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Mekong River Delta farm-household willingness to pay for salinity intrusion risk reduction

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ABSTRACT

Sea level rise and upstream development is causing salinity intrusion in Vietnam's Mekong River Delta (MRD) and, as a consequence, agricultural productivity is declining. As the Vietnamese government and local communities search for a solution, it has become apparent that there are insufficient public resources to build the dykes necessary to control this problem. So, we employ a referendum contingent valuation methodology (CVM) to determine whether or not farm households might be willing to pay for part of the cost of a salinity intrusion risk reduction program. We find that farm households are willing to contribute funds to such a program. In areas where salinity intrusion is already reducing productivity, farm households are willing to contribute US$2.58 per month. In areas where salinity intrusion is expected to be reducing productivity by 2030, willingness to contribute is US$1.99 per month. Surprisingly, in MRD areas where salinity intrusion is not expected within the next 15 years, willingness to contribute remains positive at US$1.32 per month. These findings have local, national and international implications that require careful consideration. In passing, we make a methodological observation that a treatment model including 'do not know' responses provides consistent results with conventional referendum elicitation procedures.

1. Introduction

The Mekong River Delta (MRD), located in southern Vietnam, plays an important role in the country's agricultural development. The total agricultural area is four million hectares, producing approximately 45% of Vietnam's rice. While salinity intrusion impacts are beginning to affect other river deltas around the world, if mean sea levels rise by one meter above current levels, Vietnam would be the most adversely-affected region in the developing world (Buys et al., 2006).

In the past, flooding was the most typical cause of disruption to agricultural production in this region (Le Anh Tuan et al., 2007). In recent years, however, salinity intrusion has become the most significant challenge faced by farm households. Salinity intrusion is caused by two processes: a) rising sea levels as a result of adverse climate change and b) a significant decline in river flows as a result of upstream dam construction and increased extractions of water. Reduced upstream flow rates combined with increased sea levels under climate change drive lower hydrologic pressure in the MRD, which allows salt water to intrude further inland (Danh and Khai, 2014; Le Anh Tuan et al., 2007; Smajgl et al., 2015). According to the Vietnam Academy for Water Resources, salinity intrusion is on the increase and has recently been detected in the Kien Giang and Hau Giang provinces (see Fig. 1) (The Vietnam Academy for Water Resources, 2015). Currently, around 620,000 ha are affected by salinity intrusion—roughly 16% of the total MRD agricultural production area. By 2030 under current sea level increase predictions, it is estimated that up to 45% of the MRD agricultural area could be impacted, with coastal provinces such as Tien Giang, Tra Vinh, Soc Trang, Bac Lieu, Ca Mau, and Ben Tre experiencing the highest levels of impact (Center of Environmental Engineering, 2012).

Adverse impacts of sea level rise are being worsened by increasing upstream development along the Mekong River. The National Hydro-Meteorological Service of Vietnam is warning that the impact of future droughts, similar to those experienced during the 2015 and 2016 El Niño events, will also be worse in future, creating further negative salinity intrusion outcomes.

As one of the largest rice exporters in Asia, disruptions to MRD agricultural production can result in wider serious regional food security issues, as well as reduced national trade income. In the past, MRD farm households largely treated salinity intru-

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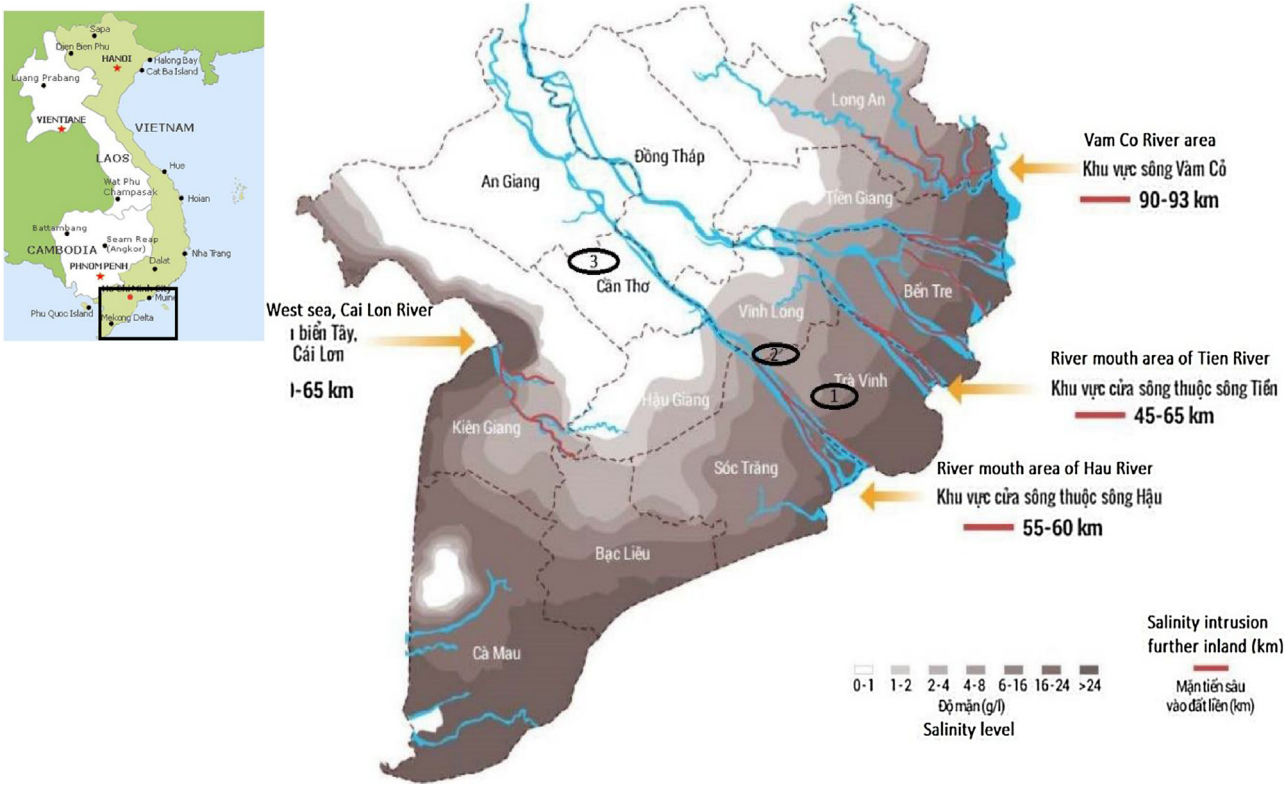

Fig. 1. MRD salinity intrusion, 2015. Study area locations are also indicated: 1) Cau Ke district, 2) Cau Ke and Tra On districts, and 3) Vinh Thanh district.
Source: Adapted from The Vietnam Academy for Water Resources (2015)

sion as a normal phenomenon (Le Anh Tuan et al., 2007). More recently, under increasing salinity impacts, farm households and local authorities have recognized the abnormal properties of local salinity intrusion, and begun searching for management solutions including changed irrigation schedules, increased water storage in dams, and altered rice-planting times. These solutions are largely viewed as short-term (1–5 year duration) fixes. However, under a recent recognition that increasing salinity intrusion cannot be managed by private on-farm actions alone, in 2016 the General Program of the Mekong Delta Economic Cooperation Forum in Hau Giang (MDEC Forum - Hau Giang) argued that it would be necessary to explore and develop longer-term (5–30 year) solutions based on public intervention.

One possible long-term approach is the use of concrete sea-dikes or embankment-structures that prevent water inundation onto low-lying floodplain areas. The MRD is a vast floodplain only 0–4 m above mean sea level. Over the last 300 years, more than 11,000 kilometers of canals have been constructed in the MRD to mitigate flooding in low-lying areas. In addition, approximately 2000 kilometers of dike walls have been constructed to minimize MRD flooding during periods of high upstream flows and very high tides that can occur during storm events (Le Anh Tuan et al., 2007). In May 2009 the Vietnamese government issued Decree No. 667/QD-TTg with a view to upgrading dike walls and increasing maintenance in the central and southern MRD. This program will include the construction of additional earthen sea-dikes and concrete sluicegates along the coastline (Danh and Khai, 2014; Smajgl et al., 2015). As there is a shortage of soils suitable for upgrading these dikes, and the incidence of erosion is high (Sorensen et al., 1984), consideration is being given to the construction of concrete sea-dike-walls.

According to a UNDP Disaster Management Unit Project (VIE/97/002) managed by the General Department of Land Administration, the total length of required sea-dike walls in MRD would be 1469 kilometers. Danh (2012) and Danh and Khai (2014) argued that Vietnam cannot afford to build the total required lengths of sea-dike walls due to public budget constraints. These authors go on to point out that, if these sea-dike walls were constructed, local authorities would also struggle to maintain them (Danh, 2012). This means that if any proposed intervention program based on infrastructure is to proceed and be sustained over time, local households may have to fill a construction and maintenance funding gap. However, it is unclear whether local households are willing to contribute to these types of public investments and, if so, how much they would be willing to contribute. The purpose of this paper is to explore MRD farm household willingness to contribute (pay) to local authority programs aimed at mitigating salinity intrusion risk.

The willingness to pay (WTP) literature is generally classified into revealed and stated preference methodologies; with stated preference methods typically employed to estimate WTP in contexts where actual markets for the good in question do not exist (Bateman et al., 2002; Competition Commission, 2010). In climate change related research, a subset of stated preference estimations known as Contingent Valuation Methods (CVM) have been widely employed to estimate willingness to pay for climate risk reduction projects. Many of these previous climate risk reduction project studies have focused on issues such as willingness to pay for insurance (Botzen et al., 2009; Botzen and Van Den Bergh, 2008, 2012; Charpentier, 2008; McClelland et al., 1993), flooding-risk mitigation through improved management (Baan and Klijn, 2004; Brilly and Polic, 2005), and willingness to pay to reduce environmental health or mortality risks (Alberini and Chiabai, 2007; Alberini et al., 2006; Corso et al., 2001). However, while Southeast Asian countries also face emerging climate risks, previous studies of WTP have mainly been conducted in developed countries.

Moreover, studies looking at people's willingness to contribute to coastal defense in climate risk areas are quite rare. So far, research on this topic has only been conducted by Jones et al. (2015) in England and Landry et al. (2011) in the US; with little that can