Monitoring Development from Space

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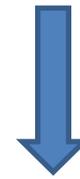
Contents

1. Research: Theory VS Data

2. Data: Ground VS Space

3. Some Remote Sensing Data
   - Nighttime Light (DMSP-OLS)   less preprocessing
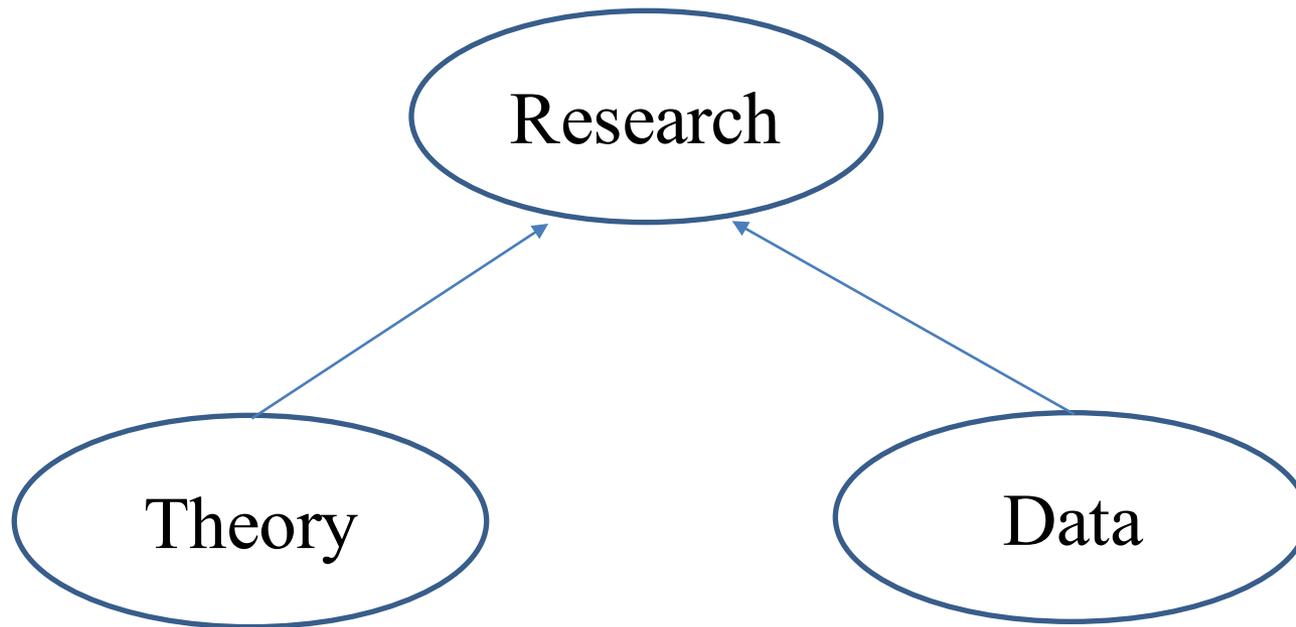   - Land Cover (MODIS)
   - Population (LandScan)   more preprocessing

4. Some Applications of Remote Sensing Data in Economics

5. Concluding Remarks

Research

Theory   Data

too much emphasis on theory (in economics)
→ better theory, better data, better research

(better) data
- (more precise presentation of) value
- (better presentation of) place
- (better presentation of) time
- (better) coverage

Data

Ground

Pros
- In-depth information
- User oriented (open-ended)

Cons
- High marginal cost
- Low spatial resolution
- Low temporal frequency
- Narrower coverage
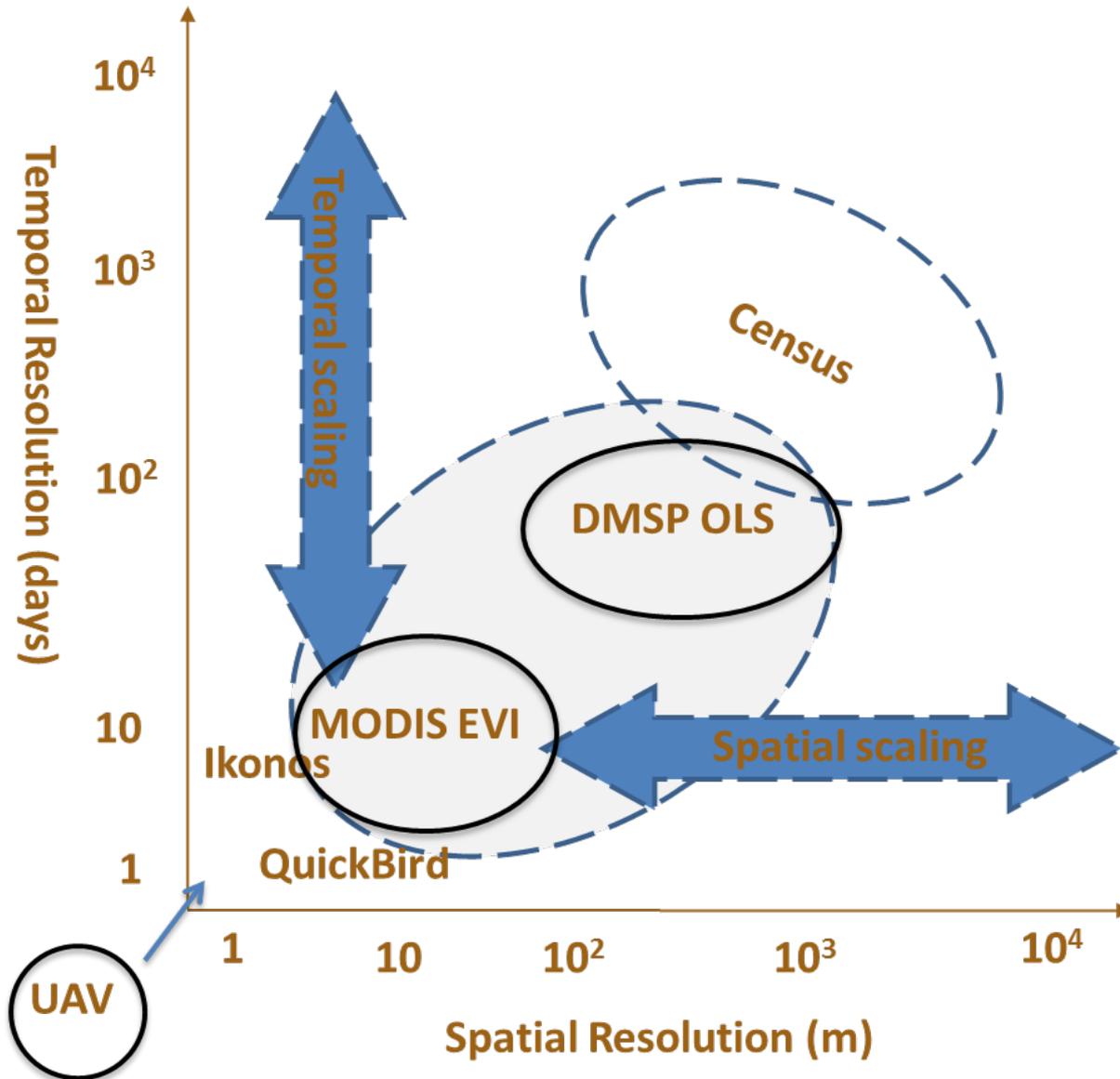- (Mostly) subjective

Space

Pros
- Low marginal cost
- High spatial resolution
- High temporal frequency
- Wider coverage
- Objective

Cons
- Pre-defined information
- Heavy preprocessing
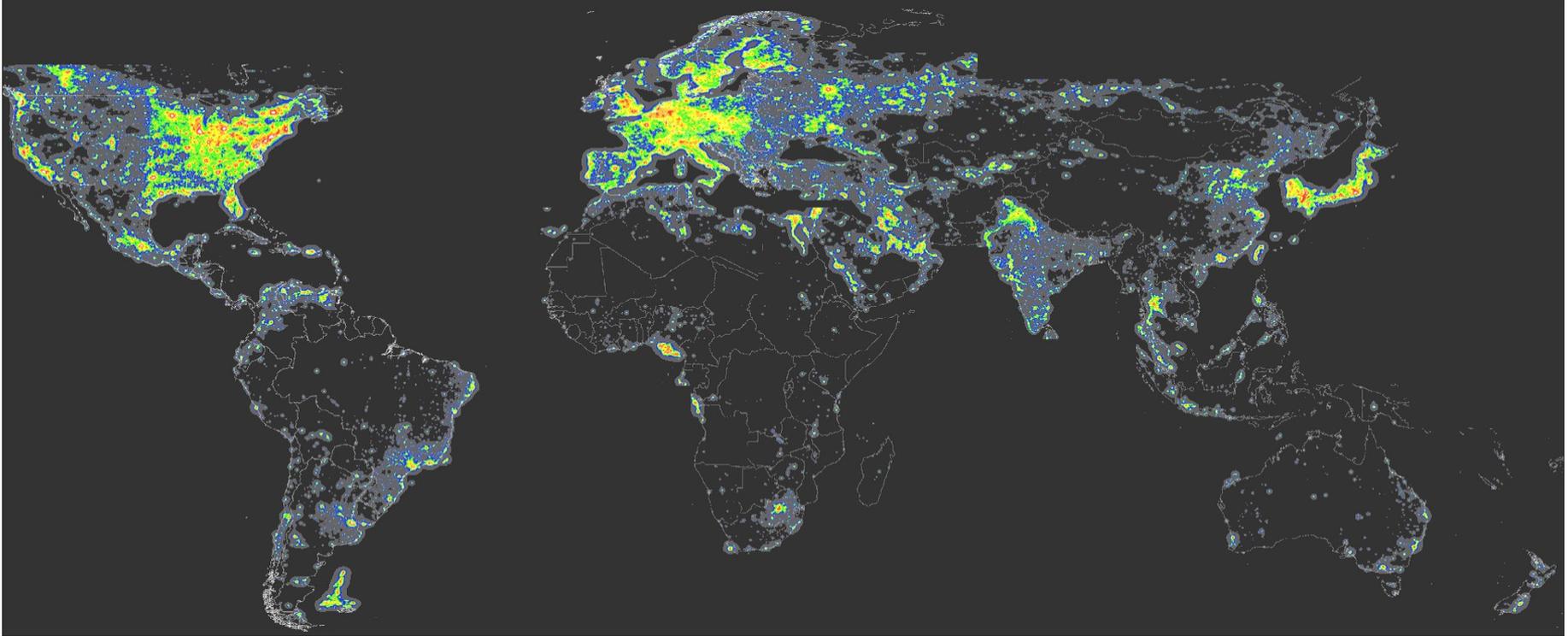- Unfriendly format (to human)

Spatial and Temporal Resolution of Data

Some Remote Sensing Data

Nighttime Light Data

The Richer the Region, The Brighter It seems from Space

Nighttime Light (index)
Spatial Resolution : approximately 1 km X 1km
Frequency: twice daily (raw data)
Value: 0-63
Cost: Free

⟷

Ground surveys
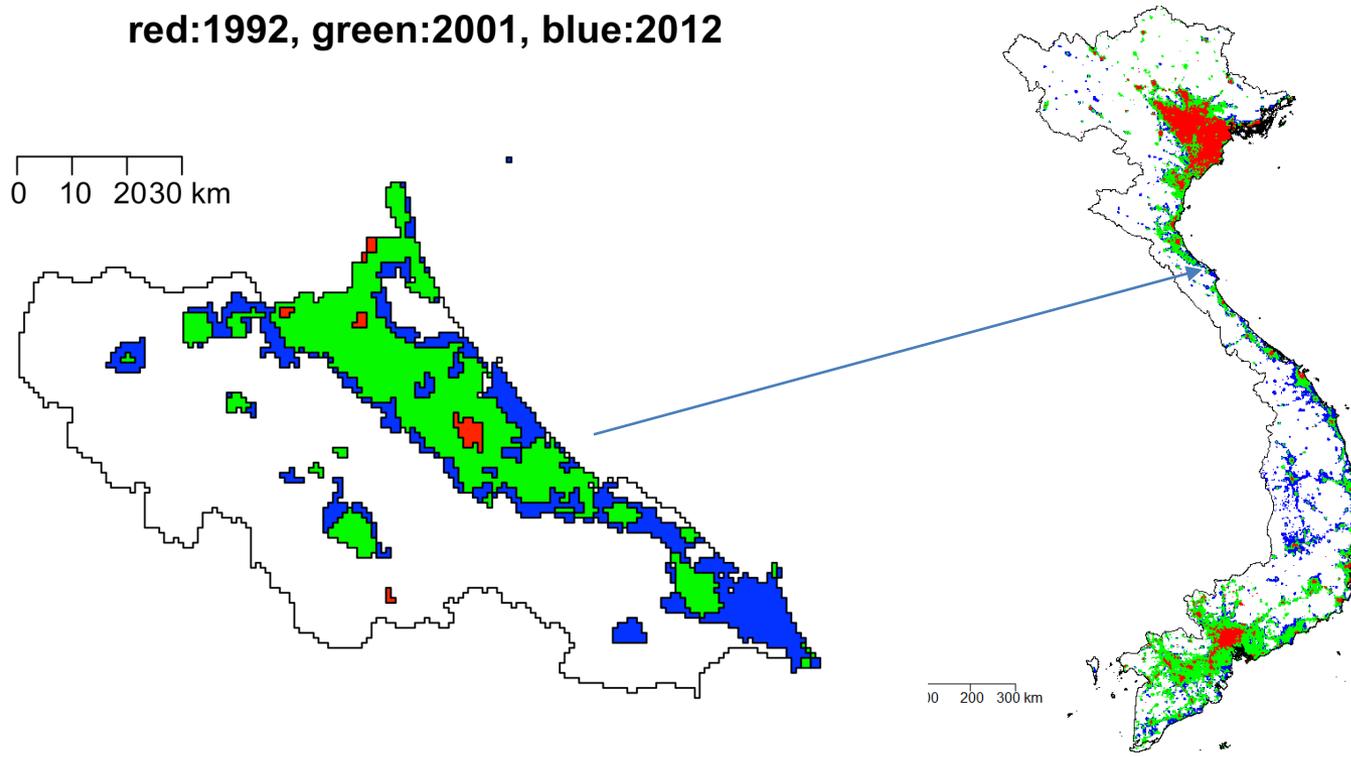Spatial Resolution: country, city, region
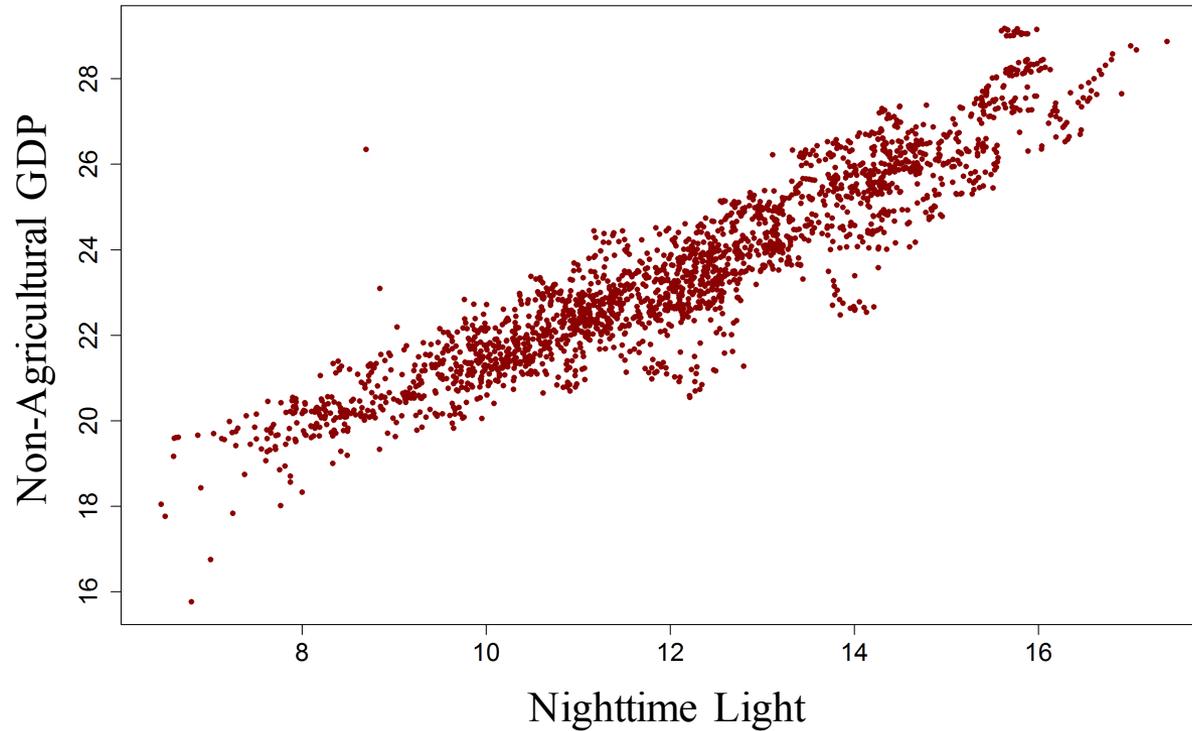Frequency: often yearly
Value: variable
Cost: expensive and time consuming

Source: Keola et al. (2015).

Urban Area Expansion Measured by Lighted Area

Lit Area Expansion
Viet Nam/Ha Tinh
red:1992, green:2001, blue:2012

0   10   2030 km

00   200   300 km

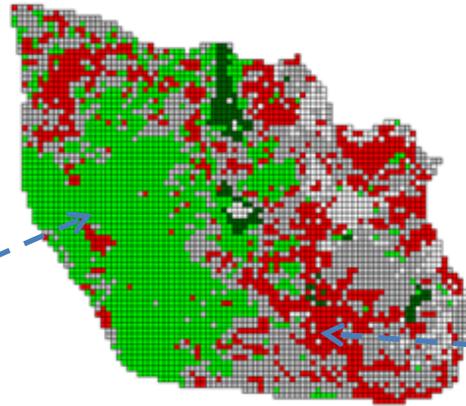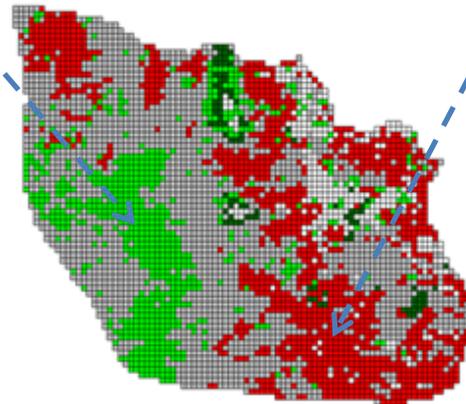# Nighttime Light and Non-Agricultural GDP

Land Cover (MODIS)

Land Cover Change of a District in Lao PDR

2002

Forest area decreased

Larger Human Habitat

2009

Forest Area Change
2001-2009

Legend:
- Increase 50% or more
- Increase less than 50%
- Decrease less than 50%
- Decrease 50% or more

Scale: 0 200 400 600 km

Source: Keola et al. (fourth coming).
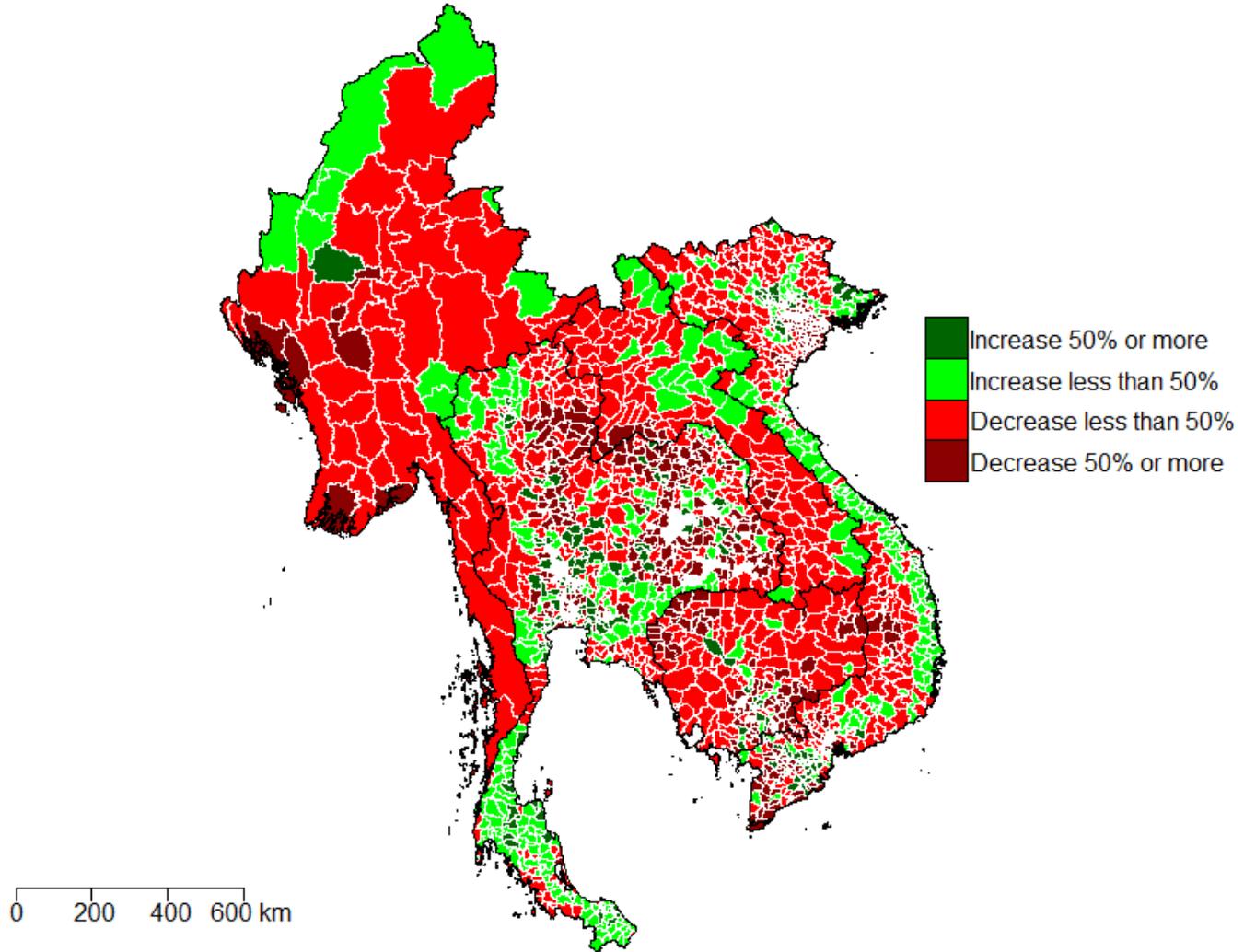
Cropland, Population and Agriculture GDP
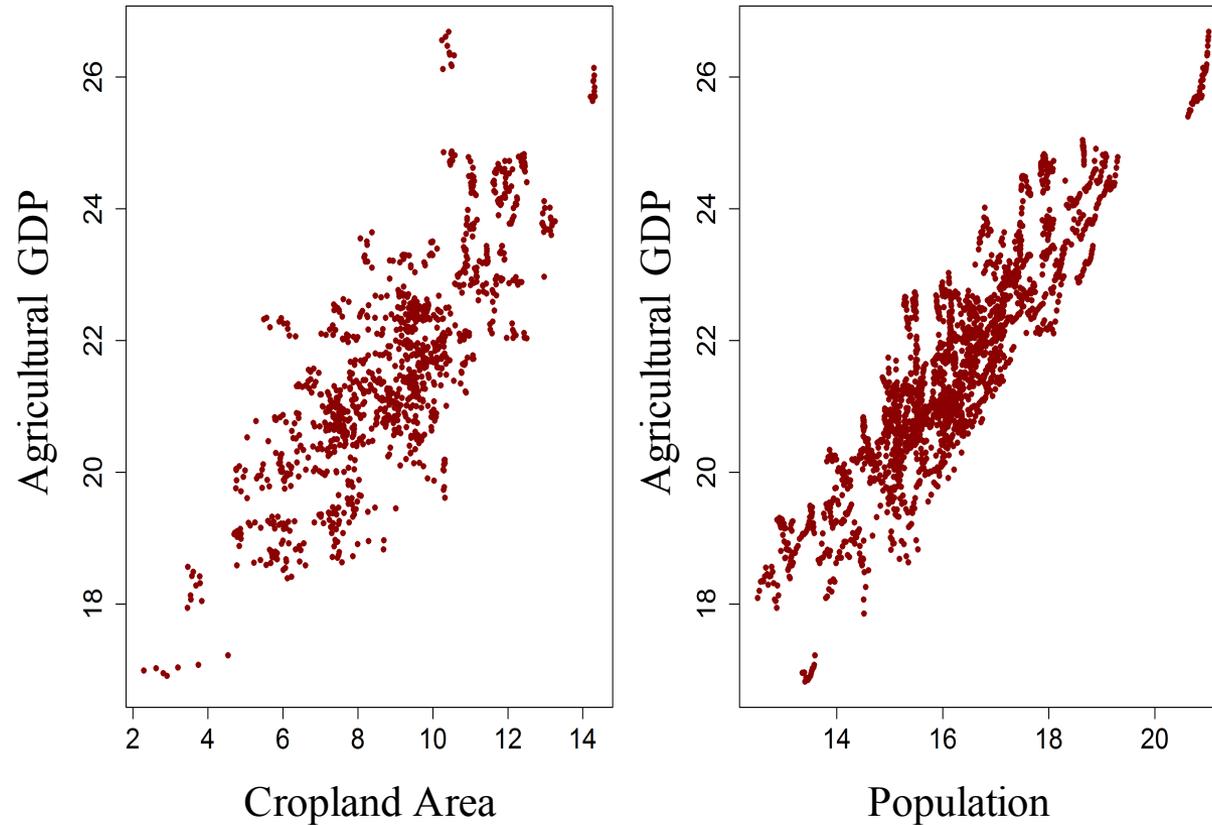
LandScan (Population) in Bangladesh and Surrounding Areas (2010)

Thimphu

Dhaka

Kolkata

Chittagong

Source: Tsubota et al. (fourth coming).
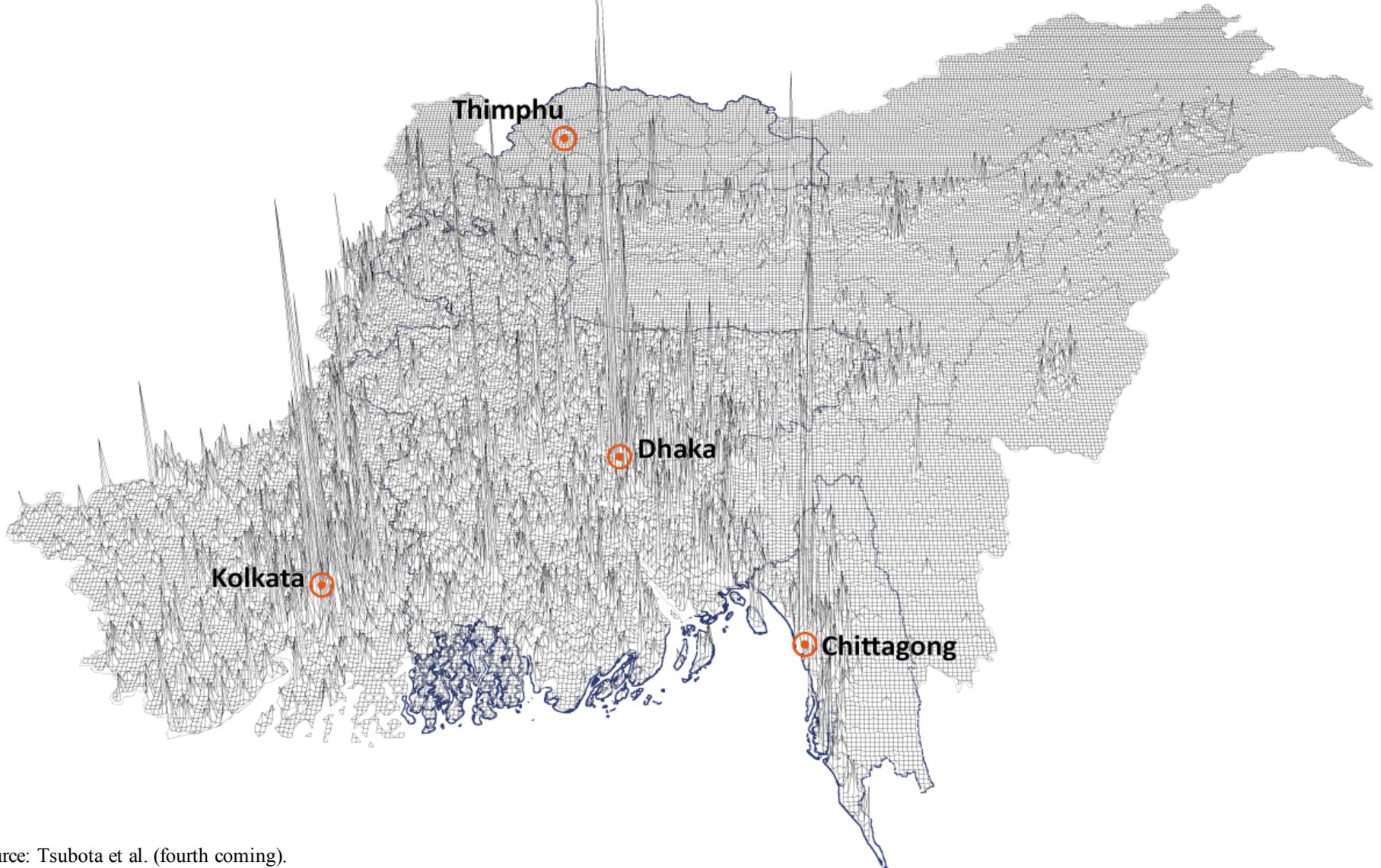
LandScan (Population)
2001-2011

Increase 50% or more
Increase less than 50%
Decrease less than 50%
Decrease 50% or more

Source: Keola et al. (fourth coming).
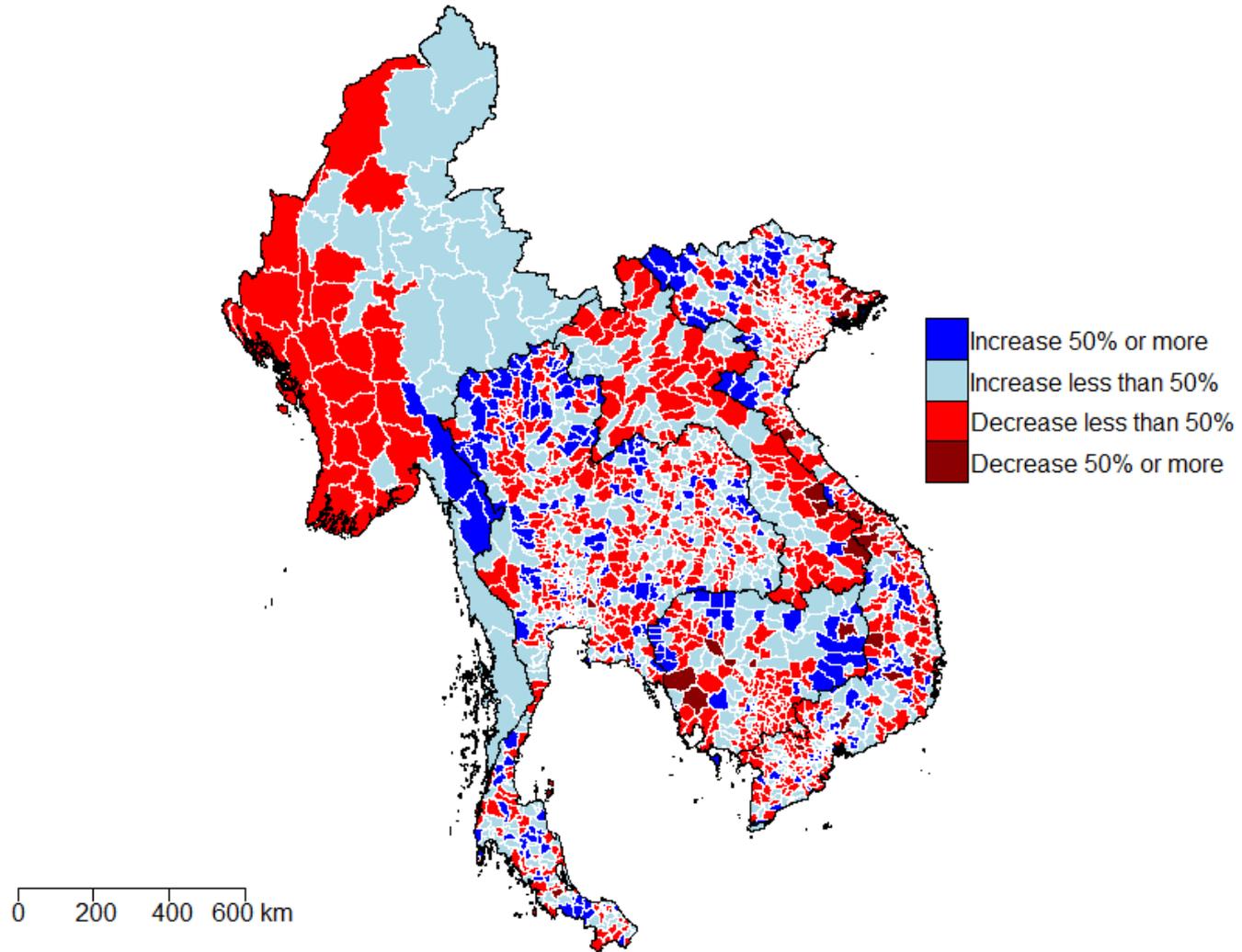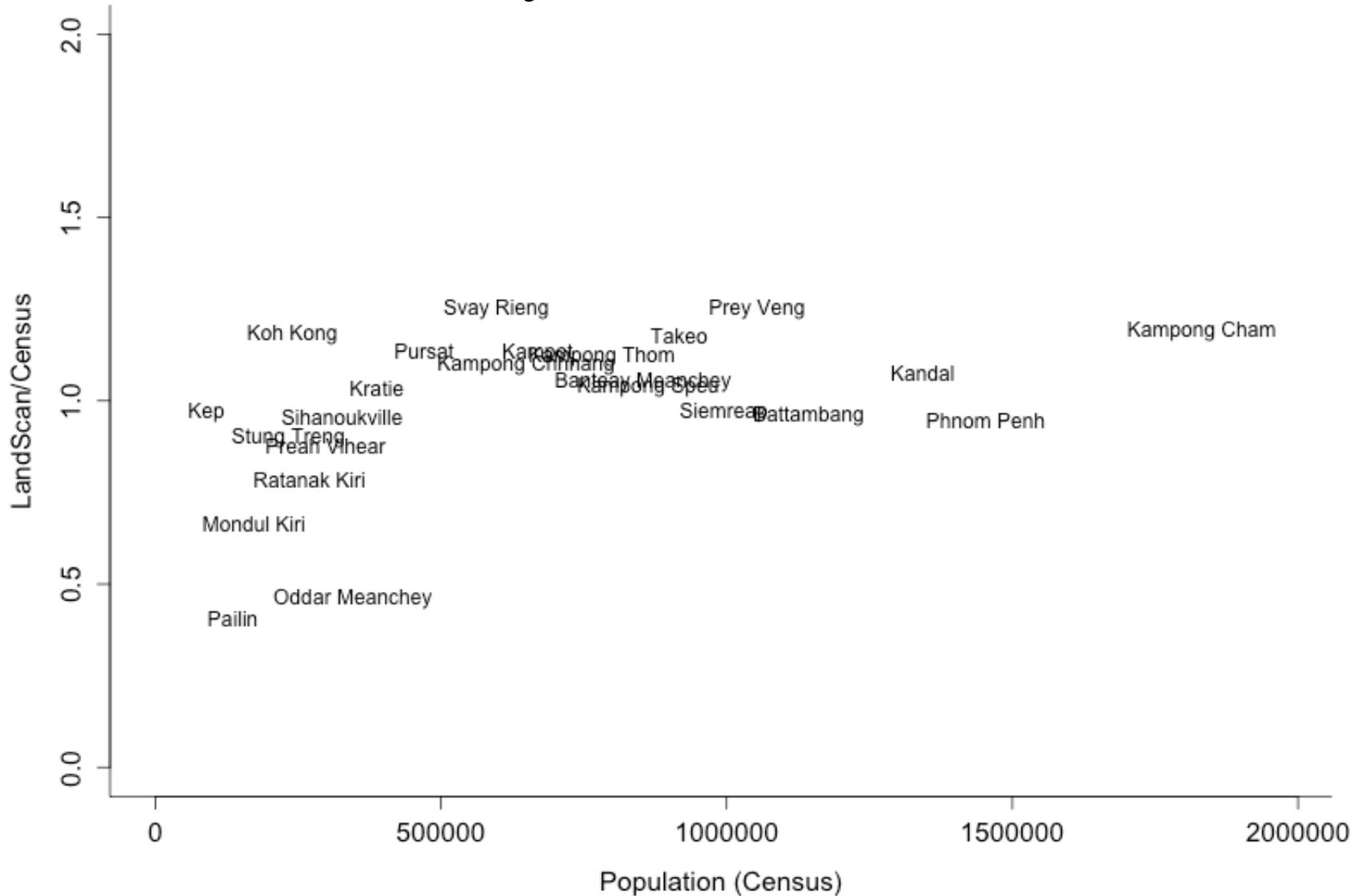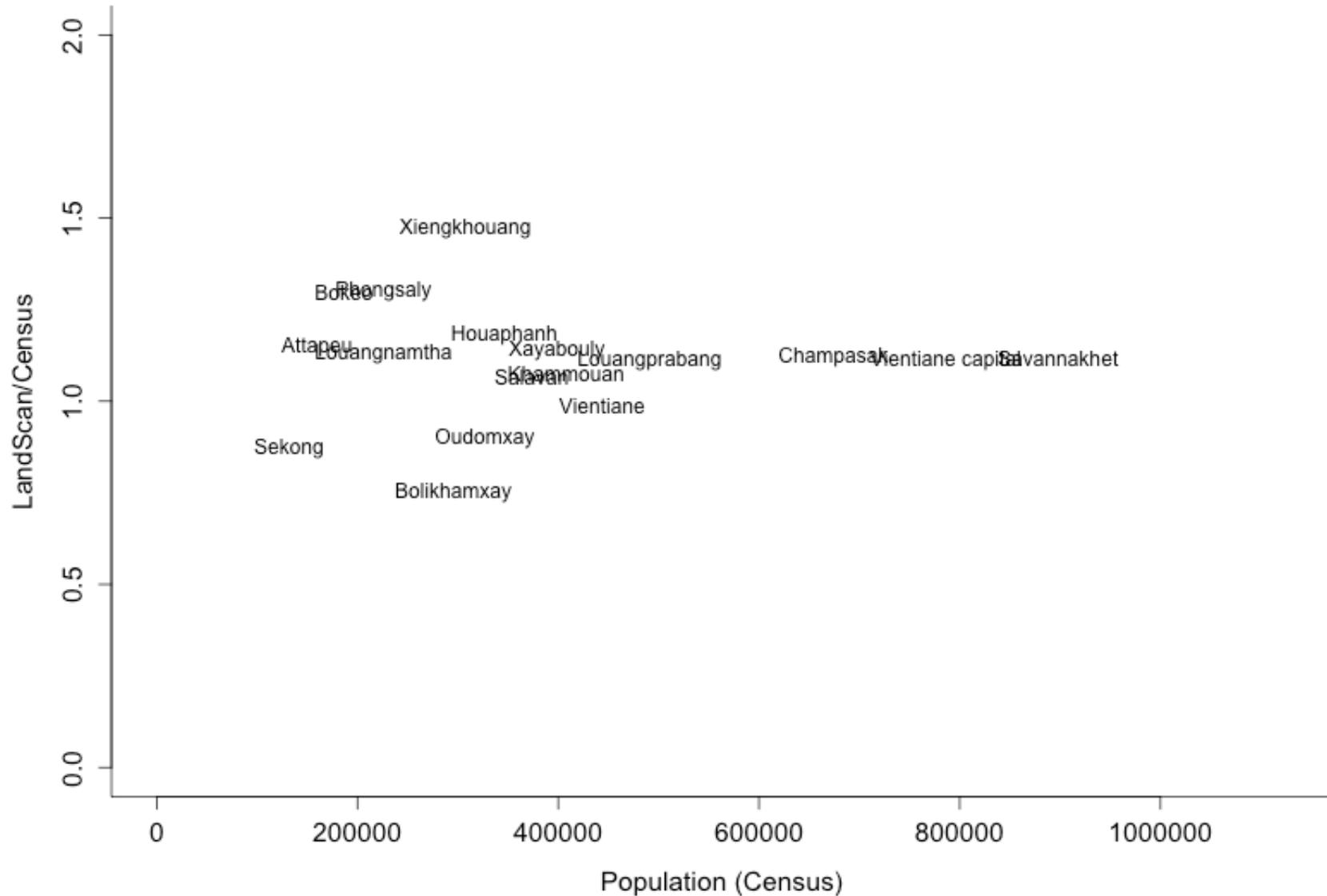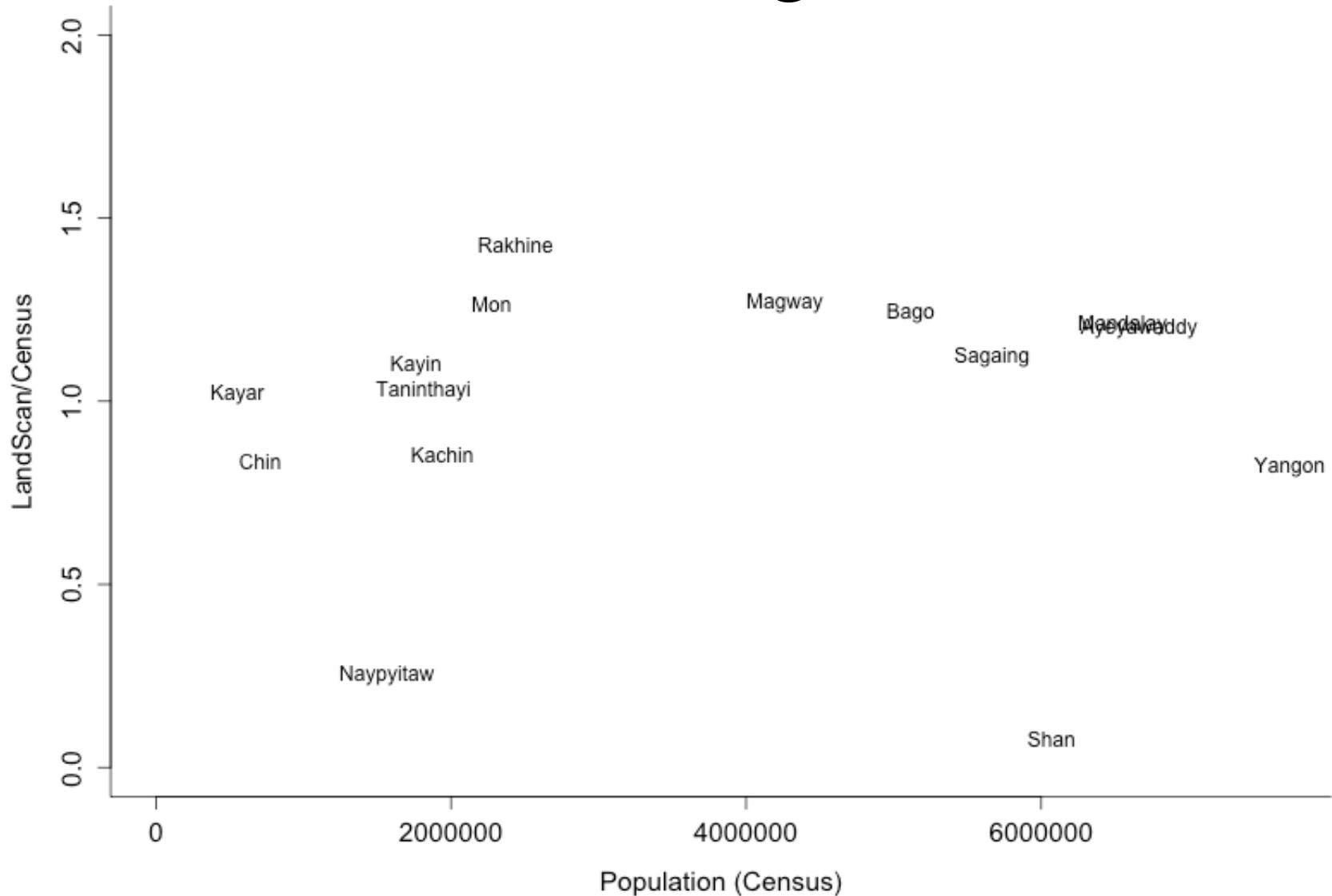
LandScan (Population) in Cambodia by Provinces

LandScan (Population) in Lao PDR by Provinces

LandScan (Population) in Myanmar by States/Regions

LandScan (Population) in Vietnam by Provinces

LandScan/Census (y-axis) vs Population (Census) (x-axis)

- VINH PHUC
- VINH LONG
- HOA BINH
- BAC NINH / PHU YEN
- LAO CAI
- THAI NGUYEN / HUNG YEN
- LANG SON
- KIEN GIANG
- NINH BINH / SON LA / THAI BINH
- KHANH HOA
- CAO BANG / HA GIANG
- LAM DONG
- YEN BAI
- HA NAM
- DA NANG / LONG AN
- NINH THUAN
- QUANG TRI / PHU THO
- SON LA / HA TINH
- BA RIA - VUNG TAU
- BINH DUONG / QUANG NAM
- BINH DINH / CA MAU
- NAM DINH
- THUA THIEN HUE / DONG NAI
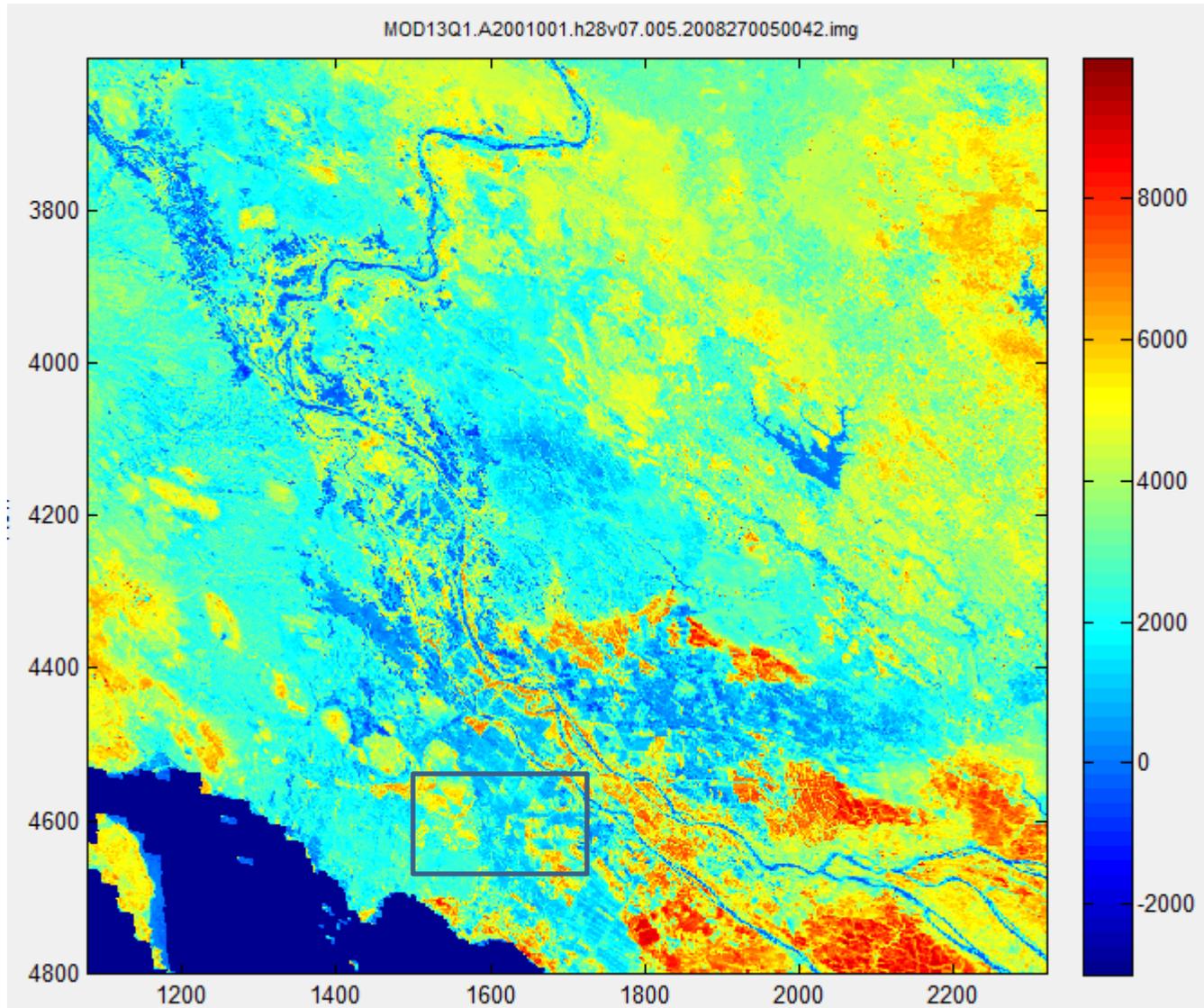- TRA VINH / AN GIANG / NGHE AN / THANH HOA
- HO CHI MINH
- HA NOI

LandScan (Population) in Thailand by Provinces

Southern Vietnam

MOD13Q1.A2001225.h28v07.005.2007050115033.img

An Giang Province

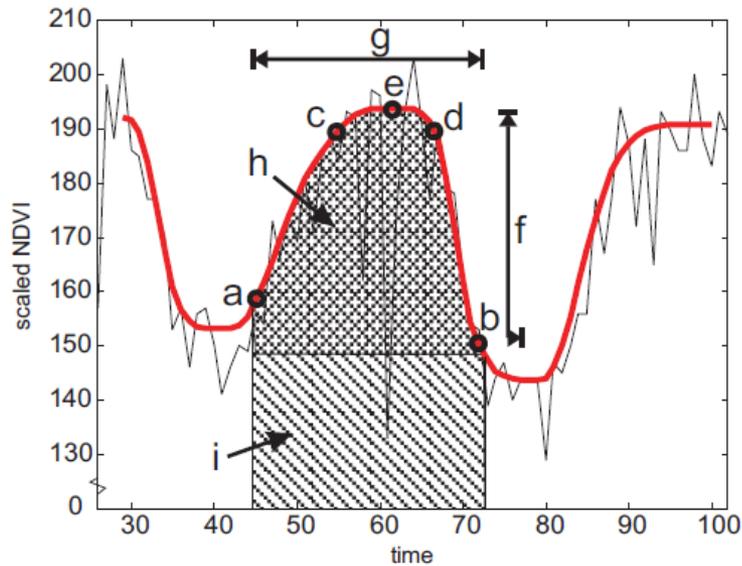
MOD13Q1.A2001001.h28v07.005.2008270050042.img
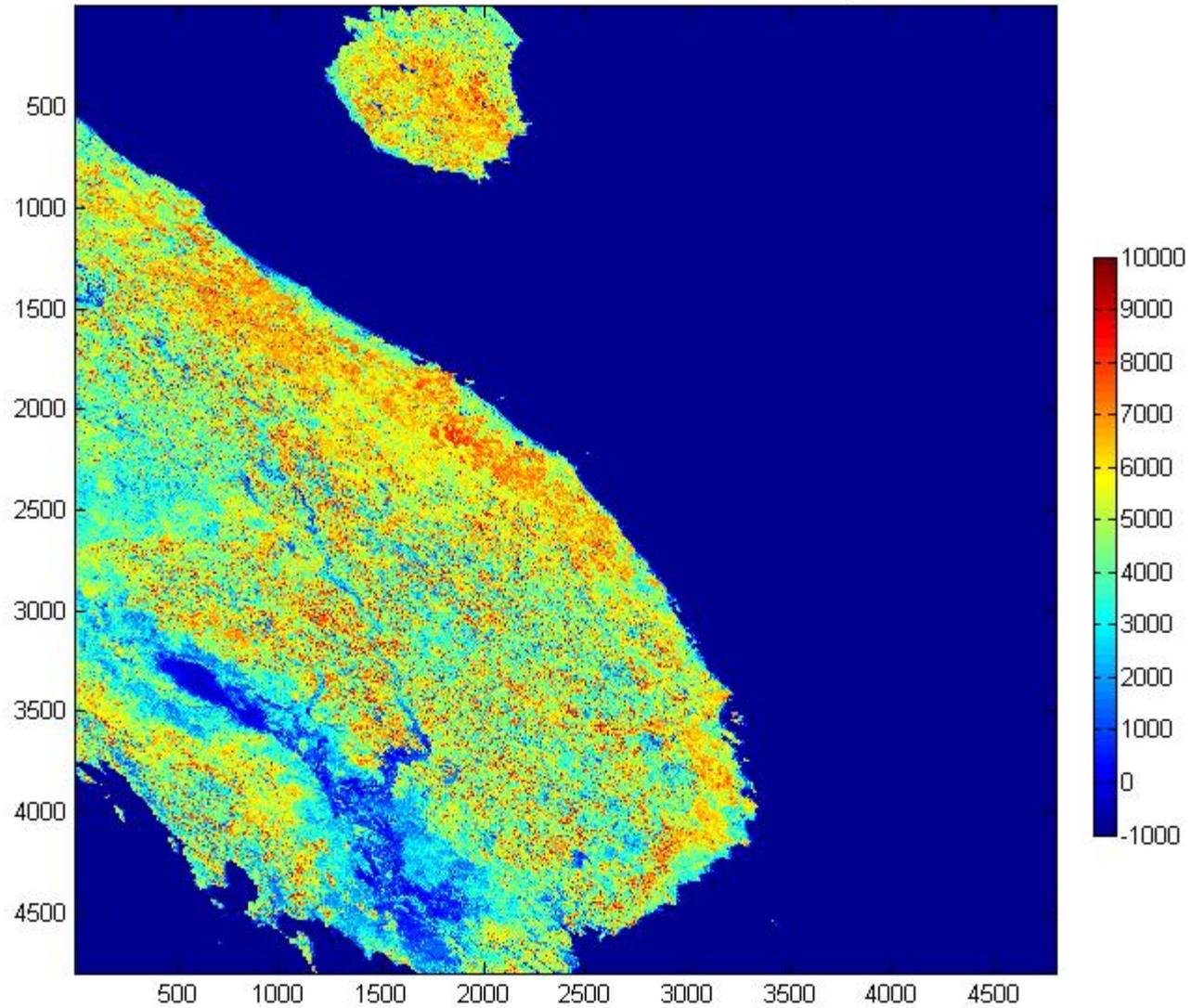
Extraction of Seasonal Parameters

Eklundh & Jönsson

1. Rice production provinces:
The Coordinates of An Giang Province:

10° 30' 0'' N, 105° 10' 0'' E
The Coordinates of Dong Thap Province:
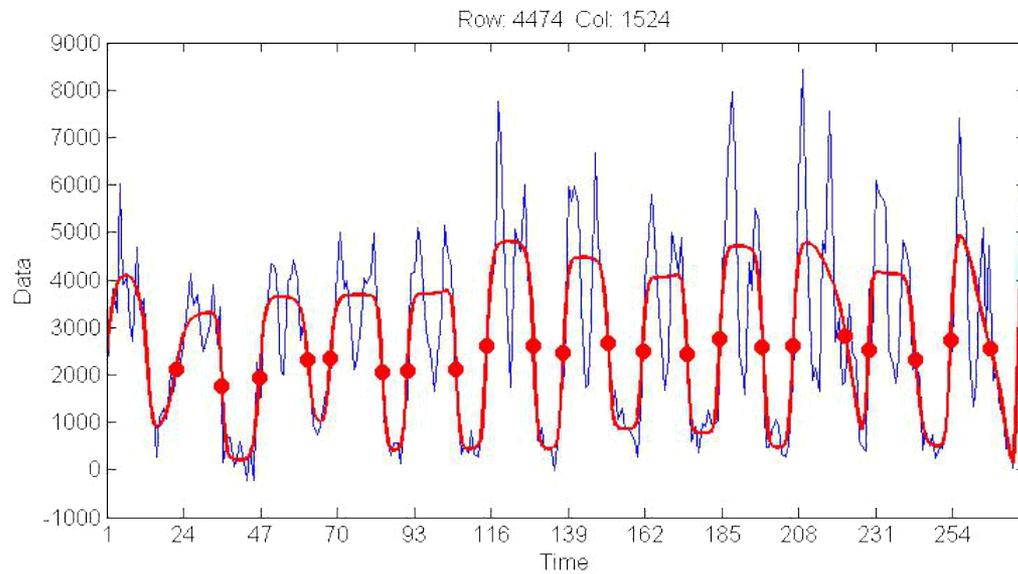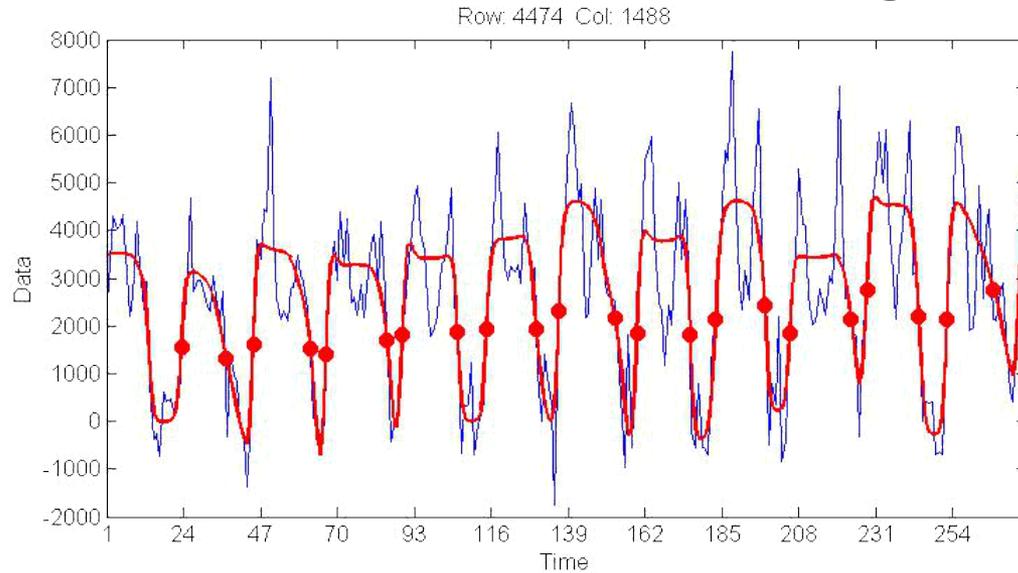10° 40' 0'' N, 105° 40' 0'' E
2. Coffee production provinces:
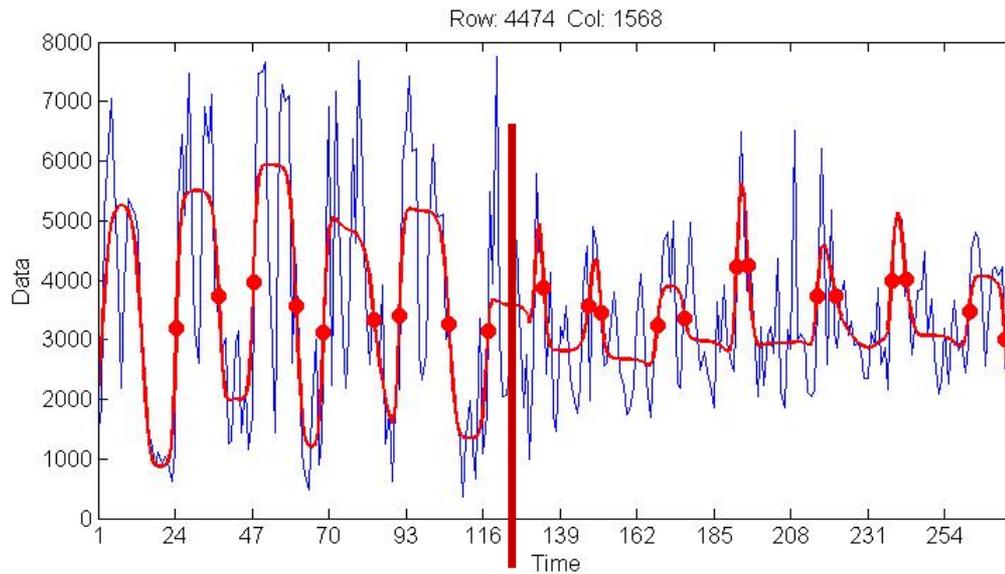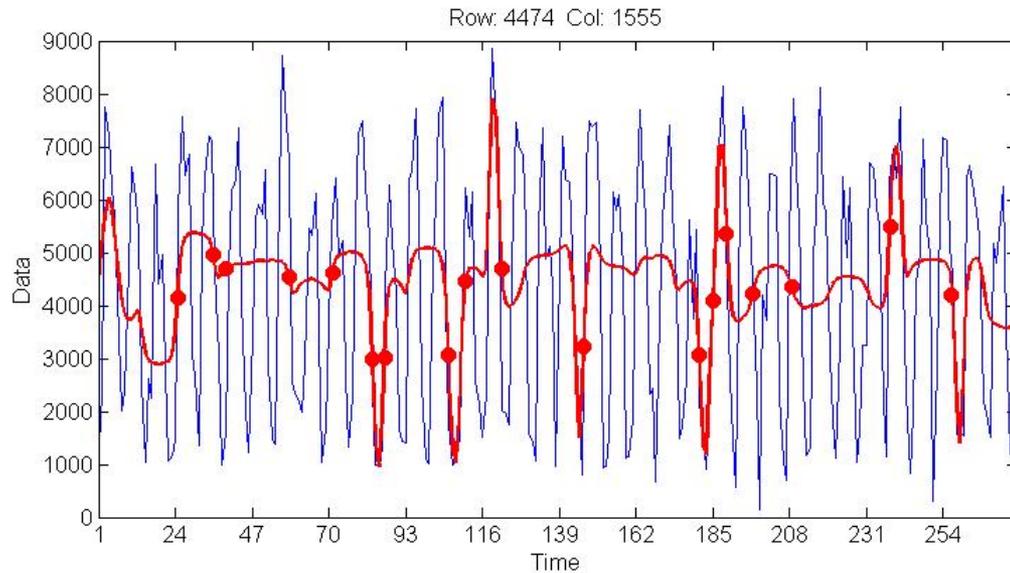The Coordinates of Dak Lak Province:

12° 40' 0'' N, 108° 3' 0'' E
The Coordinates of Lam Dong Province:

11° 57' 0'' N, 108° 26' 0'' E

Rice Cultivation Signatures

Rice Cultivation Signatures

Some Applications of Remote Sensing Data

Estimating Non-Agricultural Growth with Nighttime Light Data (National Level)

Figure 5. *Fit of non-agriculture's GDP for selected countries with large agricultural sector. Source: World Development Indicators and Estimated by Authors. Note: Natural log of real GDP in local currency. Real line represents official figures, crossed line is authors' estimations.*

Source: Keola et al. (2015).

Estimating Agricultural Growth
with Land Cover Data (National Level)
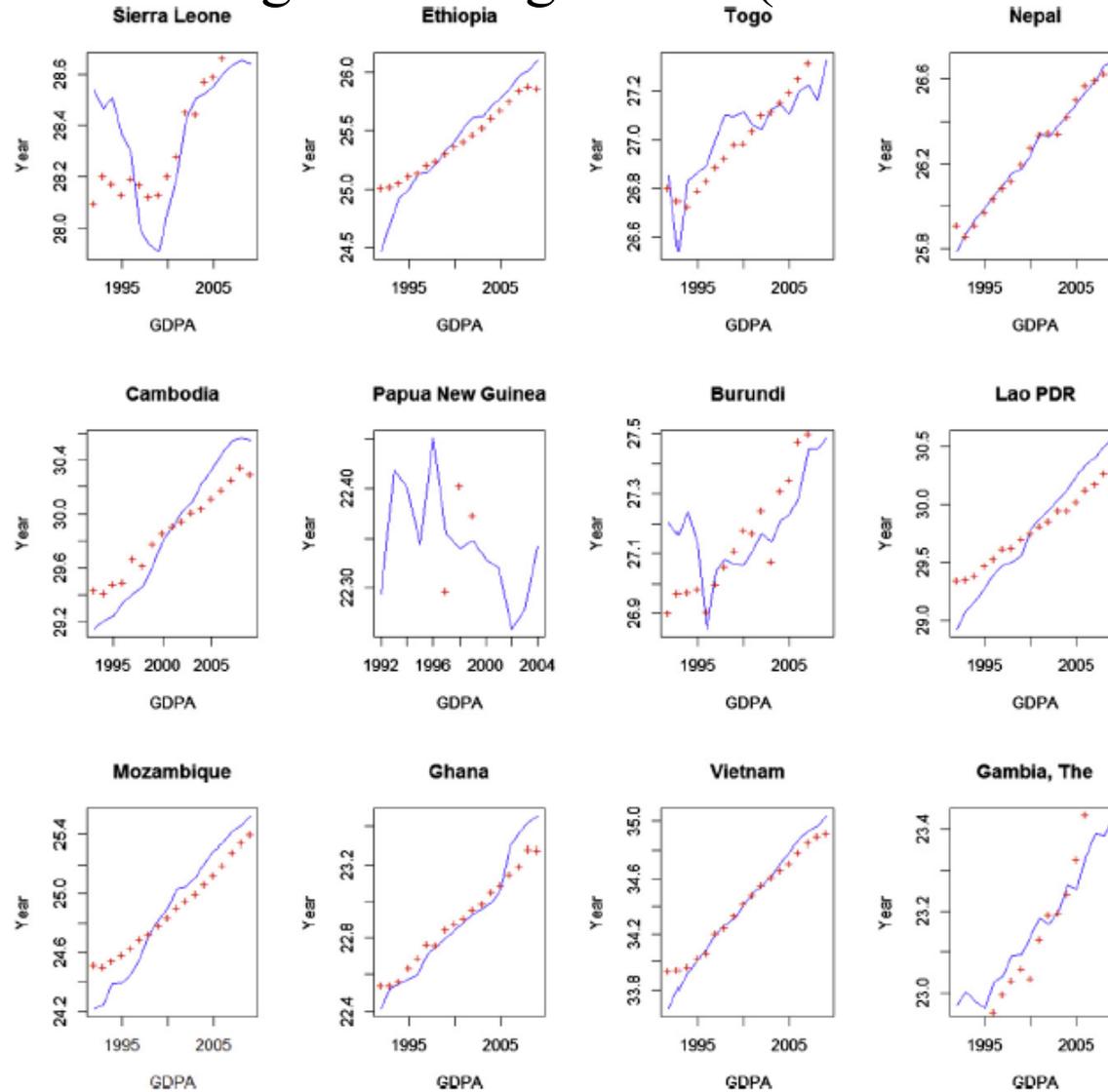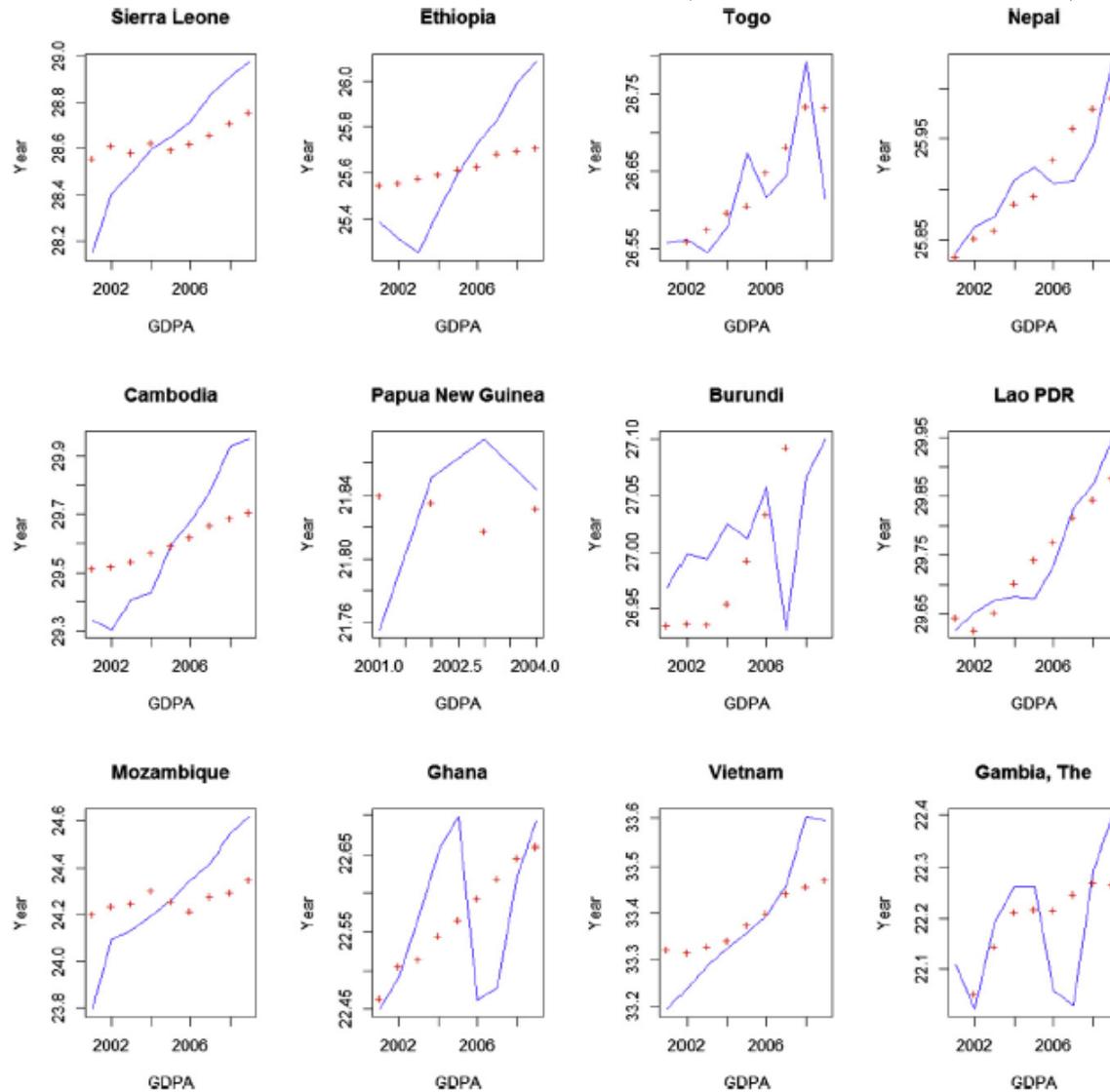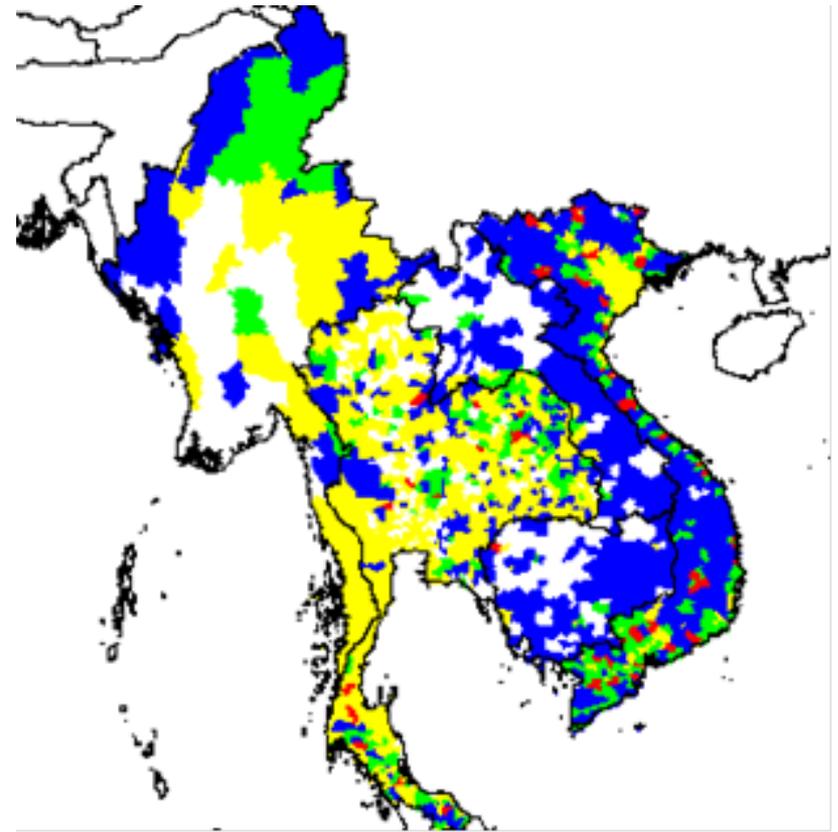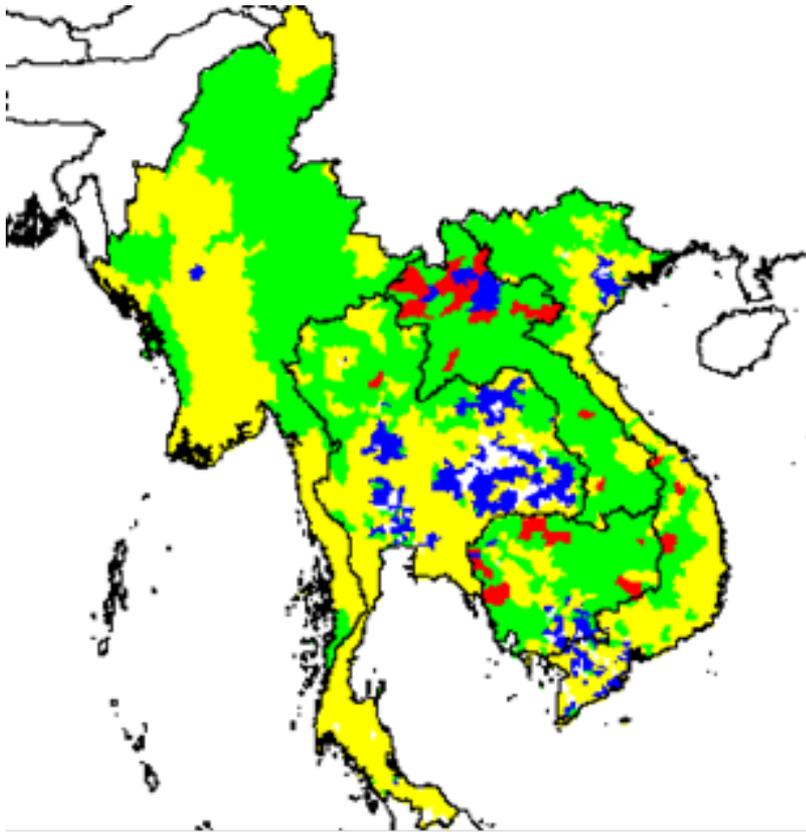

Figure 6. *Fit of agriculture's GDP for selected countries with large agricultural sector. Source: World Development Indicators and Estimated by Authors. Note: Natural log of real GDP in local currency. Real line represents official figures, crossed line is authors' estimations.*

Source: Keola et al. (2015).

Spatially Disaggregating Growth Figures with Remote Sensing Data

Agriculture
(annual average 2002-2009)

Non-Agriculture
(annual average 1992-2009)

Source: Estimated by Authors.

Figure 10 – Average Growth of Agriculture and Non-Agriculture in Indochinese Peninsula (Cambodia, Laos, Myanmar, Vietnam, Thailand).
Note: White: -0, Yellow: 0-0.025, Green: 0.025-0.05, Red: 0.05-0.075, Blue: 0.075-.
Source: Keola et al. (2015).

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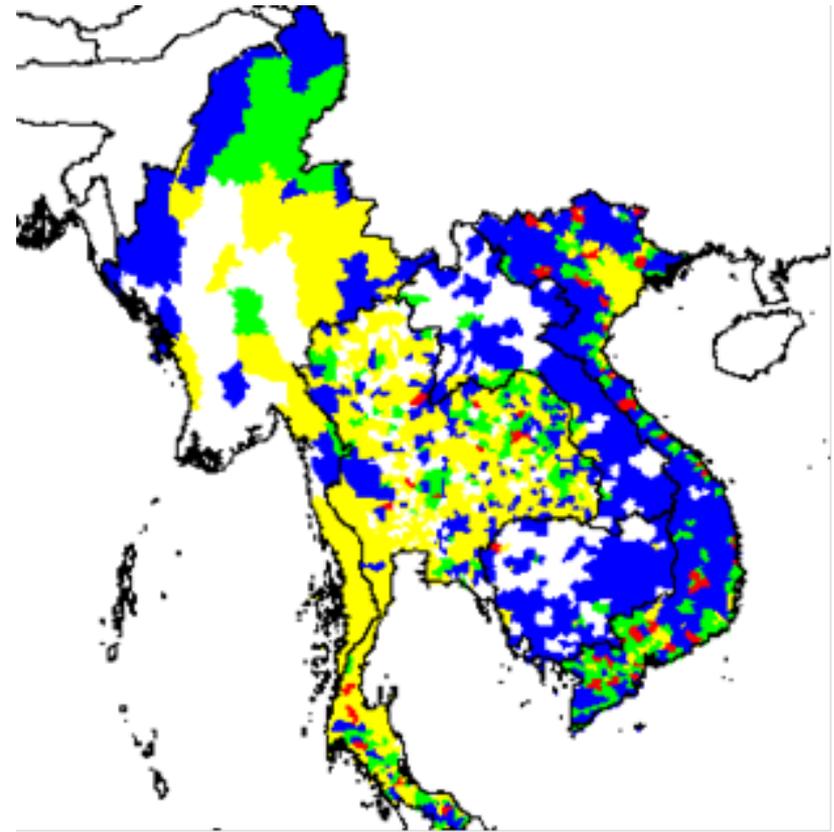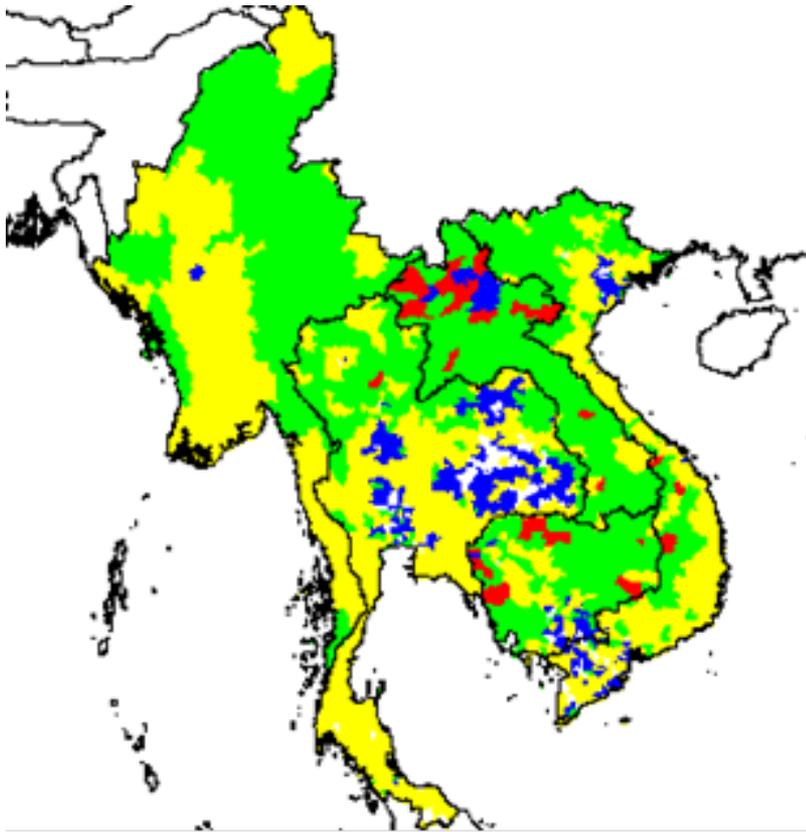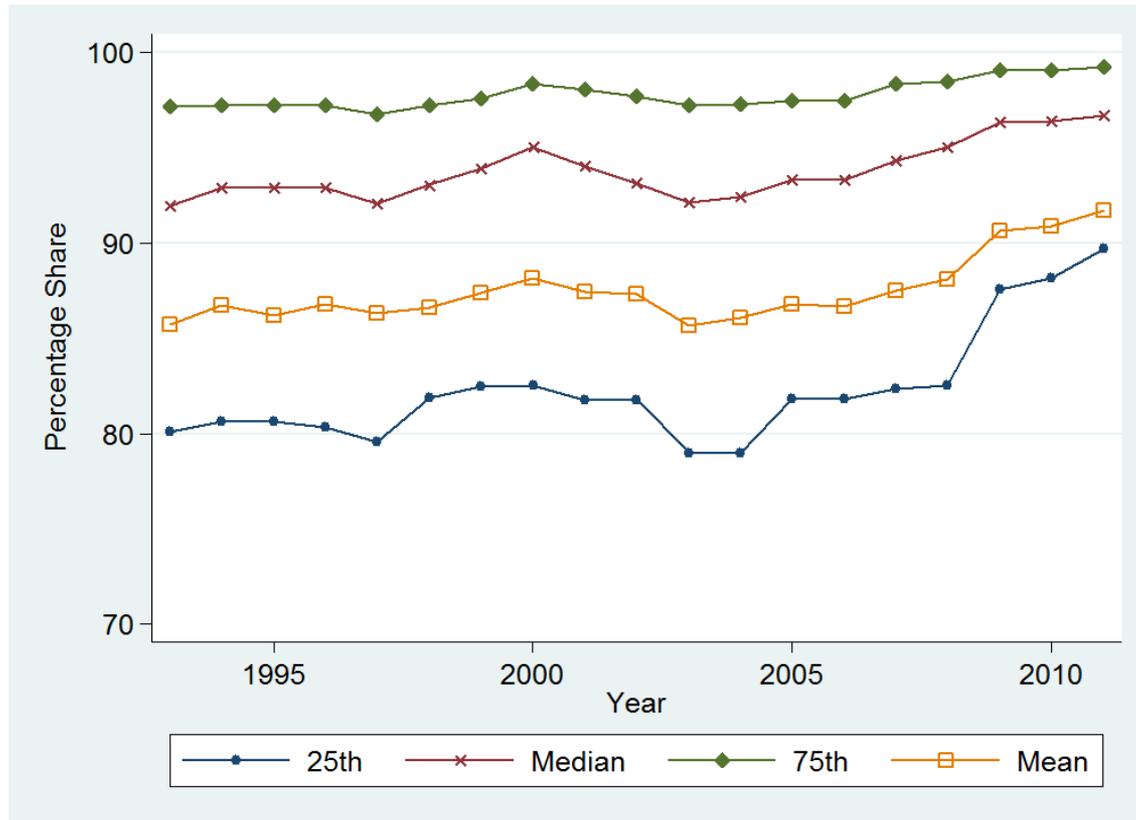   Note: White: -0, Yellow: 0-0.025, Green: 0.025-0.05, Red: 0.05-0.075, Blue: 0.075-.
Source: Keola et al. (2015).

Trends in the Share of the Informal Sector's Sales at the District Level in Cambodia

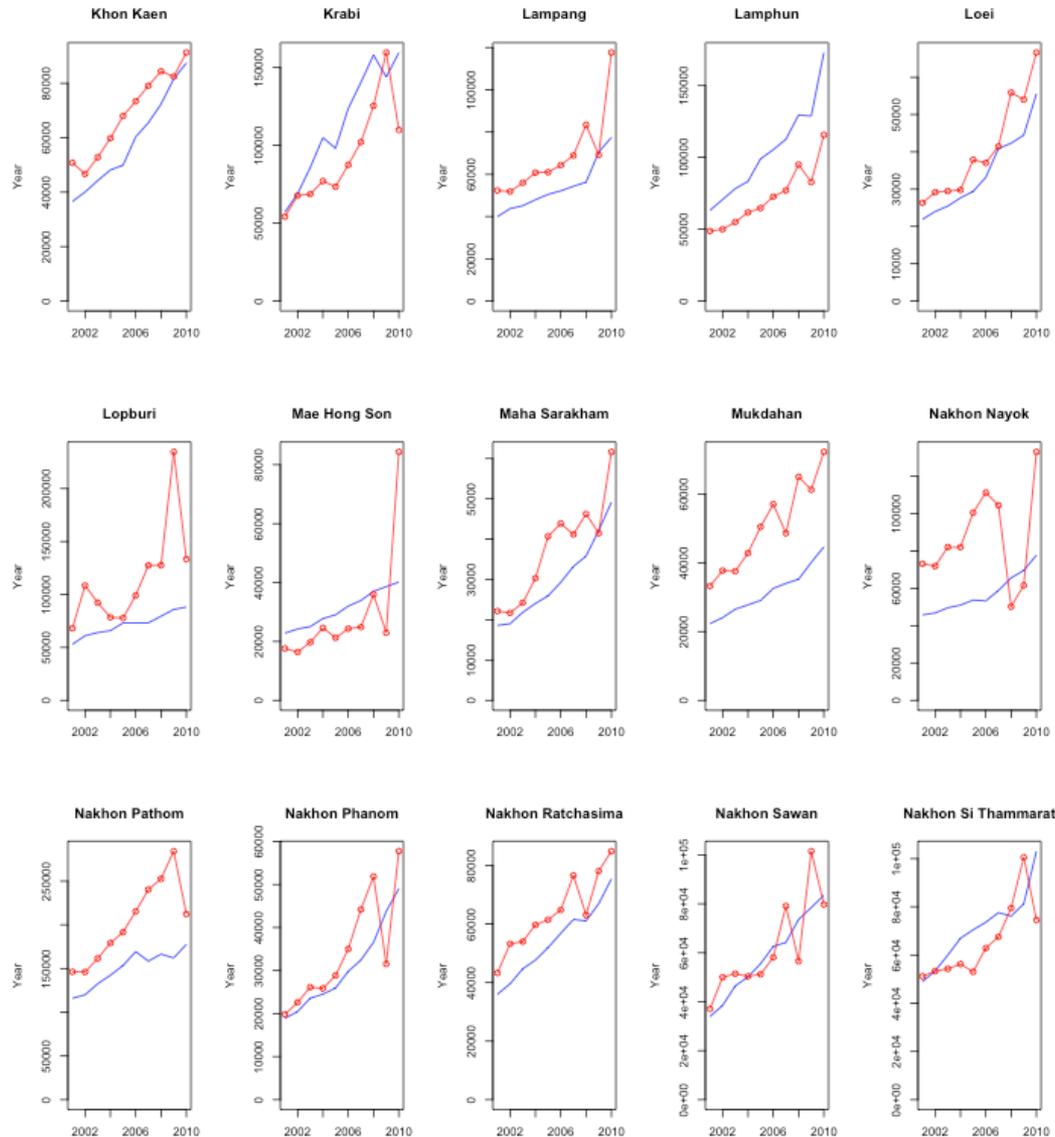*Note*: 25th and 75th indicate the 25th and 75th percentiles of the share of the informal sector's sales at the district-level in each year.

Estimation of Gross Provincial Products in Thailand with Nighttime Light and LandScan
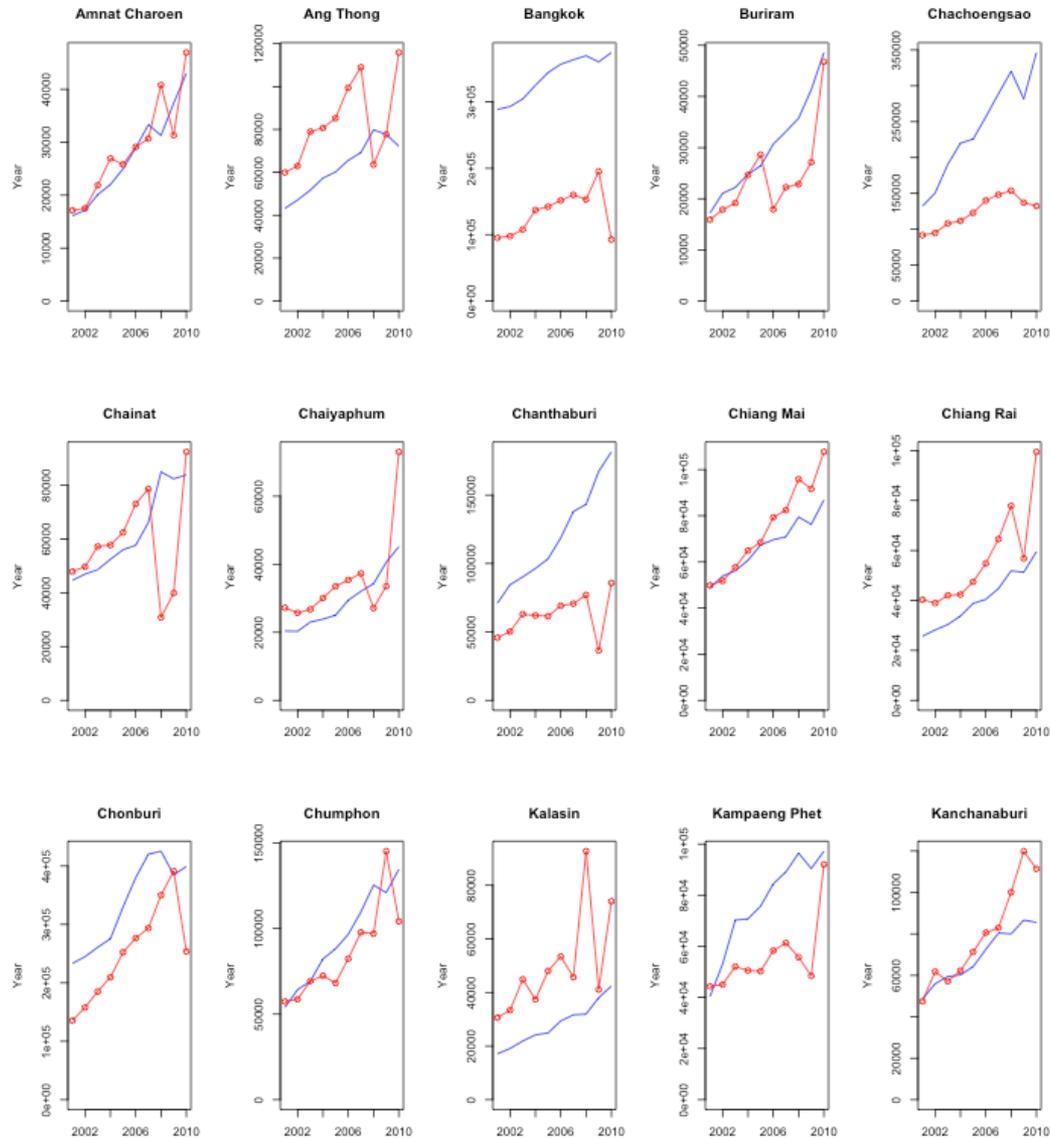
Source: Keola et al. (fourthcoming).

Estimation of Gross Provincial Products in Thailand with Nighttime Light and LandScan

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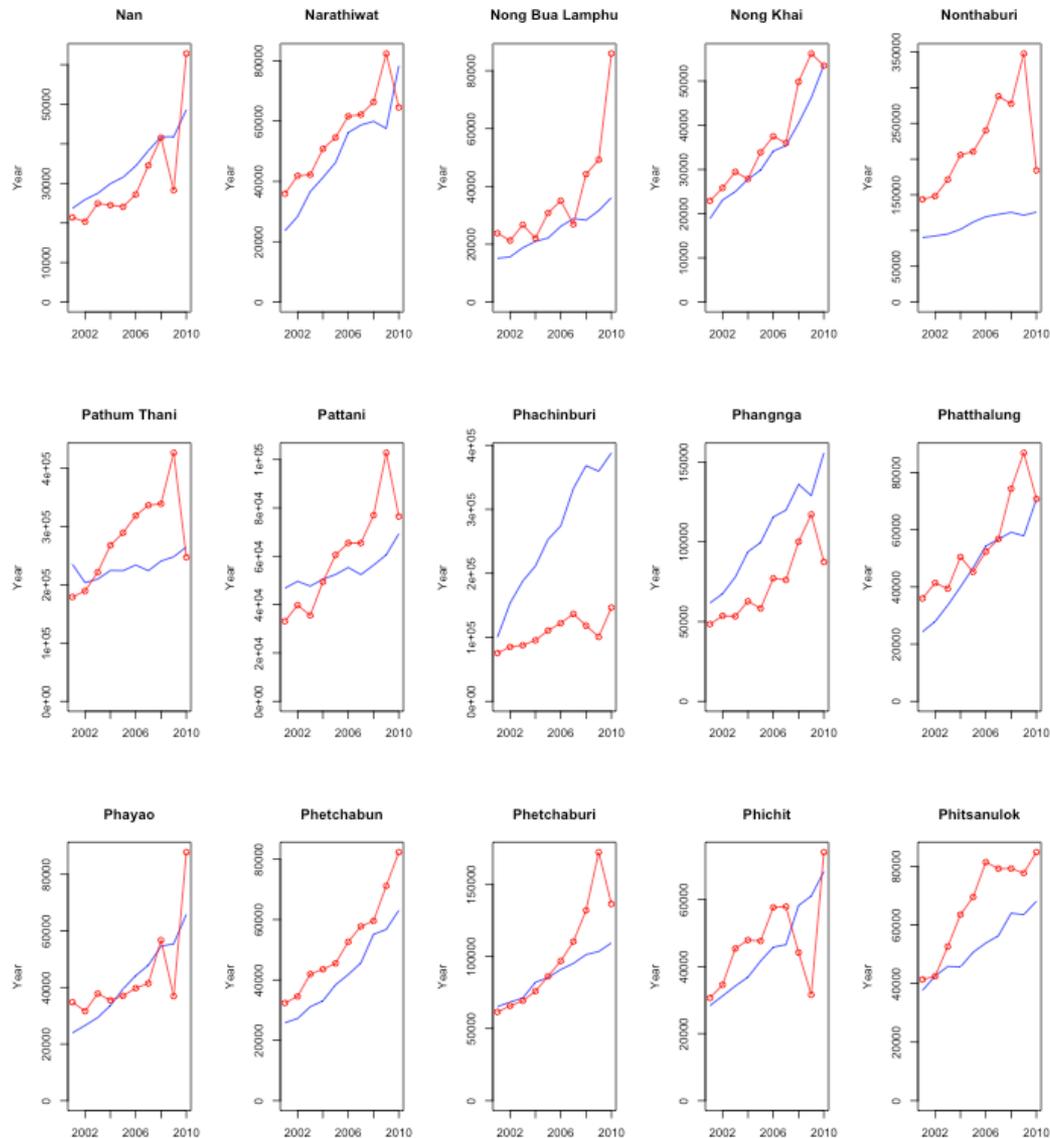
Source: Keola et al. (fourthcoming).

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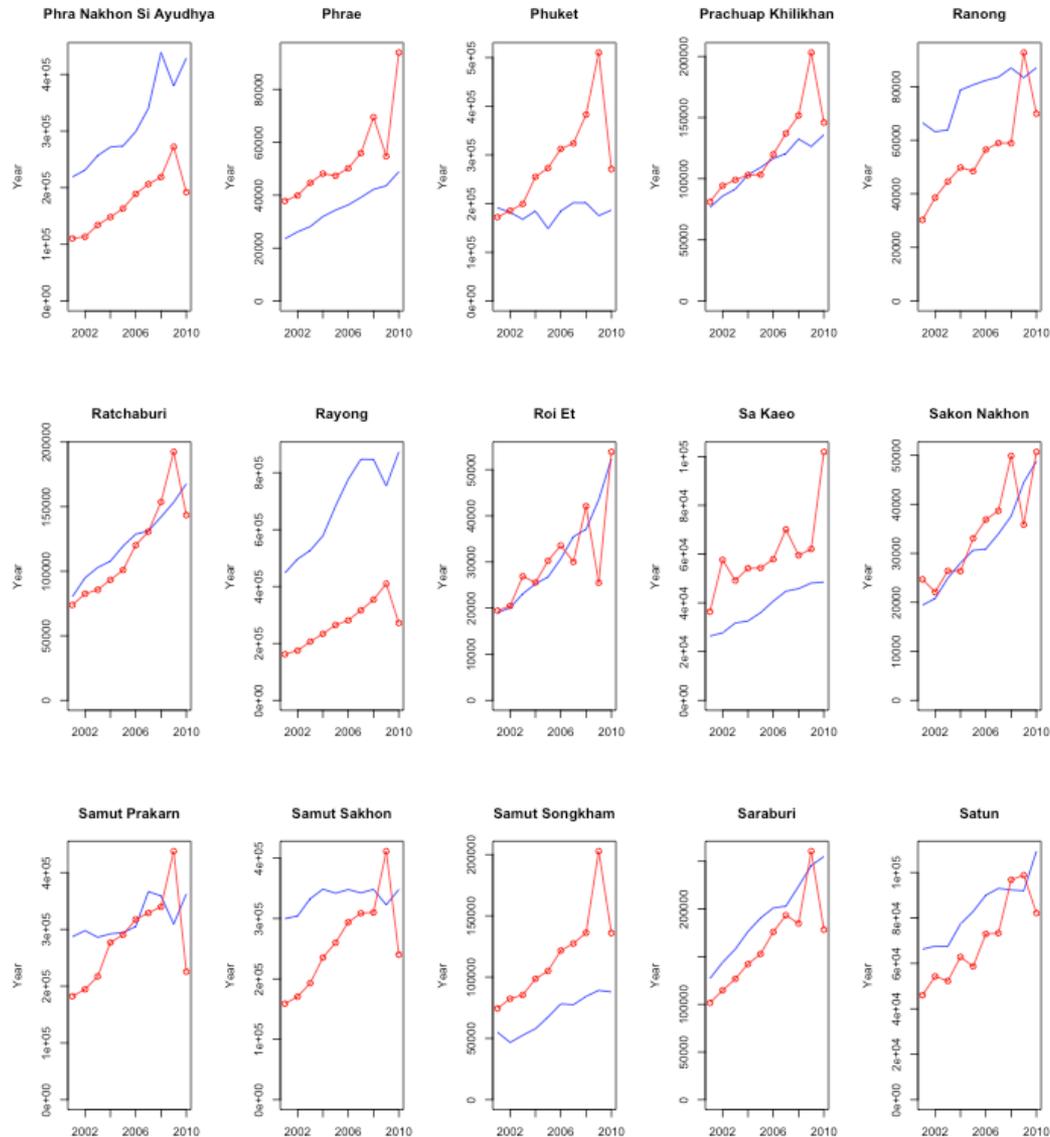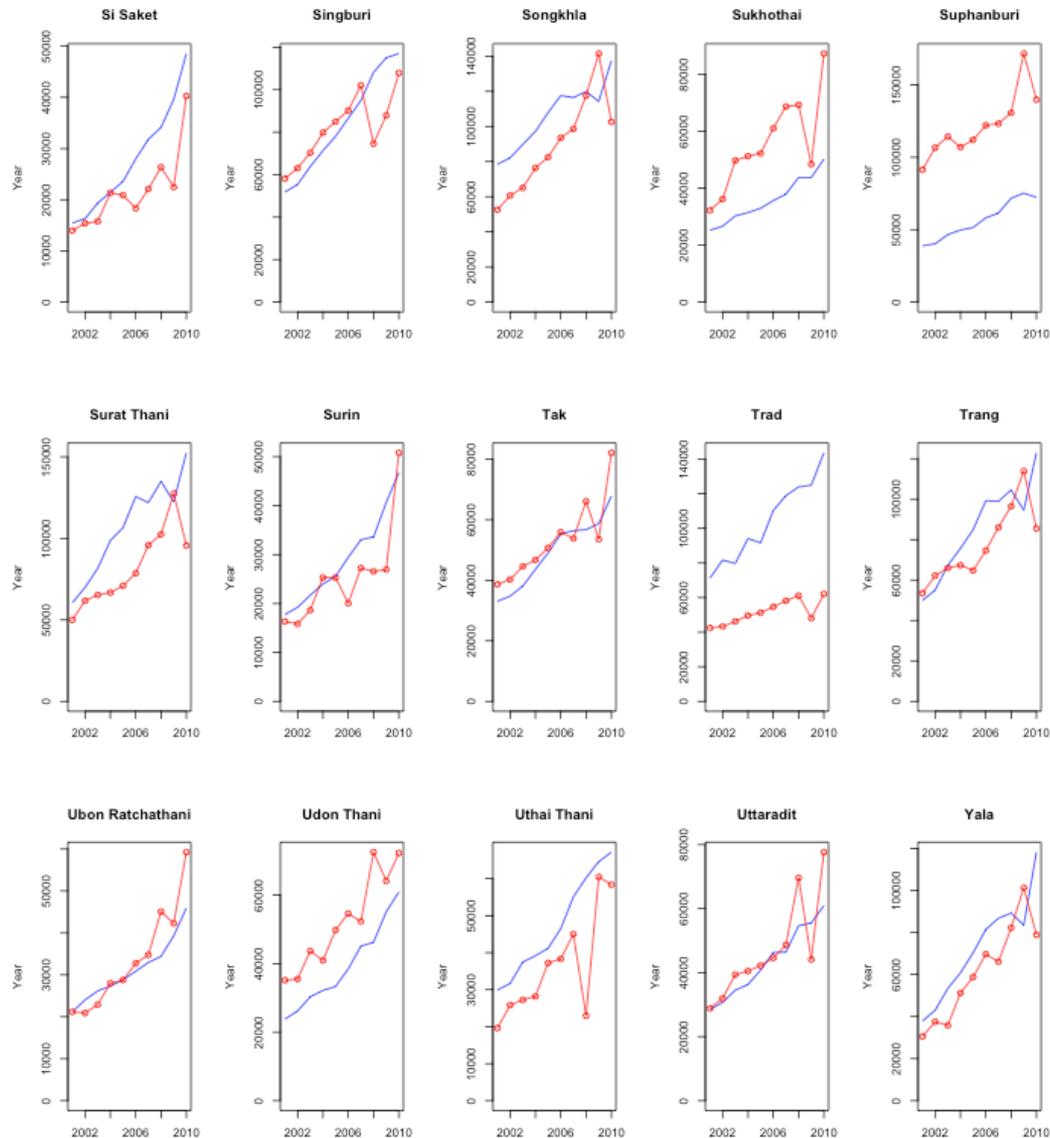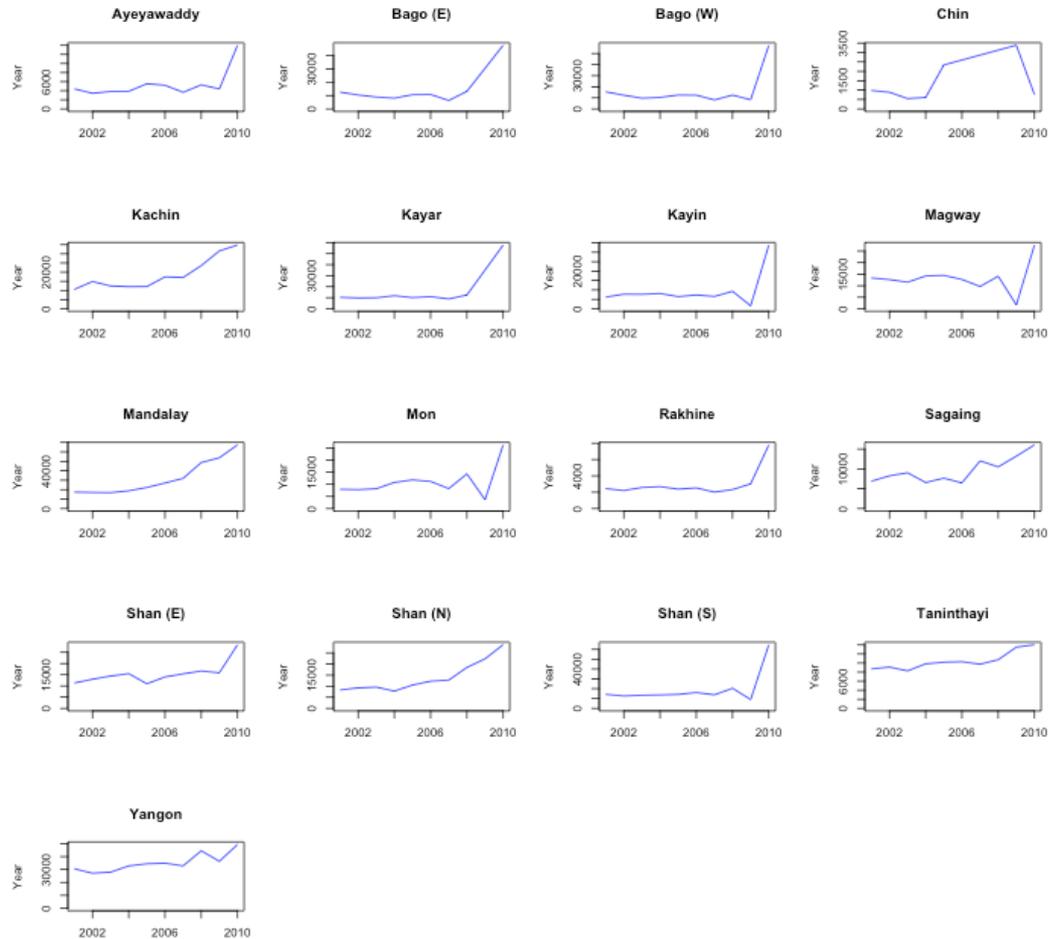
Source: Keola et al. (fourthcoming).

Concluding Remarks

Data collected on the ground and from space are complimentary

- Conventional field survey is both expensive and time consuming → low spatio-temporal resolution
- High spatio-temporal resolution remote-sensing data can be used to interpolate/extrapolate spatially patchy and infrequent ground surveys
- Remote-sensing data is free, or very cheap, so is particularly suitable for study of developing countries with budget constrain
- Combination of field surveys and remote sensing would push (economics) research to the next level

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Thank You for Your Attention

Questions and collaboration proposals are welcomed at souknilanh_keola@ide.go.jp