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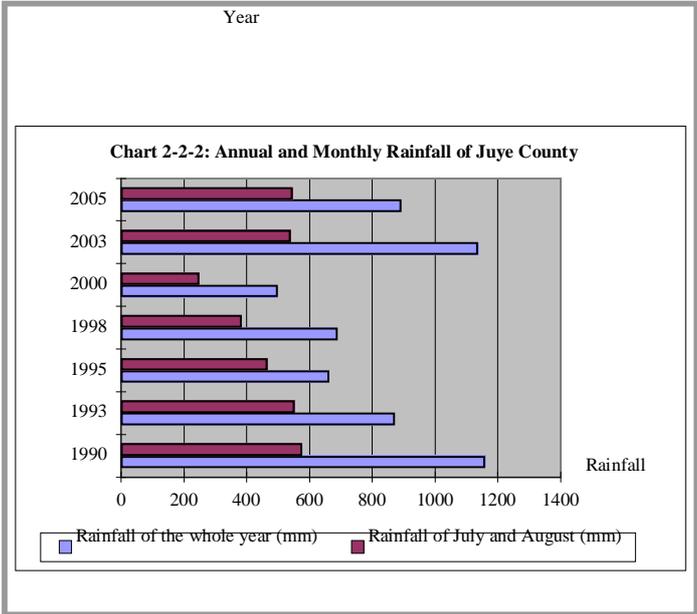
2.1 Situation and vulnerability assessment for DRM in Juye County

In September 2007 and June 2008, the Centre for Integrated Agricultural Development (CIAD) carried out a baseline survey about the socio-economic and agro-ecological context of the county, its local farming systems and practices, and peoples hazard and risk exposure. A farmer’s livelihood analysis and an assessment of the functions and roles of farmer’s cooperatives in community disaster management were also part of the study. Participatory survey methodologies were applied in these surveys.

2.1.1 Natural Framework Conditions for DRM in Juye

The climate in the county is characterized by rain during summer (June - August) and a dry winter. The annual average temperature is 13.3°C varying from 11 to 14°C. The average high temperature in the summer is 31.5°C, the recorded highest temperature is 42.3°C. The average low temperature in winter is 4.4°C, and on average, there are 213 frost free days in the year. The average annual precipitation is 655mm varying from 500mm to 1000mm. The following tables 2-2-2 and 2-2-3 show the annual rainfall and monthly rainfall in July and August in Juye for selected years. They indicate that

- From 1990 to 2000 the amount of annual rainfall had decreased regularly, after 2000 it increased suddenly and the average amount of rainfall for the years 2003 and 2005 was more than 1000 mm;
- On average more than 60% of the whole annual rainfall in Juye falls in July and August;



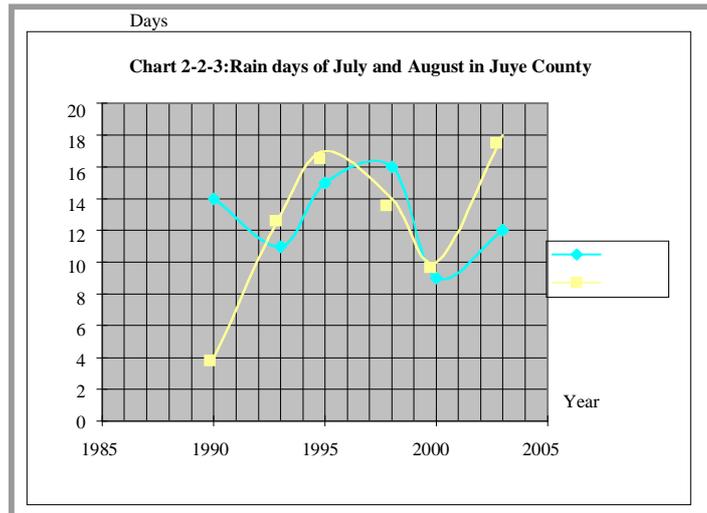


Chart 2.2.4 summarizes the average monthly rainfall in Heze (closest weather station to Juye with long term weather records available) for the years 2008 and 2009 when project field work was implemented. It shows the dry patterns in winter and spring as well as the high rainfall in July (which led in both years to local flooding and water logging in Juye). The spring season 2009 was a very dry season in all of Northern China, including in Juye. The drought prone spring season as well as the water logging which occurred after July rains made the year 2009 particularly relevant in terms of testing crop varieties with high tolerance to drought in spring (winter wheat) and water logging (cotton) in July /August.

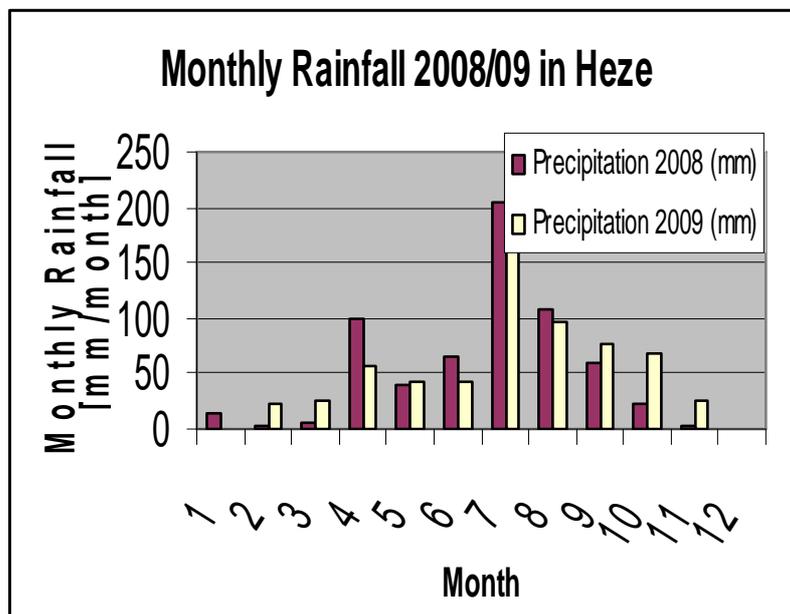


Chart 2-2-4.

Soil characteristics in the pilot sites: Due to the severe floods, low location, and the aged drainage system in the project area, the heavy, alluvial soils are characterized by salinization and alkalization, as well as a high concentration of calcium and magnesium, chloride ions, sulfate and carbonate. The salt compounds formulated by these positive and negative ions enhance the water salinity of the soil, and though this improves the activity of root cells it reduces the root's capacity to absorb soil nutrients.

2.2.2 Assessing the hazards context in Juye

Floods: Juye County is prone to both hydro-meteorological hazards such as floods, drought, extreme temperature, and strong winds, and geological hazard such as earthquakes. Floods are the most frequently faced disaster and also have the worst negative impacts on human livelihoods and agricultural production in the county.

- In 1990, 1993, 2003 and 2005, floods occurred in Juye. In these years the average annual rainfall exceeded 900 mm, and the total monthly rainfall of July and August was also over than 500 mm; These annual and seasonal rainfalls already exceed the drainage capacity of the current drainage infrastructure;
- In years with average precipitation, the average number of rainy days in July and August is about 25 days. This concentration of rainy days can easily result in the water logging in low lying villages as the drainage systems at village level do not function properly any more;

There are three major reasons for flooding:

- The low altitude: runoff water drains into the county and creates water logging and flooding in the low lying areas;
- The draining system is deteriorated and inadequate, and the poor maintenance of the drainage and irrigation channels have exacerbated the risk in low-lying areas especially the farmlands;
- Changes in land use have caused excess runoff from the surrounding regions.

Drought: Historically the counties and river plains of eastern China have been prone to periodic droughts. According to the villagers interviewed, the entire region faced severe drought in 1955 and consecutive droughts during 1987, 1988, 1989, 2001 and 2002. But in recent years there had been fewer drought events. However drought is still a problem when the rainfall is below normal and water in the river, drainage, and irrigation channels are very low. Drought still impacts wheat at the stage of its harvest, and the sowing of cotton and corn, especially in villages where the farmers rely on ground water in case of water shortages.

Wind: During the recent years, the county has experienced meso-scale strong winds and hail storms during July and August. In 2007 strong winds damaged more than 10 houses, green houses and poplar trees in the village of Liuxi.

Earthquake: According to the seismic hazard map of the Shandong province created by the China Earthquake Administration (CEA), the county of Juye lies in a seismic prone area. Based on the records and anecdotal information from the village elders, the villagers felt earthquakes in 1937, 1964 and 1970, with the 1937 earthquake causing damage. As per the seismic intensity map, the county of Juye can expect ground shaking of VIII-IX on the intensity scale. It should also be noted that most of the structures in the county are non-engineered masonry building which are highly vulnerable to earthquakes of moderate intensity.

Pests and diseases: Pests normally occur from May to the end of August, during the growing season of the major crops harvested in the autumn. In the recent years pests have been a serious problem affecting cotton and poplar trees. Much of the cotton in the region is affected by cotton bollworm during September and October, and very recently poplar trees have

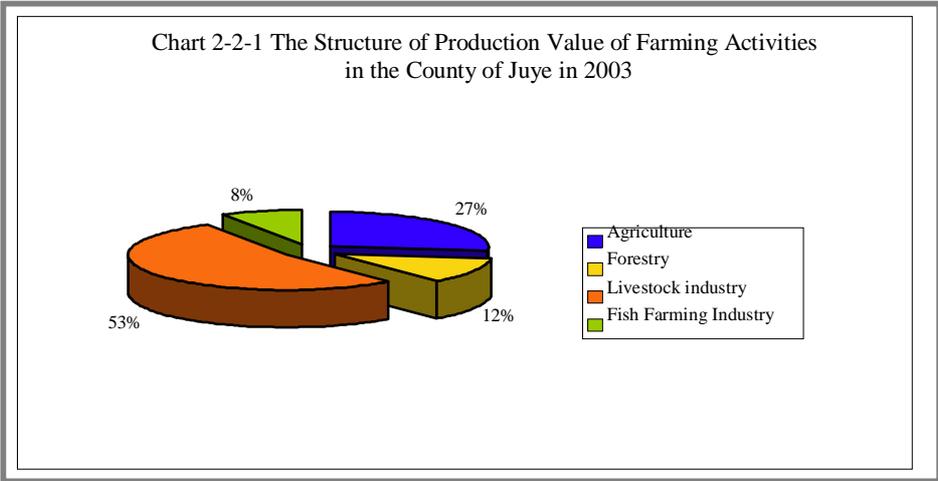
started to be affected by the poplar bug which eats the young leaves of poplar trees during March and April and affects their growth. Epidemic diseases may also threaten animal production and fishery production throughout the year.

2.2.3 Hazard exposure of agriculture

Agriculture in Juye plays a key important role in farmers’ household income. According to the county’s statistic data, the agriculture sector contributes about 55-60% to the rural income with the remaining 40-45% coming from migrant work. The average share of gross production value of different farming activities in Juye by the end of 2004 is shown below in chart 2-2-1.

Livestock production generates, on average, more than 50% of farming households’ incomes, crops production accounts for about 27%, and the other 20% is contributed by fishery and forestry. Thus climate variability and the high vulnerability of crops to floods and drought and lower crop market price are major reasons for livelihood insecurity in the county and the lower share of income from agriculture.

From 1970 to 1990, farmers in the villages cultivated rice for two seasons. From 1990, however, they shifted to the main crops being wheat, corn, and soya beans because of water shortages. In 2001, the county officials, via the township, recommended that the farmers plant poplar trees. As seen earlier on this was widely adopted by many farmers in all three villages.



The entire county is criss-crossed with rivers, natural drainage and man-made channels for irrigation. These drainage and irrigation systems are the backbone for agriculture in the region. The condition of the main backbone drainage canals in the whole county is efficient and well maintained. They function well in years with normal rainfalls, while the community based field drainage facilities in the whole county are very poor. Many villages, therefore, suffer even in years with average rainfall from floods either because of the complete lack of functioning drainage canals or the lack of connections from the community drainage canals to the main rivers or backbone canals.

As illustrated in table 2.3.1, cotton, corn, rice and popular trees the commodities most exposed to flood and storm disasters (July / August) in Juye.

Table 2-3-1 Hazard Occurrence and Growing Calendar of the Main Crops in Juye

| Items | Jan | Feb | Mar | Apr | May | Jun | July | Aug | Sep | Oct | Nov | Dec |
|---------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| A. Time of Hazards | | | | | | | | | | | | |
| Floods | | | | | | | Red | Red | | | | |
| Drought | | | Grey | Grey | Grey | | | | | | | |
| Pest | | | | | Yellow | Yellow | Yellow | Yellow | | | | |
| Hail storms & wind | | | | | | | Red | Red | | | | |
| Epidemic diseases | Yellow |
| | | | | | | | | | | | | |
| B. Crops and products affected | | | | | | | | | | | | |
| Cotton | | | | Green | | |
| Wheat | Blue | Blue | Blue | Blue | Blue | | | | | Blue | Blue | Blue |
| Corn | | | | | Red | Red | Red | Red | Red | | | |
| Soybean | | | | | Yellow | Yellow | Yellow | Yellow | Yellow | | | |
| Rice | | | | Green | | |
| Poplar | | | Orange | | | | Orange | Orange | | | | |
| Fishery | Blue |
| Livestock | Pink |

Wheat is the only crop that is not affected by floods as it grows in the spring, prior to the rainy season, however it can be affected by drought in the spring. The calendar shows not only the main cropping pattern but also the relationship between the seasonal rainfall threats and the farming seasons in the county.

Source of data: Household survey and workshops carried out in 2007 and 2008

Photo 2-3-1 Wheat field with water logging



Photo 2-3-2 Cotton field in Floods

Table 2.3.3 summarizes the perceived vulnerabilities of different crops and products in Juye (from scale 1 being low to scale 5 being high) .

Table 2-3-3 Assessed Hazard and Risk Vulnerabilities of Agro-products in Juye

| Products | Floods | Drought | Hail and Wind | Pests | Epidemic Diseases | Market |
|--------------|--------|---------|---------------|-------|-------------------|--------|
| Wheat | 2 | 4 | 1 | 2 | - | 1 |
| Cotton | 5 | 1 | 3 | 4 | - | 3 |
| Corn | 5 | 1 | 3 | 3 | - | 1 |
| Soybean | 5 | 1 | 3 | 2 | - | 1 |
| Vegetables | 1 | 1 | 3 | 3 | - | 3 |
| Poplar trees | 2 | 2 | 4 | 4 | - | 2 |
| Livestock | 1 | 1 | 1 | - | 3 | 4 |
| Fish | 2 | 3 | - | - | 3 | 4 |

Source of data: The grading figures of vulnerability are estimated based on the findings from a baseline survey (CIAD) and DRM System Assessment (ADPC).

Further details on the structure and hazard exposure of agriculture and the vulnerability of selected communities to natural hazards are given within the short descriptions of the pilot villages in the next section.