The agrarian transition in Mainland Southeast Asia: Changes in rice farming—1995 to 2018

The agrarian transition in Mainland Southeast Asia (MSEA): Changes in rice farming—1995 to 2018

• Globally, rice is one of the most widely harvested and nutritionally important food sources
• Accounts for 20% of world’s calorie supply; has been called ‘the most important food crop’
• Farmers in Cambodia, Laos, Myanmar, Thailand, and Vietnam grow rice or more land than any other crop
• Vietnam and Thailand are the top two rice exporters in the world.
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• Rural population (% of total population and % of agricultural employment) decreased by approximately 13 and 19% respectively.

• The value of agricultural production (% of GDP) decreased at rates varying between 10 and 28% with the exception of Thailand, which saw a 1.4% increase.

• Rice production per hectare increased by an average of 205%.

• The average size of farms decreased to approximately 2 ha, and the average age of farmers increased to over 50 years.

• These statistics raise one of the most interesting questions about land-use change in MSEA: How did fewer, older farmers with smaller farms increase total rice production?
Objectives

• This project seeks to monitor long-term changes and spatial variability of rice production systems, and identify variables highly correlated with these changes (socioeconomic, demographic, environmental, climatic, technological).

• Objectives will be realized regional and local scales across the major rice growing areas of four MSEA countries (a total of six rice growing regions) between 1995 and 2018.

• The four countries and six regions include:
  • 1) Vietnam (Red River and Mekong River Deltas),
  • 2) Thailand (Northeast and Central Regions),
  • 3) Laos (Savannakhet Province), and
  • 4) Cambodia (Battambang Province)
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• Integrate land-use dynamics with census and other spatially-explicit data to quantify how changing conditions are associated with changes in rice production systems.
• Identify a sample of sites in each of the six regions that have shown substantial changes in their rice production for more intensive study.
1. Intensive rice growing region: Mekong Delta.

Development and expanded adoption of irrigation infrastructure

**Technology**: Mechanized planting and harvesting starting in the 1990s

**Cropping frequency**: Expansion of double and cropping through the 1990s, followed by triple cropping around 2007.

**Land use pattern**
- More spatially uniform pattern of field preparation and harvesting
- Aggregation of individual plots into larger fields (> 0.5 ha), especially before 2000

Mekong Delta, Vietnam
2. **Major rice growing region with growing industrialization and urbanization: Central Thailand and Red River Delta, Vietnam**

**Irrigation**  
- Systems built before 1995; failing in areas undergoing rapid industrialization

**Technology**  
- Broadcasting rather than transplanting beginning in the 1980s (Central Plains) and 2000s (RRD)  
- Mechanized harvesting beginning in the 1990s (Central Plains) and 2000s (RRD)

**Land use pattern**  
- In 2000s Vietnam government begins to facilitate land consolidation (RRD)

**Diversification**: Increased diversification of crops from rice to orchards and ornamental crops (RRD)

**Urbanization/periurbanization**  
- Extensive urbanization and periurbanization  
- Establishment of industrial parks

**Labor**: Becoming scarce and cost rising
3. Rainfed and irrigated rice growing region with limited urbanization: Northeast Thailand; Battambang, Cambodia; Savannakhet, Laos

**Rainfed**: Mainly rainfed with some irrigation but irrigation beginning to become more common after 2000

**Technology**
- Direct seeding beginning in the 2000s (NE Thailand) and today (Laos and Cambodia)
- Mechanized harvesting beginning in the 2010s (NE Thailand) and 2010 (Laos and Cambodia)

**Land use pattern**
- Increase in the number of far ponds
- More spatially uniform fields
- Beginning to consolidate plots

**Diversification**: Increased diversification of crops from rice to sugarcane, cassava, watermelon, rubber, etc.

**Urbanization**: Establishment of industrial zones as early as 2000 (NE Thailand) and today (Laos and Cambodia)

**Labor**: Becoming scarce and cost rising
Identification of annual rice cropping cycles

A) Mekong Delta (intensive rice growing region)
   -> change from double to triple cropping

A) Central Thailand and Red River Delta (major rice growing regions with industrialization and urbanization)
   -> example from Red River Delta with diverse land use (1, 2, or 3 crops per year, aquaculture)
   -> example from Central Thailand (2 crops per year)

A) Northeast Thailand, Battambang (Cambodia), Savannakhet (Laos): Mainly rainfed rice, sometimes with irrigation
   -> example from Battambang with one rainfed crop per year
Mekong Delta, Vietnam

Feb 14, 2017 - approaching peak greenness
November 29, 2007 - yellow crop / harvesting period

Change from double to triple cropping around 2007
10-year period from 1997-2007: 2 crops per year
1) Feb 01, 2011 - peak greenness

2) Feb 21, 2014 - peak greenness

3) Sep 06, 2015 - bare plot

4) Jan 09, 2017 - greening of crop
10-year period from 2008-2018: 3 crops per year
1 crop per year, afterwards flooded for aquaculture
2 crops per year, fallow after 2\textsuperscript{nd} crop visible as small peak
3 crops per year - 3 peaks per year, but data gaps in 2012
Taluk, Central Thailand
2 crops per year - 3 peaks in 2015 (not captured by the model)
Muay Yeut, Battambang Province, Cambodia
1 crop per year, slight increase in greenness due to change in land management practices (?)
Work to Finish

• Build comprehensive multi-resolution database of LCLUC between 1995 and 2018 of 6 study basin.
• Conduct approximately 300 interviews per study basin (summer 2019).
• Integrate LCLUC data with socioeconomic data and determine relationships between LCLUC and socioeconomic variables.
• Write papers explore implications of these results for the future of agriculture change in Mainland Southeast Asia.
Thank you