

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

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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 on more land than any other crop
- Vietnam and Thailand are the top two rice exporters in the world.

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

- 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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- Build a multi-sensor satellite image-derived database between 1995–2018.
- 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



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



Central Plains, Plows

3. Rainfed and irrigated rice growing region with limited urbanization: Northeast Thailand; Battambang, Cambodia; Savannakhet, Laos

Raidfed: 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)

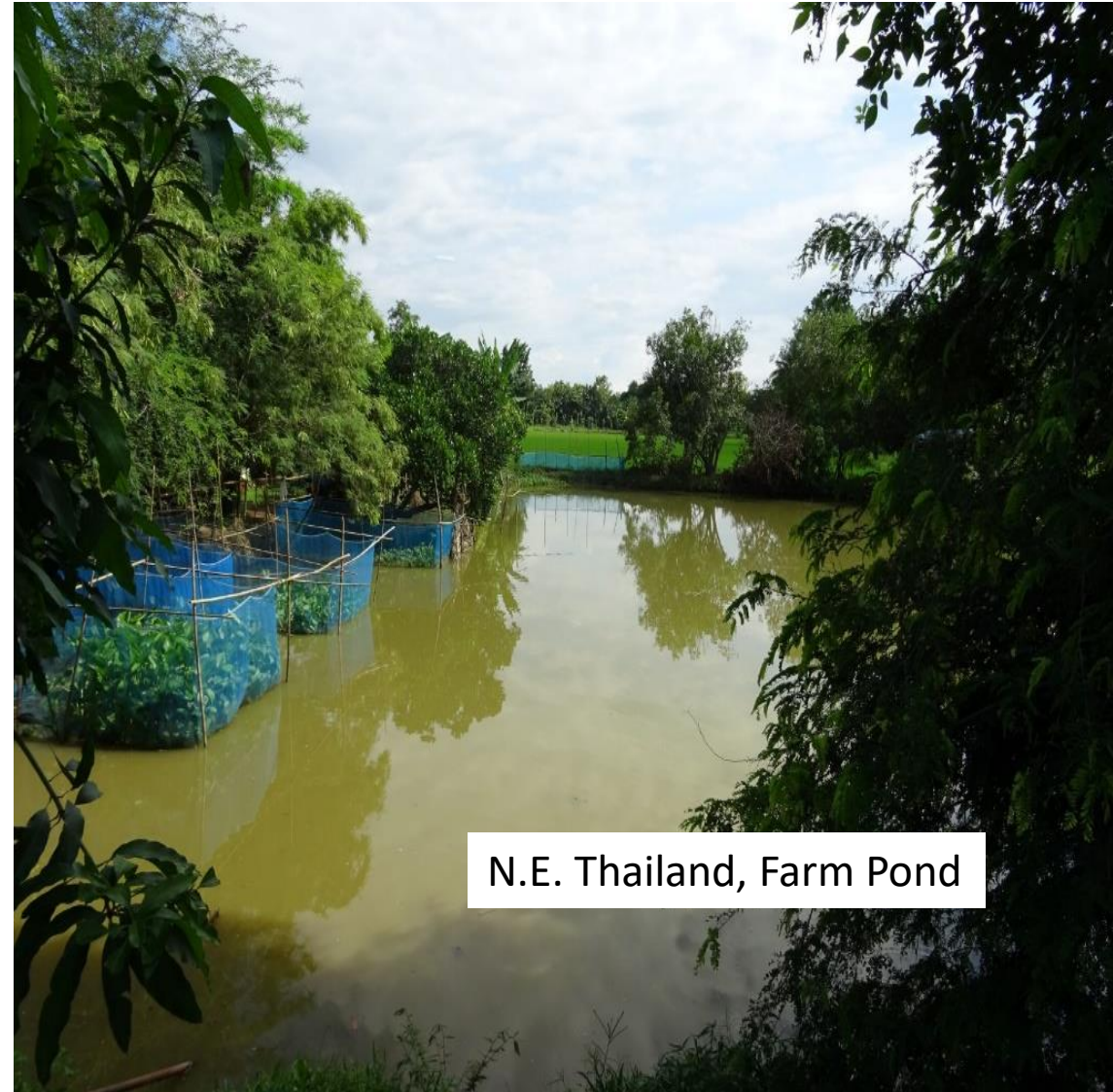
Land use pattern

- 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



N.E. Thailand, Farm Pond

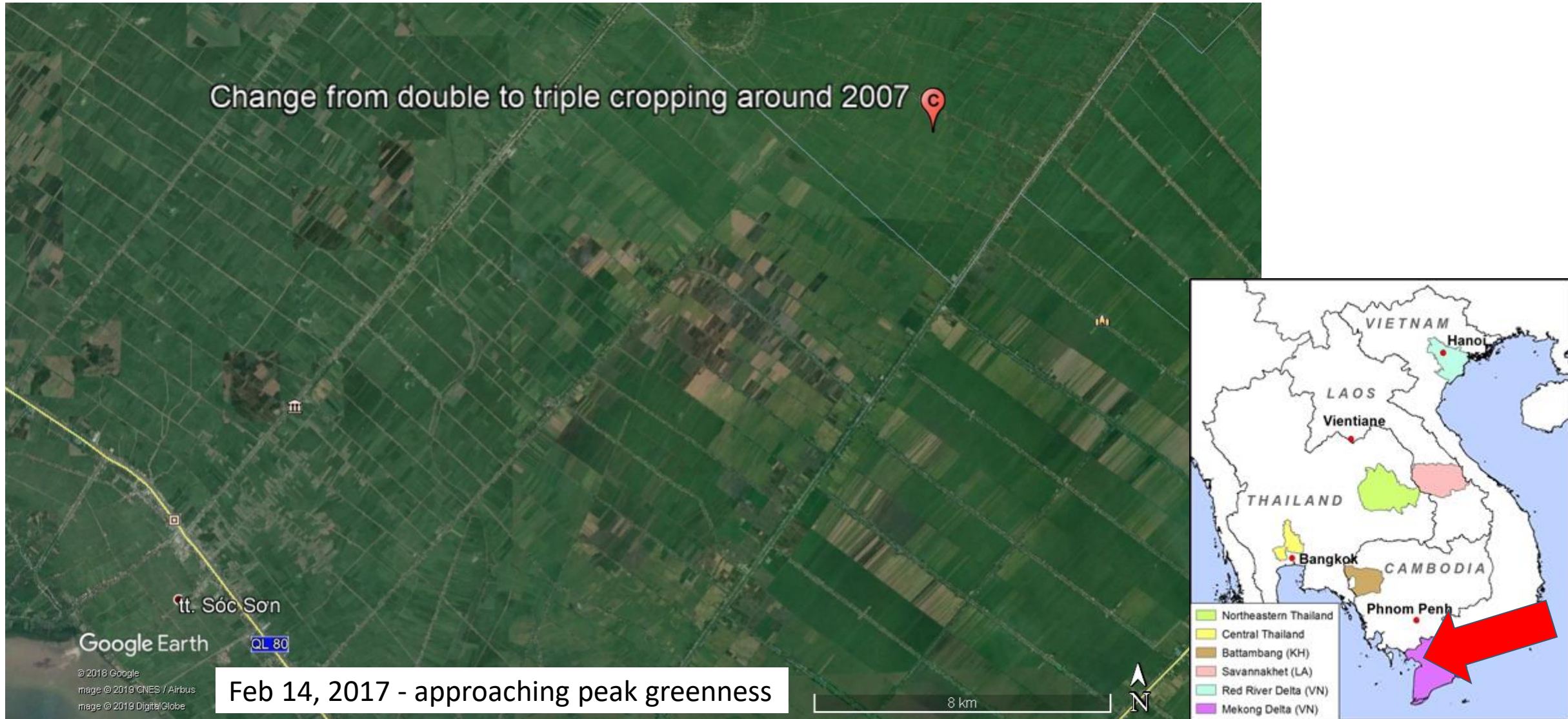
Identification of annual rice cropping cycles

- 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

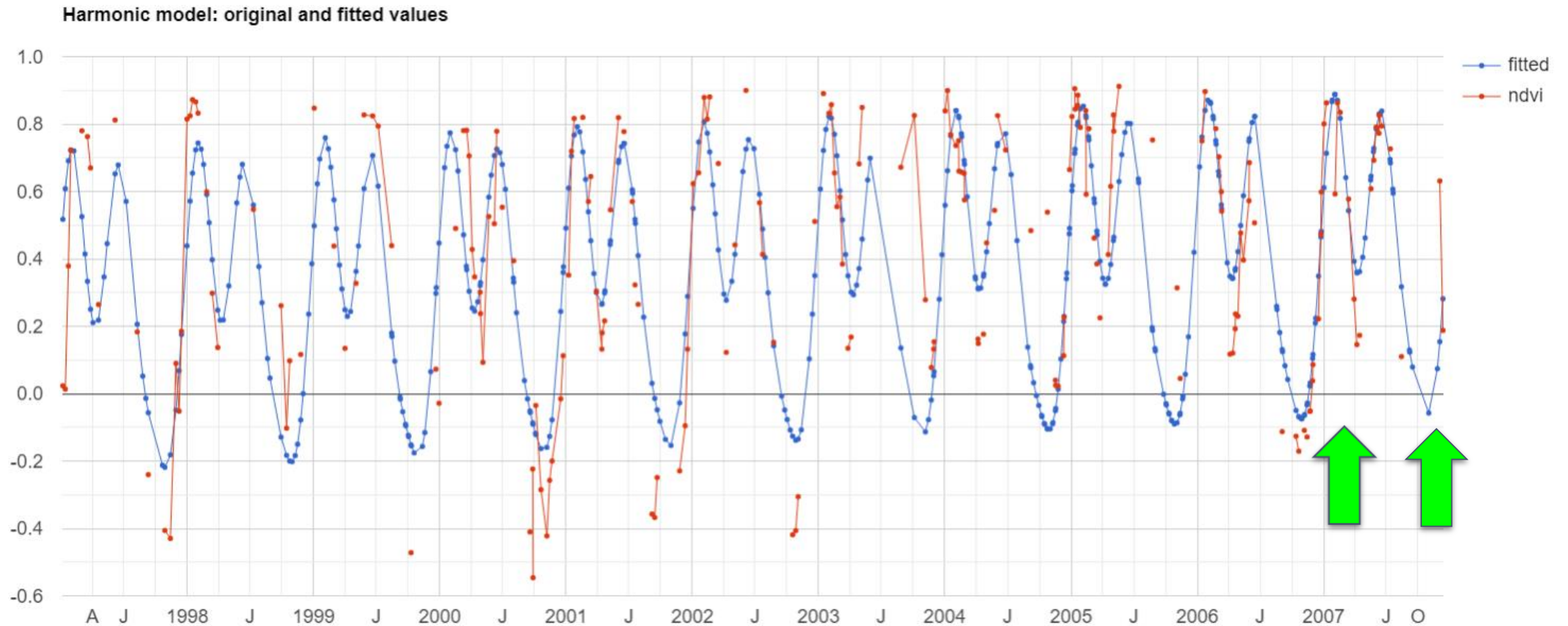


November 29, 2007 - yellow crop / harvesting period

Change from double to triple cropping around 2007

Bình Thành

10-year period from 1997-2007: 2 crops per year



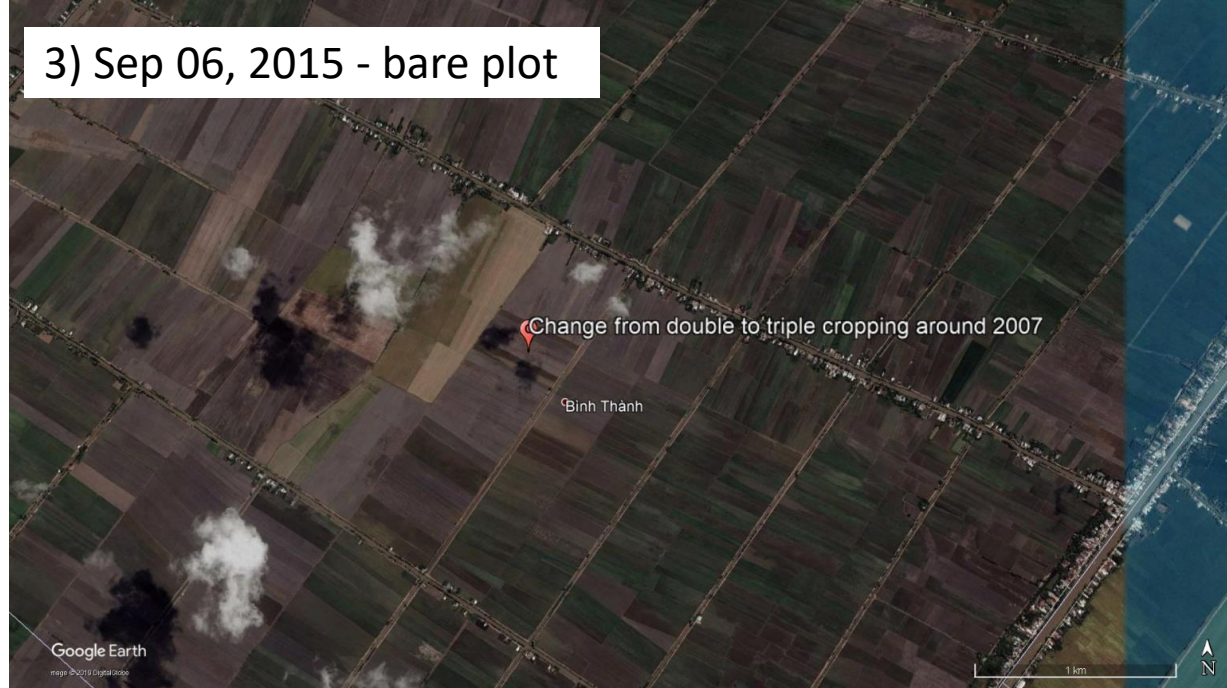
1) Feb 01, 2011 - peak greenness



2) Feb 21, 2014 - peak greenness



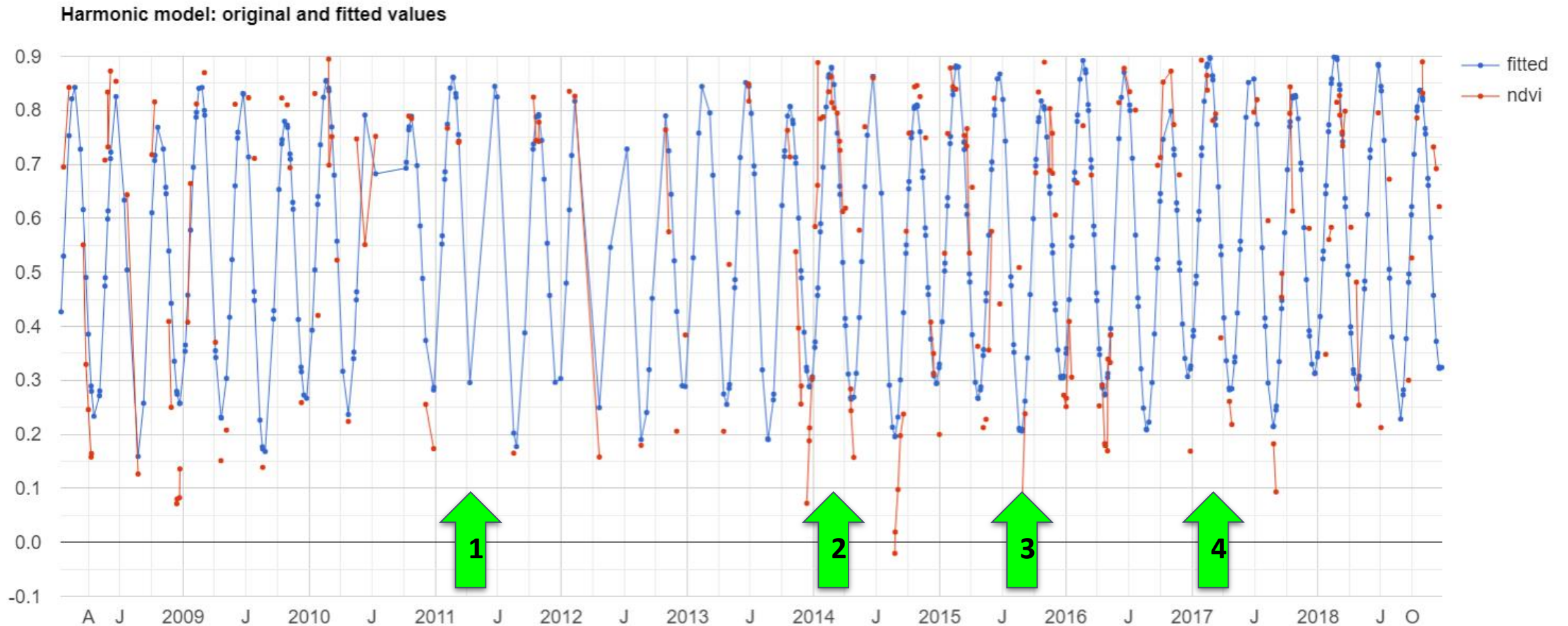
3) Sep 06, 2015 - bare plot



4) Jan 09, 2017 - greening of crop



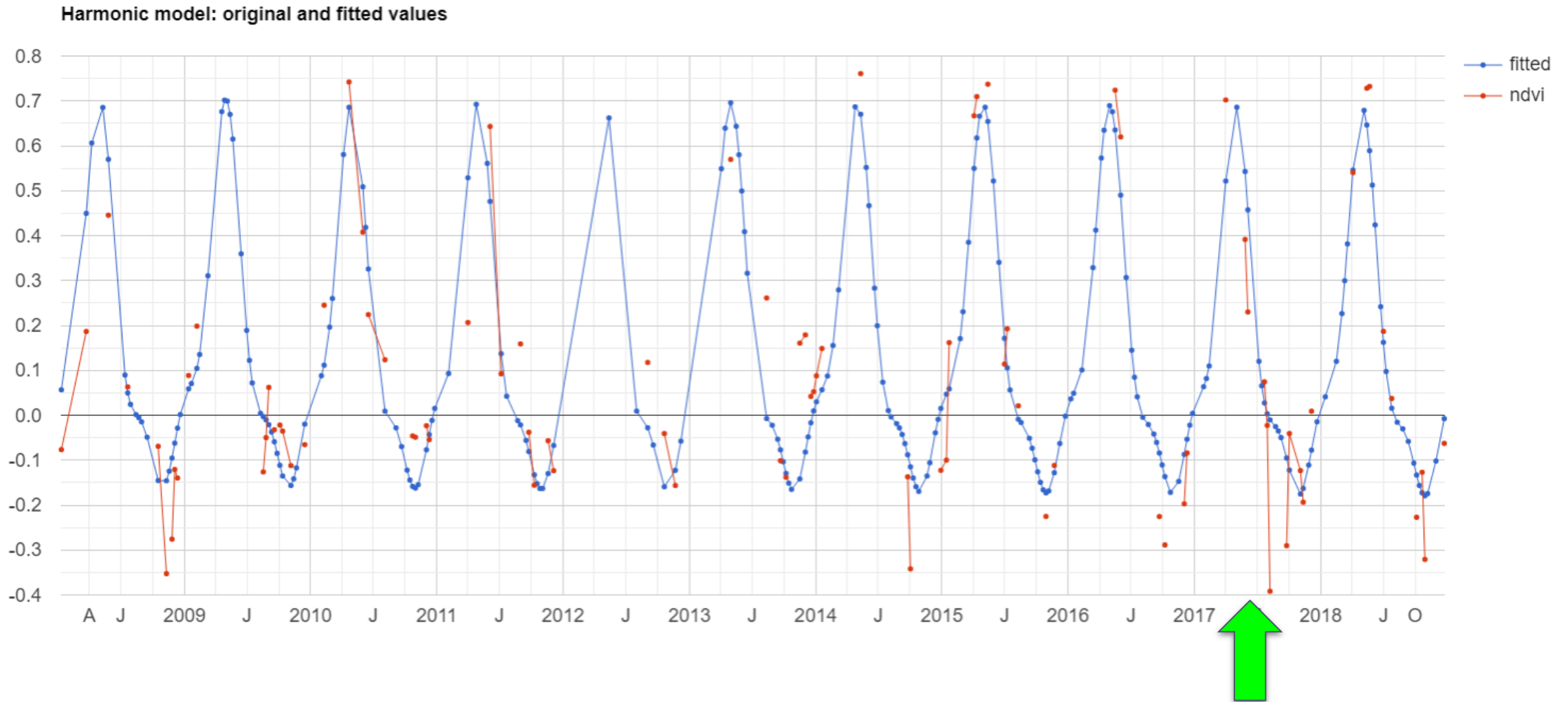
10-year period from 2008-2018: 3 crops per year



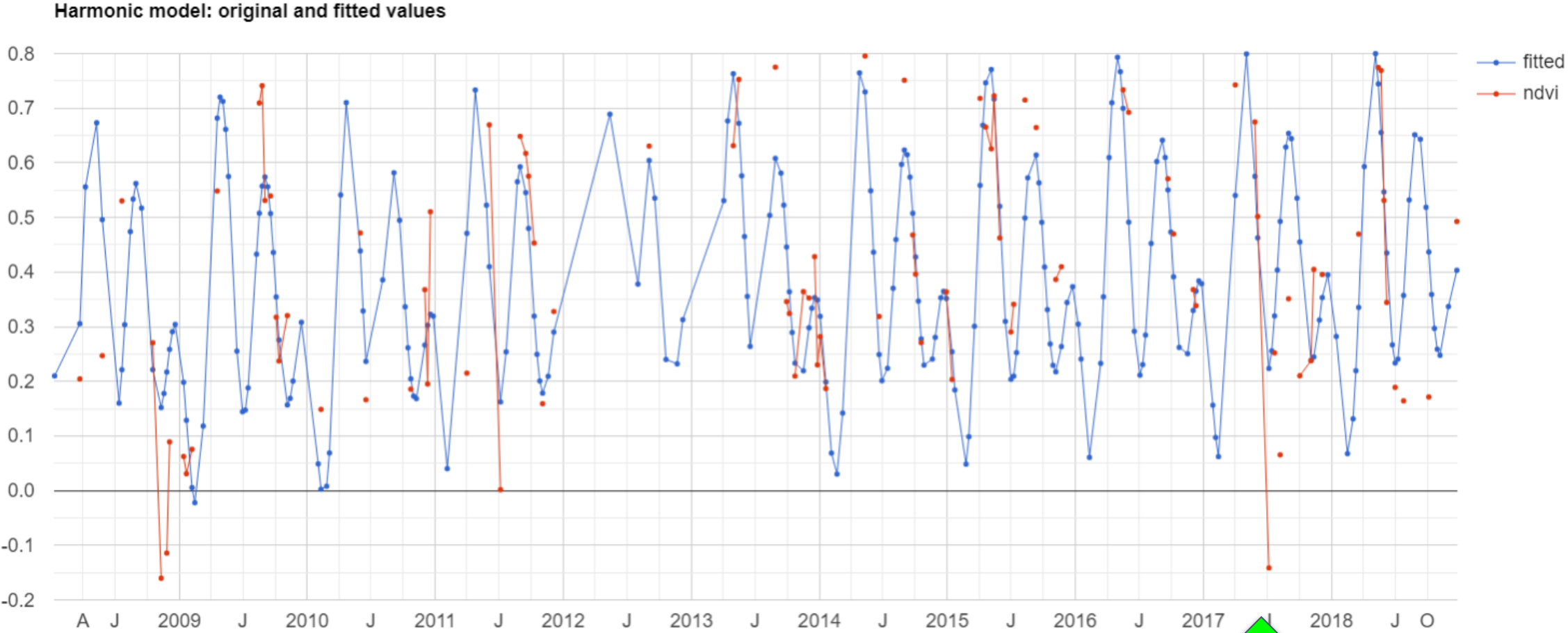
Yen Lac Commune, Red River Delta, Vietnam



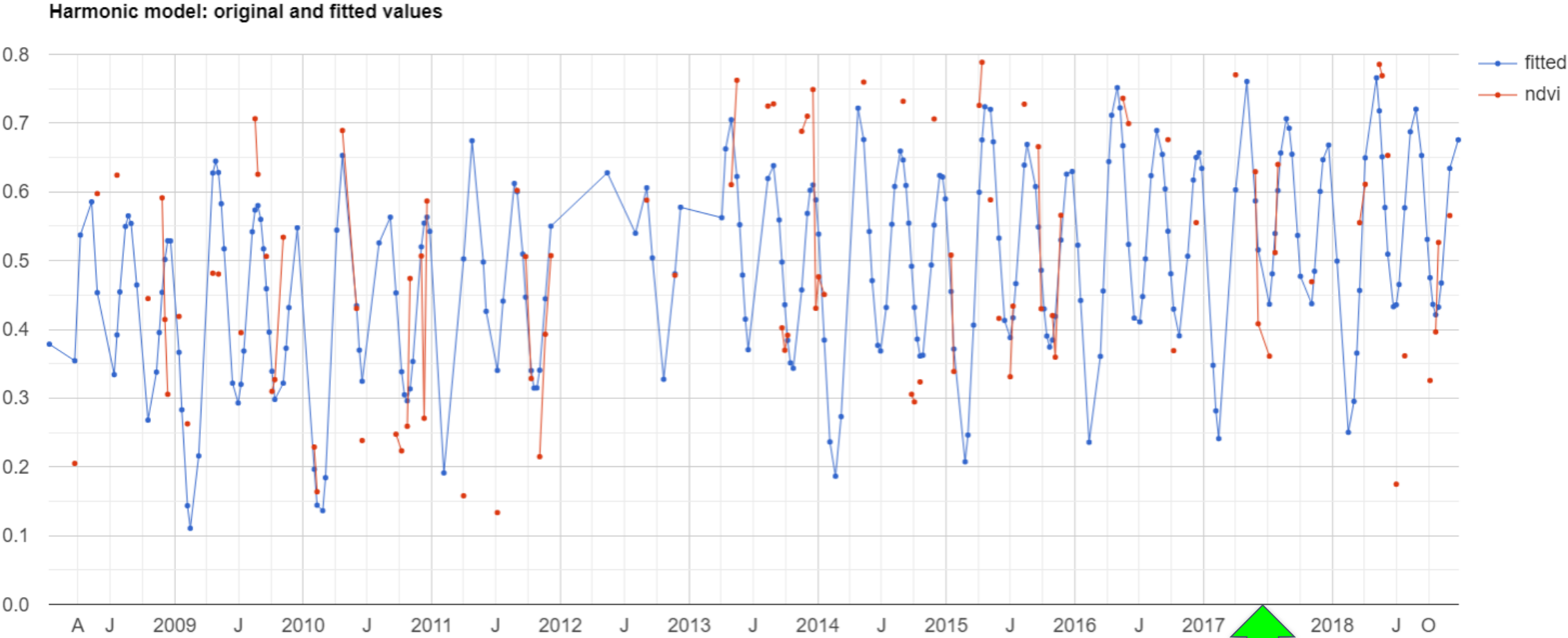
1 crop per year, afterwards flooded for aquaculture



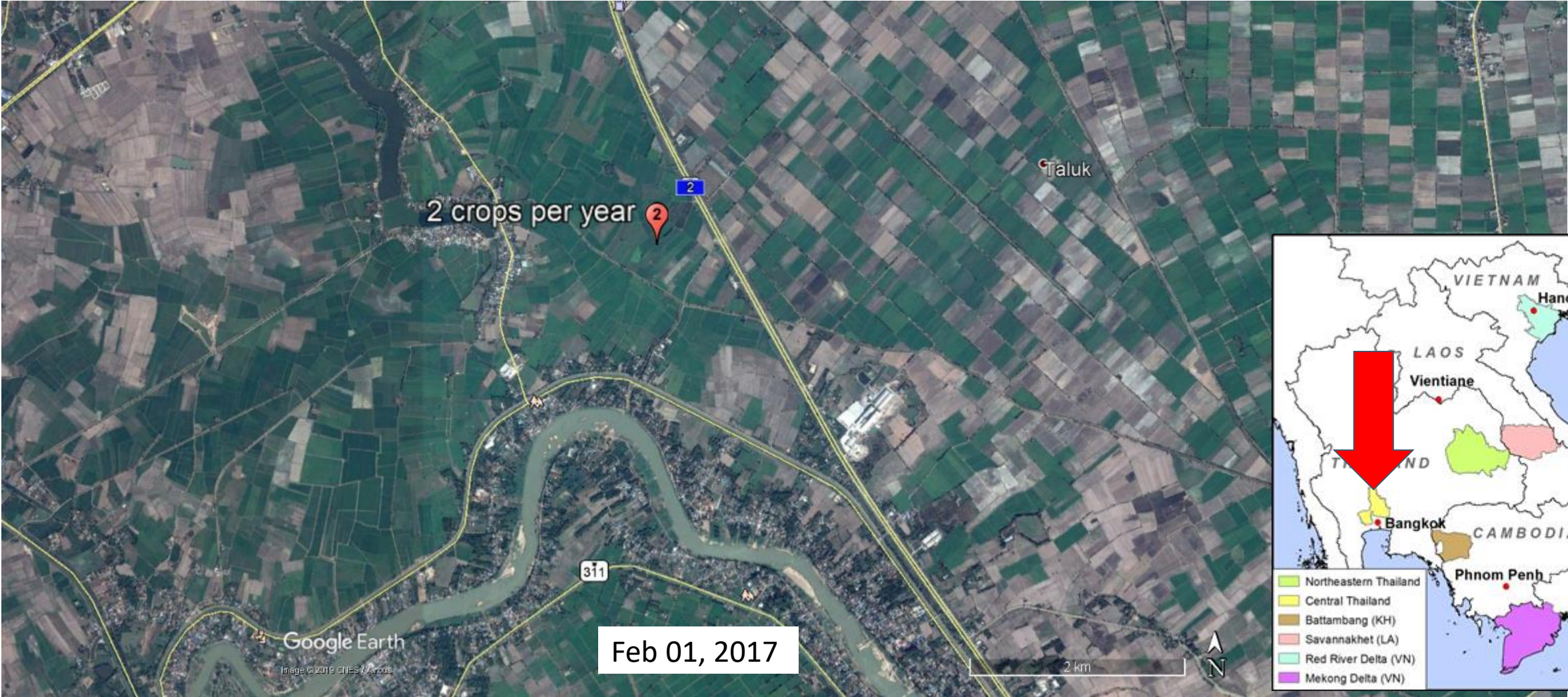
2 crops per year, fallow after 2nd crop visible as small peak



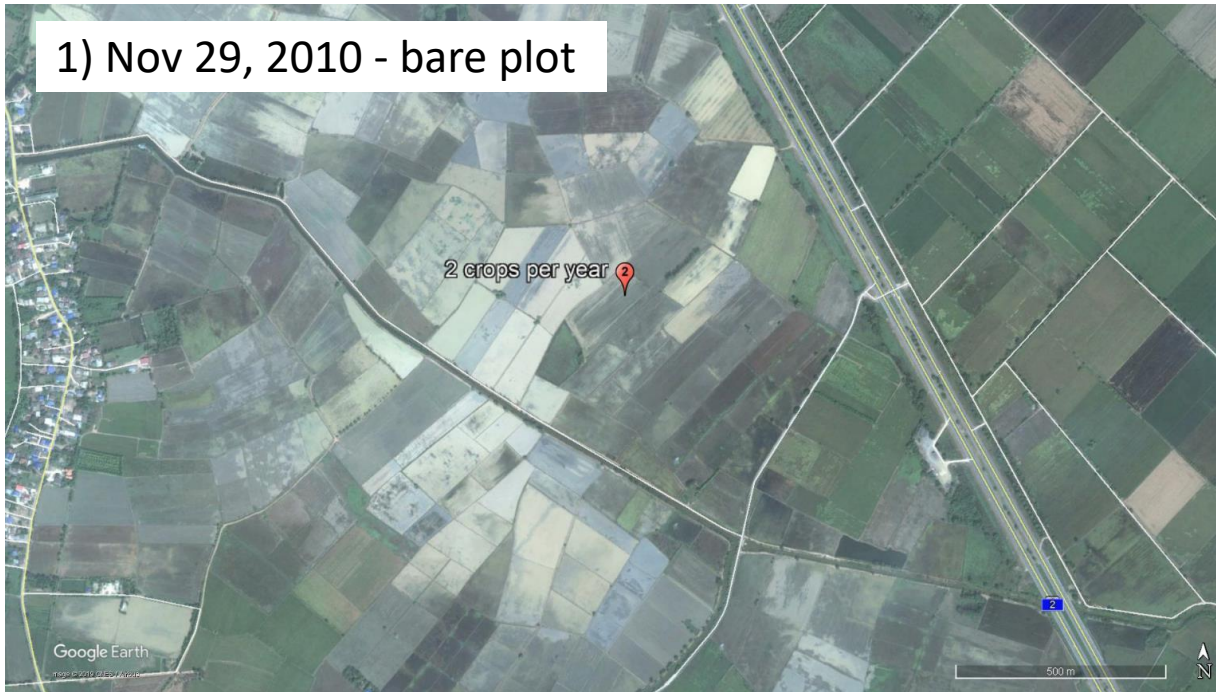
3 crops per year - 3 peaks per year, but data gaps in 2012



Taluk, Central Thailand



1) Nov 29, 2010 - bare plot



2) Dec 01, 2013 - bare plot



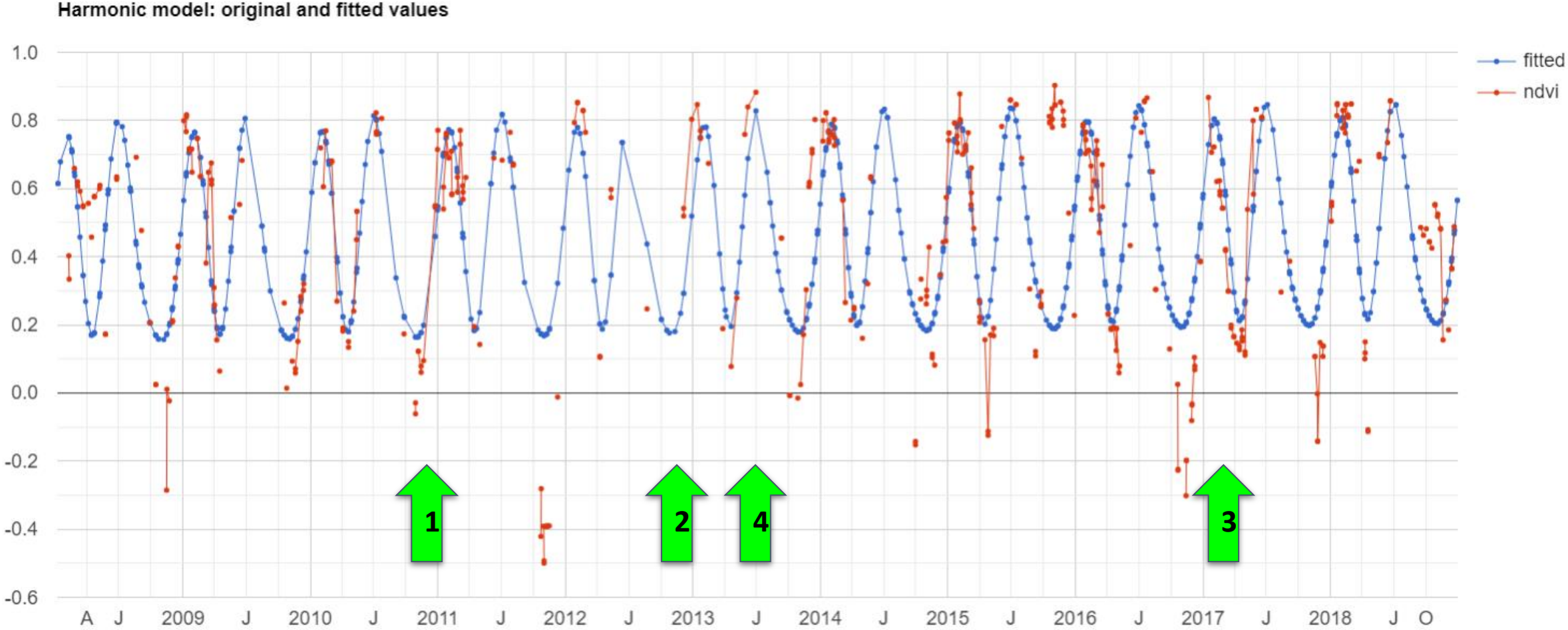
3) Feb 01, 2017 - peak greenness



4) Jun 28, 2014 - peak greenness



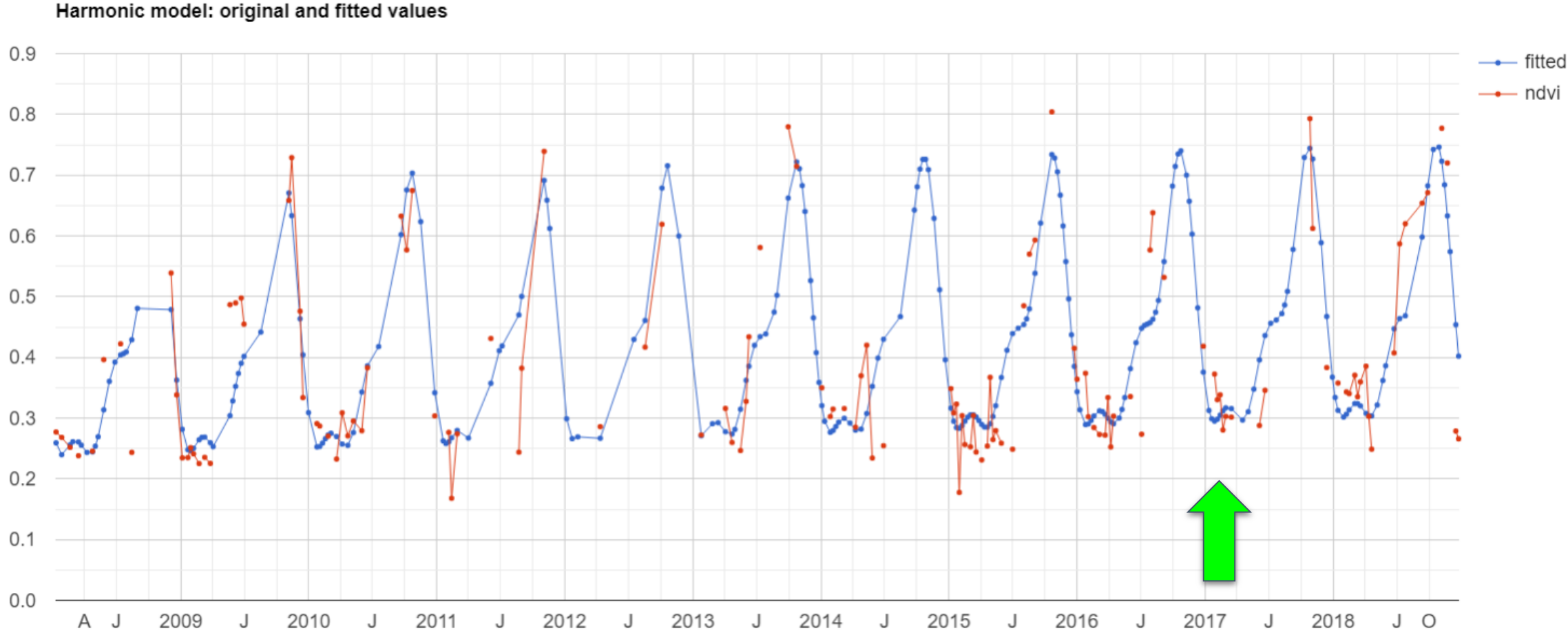
2 crops per year - 3 peaks in 2015 (not captured by the model)



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

