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Climate change impacts and adaptation for saline agriculture in north Jiangsu Province, China

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ABSTRACT

Climate change is affecting agricultural production and is expected to continue reducing water availability, potentially necessitating adaptation adjustment by related sectors to maintain sustainability of saline land use system highly vulnerable to water shortages. The drought in 2010 impacted the salt-affected land use system of the coastal region in Jiangsu Province, China. The main purpose of this paper is to determine which systems are least adaptive, and what factors limit their adaptive capacity to drought, among three typical saline land use systems of Jinhai farm located in the coastal reclamation region of north Jiangsu Province. An analytical framework for analyzing climate impacts and adaptation for saline agriculture is presented. To better understand climate change impacts and the adaptive capacity of saline land use systems, we conducted semi-structured interviews and group discussions with representatives of surrounding households and the farmer on Jinhai farm, experts and officials from government sectors and institutes. From these conversations two impact indicators were picked up and a set of determinants for adaptability and their rankings were derived. There is considerable variability in climate change impacts among different saline land use systems and a concentration of impacts on paddy systems. Adaptability in addition to climate change is cumulative to the impacts, particularly unsafe water resource planning, irrational land use mode and crop arrangement, and defective institutions and policies. Our results highlight the importance of a comprehensive and integrative land development planning involving water resource and land use arrangements participated in by representatives of stakeholders. Although there has been much progress in streamlining climate change assessments into sector planning in Dafeng – such as water resources, agriculture, beach and so on – it is clear that there is a need to improve institution, policy, market guidelines and technique R&D to ensure more consistent adaptation, especially considering the rapid evolution of the climate science behind the assessments. Achieving sustainable saline agriculture might require transformative changes in markets, policies, and science.

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1. Introduction

Extreme weather events in China have become more frequent; China's Yangtze River suffered its worst drought for more than

50 years (Qiu, 2011) in 2011, following Yunnan's worst drought in 2010 in which US\$2.5 billion worth of crops were expected to fail (Qiu, 2010). Jiangsu Province in eastern China with its usually plentiful freshwater resources experienced a rare

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drought from autumn 2010 to summer 2011, and the downstream of the Huaihe River dried up. By the 2050s, freshwater availability in East China is projected to decrease (IPCC, 2007). The regional planning in the coastal area of Jiangsu Province released in 2009 determined 1800 km² reclamation target to 2020 and will increase the pressure on water supply. Fresh water supply has not been used to sustain present beach development for agriculture, and the water shortage is over 60%. Further, increases in the frequency and severity of droughts and water scarcity would aggravate the build-up of salinization and adversely affect crop productivity and the sustainable development of agriculture. We found water shortage very prominent in Jinhai farm located in Dafeng City, in the coastal region of north Jiangsu Province, when we conducted the survey of sustainable saline land use project from October 17 to 25 of 2010. Just a short-term drought lasting about 15 days in the autumn of 2010 has resulted in great agriculture losses.

The aim of this paper is to provide an empirical assessment of (i) the observed magnitude of climate change impact on saline land use systems in Jinhai farm, (ii) the adaptive capacity of saline land use systems to water shortages, and (iii) how the systems plan to deal with the projected impacts of changing climate and water scarcity.

The literature on the potential impacts of climate change on salt-affected land tends to fall into two broad areas. First, there are a number of studies, in several countries, into climate change impacts on soil and water salinization (Schoups et al., 2005; van Genuchten and Šimůnek, 2005;

Rozema and Flowers, 2008; Ranatunga et al., 2010), some of these suggest potential adaptation strategies mainly with technical issues. A second, much smaller, group of papers examines adaptation strategies from an institutional view (Li Yixue, 2003; Dovers, 2008). In fact, there have been very few studies into how saline land use systems are actually adapting to climate change from social views. This paper contributes to the literature by providing an additional case study on adaptation in practice.

2. Methods

2.1. Study area

The north of coastal Jiangsu Province holds roughly 25% of China's beaches, and is increasing in the speed of more than 12.67 km² every year. Since the 1980s, shoals in the coastal region have begun to be enclosed. The regional planning in the coastal area of Jiangsu Province (2009) plans to cultivate 1800 km² beaches, 60% of which will be used for agriculture. But there are many problems in newly enclosed beaches such as salinization of soils and groundwater resources, lack of freshwater and poor management. Fig. 1 shows the situation of case study area. Because of its particular geographical location, water shortage in Dafeng City – lying in downstream of the Lixiahe Basin, and being the drainage corridor of this region – is very severe. The storage capacity of surface water in Dafeng City is very poor, and its use efficiency is even lower,

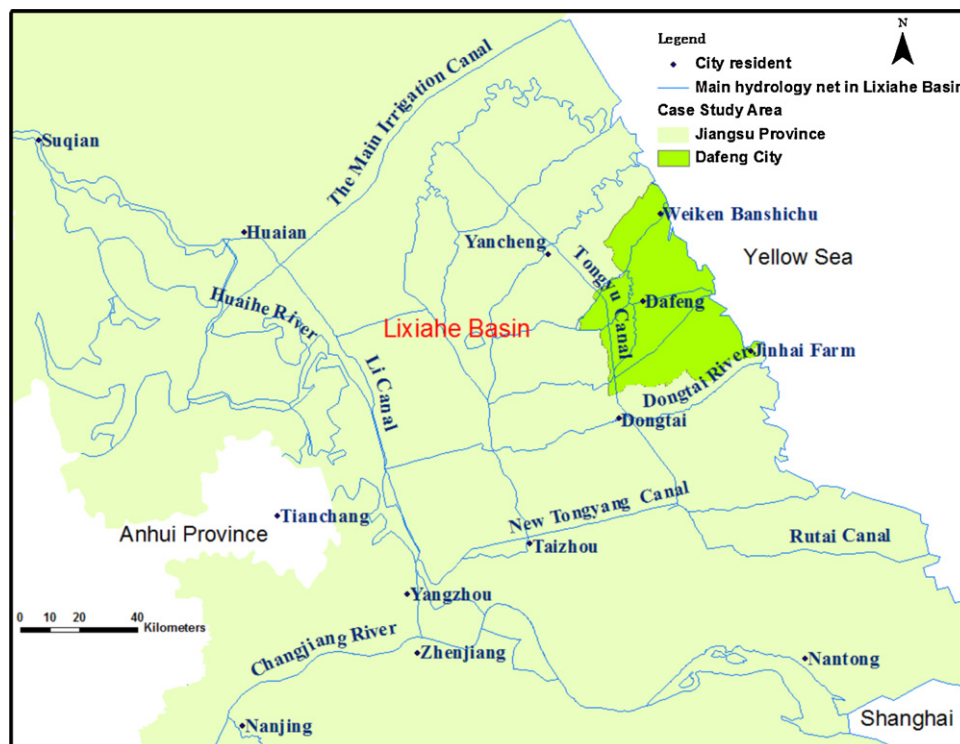


Fig. 1 – Location of Dafeng in Lixiahe Basin (Lixiahe Basin is an intensively cultivated wheat-based and rice-based agriculture area, which west to Li Canal, east to the Yellow Sea, north to the Main Irrigation Canal, south to Tongyang and Rutai Canal, covering more than 21,342 km² of rainfed agriculture area. According to topography and hydrographic net, Lixiahe Basin is divided into two parts by Tongyu Canal, including the abdomen and the coastal reclamation zone) and location of Jinhai farm in Dafeng City.

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