

An assessment of trends in the extent of swidden in southeast asia

Schmidt-Vogt D., Leisz S.J., Mertz O., Heinemann A., Thiha T., Messerli P., Epprecht M., Cu P.V., Chi V.K., Hardiono M., Dao T.M.

School of Environment, Resources and Development, Asian Institute of Technology, Pathum Thani 12120, Thailand; Department of Anthropology, Colorado State University, Fort Collins, CO 80523, United States; Department of Geography and Geology, University of Copenhagen, Øster Voldgade 10, 1350 Copenhagen K, Denmark; Swiss National Centre of Competence in Research North South, Institute of Geography, University of Berne, Hallerstrasse 10, Berne 3012, Switzerland; Walai Rukhvej Botanical Research Institute, Mahasarakham University, Maha Sarakham, Thailand; Vietnam National University, Hanoi, Viet Nam; Jl. Bukit Nusa Indah No. 70, Ciputat 15414, Indonesia; Center for Natural Resources and Environmental Studies, 19 Le Thanh Tong, Hanoi, Viet Nam

Abstract: Swidden systems consisting of temporarily cultivated land and associated fallows often do not appear on land use maps or in statistical records. This is partly due to the fact that swidden is a diverse and dynamic land use system that is difficult to map and partly because of the practice of grouping land covers associated with swidden systems into land use or land cover categories that are not self-evidently linked to swiddening. Additionally, in many parts of Southeast Asia swidden systems have changed or are in the process of changing into other land use systems. This paper assesses the extent of swidden on the basis of regional and national sources for nine countries, and determines the pattern of changes of swidden on the basis of 151 cases culled from 67 articles. Findings include (1) a majority of the cases document swidden being replaced by other forms of agriculture or by other livelihood systems; (2) in cases where swiddening is still practiced, fallow lengths are usually, but not always, shorter; and (3) shortened fallow length does not necessarily indicate a trend away from swidden since it is observed that short fallow swidden is sometimes maintained along with other more intensive farming practices and not completely abandoned. The paper concludes that there is a surprising lack of conclusive data on the extent of swidden in Southeast Asia. In order to remedy this, methods are reviewed that may lead to more precise future assessments. © Springer Science+Business Media, LLC 2009.

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Correspondence Address: Leisz, S.J.; Department of Anthropology, Colorado State University, Fort Collins,

CO 80523, United States; email: steve.leisz@colostate.edu

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Authors with affiliations:

- Schmidt-Vogt, D., School of Environment, Resources and Development, Asian Institute of Technology, Pathum Thani 12120, Thailand
- Leisz, S.J., Department of Anthropology, Colorado State University, Fort Collins, CO 80523, United States
- Mertz, O., Department of Geography and Geology, University of Copenhagen, Øster Voldgade 10, 1350 Copenhagen K, Denmark
- Heinimann, A., Swiss National Centre of Competence in Research North South, Institute of Geography, University of Berne, Hallerstrasse 10, Berne 3012, Switzerland
- Thiha, T., Walai Rukhavej Botanical Research Institute, Maharakam University, Maha Sarakham, Thailand
- Messerli, P., Swiss National Centre of Competence in Research North South, Institute of Geography, University of Berne, Hallerstrasse 10, Berne 3012, Switzerland
- Epprecht, M., Swiss National Centre of Competence in Research North South, Institute of Geography, University of Berne, Hallerstrasse 10, Berne 3012, Switzerland
- Cu, P.V., Vietnam National University, Hanoi, Viet Nam
- Chi, V.K., Vietnam National University, Hanoi, Viet Nam
- Hardiono, M., Jl. Bukit Nusa Indah No. 70, Ciputat 15414, Indonesia
- Dao, T.M., Center for Natural Resources and Environmental Studies, 19 Le Thanh Tong, Hanoi, Viet Nam

References:

- Budreski, K.A., Wynne, R.H., Browder, J.O., Campbell, J.B., Comparison of Segment and Pixel-Based Non-parametric Land Cover Classification in the Brazilian Amazon Using Multitemporal LANDSAT TM/ ETM+ Imagery (2007) *Photogrammetric Engineering and Remote Sensing*, 73, pp. 7813-7827
- Bruun, T.B., de Neergaard, A., Lawrence, D., Ziegler, A., Environmental Consequences of the Demise in Swidden Agriculture in Southeast Asia: Carbon Storage and Soil Quality (2009) *Human Ecology*, , this issue
- (2002) Nghe An Province Land Use/Cover Map, , Cartography Publishing House Cartography Publishing House, Hanoi, Vietnam
- Chaplot, V., Coadou le Brozec, E., Silvera, N., Valentin, C., Spatial and Temporal Assessment of Linear Erosion in Catchments Under Sloping Lands of Northern Laos (2005) *Catena*, 63, pp. 167-218
- Chazee, L., (1994) Shifting Cultivation Practices in Laos: Present Systems and Their Future, , Vientiane, Laos
- Colchester, M., (2006) Tanah Yan Diankan: Hinyah Saint Dan Pembebasan Tanah Si Indoneais, , Implikasi terbasap Hasyarahat dokal san Hasyarakat Adat. Forest People Programme, Perkumpulan Sawit Watch, HUMA and the World Agroforestry Centre, Bogor, Indonesia
- Colfer, C.J.P., (1991) Toward Sustainable Agriculture in the Humid Tropics: Building on the TropSoils Experiences in Indonesia, , North Carolina State University, Raleigh, North Carolina
- Colfer, C.J.P., (2008) Longhouse of the Tarsier: Changing Landscapes, Gender and Well-being in Borneo, , Borneo Research

Council, Phillips, Maine

- Colfer, C.J.P., Dudley, R.G., (1993) *Shifting Cultivators of Indonesia: Managers or Marauders of the Forest*, , FAO, Rome
- Colfer, C.J.P., Peluso, N., Chin, S.C., (1997) *Beyond Slash and Burn: Building on Indigenous Management of Borneo's Tropical Rain Forests*, , New York Botanical Gardens, New York
- (1991) *The Conservation Atlas of Tropical Forests: Asia and the Pacific*, , Collins, N. M, Sayer, J. A., Whitmore, T. C. (eds.) MacMillan, London
- Cramb, R.A., *Shifting Cultivation and Sustainable Agriculture in East Malaysia: A Longitudinal Case Study* (1993) *Agricultural Systems*, 42, pp. 209-226. , doi: 10.1016/0308-521X(93)90055-7
- Cramb, R.A., (2007) *Land and Longhouse*, , Agrarian Transformation in the Uplands of Sarawak. NIAS, Copenhagen
- Crooker, R.A., *Life After Opium* (2005) *Mountain Research and Development*, 25, pp. 3289-3292. , doi: 10.1659/0276-4741(2005)025[0289:LAOITH]2.0.CO
- 2
- de Rouw, K.K., Gray, I., *Four Farming Systems: A Comparative Test for Erosion, Weeds and Labour Input in Luang Prabang Region* (2003) *Juth Pakai*, 1, pp. 14-22
- Dennis, R., Colfer, C.J.P., *Forest cover change analysis as a proxy: Sustainability assessment using remote sensing and GIS in West Kalimantan, Indonesia* (2001) *People Managing Forests*, pp. 262-287. , In Colfer, C. J. P., and Byron, Y. (eds.) RFF/CIFOR, Washington, D.C
- Dennis, R., Colfer, C.J.P., *Impacts of Land Use and Fire on the Loss and Degradation of Lowland Forest in 1983-2000 in East Kutai District, East Kalimantan, Indonesia* (2006) *Singapore Journal of Tropical Geography*, 27, pp. 30-48. , doi: 10.1111/j.1467-9493.2006.00238.x
- Dressler, W., *Disentangling Tagbanva Lifeways, Swidden, and Conservation on Palawan* (2005) *Human Ecology Review*, 12, pp. 121-129
- Dressler, W., *Co-opting Conservation: Migrant Resource Control and Access to National Park Management in the Philippine Uplands* (2006) *Development and Change*, 37, pp. 2401-2426. , doi: 10.1111/j.0012-155X.2006.00483.x
- Dressler, W., Kull, A.K., Meredith, T.C., *The Politics of Decentralizing National Parks Management in the Philippines* (2006) *Political Geography*, 25, pp. 7789-7816. , doi: 10.1016/j.polgeo.2006.07.005
- Ducourtieux, O., Visonavong, P., Rossard, J., *Introducing Cash Crops in Shifting Cultivation Regions - The Experience with Cardamon in Laos* (2006) *Agroforestry Systems*, 66, pp. 65-76. , doi: 10.1007/s10457-005-6645-1
- Fox, J., *How Blaming 'Slash and Burn' Farmers Is Deforesting Mainland Southeast Asia* (2000) *Asia Pacific Issues*, 47, pp. 1-8
- Fox, J., *Understanding a dynamic landscape: Land use, land cover, and resources tenure in Northeastern Cambodia* (2002) *Linking People, Place and Policy: A GIScience Approach*, pp. 113-130. , In Walsh, S., and Crews-Meyer, K. (eds.) Kluwer Academic, Boston
- Fox, J., Vogler, J., *Land Use and Land Cover Change in Montane Mainland Southeast Asia* (2005) *Environmental Management*, 36, pp. 3394-3403. , doi: 10.1007/s00267-003-0288-7
- Fox, J., Krummel, J., Ekasingh, M., Yarnasarn, S., Podger, N., *Land-Use and Landscape Dynamics in Northern Thailand: Assessing Change in Three Upland Watersheds Since 1954* (1995) *Ambio*, 24, pp. 6328-6334
- Fox, J., Truong, D.M., Rambo, A.T., Tuyen, N.P., Cuc, L.T., Leisz, S., *Shifting Cultivation: A New Paradigm for Managing Tropical Forests* (2000) *BioScience*, 50, pp. 6521-6528. , doi: 10.1641/0006-3568(2000)050[0521:SCANOP]2.0.CO
- 2
- Fox, J., Leisz, S., Truong, D.M., Rambo, A.T., Tuyen, N.P., Cuc, L.T., *Shifting cultivation without deforestation: A case study in the mountains of northwestern Vietnam* (2001) *Applications of GIS and Remote Sensing in Biogeography and Ecology*, pp.

289-308. , In Millington, A. C., Walsh, S. J., and Osborne, P. E. (eds.) Kluwer Academic, Boston

- Fox, J., Rambo, A.T., Donovan, D., Cuc, L.T., Giambelluca, T., Ziegler, A., Plondke, D., Truong, D.M., Linking household and remotely sensed data for understanding forest fragmentation in northern Vietnam (2003) *People and the Environment: Approaches for Linking Household and Community Surveys to Remote Sensing and GIS*, pp. 201-221. , In Fox, J., Rindfuss, R., Walsh, S., and Mishra, V. (eds.) Kluwer Academic, Boston
- Fox, J., McMahon, D., Poffenberger, M., Vogler, J., (2008) *Land for My Grandchildren: Land Use and Land Tenure Change in Ratanakiri: 1989-2007*, , Community Forestry International, Phnom Penh, Cambodia
- Fox, J., Fujita, Y., Ngidang, D., Peluso, N.L., Potter, L., Sakuntaladewi, N., Sturgeon, J., Thomas, D., *Policies, Political-Economy, and Swidden in Southeast Asia* (2009) *Human Ecology*, , doi: 10.1007/s10745-009-9240-7
- Gustafson, E.J., *Quantifying Landscape Spatial Pattern: What Is the State of the Art* (1998) *Ecosystems*, 1, pp. 2143-2156. , doi: 10.1007/s100219900011
- Hansen, P.K., *Shifting cultivation development in Northern Laos* (1998) *Upland Farming System in the Laos PDR: Problems and Opportunities for Livestock*, pp. 34-42. , In Chapman, E. C., Bouaham, B., and Hansen, P. K. (eds.) *ACIAR Proceedings Series 87*, Canberra
- Hansen, T.S., Mertz, O., *Extinction or Adaptation? Three Decades of Change in Shifting Cultivation in Sarawak, Malaysia* (2006) *Land Degradation and Development*, 17, pp. 135-148. , doi: 10.1002/ldr.720
- Heinimann, A., *Patterns of Land Cover Change in the Lower Mekong Basin: The Relevance of Mesoscale Approaches* (2006), Doctoral dissertation. Department of Geography. Berne University, Berne, Switzerland
- Heinimann, A., Messerli, P., Schmid-Vogt, D., Wiesmann, U., *The Dynamics of Secondary Forest Landscapes in the Lower Mekong Basin: A Regional-Scale Analysis* (2007) *Mountain Research and Development*, 27, pp. 3232-3241. , doi: 10.1659/mrd.0875
- Hlaing, M., (2004) *Analysis of Impacts of Taung-Ya Program on Livelihoods of Local People. A Case Study in Bago Yoma*, , Myanmar, Tokyo University of Agriculture and Technology, Tokyo
- Horowitz, L.S., *Integrating Indigenous Resource Management with Wildlife Conservation: A Case Study of Batang Ai National Park, Sarawak, Malaysia* (1998) *Human Ecology*, 26, pp. 371-403. , doi: 10.1023/A:1018752115074
- Htun, A.A., *Local Communities and Environmental Conservation in Panglaung Watershed Area* (2007), PhD Dissertation. Department of Botany, University of Yangon, Yangon, Myanmar
- Hurni, H., *Soil Erosion in Huai Thung Choa-Northern Thailand: Concerns and Constraints* (1982) *Mountain Research and Development*, 2, pp. 2141-2156. , doi: 10.2307/3672960
- Jakobsen, J., Rasmussen, K., Leisz, S., Folving, R., Quang, N.V., *The Effects of Land Tenure Policy on Rural Livelihoods and Food Sufficiency in the Upland Village of Que, North Central Vietnam* (2007) *Agricultural Systems*, 94, pp. 2309-2319. , doi: 10.1016/j.agsy.2006.09.007
- Jones, S., *A Framework for Understanding Environmental Degradation and Constraints to the Adoption of Soil Conservation Measures: Case Studies from Highland Tanzania and Thailand* (2002) *World Development*, 30, pp. 91609-91620. , doi: 10.1016/S0305-750X(02)00056-6
- Laffort, J.R., Dufurmier, M., *From Slash and Burn to Disk Ploughing: The Land Policy and Tractors Behind Erosion and Forest Pioneer Farming in Southern Xayaboury Province (Laos)* (2006) *Moussons*, 9-10, pp. 109-130
- Lawrence, D., Pearl, D.R., Leighton, M., *The Impact of Shifting Cultivation on a Rainforest Landscape in West Kalimantan: Spatial and Temporal Dynamics* (1998) *Landscape Ecology*, 13, pp. 135-148. , doi: 10.1023/A:1007985915187
- Leisz, S.J., *Reinterpreting the Uplands of Vietnam: Towards Understanding and Correcting a Misreading of Its Land Cover, Land Use, and Resource Management System* (2007), Ph.D. Dissertation. Geography Department, University of Copenhagen, Copenhagen, Denmark
- Leisz, S.J., Ha, N.T., Yen, N.T.B., Lam, N.T., Vien, T.D., *Developing a Methodology for Identifying, Mapping and Potentially Monitoring the Distribution of General Farming System Types in Vietnam's Northern Mountain*

- Region (2005) *Agricultural Systems*, 85, pp. 340-363. , doi: 10.1016/j.agsy.2005.06.015
- Leisz, S.J., Rasmussen, K., Olesen, J.E., Vien, T.D., Elberling, B., Jacobsen, J., Christiansen, L., The Impacts of Local Farming System Development Trajectories on Greenhouse Gas Emissions in the Northern Mountains of Vietnam (2007) *Regional Environmental Change*, 7, pp. 4187-4208. , doi: 10.1007/s10113-007-0037-1
 - Leisz, S.J., Rasmussen, M.S., Mapping Fallow Lands in Vietnam's North Central Mountains: Combining Year-on-Year Multispectral Classifications with a Simple Land Cover Model to Accurately Map Previously Unclassified Areas *International Journal of Remote Sensing*, , (in press)
 - Lestrelin, G., Giordano, M., Upland Development Policy, Livelihood Change and Land Degradation: Interactions from a Laotian Village (2007) *Land Degradation and Development*, 18, pp. 55-76. , doi: 10.1002/ldr.756
 - Lestrelin, G., Giordano, M., Keohavong, B., (2005) When Conservation Leads to Land Degradation: Lessons from Ban Lak Sip, , Laos, International Watershed Management Institute (IWMI), Colombo, Sri Lanka
 - Lim, J.N.W., Douglas, I., The Impact of Cash Cropping on Shifting Cultivation in Sabah, Malaysia (1998) *Asia Pacific Viewpoint*, 39, pp. 315-326. , doi: 10.1111/1467-8373.00072
 - Long, C.L., Fox, J., Lu, X., Gao, L., Cai Kui Wang, J., State Policies, Markets, Land Use Practices and Common Property: Fifty Years of Change in Yunnan, China (1999) *Mountain Research and Development*, 19, pp. 2133-2139. , doi: 10.2307/3674254
 - Majid Cooke, F., Vulnerability, Control and Oil Palm in Sarawak: Globalization and a New Era (2002) *Development and Change*, 33, pp. 189-211. , doi: 10.1111/1467-7660.00247
 - (1998) Forest Cover Data Set for the Lower Mekong Basin, , MRC (Mekong River Commission)/GTZ (Deutsche Gesellschaft fuer Technische Zusammenarbeit) MRC/GTZ Forest Cover Monitoring Project, Phnom Penh, Cambodia
 - Mertz, O., Christensen, H., Land Use and Crop Diversity in Two Iban Communities, Sarawak, Malaysia (1997) *Geografisk Tidsskrift, Danish Journal of Geography*, 97, pp. 135-148
 - Mertz, O., Christensen, A.E., Højskov, P., Birch-Thomsen, T., Subsistence or Cash: Strategies for Change in Shifting Cultivation (1999) *Geografisk Tidsskrift-Danish Journal of Geography*, pp. 133-142. , (special Issue):
 - Mertz, O., Padoch, C., Fox, J., Cramb, R.A., Leisz, S.J., Nguyen, T.L., Vien, T.D., Swidden change in Southeast Asia: Understanding causes and consequences (2009) *Human Ecology*, , this issue
 - Messerli, P., Heinemann, A., Epprecht, M., Finding homogeneity in heterogeneity - A new approach to quantifying landscape mosaics developed for Lao PDR (2009) *Human Ecology*, , doi: 10.1007/s10745-009-9238-1
 - (1995) Myanmar Forest Policy 1995, , Ministry of Forestry Yangon, Myanmar
 - Mittelman, A., Secondary Forests in the Lower Mekong Subregion: An Overview of Their Extent, Roles and Importance (2001) *Journal of Tropical Forest Science*, 13, pp. 4671-4690
 - Ngidang, D., Contradictions in Land Development Schemes: The Case of Joint Ventures in Sarawak, Malaysia (2002) *Asia Pacific Viewpoint*, 43, pp. 157-180. , doi: 10.1111/1467-8373.00171
 - Nicolic, N., Schultze-Kraft, R., Nicolic, M., Boecker, R., Holz, I., Land Degradation on Barren Hills: A Case Study in Northeast Vietnam (2008) *Environmental Management*, 42, pp. 19-36. , doi: 10.1007/s00267-008-9099-1
 - Nielsen, U., Mertz, O., Noweg, G.T., The Rationality of Shifting Cultivation Systems: Labor Productivity Revisited (2006) *Human Ecology*, 34, pp. 210-218. , doi: 10.1007/s10745-006-9014-4
 - O'Neill, R.V., Gardner, R.H., Turner, M.G., Indices of Landscape Pattern (1988) *Landscape Ecology*, 1, pp. 3153-3162. , doi: 10.1007/BF00162741
 - O'Neill, R.V., Hunsaker, C.T., Timmins, S.P., Jackson, B.L., Riitters, K.H., Wickham, J.D., Scale Problems in Reporting Landscape Pattern at the Regional Scale (1996) *Landscape Ecology*, 11, pp. 3169-3180. , doi: 10.1007/BF02447515
 - Padoch, C., Coffey, K., Mertz, O., Leisz, S., Fox, J., Wadley, R.L., The Demise of Swidden in Southeast Asia? Local Realities

- and Regional Ambiguities (2007) *Geografisk Tidsskrift-Danish Journal of Geography*, 107, pp. 29-41
- Pedersen, M., Mertz, O., Hummelose, G., The potential for co-existence between shifting cultivation and commercial logging in Sarawak (2006) *State, Communities and Forests in Contemporary Borneo*, pp. 181-193. , In Cooke, F. M. (ed.) Australian National University Press, Canberra
 - Peluso, N.L., *Fruit Trees and Family Trees in an Indonesian Rainforest: Ethics of Access, Property Rights, and Environmental Change* (1996) *Comparative Studies in Society and History*, 38, pp. 3510-3548
 - Penot, E., From shifting cultivation to sustainable complex rubber agroforestry systems (jungle rubber) in Indonesia: A history of innovation processes (2004) *Beyond Tropical Deforestation*, pp. 221-250. , In Babin, D. (ed.) UNESCO/CIRAD, Paris
 - Potter, L., (2004) *Can Indonesia's Complex Agroforests Survive Globalisation and Decentralisation?*, , A Study in Sanggau District, West Kalimantan. 15th Biennial Conference of the Asian Studies Association of Australia, Research School of Pacific and Asian Studies. The Australian National University, Canberra, Australia
 - Potter, L., Badock, S., *Can Indonesia's complex agroforests survive globalisation and decentralisation? A study in Sanggau District, West Kalimantan* (2007) *Environment, Development and Change in Rural Asia-Pacific: Between Local and Global*, pp. 167-187. , In Connel, E. W. J. (ed.) Routledge Pacific Rim Geographies, London
 - Pravongviengkham, P., *Swidden-based farm economics in northern Laos: Diversity, constraints, and opportunities for livestock* (1998) *Upland Farming Systems in the Lao PDR: Problems and Opportunities for Livestock*, pp. 89-102. , In Chapman, E. C., Bouahom, B., and Hansen, P. K. (eds.) ACIAR Proceedings Series 87, Canberra
 - Rerkasem, K., Rerkasem, B., (1994) *Shifting Cultivation in Thailand: Its Current Situation and Dynamics in the Context of Highland Development*, , IIED, London
 - Richards, J.F., Flint, E., *A century of land use change in South and Southeast Asia* (1994) *Effects of Land Use Change on Atmospheric CO₂ Concentrations*, pp. 15-57. , In Lange, O. L., Mooney, H. A., and Remmert, H. (eds.) *Ecological Studies* 101. Springer, New York
 - Riitters, K.H., Cain, D.H., Orvis, K., *A Multi-scale Analysis of Landscape Statistics* (1997) *Landscape Ecology*, 12, pp. 199-212. , doi: 10.1023/A:1007938619068
 - Roder, W., Keoboulapha, B., Mamivanh, V., *Teak, Fruit Trees and Other Perennials Used by Hill Farmers in Northern Laos* (1995) *Agroforestry Systems*, 29, pp. 47-60. , doi: 10.1007/BF00711281
 - Roder, W., *Slash and Burn Systems in Transition: Challenges for Agricultural Development in the Hills of Northern Laos* (1997) *Mountain Research and Development*, 17, pp. 10-11. , doi: 10.2307/3673908
 - Ruankeaw, N., *Changing Land Use Patterns in Northern Thailand: Effects of Agricultural Practices in Mae Chaem* (2004), Ph.D Dissertation, Princeton, New Jersey, Princeton(2006) *The Atlas of Cambodia: National Poverty and Environment Maps*, , Save Cambodia's Wildlife Save Cambodia's Wildlife, Phnom Penh, Cambodia
 - Schipani, S., *Ecotourism as an Alternative to Upland Rubber Cultivation in Nam Ha National Protected Area, Luang Namtha* (2007) *Juth Pakai*, 8, pp. 5-17
 - Schmidt-Vogt, D., (1999) *Swidden Farming and Fallow Vegetation in Northern Thailand*, , *Geocological Research* 8. Steiner Verlag, Stuttgart, Germany
 - Southworth, C., Nagendra, H., Tucker, C., *Fragmentation of a Landscape: Incorporating Landscape Metrics into Satellite Analysis of Land Cover Change* (2002) *Landscape Research*, 27, pp. 3253-3269. , doi: 10.1080/01426390220149511
 - Spencer, J.E., (1966) *Shifting Cultivation in Southeastern Asia*, , University of California Press, Berkeley
 - Sturgeon, J.C., (2005) *Border Landscapes: The Politics of Akha Land Use in China and Thailand*, , University of Washington Press, Seattle, Washington
 - Sturgeon, J.C., *Tea for Trees: The Impact of State Policies on the Akha in Yunnan* (2005) *Indigenous Affairs*, 2, pp. 38-44

- Sturgeon, J.C., (2006) Report on NSF Grant, Understanding Dynamic Resource Management Systems and Land Cover Transitions in Montane Mainland Southeast Asia, , East-West Center, Honolulu, Hawaii
- Thiha, T., Webb, E.L., Honda, K., Biophysical and Policy Drivers of Land Use-Cover Change in a Central Vietnamese District (2007) *Environmental Conservation*, 33, pp. 2164-2172. , doi: 10.1017/S037689290700389X
- Thongmanivong, S., Fujita, Y., Fox, J., Resource Use Dynamics and Land Cover Change in Ang Nhai Village and Phou Phanang National Reserve Forest, Lao PDR (2005) *Environmental Management*, 36, pp. 3382-3393. , doi: 10.1007/s00267-003-0291-z
- Turkelboom, F., On-Farm Diagnosis of Steep Land Erosion in Northern Thailand (1999), PhD-Dissertation, Faculty of Agricultural and Applied Biological Sciences. Leuven, Katholieke Universiteit Leuven, Belgium
- Turner, M.G., Spatial and Temporal Analysis of Landscape Patterns (1990) *Landscape Ecology*, 4, pp. 121-130. , doi: 10.1007/BF02573948
- Turner, M.G., Meisel, J., Scale Detection in Real and Artificial Landscapes Using Semivariance Analysis (1998) *Landscape Ecology*, 13, pp. 347-362. , doi: 10.1023/A:1008065627847
- Turner, M.G., O'Neill, V., Gardner, R.H., Milne, B., Effects of Changing Spatial Scale on the Analysis of Landscape Pattern (1989) *Landscape Ecology*, 3, pp. 3/4153-3/4162. , doi: 10.1007/BF00131534
- Uhlig, J., Hall, C.A.S., Nyo, T., Changing patterns of shifting cultivation in selected countries in Southeast Asia and their effect on the global carbon cycle (1994) *Effects of Land-Use Change on Atmospheric CO2 Concentrations*, pp. 145-200. , In Lange, O. L., Mooney, H. A., and Remmert, H. (eds.) Springer, New York
- Vu, K.C., Land Use Change in the Suoi Muoi Catchment, Vietnam: Disentangling the Role of Natural and Cultural Factors (2007), Ph.D-Dissertation, Leuven, Katholieke Universiteit Leuven, Belgium
- Wadley, R.L., Mertz, O., Pepper in a Time of Crisis: Smallholder Buffering Strategies in Sarawak, Malaysia and West Kalimantan, Indonesia (2005) *Agricultural Systems*, 85, pp. 289-305. , doi: 10.1016/j.agsy.2005.06.012
- Weinstock, J.A., (1990) Situation and Outlook of the Forestry Sector in Indonesia. Volume 4: Social, Environmental and Institutional Aspects, , Utf/Ins/065/Ins: Forestry Studies Technical Report No. 1. Directorate General of Forest Utilization, Ministry of Forestry, Government of Indonesia, FAO, Jakarta
- Wickham, J.D., Norton, D.J., Mapping and Analyzing Landscape Patterns (1994) *Landscape Ecology*, 9, pp. 17-23. , doi: 10.1007/BF00135075
- Wu, J., Hierarchy and Scaling: Extrapolating Information Along a Scaling Ladder (1999) *Canadian Journal of Remote Sensing*, 25, pp. 3367-3380
- Xu, J., The Political, Social, and Ecological Transformation of a Landscape: The Case of Rubber in Xishuanbanna, China (2006) *Mountain Research and Development*, 26, pp. 3254-3262. , doi: 10.1659/0276-4741(2006)26[254:TPSAET]2.0.CO
- 2
- Xu, J., Fox, J., Lu, X., Podger, N., Leisz, S., Ai, X., Effects of Swidden Cultivation, Population Growth, and State Policies on Land Cover in Yunnan, China (1999) *Mountain Research and Development*, 19, pp. 2123-2132. , doi: 10.2307/3674253
- Xu, J., Fox, J., Zhang, P., Fu, Y., Yang, L., Qian, J., Leisz, S., Vogler, J., Land Use/Land Cover Change and Farmer Vulnerability in Xishuangbanna (2005) *Environmental Management*, 36, pp. 3404-3413. , doi: 10.1007/s00267-003-0289-6
- Ziegler, A.D., Giambelluca, T.W., Sutherland, R.A., Nullet, M.A., Yarnasarn, S., Pinthong, J., Preechapanya, P., Jaiarree, S., Toward Understanding the Cumulative Impacts of Roads in Agricultural Watersheds of Montane Mainland Southeast Asia (2004) *Agriculture, Ecosystems, and Environment*, 104, pp. 145-158. , doi: 10.1016/j.agee.2004.01.012
- Zingerli, C., Castella, J.-C., Manh, P.H., Cu, P.V., Contesting policies: Rural development versus biodiversity conservation in the Ba Be National Park Area (2002) *Doi Moi in the Mountains. Land Use Changes and Farming Systems Differentiations in Bac Kan Province, Vietnam*, pp. 249-275. , In Castella, J. C., and Quang, D. D. (eds.) Agricultural Publishing House, Hanoi,

Vietnam