

THE SUSTAINABILITY OF URBAN WILD AREA CHANGES AND URBAN AREA DEVELOPMENT: CASE STUDY OF WUHAN CITY'S METROPOLITAN AREA, P.R. CHINA IN 2002 - 2011

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ABSTRACT: *Urban wild areas are the land maintains a wild ecosystem in metropolitan areas and it is urban resources of ecosystem services. When city planning is based on economic development, capitalism urbanization and industrialization, urban wild areas tend to decrease in size while strictly urban areas become larger. Between 2002 and 2011, the metropolitan region of Wuhan, C.P. China, also displays the relationship of increasing urbanization and the decline of urban wild areas. Thus the researchers will attempt to explain a decrease in the urban wild area in the city of Wuhan due to urbanization. The current research will analyze changes in images from Landsat 7 satellite, as well as statistics of Wuhan and then they compare the study results with international sustainable standard. All data analyzed show that urban wild areas change in quality and quantity; the data also suggest that industrial and urban development correlates significantly with negative impact upon urban wild areas. In addition, the study conducted by the researchers of changes of the benchmarks of urban wild area in Wuhan culminate in sustainable ultimate gold: in the future we wants' commitment of the United Nations. The research displays that urban wild area changes are not according with sustainable ultimate goal and it is not suitable for the well-being of metropolitan life and it serves as a serious warning to the urban wild area conservation process.*

KEYWORDS: Urban Wild, Wuhan City, Urban Development Policy, Land Resources Management, Urban Ecology, Urban Study, Sustainability, Sustainable Development.

INTRODUCTION

Sustainability of Land Resources Management in the City

Land resources refer to a definable area of terrestrial surface of the earth, encompassing all attributes of the biosphere immediately above or below this surface (FAO/UNEP, 2014). Land resources are an important natural resource because land is the basis of life and all life needs land area for subsistence (Brandon T. Bestelmeyer, 2003). Land is the sources of many living needs of all living things; things such as food, water, habitat, medicines, ecosystem, biogeochemical cycle, cultivated area, economic production etc, all require land to develop. Land resources are a renewable resource, but they have limitations in their use and require balance in the environment. So, land resources are important natural resources that must be preserved in a special way (The World Bank, 2006).

Land resources of a city are important natural resources because every city around the world has only limited land resources and most of the world population lives in cities. While human require the limited land resources, so too do non-humans. Human and non-humans have begun

the eternal struggle between land development and environmental conservation; this is the struggle for occupancy. The struggle is even greater as non-humans have also taken up residence within cities; these parts of a city are known as “urban wild area”. It is becoming apparent that metropolitan areas do not only need infrastructure from urban areas, they also need ecosystem services and green infrastructure in these urban wild areas (Millennium Ecosystem Assessment, 2003). Hence, we can see that every city has an urban area and urban wild area overlap where these two regions coexist, so urban wild area management, conservation and ecology are important areas for land resource conservation.

Urban wild area conservation is not a simple job in present time because these areas are being attacked from many directions; urbanization, modernization, industrialization, globalization, capitalism, consumerism and materialism, all these factors affect urban wild area changes and much of these changes are not sustainable (William E. Rees, 1992). Its impact with urban ecosystem and metropolitan areas in long period. So, the conservation of urban wild area is an important mission for governor of a city and metropolitan because it promotes sustainable development and sustainable land resource management of the city.

The present research takes the metropolitan area of Wuhan city as a case study and studies the relationship between changes in urban wild areas and the development of urban areas. The researchers analyze satellite images from the Computer Network Information Center, Chinese Academy of Science capture by Landsat seventh between 2002 to 2011 and researchers use PCI Geomatica, remote sensing computer software, as a study tool for data analysis. Moreover, they show statistics of changes in urban wild area and urban area for the relationship analysis. After that, they analyze changes in urban wild area with the ultimate goal of creating a sustainable land resource management’s scenario, for the metropolitan area of Wuhan in 10 years.

Conservation of urban wild areas is one way to create sustainability of land resources in the city because it is equal treatment of land resources and ecosystem, and it is natural regeneration’s protection of land resources: they are a renewable resource (Dorothy Billings, 2011). Sustainable land resources management is linked with many local, national and global securities for people, such as food security, water safety, biodiversity, climate changes, ecosystem services and land degradation (The World Bank, 2008). Metropolitan areas, especially need better management to sustain land resources since a city use land resources more heavily than rural and remote areas (The Cities Alliance, 2007). Urban wild areas can serve as living standard indicators of metropolitan regions since they are natural resources, and they can also bring capital and other assets to a city (Millennium Ecosystem Assessment, 2005)

Urban Wild Area Conservation VS. Capitalism’s Urbanization.

The urban wild area refers to natural land and natural ecosystems that still maintain wilderness in the midst of developed and developing metropolitan areas. Moreover, an urban wild area is natural habitat in the city where wild creatures can live with the urban environment and urban atmosphere. (P. O. Cheptou, 2008). An urban wild area, by definition, includes many different ecosystems inside the city; these ecosystems include rivers, lagoons, canals, bays, sea, beaches, mangrove forests, urban forests, hills, fallows, canopies, cultivated areas, gardens, parks, etc.

Urban wild areas provide benefits for both human and non-humans as humans can take advantage of the ecosystem services, while non-human can maintain a natural habitat because humans can get ecosystem services from this area and non-human can get natural habitat within

an urban region. This co-operative living, and mutually beneficial situation, makes conservation of urban wild area an important topic and the issue should be assessed both qualitatively and quantitatively. Conservation of this area is a challenge since urban ecosystems are ecosystems of rapid change, especially since a great number of people live in cities, which creates much stress on the urban environment. Due to the stress involved in the ever-developing urban systems and with the majority of importance placed upon the people living in the urban areas, urban wild areas are often disregarded (Sven Erik Jorgensen, 2009). Urban habitats are not appropriate for wild creatures to survive in an urban ecosystem because most of the cities around the world have a problem with loss of biodiversity (UN-HABITAT, 2010) but conservation of the urban wild area is one way to protect biodiversity, conserve natural resources and for environmental maintenance for the city.

Cities all around the world have changed and developed fast during this most recent period of capitalism and global urbanization (Jussi S. Jauhiainen, 2006). This changes directly and indirectly influences the changes of urban wild area in the cities because humans need space and area for living. Moreover, humans change natural land and atmosphere with establishments and pollution (UN-HABITAT, 2010). The urban wild area are gradually becoming smaller overtime and quality of urban wild area is degrading: biodiversity, the quality of water of water resources, quality of soil of land resources, quality of air in urban atmosphere and kinds of urban wild areas are also changing with time. It can be said that a contemporary change in many realms of the biosphere is largely the product of human activities, industrialization and capitalism (B. L. Turner II, 1994).

The issues of environmental conservation and development of the economy are paradoxical as humans need money for the costs of living but they also need nature for survival. Urban wild area conservation also has this problem (Jari Niemela, 1999). So, the way to balance environmental conservation and the development of the economy is an important area of study, the way to balance a city consumes and adsorb resources from inside and outside for development and subsistence of land, fresh water, electricity, petroleum, capital, wood, food, urban wild area etc (Millennium Ecosystem Assessment, 2005). The main actors of natural balance within a city are the city planner and the city governor because they are the planners of public policy and the administrator. Moreover, they are empowered by the law to maintain the environment of the city (UN-HABITAT, 2013).

One way to keep balance of a city is through sustainable development as this type of development is concerned with caring for, and developing, a capacity of a natural system and ecosystems through the social and economic system (Tatyana P. Soubbotina, 2004). Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs; this, means that people in this generation should maintain natural resources and a good environment for people of the next generation (UN, 1987). Thus, conservation of urban wild area is one path of sustainable development for a city because it is the way to preserve ecosystem services as well as natural urban ecosystems for the next generation. It will be one way to sustain the fauna, flora, mankind and the world into the future (UN-HABITAT, 2012).

Wuhan City: Clash of Environmental Conservation and Industrialization.

Wuhan is the capital of Hubei province and located in the central region of China, it is also a hub for transportation, logistics, industry, commerce, economy, education, politics and culture. This city is not important only on a regional level, but also an important city on a national level

because it is the top ten largest cities of China. Wuhan has had an unofficial name as the “Chicago of China” (Mark Jacob, 2012). Wuhan has held important in China for at least 3,500 years. Because the city is a stronghold, exuberance and perfect ecosystem, this area have retained a civilized metropolitan feel in China from the past to the present (Hubei Provincial Government, 2014).

The area of Wuhan covers 8,494.41 square kilometers, but the metropolitan area covers 888.42 square kilometers (Pan Jianqiao, 2012). The Wuhan metropolitan area is commonly divided into three regions that are Hankou zone, Hanyang zone and Wuchang zone. Metropolitan Wuhan contains many urban wild areas such as lakes, pools, rivers, canals, hills, urban forests and agricultural areas because it is situated on the water resource bank of China. Hubei province is unofficially known as the province of lakes and Wuhan itself has hundreds of lakes in the urban areas and urban river basin (Kai Xu, 2010). This area is not only a large urban wild area, it is also considered to be a biologically diverse ecosystem in China as it has approximately 300 species of endemic and migratory birds; 200 species of fish also are native to the region (Jingyun Fang, 2006). The region is also the habitat of endangered Yangtze River dolphin or Baiji (*Lipotes vexillifer*) which can only be found in the Yangtze River (Gillian T. Braulik, 2005). Indigenous vegetation in this area is comprised of more than 830 species (Antoine Sambou, 2010), so we see that urban wild area of metropolitan Wuhan has a luxuriant ecosystem.

Cause of Wuhan city is rich in natural resources and urban wild area, the Wuhan government has tried to implement environmental conservation policies to the public such as sustainable Wuhan project (Wuhan Municipal Government, 1996) sustainable city program (UNEP&UN-HABITAT, 2003) and WWF program (WWF China, 2014), wherein the government is developing a hub for industrial and commercial markets in the middle region of China (Hubei Provincial Government, 2014). It is paradoxical phenomena in the city and the conflict is a simple situation in this era of industrialism (Candice Goucher, 1998). The impact and effect of industrialization of Wuhan impact the natural resources and urban wild area both directly and indirectly.

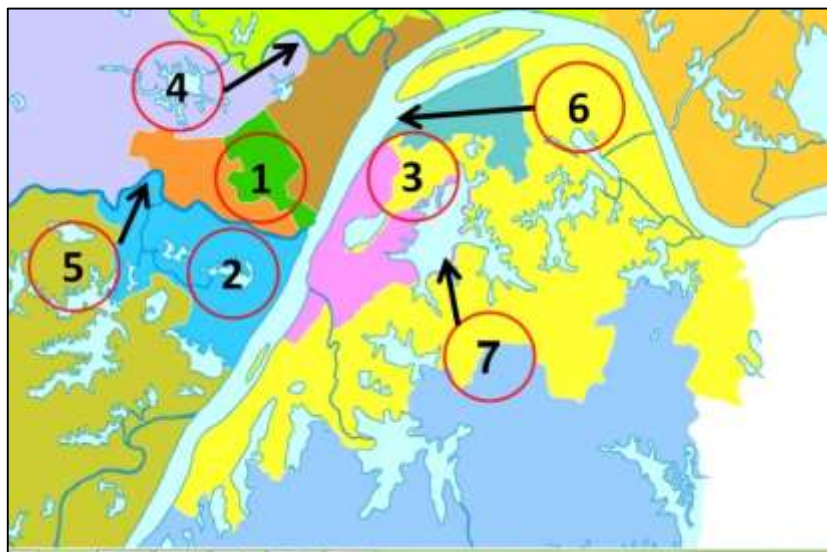


Figure 1 Wuhan City's Metropolitan Areas

Number 1 – Hankou Zone

Number 2 – Hanyang Zone

Number 3 – Wuchang Zone

Number 5 – Hanshui River

Number 7 – East Lake

Number 4 – Fuhe River

Number 6 – Yangtze River

Wuhan has approximately 17 economic and industrial zones in China, making it a center of economy. Each of these zones has been encouraged to perform a specific industry or business (Right Site, 2014). Moreover, Wuhan has developed into a transportation and logistics center with infrastructure such as high-speed train, highways, river ports and expanding airport (CAREC, 2012). The city is located in the center part of the country and has favorable geographical condition. It lies on the Yangtze River with inland and sea connections. All of the preceding conditions support Wuhan as an industrial city. It is contrasted with environmental conservation ideas.

Urban Wild Area Changes of Wuhan Metropolitan Area

When the changes of urban wild in metropolitan Wuhan are studied, from 2002 to 2011, by images taken from Landsat 7 satellite, the researchers found that urban wild areas changed in both quality and quantity. The size of urban wild areas in Wuhan was 628.71 square kilometers, or 70.77 percent, in 2002 but reduced 415.45 square kilometers, or 46.76 percent, in 2011. This indicates that people of metropolitan Wuhan lost 213.26 square kilometers, or 24.01 percent, of their urban wild area in 10 years. The current size of Wuhan's metropolitan area is 888.42 square kilometers. This means that most of the metropolitan area of Wuhan was urban composed of urban area in 2011 and it was not an urban wild area like in 2002.

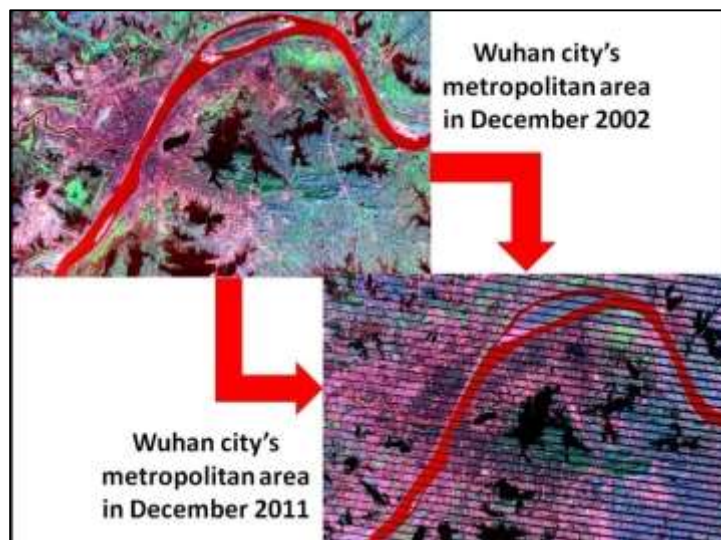


Figure 2 Wuhan City's Metropolitan Area Satellite Images Band 3, 4, 5, 6 and PAN in December 2002 and 2011.

In overview, the metropolitan area of Wuhan has lost a large quantity of urban wild area. For example, from figure 2, agricultural area, displayed in green in the Hankou zone: green color in December 2002, agricultural areas and green area in Hanyang zone: green color in December 2002: and green area in Wuchang zone: light green color in December 2002. Besides, we can see urban areas (pink color and dark blue) replacing the green area. The satellite images show that Wuhan lost urban wild area between the years 2002 and 2011.

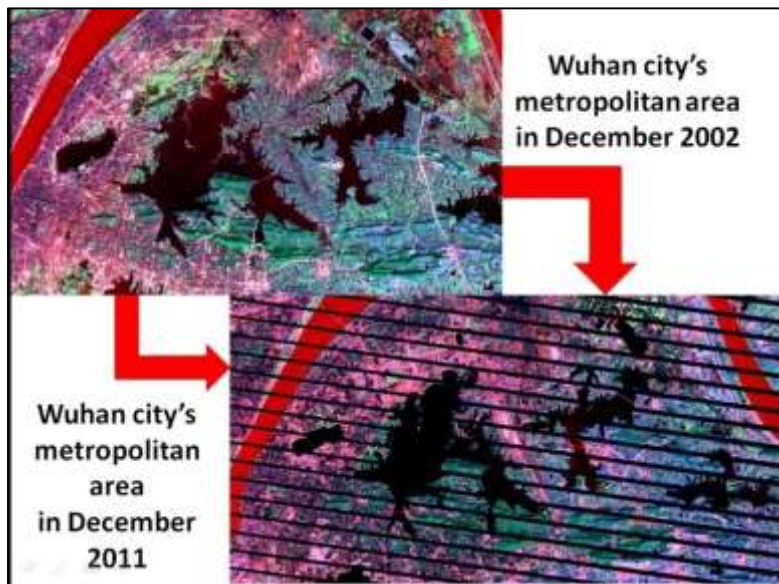


Figure 3 Wuhan City's Metropolitan Area Satellite Images Band 3, 4, 5, 6 and PAN in December 2002 and 2011.

In the detail from figure 3, we can see that, if compared to the same area in 2002. The urban wild area around East Lake is nearly gone in 2011. The urban wild area has become a completely urban area, with the expansion of urban infrastructures such as streets and railways. Looking more closely at the shape of East Lake changes in the outline of the lake are apparent between 2002 to 2011 where some sections of the lake have been reclaimed and converted to land. The urban wild area around East Lake is the biggest urban wild area of Wuhan's metropolitan area.

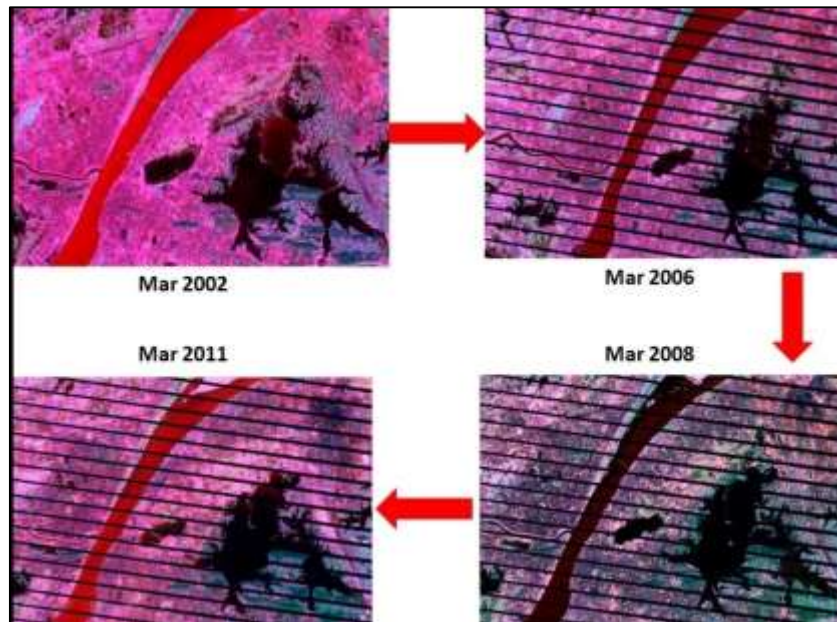


Figure 4 Wuhan City's Metropolitan Area Satellite Images Band 3, 4, 5, 6 and PAN in Mar 2002, 2006, 2008 and 2011

In figure 4, satellite images show that some changes in water resources of the metropolitan area of Wuhan do occur. The water quality of East Lake was not constant changes because East Lake had much sediment in the water in 2002 but shows less sediment in the water in 2006 and 2011. East Lake had no sediment in the water in 2008. However, water quality of the Yangtze River and Hanshui River did not change as they show sediment in the water from 2002 through 2011. The water quality is an indicator of the quality of urban wild areas and when water contains much sediment, those water resources are considered to be polluted and the quality of the water is not suitable for aquatic organisms (J. David Allan, 2004).

Satellite images of the Wuhan metropolitan area show that the urban wild area in whole area changes during the period 2002 – 2011. The changes occur slowly over a period of 10 years and its impacts and affects the urban life including, but not limited to urban flora, urban fauna and metropolitan people in both direct: some species extinctions, urban heat island, pollution etc: and indirect: destroy of food web balance, imbalance of some organic and biological chemistries etc: ways (Robert I. McDonald, 2008).

Industrial Urbanization of Wuhan City's Metropolitan Area

Changes of urban wild area of metropolitan Wuhan area in 2002 - 2011 come from industrial development of Wuhan city. We can look at statistics of changes to urban wild area during 2002 – 2011.

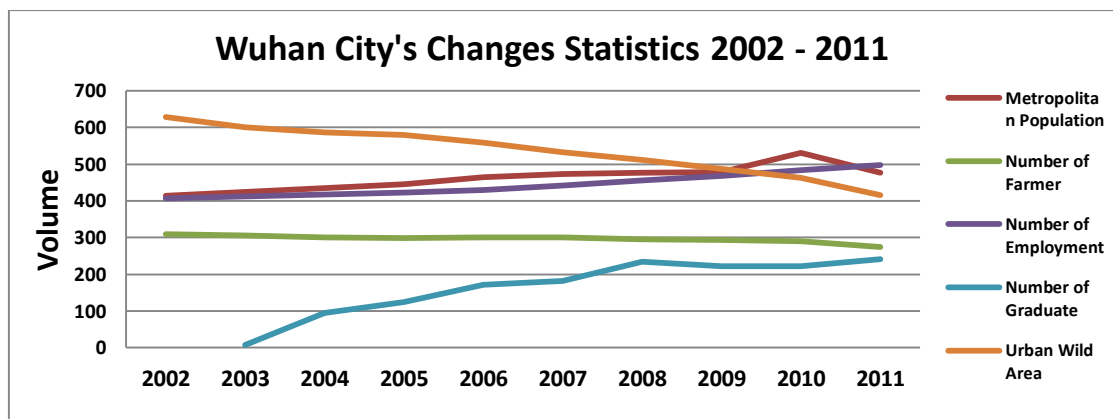


Figure 5 Graph of Statistics Changes in Wuhan City in 2002 – 2011 (Pan Jianqiao, 2012)

- Note: 1. Metropolitan population, number of farmer, number of employment and numbers of graduate's units are 10,000 persons.
 2. Units of the urban wild area are square kilometers.
 3. Number of graduates is graduates of higher education.

When the size of the urban wild area of satellite images of the period 2002 - 2011 was calculated, the researchers found that urban wild area of the Wuhan metropolitan area has declining trends in over time. When changes in urban wild area are statistically compared with changes in metropolitan population, number of farmers, number of employment and the number of higher education graduate of the city (of figure 5), the changes was found that the number of farmers is declining and it is related to the declining trend of changes in the area of urban wild area. Some urban wild areas of the city are agricultural areas that are consistent with the farmer statistics of farmer changes in 2002 - 2011.

Metropolitan population, the number of employed and the number of higher education graduate statistics show negative correlation with changes to the urban wild area. Metropolitan population and the number of employment slowly increase from 2002 – 2011 and the number of higher education graduates rose rapidly in the same period. Higher education institutions of Wuhan increased from 48 institutions in 2002 to 79 institutions in 2011; this increase in the number of institutions was one factor which leads to a rapid growth of graduates in this period (Su Jianping, 2010).

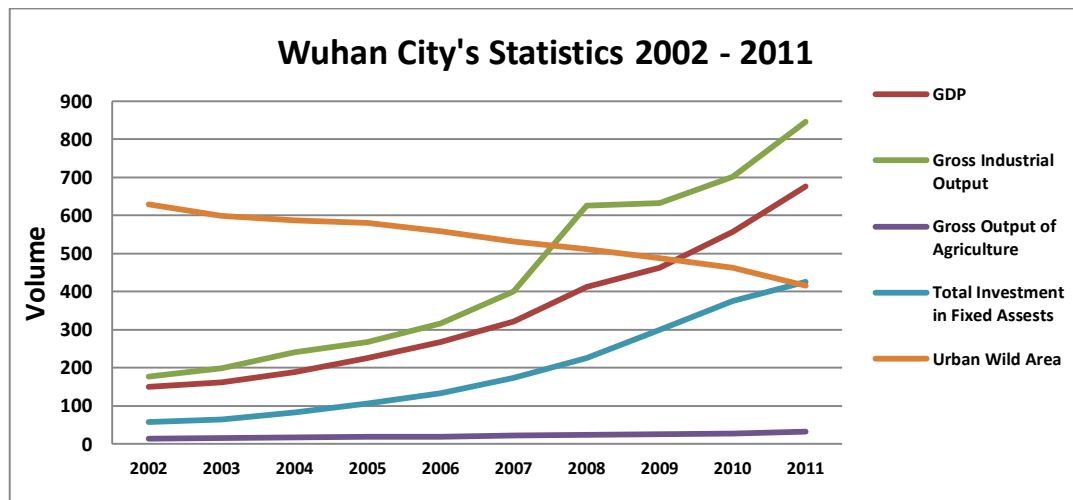


Figure 6 Graph: Statistics of Changes in Wuhan City in 2002 – 2011 (Pan Jianqiao, 2012)

- Note: 1. Units of Wuhan city's GDP, gross industrial output, gross output of agriculture and total investments in fixed assets are given in 1,000 million RMB.
2. Units for urban wild area are shown in square kilometers.

The researchers calculated GDP, gross industrial output, gross output of agriculture, total investment in fixed assets and changes of the urban wild area of Wuhan and plotted them over time. The graph above (Figure 6) shows that changes in urban wild of the city are inversely proportion to GDP, gross industrial output, gross output of agriculture as well as the total investment in fixed assets. Urban wild area decreased, but GDP, gross industrial output, gross output of agriculture and total investment in fixed assets increased in 2002 - 2011. Moreover, GDP, gross industrial output and total investment in fixed assets dramatically increased, but the gross output of agriculture increased only slightly and it was on a lower scale than gross industrial output and total investment in fixed assets. These changes show that industrial and construction developed more than agriculture in 2002 – 2011.

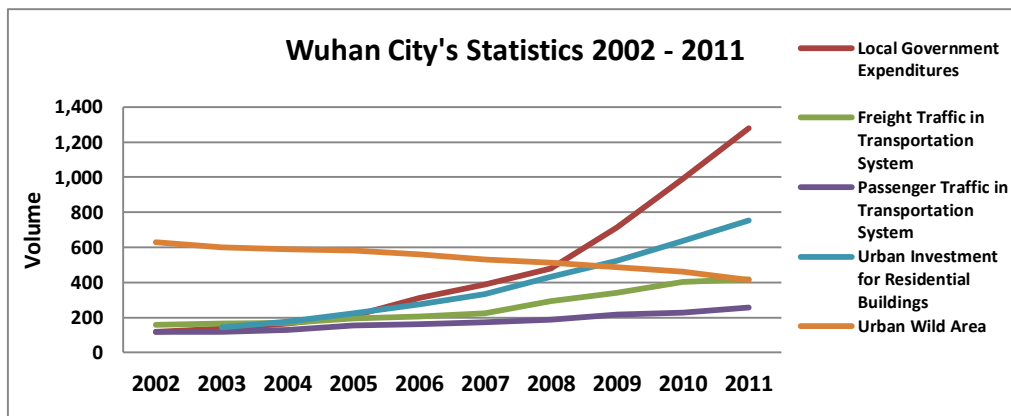


Figure 7 Statistics for Changes in Wuhan city Graph in 2002 – 2011 (Pan Jianqiao, 2012)

- Note:
1. Units for local government expenditures and urban investment for residential buildings are in increments of 100 million RMB.
 2. Units for freight traffic in the transportation system are given in 1 million metric tons.
 3. Passenger traffic in the transportation system is in increment of 1 million persons.
 4. Units for urban wild area are in square kilometers.

Figure 7 shows the urban development of Wuhan city in 2002 – 2011 and we can see that graphs for local government expenditures, freight traffic on the transportation system, passenger traffic on transportation system, and urban investment for residential building graphs are negatively correlated with changes in urban wild area. Local government expenditures increased dramatically during 2002-2011 which means the budget of the city government did not support urban wild area conservation. Moreover, freight and passenger traffic in the transportation system also increased in the same period because Wuhan has been developing as a hub of transportation (Mark Jacob, 2012); the city had passengers and goods moving in and out in high volume.

Urban investment for residential building has greatly increased during 2002 – 2011 because real estate developers sought to support the needs of population changes and urbanization. We can see that urban investment statistics for residential building are positively correlated with metropolitan population, rate of employment, the number of higher education graduate and GDP statistics for the city. All of changes are normal because the residential house is an important element for living. As the population grows and economy develops, people need more houses, so real estate development for housing is one factor for change in the urban wild area of Wuhan (Cheng Jianquan, 2001).

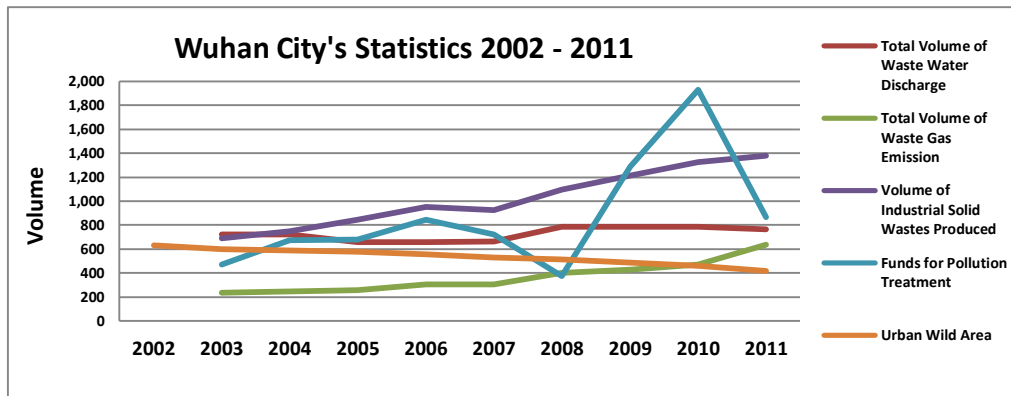


Figure 8 Graph: Statistics on Changes in Wuhan in 2002 – 2011 (Pan Jianqiao, 2012)

- Note: 1. Units of total volume of waste water discharge are in increments of 1 million metric tons.
 2. Units for total volume of waste gas emissions are in increments of 1 thousand cubic meters.
 3. Units for the volume of industrial solid waste produced is in increments of 10,000 metric tons.
 4. Units of funds for pollution treatment are in 1 million RMB.
 5. Units for urban wild area are in square kilometers.

The graphs in figure 8 show the total volume of wastewater discharge and funds for pollution treatment were fluctuating but the volume of industrial solid wastes produced, as well as total volume of waste gas emission, increased in 2002 – 2011. Statistic regarding the volume of industrial solid wastes produced and total volume of waste gas emissions is positively correlated with industrial development statistics. When four graphs are compare with the size of urban wild areas, a negative correlation with urban wild area changes.

When we compare changes in the urban wild area of metropolitan Wuhan, with some statistics of Wuhan in 2002 - 2011, we can analyze the relationship because all industrial indicators and statistics increase in the observed ten year period. We can infer Wuhan is a city undergoing industrial urbanization. During this same period, urban wild area and the number of farmers, both decrease, while gross output of agriculture was nearly unchanged; since these three factors are not industrialism indicator the researchers are further convinced that Wuhan is a city in the midst of industrialization. An increase in local government expenditures coinciding with industrial indicators also occurs and is also negatively correlated with urban wild area changes. From this information the researchers conclude that industrial urbanization of Wuhan's metropolitan area came with a negative impact upon urban wild area changes of the metropolitan area in 2002 – 2011 (Shukui Tan, 2014).

Sustainable Approach for Urban Wild Area Conservation of Wuhan City

From this study of urban wild area changes of the metropolitan area of Wuhan in 2002 – 2011, the researchers use sustainable approach for urban wild area changes benchmark because it is the optimum way to balance between urban wild area conversation and industrialization (Hartmut Bossel, 1999). Sustainability of urban wild area in the metropolitan area of Wuhan in 2002 – 2011, in order to maintain urban ecosystem services, should have four areas that are provisioning services, regulation services, cultural services and support services (The World Bank, 2008). We can apply four areas for analyzing urban wild area changes of Wuhan metropolitan area in 2002 – 2011 as a tool to study land ecosystem. Moreover, the researchers integrated “the future we want commitment” for sustainability benchmarking because it is the

ultimate goal of sustainable development for every government and country (United Nations, 2012).

Table 1: Urban Wild Area of Wuhan City’s Changes in 2002 – 2011 Benchmarking

| Urban Wild Area of Wuhan City’s Changes in 2002 -2011 | The Future We Want Commitment From The United Nations |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Provisioning Services | |
| <p>1. Wuhan’s metropolitan lost some urban wild areas that are agricultural area and food production area.</p> <p>2. The city’s statistics show that urban wild areas cover with some pollution, such as waste water, waste gas and solid wastes because they rise every year over a 10 year period. All pollutions have the possibility to contaminate with agricultural products and fresh water.</p> <p>3. The city’s statistics show that urban wild areas cover with some pollution, such as waste water, waste gas and solid wastes because they rise every year over a 10 year period. All pollutions have the possibility to contaminate with agricultural products and fresh water.</p> <p>4. They lose genetic resources, biochemical resources, ornamental resources because Wuhan metropolitan loses large size of urban wild area and they also lose fresh water resources because water quality in water resources is not clean.</p> | <p>From item 108, 111, 115, 120 and 197 of commitment that are:</p> <p>1. Everyone can access to safe, sufficient and nutritious food.</p> <p>2. Government promote, enhance and support more sustainable agriculture and conserving land, water, plant and animal genetic resources, biodiversity and ecosystems.</p> <p>3. People can access to safe drinking water and basic sanitation.</p> <p>4. The government develops integrated water resource management and sustainable water uses.</p> <p>5. The government promotes the intrinsic value of biological diversity and the role in maintaining ecosystem that provides essential services.</p> |

| Urban Wild Area of Wuhan City’s Changes in 2002 -2011 | The Future We Want Commitment From The United Nations |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Regulating Services | |
| <p>1. Wuhan city loses some resources of air quality maintenance and climate regulation because some urban wild area is urban forest and urban natural ecosystem that can solve air pollution and urban heat problems.</p> <p>2. They also lose some mechanism of water purification water regulation, waste treatment and erosion control because the urban wild area has a natural</p> | <p>From item 111, 122, 124 and 138 of commitment that are:</p> <p>1. Government enhances resilience to climate change and natural disasters.</p> <p>2. Government recognizes the key role in maintaining water quantity and quality, and support actions within respective national boundaries to protect and sustainably manage these ecosystems.</p> <p>3. The government stresses the need to adopt measures to significantly reduce</p> |

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| <p>mechanism for waste degradation and land resource destruction.</p> <p>3. They lose regulation of human diseases, biological control and pollination because the urban wild area is natural balancing mechanism.</p> <p>4. They lose storm protection because trees in an urban wild area are natural barriers that can break and reduce the power of the storm.</p> | <p>water pollution and increase water quality, significantly improve wastewater treatment and water efficiency and reduce water losses.</p> <p>4. The government understands the goals of sustainable development can only be achieved in the absence of debilitating communicable and non-communicable diseases and where populations can reach a state of physical, mental and social well-being.</p> |
| Cultural Services | |
| <p>1. Wuhan city's metropolitan lose some of areas of cultural diversity because when urban wild area become urban area, agricultural society also becomes a metropolitan society.</p> | <p>From item 41, 130, 134 and 135 of commitment that are:</p> |

| Urban Wild Area of Wuhan City's Changes in 2002 -2011 | The Future We Want Commitment From The United Nations |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cultural Services | |
| <p>2. They lose knowledge systems, educational values, inspiration and aesthetic values because the urban wild area is alive classroom, museum and instruction media.</p> <p>3. They lose social relations, sense of place, spiritual and religious values because people will change lifestyle when the environment changes, so changes of urban wild area affect with people.</p> <p>4. Wuhan people lose cultural heritage values, recreation areas and ecotourism area because urban wild area can be heritage area and recreation place for the metropolitan people.</p> | <p>1. The government acknowledges the natural and cultural diversity of the world and recognizes that all cultures and civilizations can contribute to sustainable development.</p> <p>2. Government recognizes the need to support sustainable tourism activities and relevant capacity-building that promotes environmental awareness, conserve and protect the environment, respect wildlife, flora, biodiversity, ecosystem and cultural diversity.</p> <p>3. The government is well planned and developed cities can promote economically, socially and environmentally sustainable societies.</p> <p>4. The government commits to promote an integrated approach to planning and building sustainable cities and urban settlements.</p> |
| Supporting Services | |
| <p>1. Wuhan metropolitan people lose some part of nutrient cycling and some part of the food web because the urban wild area is a natural ecosystem of a city.</p> <p>2. They also lose some part of organic chemical production and soil formation</p> | <p>From item 40 and 205 of commitment that are:</p> <p>1. Government guides humanity to live in harmony with nature and the earth's ecosystem.</p> |

| | |
|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| because the urban wild area is a natural mechanism of chemical producer and land producer. | 2. Government recognizes the economic and social significance of good land management and improving water availability. |
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Conclusion: Urban Wild Area Conservation for Happiness Development.

When we analyze changes in the urban wild area and the development of the urban area of Wuhan metropolitan region in the years 2002 - 2011, we can see that it is not a sustainable urban ecosystem because of the focus on industrial development. This industrial development is extreme and, it does not promote natural ecosystem conservation; urban wild area, or urban natural ecosystem decrease in the ten year period reviewed here. Moreover, an urban wild area change is not according to a sustainable ultimate goal: in the future we want commitment from the United Nations: and it is not suitable well-being metropolitan life. It will be environmental and physical problem's possibilities in the future (Shukui Tan, 2014).

It is a simple paradox between urban wild area conservation and industrial development because progress and stability are governmental goal, but it is not easy to take and keeps them in the similar route at the same time (The United Nations, 2012). However, the government should try to balance between industrial development and urban wild area conservation because the government and people need industry for economic development and they also need nature for ecosystem services at the same time (UN-HABITAT, 2012). Economic development is not the ultimate goal of the development of a city; rather, it is the development of happiness for metropolitan people because economic development is a tool that leads to a happy society (Kaemthong Indaratna, 2007).

REFERENCE

- Antoine Sambou, Shenggao Cheng, Lei Huang and Charles Nounagnon Gangnibo. (2010). Jiufeng Protected Area Biodiversity Threats Assessment. *Journal of agricultural science*, vol. 2, no. 3, September 2010, pp. 108 – 122.
- B. L. Turner II, Willam B. Meyer and David L Skole. (1994). Global Land – Use/Land – Cover Changes: Towards an Integrated Study. *AMBIO* vol. 23 no. 1, 1 February 1994, Royal Swedish of Science, pp. 91 – 95.
- Brandon T. Bestelmeyer, James R. Miller and John A. Wiens. (2003). Applying Species Diversity Theory to Land Management. *Ecological application*, Desember 2003, pp 1750 – 1761. The Ecological Society of America.
- Candice Goucher, Charles LeGuin and Linda Walton. (1998). *In the Balance: Themes in Global History*. McGraw-Hill, Boston, U.S.A.
- CAREC (Central Asia Reginal Economic Cooperation Program). (2012). Wuhan Action Plan: Implementing CAREC 2020 Strategic Framework. 11th CAREC Ministerial Conference, 30 October 2012, Wuhan, P.R. China.

- Cheng Jianquan and Ian Masser. (2001). Urban Growth Modelling: A Case Study of Wuhan City, P.R. China. Division of urban planning and management, international institute for aerospace and earth sciences, The Netherlands (ITC).
- Dorothy Billings and Viatcheslav Rudnev. (2011). Indigenous Knowledge and Sustainable Development. Book series of 16th International Congress of the IUAES (The International Union of Anthropological and Ethnological Sciences).
- Food and Agriculture Organization of United Nations. (2014). Land Resources. <http://www.fao.org/nr/land/lr-home/en/>.
- Gillian T. Braulik, Randall R. Reeves, Wang Ding, Susie Ellis, Randall S. Wells and David Dudgeon. (2005). Report of the Workshop on Conservation of the Baiji and Yangtze Finless Porpoise. Institute of hydrobiology, Chinese academy of science, Wuhan city, Hubei province, China. 28 November – 3 December 2004.
- Hartmut Bossel. (1999). Indicators for Sustainable Development: Theory, Method and Applications: A Report to the Balaton Group. International institute for sustainable development, Manitoba, Canada.
- Hubei Provincial Government. (2014). Hubei provincial government official website. <http://en.hubei.gov.cn/>.
- Jari Niemela. (1999). Ecology and Urban Planning. Biodiversity and Conservation 8, Kluwer Academic Publishers. pp 119 – 131.
- J. David Allan. (2004). Landscapes and Riverscapes: The Influence of Land Use on Stream Ecosystems. The annual review of ecology, evolution and systematic, 22 June 2004.
- Jingyun Fang, Zhiheng Wang, Shuqing Zhao, Yongke Li, Zhiyao Tang, Dan Yu, Leyi Ni, Huanzhang Liu, Ping Xie, Liangjun Da, Zhongqiang Li and Chengyang Zheng. (2006). Biodiversity Changes in the Lakes of the Central Yangtze. Ecology and the environment 4, pp 369 – 377.
- Jussi S. Jauhiainen. (2006). Urbanisation, Capital and Land-Use in Cities. Place and Location: Studies in Environmental Aesthetics. pp 179 – 193.
- Kai Xu, Chunfang Kong, Gang Liu, Chonglong Wu, Hongbin Deng, Yi Zhang and Qianlai Zhuang. (2010). Changes of Urban Wetlands in Wuhan, China, from 1987 to 2005. Progress in Physical Geography, volume 34 issue 2, pp 207 – 220.
- Kaemthong Indaratna. (2007). Sufficiency Economy: Happiness Development Approach. Faculty of Economic, Chulalongkorn University, Thailand.
- Niu Wenyuan. (2012). The Overview of China's Sustainable Development. Science Press: Beijing, People's Republic of China.
- Mark Jacob. (2012). Chicago is All over the Place. Chicago Tribune, 13 May 2012, http://articles.chicagotribune.com/2012-05-13/news/ct-talk-nato-chicago-0513-20120513_1_violent-crime-chicago-connection-south-america-s-chicago.
- Millennium Ecosystem Assessment. (2003). Ecosystems and Human Well-being: A Framework for Assessment. <http://www.unep.org/maweb/en/Framework.aspx>.
- Millennium Ecosystem Assessment. (2005). Ecosystems and Human Well-being Biodiversity Synthesis. Washington, DC
- Millennium Ecosystem Assessment. (2005). Ecosystems and Human Well-being Synthesis. Washington, DC.
- Pan Jianqiao. (2012). Wuhan Statistical Yearbook 2012. China statistics press, Beijing, People's Republic of China
- P.O.Chetou, O.Carrue, S.Rouifed and A. Cantarel. (2008). Rapid Evolution of Seed Dispersal in an Urban Environment in the Weed *Crepis Sancta*. PNAS vol. 105 no.10, 11 March 2008, pp 3796 – 3799.

- Prasopchoke Mongsawad, (2008). Sufficiency Economy: A Contribution to Economic Development. World academy of science, engineering and technology, vol. 2, 27 May 2008.
- Right Site. (2014). Economic Park and Zones in China. <http://rightsite.asia/en>.
- Robert I. McDonald, Peter Kareiva and Richard T.T. Forman. (2008). The Implications of Current and Future Urbanization for Global Protected Areas and Biodiversity Conservation. *Biology Conservation* 141, pp 1695 – 1703.
- Shukui Tan, Nattapat Rakwongwan and Yanin Rugwongwan. (2014). The Context for Land Resources Ecosystem in Urban Wild Area: Case Study of Wuhan City's Metropolitan Area, People's Republic of China in 1999 – 2013. *Journal of natural sciences research*, vol.4, no.10, pp 106 – 119.
- Shukui Tan, Nattapat Rakwongwan and Yanin Rugwongwan (2014). The Context of Changes for Land Resources Metabolism in Urban Wild Area. *International journal of research in applied natural and social sciences*, vol.2, issue 6, June, pp. 157 – 168.
- Su Jianping. (2010). Wuhan Statistical Yearbook 2010. China statistics press, Beijing, People's Republic of China
- Sven Erik Jorgensen. (2009). *Ecosystem Ecology*. Elsevier B.V., Beijing, PR. China.
- Tatyana P. Soubbotina. (2004). *Beyond Economic Growth: An Introduction to Sustainable Development* (second edition). The International Bank for Reconstruction and Development, The world bank, Washington, D.C., U.S.A.
- The Cities Alliance. (2007). *Liveable Cities: The Benefits of Urban Environmental Planning*. Washington, DC.
- The World Bank. (2006). *Sustainable Land Management: Challenges, Opportunities, and Trade-offs*. Washington, DC.
- The World Bank (2008). *Sustainable Land Management Sourcebook*. Washington, DC.
- UN (United Nations). (1987). *Report of the World Commission on Environment and Development: Our Common Future*. Oslo, Norway.
- UN (United Nations). (2012). *The Future We Want*. Outcome document of the united nations conference on sustainable development, Rio de Janeiro, Brazil, 20 – 22 June 2012.
- UN (United Nations). (2012). *The Millennium Development Goals Report 2012*. New York, U.S.A.
- UN-HABITAT (United Nations Human Settlements Programme). (2010). *Land, Environment and Climate Changes: Challenges, Responses and Tools*. Nairobi, Kenya.
- UN-HABITAT (United Nations Human Settlements Programme) (2010). *Supporting Local Action for Biodiversity the Role of National Governments*. Nairobi GPO, Kenya.
- UN-HABITAT (United Nations Human Settlements Programme) (2012). *Sustainable Urbanization in Asia: A Sourcebook for Local Governments*. Nairobi, Kenya.
- UN-HABITAT (United Nations Human Settlements Programme) (2012). *Urban Patterns for a Green Economy: Working with Nature*. Nairobi GPO, Kenya.
- UN-HABITAT (United Nations Human Settlements Programme) (2013). *Urban Planning for City Leaders*. Nairobi GPO, Kenya.
- UNEP&UN-HABITAT (United Nations Environment Programme & United Nations Human Settlements Programme). (2003). *Sustainable Cities Programme 1990 – 2000*. April 2003.
- William E. Rees. (1992). *Ecological Footprints and Appropriated Carrying Capacity: What Urban Economics Leaves Out*. *Environment and Urbanization*, vol. 4, no. 2, October, pp. 121 – 130.
- Wuhan Municipal Government. (1996). *Environmental Profile of the Wuhan Municipal Area*. Sustainable Wuhan project document for the United Nations Environmental Program

International Environmental Technology Center & United Nations Center for Human Settlements Sustainable Cities Program, February 1996.

WWF China (World Wide Fund for Nature of P.R. China). (2014). WWF's Wuhan Office. http://en.wwfchina.org/en/who_we_are/where_we_work/wuhan_office.