

## Analysis on the Change of Farmland Resources in China from 1996-2009

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**Key words:** Change Analysis, Cultivated Land, Land Use, China

### SUMMARY

Based on the surveying databases of the first comprehensive land surveying in 1996 and the second in 2009, the quantity and distribution of arable land, the characters and change trend were analyzed in detail. And further taking the current social and economic development situation into account, the challenging and the key questions for the arable land protection was summarized. Finally, the measurements for the arable land protection were proposed. In general, the pattern of the arable land resources in China in 2009 is abundant in the west, equivalent among the east, the middle and the northeast, more dry land and equivalent between irrigated land and paddy land. The distributions of dry land, paddy land and irrigated land are varying among the east, the middle, the west and the northeast. The acreage of the arable land in China is increasing from 1996 to 2009 with the imbalance of increase and decrease in the different regions. According the trend, the distribution center of the arable land resource is moving northwards; the dry land is increasing. The change situation and the trend of the paddy land and the dry land are different among the middle, the east and the west. The unit area of arable land per person in the east is dramatically decreasing.

### **SUMMARY (optional summary in one other language in addition to English, e.g. your own language)**

以 1996 年中国第一次全面土地调查和 2009 年中国第二次全面土地调查数据为基础，客观分析耕地数量、分布的特点和变化趋势，结合当前社会经济发展形势，分析耕地资源保护面临的突出问题 and 挑战，针对性地提出耕地保护的对策建议。总体看，2009 年全国耕地整体呈现“西部偏多，东、中、东北相当”的格局，旱地比重最大，水田、水浇地相当；旱地、水田和水浇地在东、中、西、东北地区分布差异明显。1996-2009 年，我国耕地面积整体增加，但区域增减不均衡，耕地资源空间重心北移。旱地明显增加，水田与旱地在中、东、西部变化规律差异明显；人均耕地东部地区急剧下降。

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## 1. INTRODUCTION

Cultivated land is of valuable natural resource. It is not only the base of the existing and developing of the human society but also the precondition of social and economic sustainable development. People may benefit from the adequate utilization of land resources. However, it may trigger the degradation of land resources if the utilization of land resources is not appropriate (Wang, 1998).

China is a populous country in the world. The average of land resource per unit population is extremely low although the territory is large. Moreover the quality of cultivated land is not so high in general while the hilly area takes large proportion of land resources. The unused and reserve land resources are low (Chen, 1999). The prevention and exploration are constraining each other.

To meet the increasing need of land resources with the fast development of society and economy, it is urgent task to set up an information system of territorial land resources. Two comprehensive land resources surveys over whole country have been conducted in China. The first was finished in 1996. And the second was in 2009. The data obtained in two surveys are now serving the natural resources planning, management, prevention and adequate utilization. This paper presents the status of land resources and its changes according to two surveys (Zhang Hongtao, 2001; Cheng Ye, 2002; Ministry of Land Resources, 2014). At the end, the policy for the land resource prevention and utilization was proposed.

## 2. DATA

The Data that this paper used are mainly from the databases of the two land resources surveys in China. The China's first comprehensive review of current state of land utilization was done in 1996. It took 10 years. It is also the first time for China to have a comprehensive surveying its natural resources in the history (Zhang Hongtao, 2001; Cheng Ye, 2002). The main method was the filed inventory with additional support of the aerial photography (Guo Qingshi, 1999). The China's second comprehensive review of current state of land utilization was done in 2009. it took 3 years benefited from the trained teams and the experience of first one. The main method was remote sensing imagery interpretation (Zhang Hanmei, 2012).

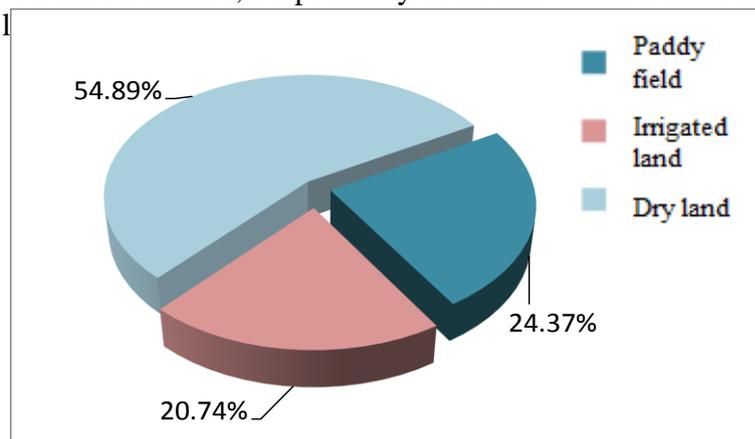
## 3. RESULTS

### 3.1 Status of China's cultivated land resources in 2009

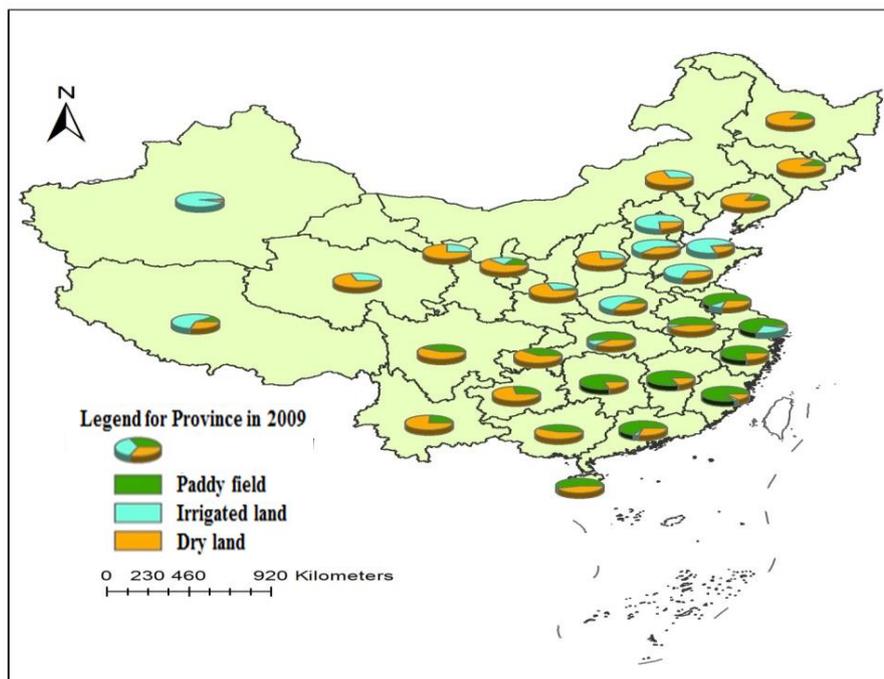
#### 3.1.1 Structure of the cultivated land resources over the whole country

Fig. 1 shows that as of 2009, China's cultivated land covered an area of 135 384 500 hectares (2 030 770 000 mu) of which paddy field, irrigated land, and dry land account for 24.37%, 20.74% and

54.89% of the total cultivated area, respectively. This fact shows that China's cultivated land is dominated by dry land



**Fig. 1** the structure of the cultivated land resources in China as of 2009



**Fig.2** China's cultivated land structure at province level in 2009

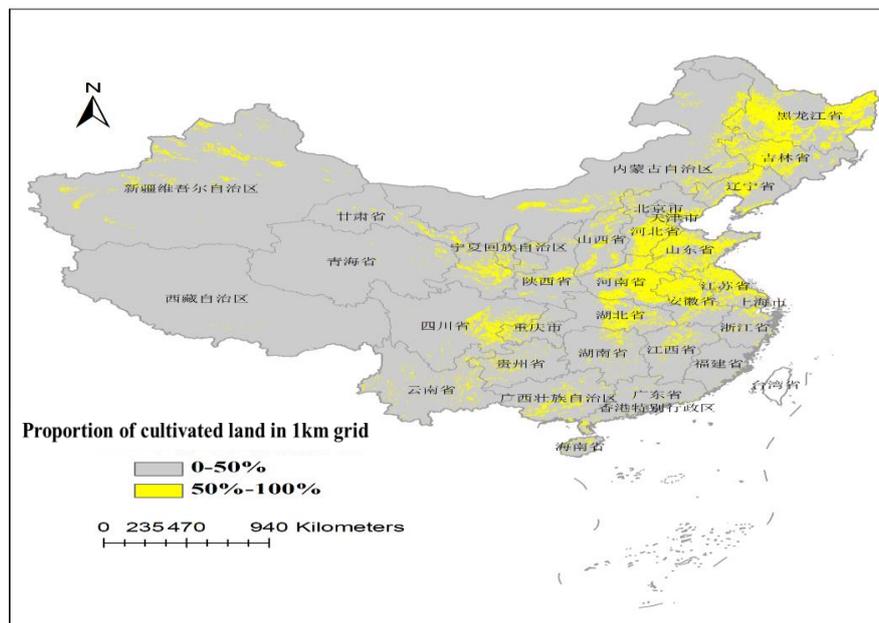
### 3.1.2 Structure and Spatial distribution of the cultivated land resource at province level

There was a vast difference in the spatial distribution of the cultivated land resource in China. Fig.2 shows that the cultivated land structure at province level and the spatial distribution over the China. Paddy field is mainly distributed in the middle and lower reaches of Yangtze River and other regions in southeast China; Irrigated land is located in the Huang Huai Hai Plain and the

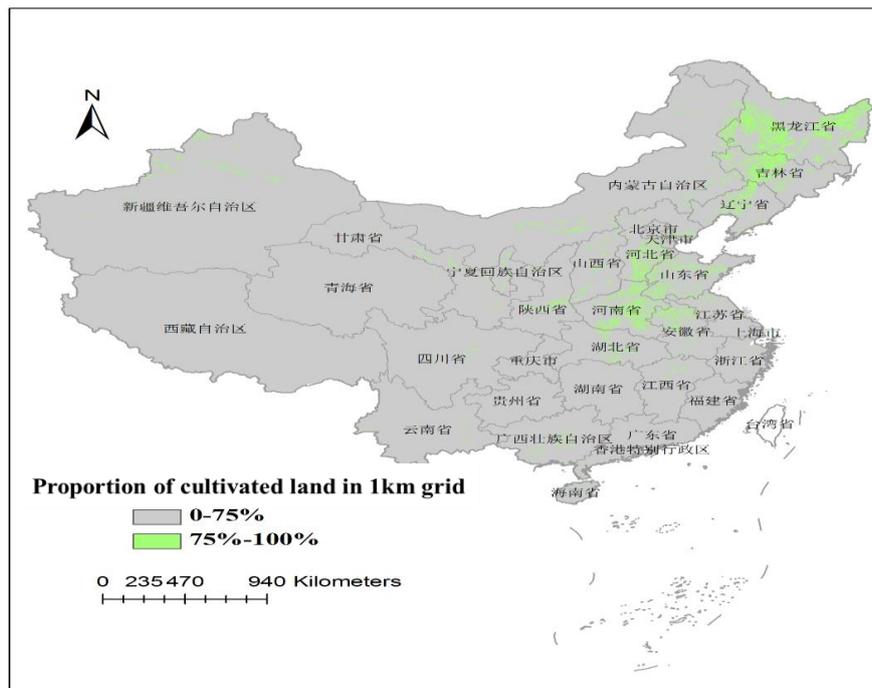
arid and semi-arid areas of northern China; Dry land is distributed in the north and south of China, especially the Northeast China Plain.

### 3.1.3 Spatial distribution of the cultivated land resources

In order to capture the spatial dense of the cultivated land resource, the percentage of cultivated land area within each 1 km grid was calculated. The higher the percentage of the cultivated land is, the more concentrated the cultivated land in the region is, and finally the region is an important area of the cereal production in China.



**Fig.3 Spatial distribution of the cultivated land of less and great than 50%**

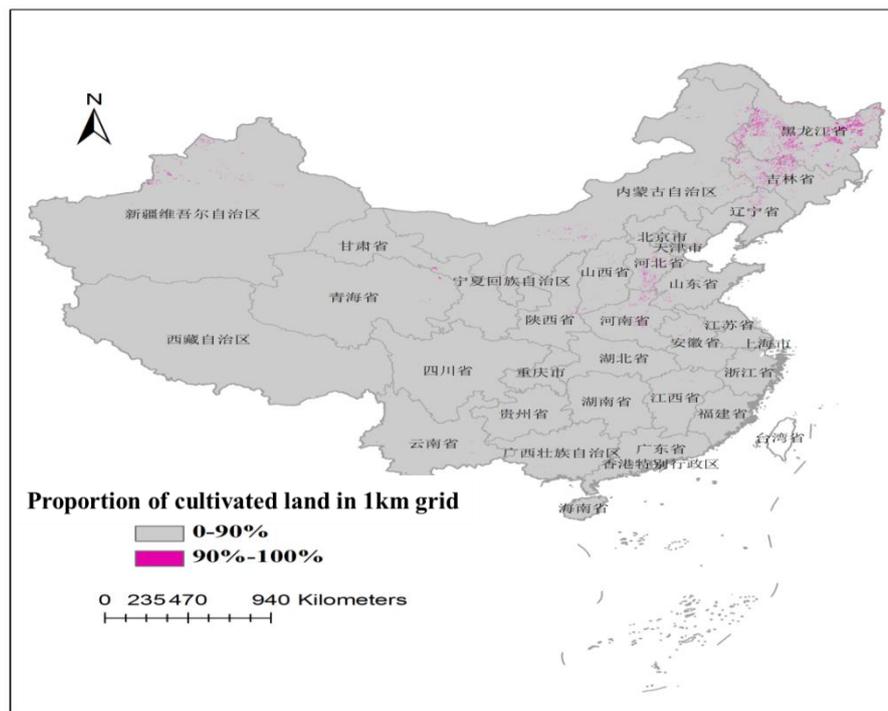


**Fig.4 Spatial distribution of the cultivated land of less and great than 75%**

Fig.3 presents the spatial distribution in 2009 of the cultivated land in two groups that are less and great than 50% in each 1 km grid. It appears that the cultivated land is mainly distributed in Northeast China Plain, Huang-Huai-Hai Plain, northern region of middle and lower reaches of Yangtze River, Sichuan Basin, and central region of surrounding areas.

Fig.4 presents the spatial distribution of the cultivated land in two groups that are less and great than 75% in each 1 km grid. It appears that the highly concentrated cultivated land is mainly distributed in Northeast China Plain and Huang-Huai-Hai Plain.

Fig.5 presents the spatial distribution of the cultivated land in two groups that are less and great than 90% in each 1 km grid. It appears that the much highly concentrated cultivated land is mainly distributed in Northeast China Plain and Huang-Huai-Hai Plain too.



**Fig.5 Spatial distribution of the cultivated land of less and great than 90%**

### 3.2 Trends of China's cultivated land resources in 1996-2009

The classification systems are different in the first and second surveys. In order to facilitate the comparative analysis, the second-class of the cultivated land types was merged into the second-class irrigated land and dry land. The changes happened in the past 13 years in the cultivated land showed three characteristics.

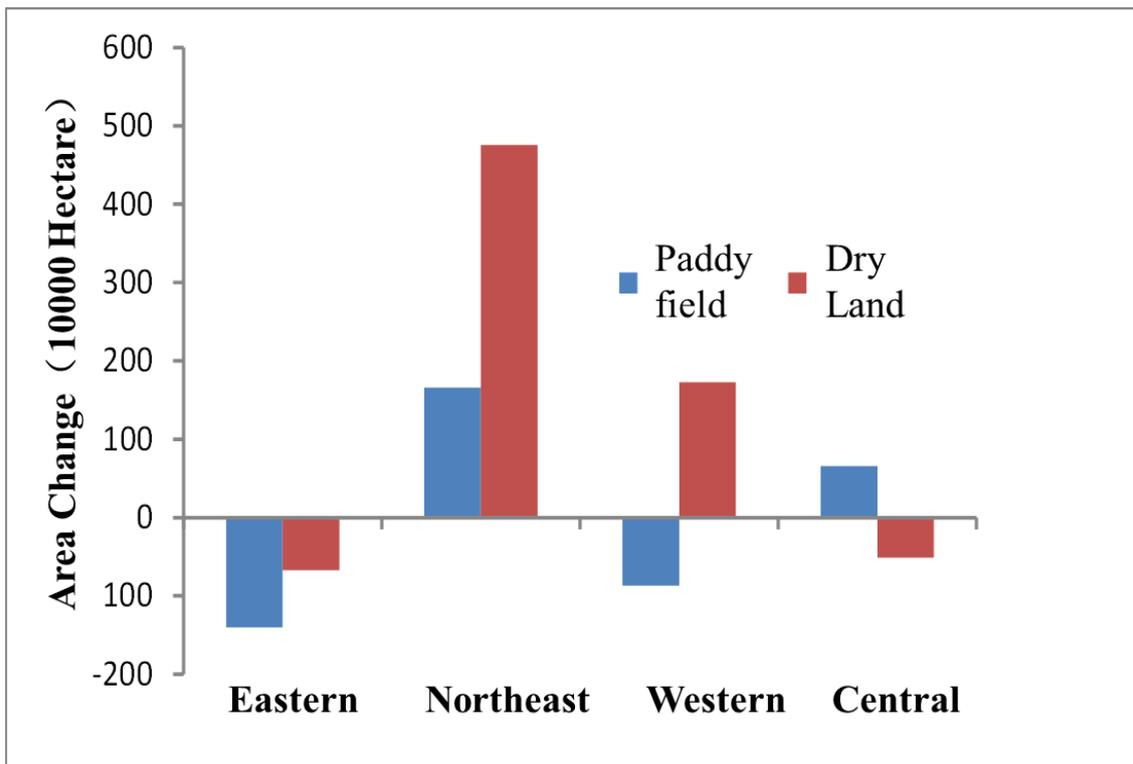
The first is that the cultivated land area was increasing, and significant increase came from the dry land area while Paddy field remained stable. At the end of 1996, the total cultivated land in China covered an area of 130 039 200 hectares (1 950 590 000 mu), and increased to 135 384 500 hectares (2 030 770 000 mu) until 2009, showing an increase of 80 180 000 mu.

The second is that an uneven distribution of the cultivated land resources in different regions, and a shift of the center of gravity of the cultivated land resources towards the northern region. Fig.6 shows that as of 2009, the Northeast China Plain, and arid and semiarid regions in northern China became the key areas for newly increased cultivated land. Paddy field and dry land showed clear differences of change in the eastern, central and western regions; There was a decreasing tendency of the cultivated land area in eastern region, a drop of 7.3% as compared with previous years due to the declining of paddy field; There was a slight increase in the cultivated land in central and western regions due to the significant increase of the dry land in the western region by an increase of 4.3%; There was a slight increase in paddy field in the central region. There was

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Analysis on the Change of Farmland Resources in China from 1996-2009 (9136)  
Yanxia Lu, Director (China, PR)

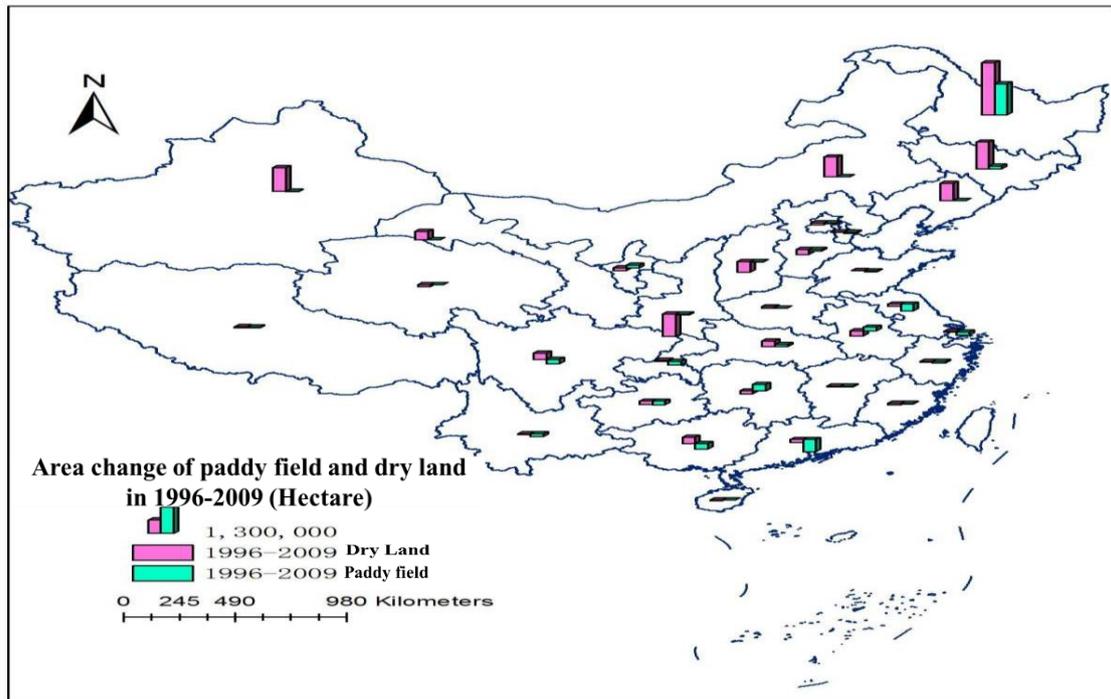
an increase in paddy field and dry land area in the northeast region, among which dry land area had increased considerably, with an increased area at 3 times of paddy field.



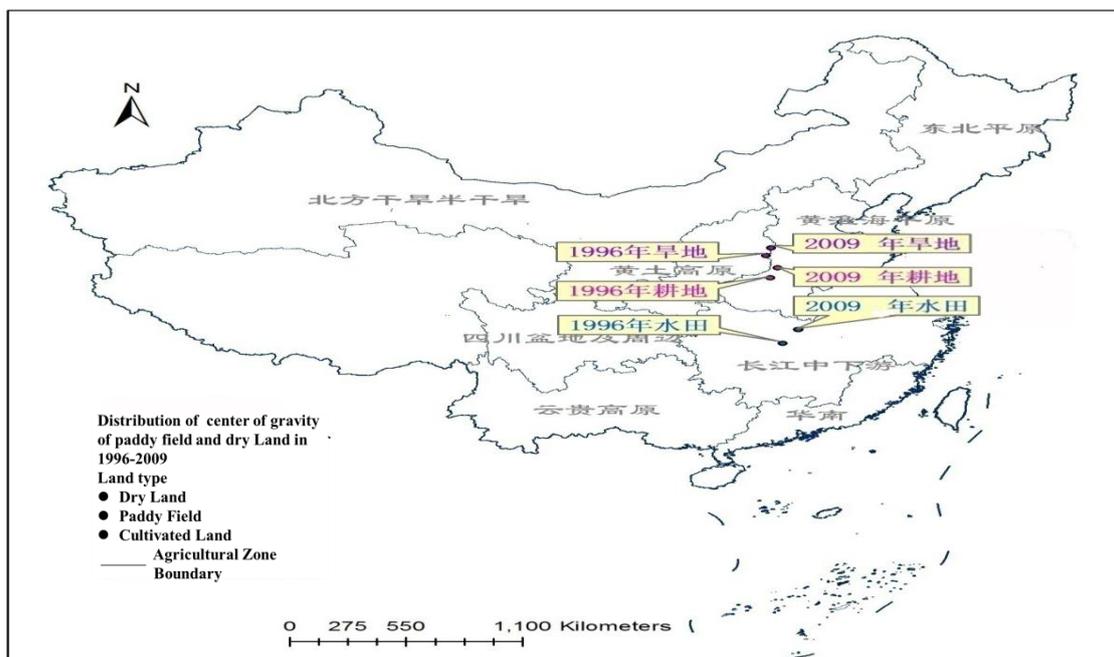
**Fig.6 the changes of paddy field and dry land in four major production regions in 1996-2009**

According to the Fig. 7, at the province level, Heilongjiang, Hunan, Anhui, Ningxia, and Jilin provinces witnessed the greatest increase in paddy field while there was a significant decline in paddy field in Guangdong, Jiangsu, Guangxi, and Sichuan provinces etc., where are in favorable of rice production in China. Heilongjiang, Jilin, Inner Mongolia and Xinjiang, located in China’s northeast and northwest regions, witnessed the greatest increase in dry land while there was a significant decline in dry land in Shanxi, Shannxi, Anhui, Hebei, and Guizhou provinces, in which it was related to the ecology policy of conversion of farmland to forest adopted by China in recent years.

From the prospective of the center of gravity of the cultivated land, there occurred a shift from the southern China towards the northeast China during 1996 to 2009. According to the Fig.8, it is obvious that the increase of cultivated land area in Northeast China is more than that in western regions (such as Xinjiang and Inner Mongolia). There occurred a shift of the center of gravity of paddy field and dry land towards the northeast China. However, the migration distance of paddy field was double that of dry land, and the paddy field in southeast China was reduced dramatically.



**Fig.7 the changes of paddy field and dry land at province level in 1996-2009**



**Fig.8 the center of gravity of the cultivated land in 1996-2009**

The natural resources and ecological environment are different in various parts of China. There was a declining trend in rainfall, temperature and other factors related to agricultural production along

Analysis on the Change of Farmland Resources in China from 1996-2009 (9136)  
Yanxia Lu, Director (China, PR)

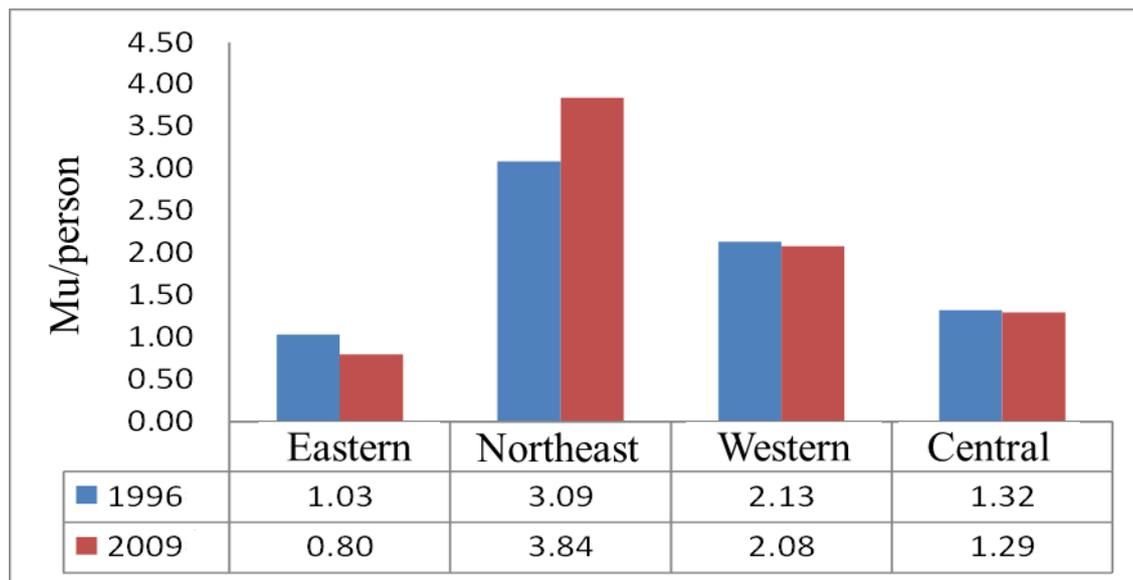
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the direction from south to north. There occurred a shift of the center of gravity of the cultivated land resources towards the north by east, which will inevitably lead to the change of overall water and temperature conditions for the grain production of cultivated land, and more and enough attentions should be paying.

Finally, there was a sudden drop in per capita cultivated land in the eastern region, and an overall increase in the central region. Among the four major economic regions(Fig.9), there was an increase in per capita cultivated land in the northeast region only, and a decline in other regions. The decline of per capita cultivated land was most apparent in eastern China by 22.8%. The increase was most pronounced in Heilongjiang and Jilin provinces, and the decline was most pronounced in Shanxi province.

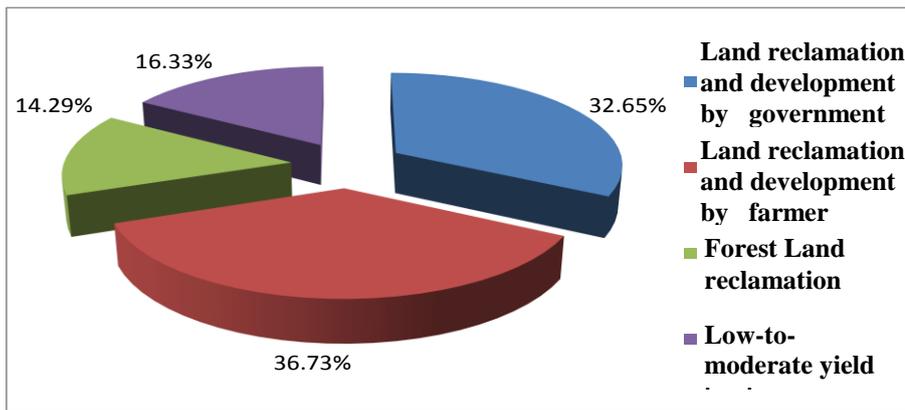


**Fig.9 Per capita cultivated land area of four major economic regions in 1996 and 2009**

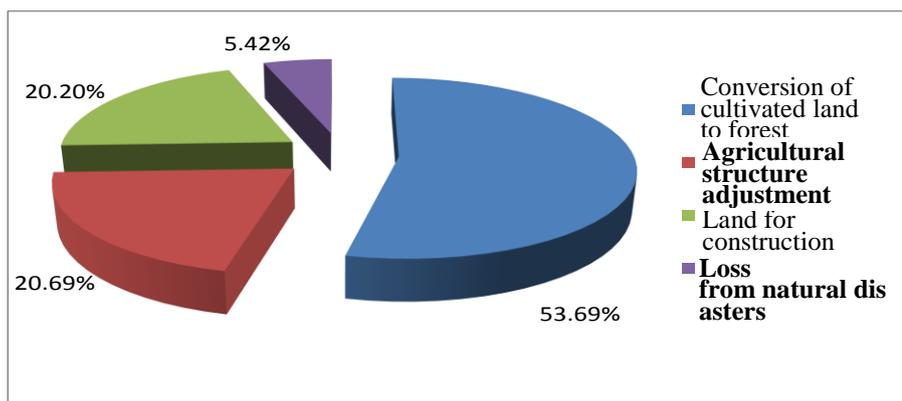
### 3.3 Driving factors of the changing cultivated land resources

In 2009, there was an increase in the cultivated land area, 80180000 mu, as compared with 1996. With regard to the increase in cultivated land (Fig. 10), the source of increased cultivated land was primarily concerned with the government's organizing the implementation of land consolidation and reclamation, farmers' reclamation of unused land, forest workers' reclamation and increase of arable land, and comprehensive agricultural development and transformation in mid-low yielded farmland, for a total of 245 million mu of arable land. With regard to the decline in cultivated land (Fig. 11), the decreased cultivated land was mainly caused by ecological restoration, accounting for 53.69%, conversion of cultivated land to forest and other agricultural land during the agricultural structure adjustment, accounting for 20.69%, cultivated land occupied by non-agricultural construction, accounting for 20.20%, and natural disaster damage, accounting for 5% of the overall reduction 203 million mu.

**Fig.10**  
**of**  
**in 1996-**



**Composition**  
**increased**  
**cultivated land**  
**2009**



**Fig.11 Composition of decreased cultivated land in 1996-2009**

### 3.4 Challenges in the cultivated land protection in China.

#### 3.4.1 Spatial mismatching of the cultivated land resources and natural conditions, and severe reduction of the high-quality arable land

China is abundant in cultivated land resources, but in unfavorable conditions for light, temperature and water. The mismatching between the distributed cultivated land resources and natural conditions of light, temperature and water influences the potential development and utilization of cultivated land resources. For example, the cultivated land area in Western and Northeastern regions accounts for 58% of the total area of cultivated land. However, there is a shortage of water in western region, and the conditions of light, temperature and water in Northeast China are for “one harvest per year” only. Thus, 70% of the cultivated land is the dry land, which lead to a huge disparity in cultivated land productivity between Northeast China and middle and lower reaches of Yangtze River and other regions in southeast China with “two harvest per year” or “three harvest per year”.

In China, the high-quality arable land is unevenly distributed. However, it is the high coincidence of the distribution between the high quality cultivated land and the major area of

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Analysis on the Change of Farmland Resources in China from 1996-2009 (9136)  
Yanxia Lu, Director (China, PR)

population and the economic development that triggered the high-quality arable land is severely reducing. Paddy field and irrigated land are concentrated in middle and lower reaches of Yangtze River, Southern China region and Jiangnan region, overlapping with spatial agglomeration in priority development areas of population, economy and urban development. Over the decades, the cultivated land taken by the economic construction led to a downward tendency in the cultivated land area, decreasing by 7.3%, which is mainly represented by the reduction in paddy field area. At the same time, there is a significant increase in dry land in western region and northeast region in which has a big influence on the grain production capacity of the cultivated land. The food transportation in China was from south to north, and now from north to south. The reduction of high-quality arable land, most high quality paddy field, in southeast China is a key factor.

The declining quality of the cultivated land is caused by variation in arable land. The newly increased arable land is mainly distributed in the northeast, northwest, southwest regions in poor conditions of light, temperature, precipitation and topography. Cultivated land "one harvest per year" accounted for 81% of the total cultivated land area, half of which are dry land without irrigation facility. There is relative large mid-low yield land of poor overall quality. Most of the decreased arable land caused by non-farming construction and agricultural structure adjustment are high-quality arable land of rural-urban fringe zone. Paddy field and irrigated land predominate in the decreased arable land, and are concentrated in southeast regions with good conditions of light, temperature and water with two harvest per year accounting for 58%, and three harvest per a year accounting for 32% of the total area.

#### 3.4.2 Sustained pressure on the protection of the cultivated land

China must maintain a certain amount of arable land to ensure food security due to the huge population (Lu Yanxia, 2013; Chen Zhigang, 2009). The taken of high-quality arable land is inevitable due to the rapid advance of urbanization and industrialization, equalization of basic public services in rural areas, and adjustment of regional development strategy, which leads to further pressures in cultivated land occupation. Under the background of ecological civilization construction, it is expected that gradual conversion of farmland to forest and grass is required for millions of acres of slope farmland and deserted arable land; Part of the polluted farmland will be gradually adjusted according to the overall arrangements of China's ecological rehabilitation and restoration programme on arable land.

#### 3.4.3 Lack of incentive in the protection and rational use of cultivated land

The agricultural development is of little significance to the increase of local fiscal revenue. There is a widespread lack of incentive in cultivated land protection. Heilongjiang and Henan provinces, China's main grain producing area, with large number of arable land, made significant contribution to the protection of national food security, but showed relatively slow economic growth. Local finance is in a relatively poor condition, without corresponding compensation. The local government is unable to benefit from the protection of cultivated land. The farmers' income from growing grain is very low, resulting in the lack of enthusiasm to protect the cultivated land. In the market economy environment, low efficiency of agricultural production is the inherent law of the industrial chain, and it is difficult for a farmer to get rich through the cultivation of a few acres of

arable land. State subsidies for farmers are unlikely to mobilize the enthusiasm of farmers to protect and use arable land. On one hand, nation can't afford to give more subsidies, and on the other hand, few subsidies have no effect. With the advance of urbanization, the rural labor force, especially young labor force in rural areas almost become migrant workers. The elder and women make their living on farming in rural areas. There is a sharp reduction in the number of farmers, especially high-quality young farmers. The era of land without cultivation may soon come.

#### **4. FURTHER CONSIDERATIONS**

With the dramatical increasing of economy and society in China, the agricultural production conditions, and all aspects of the quality of the cultivated land should be further improved. In accordance with relevant national planning, 800 million acres of high standard farmland will be established at the end of "13th Five-Year" period. RMB 2000 yuan will be invested in each mu of farmland aiming at improving agricultural production conditions, and the performance of the high and stable yield. Secondly, it is suppose to further raise the cost of occupation of arable land, impose economic constraints on the occupation of high-quality arable land to compel farmers to give up occupation of or occupy less the cultivated land. At present, Ministry of Land and Resources is studying the further increase of cost in arable land, and will further tighten the approval for cultivated land occupation by construction, and control the occupation of arable land. It is also trying to explore the establishment of mechanism of economic incentives for cultivated land protection to promote the unity of responsibilities, rights and benefits of the protection of arable land. It is further improving the transfer payment from central to local government, and take the protection of arable land as an important factor in the give financial support to the regions undertaking the task of protection of cultivated land, and actively explore various forms of incentive compensation for farmers' collective. Guangdong province and other local government have begun to provide financial subsidies to mobilize farmers' enthusiasm in the protection of cultivated land.

#### **5. ACKNOWLEDGEMENTS**

The author is grateful to colleagues who have taken part in the two land resource surveys.

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Analysis on the Change of Farmland Resources in China from 1996-2009 (9136)  
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## BIOGRAPHICAL NOTES



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