Portland region. A predecessor of Metro, CRAG was a council of governments, a type of planning agency that existed in many U.S. metropolitan areas during the late 1960s and early 1970s (Abbott, 2001). The original UGB plan encompassed 227,410 acres of land, including parts of Clackamas, Multnomah and Washington counties, along with their 24 cities inside the boundary (see Figure 6) (Christensen, 2015a). According to the “19 Statewide Planning Goals,” Portland’s regional UGB is intended to preserve prime farmland, forests and open space, efficiently provide public infrastructure facilities, distinctly separate urban and rural uses, and create compact and livable communities. This plan was eventually approved by the LCDC in 1979.

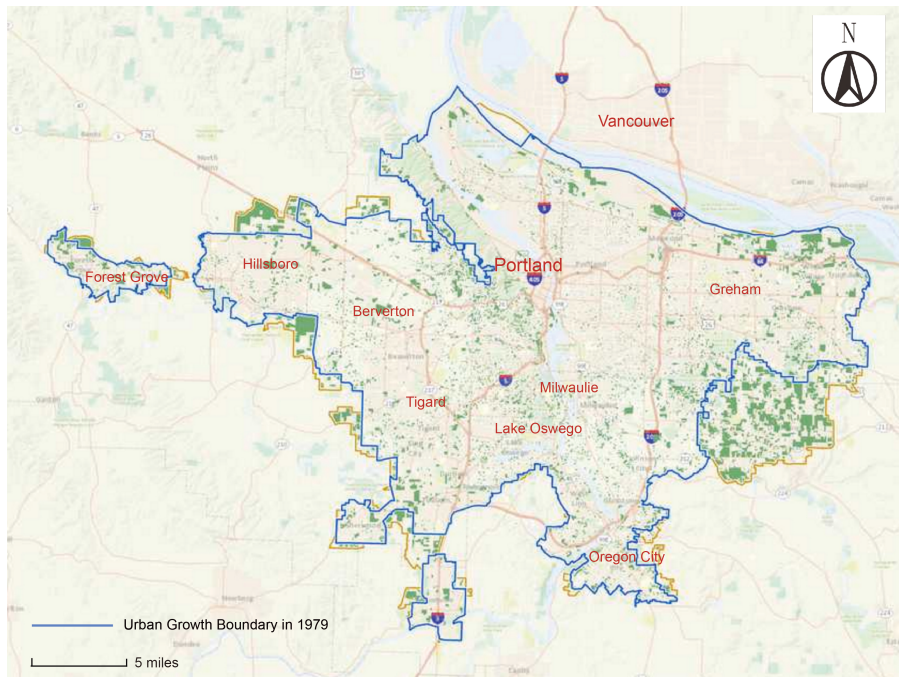


Figure 6. Portland region’s UGB in 1979

Source: Christensen, 2015a

The creation of the first UGB was primitive and all done by hand (Knaap, 2003; Anderson, 1999). Planners drew the boundary according to public interviews and subjective forecasts of population and urban growth, which was inefficient and not scientific enough. As a result, the early versions of the UGB was usually drawn too large and decreasing the effectiveness of controlling sprawl (Anderson, 1999). Due to the uncertainty of the urban development and population growth rate, it is still a controversial issue about determining and amending the size of the UGB.

3.3 Management of the Urban Growth Boundary

In 1978, the regional government agency, Metro, evolved from the CRAG was established. Created by voters to serve the Portland metropolitan area, Metro is the only directly elected regional government in the United States (“Metro Regional Government,” 2016). Metro’s administrative area is the urbanized portion of Clackamas, Multnomah, and Washington counties surrounding Portland. Metro’s political boundary does not totally overlap with the UGB. As demonstrated in Figure 7, some areas are inside the Metro boundary but outside the UGB, and vice versa.

Metro is responsible for conducting regional land-use planning, transportation planning and solid waste planning, preserving open space, and managing convention and performance venues, as well as the Oregon Zoo (“Metro Regional Government,” 2016). As for the land-use planning, Metro is granted powers to: coordinate between regional and local comprehensive plans; adopt a regional urban growth boundary; require consistency of local comprehensive plans with statewide and regional planning goals; and prepare plans with metropolitan significance, such as transportation, air quality and solid waste planning (Moldenke, 2000).

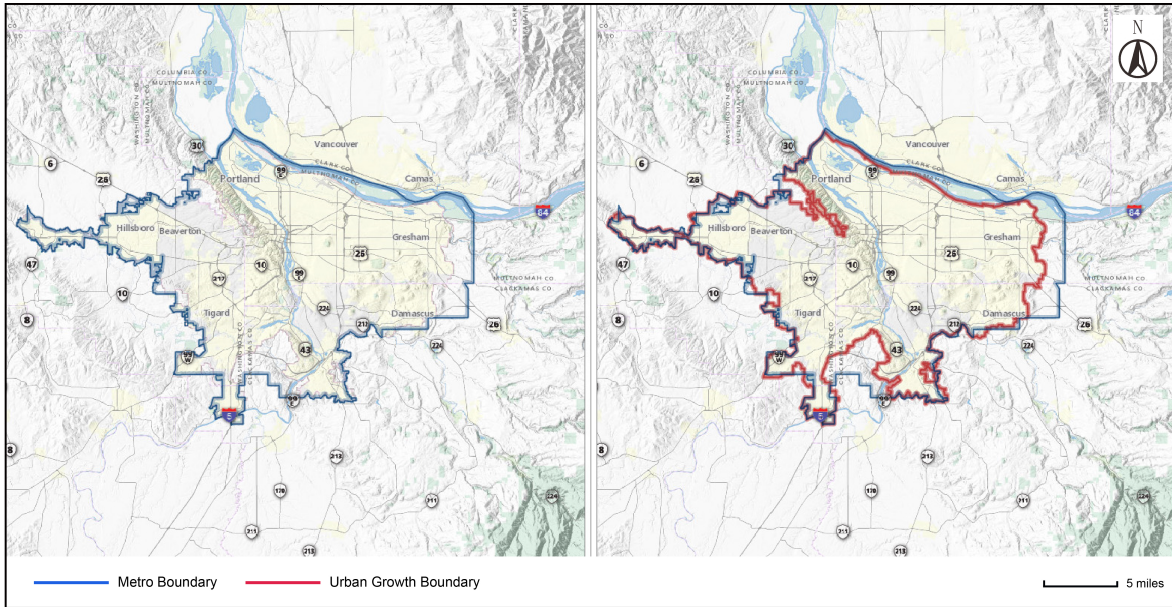


Figure 7. Metro boundary and urban growth boundary
 Source: Metro’s Regional Land Information System, 2016

When formulating and revising Portland’s UGB, Metro has to consider multiple factors to maintain the effectiveness of the system. As required by land-use planning Goal 14, changes to the UGB should be based on a cooperative process, which means all cities and counties within the boundary have to reach intergovernmental agreements before any changes are made. Metro is responsible for coordinating among cities and managing the regional UGB. In order to satisfy the need for urban land over the planning horizon and protect farmland beyond the UGB, Metro is required to assess population and employment growth projections for the next 20 years and ensure land supply for the 20-year development within the boundary. Then every six years, Metro reviews and determines whether the land can accommodate the growth. It creates an urban growth report that discusses the current situation and the necessity of expanding the boundary. The formulation of the UGB should also consider the cost-efficiency of providing public facilities and services and the compatibility of the urban lands with the adjacent non-urban uses outside the UGB (Staley et al., 1999).

Metro’s land use decisions have to get the approval of the LCDC. As required by Oregon’s Legislature, local governments have to submit their UGB proposals to the LCDC and the LCDC

will review and justify them based on the statewide planning goals (Moldenke, 2000). For example, if Metro wants to expand the regional UGB, it has to submit application to the LCDC and get the approval. However, conflicts between the local governments and the LCDC always arise, because the state usually requires less land inside the UGBs than the local governments want (Abbott et al., 1994). And if the state feels the local government's plan is inconsistent with the state's goals and policies, the LCDC can penalize the local municipality by reducing state revenue sharing and other funding for local planning (Moldenke, 2000; Anderson, 1999). Then, if the local government is not satisfied with the decisions and there are still disputes, it can choose to appeal.

There are several levels of procedures to solve land-use disputes between different entities in Oregon. There is a Land Use Board Appeals (LUBA) established to resolve disputes regarding land use issues. LUBA is a three-member board set up as an exclusive jurisdiction to review the land use decisions made by local government or state agencies (Anderson, 1999). The decisions made by the LUBA are reviewed by the state's circuit courts. LUBA was established to simplify and speed up land-use appeals, and it is required to issue decisions within three months, which is much faster than similar cases in other states (Moldenke, 2000; Abbott et al., 1994). Besides the LUBA, cases can also be appealed to the state's Court of Appeals and the state Supreme Court. Instead of coming to litigation, land-use cases can also be solved through mediation and arbitration. There are both private and public agencies that provide such mediation services. The two parties can choose the mediators to settle the dispute. The LCDC can help select the mediators and it can even cover part of the cost of resolving the dispute.

3.4 Land Reserves and Urban Growth Boundary Expansions

There are two types of land reserves outside of Portland's UGB: urban reserves and rural reserves. Urban reserves are lands that outside the current UGB but are designated as suitable lands for urban development in the future. Rural reserves are lands that are outside the UGB and with high agricultural or natural value that should be prevented from urbanization for a certain

planning horizon. Urban reserves have the highest priority to be included inside the UGB to meet the growth. The reserves have the validity for 50 years to 2060. Urban and rural reserve areas are shown in Figure 8.

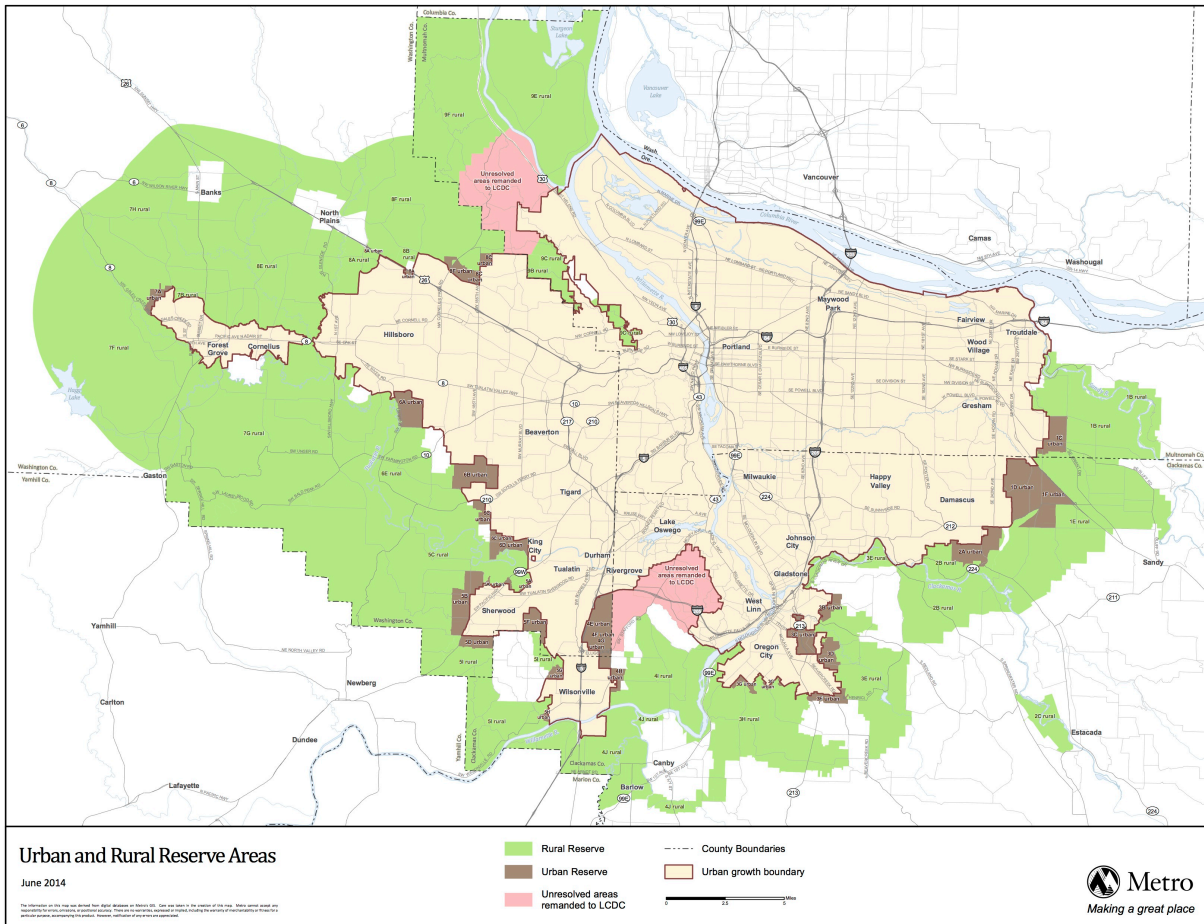


Figure 8. Urban and rural reserve areas around the Portland’s UGB

Source: Metro, 2014a

Not all the lands just outside the boundary are designated as urban or rural reserves. There are other kinds of lands outside the boundary with lower priority for urban expansion uses. When considering expanding the UGB, urban reserves will be the first class of lands considered for expansion. Exception land is the second class. It is not farmland or other resource land due to geologic and soil conditions and it is not designated as urban or rural reserves. Marginal land is the next one. It is classified as exception land but housing development is allowed on it. The last

priority is forest and farmland, and the forest or farmlands with the lowest productivity will be the first to be considered for urban expansion use.

Urban reserves are lands that are set aside for future urban uses and they should remain rural uses until they truly required to be merged into the UGB. The selection and classification of land reserves occurs after public hearings, open houses, scientific analysis, and under the guidance of statewide planning goals. The process of designating reserves involves developers, farmers, environmentalists, and local governments representatives who make recommendations to Metro and the three counties. The selection of rural reserves should consider soil quality, valuable farms and forests, and natural features such as rivers, wetlands and floodplains. Besides the engagement of the public, Metro must coordinate with cities, special districts, and state agencies to complete the designation and submit its plans for review and acknowledgement by the LCDC. It is a complex and time-consuming process to make the final decisions of the reserves. It took years of analysis and debate among the public and local governments to achieve a final agreement of the next 50-year reserves plan in 2010 (Christensen, 2015c).

The reserves are beneficial for residents and landowners on both sides of the UGB. Developers and landowners can know where the region will develop in the next decades and farmers outside the boundary can plan for their uses on their land based on the growth plan and the community needs (Moldenke, 2000; Hedstrom, 2012). This provides the individuals the certainty and direction of their own plans.

As introduced above, every six years, Metro will review the supply of land to maintain a 20-year development within the boundary, and if necessary, the boundary will be expanded. Since the establishment of the UGB in 1979, Portland region's UGB has been expanded more than thirty times. But actually, most of the changes are minor, 20 acres or less. The current area within the boundary has not changed much since the establishment of the original UGB in 1979. The map in Figure 9 shows the historic expansions of the UGB in the Portland metropolitan area.

One of the larger expansions happened in 1998, when the Metro Council concluded that more land was required to meet the future population growth in the next 20 years. About 3,500 acres of land was incorporated into the boundary to accommodate a projected 23,000 housing units and 14,000 jobs (“Urban Growth Boundary,” 2016). In 2002, over 18,000 acres of land was incorporated into the UGB to provide space for the expected increasing housing units and jobs. The most recent consideration of expansion was in 2015, but it was denied. Because the Metro Council thought there was still enough land for development from previous expansions and the next consideration for UGB expansion will be in 2018. From 1979 to now, the UGB area increased by 31,386 acres, an increase of about 872 acres annually.

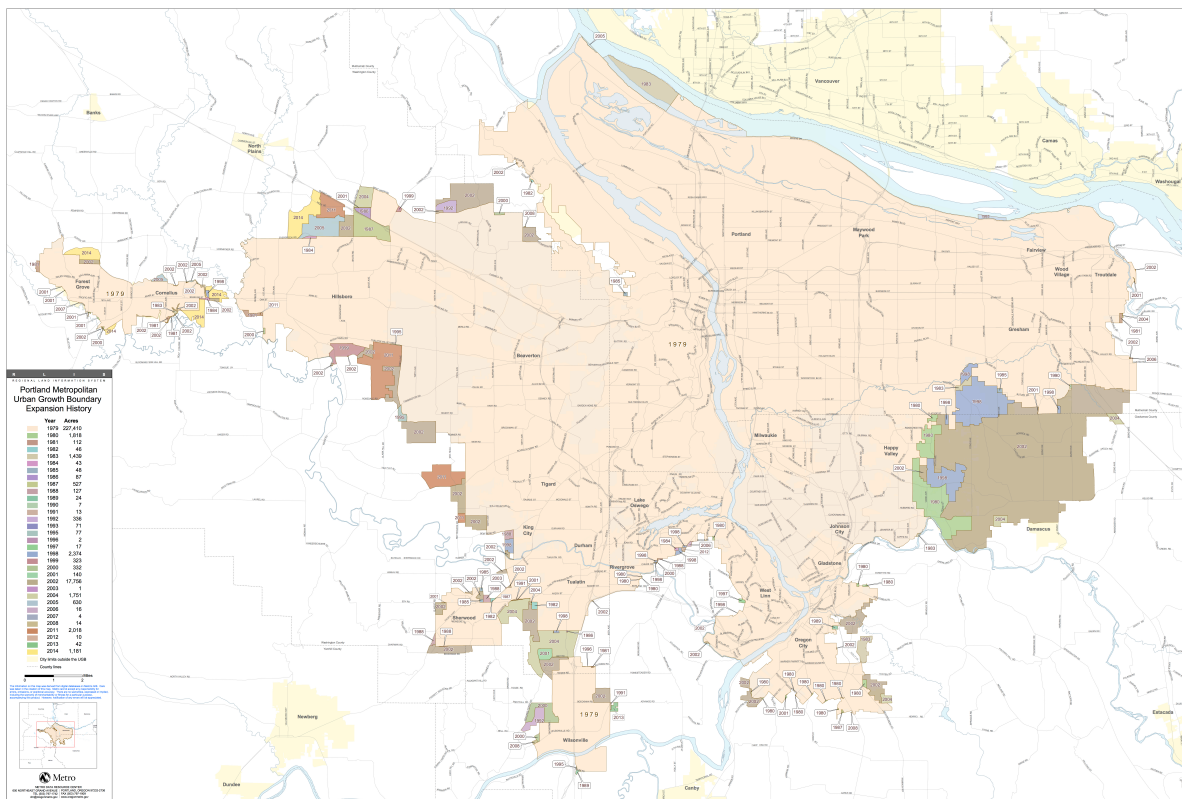


Figure 9. Historical expansions of Portland’s UGB

Source: Metro, 2014b

In the process of deciding to expand the UGB, there are three types of methods that Metro can use to amend the UGB: legislative amendment, major amendment, and minor amendment. When

reviewing the necessity of expanding the UGB, the Metro Council intends to achieve six desired outcomes (“Six desired outcomes,” 2016):

1. People live, work and play in vibrant communities where their everyday needs are easily accessible.
2. Current and future residents benefit from the region's sustained economic competitiveness and prosperity.
3. People have safe and reliable transportation choices that enhance their quality of life.
4. The region is a leader on climate change, on minimizing contributions to global warming.
5. Current and future generations enjoy clean air, clean water and healthy ecosystems.
6. Equity exists relative to the benefits and burdens of growth and change to the region’s communities.

If Metro finds that there is a need to add more urban land to accommodate the population and employment growth after its six-year review, then the Metro Council will take formal actions to amend the existing UGB. Metro makes legislative decisions to amend the UGB to address the need for urban population growth and achieve the six desired outcomes. A legislative amendment is the primary way used to make long-term UGB changes.

Amendments are used to address needs that are not in the six-year review and cannot wait until the next review. Hearings are held for such amendments. In addition, minor amendments are made for small changes that improve land-use efficiency, such as adding land for a road, but not adding land for residential or employment needs.

3.5 2040 Growth Concept

In 1995, after an extensive research and public involvement, the Metro Council adopted a 50-year growth plan for the Portland metropolitan area. The rapid population growth during the late 1980s and early 1990s caused the people in this region to think about their future development. Analysis found that if the existing development trends continued, then more than 120,000 acres of land would be required to meet the growth by the year 2040 (“The Nature of 2040,” 2016). Considering the increase of investment in public infrastructure and services and the potential impact on the surrounding communities and environment, Metro decided to analyze and make decisions about future development pattern.

After intensive study and technical analysis, Metro developed three “growth concepts” to illustrate how the region could chose to grow (see Figure 10). Concept A allows significant expansion of the UGB and new housing growth would concentrate on the edge of the boundary, and 51,000 acres of land would be added to the UGB. Concept B would not allow any expansion and all the new growth would happen within the boundary. Concept C supports moderate expansion of the UGB, with 22,000 acres of additional land, and new growth would mostly focus in urban centers, corridors and neighboring cities.



Figure 10. 2040 Growth Concepts

Source: Metro, 2000

In order to make the final decision and find out the residents opinions, Metro conducted a series of outreach effort to get people’s feedback. A regional questionnaire, public open houses and

workshops, television, radio and newspaper ads, and presentations to local communities were used to get the public involved in the process of decision-making and give them the opportunities to shape the future of the region. Finally, Metro mailed questionnaires to more than 500,000 households and received over 17,000 responses with nearly 12,000 of the responses having additional written comments.

Most people supported development along transit corridors, smaller residential lot sizes, and transit-oriented development. An alternative growth concept, close to the original Concept C but with a smaller expansion (15,000 to 19,000 acres added to the UGB over 50 years), was finally adopted. The essence behind the 2040 Growth Concept is “to preserve our access to nature, and

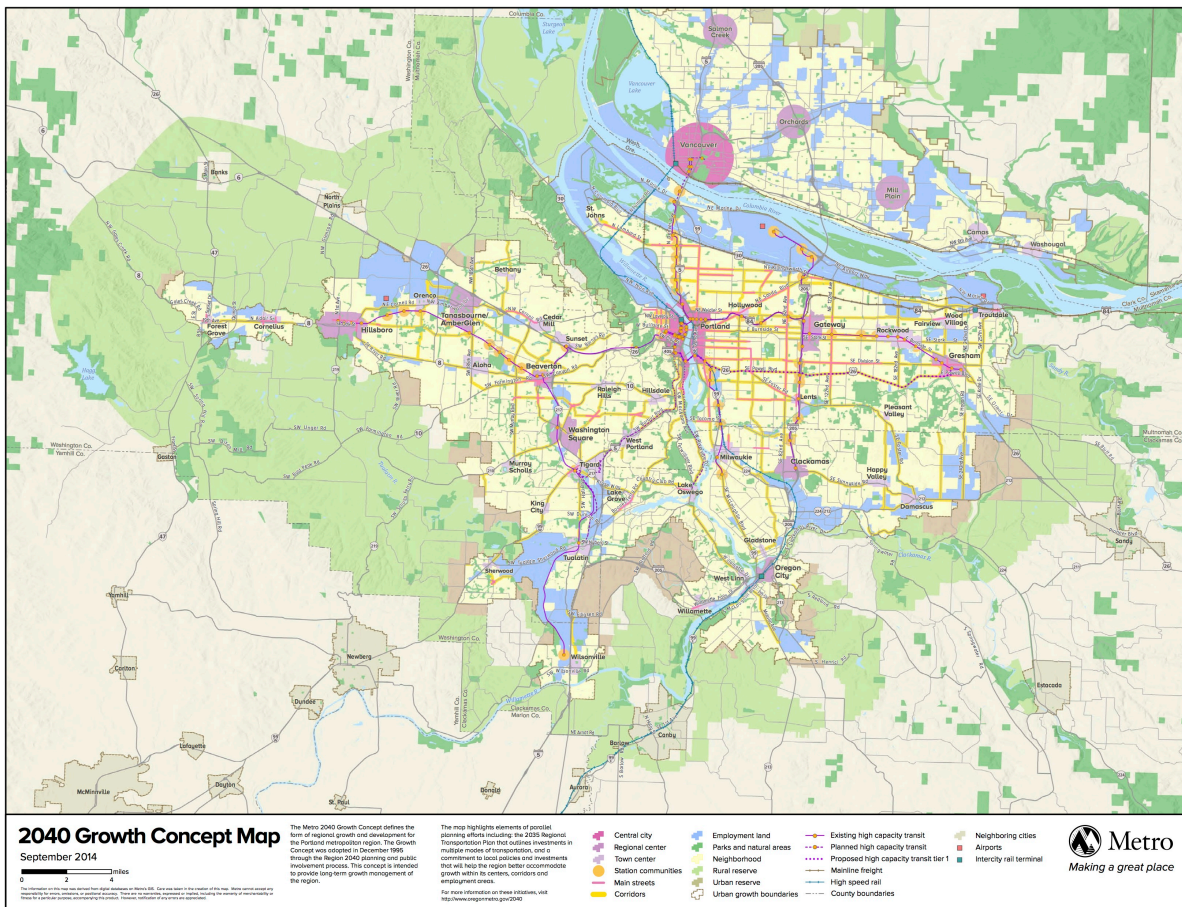


Figure 11. 2040 Growth Concept Map

Source: Metro, 2014c

build better communities for the people who live here today and who will live here in the future” (Metro, 1997). The 2040 Growth Concept Map (Figure 11) shows the form of the regional development, and the components of urban centers, transit system, and urban and rural reserves.

In order to ensure that the goals of the 2040 Growth Concept would be achieved and to move actions forward, Metro and the local cities and counties worked together to establish the Urban Growth Management Functional Plan, the Regional Framework Plan, and the Regional Transportation Plan. These plans established specific requirements and guidance to direct local governments and Metro to manage growth.

3.6 Effects of the Urban Growth Boundary

There has been a lot of literature discussing and analyzing the effectiveness and effects of Portland’s UGB. The topics mostly focus on housing affordability, land value, farmland preservation, and other unintended effects or consequences that have emerged decades after the implementation of the UGB.

3.6.1 Farmland preservation effects

According to Oregon’s statewide planning goals, there are two clear provisions requiring cities and counties to (1) establish UGBs to provide for an orderly and efficient transition from rural to urban land use (Goal 14), and (2) to preserve and maintain agricultural lands and establish zoning to limit uses that can have significant adverse effects on agricultural land (Goal 3). The UGBs can set a limit to urban development, which ensures that urban growth will not interfere with agricultural uses outside the boundary. Goal 3 further clarifies the requirement of preserving farmland.

Portland’s UGB has proven to be successful at preserving agricultural lands. Since the initiation of the UGB, the reduction of farmland in this region has been less than five percent, while over

the period of 1950-1974, before the establishment of the UGB, about one third of farmland in the Willamette Valley was lost (Hedstrom, 2012; Walker & Hurley, 2011). Metro also claimed that they had protected over 260,000 acres of rural lands from development (Metro, 2010). Compared to other areas in the country, Oregonians have a higher rate of medium and large farm ownership, and the loss rate of large farms is much lower than the national average. A comparative analysis conducted by Daniels and Nelson (1986) found that Oregon lost just 1.7% of its farmland between 1978 and 1982 while the nation lost 3%. When compared to the neighboring Washington State, which did not have the statewide land use planning system at that time, Oregon also lost less farmland.

Beside the UGB, Oregon has established a package of policies to preserve farmland. Exclusive farm use (EFU) zoning, restrictions of development in exurban districts, farm use tax, and right-to-farm policies are all the approaches that Oregon applied to protect its farmland resource. Previous studies have shown that Oregon's farmland preservation policies and tools are effective in protecting farmland and shifting the regional demand for urban development from farmland into the targeted areas (Nelson, 1992). Most of the loss of agricultural land since the establishment of Oregon's land use planning system happened in non-EFU area that was expected to develop (DLCD, 2016).

According to the history of UGB expansions, we can also find that there was minor expansion of the UGB after over three decades of implementation. Because of the UGB limit, urban growth is almost locked in the boundary, and other farmland preservation policies such as the EFU zoning outside the boundary prevent land from converting into urban uses. Oregon's land use planning program seems to have had an effect on protecting farmland, especially when compared to other regions that do not have as strict a land use planning program. Without the planning system, the farming industry in Oregon might have died, and as Nelson (1992) and Moldenke (2000) said, farmland owed its survival to the statewide land-use planning program.

3.6.2 Housing Affordability Effects

Housing affordability is another important issue that attracts many concerns when discussing the effects of Portland's UGB. Housing affordability indicates a household's ability to afford a housing unit based on its annual income (Ma, 2011). Many people argue that the UGB causes a substantial rise in housing prices because it restricts the supply of land for housing development, while increasing the demand for housing. Thus the rise of housing prices decreases the affordability of housing for local residents.

There have been a lot of studies discussing and analyzing the relationship between the UGB and housing affordability. The limited supply of land would raise the value of land and then push up the prices of housing (Knaap & Hopkins, 2001). Staley et al. (1999) also pointed out that as less land was available for development, the competition among the existing developable land raised land prices. The comparison with other cities with no UGB also provides evidence for the negative effects of Portland's UGB on housing affordability (Staley et al., 1999). From 1990 to 1995, Portland's housing prices increased by 61.5%, while in Las Vegas, the fastest growing city at that time, housing prices only increased by 22% during the same period. Further, Portland was one of the top 10 least affordable housing markets in the nation in 1999 (Staley et al., 1999). On the other hand, housing pressures were not moderated by expanding the UGB, because the support of zero growth was the mainstream.

A housing affordability analysis report released by Metro on January 2016 also admitted that Portland region's affordability was challenged (Metro, 2016). However, the report pointed out that the problem was not that there was lack of land for housing construction, but it was the high infrastructure costs that impeded the supply of affordable housing. Also, some other studies argued that the UGB did not certainly lead the increase of housing prices in the Portland region. Phillips and Goodstein (2000) used a regression model to test multiple factors that might affect housing prices in Portland. They concluded that rapid employment and income growth were the main variables that resulted in the increased housing prices. Knaap and Nelson (1992) concluded that there was little evidence supporting the idea that the UGB constrained the affordability of housing in Portland. The 1000 friends of Oregon, an environmental interest group, also claimed

that the increased housing prices in the 1990s resulted mainly from the economic rebound not the UGB (Ma, 2011).

In summary, there is no ultimate and absolute conclusion of the relationship between the UGB and the regional housing affordability. Some studies believe that the UGB limits the supply of developable land within the boundary that results in the increase of housing prices. Other quantitative research indicates that Portland's UGB does not affect housing prices, but the increased prices resulted from the growth of local employment and income. However, the more common conclusion is that Portland's UGB has some impact but not significant on the housing prices and housing affordability.

3.6.3 Some Unintended Effects

UGBs are intended to increase urban density and create compact communities. However, it seems that the region did not totally achieve its goals as expected. Early studies of the effectiveness of Portland's UGB found that the actual densities within the UGB were only one-third to three-fourth of those required by local comprehensive plans (Moore & Nelson, 1994). And because the densities were below the levels expected, the projected population growth inside the boundary was projected to create a huge shortage of housing units in the future.

In order to increase urban density, Metro applies infill and redevelopment strategies in the urban cores. The consequence is that the high infill/redevelopment rate pushes up the housing cost because of expansive small pieces of land (Staley & Mildner, 1999). This affects the lower-income residents, because they cannot afford the increased housing costs and prices, and thus they are forced to leave their original communities.

Though studies found that the UGB has successfully contained urban development within the boundary, researchers also found unintended scattered and low-density residential development outside the boundary (Moore & Nelson, 1994). A new antigrowth interest group, called "hobby

farmers,” emerged outside the UGB. They were not professional farmers, rather they operated noncommercial “hobby” farms (Moldenke, 2000). These hobby farmers were allowed to build their homes on the exception land just beyond the UGB if they cultivated Christmas trees or strawberries on their parcels (Moldenke, 2000). In the 1980s, ninety percent of farms under 160 acres where new homesites were permitted reported no farm receipts (Nelson, 1992). This low-density residential development on the rural parcels actually caused the exurban sprawl that the UGB advocates hoped to avoid. Hobby farmers were against the expansion of the UGB because higher-residential density and new development on their neighboring open space would destroy their desired quality of life (Moldenke, 2000). This would affect the efficient expansion of the UGB in the future when new supply of buildable land was truly required.

On the other side of the Columbia River, out of the Portland’s UGB and Metro’s jurisdiction, in Clark County, Washington, lies the City of Vancouver. The city did not have its own urban growth boundary until 1995, after Washington adopted its statewide Growth Management Act. Some studies have found that Vancouver or Clark County played as a safety valve for growth outside Portland’s UGB (Moldenke, 2000; Jun, 2004). Figure 12 shows that most of the urban development in the Portland metropolitan area was limited within the UGB, but the spillover effect happened in Vancouver. In the 1990s, Vancouver’s population increased over 185% and

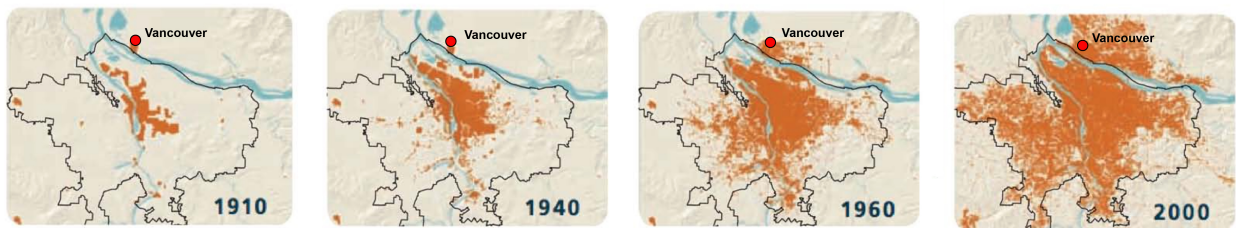


Figure 12. Historical urban development in Portland metropolitan area

Source: Hedstrom, 2012

the size of the city expanded by 187% to become the fourth largest city in Washington (Moldenke, 2000). Between 1980 and 2000, new housing construction in Clark County was much faster than the other three Oregon counties within the Portland’s UGB, because Clark

County became the area absorbing new population growth from Portland region (Jun, 2004). Bae's (2001) study also concluded that Portland's growth was diverted into other places outside the UGB, especially into Clark County, WA.

The passage of Oregon Ballot Measure 37 in 2004 seriously challenged the UGB system. Measure 37 allows property owners to claim compensation from government if the government enacts land use regulations after they've acquired their property, and if the regulations restrict the use of the property, and reduce the value of the property (DLCD, 2011). Instead of compensation, state or local government can choose to waive regulations within 180 days once a claim is received. This caused a serious administrative and fiscal challenge to Oregon's land use management system. For the Portland region, Measure 37 means that lands zoned for rural residential development or for farming and forestry outside the UGB could qualify for compensation or waivers to allow rural development (Liberty, 2006). Over 700 claims were filed in the Portland region after Measure 37 approved, and almost all of them requested to waive land use regulations rather than compensation (Liberty, 2006). This would dramatically compromise the region's ability to protect farmland and manage growth.

Beyond the threat to growth management, Measure 37 caused many other debates. Measure 37 creates uncertainty in the real estate market, because the value of property becomes less predictable. Landowners might require modification or waivers of the regulations on their property and this would affect the future use and value of their and their neighbors' property ("Oregon Measures 37 and 49," 2016). Measure 37 imposes a burden on taxpayers, because there is no particular funding for the compensation for claimants, and thus the money has to be taken from taxation. In addition, the Measure is incomplete, because it does not provide a method for determining the value of property when a claim is filed.

Then, as a response to the debates over Measure 37, in 2007, Measure 49 was passed, which fixed many provisions of Measure 37. Measure 49 requires claimants to prove the loss of their property and it allows landowners to ask compensation for new (after January 1, 2007) enacted land use regulations that restrict residential uses on their property (DLCD, 2011). Measure 49

restricts compensation to new regulations and narrows relief to property owners affected by regulations that limit their residential uses, farming or forest practices (DLCD, 2011). Measure 37 and Measure 49 are referendums on over-regulation that suggest that people want guaranteed rights to develop the property they choose (Hedstrom, 2012). However, this has become an excuse for residential development outside the UGB. The statistics showed that as of 2011, over 6,000 new home sites had been approved in Oregon and 60% of them were on lands that zoned for farming (Hedstrom, 2012).

3.7 Lessons From Portland's Experience

Portland's UGB is not just a line encircles a growth controlled area, but there are sophisticated mechanisms behind the system. The content introduced above only covers a small part of the story of the UGB. Portland's UGB has been considered as a successful and textbook example for areas which want to learn experience and import a similar program to manage urban growth. The UGB is not a perfect tool in limiting urban sprawl and leading urban growth, and there are still problems have not been solved and new problems even resulted from its implementation. However, we can still summarize lessons that may be valuable for China to establish its own UGBs.

1. Regional planning. Portland's UGB serves the entire Portland metropolitan area not a single city. It is clear if the UGB just controls the City of Portland but not contains its adjacent cities or communities, the sprawl would be displaced to the neighboring places that do not make efforts for growth management. For example, the neighboring Clark County, WA, became the place that passively absorbed growth from the Portland region because it did not have a UGB after Portland had controlled its sprawl. Besides, Metro is only one of the 241 jurisdictions in Oregon that is required to establish a UGB, which suggests that an effective UGB program requires regional coordination. Different jurisdictions have to participate in the same efforts to manage growth and they should be consistent with each other.

2. Policy regime. Oregon's land-use planning system is the base of the UGB program, and it requires a list of statewide planning goals and provisions for all the cities and counties in the state. The UGB is not the only policy that attempts to protect farmland and forestland outside the urban areas, there are also zoning ordinances and farm use tax policies dedicated to the preservation of resource lands. Growth management requires efforts on different aspects and scales, such as transportation and infrastructure planning at a regional scale, and urban design for compact communities at a neighborhood scale. The UGB in Portland is not implemented in isolation, and the UGB on its own cannot work effectively.
3. Flexibility. Portland's UGB is not a static line, it will be amended based on population, housing and employment needs. Metro is required to maintain a 20-year supply of land within the boundary to satisfy the future development and it will review the land use status every six years to decide whether to expand the UGB or to improve the land-use efficiency without expansion. The UGB needs to be adjusted to accommodate the urban growth. However, problems may emerge as the UGB could be drawn too large to prevent urban sprawl.
4. Development Guidance. Oregon's land-use planning does not intend to prevent urban growth, but rather manage the locations, densities, and rates where development can take place (Gosnell et al., 2011). Metro designates urban reserves, rural reserves, and exception lands that identify the developable lands for the potential urban growth in the future. And low-density residential development within farmland or forestland is allowed as long as the landowners get the approval from local authorities and the LCDC (Gosnell et al., 2011). In addition, the 2040 Growth Concept outlines the long-range development pattern for the Portland region, and identifies the central city, regional centers, town centers, station communities and corridors as the region's visions in the future.
5. Public Involvement. Oregon's statewide planning system is top-down to ensure that land use decisions are implemented at statewide, regional and local scales. On the other hand, the extensive public involvement ensures the UGB program gets support. Every significant planning decision or proposal in Portland has to be approved by its voters and Metro also prefers to conduct high-level public consultation during its planning formulation process. The

public can suggest the expansion of the UGB and recommend on the development pattern of the region such as in the process of formulating 2040 Growth Concept. However, public involvement is a double-edged sword, undue involvement is time-consuming and sometimes makes the planning process ineffective.

3.8 Summary

Portland's UGB is established on the basis of statewide land-use planning, which provides an institutional guarantee for the promotion and implementation of the UGBs in the state. Metro, the regional jurisdiction, coordinates the cities and counties in the Portland region to achieve goals of controlling urban sprawl, preserving agricultural lands, and creating compact and livable communities. To accommodate future growth the UGB must be amended from time to time. Urban and rural reserves have been designated to define where is developable and where is not. As a response to the rapid urban growth in 1970s, Portland's UGB is entering its fourth decade of implementation. There have always been debates and questions of the successes and failures of the UGB, and there will not be a conclusion to these controversies any time soon. However, Portland's UGB has become a planning landmark in the world and a notable example for growth management, and it does have valuable lessons for Shanghai and SWC region to learn.

Chapter 4 Adopt Urban Growth Boundary in Shanghai and Suzhou-Wuxi-Changzhou Urban Agglomeration, China

4.1 Background of Yangtze River Delta

The study area, the Shanghai and Suzhou-Wuxi-Changzhou metropolitan areas, is located in the east of Yangtze River Delta (YRD) in the southeast of China. Yangtze River Delta is the most economically developed region of China and occupies the alluvial basin of the Yangtze River (Changjiang). This region comprises the Shanghai Municipality, Jiangsu and Zhejiang Provinces (see Figure 13), and it is one of the three largest urban agglomerations in China. Pearl River Delta and the Jing-Jin-Ji (the capital region, including Beijing, Tianjin and Hebei Province) region are the other two. The total area of the YRD region is 81,300 square miles (210,700 square kilometers, about 82% of Oregon State territory), and about 159 million inhabitants lived in the area as of 2015, almost a half of the US population (National Development and Reform Commission (NDRC), China, 2010; National Bureau of Statistics of China (NBSC), 2016). It is now one of the largest urban agglomerations in the world.

By 2014, YRD's Gross Domestic Product (GDP) was 13.85 trillion RMB (2270 billion USD), accounting for 18.5% of the national GDP (NBSC, 2015). The GDP per capita of this region was about twice the national average level. In 2009, YRD surpassed other Chinese metropolitan areas (including Pearl River Delta and the Jing-Jin-Ji region) in terms of economic output and per capital income. It is now the largest metropolitan area in China, and it is also one of the six largest urban agglomerations in the world now (Gao et al., 2015; Tian et al., 2011).

As one of the most developed and densely populated areas in China, and its most competitive region, YRD has received a lot of attention due to its economic and urban development. In 1982, YRD was identified as one of the most important economic development regions in China, and Shanghai was designated as the financial and logistics center, while Zhejiang and Jiangsu provinces were designated the important manufacturing bases (Taylor et al., 2008). With the emergence of the YRD economic circle concept in 1980s, the work to establish and strengthen

regional integration and the cooperation was launched. In 1982, the Chinese Central Government set up the Shanghai Economic Area, which only included five cities: Shanghai, Nanjing, Suzhou,

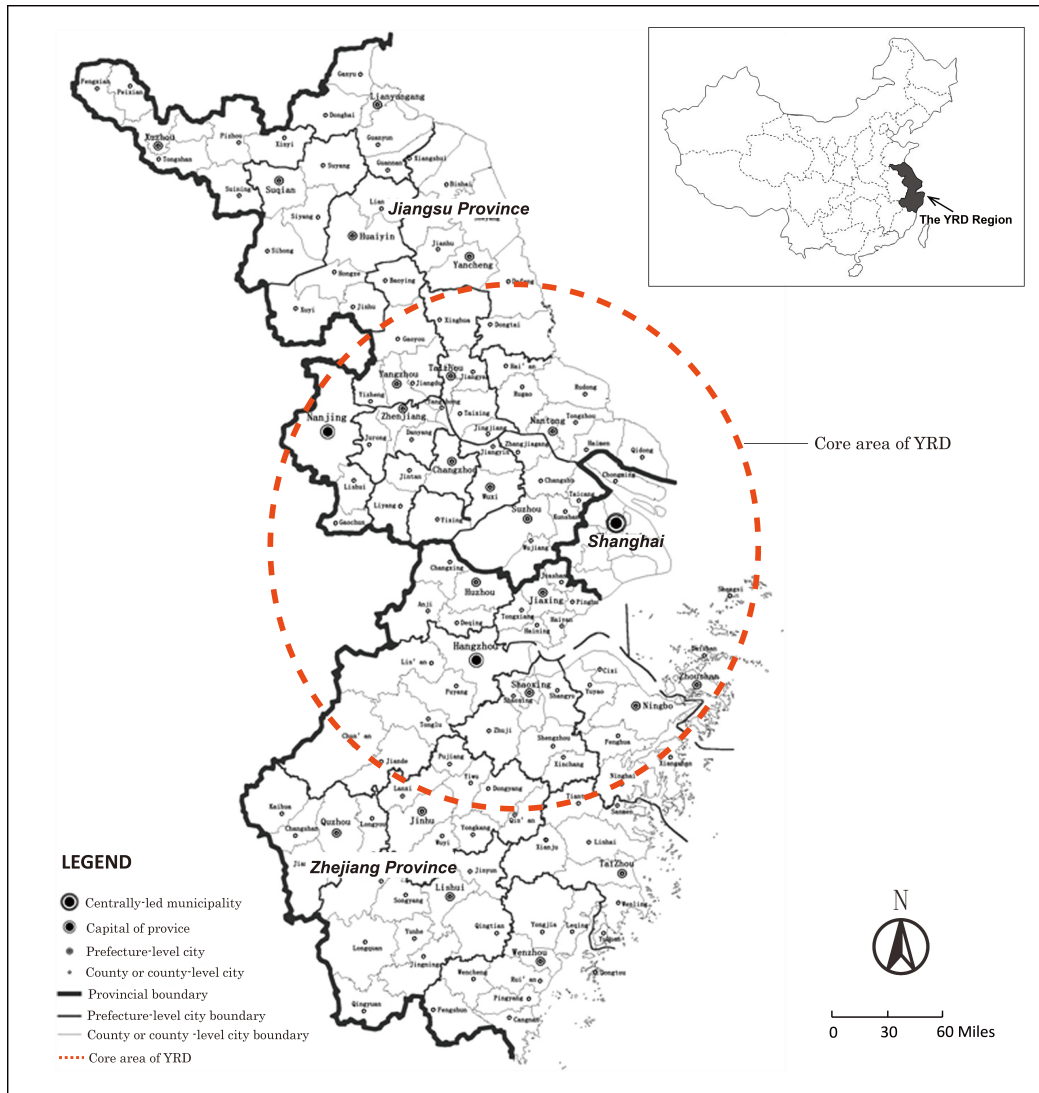


Figure 13. Location map of YRD

Source: Li & Wu, 2013

Hangzhou, and Ningbo. In 1986, the economic cooperation expanded to “One Municipality and Five Provinces”: Shanghai, Jiangsu, Zhejiang, Anhui, Fujian and Jiangxi. Only six year later, it expanded to a “1+14” (Shanghai, plus fourteen cities in Jiangsu and Zhejiang Provinces) cooperation model by 1992. Then, in 1997, the Yangtze River Delta Economic Coordination

Association was established, which included sixteen cities: Shanghai, eight cities in Jiangsu Province (Nanjing, Suzhou, Wuxi, Changzhou, Zhenjiang, Yangzhou, Taizhou, and Nantong), and seven cities in Zhejiang Province (Hangzhou, Ningbo, Huzhou, Jiaxing, Shaoxing, Zhoushan, and Taizhou). This is generally known as the Yangtze River Delta region and its 16 core cities (see Figure 14). To date, the total number of cities in the association is 30, and some of the cities in Anhui Province are also incorporated. However, because of the administrative division between provinces and cities, inter-city competition and local protectionism always exist in this region, and a real regional integration have not yet achieved (Wang, 2014).

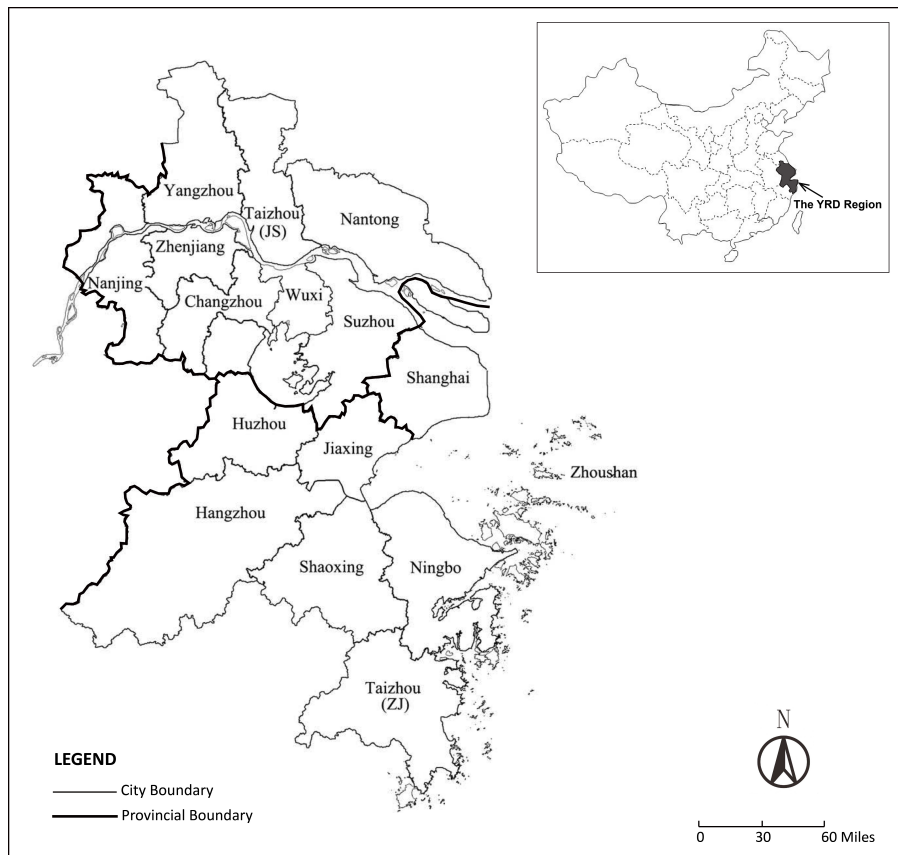


Figure 14. The sixteen core cities in YRD

Source: Luo & Shen, 2009

As the rest of the country has experienced an unprecedented urbanization, so has the YRD region been rapidly growing. By 2012, according to the urban population share, the regional

urbanization rate of YRD was 68.3%, and the urbanization rate of Shanghai, Zhejiang and Jiangsu was 89.7%, 63.2%, and 63.0%, respectively (NBSC, 2012). From 1980s to 2010, with the initiation of Chinese Reform and Opening-Up, urban construction in YRD expanded rapidly. Figure 16 demonstrates the urban growth of YRD by showing the growth trajectory of built-up area in this region. In the 1980s, when the economic reform just started, urban growth of this area was very low. In the 1990s, Chinese government launched programs to promote urbanization. The Pudong New District in Shanghai was founded and some industrial parks in Jiangsu and Zhejiang Provinces were also developed, which significantly speeded up the rate of regional urbanization of YRD (Wang et al., 2015). The beginning of the 21st century witnessed the marketization, globalization, and rapid urbanization of the region, all which were driven by national policies. Urban real estate expanded dramatically and many suburban areas or small towns surrounding county-level cities were developed into new urban built-ups. Figure 15 shows the built-up area change over the period of 1999 to 2014.

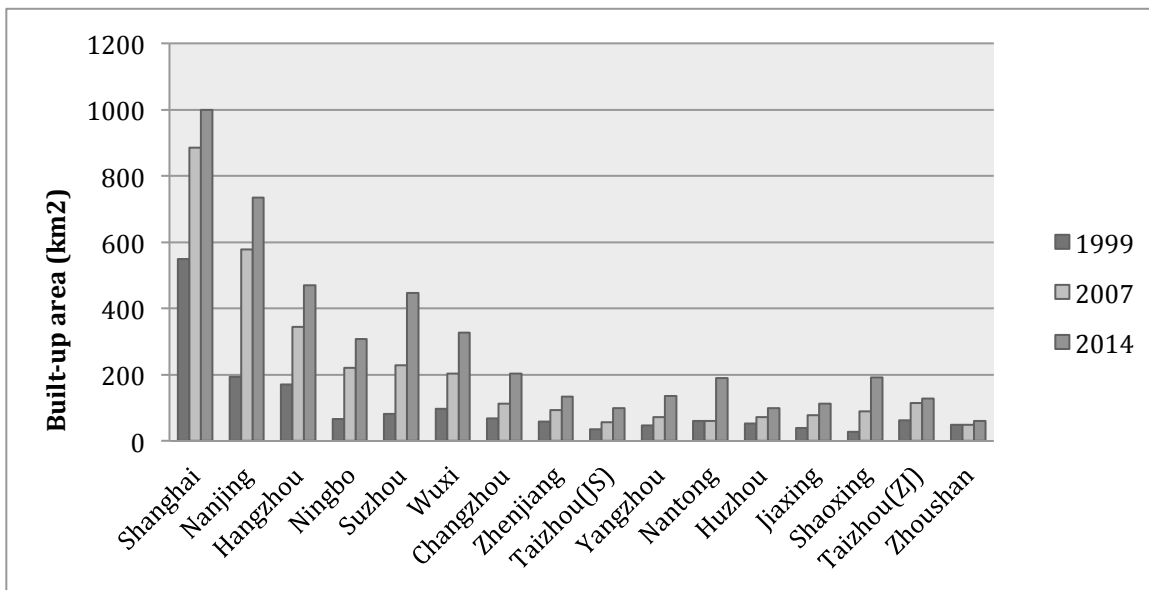


Figure 15. Built-up areas of major cities in YRD in 1999, 2007 and 2014

Source: MHURD, 1999, 2007, and 2014

Note: Except Shanghai, the built-up areas of other cities do not include their county-level cities.

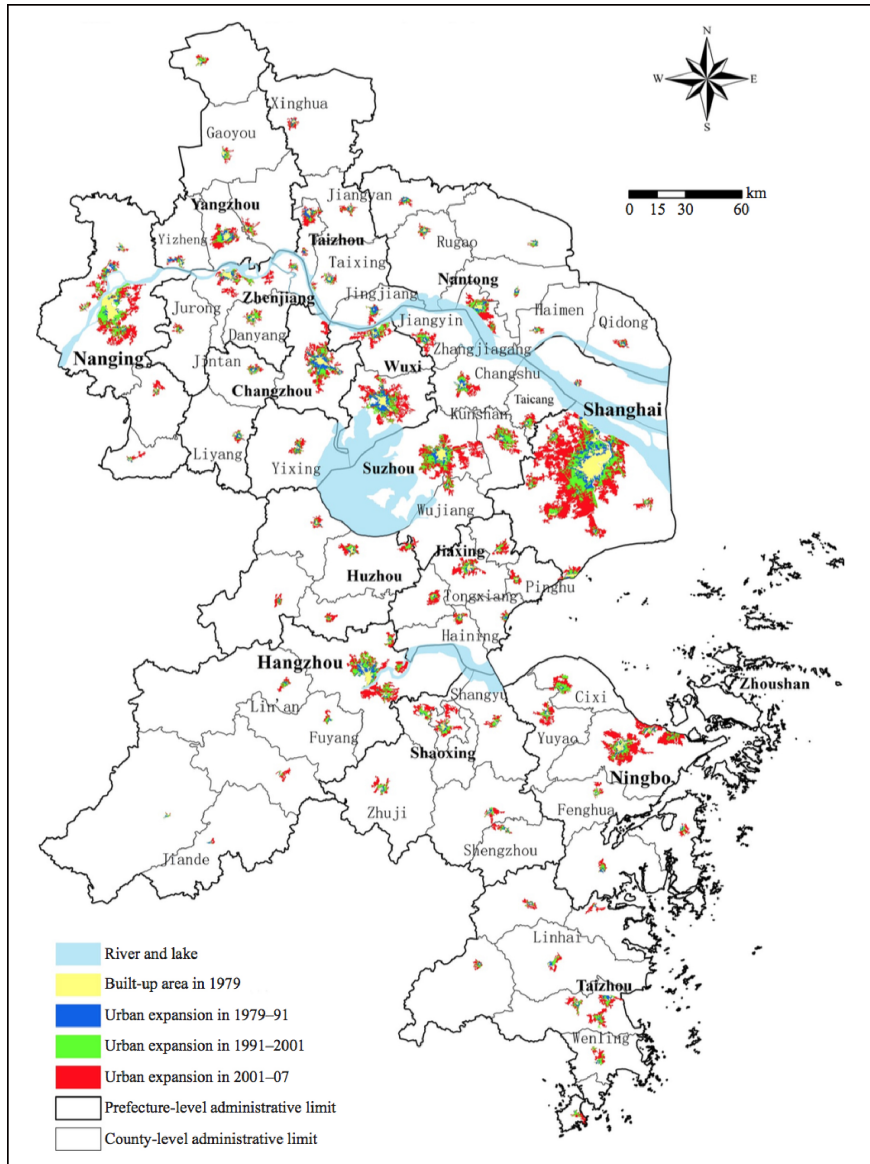


Figure 16. Historical urban expansions in YRD

Source: Chen et al., 2015

The region's urban growth continues and a great number of migrants are still moving in, all of which is hastening the consumption of agricultural lands and the degradation of environment. As a nation concerned about its food security and environmental quality, China and the YRD region have to take action to control urban growth and prevent the exacerbation of environmental and social problems.

4.2 Study Area

The study area of this thesis is Shanghai and Suzhou-Wuxi-Changzhou (SWC) urban agglomeration, which located south of Yangtze River in eastern YRD and across the Shanghai Municipality and Jiangsu Province (see Figure 17). The study area is about 24,537 km² (9,474 square miles), which covers 11.6% of the YRD land area, and 15.5% of the YRD population live in this region. Shanghai is a provincial city (直辖市), and it is one of the most important industrial and commercial centers in China and the world. Suzhou, Wuxi and Changzhou are three prefectural cities (地级市) located in the southeast of Jiangsu Province, and they form one of the three urban agglomerations (the other two are Nanjing and Xuzhou metropolitans) in the province. Shanghai Municipality and the City of Suzhou were two of the cities required to establish UGBs in 2014, however Wuxi and Changzhou were not in the list. The basic information of this area is shown in Table 6.

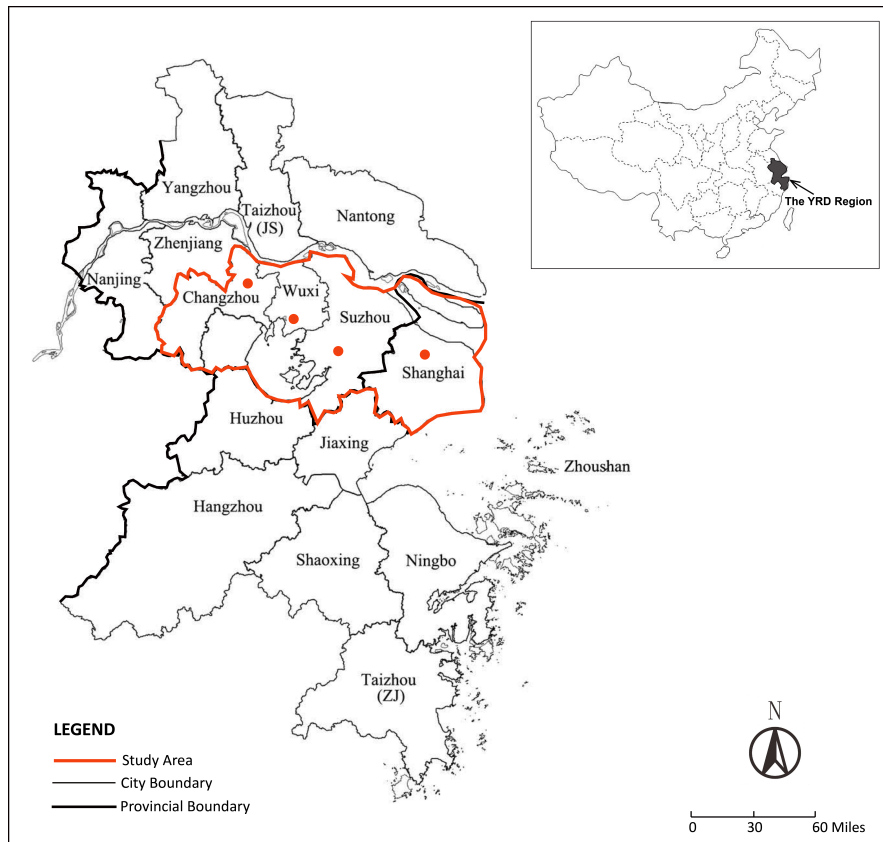


Figure 17. Study area-Shanghai and SWC region

Table 6. Basic information of the study area

City	Shanghai	Suzhou	Wuxi	Changzhou
Total Administrative Area (km²)	7,037	8,488	4,627	4,385
Built-Up Area in 2014 (km²)	998.75	735.15	522.42	253.86
Population in 2015 (thousand)	24,153	10,616	6,511	4,696
GDP in 2015 (RMB billion/USD billion)	2,496.5/400.83	1,450.4/232.88	851.8/136.77	527.3/84.67
GDP per capita in 2015 (RMB/USD)	104,329/16,553	135,849/21,563	130,769/20,757	110,874/17,599

Source: MHURD, 2014; Shanghai Bureau of Statistics (SBS), 2015; Jiangsu Bureau of Statistics (JBS), 2015

Notes: The built-up area of Suzhou, Wuxi and Changzhou is the sum of their urban districts and county-level cities.

According to China's administrative hierarchy, there are three levels of city: the provincial-level city/municipality (直辖市), prefecture-level city/municipality (地级市), and county-level city/municipality (县级市) (Gao et al., 2015). Shanghai is a provincial-level city directly administered by the central government, and there are urban districts and counties under the administration of the provincial city. Suzhou, Wuxi, and Changzhou are prefecture-level cities, and they administer some counties/county-level cities and urban districts within their administrative area (see Figure 18). The composition of the four study cities with their counties and urban districts are shown in Table 7. The data in Table 6 is the sum of all the administrative units within the four high-level administrative divisions.

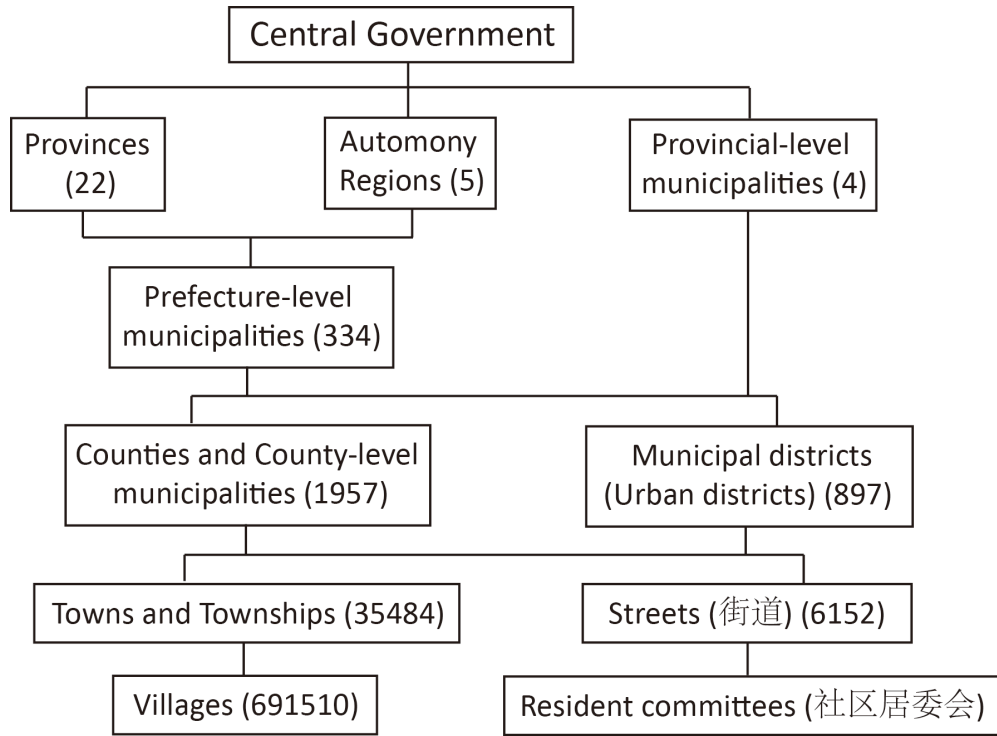


Figure 18. Hierarchy of administrative division in Mainland China

Source: Abramson, 2006; Ministry of Civil Affairs of China, 2016

Notes: Numbers in parentheses indicate the number of jurisdictions of that particular type. There is no official statistic of the number of “Resident committees.”

Table 7. Administrative divisions of the study area

Provincial/Prefecture-level city	Urban districts	County-level city
Shanghai	Huangpu, Xuhui, Changning, Jingan, Putuo, Hongkou, Yangpu, Minhang, Baoshan, Jiading, Pudong, Jinshan, Songjiang, Qingpu, and Fengxian	Chongming
Suzhou	Huqiu, Wuzhong, Xiangcheng, Gusu, and Wujiang	Changshu, Zhangjiagang, Kunshan, and Taicang
Wuxi	Xishan, Huishan, Binghu, Liangxi, and Xinwu	Jiangyin and Yixing
Changzhou	Tianning, Zhonglou, Xinbei, Wujin, and Jintan	Liyang

Shanghai is the largest city in China and Suzhou is the second largest city in Jiangsu, and they are both megacities with population more than ten million. The urban agglomeration of SWC

with the adjacent Shanghai Municipality together forms a huge metropolis circle along the bank of Yangtze River in the east coast of China. This metropolitan area is one of the most densely populated and developed regions in China. Due to its location on the fertile Yangtze alluvial plain, it is also a traditional agricultural area. But the rapid urbanization and industrialization has seriously threatened the region's farmland and ecological environment.

According to Chinese urban planning system, each municipal and county government is required to develop its urban spatial planning, and the plan should be consistent with the upper-level plans. Urban planning system in China shows high vertical consistency (Li, 2013). However, city's urban planning focuses on the context and physical development within its own administrative boundary, and there is rare consideration of inter-city planning and cooperation. Besides, since the economic reform in 1978, municipal governments' authority on local affairs has been enhanced. Local governments now have more leeway to raise revenue, expand investment, and convert rural land to urban uses than before the reforms (Abramson, 2006). Inter-city competition for economic growth and local leaders' pursuit of political achievements push the massive conversion of rural land to urban uses. With goals of increasing fiscal revenues and industrial development, competition is more frequent than cooperation among different local governments. From the perspective of promoting regional growth management, this thesis takes the study area as a case to discuss how cities in China can learn from Portland and achieve metropolitan cooperation and planning in the field of urban growth boundary.

4.3 Shanghai

Shanghai is located at the east coast of China and at the estuary of the Yangtze River. It is a traditional financial and manufacturing center in China, and as early as in the 1930s, Shanghai has been the largest financial center in the Far East (Shen, 1994; Yin et al., 2011). Shanghai is the largest city in China with a total area of 7,037 km². It is also one of the most populous cities with a population density of 3,826 per km² in 2014 (SBS, 2015). Shanghai's GDP in 2015 was 2.5 trillion RMB (400.83 billion USD), accounting for 3.69% of China's GDP (SBS, 2016). By

the end of 2013, Shanghai's built-out urbanization rate was 88.02%, while the national average was only 53.73% (NBSC, 2014).

Shanghai is a provincial-level city/municipality (直辖市) with 16 county-level administrative divisions: 15 urban districts and one county (see Figure 19). Based on the traditional urban development and following Wei et al. (2015) and Wang et al. (2016), the administrative

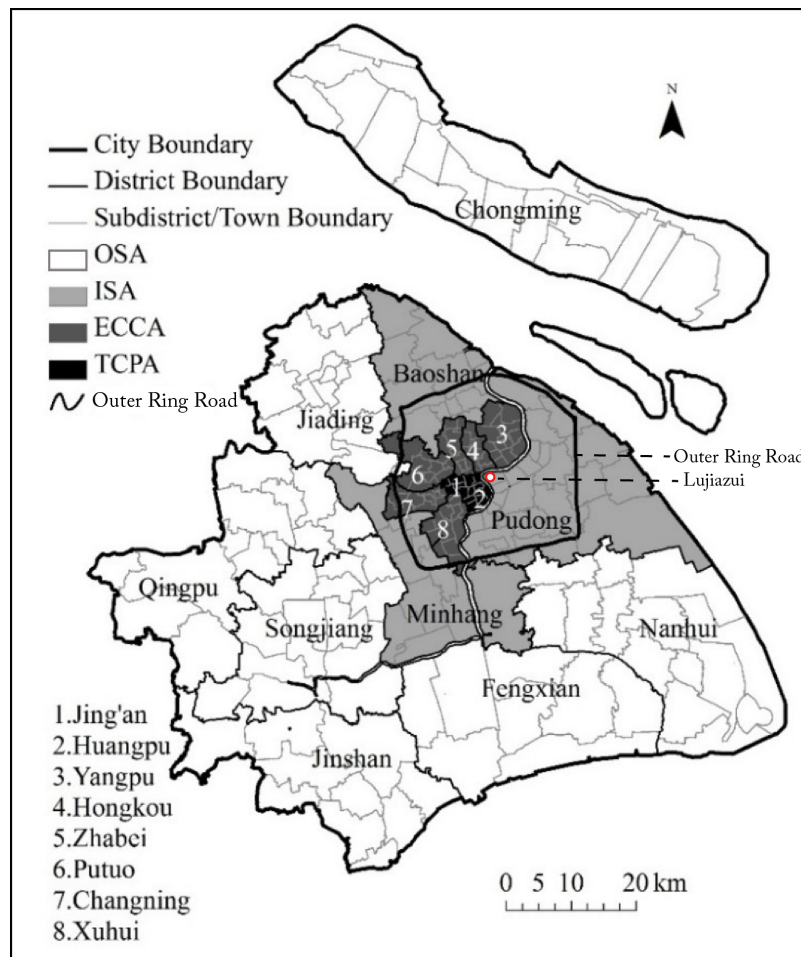


Figure 19. Administrative division of Shanghai

Source: Wang et al., 2016

Note: Zhabei was merged into Jing'an District on November 4, 2015 and Nanhui was merged into

Pudong in 2009. TCPA=traditional city proper area; ECCA=expanded central city area;

ISA=inner-suburban area; OSA=outer-suburban area.

divisions are further divided into four areas: traditional city proper area (TCPA, which includes Huangpu and Jing'an), expanded central city area (ECCA, which includes Xuhui, Changning, Putuo, Hongkou and Yangpu), inner-suburban area (ISA, which is made up of Pudong, Minhang and Baoshan), and outer-suburban area (OSA, which is composed of Chongming, Jiading, Songjiang, Qingpu, Jinshan, Fengxian and Nanhui). TCPA and ECCA are collectively referred to as the core city or Shanghai Proper. According to Shanghai urban master plan, the region within the outer ring road is the central city of Shanghai. Pudong is a new developed district, and it is located on the east side of the Huangpu River, with both urban and suburban development. The area in Pudong along the Huangpu River and located directly at the opposite of the traditional downtown district is now urbanized, such as Lujiazui is a new financial center of Shanghai, but traditionally, this region is not accounted as part of the Shanghai Proper.

Since the beginning of China's economic reform in the late 1970s, Shanghai has experienced a rapid urban expansion (see Figure 20). From 1980 to 1992, the urbanization rate in this area was relatively low, because the whole country was just recovering from the political movements and the economy was in a downturn (Han et al., 2009). By the early 1990s, economic and urban growth accelerated because of the national economic stimulus policies. In 1992, the Central Government established the Pudong New District (PND) as a special economic zone, which was aimed to attract foreign investment and stimulate regional development. In the meantime, the Shanghai municipality was granted more autonomy to deal with local revenues and land-use issues (Wang, 2012). With the establishment of the PND, urban growth in Shanghai has speeded up, because more urban construction is required to meet the demands of economic development and expansion (Li et al., 2014). During the 1990s, the urban area in Shanghai increased 11% annually (Han et al., 2009). With the admission of China to the WTO in 2001, Shanghai grew as an international port city and started to evolve into a global financial, commercial and shipping center. During this process, large-scale construction of new satellite cities and industrial parks occurred around the urban area, and much rural land were transformed into built-up area (Yin et al., 2011). New development became more attractive for investment and as more immigrants sought jobs in the city. As shown in Table 8, from 1978 to 2014, the urban population in Shanghai increased 101% from 6.4 million in 1978 to 13 million in 2014 (SBS, 2015). The

growth of the population led to even further development of urban land for public infrastructure, commercial and housing uses.

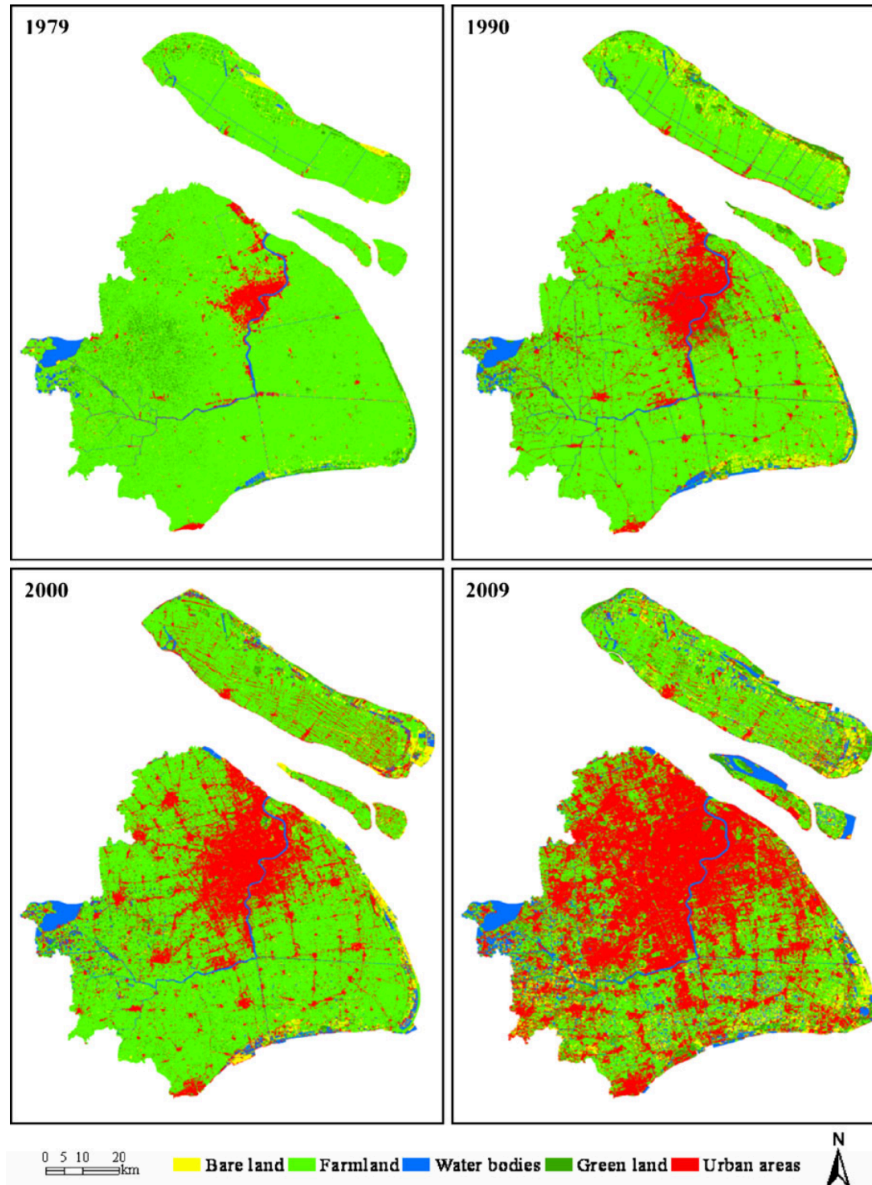


Figure 20. Historical urban expansions of Shanghai in 1979, 1990, 2000, and 2009

Source: Yin et al., 2011

Note: Bare land is defined as land to be built on, unused land, and exposed soils; Green land including forest, shrub, lawns and others.

Table 8. Demographic changes of Shanghai from 1979 to 2014

Year	Permanent Population (1000 persons)	Population Density (people/km ²)	Agricultural Population (1000 persons)	Non-agricultural Population (1000 persons)	Ratio of Non-agricultural Population (%)
1978	11,040	1,785	4,531	6,452	58.7
1990	13,340	2,104	4,189	8,645	67.4
2000	16,086	2,537	3,355	9,862	74.6
2009	22,103	3,486	1,645	12,362	88.3
2014	24,257	3,826	1,392	12,995	90.3

Source: SBS, 2015

One result of the rapid urban growth is the considerable loss of rural and agricultural lands. According to the study of Yin et al. (2011), over the period of 1979 to 2009, farmland in the Shanghai metropolitan area had decreased by 2,535 km², which means over 45% of the farmland in 1979 was lost, while urban areas increased in area by 2,713 km² with an average rate of 90.43 km²/year (see Table 9). In the 1980s to 1990s, farmland was the dominant land use in this region (Figure 20) and even in 2000, farmland and other green space still accounted for more land area than urbanized uses. However, after entering the 21st century, urban land had a dramatic expansion and a large amount of farmland had been encroached. The total urban land area surpassed the area of farmland in 2009. The urban land increased about 1,064% over the period of 1979-2009 and most of it was transformed from the farmland as shown in Table 10 (Yin et al., 2011). As Tan et al. (2005) indicated that China's urban expansion in the 1990s mostly happened on the previously arable land.

Table 9. Land use changes from 1979 to 2009 in Shanghai

Land use types (Area in km ²)	1979		1990		2000		2009	
	Area	%	Area	%	Area	%	Area	%
Urban land	254.92	3.95	832.46	12.73	1,529.43	22.69	2,968.01	42.22
Farmland	5,429.47	84.15	4,984.03	76.23	4,469.03	66.30	2,894.47	41.17
Green land	422.99	6.56	255.59	3.91	243.65	3.61	217.18	3.09
Bare land	197.47	3.06	244.49	3.74	250.70	3.72	445.42	6.34
Water Body	147.21	2.28	221.73	3.39	247.62	3.67	505.35	7.19
Total	6,452.06	100	6,538.30	100	6,740.44	100	7,030.43	100

Source: Yin et al., 2011

Table 10. Land use conversions from 1979 to 2009 in Shanghai

'From type'	'To type'	1979-1990	1990-2000	2000-2009
		Area (km ²)	Area (km ²)	Area (km ²)
Farmland	Urban land	494.88	738.44	1513.20
	Green land	167.01	165.99	119.34
	Bare land	185.19	98.05	289.79
Green land	Urban land	30.62	79.20	75.41
	Farmland	324.91	92.16	116.29
Bare land	Urban land	69.91	44.80	94.89
	Farmland	78.27	152.93	81.98
Water body	Urban land	13.87	38.58	32.82
	Farmland	12.30	32.34	35.85

Source: Yin et al., 2011

According to the Shanghai Urban Master Planning (1999-2020), Shanghai's planned construction land would be 3,226 km², however, in order to achieve more intensive land use and control urban scale, on December 2015, Shanghai Municipal announced to reduce the previous 3,226 km² target to 3,185 km², and this would be the "ceiling" of Shanghai's urban extent ("Shanghai released Thirteen Five," 2015). However, by the end of 2014, the developed land in

Shanghai was 3,124 km², 49% of the total land area of the municipality, and only left 60 km² away from the 2020's target. If Shanghai does not take timely and efficient action to curb urban sprawl and encourage infill development and redevelopment, there will be no available land for future growth. In addition, rapid urbanization has degenerated local air and water quality and caused a serious urban heat island effect. Further the increasing traffic congestion and related transportation issues are also a problem. Moreover, as the core and largest city in the YRD region, Shanghai significantly influences its adjacent areas. If Shanghai's growth were not limited, it could cause negative externalities that could spill over into the neighboring areas. In particular, nearby cities are at risk for population growth, and increases in manufacturing relocation and housing prices.

4.4 Suzhou-Wuxi-Changzhou

Suzhou-Wuxi-Changzhou (SWC) is a metropolitan area located in the south of Jiangsu Province comprising three prefecture-level cities, Suzhou, Wuxi, and Changzhou. These three cities form the core area of YRD and they are adjacent to the Shanghai metropolitan area (see Figure 21). By taking the high-speed rail, the travel time from Changzhou to Shanghai is approximately one hour, and it takes half an hour from Suzhou to the City of Shanghai. This region has a total area of 17,500 km² and with a total population of 21.8 million in 2015. The SWC only accounts for about 17% of the total territory and population of Jiangsu, but with a total GDP of RMB 2.8 trillion in 2015, it accounts for nearly 40% of the province's total GDP, and 4.1% of the nation's.

This urban agglomeration is one of the most urbanized regions in China like its neighboring city, Shanghai. By the end of 2012, the urbanization rate for the cities of Suzhou, Wuxi and Changzhou were 72.3%, 72.9%, and 66.2% respectively (Li et al., 2013). The SWC region has a similar economic and population size as that of Shanghai. As Shanghai limits its growth in the near future, the development pressure will expand to Su-Xi-Chang thanks to the short travel time between the two metropolitan areas. It is necessary to discuss the future urban growth management of this region. If the growth is unchecked, the region's fertile agricultural lands, and

cultural life style may be under threat in the future.



Figure 21. Location map of Suzhou-Wuxi-Changzhou

Source: Google Earth Pro, 2013

These three prefecture-level cities own seven county-level cities and 15 urban districts (see Figure 22). The City of Suzhou is composed of five urban districts, and the Gusu District is the central area of the city. Suzhou has four county-level cities: Changshu, Zhangjiagang, Kunshan, and Taicang. The cities of Kunshan and Taicang are both located at the border of Shanghai and Suzhou, and there is even a subway linking the two cities with the downtown Shanghai. The four cities in Suzhou all have great economic conditions and they were ranked among the top 10 best county-level cities in China according to their human talent, city scale, logistics, innovation, etc., by *Forbes China* in 2014 (“Kunshan tops ranking,” 2014). Within the administrative area of Wuxi, there are five urban districts and two county-level cities. Liangxi District is the urban core of the City of Wuxi. The two county-level cities, Jiangyin and Yixing, are both mostly developed and with a total 2.88 million inhabitants by the end of 2014 (NBSC, 2014). There are five urban districts and one county-level city administered by Changzhou. The Changzhou Proper is made up of Zhonglou and Tianning Districts, and Xinbei, Wujin and Jintan Districts are the suburbs of

the City of Changzhou. The City of Liyang situates at the border of Jiangsu and Anhui Provinces with a population of 0.79 million in 2014 (NBSC, 2014).

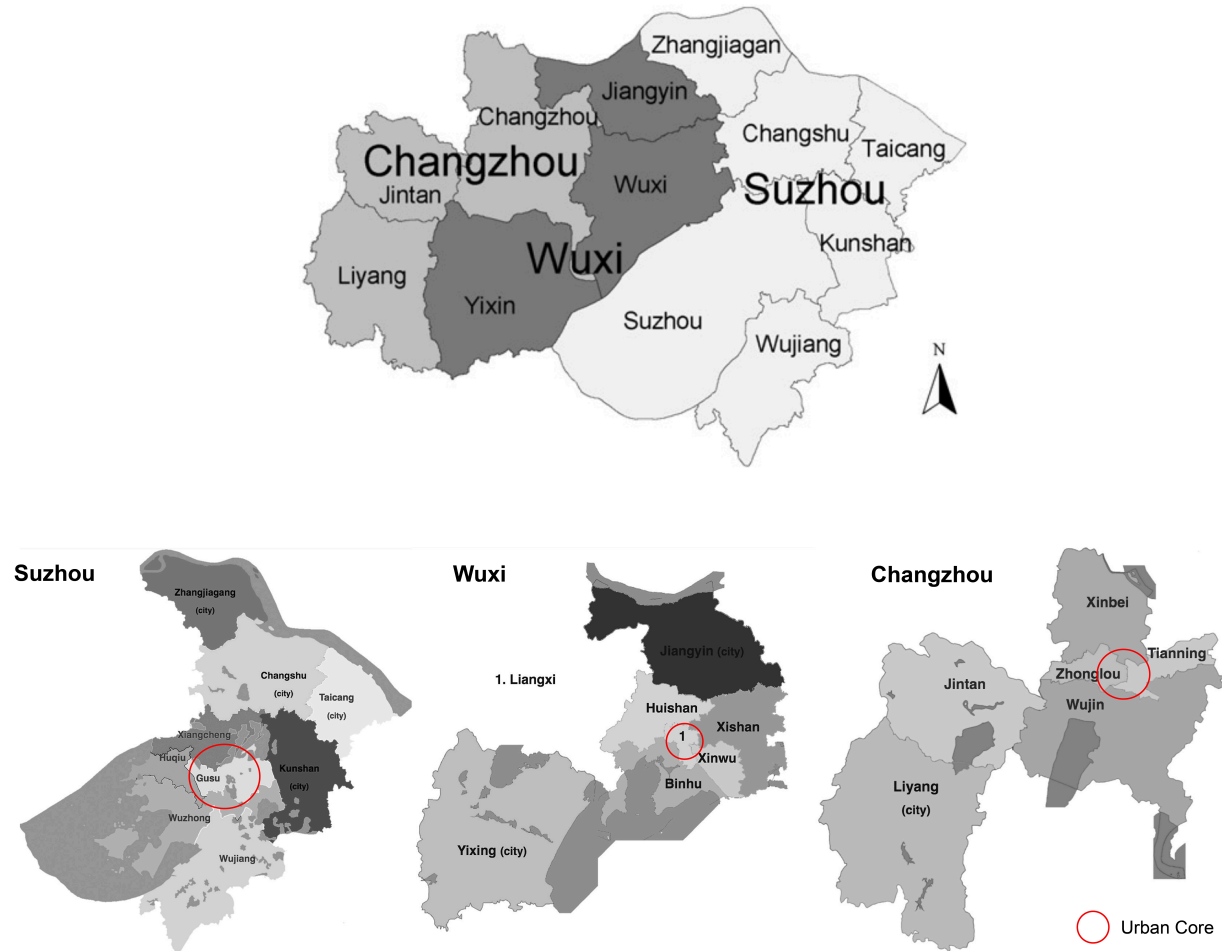


Figure 22. Administrative divisions of Suzhou, Wuxi, and Changzhou

Source: Long et al., 2009; Suzhou, Wuxi, and Changzhou, n.d., in *Wikipedia*

The SWC region has a long history of human activities and settlements. It is also a fertile region that owns rich paddy fields and other agricultural lands. However, with the rapid regional development, much of the farmland in this area is converted into non-agricultural uses. As the rest of the nation, with the initiation of China’s economic reforms in 1978, the SWC region entered a rapid industrialization and urbanization path. Between 1980 and 2000, the average annual growth of urban uses in this region was 24.46 km² with an annual growth rate of 5%

(Zhang et al., 2007). And most of the new urban land was transformed from agricultural land, especially at the cost of paddy fields. From 1980 to 2000, the total decrease of farmland in this region was 1086.51 km², 10.04% of the farmland in 1980, and paddy fields lost 864.03 km², which was 79.52% of the total loss of farmland over this period. Table 11 shows unused land in this region by year. Given these rates urban development will need to convert more farmland and forestland to accommodate future growth. From 2000-2010, the net loss of arable land in this region was 1370.16 km², while the construction land increased 1201.88 km² (Zhou et al., 2014).

Table 11. Land use changes in the SWC region during 1980-2010

Land Use Types (Area in km ²)	Paddy Field	Dry Land	Forest Land	Grass Land	Water Bodies	Urban Land	Rural Settlements	Other Construction Land	Unused Land
1980	9683.65	1139.63	966.82	42.30	4472.64	504.23	775.90	31.78	6.79
1990	9573.23	1135.06	941.25	42.38	4488.12	581.01	821.18	32.62	6.80
2000	8819.62	917.15	942.78	42.95	4563.98	993.54	1256.45	80.06	7.21
2010	7550.34	816.27	917.07	38.15	4543.31	1619.18	1724.61	177.14	7.25
Area Changes 1980-1990	-110.42	-4.57	-25.57	0.08	15.48	76.78	45.28	0.84	0.01
Area Changes 1990-2000	-753.61	-217.91	1.53	0.57	75.86	412.53	435.27	47.44	0.41
Area Changes 2000-2010	-1269.28	-100.88	-25.71	-4.8	-20.67	625.64	468.16	97.08	0.04

Source: Zhang et al., 2007; Zhou et al., 2014

Note: “-” means negative growth.

Besides the increase of urban uses, another significant land-use change in this area was the substantial increase of rural settlements. Rural residential uses increased at almost the the same rate as urban uses. Between 1980 and 2010, urban land increased 959.71 km², while rural residential land increased 948.71 km². Because of the favorable agricultural conditions and the rapid growth of township enterprises, rural residents in the SWC region have always had good

incomes that allow them to reside in the urban area. Many rural residents buy houses in cities while keeping their homes in the countryside. This causes the simultaneous growth of residential uses both in urban and rural areas (Zhang et al., 2007). The functions of “rural housing” are always diverse and not limited in residential uses. Many private houses are actually mixed use. Though registered as rural housing, they are used as small factories, family workshops, retail stores and restaurants (Xie et al., 2007). There is an argument that rural residential development may be a great contribution to the loss of farmland in the SWC region (Xu, 2004; Long et al., 2008). Rural urbanization, because of the growth of rural settlements and small towns in rural areas, is becoming another major form of urbanization in China, after traditional urban sprawl (Cui & Ma, 1999).

The excessive urban and rural development and the large decrease of arable land are closely related to the national policies. In 1984 and 1992, respectively, China successively implemented the Open Coastal (沿海开放) and Development Along the Yangtze River (沿江发展) strategies. Since then, as one of the target areas, the SWC region experienced a rapid urban and economic growth. During the period of 1990 to 1995, urban and rural construction land increased 773 km² and over 99% of the development land was converted from arable land (Zhou et al., 2014). In order to curb the rapid loss of farmland, the central government promulgated the Basic Farmland Protection Regulations in 1994. It temporarily mitigated the loss of farmland. The statistics show that during 1995 to 2000, the loss of farmland in this region was only 57% of the previous five years (Zhou et al., 2014). In 1998, the new Land Management Law was implemented, which promoted land market development and required ‘total cultivated land dynamic balance’ (耕地总量动态平衡) (Ding, 2003). However, some scholars argue that the policy of ‘cultivated land dynamic balance’ actually promotes the conversion and development of the non-basic farmland (Xie et al., 2005). After entering the 21st century, China’s urbanization was further accelerated. During the period of 2000-2010, the urban expansion rate was significantly speeded up, especially in the coastal areas (Liu et al., 2014). The conflict between farmland protection and urbanization is further highlighted.

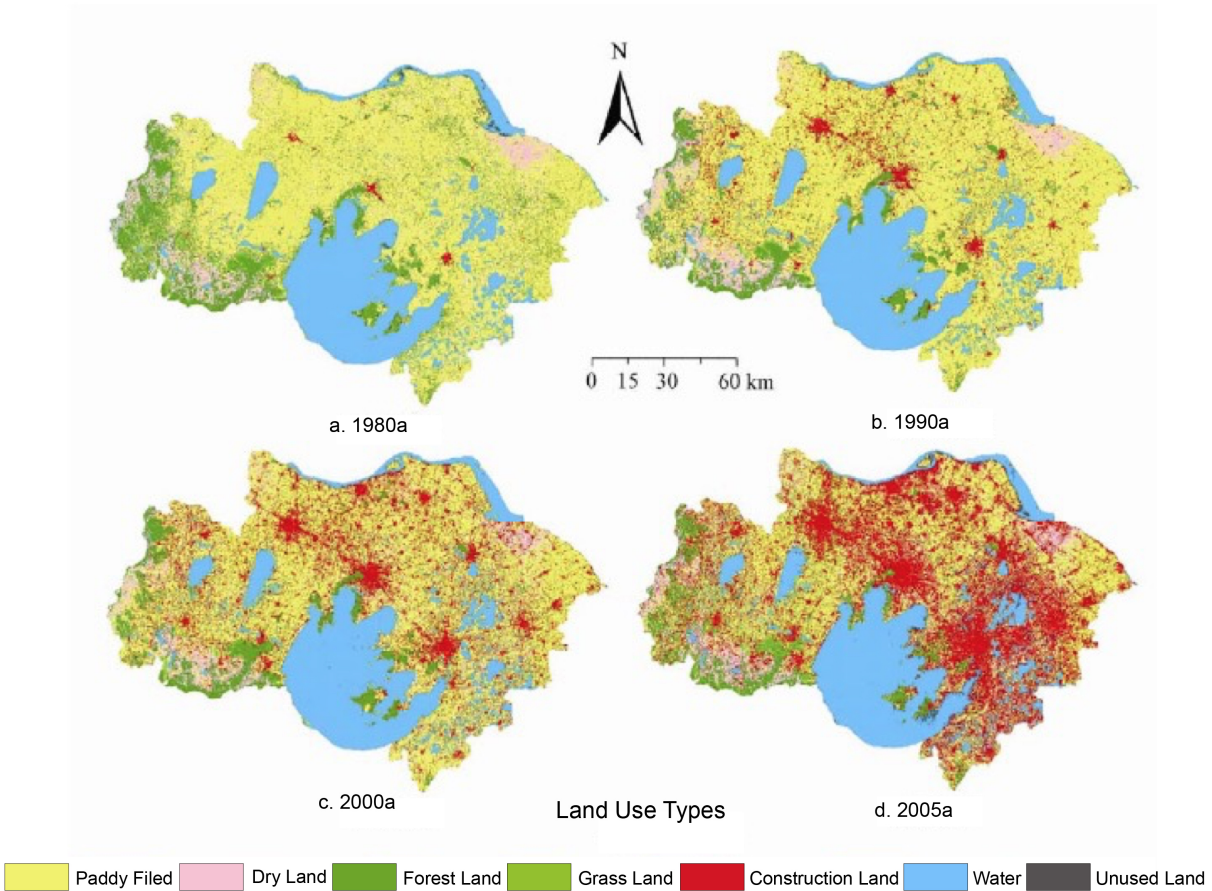


Figure 23. Historical land use changes in SWC region in 1980, 1990, 2000, and 2005

Source: Xiao et al., 2012

Note: Construction Land includes all the developed land in urban and rural areas.

A direct effect of the loss of arable land is the reduction of grain yield. In 2010, the regional food production was less than 50% of what in 1990 (Zhou et al., 2014). Such large-scale contraction of cultivated land and consequent reduction of grain yield is hard to be compensated by agricultural technology development in a short time, thus, preserving farmland from loss is urgently required for this region.

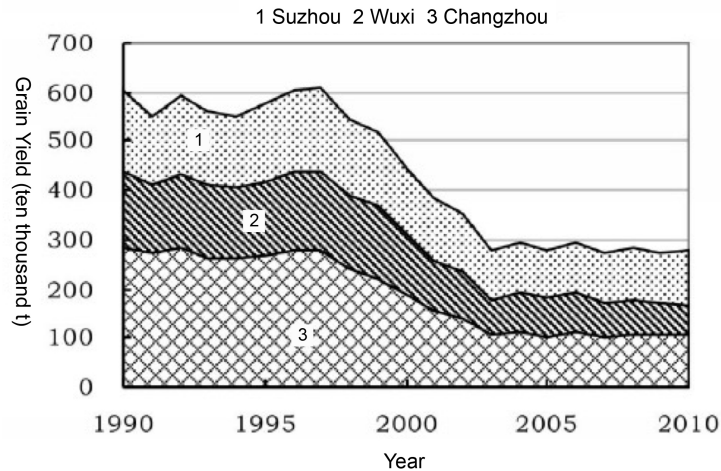


Figure 24. Changes in grain yield from 1990 to 2010 in the SWC region

Source: Zhou et al., 2014

As the “Dragon Head” of the YRD region, Shanghai’s growth also greatly affects the adjacent SWC metropolitan area. The extensive transportation networks have connected the two metropolitan areas. By taking the Beijing-Shanghai High-Speed Railway, which was completed in 2011, you only need to take 1 hour from downtown Shanghai to the City of Changzhou and half an hour from Shanghai to Suzhou. On October 2013, the Line 11 of the Shanghai Metro extended one of its branches into Kunshan, one of the county-level cities of Suzhou, and the line also became the first interprovincial subway in China. It takes about 70 minutes from downtown Shanghai to the terminus station of Huaqiao, Kunshan, with a cost of 7 RMB (see Figure 26 below). On the high-speed rail line, the commuting time between Kunshan and Shanghai is only 20 minutes. Because of the short commuting distance and Shanghai’s ultrahigh housing prices, more and more office workers buy houses and live in Kunshan but work in Shanghai during the day. This resembles the suburbanization or exurbanization in the US. Kunshan is becoming a sleeping city for many of Shanghai’s young employees. The population growth pushes the development of urban settlements and thus results in the urban sprawl of the city. Except for the population migration from Shanghai, the short travel time also results in the relocation of some light industrial plants from Shanghai to Kunshan, which further accelerates the urbanization and industrialization of Kunshan (Taylor et al., 2008).

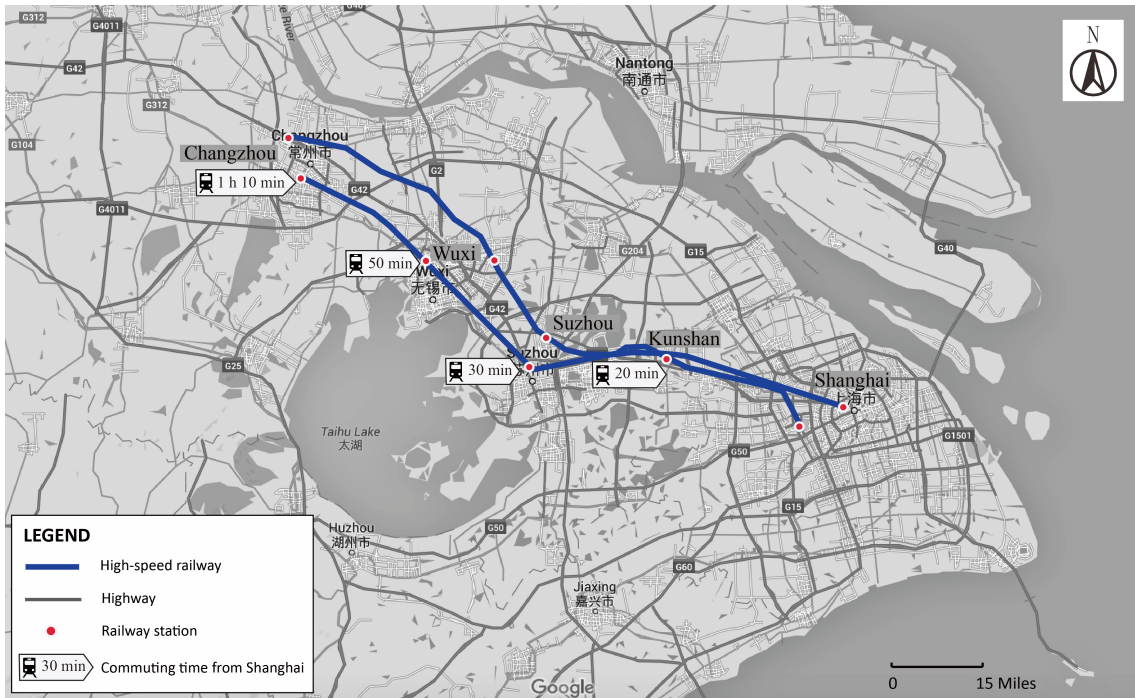


Figure 25. Transportation networks between SWC and Shanghai metropolitan areas

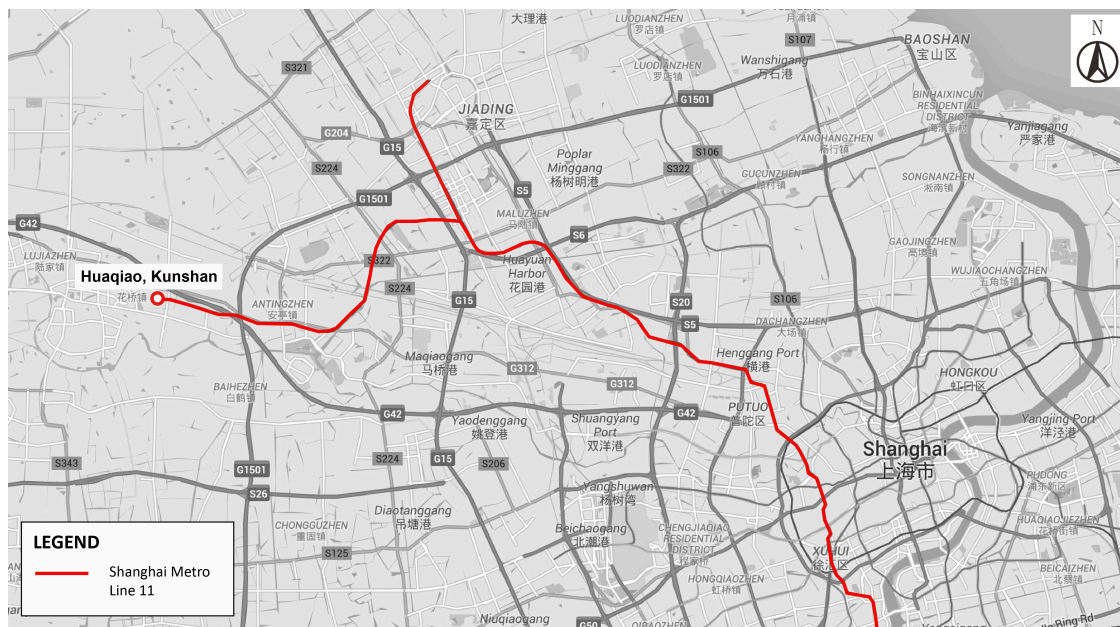


Figure 26. Shanghai Metro Line 11 extends into City of Kunshan, Jiangsu

Inter-city competition is another important driving force of urban expansion in the SWC region. As China has transformed from planned economy to market economy, cities are keen on

competition to attract foreign investment to their own cities to stimulate local development. This phenomenon is universal in the YRD region and restructures the region to be polycentric (Wang et al., 2015; Luo & Shen, 2008). In the SWC region, the three prefecture-level cities compete for financial investment and skilled labor, and this process has caused many negative externalities such as industry isomorphism, environment degradation, and urban sprawl (Luo & Shen, 2008; Xu & Yeh, 2008). In order to attract foreign investment, excessive land is designated as industrial zones, then the increasing investment attracts large migration of labor from both rural areas and other cities (Gao et al., 2015; Liu et al., 2014). All of which consequently results in the expansion of urban areas. Intercity competition and local protectionism is accelerating the urbanization process of this region.

As one of the most urbanized areas in China and the core area of the YRD region, the SWC region owns unique natural and geographical conditions, but also as the rest of China, rapid urbanization and industrialization is encroaching this area's environmental and agricultural resources. The rapid economic growth and demands for more non-agricultural land drives the urbanization of land, which, in return, diminishes the arable land and threatens food security. It is urgent to take appropriate actions to control urban sprawl and protect farmland. It is impossible, or at least less likely, to curb economic growth, but it is possible to lead the growth of urbanization. Tactics such as the encouragement of compact development, improvements in the efficiency of land use, limits on urban growth within a rational scope, and the stopping of the excessive pillaging of agricultural land, could set the region on a new, future direction. It will also be necessary to achieve intercity cooperation to prevent urban sprawl transferring from one city to another, because urban sprawl will shift to other places if growth management is only applied on one single city.

4.5 Discussion

Urban growth boundaries have been successfully experimented in Oregon State and have been proved to be an effective tool to curb urban sprawl and protect agricultural lands. As introduced

before, Shanghai and Suzhou were required to establish their UGBs to control urban sprawl in 2014, but the final plans of the two cities' UGBs have not been enacted. On October 2015, Suzhou announced that its UGB for the central city had been delineated and submitted to the Ministry of Land and Resources (MLR) and the Ministry of Housing and Rural-Urban Development (MHURD) for approval. The boundary covers 643 km² and it is valid for 5 years (2015-2020), but there is no available data or map of the designated UGB yet (Zhang, 2015). While, Shanghai released two sketch maps of its UGB and the basic farmland protection area in the Outline of Shanghai Master Plan (2015-2040) on January 2016, but with no any detailed information and data of the UGB either. However, it is clear that Shanghai intends to protect farmland and manage urban growth within its whole administrative area, while Suzhou just focuses on the central area of the City of Suzhou and does not consider its suburbs and county-level cities.

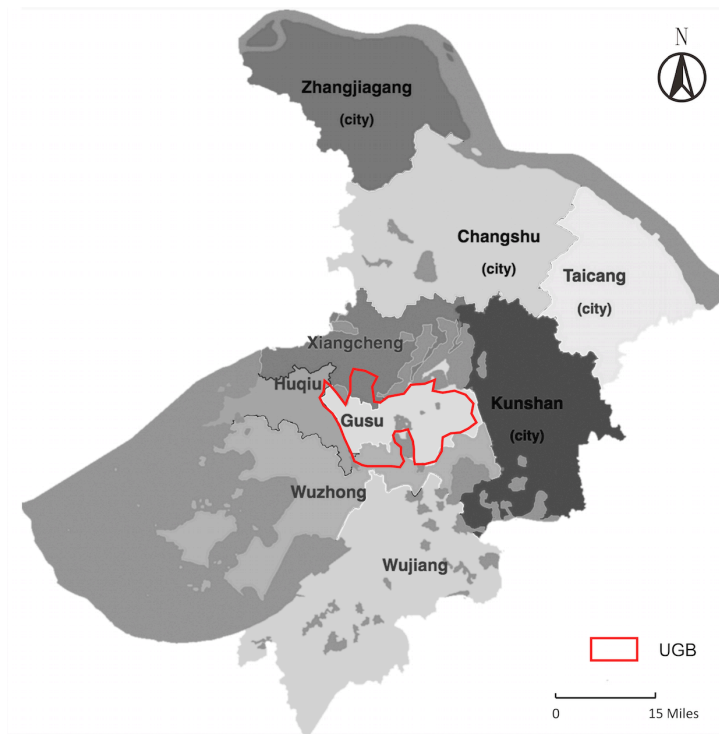


Figure 27. The approximate location and range of Suzhou's UGB

Source: Suzhou, n.d., in *Wikipedia*

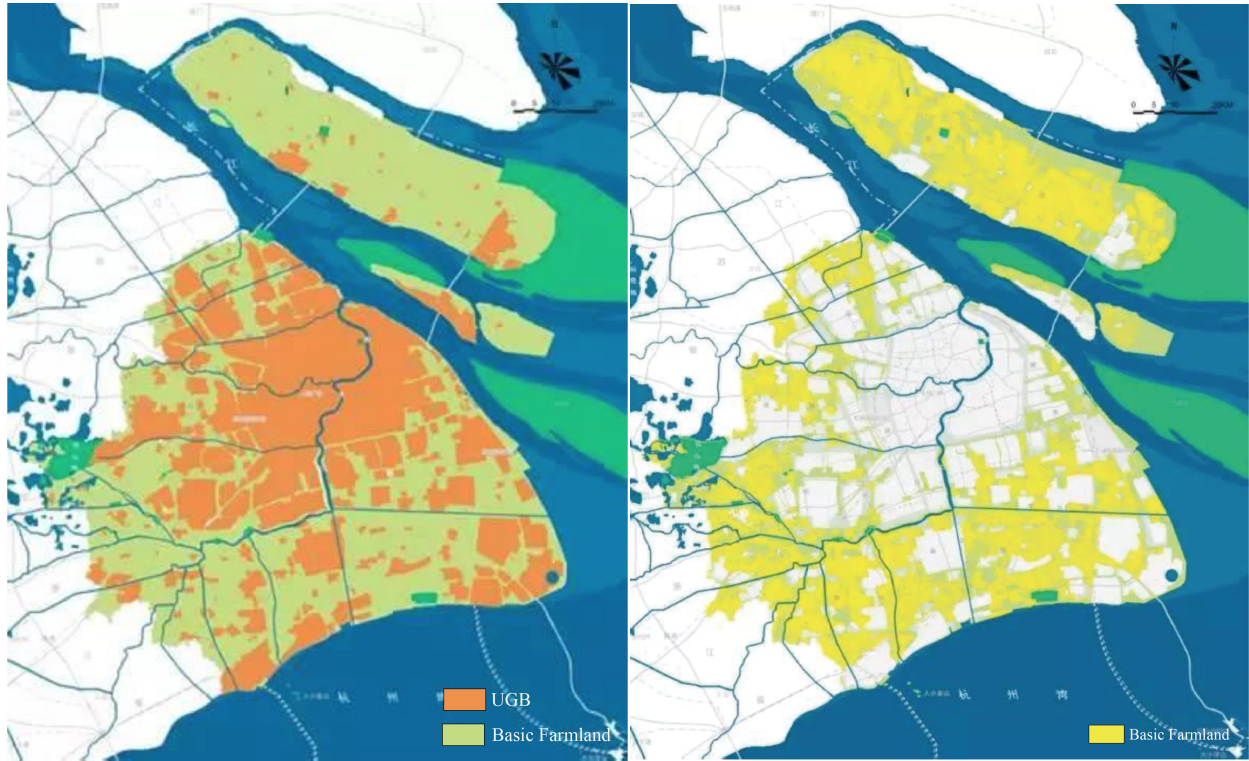


Figure 28. Shanghai's UGB and basic farmland protection area

Source: Outline of Shanghai Master Plan (2015-2040)

From Portland's experience, we know that an effective UGB program requires regional cooperation, because urban sprawl can be spread to other places that do not have growth management efforts. For example, if just Shanghai and the central city of Suzhou establish the UGBs, then the demand of land for construction can be transferred to their neighboring cities like Kunshan that do not have a UGB. Given the relationship between Portland's UGB and Vancouver's growth patterns, the cities of Wuxi and Changzhou (which do not intentionally manage their urban growth) will become safety valves for Shanghai and Suzhou. There have been efforts that aim to promote regional cooperation in this area. In 2010, the State Council approved the Yangtze River Delta Regional Planning, which was initiated by the National Development and Reform Committee in 2005. The planning spans Jiangsu, Zhejiang and Shanghai, and it intends to facilitate interregional cooperation, dismantle administrative barriers, and optimize resource allocation in this region. In 2002, the Jiangsu provincial government formulated an intercity planning for the SWC region to enhance the three cities' coordination and

alleviate their competitions. However, it did not work well (Luo & Shen, 2008), mainly because of institutional barriers and weak consciousness of cooperation among different jurisdictions (Zhang, 2010). Local governments always have their own economic interests and their desires for improving local development performance, and this causes vicious competition among different governments. They care about their GDP growth and local industrial development, while overlooking the impacts on the surrounding areas. Since the reform in 1978, the administrative and fiscal powers have been decentralized. Local governments now have much more autonomy in pursuing growth and allocating resources. Regional planning is hard to implement because the role of central government and provincial government has changed from ‘command-control’ to ‘governance guidance’ (Zhao, 2011). On the other hand, the existing regional planning just provides a macro vision for the region’s future, and the vague statement is difficult to practice and implement. Last but not the least, regional planning lacks legal and mandatory authority, which makes it easily be put aside by local governments.

In order to achieve real cooperation among different cities and break down the barriers, both vertical and horizontal political coordination are required. Higher-level governments, such as the provincial government or central government, should set up mandatory mechanisms to promote regional cooperation. The Jiangsu provincial government did not have legislative power to guarantee the implementation of the SWC regional planning and this made their plans ineffective. However, in the future, the central government can play the role of promoting regional planning by decreeing legislation and specific rules to supervise cities to coordinate on land-use issues, or it can authorize the provincial government to do. By comparison, Oregon State has statewide planning goals and legislation to ensure that local governments will follow the state’s requirements. In the Portland region, Metro was created to manage and coordinate regional affairs. It is possible to set up a Regional Planning Agency (RPA) that is created by the provincial government and composed of officials from Department of Land and Resources and Department of Housing and Rural-Urban Development in Jiangsu Province, and the governor or a vice governor can be directly in charge of the commission. The commission would be responsible to promote intercity cooperation and formulate regional plans especially land-use planning for the identified metropolitan areas, and supervise their implementation. It will also

provide technical and financial support for local governments and departments to achieve the planned goals.

On the horizontal dimension, establishing communication and consultation among the same level governments is also necessary. It is important to build trust and consensus among cities (Luo & Shen, 2008). Since 1997, there has been a formal and regular conference, Urban Economic Coordination Conference for YRD region (UEC Conference, 长江三角洲城市经济协调会), that aims to establish communication and enhance intercity cooperation among cities in the YRD region. The UEC Conference is a biennial mayor-level conference that creates a platform for local leaders and departments to share information and build understanding. Further it provides opportunities for cities to cooperate in many areas. Though the themes of the conference are almost related to economic partnerships such as transportation, tourism and infrastructure cooperation, it has set up a platform and mechanism for cities and provinces to cooperate and this can be extended to various subjects and fields. Urban planning and land-use issues such as the establishment of UGBs can be a topic in the future.

The Portland region established a continuous and united UGB for the whole metropolitan area to manage regional urban growth. In my study area, Shanghai and SWC urban agglomeration, there are three main forms of UGB system that this region can choose. First, following the central government's requirement, Shanghai and the City of Suzhou could establish their own UGBs, while other cities in the region maintain their status quo. Second, cities linked by their built up areas such as the cities of Suzhou, Wuxi, Changzhou and Kunshan can establish one continuous regional UGB, and some other discrete urban areas establish their own separated UGBs. Third, each city in this region including prefectural cities and county-level cities all establish their own UGBs, and this sets up a UGB network in this region. Based on the existing built-up areas in the satellite imagery, the conceptual drawings of the three scenarios are shown as below.



Figure 29. Scenario 1: Shanghai and the City of Suzhou establish UGBs

Source: Google Earth Pro, 2013



Figure 30. Scenario 2: Establish continuous regional UGBs

Source: Google Earth Pro, 2013

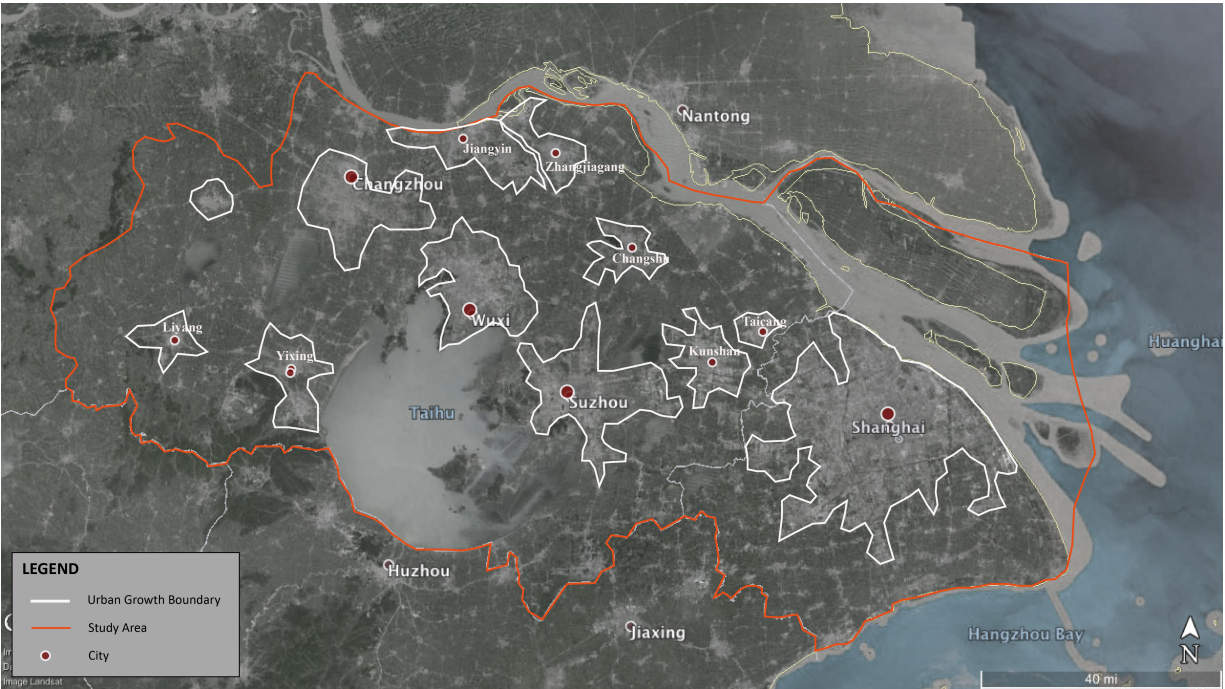


Figure 31. Scenario 3: Each city establishes its own UGB

Source: Google Earth Pro, 2013

In the first scenario, only Shanghai and Suzhou establish UGBs, while other cities do not. This is not a good choice. As discussed earlier and as Portland’s experience has shown, the growth of the controlled cities will be shifted to their neighboring cities that do not have growth management, which negates the effectiveness of the strategy. Establishing continuous regional UGBs will be cost saving, however, it will be difficult to draw such a line that perfectly includes urbanized area and excludes those undevelopable lands. Besides, it will also be difficult to implement such a plan under the existing political and institutional environment. Though some cities have been almost merged with each other because of their continuous urbanized areas, cooperation on land-use planning among different cities will be a great challenge. Because each justification has their own administrative areas, and land has been regarded as one of the most important resources for a local government. No city will easily compromise on land-use issues, especially the issue may damage their own interests. However, if the higher-level agency such as the RPA can urge the success of regional cooperation and plan for the regional UGB in the future, the large continuous UGB will be an efficient way to manage regional urban growth. Currently,

discontinuous UGBs for different entities may be a more appropriate choice for this urban agglomeration. Municipality, prefectural city, and county-level city at different stages of development, each set up their own UGBs, and a complete UGB system covers the whole region and together to manage the regional urban growth. This also requires the RPA to coordinate all cities to make efforts to appropriately establish their own UGBs.

Table 12. Comparison of the three UGB scenarios

	Coordination	Accuracy	Cost	Effectiveness
Scenario 1	Easy	High	Low	Poor
Scenario 2	Very Hard	Moderate	Moderate	Significant
Scenario 3	Moderate	High	High	Significant

Note: “Coordination” indicates the difficulty of achieving inter-city coordination; “Accuracy” means whether the UGBs can accurately delimit the developable areas without over inclusion; “Cost” considering the inputs of human and material resources and the cost of management; “Effectiveness” is the achievement of managing regional urban growth.

Compared to the second scenario, the third scenario of establishing respective UGBs seems easier to achieve because it requires less coordination among cities and reduces conflicts on issues of land resource management. However, it will increase the cost of formulating and managing UGBs, because more human and material resources have to be invested than regional UGBs. Dispersed UGBs can also relatively accurately separate developable lands and protected areas, because regional UGBs may include excessive amount of lands that should be protected. Thus dispersed UGBs seem have more significant effect of controlling urban sprawl and preserving farmland than continuous regional ones.

Regardless of whether the UGBs are continuous or separated by cities, the key is that the UGB should not only serve for one city and its central area or urban core in this region, but a full-coverage and multi-level UGB system should be established, and all cities make efforts to manage urban growth and achieve the regional control of urban sprawl. Not only the large developed cities need UGBs, but the county-level cities that are flourishing also need

management. One big difference between Portland and the Chinese case is that Portland takes actions to manage urban growth at the early stage of the region's sprawl, while Shanghai and SWC have fully developed now. On the other hand, county-level cities under the administration of the prefecture-level cities still have huge space for development in the future. It is necessary to manage their growth before they repeat the undue sprawl as the core developed cities. For a city like Shanghai, an ultimate UGB will be a right choice, which delineates the final urban extent of the city, because there is rare developable land for the city. For county-level city like Kunshan that is still growing, a flexible UGB can be a good choice. Just like Portland's UGB, it is not a static line, but it can be amended to accommodate the future growth.

The RPA or the much higher-level agencies like MLR and MHURD need to play the role as Metro to coordinate cities' growth management and ensuring the achievement of regional planning goals. The RPA will supervise local governments' implementation of growth management and evaluate their performance in managing the UGBs. Rather than mere administrative measures, the RPA can apply fiscal strategies to harmonize growth control and local development. Local governments' fiscal incentives and tax redistribution can be linked to their performance in growth management and farmland protection. Local cadres' career achievements evaluation and future promotion can also be linked to their performance in managing urban growth. Metro's responsibility is not limited in land use planning, but it also has to conduct open space preservation, transportation planning, etc. However, China's planning system is dispersed and overlapping, with urban planning, land-use planning, environmental protection planning, and socioeconomic development plans conducted and managed by different departments, even though they have similar goals and purposes. It is a complicated issue of "planning integration" ("多规合一") in China, and it is also an objective that many local governments are trying to achieve nowadays. In the formulation and management of the UGBs, it not only requires the collaboration among different jurisdictions but also the cooperation among different departments, they have to work together to conduct an effective UGB with comprehensive functions to control urban sprawl, lead urban growth, preserve farmland, and protect environment.

As many scholars mentioned before, when adopting UGBs in China one should consider their consistency with existing urban and land-use planning systems. As introduced in the literature review section, China’s land-use planning divides a city’s land area into four districts: Construction Allowed Area, Conditional Construction Area, Prohibited Construction Area, and Restricted Construction Area. The flexible UGB could be consistent with the boundary of Construction Allowed Area (Construction Boundary). It is hard to accurately forecast long-term land demand for the next 15 to 20 years, given the rapid social and economic development in China. Portland Metro’s periodic review of the necessity of amending the UGB can be adopted. Local governments can assess their demand for land every 5 years and submit their evaluation and flexible UGB amendments to the RPA. Based on the principle of “intensive and efficient use of land resources” and local development trends, the RPA can decide to approve local governments’ plans or maintain the status quo and require them to improve land-use efficiency. However, the expansion of UGB should not exceed the Extension Boundary, which is the long-term limit of urban land supply within a planning horizon such as 20 years (see Figure 32).

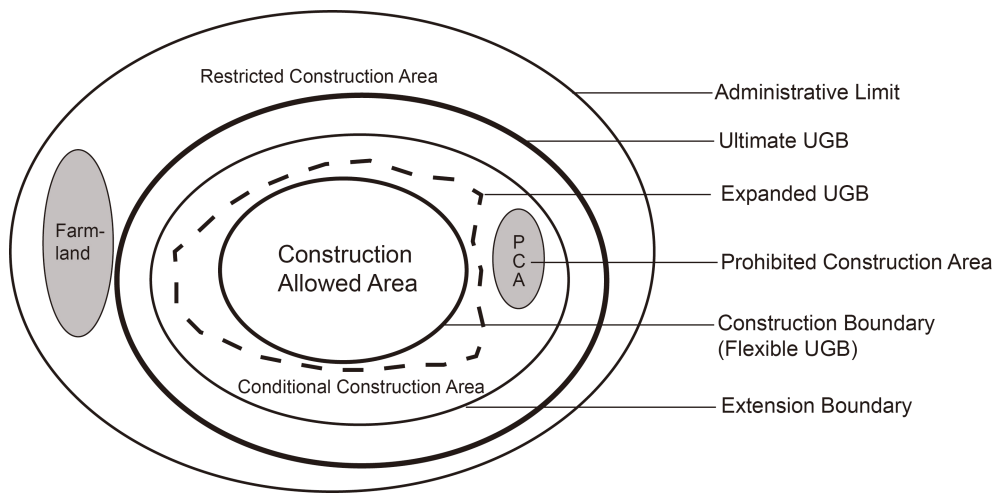


Figure 32. The conceptual drawing of the UGB links to the existing planning system

Source: Author

For a certain planning cycle, or for a longer-term planning vision, before the formulation of any UGB, especially the flexible UGB, what the local planning agencies need to do is designate the undevelopable areas (Prohibited Construction Area) including farmland, forestland, and other

natural reserves that will be strictly protected. Within the reserve areas, some agricultural land or forestland can be given the priorities that may be used for development in the future based on their geologic and soil conditions and productivity as that in Portland, and some lands such as prime farmland and ecological sensitive areas that will be permanently protected without encroachment. So, even though urban development will unavoidably occupy agricultural lands in the future, at least we can sacrifice the least valuable lands. Finally, after the designation of undevelopable lands and the priority of reserve lands, local governments can identify the developable areas for use. This is also an important anti-planning concept (“先底后图”) that is embraced by many Chinese planners and officials nowadays (Wu & Zhong, 2011). A city will apply ecological and farmland protection as the precondition, then analyze local economic, social, cultural and historical conditions, and finally decide the available land for development for the locality (Wang et al., 2014). The ultimate UGB is also based on such a method to delimit the final urban outline of a city or region on the premise of excluding all the permanently protected areas.

The core idea of the UGB is not only to curb sprawl, but it should have the effect of leading the urban growth. Metro encourages compact and transit-oriented development inside the boundary and limits or prohibits urban development outside the boundary. Shanghai and SWC region can take the UGBs as an opportunity to adopt policies to adjust existing planning strategies to promote compact and infill development to improve the efficiency of land-use and achieve regional sustainable development. Infrastructure provision can be an important strategy used to limit and lead the growth. Local governments provide infrastructure in designated areas that are fit for development and limit the time and scope of provision. This will influence the location, timing, and rate of development and thus to lead and control the growth of a city. As in the rural areas outside the UGB, zoning and other strict planning and administrative measures can be applied to limit construction activities and protect agricultural lands. UGBs combined with the existing farmland protection policies such as basic farmland protection district and cultivated land dynamic balance will build an effective mechanism to control urban sprawl and protect rural areas. Rural settlements and township enterprises outside the UGB should be strictly managed too. There should be rules and standards to restrict their densities and locations, which ensure

that they will not become a threat to the preservation of farmland.

So far, the UGB in China is almost an administrative order asking local governments to follow but it has not become a formal legal provision. It is important to legislate for the UGB to ensure its implementation. The requirement of establishing and managing UGB can be adopted into the national Urban and Rural Planning Law and Land Management Law and smoothly link to the existing urban and land-use planning system. Central governments and high-level planning agencies should promulgate detailed regulations and rules to command and guide local governments to implement their UGBs and provide them technical and financial support. Public involvement is also necessary. Traditional Chinese planning is a top-down and government-led process, and there is rare public participation. However, public involvement will improve the justifiability of urban planning and enhance the implementation of regulations. During the process of formulating UGBs, planning agencies should invite the public to help develop the programs and listen to their suggestions, and this will increase people's satisfaction and understanding of local planning and facilitate the implementation of UGBs.

4.6 Summary

The study area, Shanghai and SWC metropolitan areas, are located in the YRD region, one of the mostly urbanized area in China. After a thirty-year period of rapid growth the Shanghai and SWC urban agglomeration has experienced large-scale urban expansions, while encroaching on their surrounding agricultural lands and causing environmental degradation. It becomes urgent for this area to take action to stop the trend. Portland's UGB has proved to be an effective approach to curb urban sprawl and protect farmland. It is feasible and applicable for China to adopt such a planning tool to alleviate its own urbanization problems, though there are some institutional barriers for the smooth implementation of the approach.

Some suggestions are provided for the application of the UGB in Shanghai and SWC region: 1.) Promote intercity cooperation through vertical and horizontal approaches; 2.) Establish a full-coverage and multi-level UGB system in the region to manage urban growth; 3.) Integrate

the UGB with the existing urban and land-use planning system; 4.) Formulate flexible and ultimate UGBs for cities at different development stages; 5.) Supervise local governments' implementation and management of UGBs, and link it to the evaluation of their administrative performance; 6.) Combine with other policies and regulations to encourage compact development inside the UGB and limit rural constructions outside the UGB; 7.) Legislate to support the formulation and implementation of UGB; and 8.) Involve public in the process of UGB planning.

Chapter 5 Conclusion

It is well known that China is experiencing an unprecedented urbanization process. It is also a nation that cares greatly about farmland protection and food security in the world. In 2014, China announced the plan of adopting urban growth boundaries to control urban sprawl and protect agricultural land. The United States has a long history of implementing UGBs, and Portland region's UGB is one of the most notable and successful examples. By reviewing Portland's experience, this thesis provides suggestions for the application of UGBs in Shanghai and SWC urban agglomeration situated in the YRD region, China.

Portland's UGB is a result of Oregon's statewide land-use planning system that was established in the early 1970s as a response to the rapid urbanization at that time. Oregon's planning legislation provides a solid foundation for the formation and implementation of UGBs in the state. In the Portland region, a regional government, Metro, was created to serve this area, and it is responsible to coordinate cities of growth and manage the regional UGB. As established in the late 1970s, Portland's UGB is entering its fourth decade. There have been lots of assessments of the effects of the UGB and arguments of its effectiveness in achieving the desired goals. There appears to be a consensus, at least in urban planning field that the UGB deters the excessive expansion of urban development and protect farmland and other resource lands outside the boundary. However, the concern of housing affordability since the initiation of the UGB has never been resolved, though most scholars believe that Portland's UGB has nonsignificant impact on the housing prices and housing affordability. In the meantime, there are some unintended consequences happening during the implementation of the UGB, such as the unrealized urban density within the boundary and the undesired low-density residential development outside the boundary. Besides, spillover effects or leapfrog development occurred in its neighboring area beyond the UGB, such as in the City of Vancouver that did not have a growth management act until 1995.

It is clear that Portland's UGB is not a perfect tool, and it does have failures and ineffectiveness. But after reviewing its history and implementation, there are still valuable lessons summarized

from its experience that can be a reference for the application of UGBs in China.

1. Portland's UGB is a regional planning tool that serves for a metropolitan area but not a single city. This ensures that the whole region together makes efforts to manage urban growth and avoids sprawl being displaced to neighboring cities though this still happened in Vancouver that outside Portland's UGB.
2. Portland's UGB is not an isolated independent policy, there is a package of policies that provide further support to growth management goals. In addition to UGBs, there are zoning ordinances and farm use tax policies to protect farmland and forest outside the UGB.
3. Portland's UGB is a flexible line that can be adjusted to accommodate future growth. Metro reviews the supply of land within the boundary every six year to ensure that there is enough space for the 20-year development. Based on the assessment, Metro will decide to expand the UGB or improve the existing land-use efficiency without expansion.
4. Portland's UGB is not just a line aiming to curb sprawl and protect farmland, but it intends to lead the growth. Metro and its residents plan the future for the region and identify where and how the region should grow on the basis of the UGB.
5. Portland's UGB and the regional growth planning are the outcomes of Portlanders' collective wisdom. Portland region's planning involves extensive public participation, and people can freely recommend on the development and planning of the region.

In this thesis, I focus on Shanghai and SWC urban agglomeration, which is a highly urbanized region with high population density and experiences of rapid urbanization, industrialization and economic growth. According to the land-use analysis, the region's urbanization has encroached on large tracts of farmland and threatened regional environment and food security. It is urgent to take appropriate approaches to control urban sprawl and preserve agricultural lands. UGBs are good tools in these types of situations. Given the institutional differences between Oregon and China, it is impossible to transfer the same UGB system to China. Based on the analysis of the study area's political and institutional situation, I suggest that the region should establish

inter-city cooperation to form a comprehensive and multi-level UGB system to manage regional growth. The specific suggestions are stated as below:

1. Establish regional cooperation under the help of vertical and horizontal political approaches. The central government and provincial government as the higher-level authorities should promote inter-city cooperation through legal and administrative orders that enforce the cities to collaborate with each other. The Regional Planning Agency can be created to guide and supervise the implementation of regional land-use policies, and it should provide local governments technical and financial support for achieving regional planning goals. Regular and formal communication and conferences among cities will help build trust and understanding, and arouse a consciousness of cooperation.
2. A full-coverage and multi-level UGB system should be established. Currently, separated UGBs for each of the city within the region may be easier to achieve than create large and continuous UGBs. However, as cooperation deepens and continuous built-up areas increase, regional united UGBs would be a more efficient form of managing urban growth in this region. The UGB can be divided into two types: the flexible UGB and the ultimate UGB. A flexible UGB can be applied in those developing cities that still have space for growth, while an ultimate UGB can be imposed on the city like Shanghai that is almost built out.
3. The UGB as a new planning tool should be consistent with the existing planning system. The flexible UGB can be consistent with the Construction Boundary at first and expanded to accommodate growth after periodic evaluation, however, the expansion should not exceed the Extension Boundary within a certain planning horizon such as 20 years. The ultimate UGB will be formulated after the exclusion of all the undevelopable lands within the administrative limit and it delineates the final extent of a city. Besides the cooperation among different jurisdictions, the formulation and implementation of effective UGBs also require the coordination among different departments and the integration of their distinct planning systems.
4. The UGB should not work in isolation. It requires the support of other planning regulations and containment strategies to work together to achieve the goals of preserving farmland,

encouraging compact and infill development, and improving the efficiency of land use, such as policies are required to establish to manage rural settlements and protect cultivated lands outside the UGB.

5. The UGB should get the support from legislation. In order to ensure the implementation of the UGB program, legal provisions are required to direct local governments to establish and manage their UGBs. In order to promote the UGB, related provisions should be adopted into the national Urban and Rural Planning Law and Land Management Law. Higher-level governments and planning agencies should promulgate detailed regulations and rules to command and guide local governments to implement UGBs.
6. Higher-level governments should supervise the implementation of UGBs and link it to the evaluation of local governments' administrative performance. Administrative and financial approaches such as cadres' appointment and removal and fiscal incentives can be used to award and punish local governments for their performance in implementing UGBs. On the other hand, the public should also be involved in the process of formulating and supervising UGBs. Their participation and recommendations will enhance the effectiveness of the UGB planning.

Portland's UGB is a complex and comprehensive topic, there has been extensive literature analyzing and evaluating the UGB system from various perspectives, and it is difficult to give an exhaustive introduction to Portland's UGB in one study. Through this thesis, I want to provide a general background of the UGB in Portland. By reviewing several notable aspects of the UGB, I summarize lessons that may be valuable for China to learn. On the other hand, the suggestions and lessons summarized may not be limited to the Shanghai and SWC region, they may also be transferable across the nation because most of areas in China are confronting similar problems and they share the same political environment as the study area. However, given the complexity of political and institutional context, the recommendations presented here provide only theoretical and possible solutions for Shanghai and SWC to overcome their existing institutional barriers and achieve regional urban growth management. However if real cooperation among cities still cannot be achieved, it will be difficult to promote any effective regional planning

strategy for this region, or any other regions in China. As introduced in the literature review section, China already has quite a few urban containment strategies and policies, but their impacts are unfortunately not good enough. The decentralization of governance and fiscal administration, and local governments' huge demand for economic growth hinder the performance of those policies. The effectiveness of implementing UGBs and other containment strategies depends on the willingness of local governments and their compliance with the policies (Zhao, 2011). If economic growth and inter-city competition are still among the primary characteristics of local governments, UGBs will fail to limit the expansion of new development in suburbs as expected.

The discussion and recommendations presented in this thesis are still general and limited. Future research on this topic can be more targeted and specific. Policy analysis and suggestions can be detailed for each city based on the city's current situation and future development. Urban growth boundaries as land-use planning tools should be specific and localized, because they inevitably involve making consequential decisions about specific pieces of land and affecting local or regional stakeholders' benefits. This is also a policy implication for Chinese governments that they should make policies more place-specific. Most of the current Chinese land policies are nationwide and they require implementation in most areas of the country. However, different cities or regions have diverse conditions and are confronted with different challenges. It is arbitrary to set universal standards and requirements for all places. Even in the case of UGB policy, universal standards are arbitrary. The central government should leave more autonomy for local governments to make decisions and allow them to formulate specific plans based on their own conditions. Future research should focus on the study of the effects of implementing UGBs in China. Housing affordability, land prices, traffic congestion, etc., should all be considered before and after implementing UGBs. Some other policies may be required to alleviate those negative unintended effects.

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APPENDIX

APPENDIX A

A Summary of Oregon's Statewide Planning Goals

1. **CITIZEN INVOLVEMENT** Goal 1 calls for "the opportunity for citizens to be involved in all phases of the planning process." It requires each city and county to have a citizen involvement program containing six components specified in the goal. It also requires local governments to have a committee for citizen involvement (CCI) to monitor and encourage public participation in planning.

2. **LAND USE PLANNING** Goal 2 outlines the basic procedures of Oregon's statewide planning program. It says that land use decisions are to be made in accordance with a comprehensive plan, and that suitable "implementation ordinances" to put the plan's policies into effect must be adopted. It requires that plans be based on "factual information"; that local plans and ordinances be coordinated with those of other jurisdictions and agencies; and that plans be reviewed periodically and amended as needed. Goal 2 also contains standards for taking exceptions to statewide goals. An exception may be taken when a statewide goal cannot or should not be applied to a particular area or situation.

3. **AGRICULTURAL LANDS** Goal 3 defines "agricultural lands." It then requires counties to inventory such lands and to "preserve and maintain" them through farm zoning. Details on the uses allowed in farm zones are found in ORS Chapter 215 and in Oregon Administrative Rules, Chapter 660, Division 33.

4. **FOREST LANDS** This goal defines forest lands and requires counties to inventory them and adopt policies and ordinances that will "conserve forest lands for forest uses."

5. **OPEN SPACES, SCENIC AND HISTORIC AREAS AND NATURAL RESOURCES**
Goal 5 covers more than a dozen natural and cultural resources such as wildlife habitats and

wetlands. It establishes a process for each resource to be inventoried and evaluated. If a resource or site is found to be significant, a local government has three policy choices: preserve the resource, allow proposed uses that conflict with it, or strike some sort of a balance between the resource and the uses that would conflict with it.

6. AIR, WATER AND LAND RESOURCES QUALITY This goal requires local comprehensive plans and implementing measures to be consistent with state and federal regulations on matters such as groundwater pollution.

7. AREAS SUBJECT TO NATURAL DISASTERS AND HAZARDS Goal 7 deals with development in places subject to natural hazards such as floods or landslides. It requires that jurisdictions apply "appropriate safeguards" (floodplain zoning, for example) when planning for development there.

8. RECREATION NEEDS This goal calls for each community to evaluate its areas and facilities for recreation and develop plans to deal with the projected demand for them. It also sets forth detailed standards for expedited siting of destination resorts.

9. ECONOMY OF THE STATE Goal 9 calls for diversification and improvement of the economy. It asks communities to inventory commercial and industrial lands, project future needs for such lands, and plan and zone enough land to meet those needs.

10. HOUSING This goal specifies that each city must plan for and accommodate needed housing types, such as multifamily and manufactured housing. It requires each city to inventory its buildable residential lands, project future needs for such lands, and plan and zone enough buildable land to meet those needs. It also prohibits local plans from discriminating against needed housing types.

11. PUBLIC FACILITIES AND SERVICES Goal 11 calls for efficient planning of public services such as sewers, water, law enforcement, and fire protection. The goal's central concept is

that public services should to be planned in accordance with a community's needs and capacities rather than be forced to respond to development as it occurs.

12. **TRANSPORTATION** The goal aims to provide "a safe, convenient and economic transportation system." It asks for communities to address the needs of the "transportation disadvantaged."

13. **ENERGY** Goal 13 declares that "land and uses developed on the land shall be managed and controlled so as to maximize the conservation of all forms of energy, based upon sound economic principles."

14. **URBANIZATION** This goal requires cities to estimate future growth and needs for land and then plan and zone enough land to meet those needs. It calls for each city to establish an "urban growth boundary" (UGB) to "identify and separate urbanizable land from rural land." It specifies seven factors that must be considered in drawing up a UGB. It also lists four criteria to be applied when undeveloped land within a UGB is to be converted to urban uses.

15. **WILLAMETTE GREENWAY** Goal 15 sets forth procedures for administering the 300 miles of greenway that protects the Willamette River.

16. **ESTUARINE RESOURCES** This goal requires local governments to classify Oregon's 22 major estuaries in four categories: natural, conservation, shallow-draft development, and deep-draft development. It then describes types of land uses and activities that are permissible in those "management units."

17. **COASTAL SHORELANDS** The goal defines a planning area bounded by the ocean beaches on the west and the coast highway (State Route 101) on the east. It specifies how certain types of land and resources there are to be managed: major marshes, for example, are to be protected. Sites best suited for unique coastal land uses (port facilities, for example) are reserved for "water-dependent" or "water related" uses.

18. **BEACHES AND DUNES** Goal 18 sets planning standards for development on various types of dunes. It prohibits residential development on beaches and active foredunes, but allows some other types of development if they meet key criteria. The goal also deals with dune grading, groundwater drawdown in dunal aquifers, and the breaching of foredunes.

19. **OCEAN RESOURCES** Goal 19 aims "to conserve the long-term values, benefits, and natural resources of the nearshore ocean and the continental shelf." It deals with matters such as dumping of dredge spoils and discharging of waste products into the open sea. Goal 19's main requirements are for state agencies rather than cities and counties.

APPENDIX B

GOAL 14: URBANIZATION

OAR 660-015-0000(14)

(Effective January 1, 2016)

To provide for an orderly and efficient transition from rural to urban land use, to accommodate urban population and urban employment inside urban growth boundaries, to ensure efficient use of land, and to provide for livable communities.

Urban Growth Boundaries

Urban growth boundaries shall be established and maintained by cities, counties and regional governments to provide land for urban development needs and to identify and separate urban and urbanizable land from rural land. Establishment and change of urban growth boundaries shall be a cooperative process among cities, counties and, where applicable, regional governments.

An urban growth boundary and amendments to the boundary shall be adopted by all cities within the boundary and by the county or counties within which the boundary is located, consistent with intergovernmental agreements, except for the Metro regional urban growth boundary established pursuant to ORS chapter 268, which shall be adopted or amended by the Metropolitan Service District.

Land Need

Establishment and change of urban growth boundaries shall be based on the following:

- (1) Demonstrated need to accommodate long range urban population, consistent with a 20-year population forecast coordinated with affected local governments, or for cities applying the simplified process under ORS chapter 197A, a 14-year forecast; and
- (2) Demonstrated need for housing, employment opportunities, livability or uses such as public facilities, streets and roads, schools, parks or open space, or any combination of the need

categories in this subsection (2). In determining need, local government may specify characteristics, such as parcel size, topography or proximity, necessary for land to be suitable for an identified need. Prior to expanding an urban growth boundary, local governments shall demonstrate that needs cannot reasonably be accommodated on land already inside the urban growth boundary.

Boundary Location

The location of the urban growth boundary and changes to the boundary shall be determined by evaluating alternative boundary locations consistent with ORS 197A.320 or, for the Metropolitan Service District, ORS 197.298, and with consideration of the following factors:

- (1) Efficient accommodation of identified land needs;
- 2) Orderly and economic provision of public facilities and services;
- (3) Comparative environmental, energy, economic and social consequences; and
- (4) Compatibility of the proposed urban uses with nearby agricultural and forest activities occurring on farm and forest land outside the UGB.

Urbanizable Land

Land within urban growth boundaries shall be considered available for urban development consistent with plans for the provision of urban facilities and services. Comprehensive plans and implementing measures shall manage the use and division of urbanizable land to maintain its potential for planned urban development until appropriate public facilities and services are available or planned.

Unincorporated Communities

In unincorporated communities outside urban growth boundaries counties may approve uses, public facilities and services more intensive than allowed on rural lands by Goal 11 and 14, either by exception to those goals, or as provided by commission rules which ensure such uses do not adversely affect agricultural and forest operations and interfere with the efficient

functioning of urban growth boundaries.

Single-Family Dwellings in Exception Areas

Notwithstanding the other provisions of this goal, the commission may by rule provide that this goal does not prohibit the development and use of one single-family dwelling on a lot or parcel that:

- (a) Was lawfully created;
- (b) Lies outside any acknowledged urban growth boundary or unincorporated community boundary;
- (c) Is within an area for which an exception to Statewide Planning Goal 3 or 4 has been acknowledged; and
- (d) Is planned and zoned primarily for residential use.

Rural Industrial Development

Notwithstanding other provisions of this goal restricting urban uses on rural land, a county may authorize industrial development, and accessory uses subordinate to the industrial development, in buildings of any size and type, on certain lands outside urban growth boundaries specified in ORS 197.713 and 197.714, consistent with the requirements of those statutes and any applicable administrative rules adopted by the Commission.

GUIDELINES

A. PLANNING

1. Plans should designate sufficient amounts of urbanizable land to accommodate the need for further urban expansion, taking into account (1) the growth policy of the area;(2) the needs of the forecast population; (3) the carrying capacity of the planning area; and (4) open space and recreational needs.
2. The size of the parcels of urbanizable land that are converted to urban land should be of adequate dimension so as to maximize the utility of the land resource and enable the logical and efficient extension of services to such parcels.

3. Plans providing for the transition from rural to urban land use should take into consideration as to a major determinant the carrying capacity of the air, land and water resources of the planning area. The land conservation and development actions provided for by such plans should not exceed the carrying capacity of such resources.

4. Comprehensive plans and implementing measures for land inside urban growth boundaries should encourage the efficient use of land and the development of livable communities.

B. IMPLEMENTATION

1. The type, location and phasing of public facilities and services are factors which should be utilized to direct urban expansion.

2. The type, design, phasing and location of major public transportation facilities (i.e., all modes: air, marine, rail, mass transit, highways, bicycle and pedestrian) and improvements thereto are factors which should be utilized to support urban expansion into urbanizable areas and restrict it from rural areas.

3. Financial incentives should be provided to assist in maintaining the use and character of lands adjacent to urbanizable areas.

4. Local land use controls and ordinances should be mutually supporting, adopted and enforced to integrate the type, timing and location of public facilities and services in a manner to accommodate increased public demands as urbanizable lands become more urbanized.

5. Additional methods and devices for guiding urban land use should include but not be limited to the following: (1) tax incentives and disincentives; (2) multiple use and joint development practices; (3) fee and less-than-fee acquisition techniques; and (4) capital improvement programming.

6. Plans should provide for a detailed management program to assign respective implementation roles and responsibilities to those governmental bodies operating in the planning area and having interests in carrying out the goal.