

DEEP THOUGHTS OF LAND UTILIZATION ABOUT THE RARELY SEVERE FLOODING DISASTER ALONG THE MIDDLE AND LOWER REACHES OF THE CHANGJIANG RIVER IN 1998

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ABSTRACT: In the summer of 1998, a rarely severe flooding disaster occurred in the whole basin of the Changjiang(Yan-gtze) River, which caused enormous losses. By 22nd of August, 29 provinces, autonomous regions and municipalities were involved, 21.2 million ha of land were inundated, 223 million people were affected, 3004 people were killed and 4.97 million buildings were collapsed. The estimated direct loss of the country accounted to 166.6 billion yuan (RMB). The main reason of the disaster is the unusual climate but the unreasonable land utilization also aggravated the disaster. This paper consists of two parts. One part analysed the unreasonable land utilization, including the neglect of forest land protection, which caused the forest land area to decrease by 440 thousand ha in the whole country every year, the enclosing of lakes for cultivation, which decreased the area of lakes located along the banks of the Changjiang River from 17 200 km² at the beginning of the founding of the People's Republic of China to 6531 km² in 1983, the changing of functions of lakes, which reduced the volume of storage exceedingly, for example, only 5 spots of lakes were used for storing water in Wuhan City, and the slow progress of the construction of flood diversion and storage area, which would cause huge losses once flood was diverted. The other part explored the strategy of land utilization on the supplying of land for flood control projects, such as embankment, drainage installation, flood diversion and storage area, and on tapping the potentials through narrowing and amalgamting the range of rural residential quarters and small towns, reclaiming reserved resources, transforming middle and low productive fields, attaching importance to land arrangement and recultivation, and adjusting contracted fields partially, to ensure the sustainable and stable growth of the region.

KEY WORDS: the middle and lower reaches of the Changjiang River, flooding disaster, land utilization

During the flood period of 1998, some regions of China suffered serious flooding and waterlogging. Especially in the Changjiang River, the whole basin flood once emerged in 1954 occurred again, and the most severe flood in the history also emerged in the Songhua River and the Nenjiang River, which aroused much attention across the whole country.

According to incomplete statistics, till 22nd of August, 29 provinces, autonomous regions and municipalities had been affected by the floods in varying degrees. 21.2 million ha of land were inundated, 223

million people were affected, 3004 people were killed, 4.97 million buildings were collapsed, and the estimated direct loss of the country accounted to 166.6 billion yuan(RMB). In Hubei Province, 2.54 million ha of crop land suffered from the disaster, 487 thousand ha of which would have no yield, 4.77 million people needed aids, infrastructure for irrigation, transportation and communication were damaged, 9769 enterprises suspended production wholly or partially, and the direct loss of the whole province was 38.4 billion yuan (RMB).

Abnormal climate and excessive rainfall caused the floods. In addition, unreasonable utilization of land had negative effect on it. In the thesis, the author tried to make a study on the sustainable development of flood-hit regions along the Changjiang River from the perspective of land utilization.

1 NEGLIGENCE OF LAND UTILIZATION

1.1 Neglect of Forest Land Protection Leads to Serious Soil Erosion and Sedimentation in Rivers, Lakes and Reservoirs

According to the investigation on mountainous areas in three provinces of Yunnan, Guizhou and Sichuan, forest land area decreases by 60 percent and the proportion of forest coverage decreases from 50 percent to 24 percent in the past 50 years. In Sichuan Province, forest land area per capita was 0.25 ha and forest storage per capita was 27.54 m³ in 1948; the proportion of forest coverage was over 19 percent in the 1950s, but it decreased to 13.3 percent in the 1980s. In 1990, forest storage per capita decreased to 13.14 m³, forest land area per capita decreased by 60 percent and forest coverage per capita decreased by 53 percent. In Zhejiang Province, forest land area per capita was 0.1 ha and forest storage per capita was 2.4 m³ in 1990. The forest land area decreases by 440 thousand ha in the whole country every year.

Destroying forests, reclaiming lands and cultivating on steep slopes lead to serious soil erosion and sedimentation in rivers, lakes and reservoirs. In Sichuan Province, mudrock flow occurred only in 16 counties in the 1950s, but it occurred in 135 counties in the 1980s, which made the area of soil erosion account for 66.7 percent of the total area. In the flood disaster of 1981, slide and mudflow emerged in 68.8 thousand places in northwest and southwest of Sichuan Province which created the highest record of 837 million tons of sand in Yichang Hydrographic Station. In Sichuan Province, there are 680 million

tons of mud and sand flowing into the Changjiang River every year, corresponding to loss of 0.17 m surface soil in 33.3 thousand ha of cropland and 5.7 million tons of N, P, K. In Hubei Province, the area of soil erosion makes up 39 percent of the total area, and the annual volume of soil erosion weighs more than 0.2 billion tons. In Yunnan Province, the area of soil erosion reaches 146 thousand km². The area of soil erosion in the Changjiang River basin increased from 360 thousand km² in the 1950s to 560 thousand km² in the 1980s, and the annual volume of soil erosion weighed 2.24 billion tons. Applying advanced methods such as remote sensing, the State Water Conservancy Department got the latest area of soil erosion of 1.794 million km², which was only 1.5 million km² in 1955. Since 1949, the area of crop land, damaged by soil erosion, has been more than 2.67 million ha and the annual area reaches 66.7 thousand ha, which causes annual loss of more than 10 billion yuan (RMB). Throughout the whole country, there are 5 billion tons of muds and sands flowing into rivers every year. The mainstream bed of the Changjiang River is rising at the speed of 1cm every year. The flood level of the Jingjiang River is 16 m higher than the northern plain, which not only threatens the safety of the Jiangnan Plain and the Dongting Plain, but also leads to waterlogging disaster in extensive area. The volume of muds and sands flowing into the Dongting Lake from the Changjiang River is 134 million m³, which causes 0.1 billion tons of sediment, 4 cm thickness of silting, 4000 ha of islet-enlarging and 47.4 km² of water area decreasing, and causes small floods, high water level and frequent emergencies. The monitoring results of 102 large-scale reservoirs in Sichuan Province indicate that annual silting of sands reaches 1–6 million m³, corresponding to the reduction of a medium-scale reservoir every year. Throughout the country, the total volume of 408 billion m³ of 86 thousand reservoirs has been silted 100 billion m³.

1.2 Enclosing Lakes for Cultivation Reduces the Area of Lakes and the Capacity of Lakes for Water Storage and Flood Control

Since the Ming Dynasty and the Qing Dynasty, the activities of enclosing lakes for cultivation have prevailed in the middle and lower reaches of the Changjiang River. At the beginning of the founding of the People's Republic of China, Dongting Lake was the largest fresh water lake in the country and the best reservoir for controlling the flow of the Changjiang River. However, during several decades, an area of 1659 km² has been enclosed for cultivation, only an area of 2691 km² remains. Assuming average depth for water storage of shoaly land is 1.5 m, the lake loses a volume for water storage and control of 2.4 billion m³. In Hubei Province, there were 1066 lakes at the beginning of the founding of People's Republic of China, the area of water body with normal water level was more than 8300 km²; but till 1980, 983 lakes had been enclosed for cultivation, an area of 5816 km² had been lost. Among lake groups of the Jiangnan Plain, the largest recorded area of main lakes was 6057.1 km², which was 3654.4 km² at the beginning of the liberation, but now only an area of 1445.5 km² remains. The area of Dongxi Lake was 544 km² at the beginning of the liberation, but it was only 8 km² in 1988. The area of Changhu Lake was 150 km² at the beginning of the liberation, but it was only 122.52 km² in 1979, the volume of the lake was reduced by 55 million m³. The area of Honghu Lake was 660.3 km² at the beginning of the liberation, but it was only 402.2 km² in 1979, the volume of the lake was reduced by 516 million m³. In Hubei Province, the area of 150 recorded lakes decreases by 61.3 percent from 3726 km² to 1443 km², the volume of lakes located along rivers decreases by 4.623 billion m³, 1.5 billion m³ of which is in the east of the province (Tan, 1994). There are 8 large lakes available for flood storage along the basin of the Changjiang River, but their area has declined by 33 percent since the early 1950s. In Jiangsu Province the waterbody area in 1979 was 385 thousand ha less than that in

the early 1950s, the lake area in 1979 was 283 thousand ha less than that in early 1960s, and 42 lakes have been extinct since the 1950s. At the beginning of the founding of People's Republic of China, the area of lakes located along the banks of the Changjiang River was 17 200 km², but only an area of 6531 km² remained in 1983 because of enclosing lakes for cultivation. In the last 30 years, the total area of 12 000 km² lost for the same reason in the 5 provinces of Hunan, Hubei, Anhui, Jiangxi and Jiangsu, the total volume of 60 – 70 billion m³ was reduced, equal to the volume of hundreds of large scale reservoirs.

1.3 Changing the Function of Lakes Reduces the Volume of Lakes for Water Storage and Control Sharply

Storing excessive water is the main function of lakes, but with the development of economy and intensive utilization of lakes, this function is weakened gradually. In the 1970s, the downstream of the Huangxiao River in Hankou District with an area of nearly 20 km² available for water storage was changed into refined fish pond and almost lost the ability of storing water. Since the building of Wufeng Hydraulic Sluice-gate in 1931, East Lake in Wuhan City has been converted from natural lake to man-governed lake for water supplying, visiting and breeding. Amidst the heavy rain of 1991, water level of the East Lake was just 1.55 m higher than the normal water level, but caused major scenic spots along the lake drown and waterlogged 1m deep, traffic obstructed for 5 days, and business income reduced by 0.3 million yuan (RMB). Moreover, it made Qingshan Coal Power Plant suffer a loss of hundreds of thousand yuan (RMB) and Wuhan Iron and Steel Company suffer a loss of more than 1 million (RMB). In urban region of Wuhan City, the total area of lakes accounts to 122.26 km², but most of which are used for breeding, visiting, and watersupplying, only 5 spots of which are really used for storing water, so the volume of storage is rather limited. On July 21st of 1998, rainstorm and torrential rainstorm attacked

Wuhan City and its surrounding area. The daily precipitation reached 66 million m^3 , and because drainage capacity was insufficient and many lakes couldn't contain excessive water, over 60 roads in the city were waterlogged and 23 of which couldn't be passed through by cars.

1.4 The Construction of Flood Diversion and Storage Area Progresses Slowly, Causing Heavy Potential Losses

Flood diversion and storage area is made to take advantage of low-lying plain to store excessive water, which is the determinant of securing key regions. In 1980, more than 50 billion m^3 of flood diversion task was assigned on Symposium on Flood Control in middle and lower reaches of the Changjiang River, but it was not done well. In Hubei Province, safety measures such as safety zone and safety island are not taken in the area except for Jinjiang Flood Diversion Area. So residents can only move out of the area or take refuge on the embankment when flood is diverted. Meanwhile, economic development of the area hasn't been adjusted or redesigned in conformity with the requirements of flood control and waterlogging storage, and population in the area increases rapidly. Thus it will cause huge losses once flood is diverted. As Water Conservancy Commission of the Changjiang River estimated in 1990, while 0.1 billion m^3 of flood was stored, 805 ha of cropland would be drown, 7 thousand people would move temporarily and direct loss would be 16 – 20 million yuan (RMB). An investigation from Dongxihu Flood Diversion Area indicates that if the area is drown less than 1 m deep, flood-affected households account for 70 percent of the total and the property value of every household decreases by 50 percent, if the area is drown more than 4m deep, flood-affected households account for more than 90 percent of the total and the property value of every household decreases by 70 percent. In the Jiangnan Plain, the loss was 171 yuan (RMB) when 1 mu (1 mu = 1/15 ha) land was drown in the 1950s, and it increased to 2200 yuan (RMB) in the

middle 1980s. Thus if the flood of 1954 reoccurred today, it would take at least 5 years for flood-struck area to resume economic development, and the economic development targets of Hubei Province would be fulfilled 1 year later than the planned.

Jingjiang Flood Diversion Area has an area of 921.34 km^2 . If flood is diverted, 513 thousand people and fixed asset valuing nearly 5 billion yuan (RMB) would be involved. In the heavy flood of 1998, in order not to cause huge losses in Jingjiang Flood Diversion Area, flood is diverted in 46 places of the rest of the province, 31.3 thousand ha of land and 129 thousand people were involved. Even doing so, embankments collapsed in HezhenYuan, Paizhouwan of Jiayu County and MengxiYuan, Gonggan County. In Hubei province, over 2 million people garrisoned the embankment of the Changjiang River for 2 months. Throughout the whole country, more than 8 million cadres and masses took part in fighting floods, 4.33 million People's Liberation Army men and military police and over 5 million military reserve force combated with floods, 78.92 million tons of goods and materials were saved and transferred, 7619.6 km embankments were repaired and strengthened, several dangers were eliminated and 5762 breaches were blocked, and 4195 million people were transferred to safe regions.

2 PRINCIPLES OF LAND UTILIZATION IN THE FUTURE

2.1 Giving Priority to the Supply of Lands for Flood Control Projects

2.1.1 *Forest land should be protected and ensured and construction of ecological environment should be enforced*

The idea of paying attention to the whole basin of rivers must be held in flooding and waterlogging control. Muds and sands in the lower reaches of the Changjiang River come from its upper reaches. Since the Ming Dynasty and the Qing Dynasty, it has been pointed out that mature forests in ancient Shanxi and

Sichuan being cut, sands were washed away to the lower reaches, so rivers and lakes became shallow day by day. Moreover, people living near waterbody enclosed silty lands for cultivation, making the area of waterbody decrease by 70 – 80 percent. In view of these reasons, we should pay attention to harnessing the upper reaches of the Changjiang River, which includes protecting and improving vegetation, establishing water conservancy base and restraining ecological environment from deteriorating to control flooding and waterlogging in the middle and lower reaches of the Changjiang River.

According to the statistics from the State Water Conservancy Department, an aggregate area of 0.67 million km² of soil erosion has been transformed, annual soil loss is reduced by 1.1 billion tons and ability to control water is increased by 18 billion m³. However, soil erosion is continuously caused by human activities such as exploiting resources, building roads, mining minerals and constructing infrastructure. So the progress is fairly slow for the arduous task. The flood disaster of 1998 gives us a lesson: we ought not to achieve economic development at the great cost of environment degradation, but ought to keep sustainable development. The State Council has shown its concerns. “General Outline of National Water and Soil Conservancy Planning” stipulates that we have to lay special emphasis on the construction of water and soil conservancy projects of large rivers such as the Changjiang River and Huanghe (Yellow) River, make efforts to afforest and conserve the whole basin of rivers. Within the period of the Ninth Five-Year Plan, we have to hold up the increasing of soil erosion and transform an area of 250 thousand km². By the end of 1998, 51 key forest industry enterprises and several local forest industry enterprises in the middle and upper reaches of the Changjiang River and the Huanghe River will have been transformed from cutting trees to afforesting. With more than ten years of hard work, we try to make ecological environment improved greatly and soil erosion relieved and sedimentation in large rivers like the Changjiang River and the Huanghe River changed. In plain areas, shel-

ter belts to protect farmland should be constructed urgently, shelters along the banks of rivers and lakes should be developed properly, and arbors and shrubs should be fostered to prevent disasters and supply woods for daily uses. We have to restore forest land as well as protect forests, regulating the uses of forest lands as what we do to protect croplands.

2.1.2 Ensuring the supply of lands for embankments

Embankments are old, prime and widely-used measures for flood control. Since the Tang Dynasty and the Song Dynasty, the economic center of the whole country has been moving toward southern regions. Cropland is in increasing need, which makes progress of building embankments for cultivation be accelerated. Embankments are built longer and higher than ever although their disadvantages are constantly pointed out. During the period of 1949 – 1985, 10 million m³ of earth and 6.37 million m³ of stones were added to over 180 km embankments of the Jinjiang River, embankment per meter was reinforced with 180 m³ of stones and earth and raised over 12 m higher, but the embankments can only control once-in-ten-year flood. In the Symposium on Flood Control in the Middle and Lower Reaches of the Changjiang River of 1980, it was requested that main embankments of the Changjiang River should reach a height of 2 m higher than the actual flood level of 1954, but over ten years having passed little progress has been made, and nearly 100 km embankments can't reach the standard even in Wuhan City. During this period, water levels that surpassed previous highest record emerged several times, especially in 1998, water levels of most of the middle reaches of the Changjiang River exceeded warning level for 2 months and highest recorded level for more than 1 month. In many parts of the embankments, flood was only kept off by sub-embankment, and naturally dangers emerged frequently. On the main embankment of the Changjiang River, dangers emerged in over 6000 places and serious dangers emerged in over 4600 places. The flooding and waterlogging disaster makes us reach an agreement: as an important means

to control flood, the embankment projects should not be neglected but be strengthened and heightened and dangers should be eliminated by all means. The State Council has determined to raise the standard of flood control within a few years, and transform main embankments of large rivers and lakes into high level of flood control. To provide enough funds for the project, the State Developing and Planning Commission has issued a plan on investment of water conservancy construction of 17 billion yuan (RMB), and the investment will increase by a big margin in the next months of 1998.

2.1.3 Keeping a proper proportion of waterbody to the total area

Taking factors such as rainstorm flow, variety and distribution of crops, hydrological condition, landform and level of waterlogging control into account, we should keep the proportion of lake area at 10 percent around so that the middle and lower reaches of the Changjiang River can overcome once-in-ten-year flood. But at present, the proportion is only 3 percent in the regions along the Changjiang River in Hubei Province. Thus, according to provisions of "Flood Control Acts", enclosing lakes for cultivation should be prohibited; existing area of rivers and lakes should be stabilized; the life span of lakes should be extended; occupying shoaly lands along rivers and lakes, blocking waterways leading to rivers and excavating stones and sands in rivers should be prohibited; obstacles in river ways should be eradicated, drainage channels of large lakes should be dredged and built; rivers and lakes and other regions easily flooded and waterlogged should be kept under strict control, and blind exploiting flood detention zone should be opposed. Meanwhile, we should continue giving cropland back for lakes, and enhance propaganda and education in rural areas to make villagers aware that it is reasonable to give cropland back for lakes. According to the investigation in areas of Sihui, Hannan and Hanbei in 1984, giving back 1 ha land for water storage can ensure ten ha of cropland not to be hit by flood. If enclosing 1 ha of lake, we will spend 7500 yuan(RMB) on building dams, and if maintain-

ing 1 ha land, we will spend 7500 yuan (RMB) on discharging waterlogging. So in the region of Dongting Lake, where the ground water is less than 0.3 m deep under the ground surface, the cropland which is formed by enclosing lakes should be given back for lakes; and the low-lying and frequently flooded cropland, generally no yield or low unit yields but high production cost, should be given back for lakes in order to avoid losses when they are attacked by flooding. In addition, the supervision and administration of giving cropland back for lakes should be reinforced. In the past several decades, not all land given back was used for water storage. According to the statistics in 1987, 28.1 thousand ha of land were given back for lakes in Hubei Province, but 14.8 thousand ha of which were converted into refined fish ponds(Tan, 1995a), so the capacity of lakes for water storage was nearly not raised.

2.1.4 Strengthening the construction of drainage installation and increasing pumping machines properly

People in the middle and lower reaches of the Changjiang River have struggled against flooding and waterlogging for more than 40 years. They excavated drainage ditches in the 1950s, set water sluice gates in the 1960s and built electricity drainage stations in the 1970s. Now 12 thousand m³ of water can be drained per second in the Jiangnan Plain and Dongting Lake region. If half of the machines operate at the same time, the discharge will be equal to one normal floodwater of the Hanjiang River. Shortly after the extraordinary rain this year, the Chinese Academy of Sciences scanned 18 cities and counties around Wuhan City through satellite and found that 50.2 thousand ha of waterlogged farmlands were drained within 5 days.

However, the task is still arduous. The drainage basin area in the plain of Hubei Province is 43.1 thousand km². Assuming once-in-ten-year rainstorm can produce 6672 million flow in 3 days, and lakes and ditches can accommodate half of that, the pumping capacity should amount to 8380 m³ per second, but now the first-step pumping capacity is 6755 m³

per second, and 17-thousand-kW pumping machines should be installed. In the near future, the establishment of pumping projects should be quickened and first-step and second-step pumping stations should be arranged rationally. First-step stations are responsible for draining water into the river and second-step ones have to deal with both surface water and underground water. The drainage networks should be perfected in accordance with different topographical factors and principal and offshoot drainage canals should be constructed according to requested capacity. Water conservancy facilities damaged such as reservoirs, ditches, pools, dams, should be repaired, remade and renewed for their flood storage and irrigation.

The construction of water conservancy facilities should not only meet the demand of flood drainage, but also satisfy the need of water storage for resisting drought. Making an organic combination of them, we will really transform flood disaster into water conservancy.

2.1.5 *Quickening the construction of flood diversion and storage area*

According to the design, Three Gorge Reservoir can store up water coming from 1 million km² area of the upper reaches of the Changjiang River, govern 90 percent of the source of Jingjiang flood, and raise the capacity of preventing flood of Jingjiang Section from once-in-ten-year to once-in-100-year. However, if the interval of two once-in-100-year flood is very small, the reservoir can not work well, and the flood must be diversified to secure Jingjiang embankment. If once-in-1000-year flood or flood in 1870 (biggest in history) happens, flood diversion areas in Jingjiang and elsewhere must be operated. In addition, 10 years exist before finishing the reservoir and we are not sure whether extremely powerful flood occurs. Therefore we should pay much attention to the construction of flood diversion and storage areas and complete them as soon as possible. Flood diversion & storage areas are coordinated with particular river sections, so every region must make the best use of its time, and can not wait for other's help (Tan, 1995b). Big cities and main lines should especially fulfill the con-

struction in their upper reaches.

Main points of constructions of flood diversion and storage areas are as follows: Firstly, economic developments in the area should be governed and adjusted to flooding and waterlogging prevention. In the scope of administration and protection of rivers, lakes and reservoirs and flood storage and detention areas, land utilization should accord with the comprehensive administration and exploitation of rivers and lakes, and with flood flow, storage and detention. Population growth must be controlled strictly, no permanent housing estates are permitted and residents there should migrate in a restricted period. It is also forbidden to set up big cities and major installations there. Secondly, security facilities must be strengthened. Perpetual flood diversion buildings and safety area and island in uplands must be set up to ensure that the residents and their properties can be transferred promptly. The government should quicken the formulation of compensation policy of flood storage and detention area to free the people's anxiety, and to ensure the decision of diversion can be made decisively when a catastrophic flood confronts.

2.2 Tapping the Potentials to Ensure the Sustainable and Stable Growth in Economy

Rapid growth in population and urban and capital construction lead to acute man-land contradiction in the middle and lower reaches of the Changjiang River. In Hubei Province, the cultivated land per capita was 0.145 ha in 1949, 0.137 ha in 1960, 0.065 ha in 1990 and 0.057 ha in 1996, which is close to the warning level (0.065 ha). However the serious flooding compels several parts of land to be used for avoiding calamity and improving environmental conditions, so excellent strategies of land utilization and administration are required. Land utilization must walk toward intensive exploitation.

2.2.1 *Narrowing and amalgamating the range of rural residential quarters and small towns, giving house bases back for farming*

“The Outline of National Overall Planning of

Land Utilization” limits the area of rural residential quarters to 13.7 million ha by 2000. However the thorough land investigation shows that it reached 16 million ha in 1990. It means that the average area per villager is 192 m². According to stipulated standard of 120 m² per villager, the potential land for farming in rural residential quarters can reach an area of 6 million ha. During the Eighth Five-Year Plan period, the construction of rural residential quarters took up 96.7 thousand ha of cultivated land per year (ISG-CLC, 1997). In Lu’an District, Anhui Province, house bases of 1.5 million households occupy 120 thousand ha of land, i. e. , 0.067 ha per household. In Zhangjiagang City, Jiangsu Province, 231 375 rural households took up 11.569 ha of land , i. e. , 0.05 ha per household. In Hubei Province, the density of structures of the whole rural residential quarters is only 17.5 percent and vacant land inside and around reaches 86.7 thousand ha, and 40 thousand of which can be used for farming. Also in the province, 7769.9 thousand villagers occupy 400 thousand ha of land for housing. If 60 percent of scattered rural dwelling are amalgamated, 256.7 thousand ha of land will be saved, among which 80 percent can be re-cultivated for farming. Among 93 villages investigated in Zhejiang Province, it is normal that one household has several scattered houses and a few of house bases are not used, and the result is 15.53 ha of land are not fully harnessed(Zhao *et al.* , 1998).

In order to relieve the sharp-pointed man-land contradiction, the governments in some regions are taking measures to tap potentials and condense spontaneous villages.

Jiangsu Province carried out village and town planning and condense more than 280 thousand spontaneous villages into just 50 thousand big ones, which will add about 200 thousand ha of cultivated land. The government of Zhangjiagang City launched housing revolution as transplanting dwelling-places for agriculture, which had added over 33 ha of cultivated land by 1996 and would add over 400 ha within 5 years. Lu’an District, Anhui Province, adjusted housing estates gradually and can add over 53.3 thou-

sand ha of cultivated land. In light with united planning and surveying, Yanglinwei, a town of Xiantao City of Hubei Province, enhanced villagers’ consciousness and persuaded 91 households to construct their new houses at wasteland and abandoned pits, which added 13 ha of cultivated land. Xiangyang County transformed 150 villages and increased 440 ha of cultivated land. Gucheng County compiled land planning of 310 villages and persuaded 6100 households to reside in planned regions and increased 213.3 ha of cultivated land. In the middle of Jiangnan Plain, the government of Lishi Town advanced a new action of transforming villages into cropland, and 40 of its total 50 families can build two-storey houses, which increases 2.67 ha of cultivated land and reduces the land area occupied per capita to 0.01 ha from 0.05 ha.

The relatively dense construction of rural housing estates is one means to raise the efficiency of land utilization and one main direction of adjusting rural residential quarters in the future. Yet the implementation of the great project needs both villagers’ understanding and support and capital. It costs 75 – 100 thousand yuan(RMB) to recultivate one ha of rural residential quarters, which is the main reason why the project spreads slowly.

At present, millions of houses were collapsed under the vicious flood and waterlogging. Governments and others are investing a lot in rehabilitating peasants’ homeland, which is a rare opportunity to condense spontaneous villages. The rebuilding should relieve man-land contradiction and compensate flood and waterlogging losses through transplanting.

Homeland rebuilding depends on rational and feasible planning. A small amount of villages and towns and large individual scopes of them must be fulfilled. Villages and towns must be located carefully and highland and wasteland should be utilized as much as possible. Disaster-control installations must be set up. Protective forests and life-saving trees around villages must be planted. Amounts of land for residential quarters must be controlled strictly. Buildings rather than 1 floor are encouraged. In principle

new houses should be built on old house bases, vacant land and wild mounds and slopes around and can not occupy cultivated land, let alone essential croplands. New types of building materials should be used. Digging, taking up and destroying cultivated land are prohibited. Function division should be improved during the adjustment of rural residential quarters. Housing bases should be considered after public installations and roads. Land for main buildings, threshing grounds, yards, attached buildings, etc. of rural households must be controlled strictly. Designs for rural buildings must be paid attention to and be in accordance with development of small towns.

Flooded township-enterprises can not be simply duplicated. We should seize the rebuilding opportunity to improve their distribution, structure and efficiency. Recently, the National Economy and Trade Committee put forward a principle of recovery. The principle stipulates that enterprises must be recovered and supported according to their excellent characters. Enterprises which have powerful market potentials but duplicated production and dispersed distribution must be united to the leading and superior ones inside or outside regions. And those who have old fashioned technique, severe pollution, no market potentials, long-term losses and no hope to recover should be closed firmly. All enterprises easily flooded must be transplanted.

2.2.2 Reclaiming reserved resources scientifically, transforming middle and low productive fields

On condition that ecological environment is protected and improved and soil erosion and desertification are prevented, the government encourages units and individuals to exploit unused land for agriculture according to the overall planning of land utilization. Flooded and waterlogged villages should legally reclaim reserved resources permitted by the planning on the basis of scientific demonstrations and evaluations. Nowadays China has 13.47 million ha of reserved fields. Hubei Province has 188.8 thousand ha of reserved fields, Jiangxi Province has 188.8 thousand and Hu'nan has 281.9 thousand, and the areas that

can be reclaimed are 113.3 thousand, 79.3 thousand and 169.2 thousand ha respectively assuming the ratio of reclaiming to be 0.6. But exploiting 1 ha of reserved field costs 15.0 – 22.5 thousand yuan (RMB), which hinders the further development of it. Therefore the government should establish land reclaiming funds urgently, formulate regulations to encourage land reclaiming, protect exploiters' lawful rights and quicken healthy reclaiming. Meanwhile the government should transform middle and low protective fields energetically, increase capacities of production of them and lighten the pressure of population growth. In 1994, Hubei Province had 2.45 million ha of middle and low productive fields, and 56.4 percent of the middle productive fields met basic requirements of exploiting and could be easily transformed and get great profits. Assuming middle and low productive fields can be raised one grade through transformation, Hubei Province will increase more than 7 million tons of grain, which is approximately one third of its annual total output.

2.2.3 Attaching importance to land arrangement and recultivation

A certain amount of cultivated land can be added if we attach importance to the arrangement of vacant land, disused gullies and pools, and earth-dugged pits because they are widely distributed in our farmlands. Hubei Province has nearly 66.7 thousand ha of disused land, and at least 60 percent of which can be converted into croplands. Just in 1997, Xiaogan City recultivated 1.6 thousand ha of land and increased 400 ha of land for agriculture. Starting with land reclaiming, according to basic demands of modernization and adopting means of economy and technology, Suzhou City, Jiangsu Province, levelled and connected irregular fields, adjusted and transformed villages, formed a complete set of fields, roads, forests and ditches, harmonized farmlands, villages, mineral pits and towns and formed a new framework of land utilization which even met the requirements of production and living in modernized countryside. During the Eighth Five-Year Plan period, Suzhou City reclaimed 8 thousand ha of disused land. An investigation

shows Jiangsu Province can increase 5 – 10 percent of its total cultivated land through arrangement. Assuming the proportion to be 8 percent, China may increase 13.33 million ha of cultivated land through arrangement and meanwhile improve agricultural conditions and environments and increase peasants' income, which forms a new economic growth point in countryside. The flooding of 1998 caused a great amount of farmlands and roads submerged and washed out, and therefore the governments concerned should carry out land arrangement and re-cultivation urgently according to the requirements of the overall planning of land utilization.

2.2.4 *Checking the protective zones of essential cropland further*

Protective zones of essential croplands are cultivated land which must be guaranteed to satisfy the grain demand of the regional population growth and to fill the order of agricultural production from governments in planned years. China is implementing the protective system of essential cropland since the execution of "Protective Regulations of Essential Cropland" on October 1st, 1994, all over the country has been acting actively and has finished the delimitation. However a quite part of essential croplands was inundated by the flooding and its production capacity was lowered seriously, hence land administration departments, taking charging of the protective zones, must check them one by one and take necessary measures for recovery. If some zones are truly difficult to recover, new ones should be delimited basing on the standard and the fixed area of essential croplands should be ensured not to decrease. At the same time, the routine administration should be strengthened. Inside protective regions, activities, such as building houses, excavating sand, digging earth, burying graves, constructing orchard and digging fish pools, should be prohibited and leaving uncultivated should also be prevented. Nothing can take up the protective zones except for important national capital projects.

2.2.5 *Adjusting the contracted fields partially on the basis of stabilizing the output related system of contract*

The essential content of rural policies of the Chinese Communist Party is the stability of the contracted relationship of rural land. The Central Committee of the Party and the State Council are always taking the matter seriously. The 15th Plenary Session of the Party stressed that the responsibility system, mainly with families as contractors, should be stabilized in a long term, the double management system combining unity with division should be perfected and the collective economy should be strengthened progressively. General Secretary Jiang Zeming also stressed that the policy which was formulated by the central authority with the content of prolonging the land contract period and stabilizing the contract relationship had to be implemented to the full. Each rural reform should ensure peasants' rights of land contract and safeguard the solemnity of the contract. It should be clear in mind that land is not only peasants' basic productive materials but also their primary social securities in a long period of time. Hence on the basis of stabilizing the contract responsibility system, it is urgent to adjust contracted fields partially. It is reasonable and imperative to adjust contracted fields partially in places where production factors, populations, labor, land, etc., have changed a lot and so man-land contradiction has been acute, and especially where the flooding destroyed a great amount of farmlands, and rebuilding houses and constructing projects of disaster-preventing and water conservancy occupied a small part of contracted fields and so stimulated the man-land contradiction further. Certainly slight adjustments must adopt necessary procedures, value peasants' wishes fully and reach unanimity through consultations. They can not be used to increase contract costs and add peasants' burdens and so impair the overall stability of contract relationships. Meanwhile the State should work out feasible measures to

encourage the land circulation among peasants, standardize the circulation and accelerate the step of management on an appropriate scale.

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