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SANTA CRUZ

As husband and wife: modern farms and mobile families in the Vietnamese Mekong River Delta

A dissertation submitted in partial satisfaction
of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

ENVIRONMENTAL STUDIES

by

Robin J. Lovell

December 2017

The Dissertation of Robin J. Lovell is approved:

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Vice Provost and Dean of Graduate Studies

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2017

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Abstract

As husband and wife: Modern farms and mobile families in the Vietnamese Mekong River Delta

by

Robin J. Lovell

The Vietnamese Mekong River Delta is an epicenter of cultural, environmental, and economic change. New irrigation infrastructure and Green Revolution rice production practice adoption in the 1990s propelled Vietnam into the regional rice market. Simultaneously, renovation policies prompted rural-to-urban migration patterns, with women surpassing men in this trend in 2006. Thus, men are increasingly managing the farm and the family, while women work wage labor jobs in the city to send remittances back home. These changes have influenced many aspects of Vietnamese life. This research explores how these economic, policy, and environmental shifts have influenced the familial relationships and farm practices of the delta.

This dissertation uses a mixed methods approach. Chapter 1 is summative rather than analytical. Chapter 2 uses remotely sensed radar data, combined with in-situ moisture readings, to determine water-saving practice adoption through change detection of a time series wetness index. Chapter 3 is a gender disaggregated plot-level study that uses a binary logistic regression to determine if livelihood approaches

on male- and female-managed plots influence adoption of farming practices. Chapter 4 uses a spatial intersectionality approach, a grounded theory, exploring identities and spaces traversed by migrant families in the city and country.

The results of this research paint a nuanced picture of present-day Southern Vietnam. Chapter 2 illustrates a water-saving practice adoption likelihood scale across the delta, indicating promise for the change detection methodology. Chapter 3 finds that gendered plot management is directly associated with SI and CI practice adoption, and there is an indirect gendered impact due to unequal access between the sexes to natural and human capitals that are associated with increased SI adoption. Chapter 4 disrupts assumptions of gender roles by taking a spatial look at intersecting identities. These women and men negotiate a Portable Family identity, based on actions rather than interactions, and oscillating between the urban-productive home and the rural-reproductive home. Chapter 5 points to a trend opposite the "feminization of agriculture" seen across Southeast Asia and parts of Latin America by showing an increasingly male-managed farm.

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Finally, I would like to thank my funders that made all research possible. The Environmental Studies Department grants, the Consultative Group for International Agricultural Research (CGIAR) Research Program on Water, Land and Ecosystems (WLE) and Australian Aid, the Strengthening Impact Assessment in the CGIAR System Grant Natural Resource Management, the Marilyn C. and Raymond E. Davis Memorial Scholarship, the Jessica Roy Memorial Award, the Pacific Rim Program – Graduate Fellowship Research Grant, the Hammett Fellowship for Interdisciplinary

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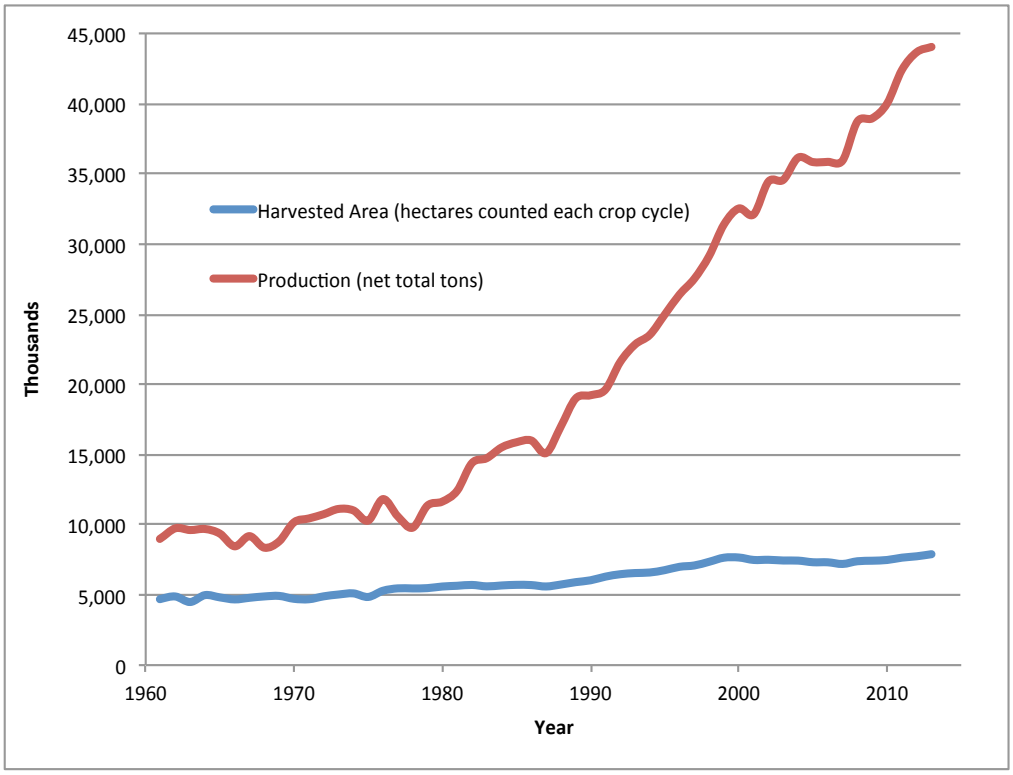
Chapter 1: Agrarian Change in Vietnam

The Vietnamese Mekong Delta is the southern tip of a large, historically divided country. During the period between 1975 and 1986 following the war, the country saw enormous agroecological, social, and economic changed as the reunified country tried to re-integrate the south into its economy and culture. Because the changes are so new, the delta is a fascinating research setting to explore these three aspects of agrarian change. Agrarian change in this context is the process of ongoing re-definition of rural livelihoods, environments, and human relationships. It is usually in the context of globalization or entering the global economy. Agrarian economies are typically based on agriculture, so part of agrarian change is a shift of agricultural production practices, or an abandoning of agriculture sometimes. The physical and social developments in the Vietnamese Mekong River Delta after the decollectivization policies of the 1980s falls within the broader debate regarding the "agrarian question," or how agricultural societies transition into or resist the industrialized global economy. Vietnam did its best to remain loyal to its socialist political system by declaring a "socialist-oriented market economy" (Hoang and Yeoh 2011), rather than the free-market capitalist approach common to many similar transitional economies. The impacts on families and farms in the delta has been extensive.

ENVIRONMENTAL CHANGES

Following these Renovation policies, known as *Doi Moi*, Vietnam focused on improving infrastructure and shifting the physical environment in the delta. The government focused on direct domestic and foreign investment to support a "big push" of government investment, a common approach in developing countries joining the global economy (Nelson 1956). In fact, cold war politics were played out through communist or democratic control over the "sinew of development": infrastructural projects (Sneddon 2012). The irrigation network in Vietnam was an example of a postcolonial and post-conflict technique for economic and social development. The global success story in the late 1980s for infrastructural progress, the taming of nature, was the Tennessee Valley. In fact, American engineer David Lilienthal designed the Mekong Delta Development Program, which systematized the control of water through canals and levees (Käkönen 2008). This plan was implemented in the 1990s, when the majority of the canal system was built. The intent was to create a highly productive, intensified, triple-rice cropping delta environment, which the farmers of the delta enacted by quadrupling production of rice per hectare (see Figure 1).

FIGURE 1. VIETNAMESE RICE PRODUCTION PER HECTARE OVER TIME. The graph below shows a clear increase in harvested area circa 1990, as well as a marked increase in tons per produced (author adapted from FAO Statistics 2015).



Now the pendulum has swung and heads of state are reevaluating the economic sustainability of intensified agriculture. In the international arena, the debate between intensification and extensification is raging. On the one hand are advocates of "ecoagriculture,"also known as the "land sharing" camp, which encourages wildlife-friendly and "pro-poor" production systems to limit the extent of agricultural impacts on ecosystem health (Scherr and McNeely 2008). On the other hand are the "land sparing" conservationists who find that ecosystem integrity is far superior without human systems influence, and thus advocate for intensification of existing agricultural lands (Phalan et al. 2011). In Vietnam, this debate is taking form

in the policy arena, as development projects and the Ministry of Agriculture and Rural Development (MARD) attempt to peel back the triple-cropping system that relies on irrigation water to push out a third crop during the dry season. For example, a recent IUCN project in the Mekong River Delta focuses on seasonally removing dykes to allow natural flooding to occur, which forces a shift to a completely different production regime.

SOCIO-ECONOMIC CHANGES

Uneven infrastructural investment led to uneven economic development. Studies in Vietnam have analyzed how *Doi Moi* policies caused shifts in rice production and export, and created a deeply stratified peasant class system (Käkönen 2008; Tanaka 1995). Not only did the policies increase the wealth gap between farmers, but they also increased disparities between provinces in the delta, which received a varying degree of support from the MARD extension agents who encouraged the triple rice crop. Further, intensified farming began to have longer-term impacts on soil and water quality, decreasing farmers' abilities to continue working the land. Mr. C, a farmer from research discussed in Chapter 4, explains the change,

> "Now, the world is mechanized. Farming in the fields now is different from the past. It's unnecessary to have so many workers as before. Moreover, the farming fields are fewer compared to the past. Therefore, the farmers have less work to do than in the past. Some of them have to move to the city to have a job. As a result, the families now are changing."

As a function of the agrarian changes described above, Vietnam is now experiencing a rural-to-urban migration trend. On top of being a regional rice production giant, Vietnam is now a powerful electronics and textile export economy. Families who cannot make ends meet farming, or wish for a non-farming future for their children through education, use migration as a coping strategy. These environmental and economic changes have had huge impacts on Vietnamese families, shifting how mothers and fathers interact with their children and each other, where family members live, and how farming and family is "done" (Thao and Agergaard 2012). Men, women, children, and families are shifting their personal and familial identities in response to environmental, economic, and social pressures.

DISSERTATION OVERVIEW AND INTELLECTUAL CONTRIBUTION

The story told in this dissertation takes place in Southern Vietnam, in the Mekong River Delta. It is a landscape blanketed with thick productive, green rice fields, and peppered with vegetable gardens and small villages. "As husband and wife" is a phrase repeatedly invoked to encapsulate a sense of togetherness in Vietnamese families and on Vietnamese farms. Shared feelings of endurance and dedication, shared work and child care, shared responsibility. Spouses attend funerals and celebrations as "husband and wife." They often raise their children "as husband and wife." And, importantly to this story, they make financial and migration decisions "as husband and wife." However, there is a tension in this sense of family cohesion, which is equally as important to this story, because farm fields are often not planted,

tended, and harvested "as husband and wife." In many cases, farmscapes are strictly divided into spaces tended by husband *or* wife. And men and women do not gain access to and control of resources "as husband and wife," necessarily. It is this tension, this intersection of rural agricultural landscapes and gender dynamics, where I do my research. The research approaches agrarian change from three scales: *regional* production practices, *household* livelihoods, and *individual* identities.

At a regional scale, Chapter 2 uses remotely sensed radar data, combined with in-situ moisture readings, to determine water-saving practice adoption through change detection of a time series wetness index. The research illustrates a water-saving practice adoption likelihood scale across the delta, indicating promise for the change detection methodology. My contribution in Chapter 2 is to explore a beta (β°) transformation and change detection approach, referred to as a "multi-temporal SAR for SWC change detection" that uses multiple passes from the same incidence angle and polarization. By exploring and refining this methodological approach, the research builds a toolbox for harnessing remote sensed data in agricultural research.

At a household scale, Chapter 3 is a gender disaggregated plot-level study that uses a binary logistic regression to determine if livelihood approaches on male- and female-managed plots influence adoption of farming practices. We find that gendered plot management is directly associated with SI and CI practice adoption, and there is an indirect gendered impact due to unequal access between the sexes to natural and human capitals that are associated with increased SI adoption. Chapter 3 contributes empirical evidence towards understanding the tension between CI and SI practice

adoption in the Vietnamese Mekong River Delta. The study also uniquely explores the gendered implications of the recent SI push in Vietnamese agriculture. To conclude, we highlight specific opportunities for improvements in female uptake of SI practices through our suggested policy reform. Vietnam plans to scale back its annual triple rice crop production in the Mekong River Delta over the next several years, making these gendered differences in sustainable practice adoption crucial to a smooth transition into a sustainable food system in the context of global change.

Finally, at an individual scale, Chapter 4 uses a spatial intersectionality approach, a grounded theory, exploring identities and spaces traversed by migrant families in the city and country. There are three gaps in the gender and migration literature in Vietnam. First, these studies have almost exclusively taken place in Northern Provinces of Vietnam, which I attempt to fill by conducting this research in Ho Chi Minh City. Second, they predominantly focus on women's identity as the migrant, which I address by analyzing men and women's experiences in the context of the mobile family. Thirdly, most recent studies focus on abstract identities such as "husband" or "father." I use space as the primary focus in which identities compete with each other, within a body, and within a family. Space and identity are co-implicated; so choosing to work and live in separate spaces has profound impacts on gender identity, gender relationships, and performative or lived family values. This research disrupts assumptions of gender roles by taking a spatial look at intersecting identities. These women and men negotiate a Portable Family identity, based on

actions rather than interactions, and oscillating between the urban-productive home and the rural-reproductive home.

Chapter 2 – Identifying Alternative Wetting and Drying Adoption in the Vietnamese Mekong River Delta: a Change Detection Approach

INTRODUCTION

Alternate Wetting and Drying (AWD) is an irrigation technique in which water is applied to the field a number of days after the disappearance of ponded water. This is in contrast to the conventional irrigation practice of continuous flooding in which farmers never let ponded water disappear. AWD allows intermittent drying during certain stages of rice growth because roots of the rice plant are still adequately supplied with water due to the initial flooding. The number of days in which the field is allowed to be "non-flooded" before irrigation is applied can vary from one day to more than 10 days. Under the effects of climate change, water scarcity will be a main concern for Asian rice producers in the dry season. Regionally, applying AWD could conserve fresh water resources and either extend the growing cycle during the dry season or expand rice production areas. Unfortunately, estimating adoption of AWD is quite difficult.

Determining the extent and degree of AWD adoption has proven difficult. The Irrigated Rice Research Consortium (IRRC) introduced AWD to paddy fields in the Mekong River Delta (MRD) beginning in 1997 through the various projects in coastal provinces, such as Bac Lieu, as well as inland provinces, such as An Giang (Lampayan et al. 2015a). There have been a number of evaluations of barriers to adoption (Quynh and Sander 2015; Rejesus et al. 2011), and one widely accepted

estimate of 40,000 farmers adopting the practice by 2011 (Mendoza and Singleton 2011). However, these studies are based on small sample sizes, expert interviews, and household surveys. These methods can be time consuming, expensive, and prone to subjectivity. Thus, the core objective of the project is to determine if remotely sensed data can be used to determine the geographic extent and the degree of adoption in MRD Provinces in Vietnam.

Radar remote sensing is an effective data for mapping soil moisture regardless of cloud cover or atmospheric interference (Hassan and Bourque 2015). Synthetic Aperture Radar (SAR) detects a backscatter digital number using microwave bursts from satellites that orbit earth. Radar data has fewer limitations than pure reflectance data (such as vegetative indices) due to the lack of cloud cover interference (Lakhankar et al. 2006; Miranda et al. 2015). Sentinel-1 in particular shows promise for change-detection approaches to understanding surface wetness (Hornacek et al. 2012; Wagner et al. 2009). There are three transformations possible with Sentinel-1 data: alpha (σ°), beta (β°), and nought (ϒ°) (Padhye and Rege 2015). We do not discuss ϒ° transformation possibilities in this paper. Further, σ° poses a great deal of trouble in creating a reliable wetness index. Vegetative interference must be carefully calculated and accounted for as a function of σ° (Barrett and Petropoulos 2013; Inoue, Sakaiya, and Wang 2014). Surface roughness is also a confounding factor in σ° transformation and use (Hassan and Bourque 2015). However, SAR σ° data has been used to understand different characteristics of the rice paddy and plant, including the contribution of leaf area index, and plant growth stage and type (Inoue et al. 2014). It

has also been used successfully to understand the extent of the triple rice crop (Guan et al. 2016; Liew et al. 1997; Nguyen et al. 2012).

Most recently, a number of authors have used the β° transformation of the SAR data in a change detection analysis. Experts have used change detection to create wetness indices that avoid the pitfalls of cloud cover interference inherent in reflectance data (Hassan and Bourque 2015; Wagner et al. 2009; Wang et al. 2011). The change detection approach also reduces complications of surface roughness and vegetative interference that arise from the alpha transformation. For these reasons, the GIS team adopted the β° transformation and change detection approach for the purposes of this project, referred to as a "multi-temporal SAR for SWC change detection" that uses multiple passes from the same incidence angle and polarization (Hassan and Bourque 2015).

The chapter proceeds in the following fashion. The first part of the chapter discusses the environmental setting of the Mekong River delta. It then outlines the need for developing low-cost methods for determining adoption of AWD and a promising remote sensing approach using change detection of a wetness index. The second part of the chapter is a detailed description of the methods used throughout the process. The third part of the chapter outlines the results of the work flow we explored. We conclude with the implications of these results, the limitations of the study, and some promising avenues for further validation of this method.

ENVIRONMENTAL SETTING

Sustainable water management is a regionally urgent issue in Vietnamese agriculture. Vietnam has a complex system of barrages, weirs, and dikes to mitigate flood and salt water intrusion (Penny 2008). The canal system expanded from two canals in 1824, 40 canals in 1934, to hundreds in the 1980s (Hung et al. 2012). Today, the channel network is over 50,000 kilometers long. Community groups in the delta often govern sluice gates and this control over hydrology allows for a double- or triple-cropping system. However, since the canal system was built, Vietnam has experienced subsequent water quality issues, salt-water intrusion, and canal bank erosion. In maximum flooding conditions, these flow obstructions can worsen flood impacts, preventing saline waters from escaping croplands. Dredging canals, upgrading roads, and other waterway improvements to protect crops can cause between five and 10 additional days of flooding, or between 0.2 and 0.3 additional meters of water depth during peak flood conditions (Hoa et al. 2008). Additionally, planned dam construction upstream in Laos could also have a synergistically negative effect with projected climate change impacts (Keskinen et al. 2010). Sediment deposits would accumulate behind the dam, causing a deficit of sediment and nutrient deposition downstream in the latter half of the century when projected impacts of climate change will be worse than the first half of the century. This may, in turn, have impacts on rice and other crop production.

Flooding is a strength and weakness of the Mekong River Delta agricultural setting. The area is considered a monsoon system, with the rainy season lasting

between May and October and averaging between 1400 and 2400 millimeters annually, and the length of the growing season is between 270 and 300 days A large proportion of the Malay Peninsula is seasonally inundated, which includes much of the Mekong River Delta in Vietnam. The floodwaters are filled with nutrient-rich sediment, which replenishes agricultural land and reduces the need for agricultural inputs (Wade et al. 1998). However, climate change is expected to increase the average and maximum water levels and flood duration in the Mekong River Delta between 2010 and 2049 (Keskinen et al. 2010). This will negative consequences for annual crops, infrastructure integrity, floodplain vegetation, and most likely decrease the amount of fertile land. The changes in flooding may increase ecosystem productivity and produce dry season water availability, which could allow extended cropping.

Drought is one of the most formidable vulnerabilities in rice cropping systems of Vietnam, in spite of the vast irrigation network. Because rice yield is linearly related to the number of days it is grown in saturated soil, water shortages can have a severe impact on rice production (Haefele and Ismail 2009). Lack of water reduces biomass, grain set, and forestalls emergence. It also disrupts crop management techniques such as weeding, fertilization, and transplanting. It is especially damaging during flowering and can incur a large weed problem if drought occurs during emergence periods. In locations without a clay hardpan, acidic water can infiltrate from deeper soil during the dry season or drought years (Hoa et al. 2008). However, some authors have taken a nutrient management approach to the drought issue,

arguing that drought is less important than how loss of soil-water saturation impacts uptake of nitrogen, phosphorus, and iron, as well as impacting toxic levels of aluminum (Bell and Seng 2004; Haefele and Ismail 2009). Additionally, small undulations in rice fields and between bunded fields, known as toposequences, can produce equally important hydrologic shifts as precipitation patterns. Climate change precipitation changes may cause yield fluctuations in already irrigated lands due to anticipated lack of irrigation water. This presents a hurdle for increasing yields in the light of increased water insecurity. Vietnam has a double- or triple-cropping system in the project area, which is sometimes subject to salt-water intrusion from the South China Sea and Gulf of Thailand.

HISTORY OF AWD

AWD was developed through the research efforts of the International Rice Research Institute (IRRI), one of the major research centers under the CGIAR. In particular, the Water-Savings Workgroup under the Irrigated Rice Research Consortium (IRRC) was instrumental in the development and dissemination of this technology in the major rice-growing countries of Asia. The IRRC was established in 1997 with the aim of providing a platform to facilitate the identification, development, dissemination, and adoption of natural resource management (NRM) technologies suitable for irrigated rice-based ecosystems in several Asian countries, including Vietnam. With funding support mainly from the Swiss Agency for Development and Cooperation (SDC) through four project phases (Phases I-IV from

1997 to 2012), the IRRC has provided a mechanism that has expedited partnerships between national agricultural research and extension system (NARES) partners and scientists from IRRI.

In Vietnam, AWD has been introduced to paddy fields in the MRD through the various projects of IRRI, CGIAR, the Climate Change Agriculture and Food Security (CCAFS) project, and Climate and Clean Air Coalition (CCAC). There are projects in coastal provinces, such as Bac Lieu, as well as inland provinces, such as An Giang. With respect to specific IRRI/IRRC dissemination efforts for AWD, there has been an integrated approach to promoting AWD. This integrated approach has been built on the long established relationship between IRRI/IRRC and the Plant Protection Department (PPD) of the Ministry of Agriculture and Rural Development (MARD).

Through the IRRI-PPD partnership, AWD was first evaluated in An Giang Province in 2005-2006 for three successive rice-growing seasons. In 2006, AWD was incorporated into a large-scale existing program called "Three Reductions, Three Gains" (3R3G) that aimed to reduce inputs of fertilizers, pesticides, and seeds. In 2009, technologies that reduce irrigation water use (through AWD) and post-harvest losses were included and the program was transformed into the "One Must Do, Five Reductions" (1M5R) program. The successful evaluation and dissemination of AWD in Vietnam through the 3R3G program and subsequently the 1M5R program were facilitated by the widespread media campaigns and training on AWD through these integrated programs. The collaboration of IRRC with the PPD was instrumental in

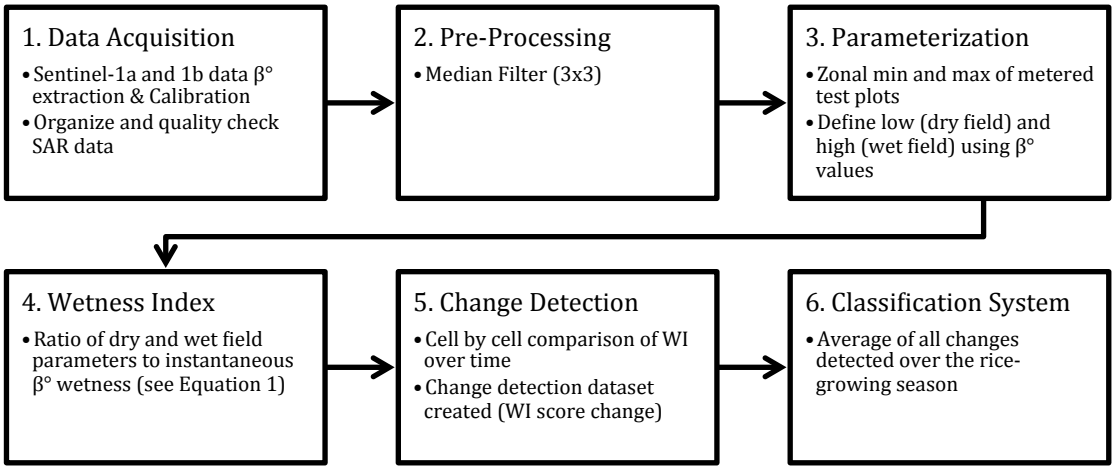
this endeavor. Moreover, 1M5R is now a national policy that aims to make rice production more sustainable. All the components of the IM5R program are being promoted and wide-scale implementation is being done throughout An Giang and in nearby provinces in the Mekong Delta. Promotion of this program is also underway for the northern part of Vietnam, particularly in the Red River Delta.

The AWD technique starkly contrasts to traditional rice cultivation. Rice fields are not kept continuously submerged, but are allowed to dry intermittently during the rice growing stage. The number of days in which the field is allowed to be "non-flooded" before irrigation is applied can vary from 1 day to more than 10 days (Lampayan et al. 2015b). The underlying premise behind this irrigation technique is that the roots of the rice plant are still adequately supplied with water for some period (because of the initial flooding) even if there is currently no observable ponded water in the field. To assist farmers in the practical implementation of AWD, a simple tool (a 25-cm-long perforated field water tube) was introduced. The field water tube can be made of plastic pipe or bamboo or any cheap material, and is embedded in the paddy field to a depth of 15 cm, with the soil removed from inside the tube, to reveal the perched water-table level. During AWD implementation, the field is irrigated to a depth of around 5 cm whenever the ponded water level has dropped to about 15 cm below the surface.

MATERIALS AND METHODS

This section outlines the methods utilized in the field and on the desktop to execute the change detection approach. The team estimated AWD adoption using geospatial analysis of remotely sensed data, with soil moisture meters used for calibration. Figure 2 represents the complete remote sensing workflow. This unique process includes data acquisition, pre-processing, parameterization, wetness index creation, temporal lag analysis, and classification system creation. Each step is detailed below.

FIGURE 2. REMOTE SENSING WORKFLOW. The following workflow was adapted and developed throughout the project, based on previous Wetness Index studies as well as project iterations.



The team installed a series of soil moisture meters throughout the Mequon River Delta (MRD) in strategic locations to validate satellite data. The meters were installed in December 2016 and removed in April 2017 to capture the dry season

growing period. Meters were installed in the three major soil types (and coincidentally three provinces: An Giang, Dong Thap, and Ben Tre) where rice is grown in the dry season to capture how SAR Data maybe effected by soil type (Montzka et al. 2011; Xiao et al. 2013), and to replicate data acquisition in case of retrieval failures. In each province, the team installed moisture meters in a known AWD field and a non-AWD field with one replication per site. In total, there were 12 meters installed, four per soil type. The meters were installed at least 10 meters away from the edge of the rice fields to account for edge affects of watering regimes in the AWD and non-AWD fields. Moisture meters were fitted with a solar panel to power the sensor in itself as well as the remote relay apparatus. Air and humidity gauges were also attached to the meters to understands climatic conditions. Because the sensors were sensitive to flood inundation they were installed at approximately 30 cm height above the soil surface. Soil moisture meter data was remotely relayed on an hourly basis for the five months they were installed. Calibration of soil moisture percentage occurred throughout the soil moisture meter tenure.

Data Acquisition

The best source of data for this project currently includes the European Space Agency's (ESA) Sentinel-1 satellite. The Vietnamese Mekong River Delta is approximately 40,000 square kilometers, with the majority of the area covered by a single tile of ascending and descending passes by Sentinel 1-a and 1-b. SAR data is downloadable in raster format, with thousands of individual cells representing a set

area in space, or tile. Each cell within the tile of Sentinel-1 data represents 10 by 10 meters (m) for which a backscatter number, or digital number (DN), is given for that area of space. Each cell contains two bands of data collected from the satellite platform at different sending and retrieving angles: vertically sent and vertically retrieved (VV), and vertically sent and horizontally retrieved (VH). The VV band was used in this analysis because it has a higher accuracy in other similar wetness index studies (Hassan and Bourque 2015). Table 1 outlines acquisition dates for which VV and VH data was available for our study location.

TABLE 1. SENTINEL-1A AND 1B DATA ACQUISITION. Acquisition dates were spaced as tightly together as possible.

Acquisition Dates[1]
January 5, 2017
January 11, 2017
January 17, 2017
January 23, 2017
January 29, 2017
February 4, 2017
February 10, 2017
February 22, 2017
February 28, 2017
March 23, 2017

[1] Acquisition times were between 22:45:06 and 22:45:46.

Pre-processing

During pre-processing, this DN can be transformed, calibrated, and filtered, to understand different biophysical parameters of that space. There are a number of different constraints that must be accounted for when determining soil water content (SWC). Depending on how the DL is transformed, we accounted for those constraints. The DN given by sentinel one data can be transformed into alpha, beta, or

gamma values. The team explored these different transformations to determine what was best for determining AWD adoption in the MRD. Because of the complexity of surface roughness and the rice crop itself, the team decided on a beta transformation, using beta values (β°) to create a wetness index (WI) that represents soil-water content (SWC) (Hassan and Bourque 2015; Wang et al. 2011). First, the β° transformation takes the DN and transforms it into reflectivity data. We then calibrate β° using a script embedded in the downloadable file via the ESA web interface for the beta calibration (Miranda et al. 2015). Calibration for beta values mostly uses a constant unique to the acquisition date, time, and incidence angle, so the shift in distribution after calibration was not as significant as it might be for alpha. After calibration, the data was run through a median smoothing filter to remove speckling (Padhye and Rege 2015). These pre-processing steps created a multi-temporal dataset ready for analysis.

Parameterization

The test plots in An Giang, Dong Thap, and Ben Tre were used to train our model. We calculated the maximum and minimum values for the VV and VH bands for each soil type, with the minimum representing a "flooded" field with low reflectivity and maximum representing a "dry" field with high reflectivity (Hassan and Bourque 2015; Lillesand, Kiefer, and Chipman 2008). Because the maximum and minimum VV and VH values were not significantly different between soil types, we used the maximum and minimum from An Giang province moisture meters. Using

these values, we excluded VV and VH values below the minimum and above the maximum of those rice paddies across the entire dataset. This process, in essence, acted as a high pass filter to pull out water features, urban features, and other non-paddy features (Padhye and Rege 2015).

Wetness Index

The team used the processed and parameterized dataset to create a wetness index (WI). The team used the formula below, as in similar studies of SWC using remotely sensed SAR data:

$$WI = \frac{\beta^0_{min} - \beta^0_{ins}}{\beta^0_{max} - \beta^0_{ins}}$$

In the wetness index, β^0_{min} is the minimum value in the test plots, β^0_{max} is the maximum value in the test plots, and β^0_{ins} the instantaneous value of any given cell in a tile at any given time. The process turned the β° values into a ratio scale from -2 to +2. In doing so, each cell represents a relative degree of moisture compared to the maximum and minimum values outlined above. Thus, each scaled cell is more "wet" or "dry."

Change Detection

The team then analyzed the WI for each acquisition date in comparison with the following time step. This analysis was performed to calculate each cell's change in dryness over time. Thus, for each set of two consecutive tiles, a third "change detection" tile was created to represent the raw WI score change for each cell.

Classification System

From the neighborhood analysis and time lag evaluation, a classification scheme was developed to average the change index across time. In this way, pixels that showed an overall drying trend over time would exhibit lower scores, while pixels that showed little change would hover around zero. Pixels that overall exhibited a wetting trend are the least likely to have adopted AWD, while those that exhibit more regular dry down periods between wetting events are likely AWD adopters.

RESULTS

The results are broken up into two sections. The section first discusses the wetness index results, including how the Wetness Index (WI) can be paired with in situ soil moisture meter readings as validation. Second, we report the delta-wide patterns of wetting and drying. The methods explored in this research illustrate a new promising approach for accounting for adoption of water-saving behavior in agriculture.

Wetness Index

Soil moisture meter readings illustrate a clear association between VV Wetness Index (WI) values and Soil Moisture Percent taken from test plots. We used the VV band data to begin calculating the wetness index, as other similar wetness index studies (Hassan and Bourque 2015). An Giang is primarily alluvial, Ben Tre is

saline, and Dong Thap is acid-sulfate. An Gian data seems to reflect WI calculations most accurately. Figures 3 and 4 illustrate how the WI and Moisture Percent align in the alluvial soils of An Giang Province.

FIGURE 3. TEST PLOT 3 SOIL WATER CONTENT VARIABILITY. The following readings from test Plot 3 in An Giang Province, in which the farmer uses AWD management practices, shows VV Wetness Index and Moisture Percent readings for the plot.

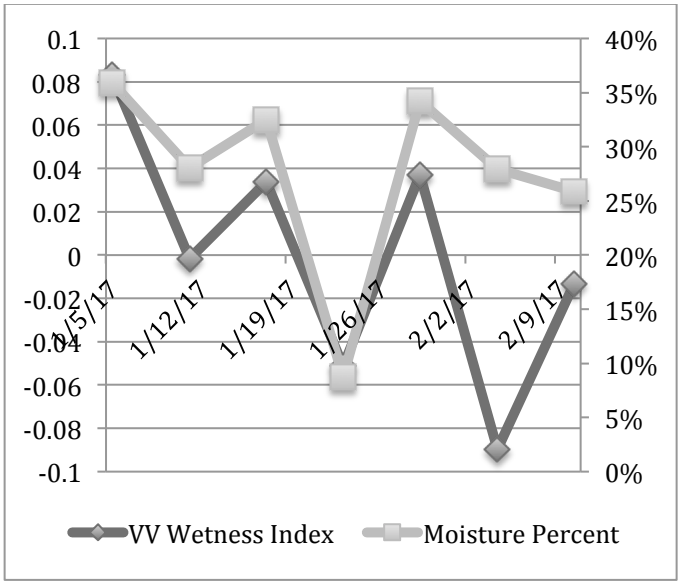
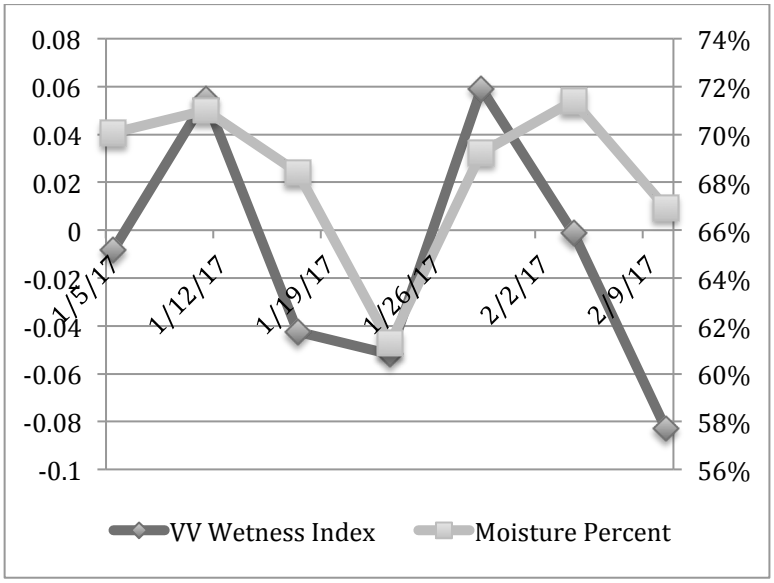


FIGURE 4. TEST PLOT 5 SOIL WATER CONTENT VARIABILITY. The following readings from test Plot 5 in An Giang Province, in which the farmer uses flooded management practices, shows VV Wetness Index and Moisture Percent readings for the plot.



AWD Adoption Likelihood

Results from the SAR analysis illustrate average drying trends in An Giang, Dong Thap, and Kien Giang (Figures 5 and 6). However, there are some hot spots in coastal regions such as Soc Trang, Tra Vinh, and Ben Tre. This is counterintuitive, as the household surveys, key informant interviews, and focus group discussions indicated that AWD was not often practiced in these coastal provinces.

FIGURE 5. COASTAL AVERAGE WETNESS CHANGE. The coastal pattern of higher wetness averages is illustrated below showing an overall average trend toward flooding, or a higher wetness index score.

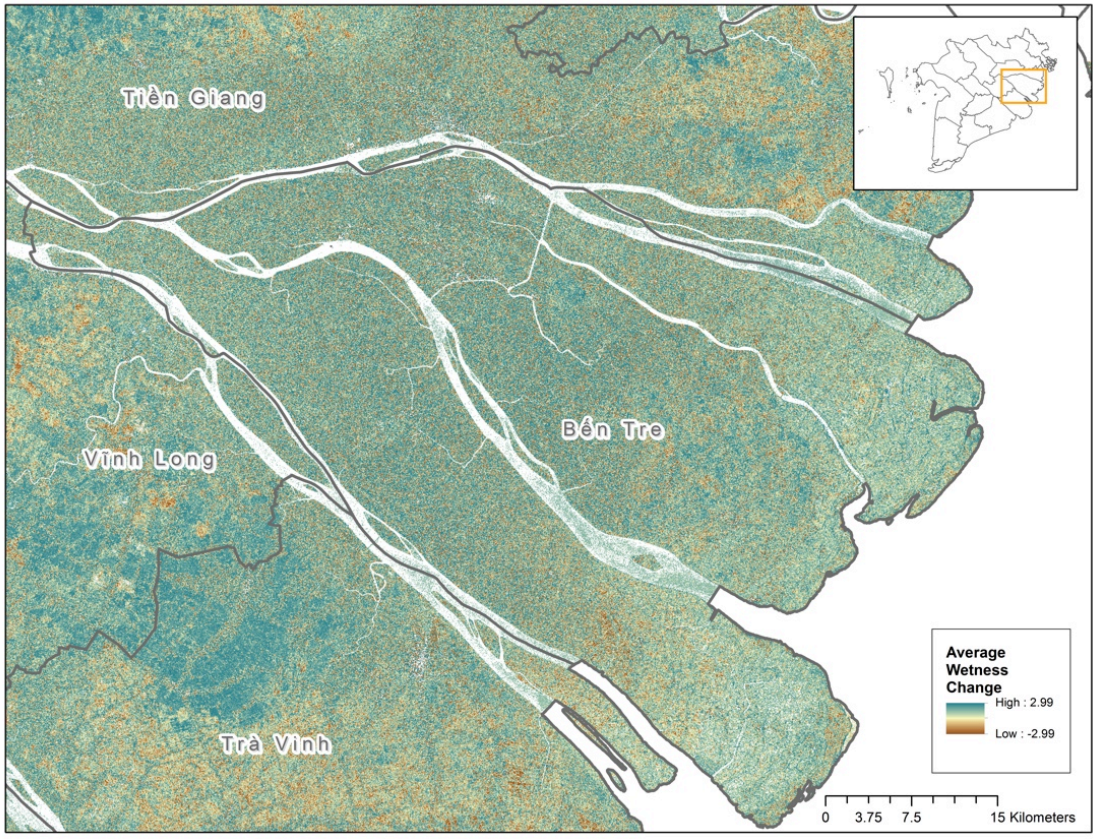
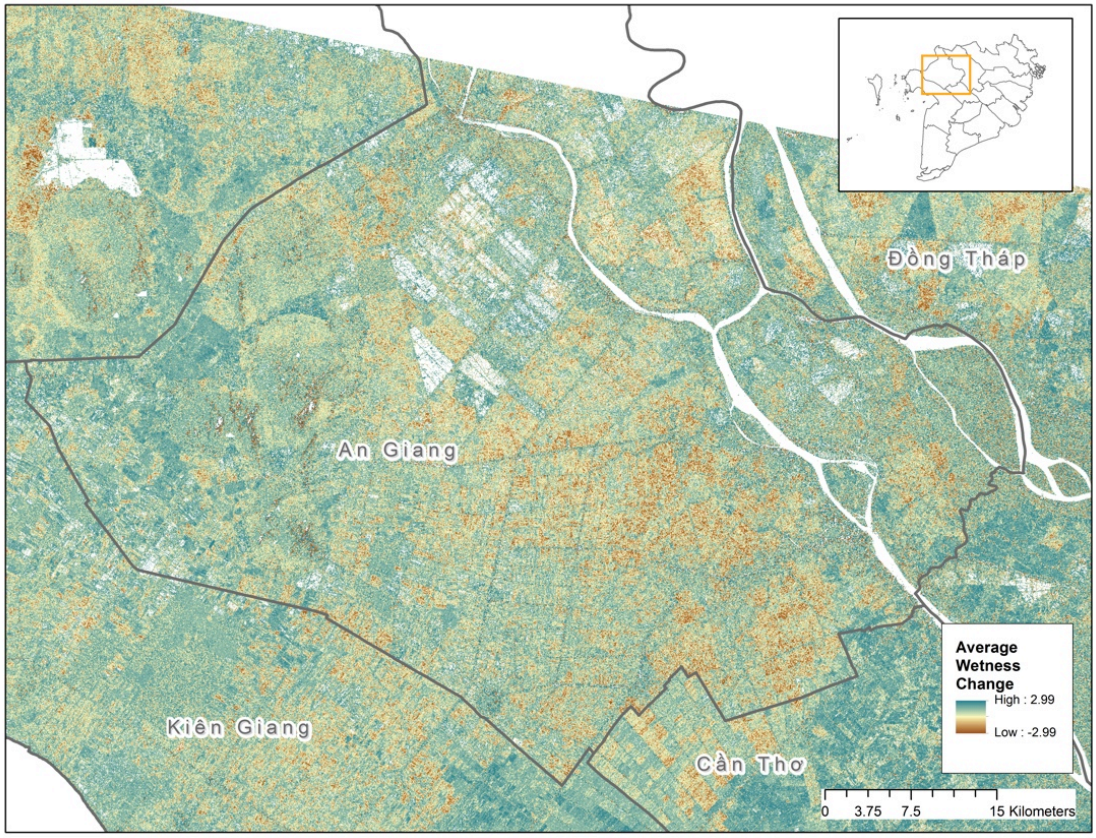


FIGURE 6. INLAND AVERAGE WETNESS CHANGE. The inland pattern of higher dryness averages is illustrated below showing an overall average trend toward drying down, or a lower wetness index score.



DISCUSSION

Results of this project are presented in three sections. First, we discuss the potential of the change detection approach in understanding regional differences in water management on the farm level. We then outline the limitations of this study and how future research could curtail these limitations and bolster the use of remotely sensed data to understand AWD adoption.

Potential of Change Detection Approach

SAR data shows promise as a tool to document adoption of water-saving practices. Results of this study support a further research and development to use remotely sensed data for documenting adoption of AWD. Specifically for alluvial soil types, as shown with the parallel patterns between the Wetness Index and in situ moisture meters, this approach shows promising links to real world conditions.

The satellite data used, Sentinel-1, had a moderately useful return time for analysis of AWD adoption in the MRD. Each satellite returns at 12-day intervals, meaning that the rate of return for the two satellites combined is every six days. While strict adherence to AWD technology would dictate that adoption means dry down of rice fields every five days, a pattern of dry down was still detectable every sixe to 12 days. Therefore, we believe that farmers are not necessarily utilizing a five-day dry down period, but perhaps a longer period of time between irrigations.

The SAR data analysis is much more cost effective than other efforts to measure the extent of AWD adoption. This research project conducted 285 household surveys in four delta provinces for approximately the same cost of developing and executing an analysis across the entire rice growing Mekong River Delta. With further development, this cost would continue to decline to near zero, using free data.

Limitations of Change Detection Approach

There are several issues with the data availability and approach discussed in this paper. Estimating AWD adoption using remotely sensed data is a complex and

nuanced issue. Not only was data availability an issue, but also the complexity of SAR data itself. We suggest two avenues for correcting data availability and data analysis issues.

Further analysis of SAR data with additional time series datasets could yield more accurate results. The GIS team originally discussed using ASTER data. The rate of return for each satellite pass-over was determined to be insufficient to detect AWD at use. Therefore, this data was not used in analysis of AWD adoption in the MRD.

To understand the sinusoidal patterns of each cell in the raster data sets, we suggest a power spectral density test. The average dry down, while a good estimate of an overall likelihood of some degree of AWD adoption, does not necessarily account for the complex periodicity of the SAR data across the delta over time. The change detection approach used for the SAR data analysis illustrates the average change over time for each cell in the tile that covers the MRD. However, a more nuanced approach would be to use a power spectral density analysis to understand the periodicity of the "dry down" signal and the power of that signal. In other words, cells with increased likelihood of exhibiting an oscillating habit (which is presumed to be the AWD signal), would score higher on the power spectral density analysis.

Second, we suggest that researchers repeat the same analysis for all three seasons of rice to increase the accuracy of the power spectral density test. While the approach was able to detect patterns of "dry down" across the delta, conclusions would create a more robust signal analysis with longer sets of continuous data. If each

growing season in a year could be analyzed continuously, especially over a series of years, this would enable detection of a more conclusive and reliable AWD signal.

Chapter 3 – From the Triple Crop Burden to Sustainable Intensification: How Gendered Livelihoods Influence Farming Practice Adoption in the Vietnamese Mekong River Delta

INTRODUCTION

The story of Vietnam's post-war rural landscape is still unfolding. Vietnam spent 25 years mired in conflict to free themselves of colonial ties, only to start a new battle: the "irrigation front" (Ehlert 2012). While American-led nation building efforts in the 1950s included a heavy focus on technology transfer and adoption (Biggs 2008), it was in the post-war period after reunification in which Vietnam built the bulk of modern irrigation and infrastructure, shifting the landscape from a traditional and flexible adaptive environment to a technologically robust and controlled deltaic system (Biggs et al. 2009). Beginning in the 1980s, a cascade of physical and social changes rippled across the Vietnamese Mekong River Delta (MRD). The canal and sluice gate system tamed the Mekong and the surrounding delta and, combined with adoption of Green Revolution philosophies of input-dependent production, allowed Vietnam to emerge as a rice production giant (Pingali and Xuan 1992). Between 1990 and 2010 Vietnam became one of the region's leading rice producers. The gross domestic product (GDP) per capita rose from $98 in 1990 to $2,052 in 2014 (World Bank 2016). Simultaneously, structural reformations in the late 1980s, known as Doi Moi, reorganized how land was distributed to individuals and privilege male ownership and inheritance (Akram-Lodhi 2005).

Farmers felt the impact of these larger environmental, economic, and social changes at the household level. The majority of farms in Vietnam consist of two or three small plots of land, totaling less than one hectare (ha). Over time, these small plots shifted to solely rice production, instead of vegetables or livestock outside the wet season (Pingali and Xuan 1992). Further, rice production is typically a man's job, leaving women with decreasing options for local agricultural labor jobs and pushing them to migrate to the city (Tacoli and Mabala 2010). Most farmers in the Mekong River Delta of Vietnam must keep pace with an increasing demand for rice, which now requires three rice crops per year, or what local experts call the triple rice crop. This primarily male burden will be referred to in this chapter as the "*triple crop burden*"[1] - the socioeconomic pressure to produce three rice crops annually. Triple rice cropping is primarily accomplished using improved seeds, fertilizers, and pesticides, which we refer to as conventional intensification (CI) in this chapter. In the late 2000s, the Ministry of Agriculture and Rural Development (MARD) began pushing a "sustainable intensification" (SI) approach, to keep steady the triple rice

[1] The phrases "triple burden" and "triple oppression" have been used in a variety of contexts to describe intersecting social burdens put upon women, women of color, queer men, and other historically marginalized groups. Within the SI debate, the "triple burden" refers to threats to food security posed by intensified agriculture including under-nutrition, malnutrition, and over-nutrition (Pretty and Bharucha 2014). In this context, it is being repurposed to describe the economic and social pressure that has manifested in a treadmill of production for Vietnamese men in the Mekong Delta. It is not to say that men are necessarily victims in this context, but that they are at the mercy of larger processes that drive production practices on their farms from a national and regional economic context.

crop while making production practices more environmentally friendly (Chi et al. 2013). Research on the gendered implications of this policy is quite new, and consists primarily of white papers and project reports.

There are three gaps in the literature on how gender influences farming practice adoption in Vietnam. First, because of Vietnam's recent success in rice production using CI methods, and the subsequent policies to reduce environmental impacts through SI practices, there are few studies outlining the current suite of CI and SI practices used by MRD farmers. Second, despite the net increase in rice farming over all other crops in the delta, there is a dearth of studies examining how variance in household livelihoods impacts gendered CI and SI practice adoption in Vietnam. Third, there is a lack of understanding in how the country's increasingly female migrant population, who sends remittances back to the farm, influences adoption of CI versus SI methods. The purpose of this research is to evaluate these three facets of the SI movement in Vietnam. We conducted gender disaggregated plot-level study in Tien Giang Province, in the heart of the triple cropping delta, using household surveys to explore gendered differences in on-farm practices. We evaluated how farmers differentially adopt SI and CI methods, how household characteristics influence male and female adoption of these practices, and to what extent remittances influence men and women's plots.

This research adopts an agroecology framework to understand gendered livelihood strategies on the farm. The discipline of agroecology analyzes the sustainability and robustness of food systems. Through altering management practices

and on-farm goals, agroecology is a distinct form of agricultural research both philosophically and materially. First, agroecology includes "facilitating" or "managing" processes rather than "controlling" them (Altieri et al. 2015; Kropff, Bouma, and Jones 2001). Second, it treats components of the system (soil, water, nutrient cycles, seed reproduction, pollinators, plant structure and function) as interrelated rather than separate, sometimes called the "environmental complex" (Gliessman 2006). Third, it accounts for complex human interactions with the food system in addition to economic viability of the farm, such as equality and fair labor practices for on-farm labor and long-term environmental impacts of production processes (Gliessman 2006; Shennan 2010; Tomich et al. 2011). To gather locally based data that links to larger geopolitical and agricultural processes, agroecology often uses the livelihoods framework, which aims to find institutional and organizational avenues to decrease poverty through access to resources (capitals) and strategies or capabilities (migration, diversification of income, etc.) (Bebbington 1999; Bury 2004; Carney et al. 1999; Scoones 1998). In agroecology, livelihood research aims to understand how populations dependent on natural resources for their livelihoods are subject to wealth inequality and that diversifying asset bundles to absorb shocks, including diversifying cropping systems or income streams, can improve household stability (Flora 2001; Nuorteva, Keskinen, and Varis 2010). In this research, we treat migration and access to markets as capabilities in this livelihood bundle, and explore the household capitals to understand gendered practice adoption.

The chapter proceeds in the following fashion. The first part of the chapter outlines the history of intensification of rice production in the Mekong River Delta of Vietnam, as well as the more recent efforts to downgrade use of inputs while sustaining yields. We also discuss how decisions to adopt more or less conventional intensification practices can be a gendered phenomenon. The second part of the chapter states the methods for data collection and analysis in this study. The third part outlines results of the household surveys and multivariate probit analysis. The fourth section discusses the implications of this research for sustainable intensification in Vietnam, gendered resource control, and female inclusion in trainings and decision-making. We conclude with several policy recommendations and future directions for research.

INTENSIFICATION AND GENDER

This section outlines the environmental and social setting that is crucial in understanding adoption of CI and SI practices. We begin by illustrating current trends in farming practice intensification in Vietnam. We then explain the MARD policy to begin reducing environmental impacts of agricultural production in the delta. Finally, we discuss the theory and current understanding of how men and women make different decisions regarding agricultural practice adoption.

Intensifying the Mekong River Delta

The Green Revolution was an international effort beginning in the 1960s to increase food security through agricultural intensification. Intensification is the

process of increasing productivity from the same unit area of land. The Green Revolution achieved intensification through three primary efforts: improved seed varieties, mechanization of labor, and chemical inputs (Rigg 1989). Irrigation was also a key component of increasing the number of crops per year. In Vietnam, the Green Revolution did not take hold as early as other countries due to the war (Ut et al. 2006). In the Mekong River Delta of Vietnam, Green Revolution practices were ubiquitously adopted, including the extensive irrigation network and improved seed varieties. Irrigation and genetically modified seeds slowly became the standard in what we conceive of as conventional intensification (CI) agriculture in this chapter, which allows three rice crops per year. The plough and combine harvester are the primary machinery used in crop production in the MRD. Chemical inputs, such as pesticides and fertilizers, become necessary in a system that is highly productive for three crops per year due to nutrient depletion and increase pest pressure.

The Green Revolution was touted as a solution to global food security issues, but criticized by many for its environmental and social costs. It has been criticized for being shortsighted and environmentally risky (Rigg 1989). With rapid urbanization and population growth, there was increased concern in the 1980s of expansion of agricultural land competing with conservation and food security efforts (Garnett and Godfray 2012). In other words, conversion of native ecosystems to agricultural land was ecologically unsustainable. These concerns have played out in many places. Globally, intensive farming practices have resulted in over application of nutrients that cause environmental damage, such as soil toxicity from nutrient pooling and

seepage, and water quality issues (Mueller et al. 2012). There are also human health impacts from pesticide application. Rice farming in particular accounts for 48 percent of cropland greenhouse gas emissions, but only 15 percent of crop kilocalories (Carlson et al. 2016). Double- and triple-mono-cropping of rice in Asia has also resulted in soil nutrient mining, increased pest problems, soil toxicity, and salinity issues (Pingali et al. 1994).

Impacts on the Mekong River Delta are extensive. Environmental and economic viability of triple rice cropping is highly questionable. Water quality in the Mekong River Delta has declined rapidly, with heavy metal, phosphorus potassium, and nitrate pollution above Vietnamese acceptable limits for surface waters (Guong and Hoa 2012). Simultaneously, available nitrogen, phosphorus, and potassium in the soil diminish as irrigation water is flushed through the system (Tran and Kajisa 2006). In addition to and because of these environmental impacts, the triple crop burden is decreasingly economically viable in the Mekong River Delta compared to a double-crop rotation (Tong 2017). A "balanced cropping" system of two rice crops and one fallow period outperforms the triple crop environmentally and economically. Further, conventional farming practices create concentrated pockets of wealth in fewer farmers' hands, creating a larger gap between rich and poor farmers in the MRD (Akram-Lodhi 2005).

Sustainable Intensification

Sustainable intensification (SI) is a philosophy conceived in the 1990s based on reducing environmental damage of agricultural production, while increasing yield without increasing the total land under production (Garnett et al. 2013; Mahon et al. 2017; Tilman et al. 2011). SI was conceived as a middle ground to take advantage of areas already in production, while looking to fulfill future food production demands. SI increases food security and minimizes environmental damage, with the goal of "environmentalizing agricultural development" (Alauddin and Quiggin 2008). SI is based on the logical progression that food production must increase in the coming decades, and that this increase must be met through intensification rather than extensification of agriculture (Garnett et al. 2013). Thus, SI has two defining characteristics. First, it focuses on production increases, rather than holistic farm-level balance (Cook et al. 2015; Mahon et al. 2017). And second, it is a goal, rather than a method of achieving sustainability, with an infinite number of production regimes and avenues available to achieve its end (Garnett et al. 2013; Pretty, Morison, and Hine 2003). For these reasons, it has been criticized for excluding social, political, and economic factors in production systems while privileging production (Mahon et al. 2016). It has also been highly criticized for ignoring the distributive issues that are often the origin to food security problems, repackaging genetically modified crops as a silver bullet for SI outcomes, and failing to fund or privilege agroecological methods to achieve SI (Cook et al. 2015). In other words, it has been coopted by the very same entrenched powers of the Green Revolution that pushed

intensification practices in the first place, such as the World Bank and United Nations branches. This case study takes a critical look at the SI policies in the MRD of Vietnam to understand the mixture of social, environmental, and economic considerations of current rice cropping guidance from the Ministry of Agriculture and Rural Development (MARD).

New efforts aim to improve the social equity and justice aspects of SI as a resilience strategy (Zimmerer, Carney, and Vanek 2015). This includes understanding the cultural and biophysical limitations facing smallholders with varying degrees of intensification and diversification on their farms. This study aims to understand the barriers to SI adoption in the MRD. Sustainably intense and diverse cropping systems, such as crop-livestock and agroforestry, create emergent properties that support soil fertility, sustained and increased yields, and pest regulation (Altieri et al. 2015). Case studies in Vietnam have shown outstanding results for combined rice-fish culture systems (Dey and Prein 2005), fruit tree intercropping, and vegetable strips on bunded fields (Pretty et al. 2003). However, the majority of the time, powerful non-government organizations as well as MARD push "diversification" practices that include purchasing more drought- or flood-resistant cultivars of rice. MARD extended the Agricultural Competitiveness Program (ACP), a World Bank program, to the Mekong River Delta in November 2012. The program promotes the slogan "1 Must Do, 5 Reductions" (1M5R) a catchy and easy way for farmers to adopt more sustainable practices. The "1 Must" promotes use of improved seeds, certified by the distributor; while the "5 Reductions" means reducing water, fertilizer, pesticides, post

harvest loss, and seed inputs. The ACP was rolled out in 2013 and adoption data indicates that 70 percent of farmers in the MRD are users (Chi et al. 2013). However, adoption is uneven across the delta and between genders. This case study looks at adoption of 1M5R through a variety of specific CI and SI practices.

Gendered Decisions

Decisions to adopt SI practices are based on access to resources and information, which is unequal between men and women. The Food and Agriculture Organization (FAO) estimates that if women had equal access to productive resources, agricultural yields would rise and there would be 100 to 150 million fewer hungry people (FAO 2011). Women are more likely to live in poverty and less likely to own land or resources, have control over production, obtain secondary school education, have institutional support, access information, maintain freedom of association, or gain positions in decision-making bodies (Alston 2013). Women's "triple burden" of child bearing, domestic care, and on-farm duties limit their ability to attend educational and trainings. 1M5R is the primary avenue through which men are gaining access to information and training. Trainings on integrated pest management (IPM), alternative wetting and drying (AWD), certified seeds, and post-harvest loss have been ongoing since 1992, when the "3 Reductions, 3 Gains" (3R3G) campaign was under way (Huelgas, Templeton, and Castanar 2008). The 3R3G campaign, 1M5R's predecessor, pushed for reductions in seeds, pesticides, and fertilizers; and gains in yield, farmers' health, and the environment. However, the

majority of trainings consisted of male farmers (Nguyen Nhat 1997). Additionally, even with the proper training, it has been shown that women often do not have the necessary time or capital to correctly implement sustainable practices (Ragasa 2014). This study looks at issues of unequal access between the sexes, and relates it to SI and CI adoption rates.

Men and women tend to use different strategies to deal with stresses on the farm, such as soil quality issues and increasing demands for productivity. Growers may intensify production, diversify cropping systems, or abandon their farming operations to seek wage labor (Munroe et al. 2013; Tscharntke et al. 2012). Case studies in South America demonstrate that women are more likely to intensify farming practices, such as mechanization and investment in tree crops, to reduce labor demands (Radel and Schmook 2008; Zimmerer 2014). Men, on the other hand, tend to perform more labor-intensive activities on the farm, or simply abandon their own land to sell their labor. However, the influence of gender on SI adoption is poorly understood in general, let alone in Vietnam. A case study in Kenya demonstrated a promising approach to evaluating gendered differences in SI adoption using a livelihood survey approach (Ndiritu, Kassie, and Shiferaw 2014). A subsequent case study in Burkina Faso demonstrated a similar approach (Theriault, Smale, and Haider 2017). This study contributes to the SI adoption literature by using this approach in Southeast Asia, as well as including "capabilities" in addition to other standard capitals included in livelihood analyses.

METHODS

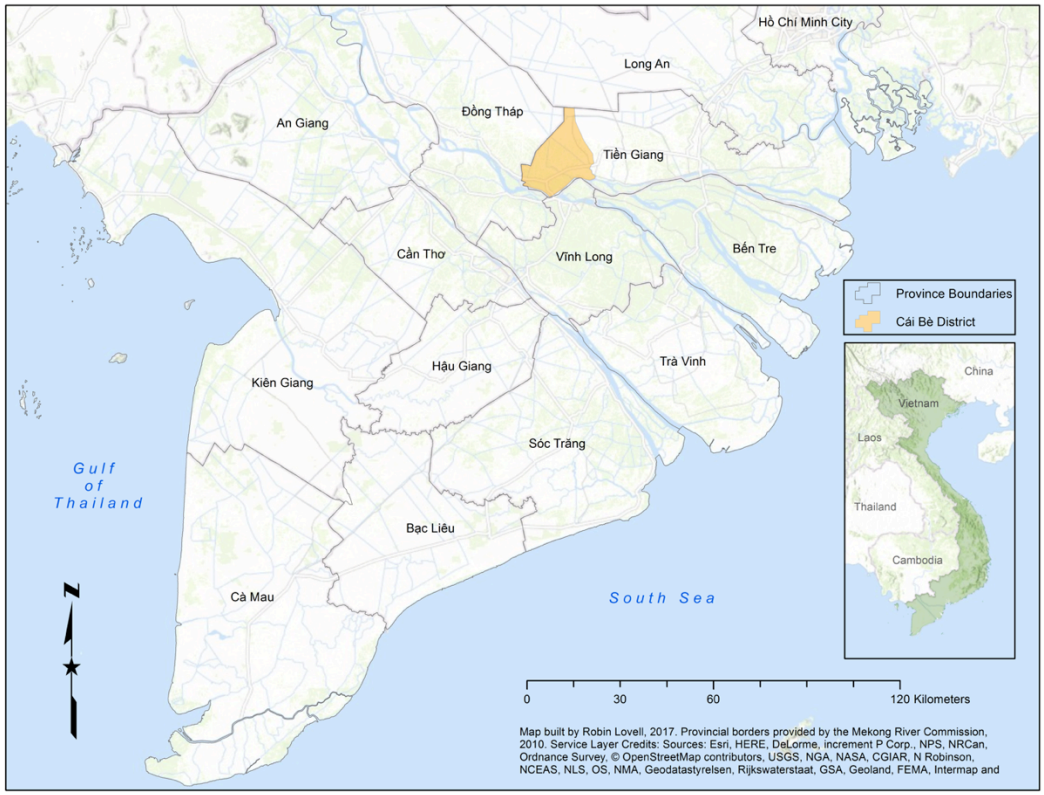
Methods for sampling, data collection, and data analysis for this project were adopted from similar case studies of intensification and gender (Kassie et al. 2015; Ndiritu et al. 2014). The study uses a household survey designed around the five "capitals," or the livelihoods approach. Surveys were chosen for this research project in order to gather quantitatively meaningful information to deduce statistical relationships between household capitals and farming practice adoption. The survey included gender-disaggregated plot-level management questions to understand production practice adoption (Ndiritu et al. 2014). The survey consisted of a structured questionnaire designed to understand how men and women manage plot-level decisions differently, including how remittances from household members that have migrated to urban areas impact agricultural practices. It also includes planned crop diversity, or number and abundance of species, gathered through observation and structured questionnaire, as is common in similar studies (Pacini et al. 2014). Each survey was given to the adult head of household, if available, or their spouse if not. The preliminary survey was pilot-tested on October 25 and November 9, 2015. After both test interviews, it was heavily edited and altered according to feedback from households and extension agents. The final surveys were eight pages, with over 350 questions, including a detailed map of the farm to illustrate resources and access to transportation infrastructure. Extension agents conducted 160 household surveys between November 10 and 13, 2015, covering 187 total plots (most households only cultivate one plot). The majority of the questions included fixed responses, while a

few open-ended questions were included to build information about types of pesticides and fertilizers, crop choices, and other such items not well known to the research team in this particular district. Again, this approach fits squarely into the livelihoods tradition of research, designed to understand how the mix of capitals in a household influence natural resource management choices. Staff at Nong Lam University in Ho Chi Minh City translated the open-ended responses.

Study Area and Sampling Strategy

As other similar farm practice adoption studies have done, we employed a multi-stage sampling protocol for choosing study farms, using purposive sampling at the Province-, District-, and hamlet-level; and proportionate random sampling at the hamlet and sub-hamlet-level (Kassie et al. 2015; Ndiritu et al. 2014) . Tien Giang was chosen for the household survey because it is within the Mekong River floodplain with a high degree of irrigation infrastructure and ample water availability, making the lands most suitable for the triple cropping system (Figure 7). Historically, they have a high proportion of triple rice cropping (Sakamoto 2009) and a pattern of seasonal and permanent out-migration (Dang 1999), making it an ideal case study illustrating the confluence of SI, gender, and mobile families.

FIGURE 7. STUDY LOCATION. The Lower Mekong Delta extends from Phnom Penh in Cambodia to the South Sea on the eastern edge of Vietnam's Macau Peninsula. The Cái Bè District is located in the westernmost portion of Tien Giang Province, shown in orange.



Two hamlets were sampled in the Cái Bè District of the Tien Giang Province. Mỹ Quới and My Phú hamlets were chosen, which are in the heart of triple rice cropping territory (Sakamoto 2009). Based on the advice of experts in the People's Committee of Mỹ Quới and My Phú, we chose sub-hamlets purposively to include the largest proportion of households that were likely to farm. We then chose eight sub-hamlets in each hamlet and surveyed households using a random proportionate approach. Each sub-hamlet consisted of 100 households at most, so this survey achieved a sampling rate of at least 20 percent of the sub-hamlet population. If a

household did not participate in farming activities, the next household was chosen on the list provided by each hamlet. Trained extension agents deployed approximately 20 surveys in each sub-hamlet, totaling 160 household surveys, with 187 total plots. Thus, the sampling strategy achieved a representative sample of the Cái Bè District of the Tien Giang Province, Vietnam.

Data Analysis

A binary logistic regression was run for each practice that achieved a 10 percent adoption rate to understand how each independent variable influenced practice adoption. Equation 1 below outlines the binary logistic regression run for each intensified and sustainable practice. The equation calculates the odds (ρ) of the predicted probability of adoption of any given practice (Υ, score of 1) over the predicted probability of non-adoption ($1-\Upsilon$) as equal to the intercept ($\mathfrak{a}$) plus the occurrence ($\mathfrak{b}$) of any given predictor variable (X_i) which in this case is represented by a number of household capitals outlined above.

Equation 1: $$\rho\left(\frac{\Upsilon}{1-\Upsilon}\right) = \mathfrak{a} + \mathfrak{b}X_i + \mathfrak{b}X_j \ldots$$

Independent variables were established using common indicators of farm and household wellbeing, based on the livelihoods approach (Pacini et al. 2014). To determine whether adoption of sustainable practices covaried, the Pearson's correlation coefficient was calculated for each pair of practices, such as intercropping and using mulch. Independent variables included material and intangible capitals maintained by each household such as natural (soil quality and plot size), financial

(income and credit access), human (education and age), social (connectivity and support), and physical capitals (assets) and capabilities (migration and access to markets). Detailed lists of questions and variables included in each capital are included in Appendix 1, Table A.

Similar to other gender-disaggregated plot-level studies, dependent variables included adoption of sustainable practices, outlined in detail below (Ndiritu et al. 2014, Kassie et al 2015). Farming practices were considered the dependent variable in the regression, broadly divided into "CI" practices and "SI" practices. CI practices included improved or genetically modified seeds, using machinery, using more fertilizer over the last year, and using more pesticides over the last year; while the model considered SI practices to include using reduced tillage, management to reduce water consumption, using organic fertilizers, or practicing integrated pest management.

RESULTS

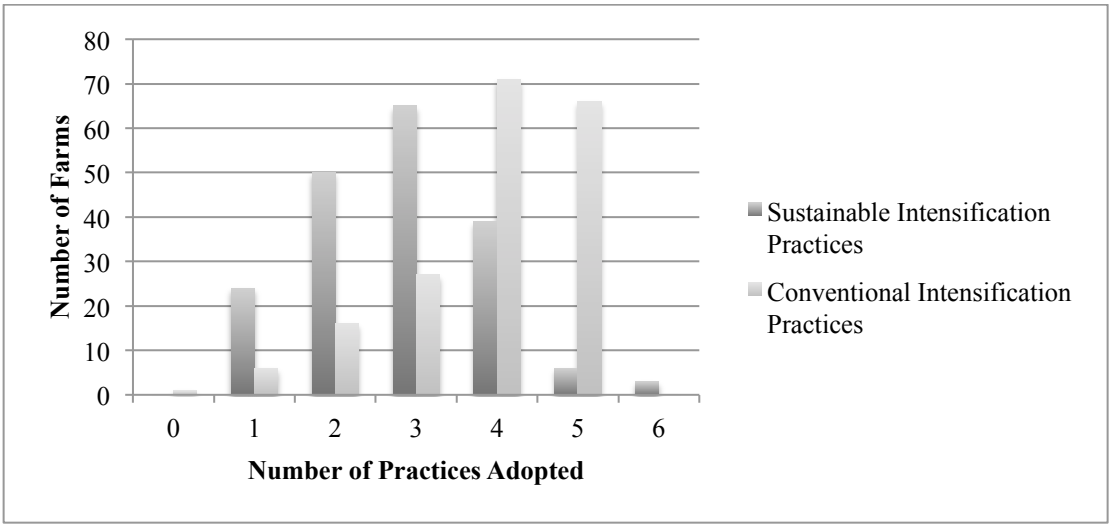
The results are broken up into three sections, mirroring the research goals. The section first discusses the overall adoption of CI and SI practices. It then reports results of the binary logistic regression analysis that aims to uncover how household capitals and capabilities are influencing CI and SI adoption.

Sustainable and Intense Practice Adoption

In Tien Giang Province, sustainable practices are less likely to be used than intensification practices. The legacy of the Green Revolution is intensification of

agriculture through improved seed varieties, fertilizers, pesticides, and machinery. Both male and female farmers are still much more likely to practice intensified agriculture than sustainable agriculture. Figure 8 illustrates adoption of sustainable practices and intensification practices. Intensification practices are highly popular among farmers. Distribution of adoption indicates that sustainable practices are half as popular as intensification practices.

FIGURE 8. PRACTICE ADOPTION. Conventional Intensification (CI) and Sustainable Intensification (SI) Practice Adoption. The number of farms from the study sample is shown on the vertical axis, while the number of CI or SI practices is show on the horizontal axis.



A snapshot of SI practice adoption illustrates that some are much more popular than others, regardless of gender (Table 2, see "Total" column). First, it is clear that in the hamlets sampled, reduced tillage and water-saving practices are widely adopted by the majority of farmers, with average adoption rates of 75 percent and 87 percent, respectively. IPM and composting or applying organic fertilizer are

less popular, with adoption rates of 60 percent and 36 percent, respectively. Finally, intercropping and using mulch are not widely adopted, with an average of 10 percent adoption, and 7, respectively. CI practices are shown to be consistently popular, with adoption rates at 60 percent or higher in the sample population. However, pesticides, herbicides, and non-plough machinery are particularly popular amongst farmers, with average adoption rates of 86 and 88 percent, respectively; while using a plough is the least popular practice at 60 percent adoption. These popularity numbers support the conclusion that CI practices, overall, are much more popular with farmers in Tien Giang Province.

TABLE 2. PERCENT ADOPTION OF PRACTICES BY PLOT MANAGEMENT. Gender disaggregated plot measurements illustrate a male bias for all practice adoption.

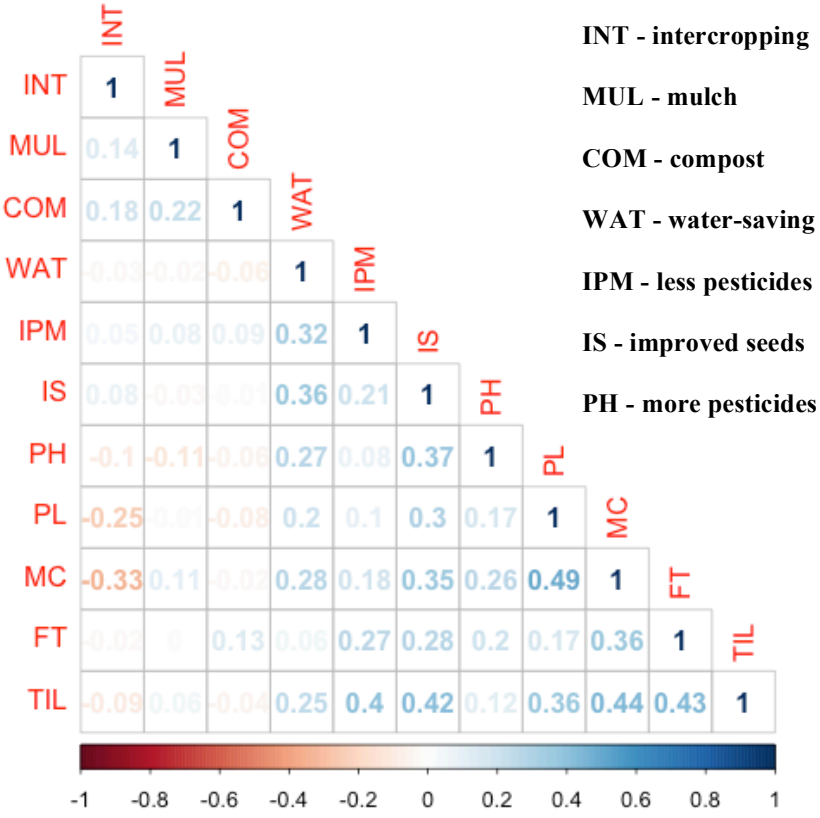
	Total n=187	Male-managed n=88	Female-managed n=45	Jointly-managed n=54
Sustainable Intensification (SI) Practices				
Intercropping	10%	11%	2%	13%
Reduced tillage	75%	82%	67%	72%
Use of water-saving practice	87%	83%	87%	94%
Mulch used in cultivation	7%	10%	2%	7%
Started using organic fertilizer/compost	36%	44%	22%	33%
Started using IPM	60%	66%	38%	70%
Conventional Intensification (CI) Practices				
Modified Seeds	79%	80%	76%	80%
Plough used in preparation	60%	64%	67%	48%
Other machinery used in cultivation	88%	89%	91%	83%
Started using more chemical fertilizer	76%	83%	73%	69%
Started using more pesticides/herbicides	86%	77%	91%	94%

Practice cluster correlations indicate relationships between the individual SI practices. Positive correlations indicate that the practices are complementary, while a negative correlation indicates that one practice may replace the other (Ndiritu et al. 2014), summarized in Figure 9. The less popular practices illustrated in Figure 9 include intercropping (INT), using compost or organic fertilizer (COM), and using mulch (MUL). Intercropping is significantly positively correlated with composting and organic fertilizer use (r=.174). Compost and organic fertilizer is significantly positively correlated with using mulch (r=.254). Composting and mulch use are primarily focused on soil quality and nutrient management. Intercropping aims to diversify a farmer's crop while also efficiently managing nutrient cycling. All three practices are linked through their common goal of recycling, reducing, and efficiently distributing nutrients. The more frequently adopted practices include reduced tillage (TIL), water-saving efforts (WAT), and integrated pest management (IPM). Reduced tillage adoption is significantly positively correlated with water-saving efforts (r=.250) and integrated pest management (r=.405). Similarly, these more popular practices are linked in theory of water, soil, and pesticide management.

CI practice correlations tell a similarly logical story, but are not correlated along popularity lines. Machinery use and plough use are negatively correlated with intercropping (r=-0.33 and r=-0.25, respectively). This indication of non-complementarity is because of the difficulty of using machinery with varying types of crops in close proximity to one another. Machinery (MC) and plough use (PL) are

highly correlated with each other, as two sides of the technology adoption coin. Improved seed use (IS) is highly correlated with reduced tillage (r=0.42) due to the necessity to use herbicides to control weeds that crop up when using reduced tillage. Improved seeds are necessary to withstand herbicide use on these fields. Reduced tillage is highly correlated with machinery use (r=0.44), as is using more chemical fertilizer (FT) (r=0.43). This result is not intuitive to agroecology principles, as reduced tillage is usually linked with reduced machinery use as well as reduced need for fertility inputs due to increased soil quality. Further research is needed to understand why the correlation exists between reduced tillage and machinery and fertilizer use.

FIGURE 9. PEARSON CORRELATION COEFFICIENTS FOR PRACTICE PAIRS. Practice pairs with higher positive (blue) correlations show complimentary relationships, while practice pairs with larger negative (red) correlations show non-complimentary relationships.



Gendered Sustainability

There are very distinct differences in technological adoption between plots on which men have decision-making power (i.e. male-managed and jointly-managed) and plots that are female-managed only (Table 2). On average, male influence increases adoption of SI practices by 15 percent. The exception is water-saving practices, where we still see the highest adoption rate of any practice (94 percent) on jointly-managed plots, but the second-highest rate (87 percent) on female-managed

plots. Conversely, some female-managed plots preferentially adopt CI practices. For example, the female-managed plots lead adoption of the plough and increasing pesticide/herbicide use. However, to understand the statistical relationship between gender, among other household parameters, and CI or SI adoption, we used a regression analysis.

A binary logistic regression was performed to ascertain the effects of the natural, financial, human, social, and physical capitals and capabilities on the likelihood that participants would adopt each SI or CI farming practice. Because so few farmers used mulch or intercropping, the regression was not run on these SI practices. We also only included results from the machinery CI practice, as results were identical for the plough CI practice and the two are very similar. Each regression illuminates distinct differences in capital influence for practice adoption (Tables 3 and 4). First, the binary logistic regression shows that gender is directly associated with sustainably intense and intense practice adoption. Male-management was associated with adoption of fertilizers and pesticides, while female plot management was associated with a decreased likelihood of adopting IPM or using organic fertilizer. Secondly, the regressions shows that capitals that men and women have differential access to influence practice adoption. For example, bad soil quality was associated with decreased likelihood of adopting reduced tillage, which was notably a bigger problem on female-managed plots.

TABLE 3. BINARY LOGISTIC REGRESSION RESULTS FOR CI PRODUCTION PRACTICES. Male management illustrates a significant effect on adoption of CI production practices.

	Chi-squared	P-value	Variance explained by model (Nagelkerke R2)	Cases classified correctly	Associations
Improved Seed Varieties Used	59.50	p < .0005	100%	100%	None
Machinery Used in Cultivation	41.79	p = .007	39%	88%	Percentage of income from the farm and improved soil quality were associated with an increased likelihood of adopting machinery.
Increased Fertilizer Use	73.18	p < .0005	49.2%	85.3%	Male management, joint management, decreased soil quality, and the household's asset score were associated with decreased likelihood of increased fertilizer use; while relatives living in the village, and livestock production were associated with an increased likelihood of increased fertilizer use.
Increased Pesticide Use	34.20	p = .047	30.4%	85.9%	Male management and joint management were associated with an increased likelihood of increasing pesticide use.

TABLE 4. BINARY LOGISTIC REGRESSION RESULTS FOR SI PRODUCTION PRACTICES. Female plot management illustrates an association with decreased adoption of organic fertilizer and IPM.

	Chi-squared	P-value	Variance explained by model (Nagelkerke R^2)	Cases classified correctly	Associations
Improved Water Management	54.43	$p <$ .0005	50.6%	90.7%	The farm's asset score and livestock production were associated with decreased likelihood of adopting water saving techniques; while distance to the market was associated with an increased likelihood of adopting water management techniques.
Organic Fertilizer	39.28	$p = .013$	26.5%	75%	*Female plot management* was associated with decreased likelihood of adopting organic fertilizer; while the farm's asset score was associated with an increased likelihood of adopting organic fertilizer.
Integrated Pest Management	43.28	$p = .004$	28.4%	71.2%	*Female plot management*, household size, and farm asset score were associated with decreased likelihood of adopting IPM; while livestock production was associated with an increased likelihood of adopting IPM.
Reduced Tillage Used	43.05	$p = .005$	31.1%	77.7%	Bad soil quality, increased household size, and access to extension training were associated with decreased likelihood of adopting

	Chi-squared	P-value	Variance explained by model (Nagelkerke R^2)	Cases classified correctly	Associations
					reduced tillage; while better soil quality was associated with an increased likelihood of adopting reduced tillage.

DISCUSSION

This section outlines the implications of this study on the future of sustainable intensification in Vietnam, as well gender equity and inclusion. We discuss the technical, financial, and environmental challenges of promoting less popular SI practices. We then discuss the feedback loop between decreased access to and control of resources, and decreased adoption of SI practices. Finally, we discuss the prospect of focusing on gender equity and inclusion in future SI outreach and trainings, as well as building capacity of female farmers to be leaders in the SI movement in the Vietnamese Mekong River Delta.

A Case for Promoting Sustainable Practices

Correlations between more and less popular sustainably intense practices make sense, given the outcomes and inputs of each. However, because intensification practices are used with twice the frequency, there is room for the sustainable practices promoted in 1M5R to take on more popularity amongst MRD farmers. What is notable is that the more popular practices are highly correlated (intercropping, using

compost or organic fertilizer, and using mulch), as are the less popular practices (reduced tillage, water-saving efforts, and integrated pest management). This correlation between practices represents a complimentary relationship.

Thus, the study supports a possible avenue for further promoting use of these less-popular practices. For example, composting methods can be integrated into mulching practices by using rice straw as a mulch (Balwinder-Singh et al. 2011) or tilling the rice straw into the soil (Kramer et al. 2002) instead of using plastic mulch to cover the soil surface. Perhaps if composting and mulching practices are combined, farmers in the MRD would be more likely to utilize these approaches for fertility management. Similarly, if intercropping with legumes (mungbeans or soybeans) can be promoted as another form of organic fertilization, farmers may be able to adopt both practices while adding cash crops and diversification to their crop portfolio (Sarkar et al. 2009). Reduced tillage can keep soil structure intact and improve water-holding capacity, which would reduce watering requirements (Chauhan, Gill, and Preston 2006). Reduced tillage often requires pesticides, which are expensive and come with environmental impacts of their own, to control for volunteer and weed species. Integrated pest management is a logical choice for farmers to reduce pesticide use and, thus, additional reduce financial resources. Water-saving practices are also positively correlated with using integrated pest management ($r=0.322$). This is a counterintuitive result, as the two practices are not necessarily a natural compliment. Water-saving practices are focused on water resources, while integrated pest management, again, is focused on reducing pesticide inputs. It should be noted

that the PPD and MARD intensely promote water-saving practices and integrated pest management under the 1M5R program, which could explain the common use of both practices together (Takayoshi et al. 2016).

Understanding Gendered Resource Control

While men may be disproportionately adopting sustainable practices, the story is not simply that men are more sustainable farmers. Socioeconomic characteristics illustrate results in line with what is expected across gender lines in the Vietnamese Mekong River Delta. Overall women have less access to and control over capitals across the sample. Human capitals, as anticipated, are significantly lower in female-headed households. The average age of female-headed households is 13 years older than men, indicating that women lead households must contend with the challenges of physical aging in addition to the challenges already facing women in smallholder agriculture (Table 5, notable results bolded). It is unclear why this age gap exists, but further research needs to be done to understand the drivers and implications of the age difference between male- and female-headed households.

TABLE 5. AVERAGE HUMAN, SOCIAL, FINANCIAL, AND PHYSICAL CAPITALS AND CAPABILITIES OF FEMALE AND MALE-HEADED HOUSEHOLDS. Female-headed households illustrate a disadvantage in accessing and controlling human capital.

	Female HH (n=29)	Male HH (n=131)
Household Characteristics (Human Capital)		
Age	**66**	**53**
Education (number of years)	**3.79**	**6.71**
Household Size (number of individuals)	4.76	4.77
Credit Constrained (trouble getting loans)	**0.24**	**0.09**
Household member works at local farm (1=yes, 0=no)	0.14	0.18
Household member has local non-farm work (1=yes, 0=no)	**0.38**	**0.50**
Kinship/Support (Social Capital)		
Membership in crop or farm support group (1=yes, 0=no)	0.00	0.03
Relative/friend in leadership position (1=yes, 0=no)	0.97	0.98
Relatives that live in village (number of individuals)	4.52	4.49
Household Resources (Financial/Physical Capital)		
Size in Hectares of whole farm (hectares)	**0.50**	**0.69**
Household Asset Score (items owned minus items rented)	8.97	9.70
Farm Asset Score (items owned minus items rented)	5.00	5.08
Produce small livestock, large livestock, or products (0=no, 1=yes, 2=more than 1)	**0.55**	**0.67**
Or you rent your land (1=own, 0=rent)	0.93	0.94
Income from plots last year (percentage)	56.28	58.18
Access to Services (Capabilities)		
Received extension training (1=yes, 0=no)	**0.21**	**0.50**
Distance to nearest market (kilometers)	1.81	1.70

Educational inequality is perhaps the most stark and telling driver of the unequal adoption of sustainable practices between men and women. The average education span of female-headed households is only 3.8 years, while for men it is 6.7

years. With twice as much education, men are better candidates for extension trainings, are more likely to adopt practices they are trained on, and are more able to utilize training effectively (Nguyen Nhat 1997). To add to this educational issue, extension trainings are crucial for shifting farming practices in the delta. In male-headed households, women often do not receive access to extension trainings because extension agents prefer to work with the household decision-makers, assume the information will be passed to other household members, or prefer to work with the land-owner rather than the plot manager (Ragasa 2014). Unfortunately, only 21 percent of women receive extension training, while 50 percent of men receive it. In other words, female-headed households are not receiving equal access to and successful inclusion in extension trainings. This is the most policy-relevant finding of this study, indicating that intense targeting of women would yield a much higher adoption rate of sustainable practices among female-headed households, which account for approximately 26 percent of MRD households overall (FAO 2002).

Results also show that women are at a disadvantage in financial and land tenure positioning. Financially speaking, 24 percent of women are credit constrained, while only nine percent of men face obstacles borrowing money for farm and household needs. Countless studies support this trend, finding that rural savings, credit, and insurance programs do not adequately account for women's social and legal status (Fletschner and Kenney 2014). This has a huge impact on farm practice choice, as it comes down to being able to purchase high quality inputs on credit for the upcoming season, without which women must make more conservative planting

choices. To amplify the effects of credit constraints, women are found to be less risk tolerant when it comes to adopting new technologies and practices (Boucher, Carter, and Guirkinger 2008; Dercon 2006; Liu 2012).

Women are disadvantaged as far as stocks of natural capital at their disposal, including overall size of their plots as well as the health of their soils. Women-headed household farms are 0.5 hectare on average, while male-headed household farms are 0.69 ha (Table 5). Similarly, female-managed plots are 0.56 ha, while male-managed plots are 0.66 ha (Table 6). This 15 to 30 percent reduction in productive land makes a difference in overall ability to produce. Further, biophysically the difference between the plot characteristics of male, female, and jointly-managed plots is that female-managed plots have a much higher frequency of "major problems" with soil health and plot productivity. This illustrates an avenue for further research, as the source and nature of these major problems is not clear from this particular survey. Major soil problems could include soil fertility and salinity issues, which are common in the MRD (Guong, Hien, and Minh 2010; Pingali et al. 1994; Tran and Kajisa 2006). Again, this having "major soil problems" was associated with decreased adoption of reduced tillage.

TABLE 6. AVERAGE PLOT CHARACTERISTICS BY PLOT MANAGEMENT (NATURAL CAPITAL). Female-managed plots are more likely to experience major soil problems than male-managed plots.

	Female Managed Plots (n=44)	Male Managed Plots (n=87)	Jointly Managed Plots (n=56)
Soil quality (1=poor, 2=average, 3=good)	2.18	2.41	2.36
Major soil problems? (yes=1, no=0)	**0.23**	**0.09**	**0.03**
Size of Plot (hectares)	**0.56**	**0.66**	**0.67**

A Case for Female Inclusion

The results of this study have several policy implications. Findings show several trends regarding this unequal adoption of 1M5R. Given the unequal participation of women in extension training and education more broadly, it would be an efficient and effective use of MARD's training budget to target female farmers for promotion of sustainable practice adoption.

Results of this study support a slightly modified policy that specifically targets women. The first policy recommendation would be to improve extension-training outreach to women. As is often effective with gendered agricultural training, extension agents in the MRD could run female-only trainings to update women on "5 reductions, 1 must do" policies. As is often effective with gendered agricultural training, extension agents in the MRD could run female-only trainings to update women on "5 reductions, 1 must do" policies. This would ensure that the female attendees feel comfortable asking questions and absorbing the information with the proper support, as women's lack of primary education is often a hindrance to the arithmetic of the trainings (Ragasa 2014).

To improve female adoption of sustainable practices, trainings must be specifically relevant to women's crops, which would be the second recommendation. Because women often grow crops other than rice, the female-only training could focus equally on sustainable rice and non-rice cropping practices (Meinzen-Dick, Quisumbing, and Behrman 2014). This would not only encourage sustainable rice production, but also diversification of crops and a specific niche for female farmers.

The third recommendation would be to convene a task force of extension agents from each province of the MRD. To implement these trainings and ensure more even adoption across the MRD, convening a task force by choosing one representative from each MRD province in the existing extension agent system could help improve adoption. The task force could devise training materials for extension agents, create pre- and post-surveys to understand how much women learn, and request feedback from women regarding more systemic obstacles to obtaining financial credit and training for the "1 Must Do, 5 Reductions" practices. Each province representative could tailor the training slightly, depending on the specific crops typically grown in each season.

CONCLUSION

The results of this study outline adoption of sustainable practices on a household and gender-disaggregated level, illustrating a tension between gender equity and sustainable farming practice adoption. Understanding adoption given existing environmental limitations and household resources builds a case that agriculture in the Vietnamese Mekong River Delta is a male-dominated landscape. This dominance can be seen as a positive trend for environmental outcomes, including reduced use of inputs as well as a more productive rice cropping system – the very definition of sustainable intensification. However, men choose sustainable practices because they have greater access to extension training, education, and credit resources. This dichotomy between men and women's opportunity and access to

resources creates an opportunity for increased gender equity in future of Vietnamese farm policies.

The currently promoted 1M5R is the primary avenue through which men are gaining access to information and training. Therefore, evidence from this study indicates that the PPD and MARD should target women for training and education so that adoption rates of sustainable practices on female-managed plots can catch up to male- and jointly-managed plots. To accomplish this, we suggest gender-separated trainings, gender-appropriate cropping practices, and building female extension agent capacity to further this effort.

More research is required to understand delta-wide trends of sustainable and intense practices. There is a need for similar studies from other southern provinces, especially those that show opposite or starkly different production regimes from Tien Giang. These future studies could build a robust case for understanding gendered impacts on sustainable practices across southern Vietnam, helping target effective extension trainings to improve sustainable practice adoption. Specifically, research must target understanding why men and women see significant differences in training, education, farm size, and seeing significant problems with soil fertility. Pilot tests of a female-focused training regime could further explore the theory of female farmer inclusion as an avenue toward higher adoption of 1M5R. By learning about the linked socio-ecological system, male and female farmers of the MRD can improve their livelihoods while maintaining environmental quality.

Chapter 4 – Fixed Genders in a Portable Family: (Re)Producing Tradition and Modernity in The Mobile Mekong Delta

INTRODUCTION

The stark contrast between city and country in the Vietnamese Mekong River Delta is increasingly unclear. As economies enter the global market, agrarian production concentrates in the hands of fewer and fewer farmers and rural-to-urban migration quickens, migration in rural families is the new normal. Mobile families further blur the social and economic boundaries of rural spaces, creating a rural base with an urban satellite member. This Portable Family can take on infinite arrangements, with weekly, monthly, seasonal, or permanent return rhythms; multiple family members joining the satellite location or just a single person braving the destination alone; and a variety of receiving spaces including other rural towns, city centers in the same region of the country, or a culturally distinct city afar. Importantly, the sex of that satellite member has dramatic impacts on how gender is produced and reproduced in this distinctly mobile Mekong Delta. Each space and place has substantive impacts on how men and women express their identity, creating a malleable concept of family dependent on the situation. We call this imaginary the Portable Family, which must be consciously constructed due to intermittent or permanent absence.

The study of how migration influences gender roles is an emerging literature in Vietnam. Women are forced to migrate because of fewer local job opportunities

and the predominantly patriarchal land tenure system, and yet remit a higher proportion of their income while simultaneously being criticized more by older men for migration work (Tacoli and Mabala 2010). However, women also assert more power in decision-making without openly confronting patriarchal norms (Thao and Agergaard 2012), using more "passive" techniques (Hoang 2011). Women take on a transitory "betweeness," with remittances as "acts of recognition" in constructed gender identities that secure their place in the family despite distance (Yeoh et al. 2013). Meanwhile, men must become childcare givers while living up to masculine social ideals (Hoang and Yeoh 2011). When men take on "social reproductive work," it challenges traditional social roles, but is relieved by women returning home often (Resurreccion and Van Khanh 2007).

There are three gaps in the gender and migration literature in Vietnam. First, these studies have almost exclusively taken place in Northern Provinces of Vietnam, which I attempt to fill by conducting this research in Ho Chi Minh City. Second, they predominantly focus on women's identity as the migrant, with few exceptions investigating men's experiences. I address men, women, and to a lesser extent children's roles in reifying or subverting tradition in the context of the modern family. Thirdly, most recent studies focus on abstract identities such as "husband" or "father," rather than how competing identities interact in a given situation or space. I use space as the primary focus in which identities compete with each other, within a body, and within a family. Because space and identity are co-implicated, choosing to work and live in separate spaces has profound impacts on gender identity, gender

relationships, and performative or lived family values. This study aims to trouble, rather than define and encode gender. I ask what identities are in contention? In which spaces are these identities in conflict? In this vein, I attempt to "trouble, rather than reinforce identity demarcations" (Valentine 2007, page 19).

This chapter adopts a Feminist Political Ecology (FPE) framework to create a grounded theory of gendered change in Vietnam. We choose FPE because it privileges gender as an axis of difference, it uncovers complexities of presumed social orders such as family and community, and it takes into account larger geopolitical processes that shape individual experiences. FPE privileges gender as the critical variable in the shifting landscape of family life because gender interacts with "class, caste, race, culture, and ethnicity to shape processes of ecological change, the struggle of men and women to sustain ecological viable livelihoods, and the prospects of any community for "sustainable development" (Rocheleau, Thomas-Slayter, and Wangari 1996, p. 4). FPE seeks to challenge conventional understandings of household as "a presumed unit of homogeneous conditions and shared interests, the household" (Rocheleau 2008), as well as similar assumptions of local or community identity. Dissecting intra-household dynamics uncovers valuable gendered experiences of difference (de Hann and Zoomers 2005). FPE also takes into account national, regional, and global processes of socioeconomic change as they impact individuals and households.

The chapter proceeds in the following fashion. The first part of this chapter describes migration trends, the competing identities of modern families, and spaces in

which they compete.[2] It outlines the major trifurcation of traditional, Socialist, and modern Vietnamese gender identities; the dominant other identities described by men and women of this study; and the spaces and places in which these identities are negotiated as part of migration. The second part describes the methods and approach taken in conducting interviews and analyzing the data. The third section discusses the results of this spatial study for the city and village, work place, public meetings, and rural and urban homes. The fourth section outlines implications of the Portable Family for the social fabric of Vietnamese society. We conclude with some potential future research directions in the area of mobile families.

THE CASE

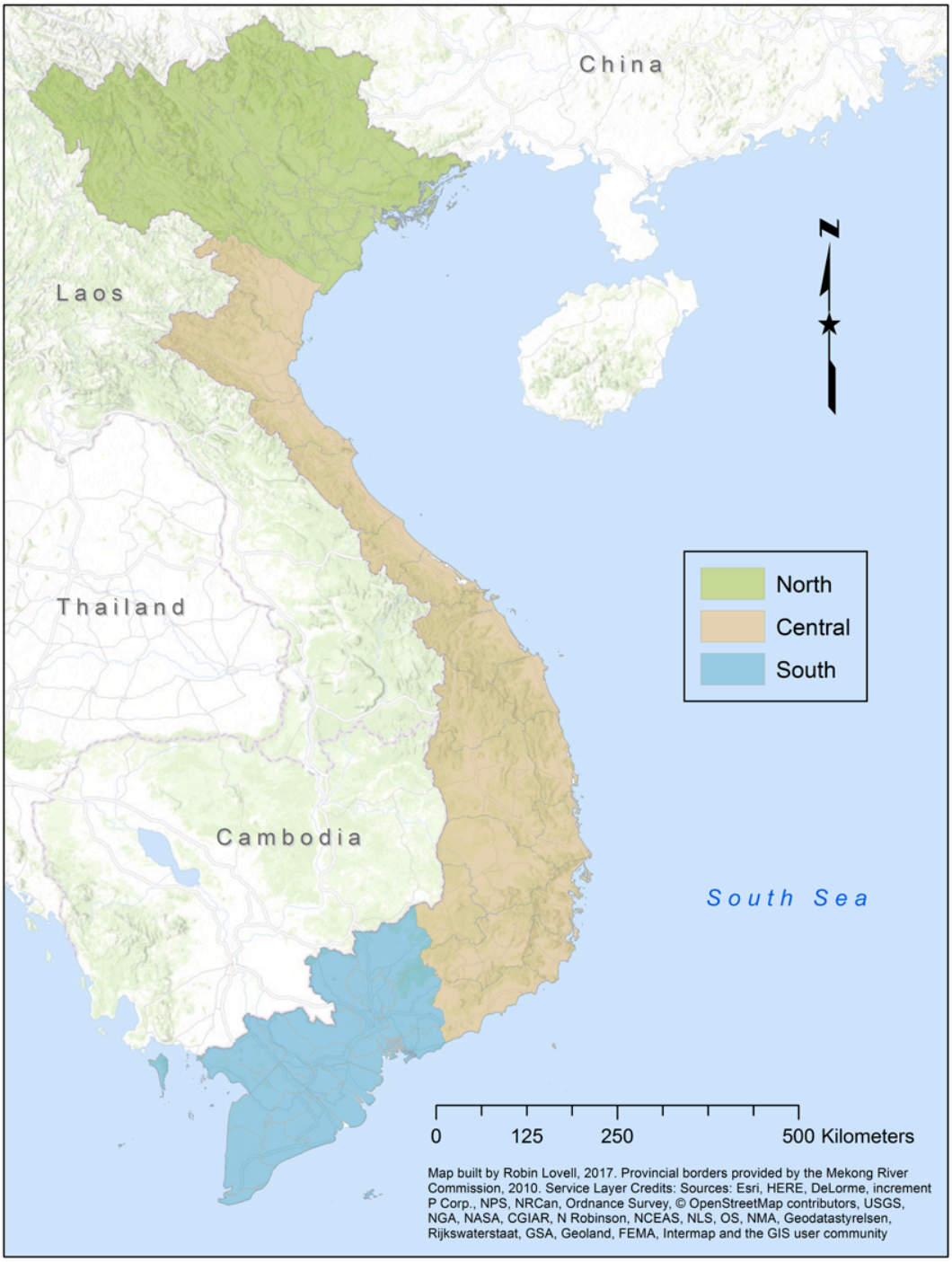
This section outlines the setting and subjects that are crucial in understanding the Portable Family. We begin by illustrating current trends in migration in Vietnam. We then explain the identities Portable Family members must negotiate, and the spaces in which these internal, familial, and community contestations occur.

[2] Guiding research questions include: A) What drives seasonal or permanent female migration to the city for work? B) What identities are in contention? C) What spaces are in contention? D) How does female migration influence "reproductive" and "productive" tasks in the sending and receiving spaces? E) How is female migration affecting concepts of traditional and modern?

Migration

The Vietnamese Mekong River Delta hosts a highly mobile population. This mobility has its roots in two distinct migration policy periods: post-reunification between 1975 and the late 1986, and 1986 to the present. Northern Vietnam's population density in 1975 was much higher than in Central and Southern Vietnam (see Figure 10) (Nguyen-Hoang and McPeak 2010). After the war ended, the government focused on redistributing this dense population by organizing rural-to-rural and urban-to-rural repatriation. Their goal was to redistribute one fifth of the Vietnamese population (Desbarats 1987). They constructed New Economic Zones (NEZs) as destination locations for the migrants, with the dual purpose of planned settlement and establishing new agricultural productive lands (Nguyen-Hoang and McPeak 2010). However, there was a mismatch between migrants' objectives and conditions in the NEZs, as well as financial roadblocks to building the public services in NEZs. Thus, organized migration slowed and was unsuccessful by 1987.

FIGURE 10. REGIONS OF VIETNAM. There are three distinct regions of Vietnam: North, Central, and South. Each region has distinct historical and cultural traditions that influence behavior in the context of migration.



The period following 1986 showed three distinctly different migration trends due to major political and economic shifts in Vietnam. The Doi Moi Policy (Chính sách Đổi Mới), translated as "Renovation," was a series of regulations passed during and after 1986 designed to create a socialist-oriented market economy in Vietnam. Doi Moi prompted numerous structural and socioeconomic shifts in Vietnam. Resolution 10 in 1988 de-collectivized large communal farms and redistributed lands to individual families, while the Land Law of 1993 made familial land tenure official, providing a certificate guaranteeing long-term rights to transfer, exchange, mortgage, lease, and inherit land (Nguyen-Hoang and McPeak 2010). These laws resulted in rural populations feeling less tied to the land (Yoko Niimi, Thai Hung Pham, and Barry Reilly 2008). Doi Moi also encouraged individual entrepreneurship, foreign direct investment (FDI), and industrials zones in lieu of government-sponsored migration (Anh et al. 2012). Finally, the policies loosened restrictions on the household registration system (hộ khẩu), allowing not only increased flexibility in destinations for migrants, but also access to services in urban centers (Nguyen-Hoang and McPeak 2010).

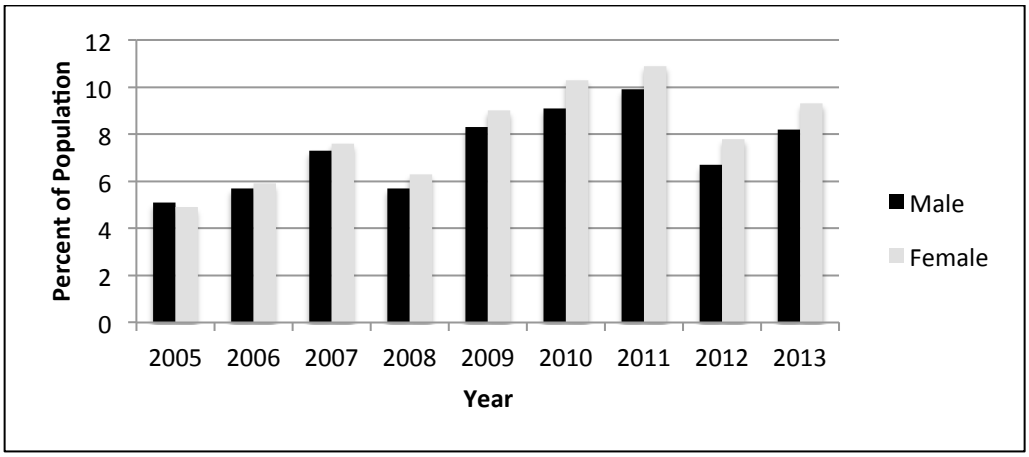
The first post-1986 trend is that migration became increasingly independent of government control. In Vietnam, there is "organized" or "spontaneous" migration, two distinct types as defined by the government (Anh et al. 2012). Organized migration is sponsored or government-controlled, and occurs in the case of loss of land, planning policies, or encouraging people to move to NEZs. Spontaneous migration is not organized by the government, but pursued by individuals. The period

between 1986 and the present shows primarily spontaneous migration (Anh et al. 2012; Déry and De 2000). While the government may not explicitly sponsor spontaneous migration, many policies since 1986 have encouraged it indirectly including the redistribution of land, decreased reliance on government subsidies for daily living, and more economic freedom for the younger generation (Nguyen-Hoang and McPeak 2010; Yoko Niimi et al. 2008). Additionally, the Vietnamese government's efforts to attract FDI have resulted in uneven pockets of wealth concentrated in city centers. Specifically, FDI in Ho Chi Minh City created inter-provincial disparities in growth, creating a "pull" effect for delta migrants who believe overall economic development means available jobs.

The second trend following Doi Moi policies is that an increasing proportion of Vietnamese internal migrants are female (see Figure 11) (Anh et al. 2012; Niimi and Reilly 2008). Along with the overall increase in rural-urban migration, beginning in 2006, female out-migration away from rural locations outpaced men (Anh et al. 2012; GSO 2015). Doi Moi pushed female farmers from the delta to the city due to the lack of local wage labor jobs and a largely patriarchal land tenure system (Goldstein, Mcnally, and Dang 1997; Tacoli and Mabala 2010; Thao 2013). Thus, families are gradually sending female members to find work in urban centers, both domestically and internationally. However, the third difference in migration trends after 1986 was that migrants increasingly favored staying in Vietnam, or internal migration, as opposed to the international trend occurring before 1986 (Déry and De

2000). Of significant importance, remittances from international sources has fallen, while remittances between provinces has risen since the 1990s (Pfau 2008).

FIGURE 11. GENDER DISAGGREGATED RURAL-URBAN MIGRATION IN VIETNAM. Noticeably, the female migrant population overtakes men between 2005 and 2006.



There are a number of motivating factors for rural-to-urban, internal, female migrants. Motivators are primarily financial, and include the anticipated increase in pay rate, the unemployment rate between provinces moving costs, public service disparities between provinces, demographic composition between provinces (Nguyen-Hoang and McPeak 2010; Yoko Niimi et al. 2008). Pay and unemployment rates are perhaps the most important motivators, regardless of actual availability of jobs in the city. Unemployment is 10 percent or under in urban areas, while it hovers around 25 percent in rural places (Yoko Niimi et al. 2008). This pushes migrants to city centers for promises of higher wages with more regular employment. Public services are also a huge draw. The Tiebout hypothesis, that people "vote with their feet" and shop around for a province that provides a high quality of public service, is a proven motivator for migration (Nguyen-Hoang and McPeak 2010). These services

include education, health care, and phone services. Often times the decision to move can be highly influenced by a perceived loss of good public services in the destination location.

Migrants face pitfalls and windfalls in their new lives in the city. The primary benefit of migration is to improve economic prospects, especially by sending remittances back home. Remittances make up between 60 and 70 percent of rural household income (Anh, Tacoli, and Thanh 2003). They can be used for paying debt, sending children to school; costs incurred by ill family members, and can reduce the need to sell paddy rice for income, increasing a family's food security. Older women tend to participate in the informal economy, hired by families or selling prepared food on the street; while younger women tend to participate in the formal economy, working in physically-demanding factory jobs that prefer to hire younger female employees (Thao and Agergaard 2012). Migrants unfortunately also face psychological, physiological, cultural, and practical challenges. City cost of living is higher, leaving the migrant family member with a meager allowance once remittances are sent (Anh et al. 2012). Cultural norms and expectations are very different than village life, with increased noise, population density, foreign influence, and a distinct lack of social support. These environmental factors take a toll on the satellite family member.

Identities and Spaces

Dominant ideologies in Vietnamese spaces underwent distinct shifts during the same time periods in which migration patterns shifted, as described above. In Southern Vietnam prior to 1975, Confucian philosophy was still the dominant ideological tradition. In this Confucian philosophy, there are three foundational concepts of community: household (nhà), country (nước), and people (thiên hạ) (Truitt 2013). The home, or household, has a particularly important history in Vietnam, invoking "a moral economy characterized by unity and solidarity" (Truitt 2013, p. 41). Regions include not only Vietnam as a whole, but also the three major geographic regions of the nation, North, Central, and South. Within each region, the village is a distinct and important geographic unit, where collective regional identity is enacted and reproduced through daily activities. These daily activities produce and reproduce personal identities, such as the "four virtues" (tu duc) traditional women must maintain: labor (cong), appearance (dung), speech (ngon) (speech), and behavior (hanh) (Binh 2004). Men must be the "pillar of the household," a role model for the children, and the breadwinner (Hoang and Yeoh 2011, p. 722). Following the end of the war in 1975, these identities and relations in space shifted.

Reunification brought a tumultuous time period for many people in Ho Chi Minh City and Southern Vietnam. Confucian philosophies were subsumed by Socialist party ideals. The People's Committee in each village and city district became the embodiment of an organized community institution, holding public meetings at which households sent a representative, usually male. Individual

identities gave way to the Socialist concept of citizen, and the home morphed into the household as a registered entity of the state, a focus of reunification efforts (Truitt 2013). In this new conception of society, women and men were meant to be equal in the home, as well as the public sphere where women were granted the right to study and seek employment (Thao and Agergaard 2012). The phrase for citizen, công dân, conveyed both an abstract version of a person without social ties, but also a contributor to the revolution (Truitt 2013). After 1975 in Southern Vietnam, citizens were assigned to a household at birth through the registration system (hộ khẩu), and allocated government resources such as education and health care. In urban areas such as Ho Chi Minh City, these resources are doled out on a tiered basis, first to urban residents and selectively to migrant populations. Because many citizens of Southern Vietnam were regarded with suspicion after the war, the household became the target of many reformist policies that punished previous capitalist endeavors or anti-Socialist activities. It was not simply the individual judged by their own actions, but the citizen connected to the historic actions of all household members.

Following Doi Moi implementation, the government shifted productive functions from society as a whole to household economies (kinh tế gia đình) (Thao and Agergaard 2012). This campaign was an effort to remove some of the capitalist undertones of shifting Vietnam to a market economy (Truitt 2013). In other words, integrating family economies with the larger economy still connoted positive socialist behavior, but encouraged individual entrepreneurship. Because of relaxed restrictions on household registration guidelines, the Doi Moi era has seen a decrease in deep

regional divides, with more cross-pollination between North, Central, and South Vietnamese populations. Urban economies were revitalized by FDI, lessening the need for government subsidies and relieving the limitations on urban migrants subject to the household registration system (Yoko Niimi et al. 2008). Families increasingly focus on providing high quality education for their children, attending *school meetings*, and migrating to urban centers to increase income for their household.

Today, as Vietnamese migrants move through a variety of spaces, several important situations and identities remain. Important locations include the *city* and *village*; the *work* place, whether formal or informal; *public meetings* and *celebrations;* and the rural and city *home*. In each space, the recent history of Vietnam demands differing social pretense and decorum. In each space, family members enact varying identities to contest or comply with tradition. There are limitless identities in a given person, but the dominant aspects of personal history that influence behaviors in migrant families include the traditions of the three primary regions of Vietnam, age, gender (including being a wife or husband), level of physical ability, parenthood, and fealty to traditional values.

Throughout recent history, the concept of family remains strong in Vietnamese society, although it has shifted in practice for the Portable Family. Absence of family members forces each person to consciously construct their household because daily practices are missing due to migration. Family is less about daily interactions in the rural home, and "...family materializes as an imagined community of emotional ties and reciprocal obligations" (Thao and Agergaard 2012,

p. 106). In this way, some believe family has been "relativized," and that women must "do family" through actions that take place at a distance and in person, periodically. The following case study explores this imagined community, and how men and women of the Vietnamese Mekong Delta do family.

DATA AND METHODS

The research team conducted interviews of spousal couples to understand how female migration impacts performance of "social reproductive work" in rural communities and in the city. As in similar studies in Vietnam, a convenience sample was used, as research was conducted out of the University of Social Sciences and Humanities in Ho Chi Minh City (Resurreccion and Van Khanh 2007). We identified local women whom had migrated to Ho Chi Minh City for work, either seasonally or permanently. Respondents self-identified as "migrants." No minimum amount of migration tenure is required to be considered a "mobile family." Nineteen total interviews were conducted in-person between January and May of 2017, 11 of which were women and eight of which were men. Interviews were then translated into English for analysis (see Table 7 for respondent characteristics).

This research used spatial intersectionality analysis, employing grounded theory to understand how identities manifest in different spaces. We used a grounded theory approach to determine a concepts, themes, and processes that pertain to the

Portable Family. Grounded theory principles[3] were used in developing codes and themes, with literature review co-occurring with interview coding in a flexible approach (Flick 2014). As the individuals give answers for each question, I will code initial transcripts to establish categories, then selectively code transcripts as I move farther into the interviews (Strauss and Corbin 1990). In this way, the research elicits a "thick description" of how constructed gender roles are being reformed in the new rural Vietnam, as well as a systematic approach to this theoretical description. As codes were established, we continued detailed memo writing to capture themes, phases, and processes (Bernard 2006). The salience and centrality of each theme was tested using Dedoose software to check for connectivity and frequency between cases. In other words, salience was measured by consistency with which the code appeared throughout all transcripts (regularity), while centrality was measured by the number of occurrences across cases (frequency).

[3] This research project attempted to comply with all principles outlined in (Flick 2014, p. 155): "1. Conduct data collection and analysis simultaneously in an iterative process. 2. Analyze actions and processes rather than themes and structure. 3. Use comparative methods. 4. Draw on data (e.g. narratives and descriptions) in service of developing new conceptual categories. 5. Develop inductive categories through systematic data analysis. 6. Emphasize theory construction rather than description or application of current theories. 7. Engage in theoretical sampling. 8. Search for variation in the studied categories or process. 9. Pursue developing a category rather than covering a specific empirical topic."

TABLE 7. RESPONDENT CHARACTERISTICS. General characteristics of each respondent in the study are shown below. Nicknames, sex, age, education in years, occupation, and the number of years the woman migrated.

Name	Sex	Age	Education	Occupation	Years Migrated
Mr. A	Male	44	16	Freelance labor	
Ms. A	Female	42	16	Worker	20
Mr. B	Male	48	9	Farming & Business	
Ms. B	Female	47	3	Business	10
Mr. C	Male	57	8	Farming	
Ms. C	Female	56	8	House Keeper	3
Mr. D	Male	57	8	Home	
Ms. D	Female	56	8	Housekeeper	3
Ms. E	Female	45	8	Business	10
Ms. F	Female	41	8	Sale Assistant	10
Ms. G	Female	30	9	Teacher	
Mr. G	Male	29	12	Aluminum Shop	
Ms. H	Female	51	12	Business	5
Ms. I	Female	50	2	Worker	8
Mr. I	Male	53	5	Lottery Ticket Sales	
Ms. J	Female	34	16	Teacher	6
Mr. J	Male	37	12	Fisher	
Ms. K	Female	30	16	Teacher	20
Mr. K	Male	34	12	Real estate business	

In addition to interview data, migration rates were obtained from the General Statistics Office of Vietnam (GSO). Net migration rates, in-migration, and out-migration were obtained by year and by province in the Mekong River Delta area (GSO 2015).

RESULTS

This section delves into the intricate display of living a Portable Family life in multiple situations. We take a spatial approach, beginning at a community scale and

narrowing inward towards the individual. The *city* and *village* represent a philosophical divide between tradition and modernity, especially as migrants enter a city in a new region of the country that does not reflect the values from which they descend. Similarly, the *work* place, whether formal or informal, in the urban center can be a setting in which many identities are muted or suppressed to fulfill the ultimate goal of migration: producing income. *Public meetings* and *celebrations* are spaces where individuals enact traditional or modern conventions in their rural home, outwardly portraying a family persona that either reflects or negates parts of their individual identities. And finally, the *rural home* and *urban home* is the primary space where negotiations between family members occur, in person and over distances via phone conversations. The dominant group of each space establishes normal behavior of a given space. The identity of particular spaces are thus "produced and stabilized through the repetition of the intersectional identities of the dominant groups that occupy them" (Valentine 2007, p. 19). The following is an analysis of how this dominance in Vietnamese society is being contested and subverted in the different settings of a Portable Family.

The City and the Village

The city and village encapsulate modernity and tradition, respectively, in Portable Family minds. This is especially true if the dominant values of the destination city contrast with the regional identity of the home village. In the city, the identity that dominates decisions among migrant populations is regional identity. For

women, this identity influences how often to return home for visits, whether or not to take children with them to migrate, and how much help they receive from home village connections in getting a job or housing. For men, regional identity influences their decision to stay back home because men are traditionally responsible for caring for elderly parents and practicing the family's worshipping ceremonies. Finally, regional identity can be shifted when men and women migrate between the city and the village, having a profound impact on perceived and practiced gender roles for both men and women.

Perceptions of other regions show up repeatedly as motivators for certain gendered behaviors. For example, women from the Central and Northern regions perceive that Southern women are less dedicated or less willing to sacrifice for the good of their children. As Ms. E puts it,

> "Northern and Central women love their children. They sacrifice to raise their children. On the other hand, Western and Southern women couldn't bear the difficulties, they will leave their children for the husband's side to bring them up. According to my hometown point of view, traditional women have to serve the husband's family and have to listen to the paternal parents."

Spending time in the city is not a guarantee that regional traditions will be lost, but many couples discussed travel as an experience that influenced their thinking about traditional male behavior. Specifically, several couples discussed how the division of childcare and chores observed in the North/Central region compared to the South is quite different. The experience of living in Ho Chi Minh City and other

Southern provinces slowly shifted those Northern/Central traditions. As Mr. K remembered,

> "During the time I lived in the dormitory with my wife, her man colleagues who were from the South were very open and friendly. They considered their wives as a treasure. They prepared meals, cleaned up the house and washed dishes for their wives without complaining. They loved their wives so much. At first, I felt strange. However, day by day, I changed my mind. Love emotions are demonstrated by actions."

Women's role in the city as a Portable Family member has also shifted because of migration, away from regionally prescribed roles and towards a new model. Ms. B explains, "It seemed that I moved from the countryside to the city, then my opinion was changed. Migration might cause [a] change [in] traditional concepts in the mind." Specifically, the city allows women to take on the breadwinning identity not previously accepted back in the village. As Ms. C describes it,

> "Modern women go out for employment, traditional women in the countryside are timid. Nowadays, travel broadens the mind. You will be ignorant about certain aspects of life if you choose to remain within your comfort zone. I am glad that I have a chance to go outside my comfort zone and learn more."

In the village, the dominant identity is the prescribed gender role and traditions of the region. Men in all regions are also bound to the land and duty to farm, regardless of how profitable or unprofitable that endeavor may be. However, regional identity has a huge impact on how much responsibility a man will take over caring for children and doing chores once his wife has left for the city. Some

husbands and wives more influenced by Southern tradition have a more equal distribution of childcare and chores. For example, Mr. A and Ms. A decided she would migrate to Ho Chi Minh City permanently rather than settling back in the Central region with her husband. He is the eldest son and felt obligated to take care of his aging parents, so traveled back to the Central region after living with his wife in the South for several years. In addition to lack of accessible jobs and a dialectic difference in his hometown, Ms. A's migration is due to the incongruent regional expectations of husbands and wives. As Mr. A explains,

> "The central people are very feudal, there are distinctions that they still hold. Men have to be the breadwinner, carry the family, and work in agriculture. Women have to stay in the house, they only walk around the house and take care of the children. In general, the traditional values are still feudal in the central. The central people hold these traditional notions very much."

These regionally distinct gender roles and traditions also influence what activities a woman will do when she returns home for a visit the village, such as chores and childcare. For example, despite his wife migrating to work in Ho Chi Minh City, Mr. B does not take on chores traditionally done by women. When asked if he cooks for his wife when he visits her in the city, Mr. B plainly states, "I am a man, I don't cook. She cooks for me and after taking the meal, I come back home." However, as Ms. J puts it,

> "The people of the South are generally… when the husband speaks, the wife listens - when the wife speaks, the husband listens… both of

> them listen. Work on the other hand… when the wife sees the hard work that the husband endures, the wife helps in anyway she can, and vice versa. But they don't… the South has a lot families that have patriarchal values, but the patriarchy is limited… and although the root of our family is from the South, our family has never upheld patriarchal roles within the family."

The Work Place

Physical ability and age are the dominant identities in the formal and informal job sector in Ho Chi Minh City. In Mr. D's case, he contracted a sudden and extreme case of heart disease that makes it impossible for him to work, even on the farm back home. Ms. D was forced to migrate to the city to pay for hospitalizations, medicine, and ongoing treatment. She therefore took up the torch of breadwinner, regardless of her gender or how difficult it is to live at a distance:

> "My family's situation is a can of worms. Now I am controlling the purse strings, and I must work to earn a living. About my husband, he quit the breadwinner's role to fight heart disease. Sometimes, you have to accept tragic fate."

In contrast to ability and age, gender determines the type of job performed by migrants in Ho Chi Minh City. Informal women's jobs include being a housekeeper or "assistant" and cooking. Formal women's jobs include sewing in a factory or selling clothes in a market or on the street. Notably, job availability in the city is considerably higher, especially when women living in rural areas compare opportunities locally to seeking work in the city. Men's informal jobs include selling

lottery tickets, while formal men's jobs include being a mechanic, construction worker, and engineer. While these jobs perhaps earn higher wages for men, the opportunity cost of leaving the family land is not always worth it for the Portable Family.

Public Meetings and Celebrations

Traditional gender roles dominate decisions of who attends and what activities are acceptable at public meetings and celebrations. Traditionally, men represent the family at public meetings, which refer to People's Committee meetings in village. Women usually represent the family at school meetings to discuss their children's progress. Similarly, at weddings, funerals, and other celebrations, women traditionally cook and make preparations; while men gather with (mostly male) guests, sit at a gender-separated table, and drink.

These situations are important in the context of migration because the Portable Family increasingly pushes traditional boundaries in public settings. For example, Mr. K explains that traditions are slowly changing during the Vietnamese New Year (Tết Nguyên Đán, often shortened to Tết) in the North, regardless of your origin. Mr. K explains traditional Northern practices and the slow shift over time, regardless of regional origin:

> "In the past, according to Northern tradition, son or the oldest son was supposed to sit on the top table in feasts or anniversary occasions. In contrast, daughters or women are forced to sit on the inferior table. Everything is better than before now. However…families remain that

> old custom in the countryside. A man sits with a man; a woman sits with a woman. They are hardly mixed. Husbands will be in charge of social relations, and wives are only the assistant. Woman prevented from being a breadwinner. Nevertheless, it is the past; the present is better. Besides, every people have their mindset regardless of Northern or Southern people."

The Rural Home

In the rural home, the dominant identities are spouse and parent, creating a distinctly *reproductive*[4] focus, for migrant wives when they return home and for husbands on a daily basis. Individual's identity as husband, wife, father, and mother are followed by regional identity and filial piety. Women return home from the city to do chores, care for their husbands, and spend time with their children. Men, traditionally do not do chores, but spend their days cultivating the family land. However, if families are from the South, have been influenced by Southern regional identity, or influenced by city living, men will participate more in chores and childcare. Further, eldest sons in the Central and Northern regions, and youngest sons in the Southern region, are expected to return home and care for their parents in their old age. This is distinctly influenced by regional traditions of the rural village, and enforced through community and extended family judgments. Mr. A explains his duty

[4] "Reproductive" in this chapter is meant to include all actions and interactions in the household that further the generation and maintenance of a family. In other words, reproductive tasks include procreation, care, and nourishment of a family unit. It includes care of spouses, children, and elders; chores; and other such non-livelihood focused tasks.

to return to his village in the Central region, leaving his wife as a permanent migrant in Ho Chi Minh City:

> "My parents were old and weak at that time, they wanted their children and grandchildren to be close. I was also the oldest, so I had to think of my parents. Because of filial piety, I had to take care of my parents at their old age, that is why I decided to go back to the countryside. I am the oldest, I bare the family, so I had to respect and care for my parents. Even sacrificing my personal affections to take care of my mother and father. That is the Vietnamese tradition, Children need to be filial to their parents and take care of them when they are old and weak."

The influence of Doi Moi policies in shifting societal and community foci to the family and individual is an internalized value displayed by migrant families. For example, Mr. and Ms. A encounter judgment from people in their village about Ms. A migrating to Ho Chi Minh City for work. However, while this judgment saddens her, she chooses to focus on her family and seeks support from her husband in lieu of support from village and family members. Ms. A defends her decision to migrate and become the breadwinner in the city:

> "Yes, there are a lot of people who complain about me, I get sad when I hear it. But my husband and I understand each other, even if we do not say anything…It doesn't matter who says anything, he still understands. We worry about supporting each other, whatever I do I just keep working and worry about myself. Many people know that. My mother-in-law also urges me to come home because she hears a lot of talk around the village."

Urban Home

The women who migrate to become breadwinners dominate the urban home, creating a distinctly *productive*[5] focus. All identities other than breadwinner are subsumed in the migrant's daily grind, which is both the source of an incredible amount of loneliness and where refuge from this loneliness is found for these women. There is little leisure time, time spent socializing, or reward in the present for their sacrifice. As Ms. A explains, "…I am here working to provide for my husband and children, I am not doing anything else fun or playful, I just work day and night." This lifestyle has impacts on the migrants' happiness, particularly when the daily actions of a productive lifestyle grind to a halt. Ms. A feels as many in the study do,

> "I get really sad being far from my husband because I have no one there to share my thoughts and feelings with. There are many times when my body and soul are tired, but I have no one to take care of me. I am always alone, I have no one close near me, my children are far, no one wants that. Especially not being with my children and teaching/being there for them. But I still encourage myself to stay for a couple of years for my husband and children" Ms. A

Motherhood and familial duty is cited as the reason for migration, acting as the background motivator in the mission for economic productivity. Especially for new migrants, the motivation of providing a good life for their children is a token of

[5] "Productive" is meant to include economically or livelihood-focused tasks, such as producing capital for use by a family unit. It excludes care of spouses, children, and elders; chores; and other such non-livelihood focused tasks.

comfort when the breadwinner identity fades at night and they experience intense sadness. Ms. C explains:

> "Sometimes, I burst into tears when I think about my family and our situation. My first year on the job turned out to be a lot of tears. However, day by day, I get used to my circumstance. I do miss my husband, but I have to move on."

DISCUSSION

As the social, environmental, and economic setting in the Mekong River Delta has changed, so have people's mobility and behavior. Technology has shifted how agricultural production is practiced, requiring less human labor (Thanh, Hossain, and Ut 2002); and the privatization of land has created pockets of wealth and land concentrated in fewer farmer's hands (Akram-Lodhi 2005). Many of the men and women in this study sited these overall shifts in the rural economy as the reason for migration, and claimed that this mobility has an impact on family and individual values. As Mr. C explains it,

> "Now, the world is mechanized. Farming in the fields now is different from the past. It's unnecessary to have so many workers as before. Moreover, the farming fields are fewer compared to the past. Therefore, the farmers have less work to do than in the past. Some of them have to move to the city to have a job. As a result, the families now are changing."

This section outlines the implications of this study on tradition and modernity, as well as family values. We discuss the challenges, both socially and economically, brought by fealty to tradition or modernity. We then discuss the themes of the Portable Family, regardless of how tradition or modern the men and women of that family perceive themselves.

Modernity and Tradition

This study brings to light many changes in Vietnamese families as women migrate to the city for work. Table 8 illustrates some of the impressions and characterizations of identities between more "traditional" and "modern" families. Some aspects of traditional or Portable Family men, women, children, and marriage are perceived as good or bad, depending on the self-identification of the respondent. In other words, those who identify as traditional tend to find moral ills concentrated in the city. Those who identify as modern see progress and development in modern family arrangements.

TABLE 8. TRADITIONAL AND MODERN FAMILY TRAITS. [6] Self-identified "modern" and "traditional" families described traits of their own and other family identities.

	Traditional Family	Modern Family
Woman	Gentle way of talking	Self expression
	Mild ton	Straight forward
	Kind	Works for a living
	Cooks for family	Independent
	Stays inside	Indulges in enjoying life too much
		Career-focused
		Mobile
		Brave
Man	Breadwinner	Knows how to do housework
	Handles important matters	Doesn't force his wife to stay home
	Carries burdens	Shares responsibilities
	Pillar or "backbone" of the family	Respects his wife
	Strict	Doesn't condescend to his wife
	Takes control	
Children	Make good friends	Economic freedom
	Love their parents	Good steady jobs
	Take care of their father	Dye their hair
		Have tattoos
		Use drugs and drink beer
		Use the internet too much
Marriage	Soft spoken to each other	"Not very fond and faded"
	Do not yell	"Blurred"
		"Sentiment is less deep"

There is a general perception amongst self-identified traditional men and women that modernity, exemplified in city living, is bad. Many men and women who consider themselves traditional bemoaned the negative impacts of migration and the city on family values. While most women in the study were staunch in their decision to migrate, some were bitter about the amount of work required to maintain their

[6] If traits were only mentioned once in the sample group, they are quoted. If traits were mentioned more than once in the sample, they are non-quoted.

lives, especially compared to how much their husbands worked. For example, Ms. B says, “I am unfortunate to marry a husband that is lazy, easy to discourage and he doesn’t try to work. I have done everything by myself.” This comment is said in absence of a breadwinning husband, which is often equated with masculinity and power (Hoang and Yeoh 2011). While Ms. B actively produces capital for her family, it is clearly in opposition to her personal traditional values.

Similarly, traditional men cited city living as the impetus for negative behavior in women and children. Mr. C, a traditional man, explains, “They come to the city so they are infected by multi-culture there, including bad habits in the city. They are no longer honest. Some fall into social evils.” Children die their hair, drink beer, and use the Internet too much. Women are outspoken, brash, and bold. He adds that the impact of a market economy has the effect of reducing the amount of time parents spend with their children, limiting their authority and furthering the disintegration of the traditional family.

In contrast, the perception within families that self-identified as modern, staying traditional is sometimes perceived as a drawback. A similar study that found women’s participation in the market economy weakens men’s patriarchal dominance in the household (Hoang and Yeoh 2011). Further, respondents in this study explained that patriarchal norms, including keeping your wife in the home, become oppressive and decrease family wellbeing in the quickly changing Vietnamese Mekong Delta. Ms. A describes a mutual friend couple of her and her husband. This

family does not embrace modern family life as Mr. and Ms. A do, which results in turmoil for the family. She explains,

> "My friend who is the same age as me from the same hometown, but her husband is not as good as my husband. Her husband is still very traditional (antiquated). Not everyone is like my husband. Her husband is old in his ways and patriarchal so it is hard for their family."

The Portable Family

Three themes emerge in the Portable Family. The first is the incredible level of *respect* for spouse. The second is a strong theme of *enduring* almost ubiquitously expressed through each interview. And finally, individuals and families *embrace change* in different ways, whether they perceive themselves as traditional or modern. These themes solidify an imaginary, an intangible concept of Portable Family that must be lived through action, rather than interaction. Because family members are separated by distance, respect, enduring, and embracing change are the qualities that unite Portable Families regardless of tradition or modernity.

Unique to this study, we find that husbands and wives expressed respect for one another in specific and general ways, directly and indirectly. It primarily takes the form of acknowledgment of their spouse's hard work and sacrifice. There is confirmation from several of the men and women that the societal change felt by all of Vietnam has resulted in higher equity between husbands and wives. As Mr. D put it, "Men and women now respect each other. Men are not condescending like before.

Society has become better. Everything has developed and advanced." Respect, as a tenet of the Portable Family, helps bridge the distance and provides comfort for husbands and wives as they struggle to endure.

The second unique finding is that the men and women in this study express strong personal dedication to enduring and sacrifice as members of the Portable Family unit. This is particularly felt by migrant wives, who do not necessarily have the social network they do back in the village. However, husbands and children also experience this sacrifice, and must endure as their wife or mother works and lives in the city. The family endures for the sake of the children, to demonstrate how to be "self-made," as Mr. A puts it. They endure for the sake of their family's health, wellbeing, and future prospects. In Ms. D's words, "Sometimes, at night, thinking about him makes me burst into tears. I give all my love to him, and I wish my other half will be alright." Each member of the Portable Family, living geographically distinct lives, galvanizes this sacrifice day in and day out over years of separation and enduring.

Portable families are embracing change through migration. While it is not always intentional, change is often inevitable as the result of privileging economic and educational goals above traditional gender roles. As in a similar study in Thai Binh Province, men increasingly take on chores and childcare when women are absent (Hoang and Yeoh 2011). Depending on how young the children are, men take on tasks such as cooking, bathing, transporting them to school, and even attending school meetings for their children. When men take on this "social reproductive

work," it challenges traditional social roles, only relieved by women returning home when they visit. Some families confront tradition intentionally, however, and see it as a spousal strength in the context of modern Vietnam. Contesting convention often follows traveling and exploring traditions outside one's region, as discussed above. As Mr. A explains,

> "Plus we share and exchange thoughts and feelings with each other…She also understands me, and does not hold traditional concepts. Now we want to take care of our children, live soundly and peacefully. Happiness is when two people have their own shared responsibilities, not when they are distinguished between men and women. I have experienced a lot, I have gone through so much, so that is why I know to think this way."

Other Portable Families are remaining loyal to tradition even in the midst of migration. Despite women participating in daily actions that force them to become the breadwinner, contradicting tradition, women's internal lived experience remains conventional and is reinforced upon returning home. In other words, while their actions may be modern, in their hearts they are traditional Vietnamese women. They may live in the city, but they do not indulge in fun activities when they are not on the job. Similar to a study done in the Red River Delta, when they return home they cook for the celebrations and ceremonies, care for children, and are obedient to their husbands (Resurreccion and Van Khanh 2007). By returning to their traditional role when they return to their rural home, Portable Families experience a temporary coping with change and reproducing their traditional values. For example, Ms. A expresses this dichotomy:

> "I still keep the characteristic/roles of a traditional woman. I still care for my husband and children, I only worry about working for my family. But I do have differences from the traditional woman because I go out and work, make money, and help my husband with the family economy."

CONCLUSION

This study takes a spatial intersectionality approach to understanding how identities interact in the various spaces encountered by the Portable Family. The city and village, rural and urban homes, public meetings and celebrations, and the work place maintain dominant rules and identities that take precedence over other internally experienced individual identities. Thus, Portable Families are both challenging and reproducing tradition depending on the dominant identity of the space in which they act. Each member of these families demonstrates respect, embraces change, and shows endurance during extended and sometimes permanent migration patterns.

Appendices/Supplemental Files

TABLE 9. VARIABLES ASSESSED IN HOUSEHOLD SURVEY. The following factors were used to assess each of the capitals and capabilities outlined in Chapter 3.

Capitals and Capabilities	Variables Included
Natural Capital	Land ownership, soil quality (self-reported), plot size (self-reported)
Financial Capital	Percentage of income from farm, credit constraints, off-farm local income
Human Capital	Age, education, household size
Social Capital	Related to hamlet leader, relatives in hamlet,
Physical Capital	Household assets, farm assets, livestock production
Capabilities	Migration income, distance to market, extension training access/frequency

Sustainable Intensification Practices	Questions Asked
Intercropping	Do you plant more than one crop within one field?
Reduced tillage	Do you reduce the number of passes with a plow or other machinery?
Use of water-saving practice	Water-saving practices included the use of alternative wetting and drying; check damn and ditches; or other water conveyance to pool and save water
Mulch used in cultivation	Do you use mulch?
Started using organic fertilizer/compost	In the past year, have you started using more organic fertilizer or compost?
Started using integrated pest management	In the past year, have you started using integrated pest management?

Conventional Intensification Practices	Questions Asked
Modified/certified seeds	Do you use high yielding, short-day, long-day, drought tolerant, submergence-tolerant, salt-tolerant or pest-resistant varieties?
Plough used in preparation	Is a plow used during cultivation?
Machinery used in preparation	Is other machinery used during cultivation?

Started using more chemical fertilizer	In the past year, did you start using more fertilizer?
Started using more pesticides/herbicides	In the past year, did you start using more pesticides or herbicides?

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