

Multi-scalar telecouplings in the East-
West Economic Corridor between Da
Nang, Vietnam and Khon Kaen,
Thailand: urban and rural land changes.

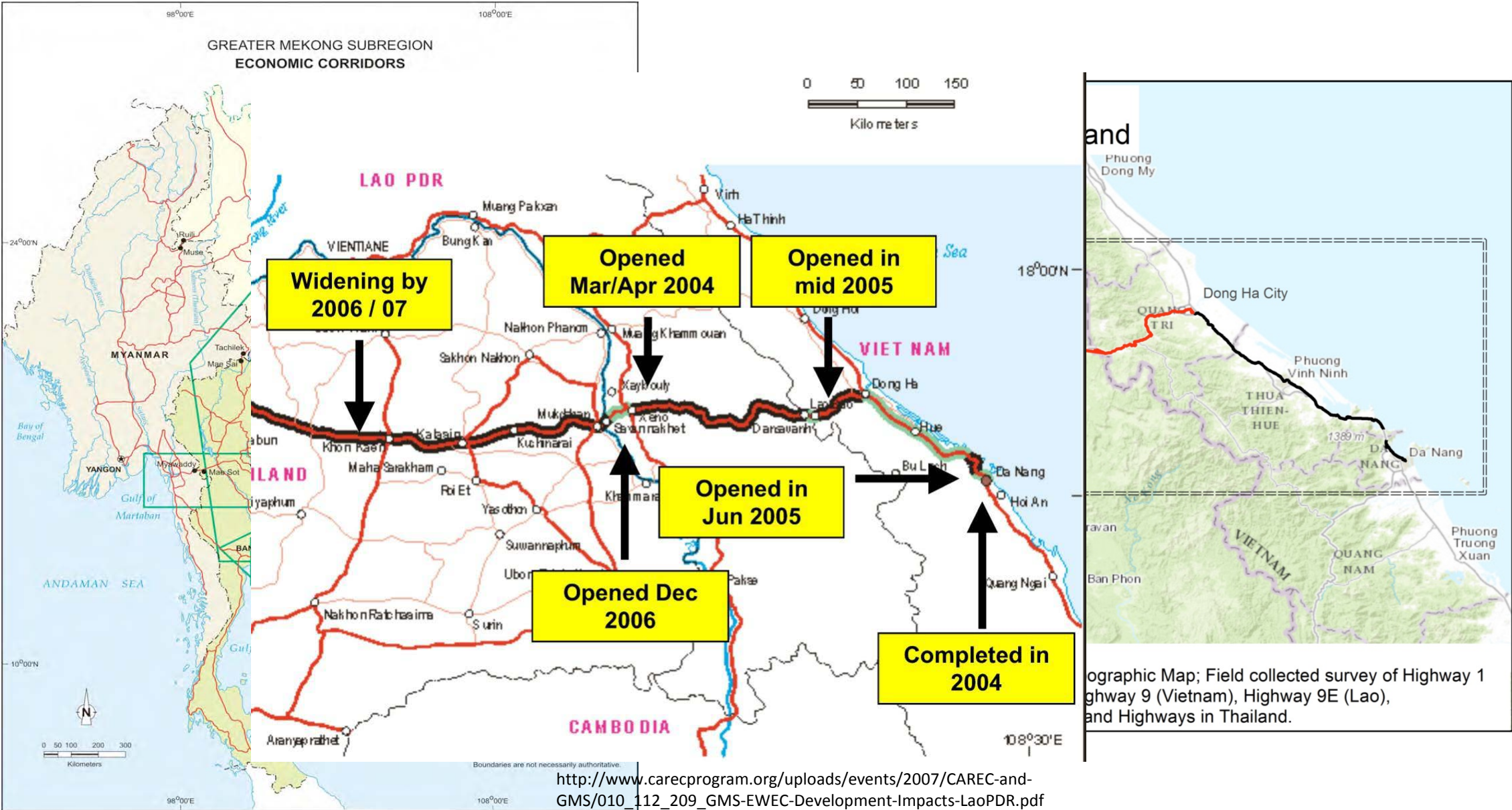
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Overview

- Background to study
 - The East-West Economic Corridor
 - Telecoupling explained
 - Objective
- Methods
- Results
 - Urban changes (need new slides from urban analysis)
 - Rural changes
- Discussion: multiple telecoupled systems
 - Global telecouplings, spillover systems, and land changes
 - Regional Urban-rural telecouplings, spillover systems and land changes
 - Local telecoupling
- Conclusions

Background: East-West Economic Corridor



Background: Telecoupling

- Conceptualize linkages of local land-use change and related land-cover change to geographically distant events
- Analyzes feedbacks:
 - Between where land-cover/land-use changes are taking place; and
 - Where the drivers of the changes originate; and
 - Multi-directional flow of goods and services between these (and other) locations
- This presentation looks at telecouplings (based on Jianguo Liu et al. (2009)) in terms of “sending systems”, “receiving systems”, and “spill-over systems”, and the agents, flows, causes and effects of the telecoupling

Objectives

- Identify land-cover/land-use changes within the corridor
- Identify if similar changes are taking place in all three countries
- Identify telecoupled systems driving these changes.
 - Examine the interaction between nested telecoupled systems

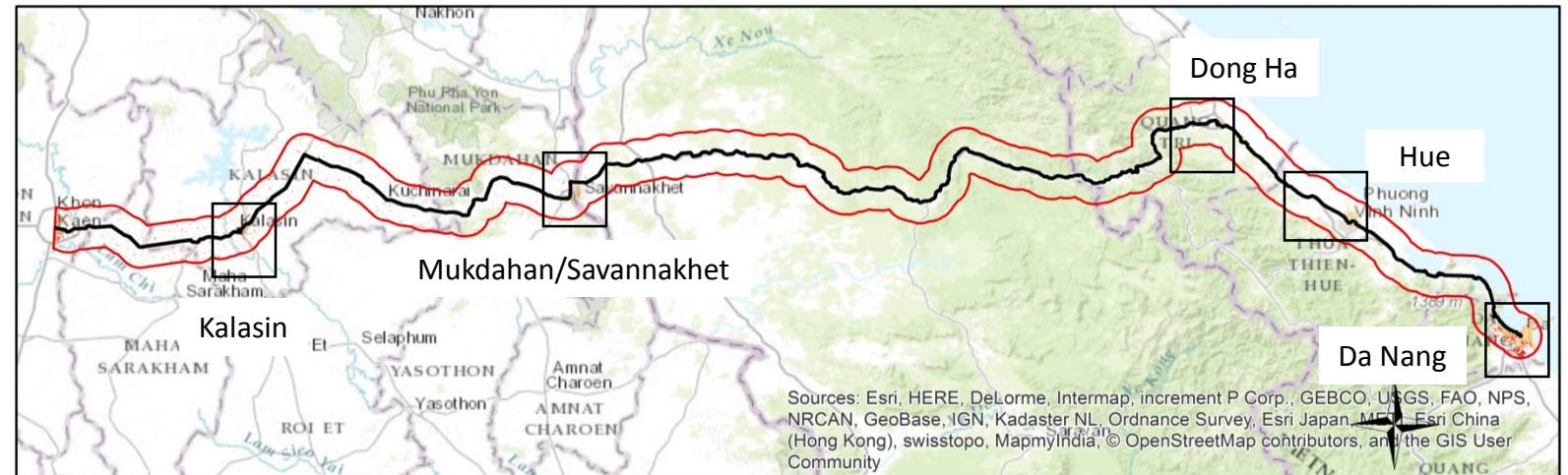
Methods

- Remote sensing to identify land-cover (and some land-use) changes
 - Hypertemporal analysis of 212 stacked MODIS EVI layers from 2000-2014 identified coarse scale changes
 - Landsat TM and ETM+ analysis of rural changes in Laos and Vietnam – finer scale changes in rural and some urban areas
 - Urban changes from Global Human Settlement Database (made using Landsat TM, ETM+ data)
- Fieldwork to identify drivers of land-use changes from local perspective
 - Interviews at Province, District, Commune, Village levels in Vietnam, Laos, Thailand
 - Transect walks in selected villages
 - Structured questionnaires focusing on livelihood changes (Vietnam and Laos)
- Literature review: government policies, ODA policies, etc.

Results: Urban Land Cover Change

- Vietnam: increase from 97 km² in 1975 to 147 km² in 2014.
- Laos: least urban, increase from 1 km² in 1975 to 7.5 km² in 2014
 - Mostly around Savannakhet City; very little in rural areas
- Thailand (between Khon Kaen City and Mukdahan): increase from 25 km² in 1975 to 128 km² in 2014
- Infilling of existing urban areas; extension of urban built-up areas; transformation of 'rural' villages into areas with urban built-up characteristics

Built-Up Areas in the EWEC 1975-2014



Legend
 — Highways AH 16 and AH 1
 □ Area in close proximity (8 km) of EWEC Highway

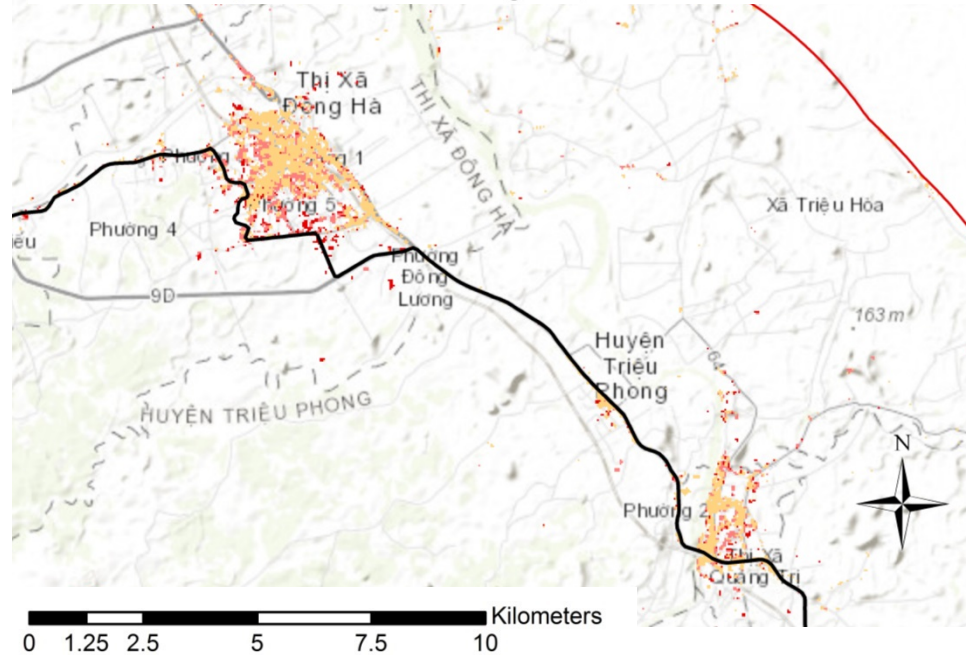
Built-Up (urban) Areas
 ■ built-up from 2000 to 2014 epochs
 ■ built-up from 1990 to 2000 epochs
 ■ built-up from 1975 to 1990 epochs
 ■ built-up up to 1975 epoch

0 25 50 100 150 200 Kilometers

Change in Built-Up (Urban Area)	Thailand sq. km	Laos sq. km.	Vietnam sq. km.	Total sq. km.
Built-up prior to 1975	25.06	1.18	96.92	123.16
Built-up 1975-1990 change	57.57	3.68	11.94	73.18
Built-up 1990-2000 change	20.50	1.34	13.13	34.98
Built-up 2000-2014 change	24.97	1.28	25.18	51.43
Total in 2014	128.10	7.47	147.17	282.75

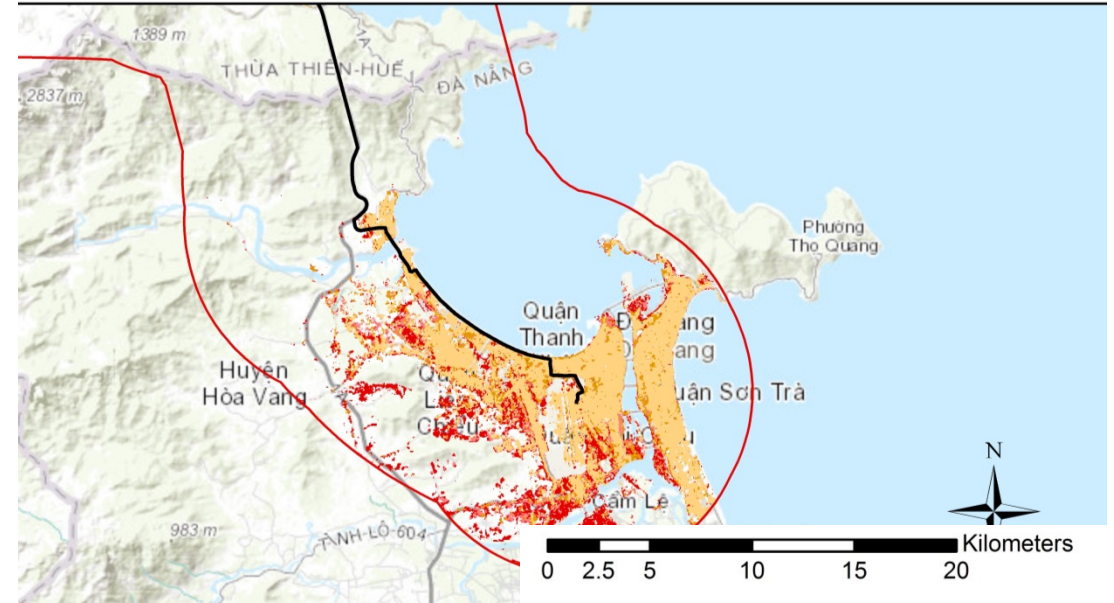
Urban Changes: Vietnam

Built-Up Areas in Quang Tri, Vietnam 1975-2014



Change in Built-Up (Urban Area)	sq. km.
Built-up prior to 1975	96.92
Built-up 1975-1990 change	11.94
Built-up 1990-2000 change	13.13
Built-up 2000-2014 change	25.18
Total in 2014	147.17

Built-Up Areas in Da Nang, Vietnam 1975-2014



Legend

- Highways AH 16 and AH 1
- Area in close proximity (8 km) of EWEC Highway

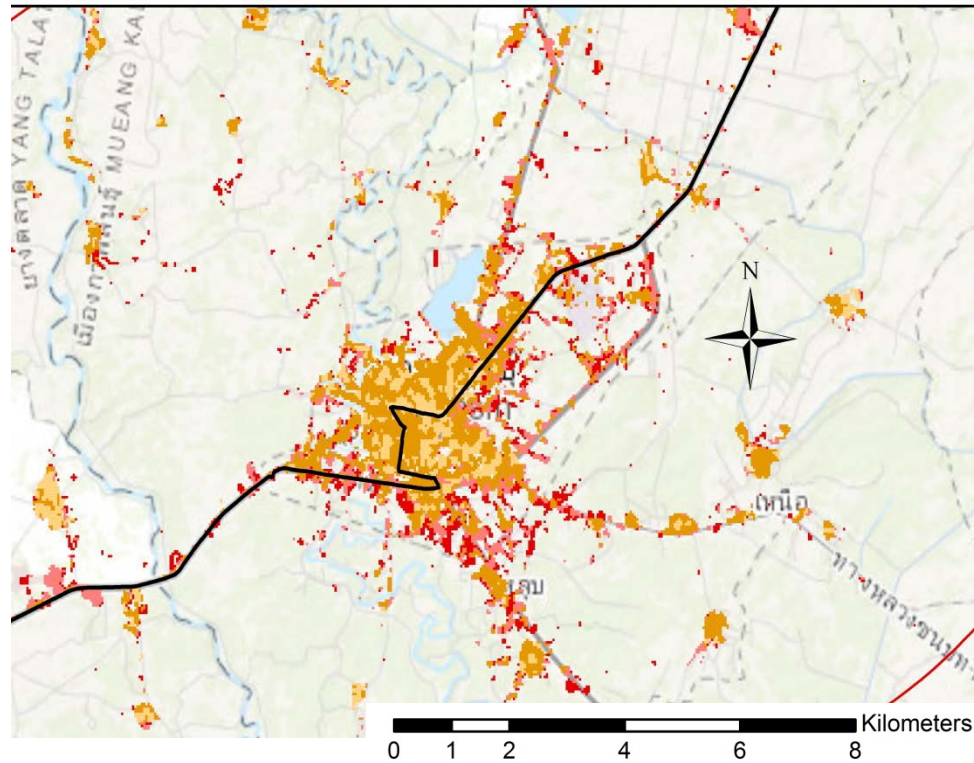
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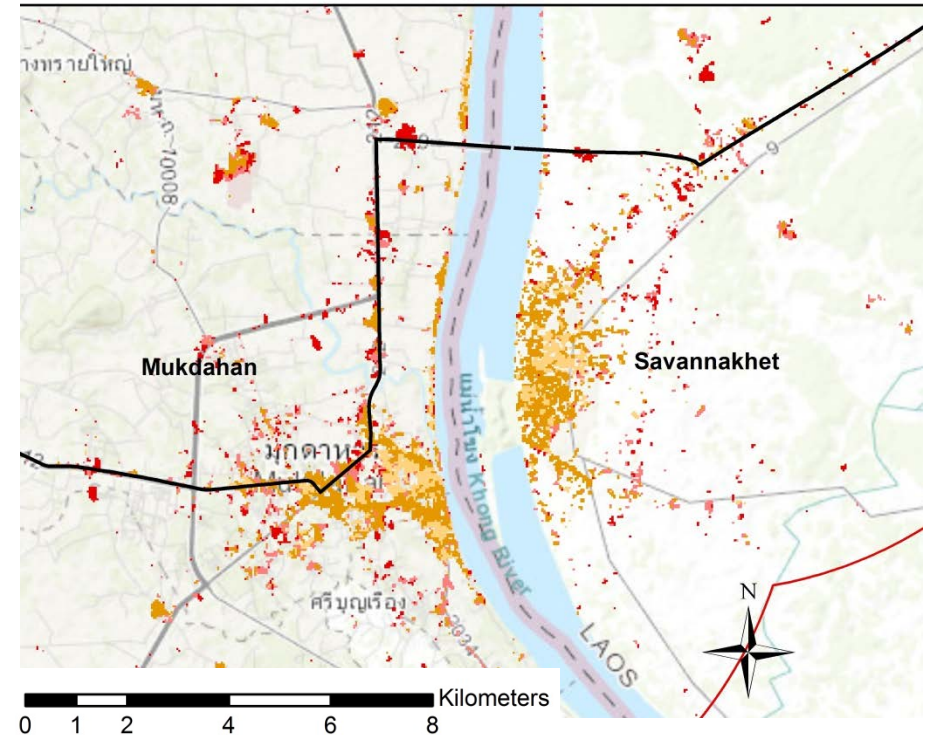


Urban Changes: Laos and NE Thailand

Built-Up Areas in Kalasin, Thailand 1975-2014



Built-Up Areas in Mukdahan, Thailand, and Savannakhet, Laos 1975-2014



Change in Built-Up (Urban Area)	sq. km	Change in Built-Up (Urban Area)	sq. km
Built-up prior to 1975	25.06	Built-up 2000-2014 change	24.97
Built-up 1975-1990 change	57.57	Total in 2014	128.10
Built-up 1990-2000 change	20.50		

Legend

- Highways AH 16
- Area in close proximity (8 km) of EWEC Highway

Built-Up (urban) Areas

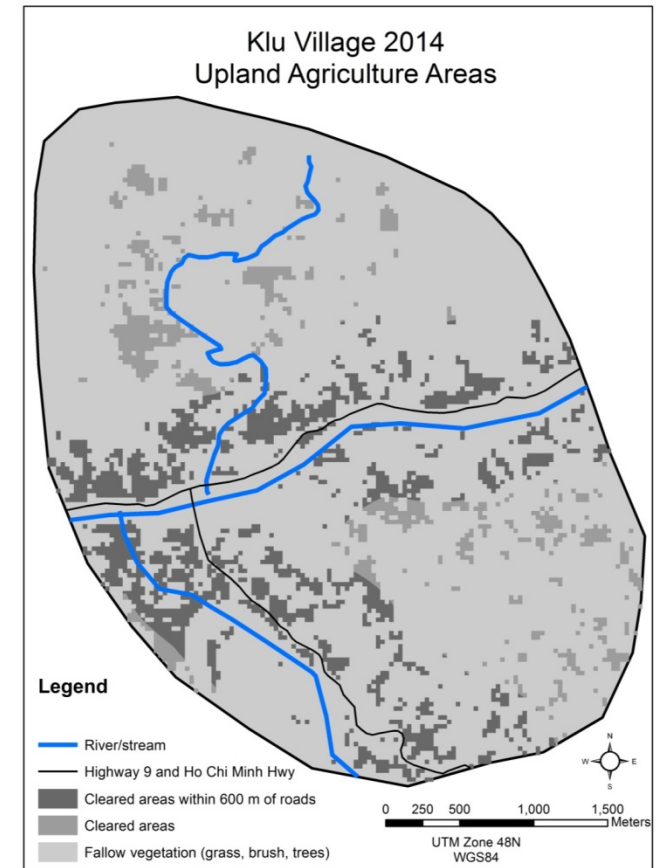
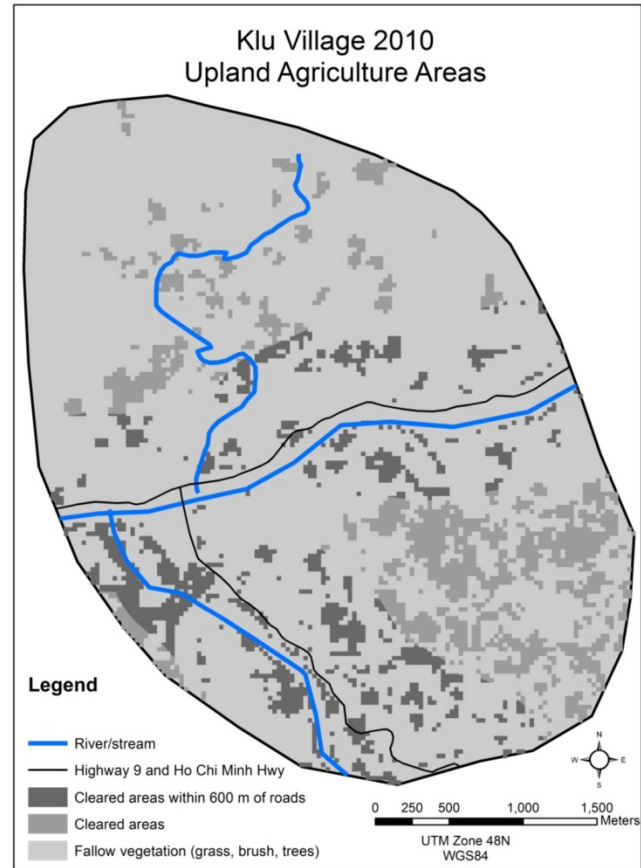
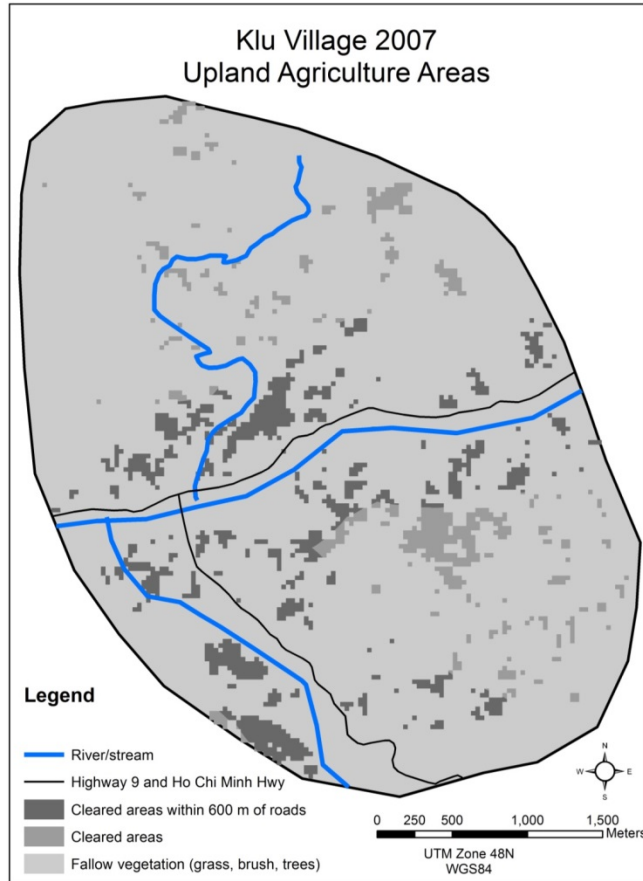
- built-up from 2000 to 2014 epochs
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Results: Rural Land Cover Changes Vietnam

- Change in crops planted (less upland rice; more cassava, more tree crops)
- Distant land fallow for longer (in places)
- Change in placement of field locations
- Rural urbanization taking place along road in some rural villages



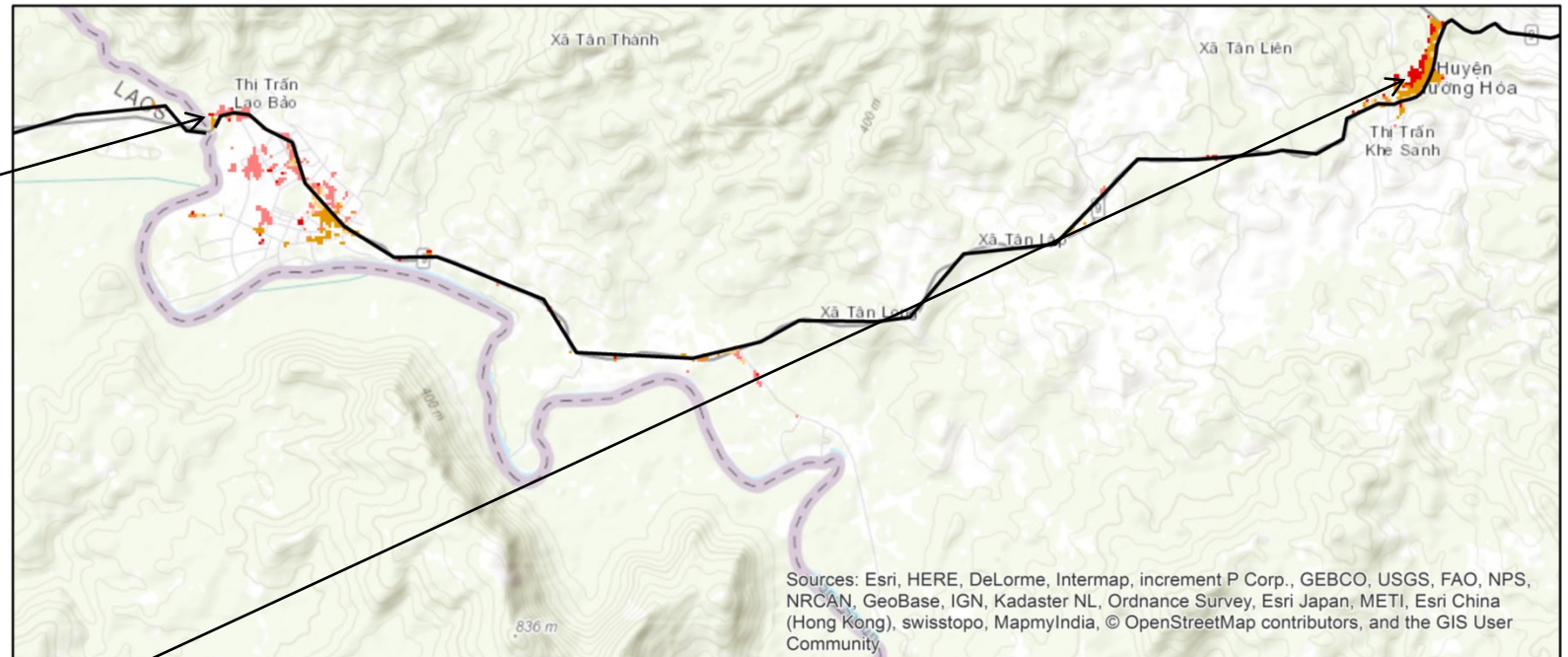
Rural Changes: Example of Klu Village





Rural Changes: Rural Urbanization in Vietnam







Built-Up Areas: Rural Vietnam / Laos Border 1975-2014

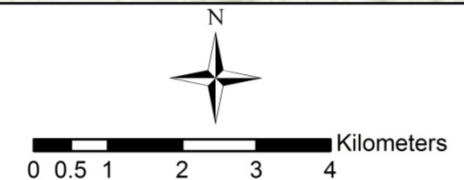


Legend

-  Highways AH 16
-  Area in close proximity (8 km) of EWEC Highway

Built-Up (urban) Areas

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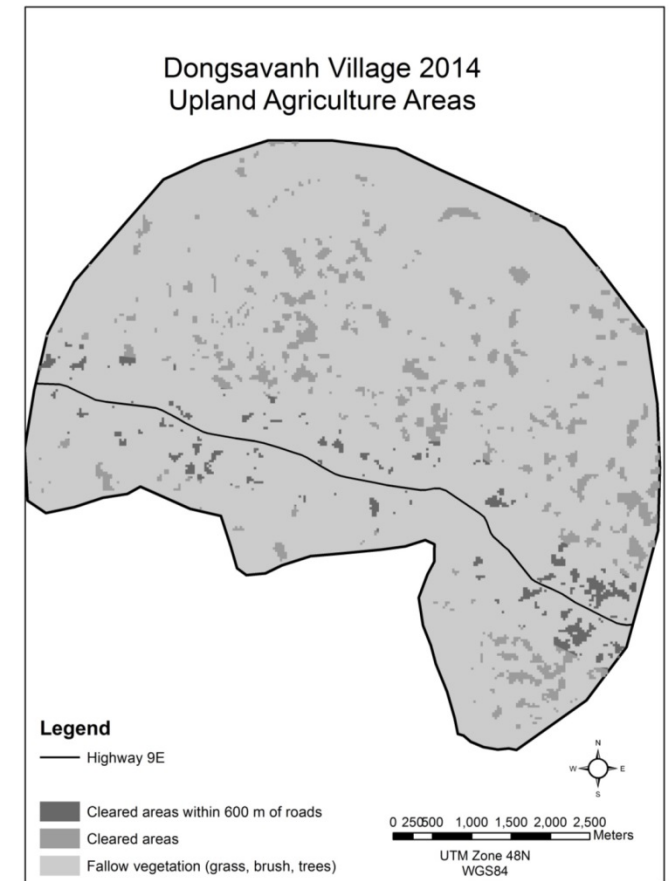
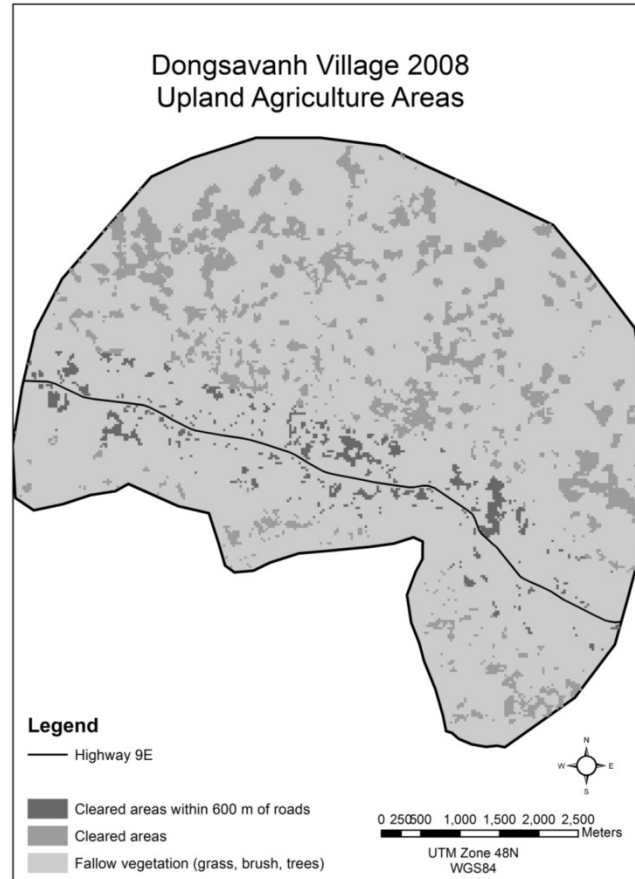
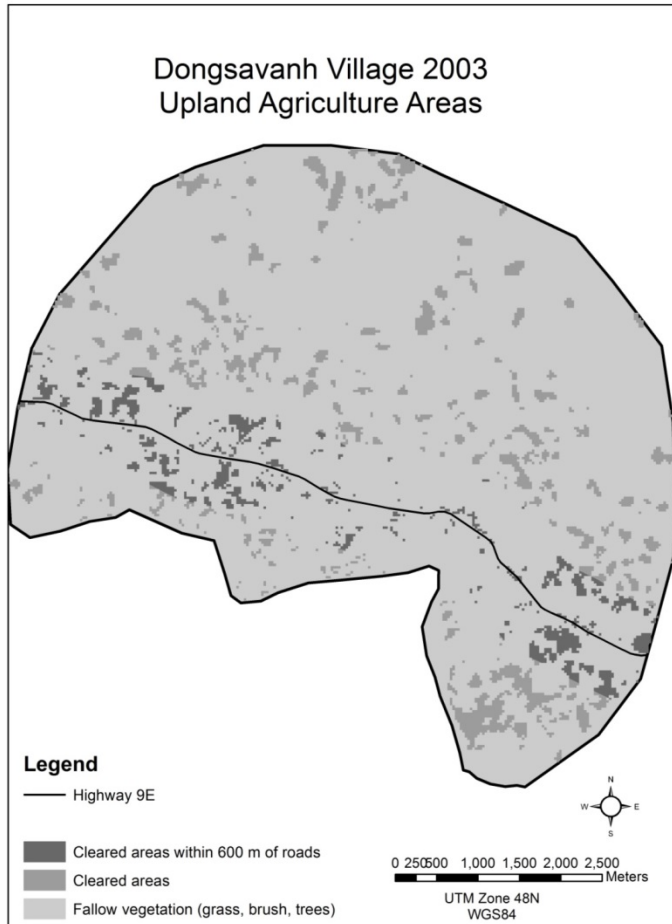


Results: Rural Land Cover Changes Laos

- Change in crops planted (banana, hybrid cassava, eucalyptus introduced)
- No significant changes in landscape (still dominated by swidden agriculture and associated land cover types)
- Along road some 'rural urbanization' but not as significant as in Vietnam or Thailand

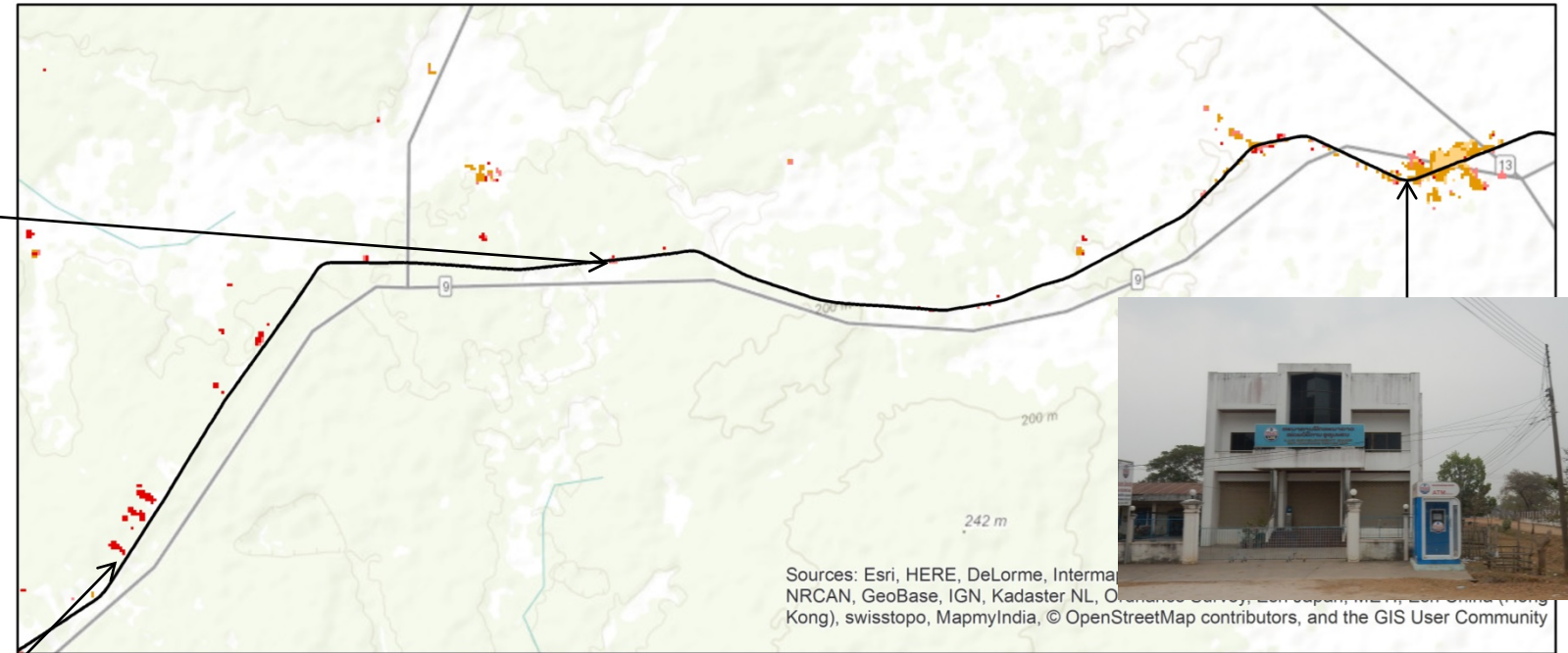


Rural Changes: Example Dongsavanh Village



Rural Urbanization in Laos

Built-Up Areas: Rural Laos East of Savannakhet City 1975-2014



Legend

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Built-Up (urban) Areas

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0 0.5 1 2 3 4 Kilometers

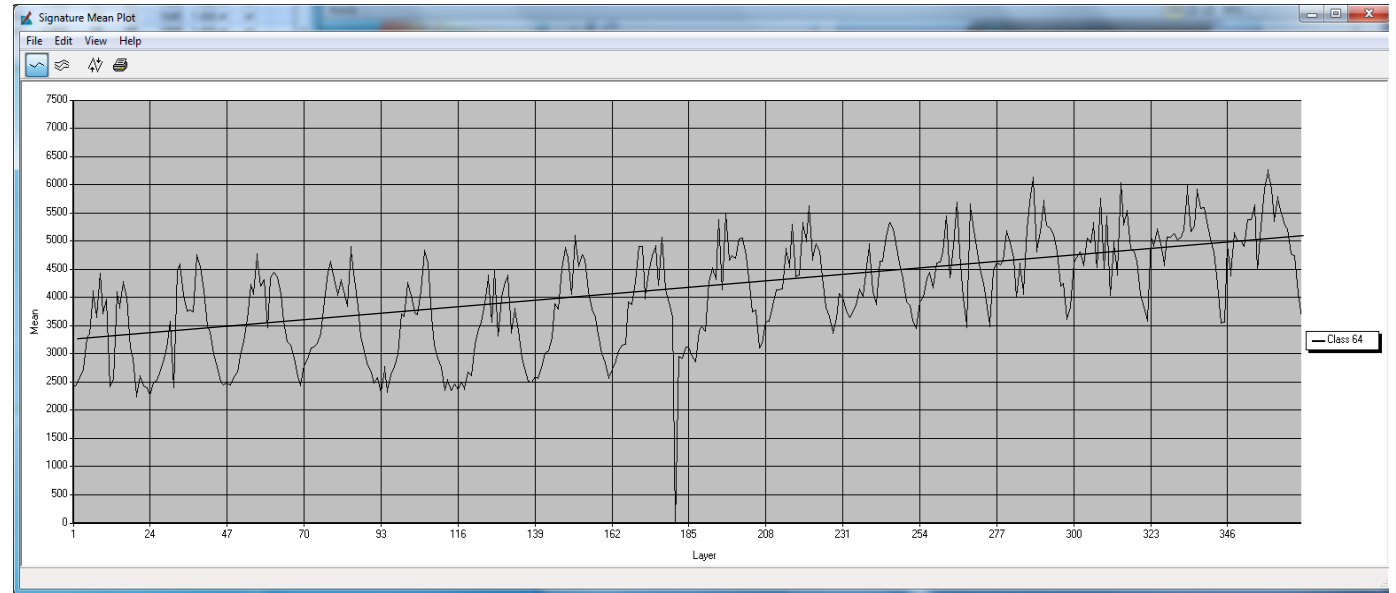
Results: Rural Land Cover Changes Northeast Thailand

- Evidence for increase in tree cover from MODIS hypertemporal analysis and village-level interview data
- Change in agricultural practices: less emphasis on rice growing, more on market oriented crops
- Rural urbanization taking place along road – increase in small and medium size enterprises near main roads



Rural Land-cover Changes Northeast Thailand

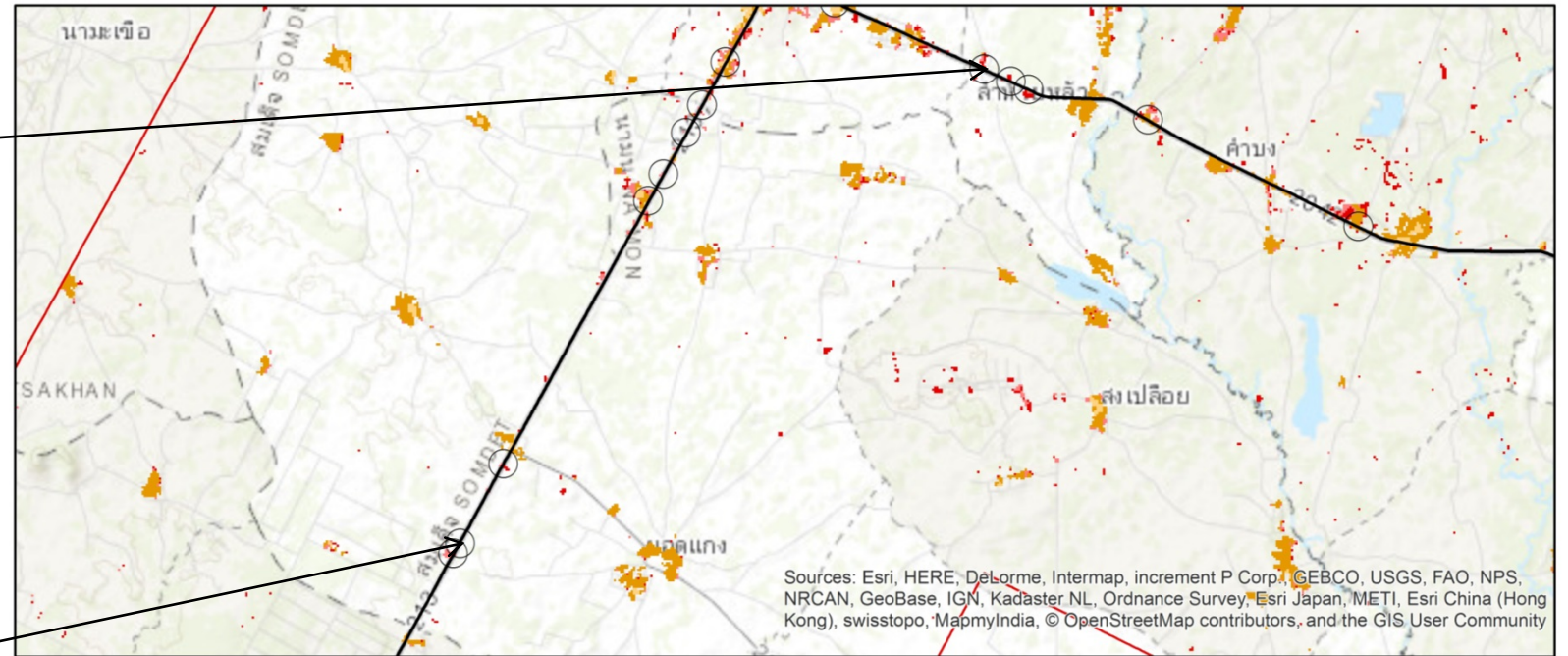
- Hypertemporal MODIS analysis for Vietnam and Laos identified
 - Urban expansion
 - Reservoir creation
 - Decreasing vegetation
- In Thailand analysis showed little change in vegetation except for two class where vegetation increased



One of the two hypertemporal MODIS signatures indicating increasing vegetation per pixel between 2000 - 2014.

Land-Cover Changes: Rural Urbanization in Thailand

Built-Up Areas: Rural Thailand between Khon Kaen and Mukdahan Cities 1975-2014



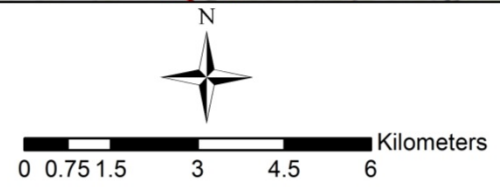
Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Legend

- Highways AH 16
- Area in close proximity (8 km) of EWEC Highway
- Factory near road

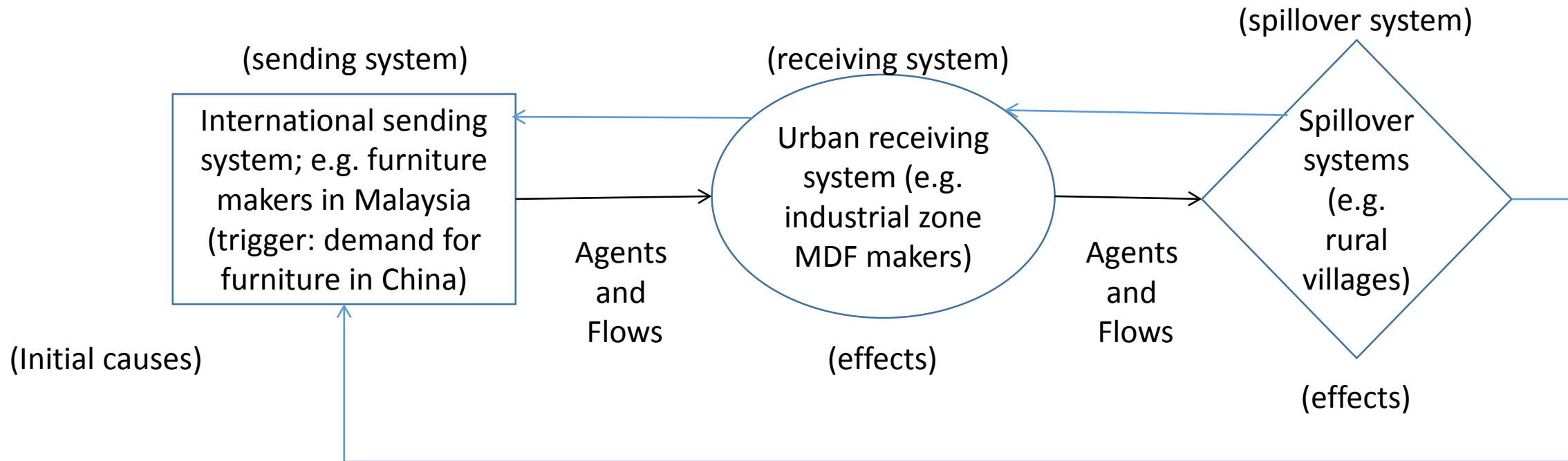
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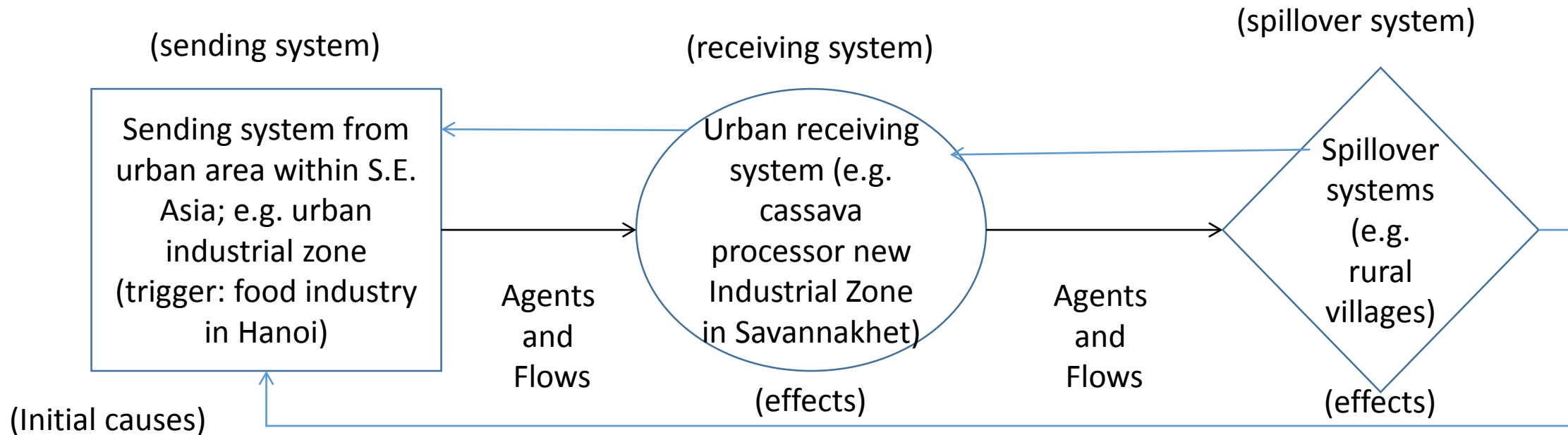
Discussion: Telecoupling at multiple scales in the EWEC

- Global to urban (each country, the whole corridor)



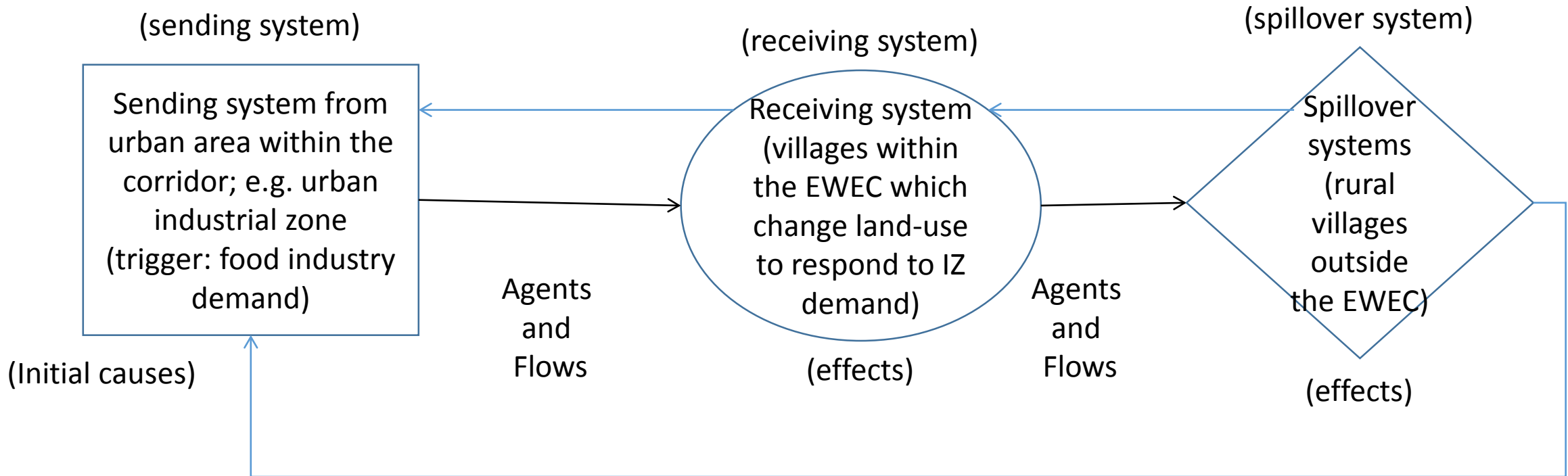
Discussion: Telecoupling at multiple scales in the EWEC

- Regional urban to urban (in Thailand and Vietnam and across borders to Laos)



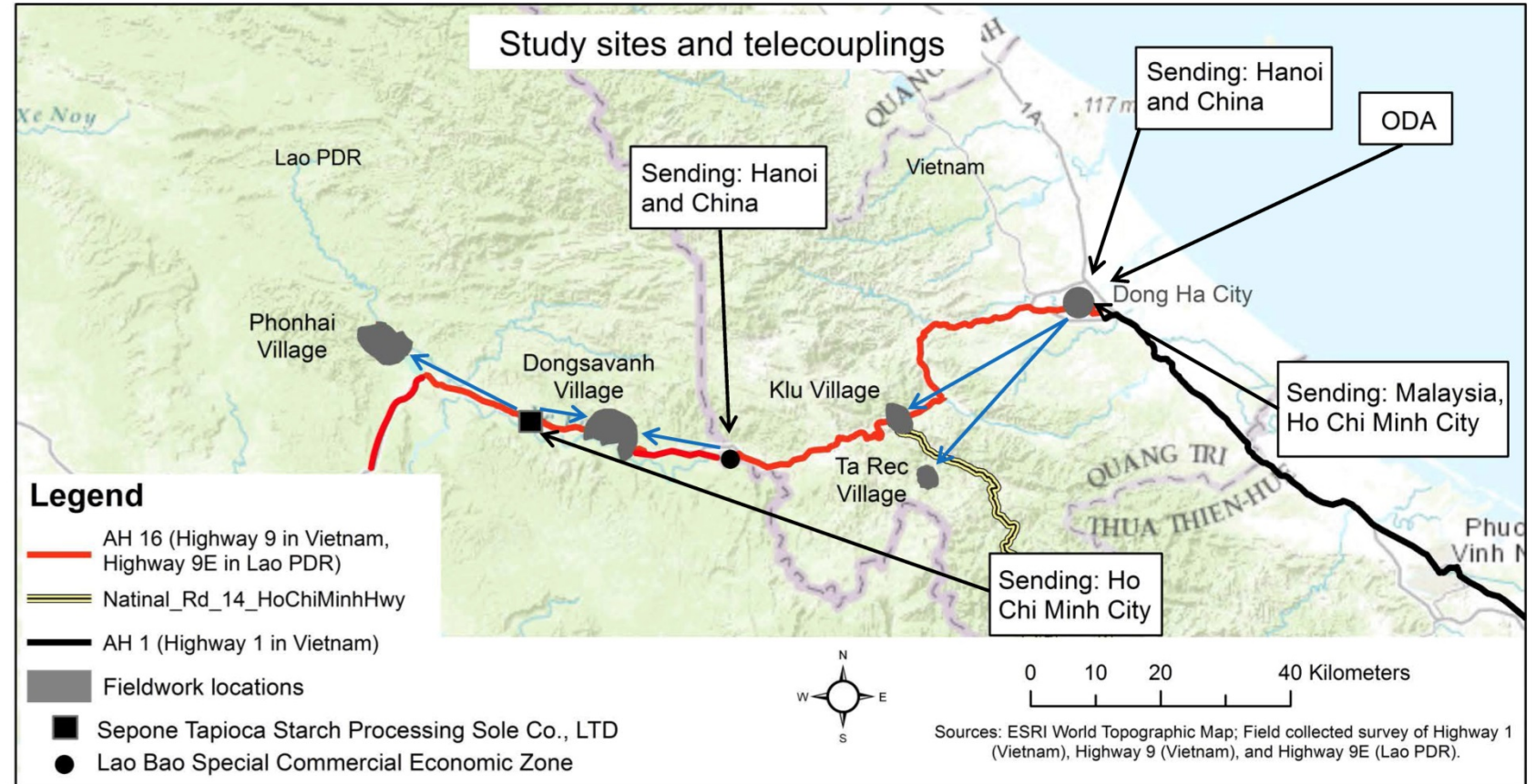
Discussion: Telecoupling at multiple scales in the EWEC

- Local urban to villages



Global and regional scale telecouplings driving changes in Vietnam and eastern Savannakhet

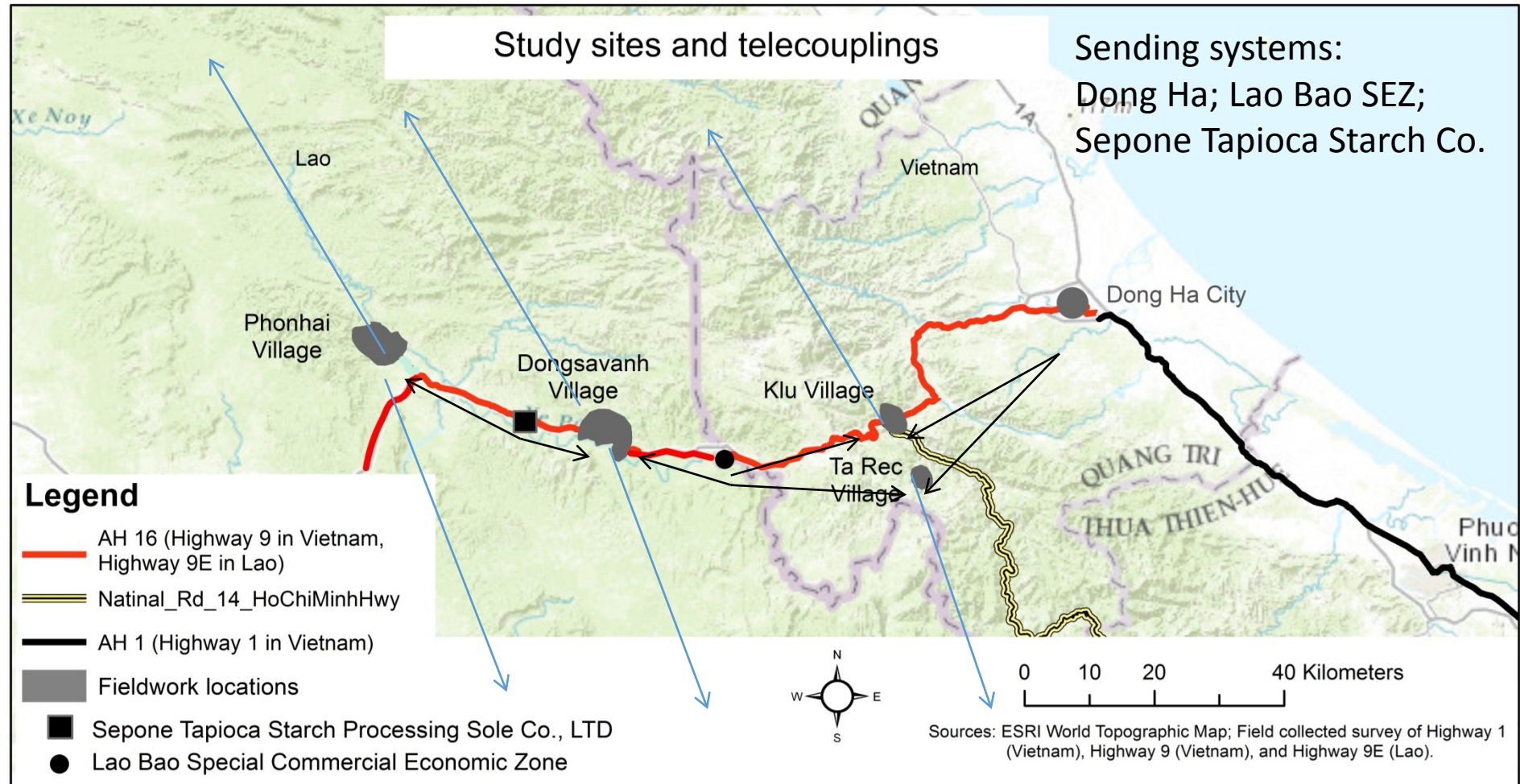
- Initial causes: policy and finance
- Sending systems are outside the EWEC
- Receiving systems are the urban areas and industrial zones within the EWEC
- Spillover systems are the villages which change land-use practices (and consequently land-cover) to respond to receiving systems' demand for products (e.g. cassava, softwood trees, bananas)



- Flows: capital, information, people, goods, ecosystem services, etc.
- Effects: livelihood changes, land-use changes, land-cover changes

Discussion: Local telecoupling within the EWEC – from urban to villages

- Initial causes: policy and finance
- Sending systems are within the EWEC
- Receiving systems are the villages within the EWEC
- Spillover systems are villages outside the EWEC which the receiving villages directly and indirectly compete with
- Flows: money, information, people, goods, ecosystem services, etc.



- Effects: livelihood changes, land-use changes, land-cover changes

Conclusions

- Land-cover/Land-use changes are complicated in the corridor
 - Evidence of both decreasing tree cover (mainly in urban areas, some upland areas) and increasing tree cover (planted, not natural forest)
 - Evidence of changes in upland field placement and agricultural crop growing; and evidence of changing fallow patterns
- Urban forms are being found in rural areas – changes in human settlements, land-use patterns and also human livelihood systems
- Changes are happening across three countries
 - Thailand changes are most advanced; Laos least advanced
- Telecouplings are found across multiple scales within the corridor ranging from global level to regional to local (village to village)

Acknowledgements: This research was supported by the National Aeronautics and Space Administration's (NASA) Land-Cover and Land-Use Change Program (LCLUC) Grant #NNX13AC51G to Colorado State University.

I would like to thank the many officials who participated in our interviews and patiently discussed the land-use/cover and system changes they are seeing, and also the villagers who allowed us to stay in their villages, answered our questions, and guided us through the research process.

Thank you; any questions?

Extra

