

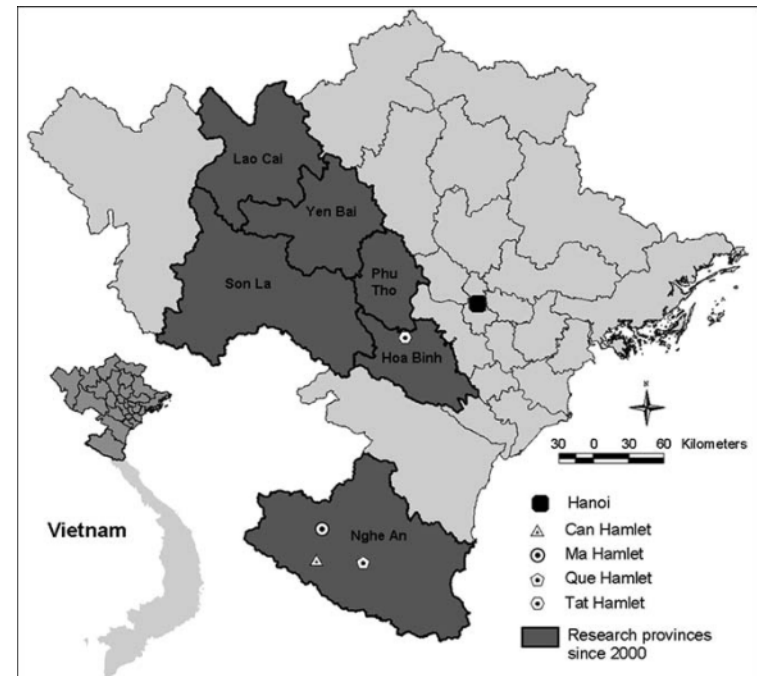
Farming System Transitions in Vietnam's North Central and Northern Mountains

Systems' resiliency and farmer vulnerability

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Overview

- Evidence for farming system changes
 - Government policies
 - Observed changes from satellite data
- Trends regarding what swidden systems are transitioning to
- Potential impacts of changes
 - Resiliency of farming systems
 - Vulnerability of upland farmers
- Conclusion



North-Central and Northern Mountains
Vietnam

Upland Farming Systems



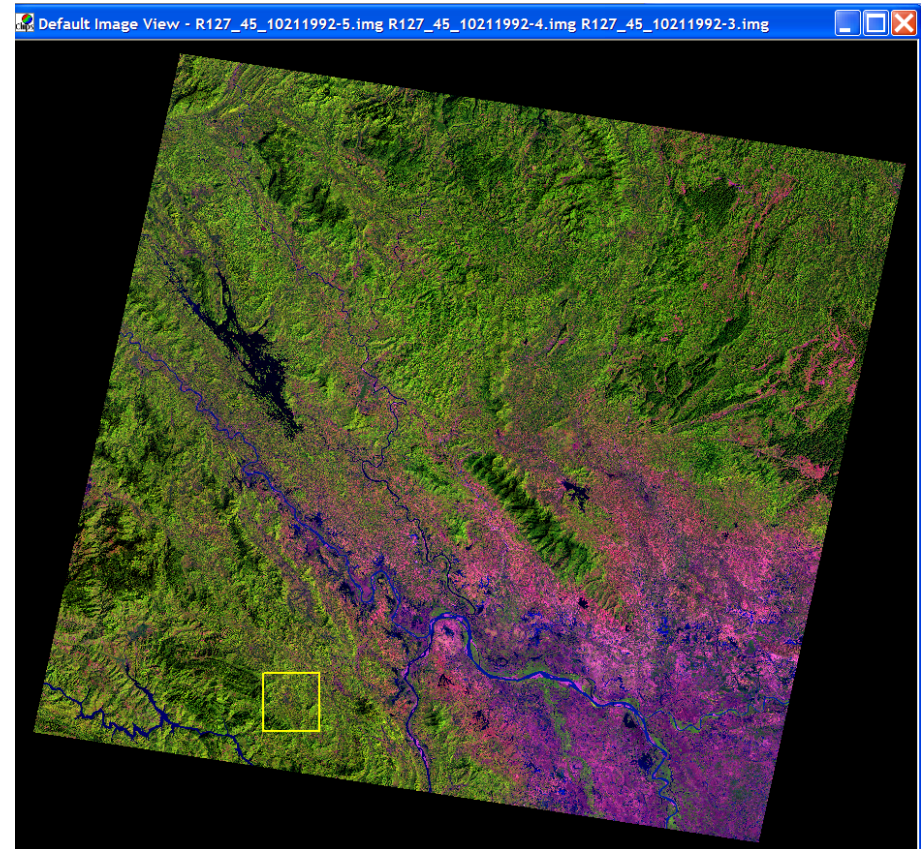
Evidence for farming system changes

- Government views of swidden
- Government policies
 - 1960s to present – Sedentarization and fixed
 - Cultivation program
 - 1986 – Upland management regimes
 - (production, protection, special use forests)
 - 1992 – 327 Program
 - 1994 – forest land allocation
 - 1998 – 5 million hectare program

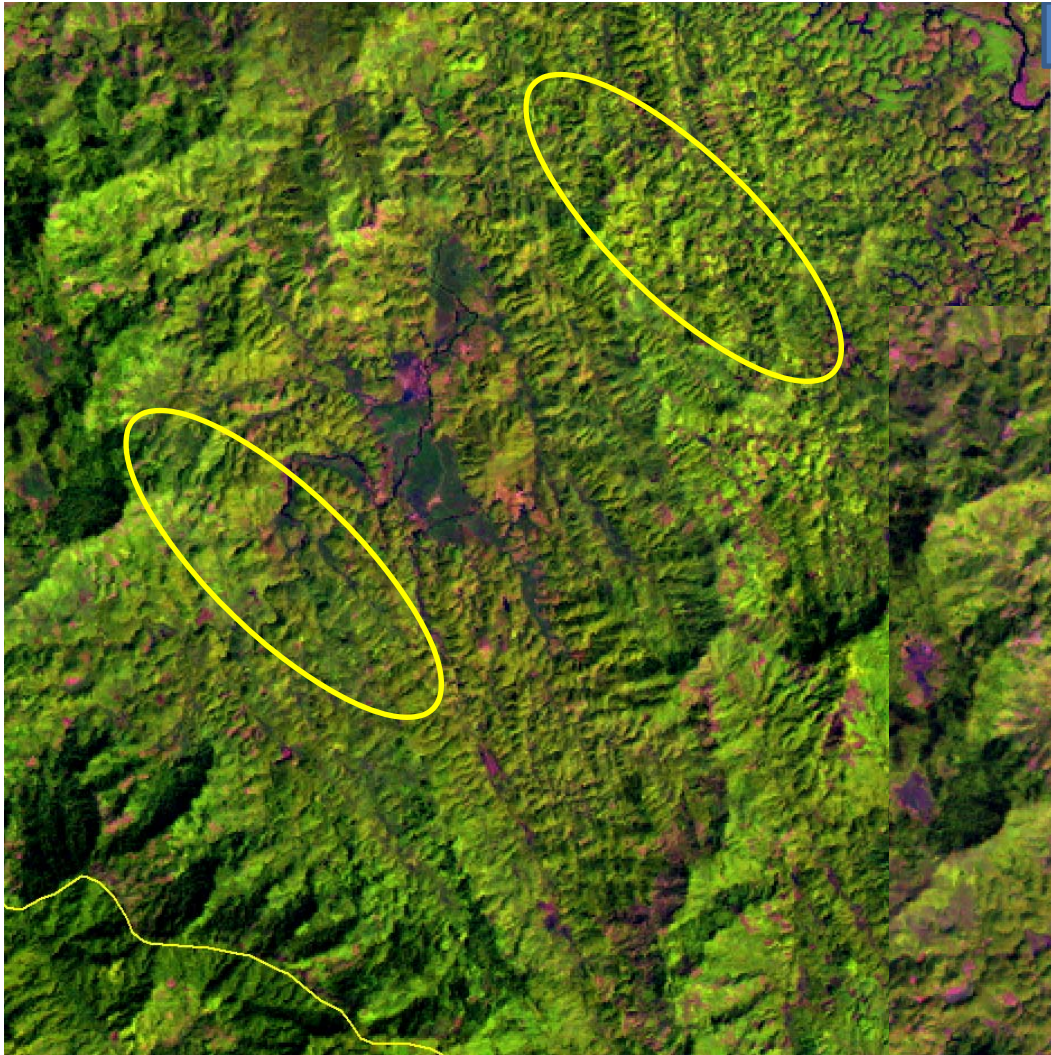


Observed changes from satellite data

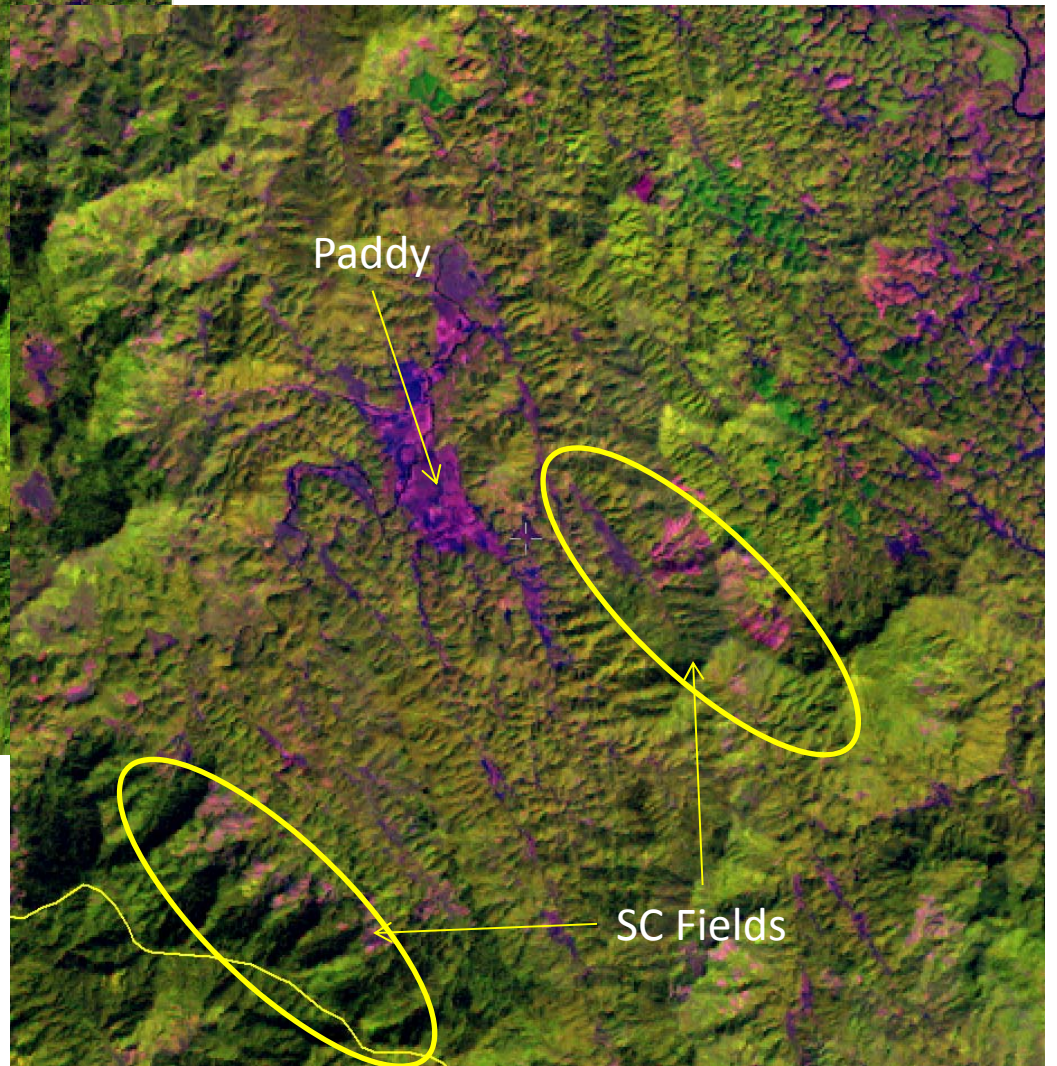
- Image analysis provides insight into both land-cover and associated land-use
- Landscape metrics were determined for each commune area
- Farming System types associated with commune landscape metrics
- Each commune was assigned a farming system classification
- Analysis was done for two points in time
- Farming System change between two dates was assessed



Example location (within 127/45)



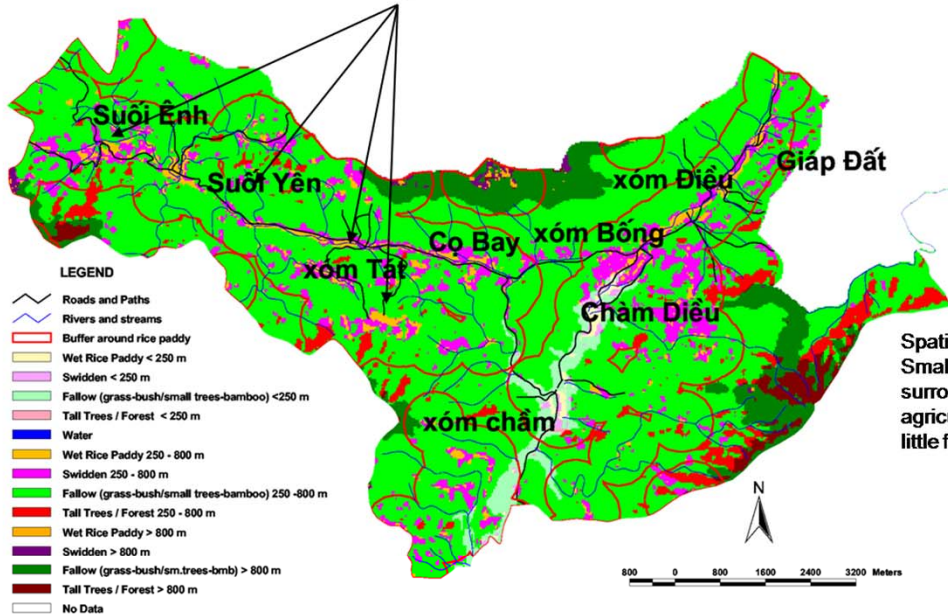
October 21, 1992



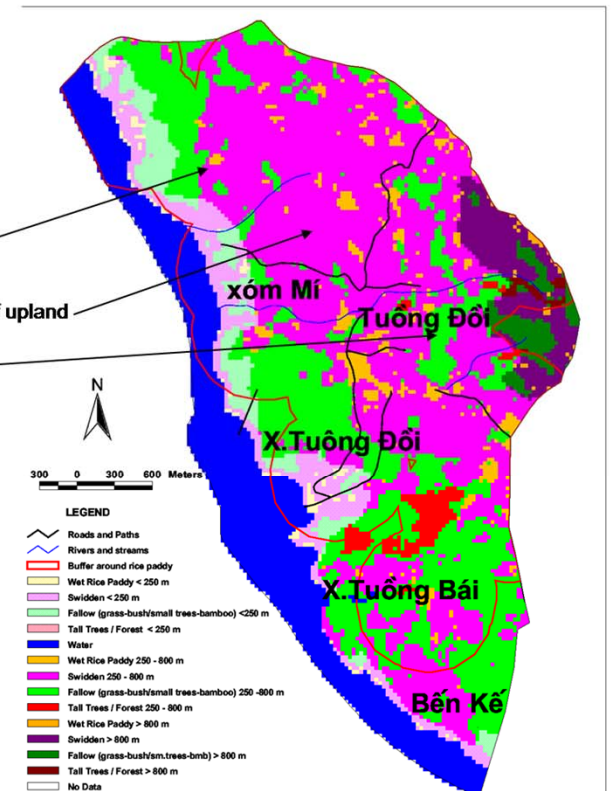
November 4, 2000

Examples of landscape patterns associated with farming system land-use types

Spatial land cover pattern:
Scattered upland agriculture, near rice paddy,
With large amounts of fallow land



Spatial Landcover pattern:
Small areas of paddy
surrounded by large continuous areas of upland
agricultural land,
little fallow land or tree/forest cover



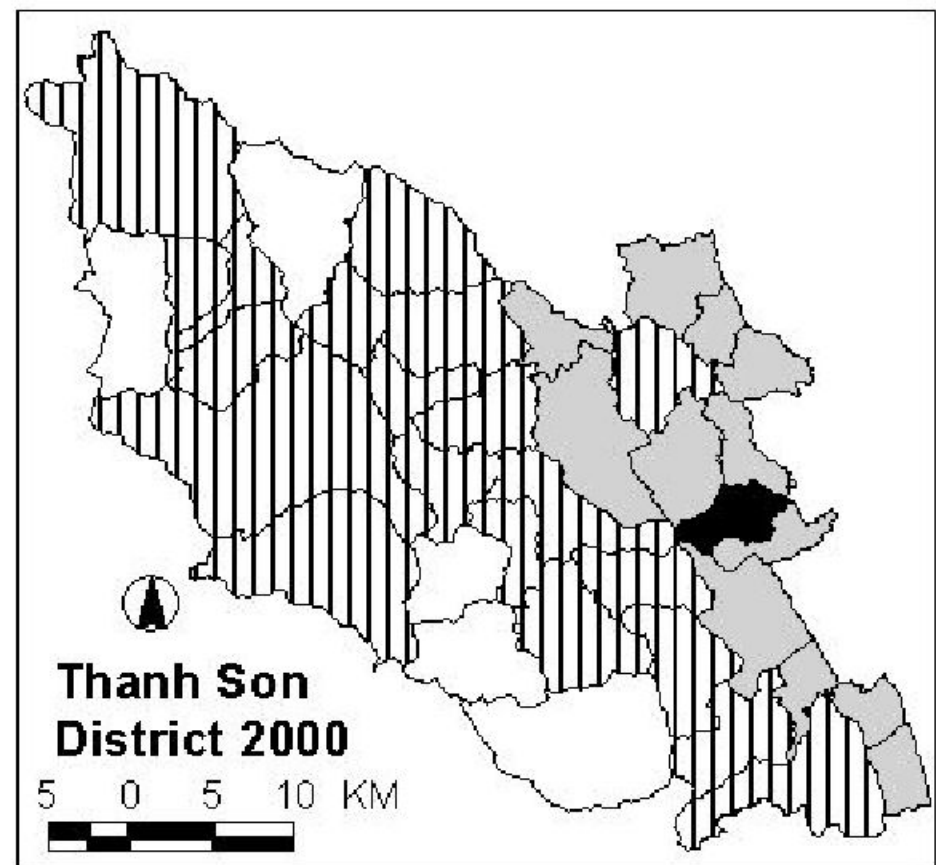
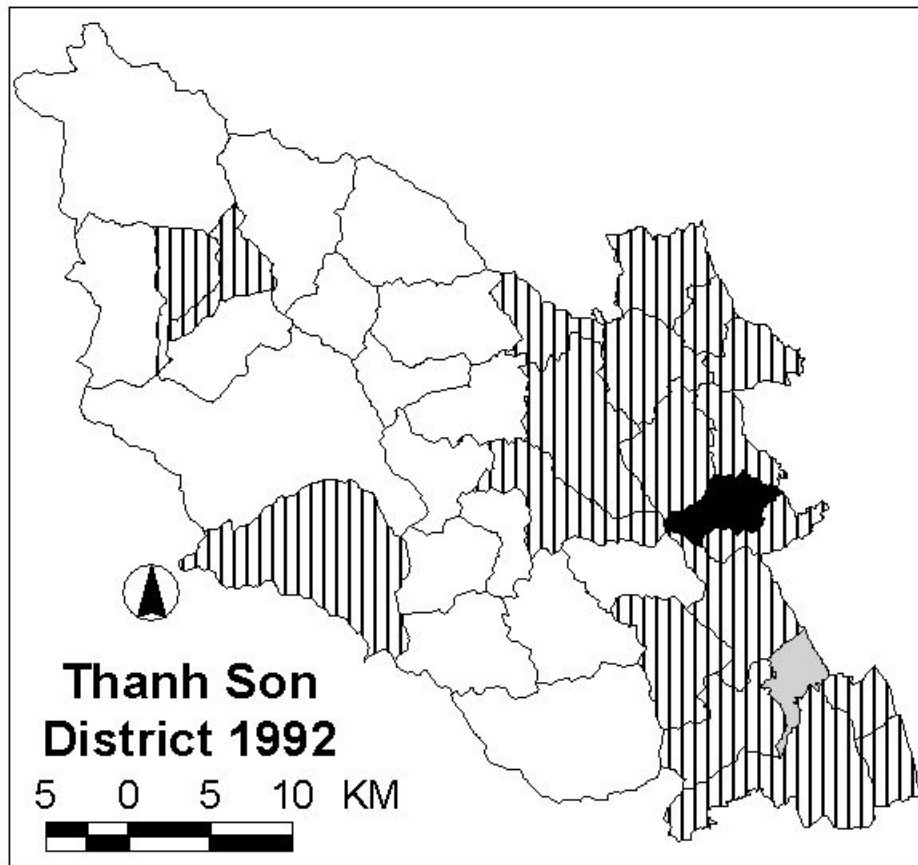
Landscape metrics identifying farming system type by commune

General Village Level Farming System Type	% of landscape under cultivation	Ratio of upland fields to rice paddy	NLSI upland	NLSI rice paddy	Landscape pattern guidelines for visual interpretation*
Pure systems					
Rotational swidden system (RSA)	Less than 25%	Greater than 10:1	>0.27	>0.40	Little rice paddy (very scattered); upland ag. (0.3 ha to 10 ha) patches; regrowth and trees intermixed with patches of upland ag. and paddy.
Permanent rice paddy system (PRP)	Greater than or equal to 40%	Less than 1 : 7	Not important	<0.20	Little upland ag.; rice paddy (large areas); other land cover (large continuous areas)
Permanent upland agriculture system (PUA)	Greater than or equal to 40%	Greater than (+/-)8 : 1	<0.20	Not important	Little rice paddy; permanent upland cultivation (large areas); other land cover (large continuous areas)

Mixed Systems

General Village Level Farming System Type	% of landscape under cultivation	Ratio of upland fields to rice paddy	NLSI upland	NLSI rice paddy	Landscape pattern guidelines for visual interpretation*
Systems with Paddy and Permanent Upland Agriculture	Greater than 25%	Roughly equal; can be more 7:1 or 1:7	<0.20	<0.20	Rice paddy and upland ag. (large and aggregated); other types of land cover (aggregated). Few to no scattered upland ag. fields.
Systems with Permanent Upland and Rotating Swidden Agriculture	Between 25% and 50%	Greater than 10:1	Between (+/-) 0.20 and 0.28	N/A	Large continuous upland ag. in parts of commune; patches of upland ag. interspersed with other land cover in other parts of commune. Little if any rice paddy.
Systems with Permanent Upland Agriculture , Paddy and Rotating Swidden (can be Composite Swidden)	Between 25% and (+/-)40%	Usually roughly equal; can be more 3:1 or 1:3	Between 0.20 and 0.28 (can be > 0.28; determined by visual analysis)	> 0.28	Large continuous upland ag. found in parts of commune; large continuous rice paddy found in parts of commune; patches of upland ag. (swidden) interspersed with other land cover. (If in close proximity (500m) of small and/or medium size paddy then can be CSA).
Composite Swidden or mixed with Rotating Swidden in the same commune	Less than 25%	Greater than 1.5:1 (can be 1:1 or have more paddy than swidden; refer to visual analysis)	>0.27	>0.27	Patches of upland ag. 0.3 to 10 ha (swidden) interspersed with other land cover (regrowth and trees); in close proximity (500m) of small to medium size paddy. If rotational swidden fields not in close proximity to rice paddy, can be areas of “only” RSA.

Example Results District Level Farming Systems change 1992 to 2000



- Rice paddy systems
- ▨ Systems with permanent upland, rice paddy, and swidden (can include composite swidden)

- Mixed rice paddy and permanent upland agricultural systems
- Composite swidden; or composite swidden with rotational swidden agriculture

Trends in upland farming and livelihood system changes

- Permanent cultivated fields (year-on-year cultivation)
- Tree crops
 - Pulp trees (acacia, eucalyptus, pine)
 - Rubber
 - Other tree crops (fruit, bamboo)



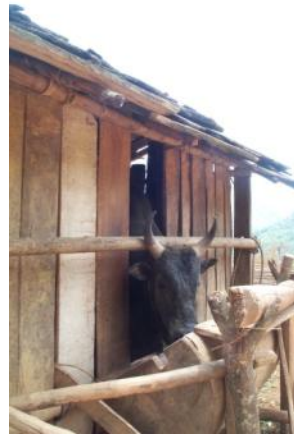
Rubber in northern mountains of Vietnam

Trends in upland farming and livelihood system changes

- Shortened fallow / swidden systems
- Continued medium to long swidden/fallow
- Diversification strategies within swidden systems



Shortened fallow



Animal husbandry and swidden



Fruit trees in long-fallow

Analyzing the resiliency of the farming system change trends

1. How diverse are the production activities within the system?
2. Is the system seeking to optimize the efficient production of an output at the expense of the production of other potential outputs?
3. Is the system open to adopting other production activities?

Permanently Cultivated Field Crops

- System Diversity? Limited
- Seeks efficient production of specific field crops; reliance on inputs; reliance on markets for both inputs and for selling of crop
- Limited scope within farming system for adopting other activities

Replacement Tree Crops

- Farming Diversity? Limited, but not totally eliminated (fallow fields are replaced by rubber, pulp trees, fruit trees, bamboo)
- Tree crops reliant on outside inputs (seedlings)
- System reliant on external markets for selling outputs (and also reliant on market to set price)
- System seeks to optimize production of specific crop (chosen tree crop)
- Potential of the system to adopt other production activities? limited

Shortened Fallow Swiddens

- Diversity of activities – decreased (less options within shortened fallow areas)
- Not seeking to optimize one production activity
- Open to adaptation and adoption? Yes, but limited capacity given stress on system (the shortened fallows)

Continued medium to long-fallow swidden with diversifying of activities

- High diversity
- Not seeking to optimize production of anyone activity
- Actively adopting other activities

Which systems are most resilient?

- Permanently cultivated fields: low resiliency
- Tree crops: depending on the management techniques provide low to medium resiliency
- Shortened fallow systems: medium resiliency (decreasing?)
- Continued medium to long-fallow with diversified activities: high resiliency



Vulnerability?

- Less resilient systems less adaptable to changes in conditions – more vulnerable to shocks
- Climate change projections suggest there will be these shocks: increase in average yearly temperatures and more extreme events
- Trends in changing farming systems suggest more potential vulnerability for upland peoples

Conclusions and Implications

- Two independent lines of evidence show changes in upland farming systems are taking place from swidden systems to mono-cropped permanently cultivated systems
- Changes are leading to
 - less resilient farming systems in the uplands
 - Increased vulnerability of upland populations who rely on these systems

Acknowledgements

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References

- IPCC (2007) Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 2007 . Cambridge University Press, Cambridge, UK.
- Leisz, S.J., N.T. Ha, N.B. Yen, N.T. Lam, T.D. Vien (2005) Developing a methodology for identifying, mapping, and potentially monitoring the distribution of general farming system types in Vietnam's northern mountain region. *Agricultural Systems*, 85: 340-363.
- Mertz, Ole, Christine Padoch, Jefferson Fox, Robert Cramb, Stephen J. Leisz, Nguyen Thanh Lam, Tran Duc Vien (2009). Swidden Changes in Southeast Asia; Understanding Causes and Consequences. *Human Ecology* 37(3): 259-264.
- Trong, T.D. (2009) Climate Change Projection over Vietnam Simulated by a 20 km-mesh MRI-AGCM. Capacity Change for Adaptation to Climate Change in Asia – Climate Change Analysis. Hanoi, 2009.
- Walker, B., Sayer, N.L. Andrew, B. Campbell (2010). Should Enhanced Resilience be an Objective of Natural Resource Management Research for Developing Countries? *Crop Science*, 50:S-10-S-19.

Methodology – Field Checking Model

Field checking was done in selected communes and villages in order to identify what the land cover and agricultural practices in the communes/ villages. The following methods were used to gather the information:

- District level: interview with relevant district officials to gain permission to do research / gather relevant information from them;
- Commune level: interview with commune officials re: local agricultural practices, whether NTFPs are collected in the area, gain permission to visit villages in the commune;
- Village/hamlet level: targeted interviews re: agricultural practices with headman and selected local farmers, walk transects with local farmers to observe local agricultural system, and use GPS receiver to mark locations of different fields and land cover.
- After fieldwork the results from the interviews and from the field transect observations were discussed and analyzed. A farming system typology for each village/hamlet was identified.
- Transects walked / GPS survey done to collect supplemental ground truth data for accuracy assessment of land-cover classification; recall interviews done with farmers to get land-cover recall information for older images.

Projected Climate Change and Vietnam

- Projected regional changes (IPCC 2007):
 - Increase in average yearly temperatures of 2.5⁰ C
 - Increase in annual rainfall ~ 7%
 - Increase in extreme (warm and wet) events: 100% and 44% respectively
- Projected for north-central and northern mountains (Trong 2009)
 - Increase in average yearly temperatures of 2⁰ - 2.5⁰ C
 - Vietnam's MONRE project 's a decrease in precipitation; Vietnam's Institute of Meteorology, Hydrology, and Environment project slight increase, but changes by season
 - Increase in extreme events for mountains

Methodology – Identifying Potential Farming System Areas

Spatial Land Cover Patterns Identified within Commune Boundaries

Land Cover Pattern ID	Land Cover Pattern
A	Large areas of wet rice agriculture (greater than 20 continuous hectares)
B	Areas of small to medium continuous wet rice agriculture (1/2 to 20 hectares in size)
C	Large continuous areas of dry land agriculture fields (greater than 10 hectares) with little or no regrowth within the areas.
D	Patches of small to medium size dry land agriculture fields (1/3 to 10 hectares) that are interspersed with patches of regrowth or trees/forest land cover.
E	Large continuous areas of regrowth or trees/forest land cover found.
F	Little to no areas of regrowth or trees/forest land cover found.