

SOUTHEAST ASIAN STUDIES

<http://englishkyoto-seas.org/>

A. Terry Rambo

The Agrarian Transformation in Northeastern Thailand: A Review of Recent Research

Southeast Asian Studies, Vol. 6, No. 2, August 2017, pp. 211-246.

(<Special issue> “Rural Northeast Thailand in Transition: Recent Changes and Their Implications for the Long-Term Transformation of the Region,” edited by Yasuyuki Kono, Arunee Promkhambut, and A. Terry Rambo)

How to Cite:

Rambo, A. Terry. The Agrarian Transformation in Northeastern Thailand: A Review of Recent Research. *Southeast Asian Studies*, Vol. 6, No. 2, August 2017, pp. 211-246.

Link to this article:

<https://englishkyoto-seas.org/2017/08/vol-6-no-2-a-terry-rambo/>

View the table of contents for this issue:

<https://englishkyoto-seas.org/2017/08/vol-6-no-2-of-southeast-asian-studies/>

Subscriptions: <http://englishkyoto-seas.org/mailling-list/>

For permissions, please send an e-mail to:

english-editorial@cseas.kyoto-u.ac.jp



Center for Southeast Asian Studies, Kyoto University

The Agrarian Transformation in Northeastern Thailand: A Review of Recent Research

A. Terry Rambo*

Rural Northeast Thailand has been undergoing rapid change in recent years, a process that can be referred to as an “agrarian transformation.” This transformation involves a major restructuring of agriculture from being subsistence oriented to market oriented. It also involves concomitant changes in all components of the agricultural system, including technology, economic orientation, social relations, and cultural values. This paper presents a review of a large volume of recent research on several key dimensions of the agrarian transformation: (1) agricultural intensification, diversification, and specialization; (2) technological change and the continuing role of traditional technology in rural life; (3) the epidemiological transition and changes in health and disease risks; and (4) social system changes, including in the nature of rural-urban interactions, population structure, household composition and livelihood systems, community social organization, and cultural values and aspirations.

Keywords: rural development, agricultural intensification, social change, globalization, post-peasant society

Introduction

Rural areas in Northeast Thailand (Isan) have been undergoing rapid change in recent years, a process that can be referred to as an “agrarian transformation.” This transformation involves a major restructuring of agriculture from being subsistence oriented to market oriented. It also involves concomitant changes in all components of the agricultural system, including technology, economic orientation, social relations, and cultural values. These changes are so profound that Terry Grandstaff *et al.* (2008) have referred to them as constituting the “rainfed revolution.” Despite the magnitude of these changes, however, the perceptions of the region held by academics, policy makers, members of the mass media, and the urban public in Thailand have tended to lag behind actual changes

* Program on System Approaches in Agriculture, Faculty of Agriculture, Khon Kaen University, Khon Kaen 40002, Thailand; East-West Center, Honolulu, Hawaii 96848-1601, USA
e-mail: trryrambo@yahoo.com

on the ground (Dayley 2011; Keyes 2011; 2014; Mills 2012) so that many still conceptualize the situation of the rural Northeast according to an outmoded model (which I will henceforth refer to as the “conventional model”) that depicts the region as it used to be before it entered into a period of rapid development beginning in the late 1980s and early 1990s.

According to this conventional view, Northeast Thailand is a poor and backward region because rainfed rice farming is intrinsically unproductive. Yields are low and unstable due to the poor resource base (e.g., infertile sandy soils, limited availability of surface water supplies) and unfavorable environmental conditions (e.g., limited and erratic rainfall) (KKU-Ford Cropping System Project 1982; Rambo 1991; Viriya 2001). Intensification is inhibited by the high risk of crop failure, lack of capital and knowledge, and cultural conservatism (Rigg 1985). Despite these severe constraints, rural people survive by employing a number of time-tested environmental adaptations, especially reliance on having a highly diversified livelihood portfolio (Grandstaff 1988). This portfolio includes low-input subsistence-oriented production of glutinous rice to meet household consumption needs; growing of low-value upland crops (e.g., cassava and sugarcane) to earn cash income; heavy reliance on wild resources that can be collected from fields, forests, and streams; out-migration to find new sources of income by working outside the region; and reliance in times of scarcity on a local safety net provided by kinsfolk and fellow villagers. Until the closing of the land frontier in the late 1970s, migration of people from overpopulated villages to create new settlements in forest areas (*ha na di*) helped to maintain a balance between population and resources (Fukui 1993). The rural social system associated with this model is characterized by a relatively high degree of egalitarianism, with little economic differentiation among households, low educational levels, limited integration into the larger national social and economic systems, and high levels of community solidarity (Sukaesinee *et al.* 1988). The adaptive strategy of employing diversified livelihood portfolios must be judged as a successful one in that it ensures that rural people are almost always able to procure enough resources to meet their basic survival needs, but at the cost of being locked into low-productivity farming and persistent poverty.

Although the conventional model provided a useful framework for understanding the Northeast until the end of the 1980s, the situation has changed so rapidly and profoundly in the past two decades that it no longer accurately reflects reality on the ground. The stereotypes of a poor and backward rural economy based on low-productivity subsistence-oriented agriculture are now largely obsolete (Fukui 1996b). A new model, which I will refer to as the “transformational model,” is needed to more accurately represent current realities. Table 1 presents a comparison of the conventional and the

Table 1 Conventional and Transformational Models of the Agricultural System of Northeast Thailand

	Conventional Model (1980s–early 1990s)	Transformational Model (Mid-1990s to present)
Mode of production		
Type of agricultural system	Survival-oriented “peasant” agriculture	Profit-oriented “semi-capitalist” agriculture
Objectives of production	Production of glutinous rice for household consumption with supplementary production of cash crops	Production of cash crops, including non-glutinous rice, for market with production of glutinous rice for household consumption
Household adaptive strategy	Reliance on a diversified portfolio of primarily local sources of income	Increasing reliance on specialized sources of income, both local and extra-local, with more than half of household income from off-farm sources
Productive technology		
Type of agricultural technology	Traditional technology with some use of modern technology	Mostly modern technology
Mechanization	Two-wheel hand tillers replacing buffalo-drawn plows	Four-wheel tractors, combine harvesters, water pumps, pickup trucks
Rice varieties	Many different local varieties adapted to specific conditions in different types of fields	RD6 and KDML105 are dominant varieties.
Chemicals	Limited use of chemical fertilizer	Heavy use of chemical fertilizers and pesticides
Livelihood system		
Rainfed rice	Low and unstable yields, traditional glutinous varieties, limited use of chemical fertilizer, hand tillers used for plowing	Higher and more stable yields, improved glutinous and non-glutinous varieties, increased use of chemical fertilizer and pesticides, mechanization of all steps of cultivation, supplementary irrigation
Cash crops	Low-value kenaf and cassava in upland fields	High-value sugarcane, rubber, and specialty crops in upland fields, gardens, and upper paddy fields
Wild products	Heavy reliance on edible wild plants and animals collected from forests, water bodies, fields	Decreased reliance on wild products, specialization in collection for urban markets
Local off-farm employment	Very limited	More than half of household income obtained from off-farm sources
Extra-local off-farm employment	Short-term circular migrants bring back savings to improve living standard of rural households.	Long-term migrants send back remittances to help support rural households and invest in agricultural production
Emergency welfare assistance	Reliance on help from kin and neighbors in village	Reliance on help from extended extra-local social networks and government agencies
Social system		
Demography	Young population with low dependency ratio	Aging population with high dependency ratio
Family structure	Nuclear households are dominant form.	Increased number of skipped generation and truncated households
Cultural values	Shared poverty within village community. Limited aspirations for upward social mobility. Low value placed on formal education. Children expected to become farmers like parents.	Individualistic struggle for wealth. Greatly expanded aspirations for upward mobility with formal education of children seen as main means for improving status. Children expected to obtain jobs in urban centers.
Equitability	Relatively little economic differentiation among households. Most households own sufficient land to meet subsistence needs.	Increasing economic differentiation with a few wealthy households owning large land areas and the majority of poorer households having insufficient land to meet needs
Solidarity	Numerous local-level institutions (temple, formal and informal social groups, labor exchanges, food-sharing with kin and neighbors) bind together village households.	Declining role of local-level integrative institutions and growing importance of incorporation of individual households into extra-local social networks
Autonomy	Households capable of meeting most subsistence needs from local resource base with limited dependency on inputs from extra-local sources	Households heavily dependent on extra-local sources of income, production inputs, and information

transformational models: Key changes in agricultural technology include the widespread adoption of the RD6 glutinous rice variety, which replaced the many hundreds of traditional varieties previously planted in the region (Trébuil and Hossain 2004; Rambo 2006). The adoption of motorized hand tillers allowed preparation of land for planting without having to wait for water to accumulate in the fields. This, together with the use of diesel pumps to provide supplementary irrigation using water from newly dug farm ponds, helped to stabilize rice yields in years of low rainfall. Thus, the adoption of RD6 combined with mechanization of cultivation and small-scale supplementary irrigation has largely solved the problem of rural food security while allowing farmers to plant a larger share of their land to non-glutinous KDML105; the latter is raised as a cash crop, providing rural households with a new source of income. Sale of non-glutinous rice to the market is now the largest single source of agricultural income of farm households (Grandstaff *et al.* 2008).

Agricultural intensification, diversification, and specialization have begun to occur to an extent unimaginable just a few years ago. Relying on remittances sent back to their families by migrant workers as well as cash earned by engaging in off-farm employment in new factories and service jobs in local urban centers, Isan farmers have been rapidly adopting modern agricultural technology, including new varieties, chemical fertilizers, and farm machinery. Multiple cropping and specialized growing of high-value crops to supply urban markets are also now common, further helping to raise farm incomes (Arunee and Rambo, Chalee *et al.*, and Sorat *et al.*, this issue). It can be argued that a new pattern of adaptation is emerging as a central feature of this agrarian transformation (Grandstaff *et al.* 2008). Households continue to rely on a diversified livelihood portfolio but one that is increasingly based on agricultural intensification, diversification, specialized production of cash crops (e.g., rubber, high-value niche crops) and livestock, increased dependence on off-farm employment as the main source of income, and growing dependence on extra-local social networks and government assistance to provide a safety net to make up for weakening village solidarity (Rigg and Salamanca 2009). As also seems to be the case in Northern Thailand (Walker 2012), the rural social system has been undergoing rapid change, with declining rates of poverty, increasing levels of economic differentiation, improving levels of education, declining community solidarity, and ever-deepening integration with national and global social and economic systems (Barnaud *et al.* 2006; Keyes 2011; 2014).

The ongoing agrarian transformation involves every dimension of rural existence, including demography (out-migration, declining fertility, population aging), social organization (increased economic stratification, emergence of new types of household structures, expansion of extra-local social networks, weakening of village solidarity), culture

(erosion of indigenous knowledge base, adoption of cosmopolitan cultural patterns), health (increased prevalence of obesity and diabetes, drug addiction, and alcoholism), education (raising of age of mandatory schooling, increased valuation of education as a route to upward mobility), employment (scarcity of agricultural labor, off-farm employment as main source of income), to mention only some of the most evident types of change.

Despite the magnitude of these and other changes, and the major implications they have for agricultural and rural development policy making, there has been relatively little systemic research on the agrarian transformation of Northeast Thailand. However, there have been numerous more narrowly focused studies by both Thai and foreign scholars, including those contributing papers to this special issue, on a wide variety of specific aspects of Isan's changing agrarian system. These studies provide many of the pieces needed to assemble a more comprehensive model of the agrarian transformation, but so far no one has attempted to put them all together. Therefore, in this paper I will review recent research, much of it done by faculty members and graduate students in the Program on System Approaches in Agriculture of Khon Kaen University, on the following key dimensions of the agrarian transformation: (1) agricultural intensification, diversification, and specialization; (2) technological change and the continuing role of traditional technology in rural life; (3) the epidemiological transition and changes in health and disease risks; and (4) social system changes, including in the nature of rural-urban interactions, population structure, household composition and livelihood systems, community social organization, and cultural values and aspirations. The objective of this review paper is to present a broad overview of some of the main characteristics of the agrarian transformation in Northeast Thailand.

Agricultural Intensification, Diversification, and Specialization

In the past, growing rainfed glutinous rice was the main agricultural activity in most of the Northeast. A single crop was grown in the rainy season from June to October, with the paddy fields lying fallow for the rest of the year and serving only as pasture for livestock and as the source of some wild foods (e.g., snails, edible insects, wild vegetables) consumed by the villagers. The yield of rice was generally low, less than 1.5 t/ha, which kept many small farmers trapped in poverty (KKU-Ford Cropping System Project 1982). Intensifying rice production and engaging in multiple-cropping before or after rice, diversifying from glutinous rice into other, more profitable crops, and shifting to growing high-value specialty crops (e.g., vegetables, fruit) have all been proposed by development specialists as ways to overcome the intrinsic constraints on the productivity of rainfed

rice agriculture. Until recently, few farmers in the Northeast adopted such strategies. In the past two decades, however, many farmers have begun to intensify their rice growing, do multiple-cropping of alternative crops before or after rice, replace rice with higher-value crops, and plant high-value specialty crops.

Intensification of Rice Production

Historically, rice production in the Northeast was increased entirely through extensification—the bringing of new land into cultivation on the forest frontier (Fukui 1993). It was this gradual expansion in the area planted to rice, rather than intensification of production on existing fields, that accounted for virtually all of the increase in the total quantity of grain produced in the region until the mid-1990s. Even after the construction of new paddy fields ceased at the end of the 1980s, the total rice production of the region continued to rise as the result of intensification, with average yields increasing from around 1.6 t/ha in 1995 to almost 2 t/ha by 2005 (Grandstaff *et al.* 2008, 323, Fig. 4C). It has been suggested by Grandstaff *et al.* (2008) that it was the widespread adoption of the RD6 rice variety beginning in the late 1980s that triggered the intensification of rainfed rice production in the Northeast. In their view it led to a cascading series of self-amplifying changes in the entire agricultural system (Fig. 1). Following the widespread adoption of RD6, average rice yields increased because of the much heavier application of chemical fertilizers and pesticides by the farmers and the widespread adoption of diesel pumps to provide supplementary irrigation during dry spells. Farmers were willing to use expensive inputs because thanks to these new technologies the year-to-year stability of rice production greatly increased. For example, in Don Daeng village, yields in the 1980s varied from a low of 367 kg/ha in 1982 to a high of 1,967 kg/ha in 1983, whereas in the early years of the twenty-first century the amount of annual variation had fallen to less than 100 kg/ha (K. Watanabe, this issue).

Digging of farm ponds, which permitted small-scale supplemental irrigation using pumps, and consolidation of paddy fields into larger units were important factors contributing to this increased yield stability. Although digging of community ponds was undertaken as part of the military-initiated Green Isan rural development program in the 1980s, it was only in the 1990s that individual farmers began to dig their own ponds near their paddy fields. By the end of the decade there were 65,000 farm ponds in the Northeast (Sawaeng and Nongluck 2002), a number that the government planned to increase by 450,000 by supporting farmers with a revolving loan fund launched in 2004. The ponds contributed to stabilization of rice yields because their water could be used to keep the rice plants alive during the periods of drought that often occurred in the middle of the rainy season. They also contributed to diversification of agriculture since the water could

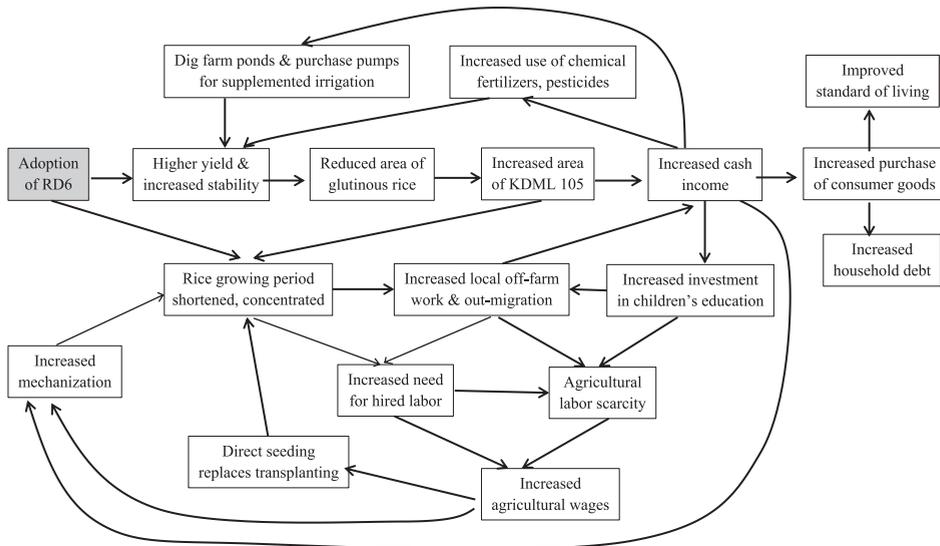


Fig. 1 Adoption of RD6 and Consequent Changes in the Agrarian System of Northeast Thailand
Source: Based on information in Grandstaff *et al.* (2008).

be used to grow dry season vegetables as well as support the rearing of fish and livestock (Ando 2003; Penning de Vries and Sawaeng 2010). Consolidation of small paddy fields into larger units has been occurring in many villages since the 1990s. Thus, in Don Daeng village near Khon Kaen city, the number of rice fields declined by one-third but the area of individual plots increased by three times between 1981 and 2005. Heavy machinery was used to level the land in these larger fields, which improved water control and increased the stability of production (K. Watanabe, this issue).

With less fear of crop failure and higher average yields, farmers reduced the area planted to glutinous rice raised for home consumption and increased the area planted to KDML105 (jasmine rice), which has become a major source of cash income (Grandstaff *et al.* 2008). Since both RD6 and KDML105 are medium-duration and photoperiod-sensitive varieties, the length of time from planting to harvest has been shortened compared to the traditional late varieties that were dominant before, and the labor-intensive cultivation operations of field preparation, rice planting, and harvesting have been concentrated into relatively brief and predictable periods. Use of hand tractors to plow the fields, adoption of broadcast seeding, and employment of combine harvesters also decreased the amount of human labor time needed to grow rice. These changes allowed farmers to spend more time doing local off-farm jobs or to engage in short-term migration to other areas to seek employment. Increased household income gained from the sale

of non-glutinous rice and off-farm wages and remittances from migrants was used to buy fertilizer, hire wage laborers, and buy or hire agricultural machinery to replace increasingly scarce and expensive agricultural labor. Rural households also began to invest more in educating their children, which increased their propensity to leave the villages to seek employment in urban centers, further worsening the shortage of farm labor in the countryside. But remittances sent back to their families by migrant children increased household income, permitting the purchase of more expensive consumer goods. This improved the quality of life in the villages but also led to increased indebtedness of many rural households. A survey of more than 2,000 rural households in Buri Ram, Ubon Ratchathani, and Nakhon Phanom Provinces found that 81% were in debt in 2010, with the average amount of debt equal to one-half of annual income (Chichaibelu and Waibel 2012, 3, Table 2).

Interestingly, households that diversified their farming systems to include crops other than rice, especially cash crops, were found to be less likely to have migrant members than households that grew only rice. This was presumably because crop diversification reduces the risk of crop failure and cash crops provide locally earned income, thus decreasing the need to rely on remittances (Piotrowski *et al.* 2013).

Multiple Cropping in Paddy Fields before or after Rice

Multiple cropping by planting alternative crops before or after rice has often been suggested as a way to increase productivity and boost rural incomes. In past years, numerous experiments and field trials to test different multiple cropping systems were carried out by Khon Kaen University (KKU) researchers, but although they were often agronomically successful, farmers failed to adopt these systems because of a lack of markets for their produce and low economic returns (Terd *et al.* 1976a; 1976b; 1978a; 1978b). However, in recent years, growing of catch crops after the rice harvest has become much more widespread in the Northeast and farmers are employing a variety of locally developed multiple cropping systems (Anan 2001; Prapatsorn and Wareerat 2010; Thongkamkaew *et al.* 2010; Patcharaporn and Orawan 2011). A survey carried out in 2012–13 found that multiple cropping after rice was practiced in 90% of the 198 sub-districts in Khon Kaen Province. The land area used for multiple cropping was relatively small, only 3% of the total paddy area, but the practice was carried out by 11% of all rainfed rice farmers (Arunee and Rambo, this issue). Most of the multiple cropped area is devoted to low-value field crops (e.g., cassava, sunn hemp), but in areas with favorable soil and water conditions, higher-value vegetables are planted. For example, in Lad Na Piang village, Mueang District, Khon Kaen Province, many farmers grow hybrid tomatoes after rice under contract to seed companies (Chalee *et al.*, this issue). Growing hybrid

tomato seed can generate as much as USD50,000/ha compared to a value of less than USD1,000 for rice grown in the first crop. Of course, growing tomatoes for seed is extremely labor intensive, so in actuality, individual farmers cultivate only small plots that generate only a few thousand dollars of extra income. Despite the evident benefits of multiple cropping, however, only some farmers in some areas engage in such intensification—for reasons that remain poorly understood.

Replacement of Rice with Higher-Value Crops

In some areas, especially on land along the banks of the Mekong River in Nong Khai and Nakhon Phanom, farmers have converted upper paddy fields to rubber plantations because rubber produces much higher net value per hectare than rice (Sorat *et al.*, this issue). Recently, however, since the price of rubber went into steep decline, some of these farmers have begun to replace their rubber trees with oil palms, although the expansion of oil palm plantations is presently limited by the lack of processing facilities. In other areas, such as the village in Khon Kaen Province studied by M. Watanabe *et al.* (this issue), farmers have begun to plant sugarcane in lower paddy fields in place of rice. Thai Vietnamese farmers in a village in Nakhon Phanom have recently stopped growing rice in their paddy fields in order to concentrate limited household labor supplies on growing vegetables in the gardens around their houses, which gives much higher returns per labor hour than rice cultivation. The paddy fields are either rented out to Thai neighbors or left fallow (Nguyen Dang Hoc *et al.* 2016).

Diversifying Production into Higher-Value Specialty Crops

In many parts of the Northeast, farmers have shifted from growing cassava and sugarcane to rubber, which is favored because it generates high incomes (Patarapong *et al.* 2011). In locations with favorable soil and water conditions along with good market access, farmers have been diversifying their production by raising high-value specialty cash crops such as vegetables, fruit, and flowers along with fish and livestock. Examples of successful adoption of high-value specialty crops are Chinese radish cultivation in Nong-Ngong village, Baanhad District (Patcharaporn and Orawan 2011) and growing of organic vegetables in Samsung village in Khon Kaen Province to sell to urban consumers seeking pesticide-free food (Mondal *et al.* 2014). An analysis of data collected in 1995–96 from 174 randomly sampled non-irrigated farms in 49 subdistricts in Khon Kaen Province found that 37% cultivated only rice and/or field crops while 63% practiced more diversified agriculture that combined rice and field crops with horticulture and/or livestock rearing. The agricultural income of the most highly diversified farms, which combined cultivation of rice, field crops, vegetables, and fruit and in some cases livestock rearing,

was 60% higher than the average for all farms in the sample, even though the size of their landholdings was much smaller than the average (Caldwell *et al.* 2007).

In mountain areas in the Northeast, especially in Loei and Nakhon Ratchasima Provinces, farmers are engaging in “value intensification” by switching from growing low-value rice and field crops to planting higher-value specialty crops such as grapes, strawberries, temperate vegetables, and flowers. Integration of such specialty agriculture with tourism (“agro-tourism”) appears to be a successful form of value intensification in scenic mountainous areas, notably in Phu Ruea District in Loei Province, which specializes in temperate flowers and mushrooms, and Wang Nam Kieo District in Nakhon Ratchasima, which specializes in grapes and temperate vegetables grown in direct association with tourist resorts, homestays, and restaurants (Sukanlaya *et al.* 2014; 2016). The limiting factors on the adoption of high-value specialized cropping systems and agro-tourism are not yet well understood, however, so the potential for wider expansion of these systems remains uncertain.

An interesting characteristic of specialty crop production in the Northeast is the apparent tendency for each of these different crops to be geographically clustered into one or a few centers of production rather than being randomly dispersed in villages across the whole region. For example, growing of hybrid tomatoes under contract to seed companies is concentrated in only a few small clusters (Chalee *et al.*, this issue). In some cases, such as growing of temperate flowers or vegetables in the mountains, this clustering may reflect environmental constraints that limit the spread of these crops to small areas with suitable soils and temperatures and good road connections to markets (Sukanlaya *et al.* 2014). In other cases, however, clustering seems to be primarily a reflection of historical accident. For example, a single farmer first began growing jujube fruit (*Ziziphus mauritiana* Lam.) about 15 years ago in Ban Meng Subdistrict, Nong Ruea District, Khon Kaen Province. Now, jujube is grown by 13 households in five villages in this subdistrict. However, because growing jujube requires a substantial initial capital investment, an adequate water supply, use of expensive inputs including fertilizers, hormones, pesticides, and hired labor, and learning of specialized skills by farmers, only wealthier farmers with suitable land can adopt this high-value crop (Waewdaw *et al.* 2013). Mushroom growing is another highly profitable specialty that requires start-up capital and learning of special skills. A successful mushroom farmer whom my students and I interviewed in Phu Ruea District in Loei Province in September 2014 said that he first learned to grow mushrooms from an aunt who had mastered the specialized skill to produce the spores. Now a dozen farm households in the same village, all closely related by kinship, grow this highly profitable crop. They all still obtain the spores from their kinswoman who initiated mushroom production in the village.

Technological Change and the Continuing Role of Traditional Agricultural Technology

In recent years, Northeastern Thai farmers have adopted new technologies at an ever-accelerating rate. Two-wheel hand tillers displaced buffalo for plowing in the 1980s and 1990s and are now in turn being displaced by four-wheel tractors. Improved rice varieties, notably RD6 and KDML105, have replaced thousands of traditional local varieties (Trébuil and Hossain 2004; Rambo 2006), while use of chemical fertilizers and pesticides has increased exponentially. So it is evident that Isan farmers are not innately conservative or resistant to change. However, while quick to adopt useful new technology, they have not mindlessly discarded all traditional technology. Instead, they appear to have selectively retained traditional technologies that are effective and serve their needs, often at lower cost than newer methods. Like farmers everywhere in the world, Isan farmers have developed a valuable pool of local knowledge and indigenous technology that they rely on to ensure their survival (Rambo 2009). For example, they have an elaborate body of knowledge about rainfall prediction (Nongluck and Wilaiwat 1987) and also know about a number of methods to maintain soil fertility using locally available resources (Craig 1988). Traditional technologies that continue to play important roles in the livelihoods of Isan villagers include collecting wild resources, growing home gardens, maintaining trees in paddy fields, using cross-stream earthen weirs (*tham nop*) for irrigation, and relying on charcoal and other biofuels for household cooking.

Mechanization

It had long been assumed that mechanization of rainfed rice farming in the Northeast was unlikely to occur rapidly or proceed very far. Adoption of modern machinery was constrained by the subsistence orientation, low productivity, and abundance of cheap labor that characterized traditional farming. In recent years, however, mechanization of rice agriculture in the Northeast has been occurring at an ever-accelerating rate. Adoption has been spurred by the growing shortage of agricultural labor and consequent increases in the cost of hiring workers. Beginning in the 1980s, two-wheel hand tillers began to replace buffalo for plowing. In 1983 there were only a few thousand hand tillers in use in the Northeast, but by 2003 there were 1.25 million of these machines, which are now in turn being displaced by four-wheel tractors. In the 1990s, combine harvesters began to replace harvesting by hand. In 1993 only 1% of households used these machines, but by 2003 they were employed by 14% of farm households (Grandstaff *et al.* 2008, 336, Table 10C). In Tung Kula Rong Hai, most farmers now rent the services of combine harvesters to harvest their rice. The main exceptions are those farmers who raise a lot

of livestock and need good-quality straw to use as fodder. The machines cut the straw into short pieces, which are not suitable for use as fodder—so these farmers continue to do hand harvesting (Sorat *et al.* 2009; 2010). In recent years, farmers in irrigated areas have begun adopting transplanting machines. Some landowners even make contracts with machine operators to carry out virtually the entire process of rice cultivation, from plowing to transplanting to harvesting. Extensive use of farm machines considerably reduces production costs: A study of farm mechanization in Kok-Si Subdistrict, Mueang District, Khon Kaen Province found that the cost of production of rice for farmers using four-wheel tractors, transplanting machines, mechanical pesticide sprayers, and combine harvesters was 9.4 baht/kg compared to 11.4 baht/kg for farmers relying on two-wheel hand tillers for plowing and human labor for other tasks (Atthasat and Suchint 2014b). Farmers say that four-wheel tractors are superior to hand tillers for plowing paddy and sugarcane fields and for land leveling. The working speed of four-wheel tractors is much faster than that of hand tillers: a four-wheel tractor can plow 3.6 rai/hour compared to 0.31 rai/hour for a hand tiller (Atthasat and Suchint 2014a). Hand tillers are now mostly used to prepare the land to plant cassava as an intercrop between young rubber trees, as mobile water pumps, and to pull small carts (Atthasat and Suchint 2013).

A number of interacting factors appear to be driving the process of mechanization, including a shift from subsistence production of glutinous rice for home consumption to the production of non-glutinous rice for sale to the market; higher prices for rice due to government support programs; the out-migration of workers seeking jobs in urban centers and the movement of rural laborers into non-agricultural employment with a consequent sharp decline in the size of the agricultural labor pool and a steep rise in wages paid for farm work; the decline in use of labor exchange arrangements among neighbors; and the increased access of farm households to capital due to the cash remittances they receive from members engaged in off-farm employment (Grandstaff *et al.* 2008). Interestingly, in a village close to the Mekong River border with Laos, farmers hire cheap Lao migrant laborers and thus avoid the need to invest in mechanization (Soimart 2014).

Many village households have also invested in purchasing motor vehicles. Motor-bikes have become virtually a necessity of life in the countryside, while better-off households often own pickup trucks, which they use for personal transportation and also to earn income by hauling their neighbors' crops to market. A longitudinal survey of investments over a three-year period by more than 2,000 households in three provinces in the Northeast found that while only 28% made any investments related to agricultural inputs, purchase of transport and farm machinery accounted for one-third of their investments (Hohfeld and Waibel 2013). The wealthy entrepreneurial farm households in Ban Hin

Lad village in Khon Kaen Province studied by Barnaud *et al.* (2006) derived a considerable share of their income from hiring out their trucks to neighbors to transport their crops to market.

The Role of Wild Resources in Rural Household Livelihood Systems

Wild products collected from forests, farm fields, and aquatic systems have traditionally played an important role in the livelihoods of Isan villagers (Prapimporn *et al.* 1988; 1998; Moreno-Black and Prapimporn 2000). However, ongoing changes in agricultural systems are having important impacts on the biodiversity of wild plant and animal species. Adoption of new technology (e.g., irrigation, mechanization, intensification) may directly affect populations of useful wild species in the fields, as in the case of trees being cut down in paddy fields converted to growing sugarcane described in the paper by M. Watanabe *et al.* in this issue. Changes in family structure as well as agricultural activities also affect the availability of household labor and increase the opportunity cost of collecting wild products. Those households enjoying increased cash incomes are able to purchase commercial substitutes in place of spending time collecting wild species, whereas poorer households with limited land resources may be becoming even more reliant on wild products to survive. At the same time, the expansion of urban markets has created new incentives for rural people to engage in collection of high-value wild products and to bring formerly wild species into domesticated status (Shirai and Rambo 2008; 2014).

Home Garden Agroecosystems

Although cultivation of home gardens to provide vegetables, fruit, medicinal plants, and other useful products is a widespread practice in Northeast Thailand (Grandstaff 1988; Rambo 1991), this indigenous technology has received little attention from researchers, and even basic descriptions of the structure and species composition of the gardens are unavailable. However, a recent survey of seven ethnic groups (Phu Thai, Kalaeng, Lao, Yoy, Nyaw, So, and Vietnamese) in the Sakon Nakhon Basin found that the gardens of each group had a distinctive overall structural pattern and no two groups had identical modal patterns (Pijika 2014; Pijika and Rambo 2015). However, the gardens of all the Tai-speaking groups except the Phu Thai share a common overall plan in that a wide variety of different species are interplanted in an essentially random pattern with irregular and ill-defined boundaries. In the case of the Phu Thai, traditional species are still planted in this pattern but temperate vegetables grown for sale are planted as monocultures in rectangular plots that resemble those of Thai Vietnamese market gardeners (Pijika 2014; Pijika and Rambo 2015; Nguyen Dang Hoc *et al.* 2016). That the different groups largely retain their own distinctive garden structures while changing so many

other aspects of their agricultural system raises interesting—but currently unanswerable—questions about the interplay between economic and cultural factors in the rural development process (Pijika and Rambo 2015).

Trees in Paddy Fields

The northeastern region is well known for its unique “trees in paddy fields” agroecosystem. This is a locally evolved system in which farmers deliberately retain numerous large trees in their rice fields (Pendleton 1943). Shading reduces rice yields to some extent under the tree canopies, but the improvement of soil fertility resulting from the recycling of tree leaf litter increases the overall yield of the field. In addition, the trees provide many valuable benefits to farmers (e.g., firewood, fruit, shade for people and livestock) (Patma 1993). In recent years, however, the density of trees in the paddy fields appears to be declining, especially in the northern central provinces (Khon Kaen, Udon Thani, Nong Khai) of the northeastern region (Watanabe *et al.* 2014). In part this decline is simply the consequence of the length of time since fields were originally reclaimed from the forest, with older fields having fewer trees. But the rate of decline may have accelerated lately because farmers are cutting down trees that present obstacles to the efficient use of tractors and combine harvesters. Trees are being cut down also because shading reduces yields of sugarcane, which in some villages is being planted in lower paddy fields in place of rice because of its much higher profitability (M. Watanabe *et al.*, this issue). However, in other villages farmers are increasing the number of trees in their rice fields by planting rows of eucalyptus trees on the paddy bunds. The Double A paper company even promotes its Khan Na brand of copier paper as being an environmentally friendly product because it is made, at least in part, from eucalyptus trees grown on paddy bunds.

Traditional Irrigation Technologies

Construction by Isan villagers of earthen dams (*tham nop*) across streams to raise the water level high enough to overflow the stream banks and spread across the paddy fields to irrigate the rice is a well-developed indigenous technology. Although many *tham nop* have fallen into disuse in recent years, or been replaced with concrete weirs, this technology is still employed in some areas (Fukui and Chumphon 1998; Fukui *et al.* 2000). A recent study of the factors influencing abandonment or retention of this type of traditional irrigation found that this system persists in areas where: (1) the topography is favorable for distributing the water to a wide area so that many farmers benefit from it; (2) the *tham nop* are reinforced with bamboo to make them more durable and less likely to break during floods; and (3) farmers have greater dependency on rice and lower dependency

on upland crops for their livelihoods so are willing to invest more effort in maintaining the weirs. Factors leading to abandonment of *tham nop* irrigation include: (1) frequent failure of the structure, requiring extensive repair work by the farmers; (2) poor distribution of water to the paddy fields, causing losses in the harvest due to prolonged flooding; and (3) government projects to replace the earthen weirs with concrete weirs and canals (Prapatsorn 2014). Adoption of mechanized plowing and direct seeding in place of transplanting have also reduced the need to have the paddies flooded at the beginning of the cropping season, which decreases the value of the *tham nop*.

Irrigation using locally constructed waterwheels, although never widespread in the Northeast, was formerly common in villages located near mountains with swift-flowing streams in Chaiyaphum, Loei, and Nakhon Ratchasima Provinces. At present, there are only about a dozen waterwheels still in use in Mueang District of Chaiyaphum Province. A comparative cost-benefit analysis found that irrigation using the waterwheels was four to five times cheaper than using mechanical pumps. However, the initial investment to construct new wheels was large, and maintenance required considerable attention from owners (Wichian 2008).

Reliance on Charcoal for Cooking

Despite the ready availability of alternative fuels in the form of electricity and bottled gas, charcoal is still the preferred fuel for cooking many foods, even in urban areas. A comparative study of biomass energy (firewood and charcoal) use in rural, suburban, and urban communities in Khon Kaen Province found that the quantity of biomass energy used per household was 21.7 GJ/yr in rural villages, 18.6 GJ/yr in suburban communities, but only 5.4 GJ/yr in urban settlements. Thus, even though urban households make much greater use of electricity and gas than do suburban and rural households, they still continue to use charcoal at one-third the level per capita compared to rural households (Analaya *et al.* 2011). Much of the demand for charcoal from rural and urban consumers is met by small-scale traditional earthen kilns operated by individual farmers or groups of farmers using a variety of local materials to convert into low-quality charcoal.

The Epidemiological Transition and Changes in Health and Disease Problems

The rural population in the Northeast is in the midst of an “epidemiological transition” (Pattanee 2013), in which traditional diseases and health problems such as malnutrition, anemia, and goiter are gradually declining but modern diseases and health problems such as obesity, type II diabetes, and alcoholism and drug addiction as well as traffic deaths

and injuries are rapidly increasing.

One traditional disease that shows no sign of declining is liver cancer resulting from the long-established custom of Isan villagers eating raw fish. This practice is a major source of infection with liver flukes (*Opithorchis viverrini*). In 2004 death from liver cancer and cholangiocarcinoma ranked fourth after HIV/AIDS, stroke, and traffic accidents as a cause of mortality in Thailand. The prevalence of liver flukes in the Northeast was much higher (18.6%) than the national average (8.7%) (Wongba *et al.* 2011).

Many other traditional diseases, however, are in decline. Malnutrition, which was widespread in the 1980s, with close to half of school-age children in the Northeast classified as having protein-energy malnutrition, has declined rapidly (Pattanee 2013). However, specific nutrient deficiencies, especially those associated with anemia, remain common, reflecting inadequate intakes of iron and vitamin A in the diet as well as the prevalence of abnormal hemoglobins—e.g., thalassemia and hemoglobin E—in the Isan population. A study of a large sample of primary school children from poor farm households in Ubol Ratchathani Province found that 31% had anemia (Thurlow *et al.* 2005), while another study of teenagers in Mukdahan and Roi Et Provinces found that 21% and 17% of individuals in the respective provinces had anemia (Anupong *et al.* 2011). A study found that 77% of elderly people in a village in Northeast Thailand had anemia compared to only 14% in a city in Japan (Ishine *et al.* 2006). High levels of zinc deficiency have also been reported for rural Northeasterners, with as many as two-thirds of schoolchildren tested having this deficiency, reflecting the low amount of this element present in glutinous rice grown in the zinc-deficient soils in the region (Woravimol *et al.* 2006; Thurlow *et al.* 2006). It has been suggested that application of zinc fertilizers to paddy fields could solve this problem (Gibson *et al.* 2007).

While malnutrition and the incidence of underweight and stunted children have greatly declined over the past 20 years, recent changes in diet and exercise levels have led to an explosion of the obesity rate in Northeast Thailand. A diet that formerly contained only small amounts of fats and sugar has been transformed by greatly increased consumption of fast foods by villagers. Village shops sell many high-calorie packaged snacks and soft drinks. Recently, when visiting in a village in Khon Kaen Province I observed three shops selling slices of white bread spread with margarine and jam as snacks. At the same time as consumption of calories is rising, energy expenditure in farm labor is declining as machines replace human muscle power in many operations. Instead of walking, villagers now use motorbikes to visit neighbors' houses, even those close by. Children spend much more time sitting in school and watching TV or playing computer games and less time helping their parents doing chores than in the past. Thus, it is hardly surprising that a survey of 12- to 18-year-old students in secondary schools

in Khon Kaen Municipality found that 5.3% were overweight and 13.7% were obese (Phouvang *et al.* 2010), while another survey of a large sample of grade 6 children in primary schools in a district in Sakon Nakhon Province found that 9% were overweight and 9% were obese (Pipop *et al.* 2005, 830, Table 2).

Associated with the increase in the number of overweight people is a rapid increase in the incidence of diabetes mellitus. A recent study comparing the health of elderly people in Northeast Thailand and Japan found much higher rates of glucose intolerance, which is an indicator of diabetic tendencies, in old people living in both urban (38.3%) and rural (34.3%) communities in Thailand than in Japan (4.4%) (Ishine *et al.* 2006). A study of diabetics receiving treatment at a district hospital in Sakon Nakhon Province found that 60% were in the 45–64-year age group and that the direct and indirect costs of caring for these patients were high, averaging USD881/year in 2008, which was 21% of the average per capita GDP of the country (Chatterjee *et al.* 2011). One factor that may contribute to the high incidence of diabetes among Isan villagers is their traditional preference for eating glutinous rice, which has a much higher glycemic index (144) than ordinary long-grain non-glutinous rice (91) (Ranawana *et al.* 2009, 104, Table 4).

The great increase in average life span and the consequent increase in the number of elderly people is changing the health profile of both urban and rural Northeasterners and presenting the public health system with new challenges that it is not fully prepared to meet. Problems associated with menopause and andropause, and a whole range of diseases associated with old age, including the need for specialized care institutions for the elderly who lack family support, will become more important in the next decade.

Other “modern” health problems that have become more prevalent in recent years include alcoholism, drug addiction, and traffic-related deaths and injuries. The Northeast reportedly has the highest number of drug users in the country (Somjit *et al.* 2005). In 2000 there were an estimated 600,000 drug users in the region, including 200,000 school-children. Methamphetamines (*yaa ba*) and marijuana were the most commonly used substances (Office of the Narcotics Control Board 2003). Excessive consumption of alcohol is favored by permissive Isan social norms, which see drinking as part of everyday life. Consumption is common at village social events and festivals, where alcohol is believed to help people feel happy and have a good time. A study in one village near Khon Kaen city found that 90% of males drank alcohol at least once a year, with more than half drinking at least one or two times a week. Females drank at a lower rate, with 40% of adult women drinking alcohol at least once a year. Most women were only occasional drinkers (Jirawat and Siriporn 2012).

Ownership of motor vehicles in Thailand has increased greatly in the past decade. There are 12 million registered motor vehicles in the kingdom, mostly motorcycles,

of which 3.5 million are newly registered (Ministry of Transport Information and Communication Technology Centre 2013). Not surprisingly, there is a high level of accidental deaths and injuries caused by motor vehicles. There are 13,000 deaths and more than one million injuries annually, with several hundred thousand people disabled. Eighty percent of fatalities are male (Wattanavadee *et al.* 2013). In Khon Kaen Province in 1999, the death rate was 26 per 100,000, with nearly 40% of road accidents involving drunk driving (Sirikul 2004). More recent data are unavailable, but if anything, the problem has worsened as more and more inexperienced drivers take to the road with minimal driving skills and knowledge of traffic rules.

Social System Changes

Along with changes in agriculture technology and practices, the agrarian transformation involves multiple changes in the Isan rural social system, including the nature of rural-urban interactions, population structure, household composition and livelihood systems, community social organization, cultural values, aspirations, and sense of identity.

Changes in the Nature of Rural-Urban Interactions

The tighter integration of rural villages into larger economic and social systems has led to a form of “rural urbanization,” in which many goods and services that were formerly available only within large cities are now readily accessible within the villages. Shops modeled on 7-Eleven convenience stores are found in many villages, selling soft drinks and packaged snack foods. Extension of the coverage of mobile phone networks in Thailand has made telephone service available everywhere except in the remote mountains. Today, almost every villager in Isan has a mobile phone. One reason that villagers are willing to move out of the villages to live in isolated houses on their farms is because mobile phones allow them to stay in touch with friends and neighbors and receive notification of parties and social events organized within the village (Patarapong 2010).

At the same time as their villages are urbanizing, rural people are developing closer relations with regional cities, which play an ever-increasing role in their lives. Until recently, cities in the Northeast were quite small and had a relatively limited influence on agricultural activity in their hinterlands. In recent years, however, there has been rapid growth of urban populations and expansion of urban settlements into the surrounding countryside. Urban sprawl is causing changes in land use in the peri-urban zone surrounding the cities (Sorat *et al.*, this issue). Expansion of the area of urban settlement is pushing up the value of agricultural land in the peri-urban zone, leading many farmers

to sell their land to developers for quick profits (Rigg and Ritchie 2002). Some invest their capital by buying land farther away from the city, where they continue farming; but others spend the windfall on immediate consumption and end up as landless laborers. Much of the land held by commercial developers lies unused or is planted to eucalyptus trees while the developers wait for prices to rise before building new housing estates. The growth of the urban market also creates new opportunities for those peri-urban farmers who are able to switch from growing rice to producing high-value specialty crops (e.g., organic vegetables, flowers) and meat and dairy products desired by affluent city people (Shirai 2006). Urban demand for biomass fuels (firewood and charcoal) remains surprisingly high (Analaya *et al.* 2011), providing a valuable market for eucalyptus farmers and rural small-scale charcoal makers. Access to urban employment opportunities may also be facilitating the development of a new type of farm household that might be called “weekend farmers,” i.e., rural households whose members work urban jobs on weekdays but carry out agricultural activities in the evenings and on holidays.

Population Structure, Household Composition, and Livelihood Systems

Thailand as a whole has already passed through the demographic transition from high birth and death rates to low birth and death rates. Consequently, the rate of population growth has slowed and the population is rapidly aging, with the share of children and young adults declining and the share of those over 60 growing. However, total fertility rates in the Northeast have fallen more slowly than in other regions. It has been suggested that this reflects the influence of rural household structure and agricultural employment on the risk that having children poses to the income-earning potential of young women of childbearing age. Skipped generation extended-type households allow young married females who migrate to work in Bangkok to still have children: the children are sent to live with their grandparents in the mothers’ home villages in Isan, while the women can continue to engage in wage labor in the city (Shirai and Rambo, this issue). Women of childbearing age who remain in the villages can have children while continuing to earn income through agricultural work, which has more flexible hours than non-farm employment.

In the Northeast, the effects of changes in fertility and mortality on population structure have been accentuated by the high rate of out-migration. In 1986 one-quarter of rural households in the whole Northeast had at least one member working outside of their home subdistrict, a share that had increased to 35% by 1992 (Nagata 1996) and has now reached 50% or more. A recent survey of 61 sample households in Nong Ben village in Khon Kaen Province found that 57% of households had one or more migrant members (Shirai and Rambo, this issue). A survey of 22 villages in Nang Rong District in Buriram

Province found that in 2000 the migration prevalence rate ranged from 38% to 68% (Garip and Curran 2009). A longitudinal panel study of 509 individuals living in two villages in Mahasarakham Province in 1982–83 found that 49% of these individuals had moved away from their native villages by 2008, with the majority having relocated to other provinces (Rigg and Salamanca 2011). Migration has always been a common practice in the Northeast, both the movement of people from overpopulated villages to find new land on the forest frontier—the practice of *ha na di* described by Fukui Hayao (1993)—and seasonal migration of people to Bangkok to work as construction laborers or maids after the rice harvest and returning back to the villages in time to help plant the new crop at the start of the rainy season. Such seasonal migration is a long-established practice, with Robert Pendleton (1943) reporting that people from the Northeast walked down to the Central Plain to earn cash working in the rice harvest there, which did not begin until after the harvest in the Northeast was already finished. After the railroad reached Khorat around 1900, Isan farmers could also use the train to reach the Central Plain. Such seasonal migration greatly expanded after the construction of the Friendship Highway made travel to Bangkok much quicker and cheaper, at least for people living in areas close to the road. Migrants would leave their villages in the Northeast immediately after the end of the rice harvest in order to take temporary jobs as construction workers or maids in Bangkok, but then return to their villages in time to help their families plant the next crop at the start of the rainy season. Beginning in the late 1980s, however, there was a shift toward long-term migration, with migrants taking permanent jobs in factories in the Central Region and often returning to their home villages only for short visits at holidays, especially for the Thai New Year in April. Such long-term migrants rarely return home to help with the rice harvest, as was shown by a survey of migrants from Nang Rong District during the period 1984–94, which found that only 10% assisted with the harvest (Rindfuss *et al.* 2012, Table 1).

As a result of out-migration, the population of the northeastern region suffered a net loss of more than 900,000 people between 1985 and 2000 (Huguet and Aphichat 2011, 15, Table 1.9). Most of the long-term migrants were young adults, with a 2000 study in Nang Rong District finding that 87% of migrants were between the ages of 15 and 39 (Piotrowski 2009). The massive out-migration of young adults, combined with the increasing tendency of those who remain in the villages to work in nearby factories or service industries, has led to a severe agricultural labor shortage (Funahashi 1996). This has led to a rapid rise in wages for farm workers, which has been an incentive for farmers to adopt labor-saving machinery. It has also caused many farmers to shift from transplanting to broadcast seeding of rice (Pandey *et al.* 2012).

The agricultural labor force is also aging rapidly. The share of the population com-

posed of people over 60 years of age in the Northeast increased from just under 9% in 2000 to 12% in 2010, and is projected to reach 17% by 2020 and 20% by 2025 (Thuttai 2012, 161, Table 6.1). In many rural villages the population seems to be composed mostly of young children and their grandparents (Funahashi 1996; Aree *et al.* 2012; Shirai and Rambo, this issue), with the share of elderly people living in skipped generation and truncated households having increased from 22% in 1990 to 41% in 2007 (Thuttai 2012, 170, Table 6.3).

Given the shortage of younger adults, more than 40% of people over the age of 60 in the Northeast remain active in the labor force, mostly engaged in agriculture, compared to less than 20% in Bangkok (Fujioka and Sapon 2009). This is reflected in a major upward shift in the average age of Isan farmers. A longitudinal study of two villages in Mahasarakham Province found that the median age of farmers had increased from 35 in 1982 to 58 in 2008 (Rigg and Salamanca 2011). These demographic shifts are likely to have profound impacts on Isan agriculture. It has been suggested, for example, that elderly farmers are less likely than younger ones to adopt new technology, including new crop varieties and chemicals, which may serve to retard the pace of innovation in agriculture (Bryant and Gray 2005). On the other hand, because older people lack the physical strength to plow using two-wheel hand tillers, they are motivated to switch to using small four-wheel tractors themselves or contracting with tractor owners to do the plowing for them (Atthasat and Suchint 2013).

Demographic changes have been accompanied by changes in the structure of rural households (Shirai and Rambo, this issue). Although studies of village households in the 1960s found that the majority (>70%) were of the nuclear type (Lux 1962; Keyes 1975), a 2013 survey in Nong Ben village in Khon Kaen Province found that only 31% of households were nuclear (parents and children only), while 38% were extended, 11% were skipped generation extended (grandparents and grandchildren), and 19% were truncated-type households (elderly couples or individuals living alone) (Shirai and Rambo, this issue). These changes in household structure have a strong impact on the welfare of children and elderly people. Thus, a study of the nutritional status of children living in different types of households in two rural districts in Khon Kaen Province found that those living in nuclear households with both parents present fared best, while those living with their grandparents in skipped generation households fared less well, except in cases where the parents sent back remittances exceeding THB8,000/year. However, children living in extended households with both parents present also fared less well than those in nuclear households (Cameron and Lim 2007). Although the largest share of old people in the Northeast still live in extended-type households, where they can depend on the support of their adult children, two-fifths of the elderly are now living on their own

in skipped generation and truncated households (Thuttai 2012, 170, Table 6.3). A detailed study on the living arrangements of elderly people in Nang Rong District found that those living in households with migrants were more likely to live alone (Teeraphong 2001).

Accompanying changes in household composition are profound changes in sources of household income, including a growing share of income coming from non-agricultural sources. For the region as a whole, more than half of rural household income now comes from non-agricultural sources (Grandstaff *et al.* 2008; Rigg and Salamanca 2009). In Nong Ben village in Khon Kaen Province, in 2013 an average of 80% of household income came from non-agricultural sources, including local non-farm wage labor, government salaries, self-employment, government assistance, pensions, and remittances from migrant members (Shirai and Rambo, this issue). The greatly increased dependence of rural people, especially the elderly, on remittances sent back by migrants working in non-farm jobs outside of the region is noteworthy. Government statistical data show that the share of income from remittances increased in the Northeast from 3.8% in 1981 to 15.9% in 2004 (Grandstaff *et al.* 2008, 301–306). Although a national sample survey of internal migrants in 1992, of which the largest share were Northeasterners, found that only 27% sent remittances back to their families (average THB763/month) (Osaki 2003), another study on migrants from Nang Rong District found that 57% sent back money and 39% sent back in-kind goods (Rindfuss *et al.* 2012). A recent survey of rural households in Nong Ben village in Khon Kaen found that more than half received remittances. Skipped generation households (grandchildren living with their grandparents) had the highest share of receiving remittances (88.9%), followed by extended family households (65.2%) and truncated family households (60%), while only 31.6% of nuclear family households received remittances (Shirai and Rambo, this issue).

Also affecting rural livelihoods are changes in patterns of landownership. Although the majority of farm households in the Northeast still own their own land, with only a small proportion either renting land or working as sharecroppers, and concentration of landownership in the hands of a few large owners is not as advanced as in the rest of the country (Chai, this issue), the mean size of farms has declined over the past 30 years, falling from 4.5 ha in 1980 to 4.3 ha in 1990 and 3.6 ha in 2000. Surprisingly, however, the mean farm area per capita has remained almost the same as it was in the 1980s, reflecting the concurrent decline in average family size (Grandstaff *et al.* 2008, 320–321). There is great variation in the size of holdings farmed by rural households in the Northeast. Thirty percent of households have small holdings of less than 1.6 ha that occupy only 9% of the total agricultural area, and 60% have medium-sized holdings of 1.6 to 6.4 ha that occupy 60% of the total area. However, the 10% of households with farms larger than 6.4 ha occupy 32% of all agricultural land (Grandstaff *et al.* 2008). Few recent stud-

ies have been published on landholding patterns in specific villages, but a detailed investigation in Ban Hin Lad in Khon Kaen Province found that three-quarters of village households had very small farms of less than 2 ha, with less than 5% having large farms (Barnaud *et al.* 2006). Because the available data on landholding size include both paddy fields and upland crop fields, they provide only a crude indicator of the extent to which Isan households are able to be self-sufficient in rice production to meet their consumption needs; but it is evident that many households have too little land to provide a decent standard of living from agriculture alone.

Changes in Community Social Organization

The conventional view of rural villages in the Northeast is that they are cohesive moral communities with limited economic differentiation among households and a high level of solidarity based on kinship ties and participation in community social activities, often centered on the temple (Sukaesinee *et al.* 1988; Keyes 2014). Research in the 1980s in Ban Hin Lad in Khon Kaen Province found that villagers were linked together through participation in many different formal and informal associations and groups (Wilaiwat *et al.* 1986). Informal labor exchange groups played a critical role in agricultural activities at times of peak labor demand for rice transplanting and harvesting. Households that encountered short-term economic difficulties due to crop failure or illness could rely on their fellow villagers to assist them with gifts or loans of food (Rigg and Salamanca 2009). In recent years, however, village solidarity has declined markedly. Exchange labor has virtually disappeared, with farmers relying on hired workers to assist them at peak periods in the rice production cycle. Village households increasingly depend for social support on government assistance and their own extended extra-local networks and rely much less on assistance from neighbors or village welfare institutions (*ibid.*).

One major social change that may contribute to the decline in community solidarity is the increasing tendency for households to move out of densely populated nucleated villages to live independently on their own farmsteads, where they are quite isolated from neighbors. This type of relocation happens most frequently in villages with high population densities, where keeping of livestock in houses within the settlement is prohibited and social conflicts among neighbors are more likely to occur. Households that have moved to live on their farmsteads have more time to devote to agriculture, so they farm more intensively and practice better soil management than those who remain in the villages (Patarapong 2010). Another factor that has weakened community social solidarity is the massive out-migration of young adults to work in Bangkok, the Eastern Seaboard, and abroad. Although many migrants continue to provide assistance to their families remaining in the villages, and occasionally return for short visits, the horizontal

ties with other villagers in their own generation tend to atrophy since they are no longer continually reinforced by daily face-to-face interactions and joint participation in community activities and ritual affairs.

Cultural Values, Aspirations, and Sense of Identity

The prevalent image of Isan people in the Thai mass media is of tradition-bound, village-centered peasants having only limited involvement with or knowledge of the larger world (Keyes 2014), the Isan equivalent of American hillbillies or country bumpkins. This image is almost the opposite of reality. Rural people in Isan may well be the most dynamic and receptive to change of any people in the kingdom (Fukui Hayao, personal communication). Although often referred to in the social science literature as “peasants,” the people of Isan were never fully incorporated into the absolutist Siamese “feudal” (*sak din na*) system. Instead, until the administrative reforms of Rama V in the 1890s, they had lived in relatively autonomous villages that were under the rule of local chiefs (*chao muang*) who had only limited coercive power to control the lives of their rural subjects (Keyes 2014). Consequently, Isan villagers never developed the social atomism and lack of individual initiative that characterized peasants in highly developed feudal societies in Europe (Banfield 1958), Mesoamerica (Foster 1965), or central Siam (Jit 2007).

Since the 1970s they have eagerly embraced globalization, both by finding employment in export-oriented factories in Bangkok and the east coast and by migrating in large numbers to live and work abroad. Isan laborers are employed in large numbers in construction, agriculture, and factory work in the Middle East, Taiwan, and South Korea. The Thai diaspora, mostly migrants from Isan, in the United States numbers over 300,000 people (Wikipedia contributors 2015). Thai Town in Los Angeles has become a major tourist attraction. Many Isan village women have married foreigners and live abroad with their spouses, mostly Western Europeans and Americans. According to a 2004 survey by the National Economic and Social Development Board (cited in Sirijit 2013), these women, who then numbered 15,000, sent back remittances to their families totaling more than USD44 million per year (about USD2,930 per person). In many other cases, which seem to replicate the traditional Isan custom of postmarital matrilocality, the foreign husbands have moved to Northeast Thailand to reside in their wives’ home villages. No official data are available on the number of foreigners involved, but according to one journalistic source they number more than 100,000 (Frensham 2014). In one village, 84 out of 334 adult females had married foreigners (Rattana 2005). Although in Thai elite discourse women who marry foreigners are commonly viewed pejoratively as being little better than prostitutes who are immoral seekers after material wealth (although they are also sometimes presented as naive victims of neocolonialist sex trafficking), an alternative

view is that these women, who are mostly widows or divorcees with little chance of finding a Thai husband (Orathai 2012), have found an innovative way to expand the diversified portfolios of their families, by tapping new extra-local resources (Chai Podhisita, personal communication). This view is supported by research by Leonora Angeles and Sirijit Sunanta, who found that the women themselves viewed their transnational marriages "... as a way to gain social and spatial mobility for themselves and their families" (Angeles and Sirijit 2009, 553). It has even been suggested that the phenomenon of transnational marriage "contributes to the village scale-jumping to global space, thus bypassing the Thai nation-state" (Sirijit 2009).

The willingness to use spatial mobility as a way to gain access to more resources is, of course, hardly a new characteristic of Isan farmers. The Thai-Lao of Isan are descended from Lao migrants from Lan Xang who, beginning in the 1400s, had gradually trickled down into this sparsely populated frontier zone (Keyes 2014), which, until the 1940s, was 90% covered by forest (Pendleton 1943). Historically, when villages became overpopulated and the size of landholdings declined, some households would set off in search of unoccupied lands. Wherever they found suitable land for making new rice paddies, they would settle down and form a new village, often 50 or 100 kilometers from their natal communities (Fukui 1993).

The underlying character of Thai-Lao people has not changed, with the willingness to take risks to find and exploit new resources still being highly valued. Recently, however, there has been a major shift in the attitude toward education, which is reflected in the investment preferences of rural households. Until recently parents favored investment in land, hoping to increase their holdings to have a sufficiently large area to be able to give each of their children a farmstead when they became too old to work it themselves. Thus they tended to pull their children out of school as early as was legally allowed, so they could augment household labor resources; now, parents are not interested in accumulating larger landholdings but instead choose to invest capital in educating their children in order to prepare them to take non-farm employment in the cities that will allow them to support the elderly parents with remittances (Fukui 1996a; Grandstaff *et al.* 2008; Wanichcha and Dusadee 2013). In Khon Kaen University, where I teach, there are quite a number of graduate students from Isan farm families, including three of my own doctoral students. Their parents, most of whom have only a few years of primary education, definitely do not want them to return to farming after getting their degrees, and they themselves do not expect to do so. The value placed on higher education is shown by the fact that the parents of a doctoral student of one of my colleagues have even mortgaged part of their farmland in order to finance completion of her degree.

Perhaps the most important recent change in the culture of Isan villagers is in the

way they perceive themselves and their role in the world. Although they were never the servile peasants that the urban elite imagine them to be, their participation in mass political movements—first the Communist mobilization of villages in the 1960s–1980s, then the organizational work by NGO community development activists in the 1990s, and most recently the Red Shirt movement and the formation of “Red villages”—has affected the sense of self of many villagers (Keyes 2014).

Conclusion

The agrarian system of Northeast Thailand is changing in multiple ways at unprecedented speed. But perceptions of the rural Northeast held by many members of the Thai urban elite lag far behind present realities. The stereotypical view is that rural Isan people are poor, uneducated, and ignorant, resembling the buffalo they formerly used to plow their paddy fields (Chairat 2013). In this view, these backward peasants must ceaselessly struggle using antiquated technology to scratch a bare living out of a harsh environment. They live their lives within the confines of their native villages with their time horizon limited to the next crop and their only aspiration for the future being to produce sufficient food to keep their families alive. This stereotypical view seems impervious to empirical disconfirmation. Indeed, what is remarkable is that despite the massive social transformation of the rural Northeast over the past half-century, the conventional elite view has changed so little from that described by the late American anthropologist A. Thomas Kirsch in a paper published in 1966:

Both popular discussions of Northeast Thailand and its problems and more programmatic statements defining development aims seem to be rooted in certain conceptions about the “kind” of people Northeasterners are. Northeasterners are conceived, for example, as people with strong commitments to a particular mode of life, that of rice farmer; to a traditional set of village based social relations and customs; and to particular localities, whether native villages or the northeastern region in general. That is, Northeasterners are seen as “typical peasants.” Given this conception of the way that Northeasterners are, and the massive fact of the economic underdevelopment of the Northeast, solutions to the region’s problems have been seen largely in economic terms. . . . The assumption seems to be that by raising income levels, by making life more comfortable for the Northeastern peasant population, the central government will lessen the appeal of “subversive elements.” In return for a better standard of living, peasants apparently are expected to give political support, or at least to remain politically apathetic. (Kirsch 1966, 370)

Kirsch goes on to say:

I would suggest that far from solving the problems of the Northeast, such measures are likely to

aggravate the specifically political dimensions of the problem. By raising villagers' income levels within the traditional economic framework, by making life easier and more comfortable for the rural villager, the levels of aspirations among young men are also likely to rise, and the means of achieving such aspirations—e.g., freedom from poverty, better educational facilities—will be available. Thus, more young men are likely to want to achieve social status outside of the rural village and outside of the peasant style of life. But most plans for development of the Northeast do not seem to take into account the possibility of such an increase in aspiration, for Northeastern villagers are viewed as an undifferentiated mass with common commitments to a peasant style of life. Unless efforts are made to keep channels of mobility open, and to expand them, we are likely to find a crucial segment of the Northeastern population thwarted in their aspirations—perhaps an easy prey to those who might offer alternative commitments and alternative opportunities for status achievement. (*ibid.*, 377–378)

I doubt it would have surprised Kirsch to learn that it was in the villages of the Northeast that the Red Shirt movement first arose after the 2006 coup, or that the majority of the core participants in the Red Shirt demonstrations in Bangkok in 2010 were members of the newly emerging Isan rural middle class. Most of these demonstrators were what Naruemon Thabchumpon and Duncan McCargo (2011) have called “urbanized villagers,” rural people who gained considerable education and became entrepreneurial farmers, using newly gained access to capital provided by village development funds to modernize their farming and establish small businesses. As Kirsch so presciently recognized, the potential for the agrarian transformation that is currently reshaping rural society in the Northeast was already there in the 1960s—but it was invisible to most observers who were blinded by their preconceptions about the Isan people being a tradition-bound peasantry.

Because the agrarian transformation of Northeast Thailand is still very much a work in progress, it would be foolhardy to try to predict in detail how it will turn out in the future. What is already evident, however, is that the traditional subsistence-oriented agricultural system has largely been replaced by a capitalist market-oriented one inextricably linked to the national and global markets, just as the old village-centric social system has been subsumed into a multiplicity of extra-local networks that tie Isan villagers ever more closely into the larger world. Barring a catastrophic meltdown of the global system, it can reasonably be expected that Northeast Thailand will become more deeply integrated into national, regional, and global economic and social systems.

Accepted: January 19, 2017

Acknowledgments

The writing of this paper was supported by a grant (BRG5680008) from the Thailand Research Fund (TRF) Basic Research Program, but the views expressed in it are not necessarily shared by TRF. Although I am solely responsible for the views expressed in this paper, my thinking about Isan has been strongly influenced by intellectual exchanges over the years with many colleagues at Khon Kaen University, including the late Terd Charoenwatana, Aran Patanothai, Suchint Simaraks, Patma Vitayakon Rambo, Nongluck Saphanchaimat, Viriya Limpinuntana, and Banyong Toomsan. I am particularly indebted to Fukui Hayao and Terry and Somluckrat Grandstaff, who have so generously shared their vast knowledge of the Northeast with me in our many conversations over the years. I want to thank George W. Lovelace and John S. Parsons for their helpful comments on earlier drafts of this paper.

References

- Analaya Nansaioir; Aran Patanothai; Rambo, A. Terry; and Suchint Simaraks. 2011. Climbing the Energy Ladder or Diversifying Energy Sources? The Continuing Importance of Household Use of Biomass Energy in Urbanizing Communities in Northeast Thailand. *Biomass and Bioenergy* 35(10): 4180–4188.
- Anan Polthanee. 2001. Rice-Based Farming Systems in the Korat Basin of Northeast Thailand. In *Natural Resource Management Issues in the Korat Basin of Northeast Thailand: An Overview*, edited by S. P. Kam, C. T. Hoanh, G. Trebuil, and B. Hardy, pp. 19–26. Proceedings of the Planning Workshop on Ecoregional Approaches to Natural Resources Management in Korat Basin, Northeast Thailand.
- Ando, Masuo. 2003. Potential and Constraints for Intensive Land Use with Pond Irrigation in Northeast Thailand. Paper presented at international symposium on “Alternate Approaches to Enhancing Small-scale Livelihoods and Natural Resources Management in Marginal Areas,” October 29–30, United Nations University, Tokyo.
- Angeles, Leonora C.; and Sirijit Sunanta. 2009. Demanding Daughter Duty. *Critical Asian Studies* 41(4): 549–574.
- Anupong Pansuwan; Goonnapa Fucharoen; Supan Fucharoen; Boonmee Himakhun; and Samrit Dangwiboon. 2011. Anemia, Iron Deficiency and Thalassemia among Adolescents in Northeast Thailand: Results from Two Independent Surveys. *Acta Haematologica* 125: 186–192.
- Aree Jampaklay; Patama Vapattanawong; Kanchana Tangchonlatip; Richter, Kerry; Nipat Ponpai; and Charita Hayeeteh. 2012. *Children Living Apart from Parents due to Internal Migration (CLAIM)*. Nakhon Pathom: Institute for Population and Social Research, Mahidol University (Publication/ Institute for Population and Social Research, Mahidol University; No. 397).
- Atthasat Wiseansart อรรถศาสตร์ วิศิษฐศาสตร์; and Suchint Simaraks สุจินต์ สิมารักษ์. 2014a. Middle Size Tractors and 2-Wheel Tractors Utilization and Services Break-even Point of the Farmers in Kok-si Sub-district. *Khon Kaen Agricultural Journal* 42(1): 55–64.
- . 2014b (2557). *Ponlawat khong kan chai kruang chak kon nai kan phuuk khao: Koranee sueksa nai tambon Khoksi amphoe Muang changwat Khonkaen* พลวัตของการใช้เครื่องจักรกลในการปลูกข้าว: กรณีศึกษาใน ตำบลโลกสี่ อำเภอเมือง จังหวัดขอนแก่น [Dynamics of rice farming mechanization: Case study in Kok-Si Subdistrict, Mueang District, Khon Kaen Province]. *Nakhon Phanom University Journal* (September): 258–264.
- . 2013 (2556). *Padjai thii mii phon tor kan tadsinjai chai borikan rot thraektor khanaadklang*

- khong kasetrakon nai tambon Nam-om amphor Kra-nuan changwat Khonkaen* ปัจจัยที่ผลต่อการตัดสินใจใช้บริการรถแทรกเตอร์ขนาดกลาง ของเกษตรกรในตำบลน้ำอ้อม อำเภอกระนวน จังหวัดขอนแก่น [Factors influencing decision making on middle-size tractor utilization of farmers in Nam-aom Subdistrict, Kranuan District, Khon Kaen Province]. *KKU Research Journal* 13(4): 14–26.
- Banfield, Edward G. 1958. *The Moral Basis of a Backward Society*. New York: Free Press.
- Barnaud, G.; Trebuil, G.; Dufumier, M.; and N. Suphanchaimart. 2006. Rural Poverty and Diversification of Farming Systems in Upper Northeast Thailand. *Moussons* 9(10): 157–187.
- Bryant, John; and Gray, Rossarin. 2005. *Rural Population Ageing and Farm Structure in Thailand*. Bangkok: FAO.
- Caldwell, John S.; Chumsri Pomlet; Mayura Prabpan; and Somsak Sukchan. 2007. Assessment of Spatial Variability of *Tambons* Based on Farming Systems Characteristics for Scaling-up of Diversification in Khon Kaen Province, Thailand. *Japan Agricultural Research Quarterly* 41(4): 333–340.
- Cameron, Michael; and Lim, Steven. 2007. Household Resources, Household Composition, and Child Nutritional Outcomes. Paper presented at the Australian Agricultural and Resource Economics Society Conference, Queenstown, February 13–16. ageconsearch.umn.edu/bitstream/10371/1/cp07ca02.pdf, accessed June 1, 2017.
- Chairat Charoensin-o-larn. 2013. Redrawing Thai Political Space: The Red Shirt Movement. In *Cleavage, Connection and Conflict in Rural, Urban and Contemporary Asia*, edited by T. Bunnell, D. Parthasarathy, and E.P. Thompson, pp. 201–222. Dordrecht, Heidelberg, New York, and London: Springer.
- Chatterjee, S.; Riewpaiboon, A.; Piyauthakit, P.; Riewpaiboon, W.; Boupajit, K.; Panpuwong, N.; and Archavanuntagul, V. 2011. Cost of Diabetes and Its Complications in Thailand: A Complete Picture of Economic Burden. *Health and Social Care in the Community* 19(3): 289–298.
- Chichaibelu, Bezawit Beyene; and Waibel, Hermann. 2012. Financial Vulnerability and Indebtedness of Poor Households in Thailand and Vietnam. Paper presented at Tropentag 2012, Göttingen, September 19–21.
- Craig, Ian. 1988. Agronomic, Economic and Socially Sustainable Strategies for Soil Fertility Management in Northeast Thailand. In *Sustainable Rural Development in Asia*, edited by T. Charoenwatana and A. T. Rambo, pp. 153–166. Khon Kaen: KKU-USAID Farming Systems Research Project and the Southeast Asian Universities Agroecosystem Network.
- Dayley, Robert. 2011. Thailand's Agrarian Myth and Its Proponents. *Journal of Asian and African Studies* 46(4): 342–360.
- Foster, George M. 1965. Peasant Society and the Image of Limited Good. *American Anthropologist* 67: 293–315.
- Frensham, Mike. 2014. Thai Women & Western Men Seeking Romance. London FCOL News. January 31. <http://fcolnews.com/thai-women-western-men-seeking-romance/1210>, accessed February 20, 2015.
- Fujioka, Rika; and Sopon Thanphet. 2009. *Decent Work for Older Persons in Thailand*. Bangkok: ILO Regional Office for Asia and the Pacific.
- Fukui, Hayao. 1996a. Expansion of Arable Land and Its Cessation: The Case of Northeast Thailand. *Southeast Asian Studies* 33(4): 675–702.
- . 1996b. Transformation of Agriculture in Northeast Thailand: Preface. *Southeast Asian Studies* 33(4): 521–522.
- . 1993. *Food and Population in a Northeast Thai Village*. Monographs of the Center for Southeast Asian Studies, Kyoto University. Honolulu: University of Hawaii Press.
- Fukui, Hayao; and Chumphon Naewchampa. 1998. Weir Irrigation in the Upper Mun River Basin: A Field Trip in March 1998 with Some Preliminary Discussions. *Southeast Asian Studies* 36(3): 427–434.

- Fukui, Hayao; Chumphon Naewchampa; and Hoshikawa, Keisuke. 2000. Evolution of Rain-Fed Rice Cultivation in Northeast Thailand: Increased Production with Decreased Stability. *Global Environmental Research* 3(2): 145–154.
- Funahashi, Kazuo. 1996. Farming by the Older Generation: The Exodus of Young Labor in Yasothon Province, Thailand. *Southeast Asian Studies* 33(4): 625–639.
- Garip, Filiz; and Curran, Sara. 2009. Increasing Migration, Diverging Communities: Changing Character of Migrant Streams in Rural Thailand. *Population Research and Policy Review* 29: 659–685.
- Gibson, R. S.; Winichagoon, P.; Pongcharoen, T.; Thurlow, R.; Krittaphol, W.; Bailey, K.; and Anderson, V. 2007. The Feasibility of Using Zinc Fertilizers to Improve the Adequacy of Zinc Intakes of Children Consuming Rice-Based Diets in NE Thailand. Paper presented at the Zinc Crops 2007 International Conference, Istanbul, May 24–26.
- Grandstaff, Terry B. 1988. Environment and Economic Diversity in Northeast Thailand. In *Sustainable Rural Development in Asia*, edited by T. Charoenwatana and A.T. Rambo, pp. 11–22. Khon Kaen: KKU-USAID Farming Systems Research Project and the Southeast Asian Universities Agroecosystem Network.
- Grandstaff, Terry B.; Somluckrat Grandstaff; Viriya Limpinuntana; and Nongluck Supanchaimat. 2008. Rainfed Revolution in Northeast Thailand. *Southeast Asian Studies* 46(3): 289–376.
- Hohfeld, Lena; and Waibel, Hermann. 2013. Investments of Rural Households in Northeast Thailand and the Future of Small Scale Farming. *Quarterly Journal of International Agriculture* 52(3): 217–236.
- Huguet, Jerrold W.; and Aphichat Chamratrithirong. 2011. *Thailand Migration Report 2011*. Bangkok: International Organization for Migration.
- Ishine, Masayuki; Sakagami, Teiji; Sakamoto, Ryouta; Wada, Taizo; Khampitak Kovit; Fushida, Mutsuko; Kawakita, Toshiko; Okumiya, Kiyohito; Kita, Toru; and Matsubayashi, Kozo. 2006. Comprehensive Geriatric Assessment for Community-Dwelling Elderly in Asia Compared with Those in Japan: VII. Khon Khen [sic] in Thailand. *Geriatrics & Gerontology International* 6: 40–48.
- Jirawat Moolasart; and Siriporn Chirawatkul. 2012. Drinking Culture in the Thai-Isaan Context of Northeast Thailand. *Southeast Asian Journal of Tropical Medicine and Public Health* 43(3): 795–807.
- Jit Phumisak จิตร ภูมิศักดิ์. 2007 (2550). *Chom na sakdina Thai โฉมหน้าศักดินาไทย* [The face of Thai feudalism]. Bangkok: Samnksphan Sripanyaa.
- Keyes, Charles F. 2014. *Finding Their Voice: Northeastern Villagers and the Thai State*. Chiang Mai: Silkworm Books.
- . 2011. From Peasant to Cosmopolitan Villagers: Refiguring the “Rural” in Northeastern Thailand. Paper presented at the joint conference of the Association for Asian Studies and the International Conference of Asian Scholars, Honolulu, April.
- . 1975. Kin Groups in a Thai-Lao Community. In *Change and Persistence in Thai Society: Essays in Honor of Lauriston Sharp*, edited by G. William Skinner and A. Thomas Kirsch. Ithaca: Cornell University Press.
- Kirsch, A. Thomas. 1966. Development and Mobility among the Phu Thai of Northeast Thailand. *Asian Survey* 6(7) (July): 370–378.
- KKU-FORD Cropping System Project. 1982. *An Agroecosystem Analysis of Northeast Thailand*. Khon Kaen: Faculty of Agriculture, Khon Kaen University.
- Lux, Thomas E. 1962. The Thai-Lao Family System and Domestic Cycle of Northeastern Thailand. *Journal of the National Research Council of Thailand, Part II, Social Science*: 1–17.
- Mills, Mary Beth. 2012. Thai Mobilities and Cultural Citizenship. *Critical Asian Studies* 44(1): 85–112.
- Ministry of Transport Information and Communication Technology Centre. 2013. *Transtat 2013*. Bangkok. www.news.mot.go.th/motc/portal/graph/transtat13.pdf, accessed October 12, 2015.
- Mondal, Shimul; Theerachai Haitook; and Suchint Simaraks. 2014. Farmers’ Knowledge, Attitude and

- Practice toward Organic Vegetables Cultivation in Northeast Thailand. *Kasetsart Journal (Social Science)* 35: 158–166.
- Moreno-Black, Geraldine; and Prapimporn Somnasang. 2000. In Times of Plenty and Times of Scarcity: Nondomesticated Food in Northeastern Thailand. *Journal of Ecology of Food and Nutrition* 38(6): 563–586.
- Nagata, Yoshikatsu. 1996. Mapping the Village Database: The Spread of Economic Growth to Rural Areas of Northeast Thailand. *Southeast Asian Studies* 33(4): 138–156.
- Naruemon Thabchumpon; and McCargo, Duncan. 2011. Urbanized Villagers in the 2010 Thai Redshirt Protests. *Asian Survey* 51(6): 993–1018.
- Nguyen Dang Hoc; Pijika Timsuksai; and Rambo, A. Terry. 2016. Cost-Benefit Analysis of Vegetable Production in Thai-Vietnamese Homegardens in Northeast Thailand. *Khon Kaen Agricultural Journal* 44(3): 527–536.
- Nongluk Suphanchaimat; and Wilaiwat Grisnaputi. 1987. Traditional Knowledge of Rainfall Prediction of the Khon Kaen Rice Farmers in Thailand. In *Impact of Development on Human Activity Systems in Southeast Asia: Selected Papers from the First SUAN/EAPI Regional Research Symposium*, edited by O. Soemarwoto and A. T. Rambo, pp.178–182. Bandung: Padjadjaran University Institute of Ecology and the Southeast Asian Universities Agroecosystem Network.
- Office of the Narcotics Control Board, Ministry of Justice. 2003. Thailand Narcotics Annual Report, 2003. Bangkok: Ministry of Justice, Government of Thailand.
- Orathai Piayura. 2012. Thai Women, Cross-cultural Marriage and Sexuality. *International Journal of Social Science and Humanity* 2(2): 156–158.
- Osaki, Keiko. 2003. Migrant Remittances in Thailand: Economic Necessity or Social Norm? *Journal of Population Research* 20(2): 203–222.
- Pandey, Sushil; Nongluck Suphanchaimat; and Velasco, Ma. Lourdes. 2012. The Patterns of Spread and Economics of a Labor-Saving Innovation in Rice Production: The Case of Direct Seeding in Northeast Thailand. *Quarterly Journal of International Agriculture* 51(4): 333–356.
- Patarapong Kroeksakul. 2010. Padjai thi tham hai kasetrakon yaai ook ma asai yuu nok muu baan pheua tham gan kaset ปัจจัยที่ทำให้เกษตรกรย้ายออกมาอาศัยนอกหมู่บ้านเพื่อทำการเกษตร [Factors causing villagers moving to live on their own farmland for agricultural activities]. Doctoral dissertation, Systems Agriculture, Khon Kaen University.
- Patarapong Kroeksakul; Aree Naipinit; and Thongphon Promsaka Na Sakolnakorn. 2011. The Economic and Social Effects of Farmers Growing Para Rubber in Northeast Thailand: A Case Study of Sapsomboon Village, Dun Sad Sub-District, Kranoun District, Khon Kaen Province. *Journal of Business Case Studies* 7(1): 113–117.
- Patcharaporn Phumchantuk. 2014. The Impact of Urbanization on Agricultural Land Use in Khon Kaen City. Paper presented at the TRF Seminar Series in Basic Research: The Agrarian Transformation in Northeast Thailand, Faculty of Agriculture, Khon Kaen University, September 15.
- Patcharaporn Phumchantuk; and Orawan Kanchat. 2011. Factors Influencing the Sustainability of the Chinese Radish Production System at Baan Nong-Ngong, Tambon Baanhad, Amphoe Baanhad, Changwat Khon Kaen. Unpublished case study report. Program on System Approaches in Agriculture, Faculty of Agriculture, Khon Kaen University.
- Patma Vityakon. 1993. The Traditional Trees-in-Paddy-Fields Agroecosystem of Northeast Thailand: Its Potential for Agroforestry Development. *Regional Development Dialogue* 14(1): 125–148.
- Pattanee Winichagoon. 2013. Thailand Nutrition in Transition: Situation and Challenges of Maternal and Child Nutrition. *Asia Pacific Journal of Clinical Nutrition* 22(1): 6–15.
- Pendleton, Robert L. 1943. Land Use in Northeastern Thailand. *Geographical Review* 33(1): 15–41.
- Penning de Vries, F.; and Sawaeng Ruaysoongnern. 2010. Multiple Sources of Water for Multiple Purposes

- in Northeast Thailand. Colombo: International Water Management Institute (IWMI Working Paper 137). doi:10.3910/2010.208.
- Phouvang Sengmeuang; Upa Kukongviriyapan; Orapin Pasurivong; Chulee Jones; and Wilaiwan Khrisanapant. 2010. Prevalence of Obesity among Thai Schoolchildren: A Survey in Khon Kaen, Northeast Thailand. *Asian Biomedicine* 4(6): 965–970.
- Pijika Timsuksai. 2014. A Comparative Ecological Study of Homegardens of Different Ethnic Groups in the Sakon Nakhon Basin, Northeast Thailand, and Some Related Groups in Vietnam. Doctoral dissertation, Systems Agriculture, Khon Kaen University.
- Pijika Timsuksai; and Rambo, A. Terry. 2015. A Comparative Study of the Ecological Structures of Homegardens of Different Ethnic Groups in Northeast Thailand. *Khon Kaen Agricultural Journal* 43, Supplement 1: 62–68.
- Piotrowski, Martin. 2009. Migrant Remittances and Skipped Generation Households: Investigating the Exchange Motive Using Evidence from Nang Rong, Thailand. *Asian and Pacific Migration Journal* 18(2): 163–196.
- Piotrowski, Martin; Ghimire, Dirgha; and Rindfuss, Ronald R. 2013. Farming Systems and Rural Out-migration in Nang Rong, Thailand and Chitwan Valley, Nepal. *Rural Sociology* 78(1): 75–108.
- Pipop Jirapinyo; Narumoon Densupsoontorn; Supinya Kongtragoolpitak; Renu Wong-arn; and Nuchnoi Thamonsiri. 2005. Increasing Risks of Becoming Obese after 6 Years in Primary School: Comparing the Relative Risks among Some Schools in Bangkok, Saraburi and Sakolnakorn. *Journal of the Medical Association of Thailand* 88(6): 829–832.
- Prapatsorn Wongsalee. 2014. Factors Influencing the Decline of Traditional Cross-Stream Earthen Weir (*Thammop*) Irrigation in Northeast Thailand. Master's thesis, Systems Agriculture, Khon Kaen University (in Thai with English abstract).
- Prapatsorn Wongsalee; and Wareerat Pannarat. 2010. Tomato Seed Production by Contract Farming in Lad Na Piang Village, Savatee Sub-district, Muang District, Khon Kaen Province. Unpublished case study report. Program on System Approaches in Agriculture, Faculty of Agriculture, Khon Kaen University.
- Prapimporn Somnasang; Moreno, Geraldine; and Kusuma Chusil. 1998. Indigenous Knowledge of Wild Food Hunting and Gathering in North-east Thailand. *Food and Nutrition Bulletin* 19(4): 359–364.
- Prapimporn Somnasang; Pagarat Rathakette; and Sumalee Rathanapanya. 1988. The Role of Natural Foods in Northeast Thailand. In *Rapid Rural Appraisal in Northeast Thailand: Case Studies*, edited by G. W. Lovelace, S. Subhadhira, and S. Simaraks, pp. 78–103. Khon Kaen: Khon Kaen University Farming Systems Research Project.
- Rambo, A. Terry. 2012. The Agrarian Transformation in Northeast Thailand. Invited presentation at the 8th National Agricultural Systems Conference, Nakhon Phanom University, Nakhon Phanom, September 5.
- . 2009. Are the Farmers Always Right? Rethinking Assumptions Guiding Agricultural and Environmental Research in Southeast Asia. *AsiaPacific Issues*, No. 88. Honolulu: East-West Center.
- . 2008. The Interface between Social Science and Agricultural Science. Invited lecture presented at a joint session of the sections on agricultural science and social science and humanities at the 9th RGJ-Ph.D. Congress, Pattaya, April 4–6.
- . 2006. Book Review of *Le Riz: Enjeux ecologiques et économiques* by Guy Trebil and Mahabub Hossain. *Southeast Asian Studies* 44(2): 267–270.
- . 1991. *The Human Ecology of Rural Resource Management in Northeast Thailand*. Khon Kaen: Farming Systems Research Project, Khon Kaen University.
- Ranawana D. V.; Henry, C. J.; Lightowler H. J.; and Wang, D. 2009. Glycemic Index of Some Commercially Available Rice and Rice Products in Great Britain. *International Journal of Food Science and*

- Nutrition* 60, Supplement 4: 99–110.
- Rattana Bunmattaya. 2005. Summary Report on “Farang’s Wife: Relationship between Thai Women and Foreign Men.” Bangkok: Princess Maha Chakri Sirindhorn Anthropology Center. ftp://smc.ssk.ac.th/intranet/sac.or.th/Subdetail/seminar/sum_of_seminar/seminar53_E.html, accessed June 2, 2017.
- Rigg, Jonathan. 1985. The Role of Environment in Limiting the Adoption of New Rice Technology in Northeastern Thailand. *Transactions of the Institute of British Geographers* N.S. 10: 481–494.
- Rigg, Jonathan; and Ritchie, Mark. 2002. Production, Consumption and Imagination in Rural Thailand. *Journal of Rural Studies* 18: 359–371.
- Rigg, Jonathan; and Salamanca, Albert. 2011. Connecting Lives, Living, and Location: Mobility and Spatial Signatures in Northeast Thailand, 1982–2009. *Critical Asian Studies* 43(4): 551–575.
- . 2009. Managing Risk and Vulnerability in Asia: A (Re)Study from Thailand, 1982–83 and 2008. *Asia Pacific Viewpoint* 50(3): 255–270.
- Rindfuss, Ronald R.; Piotrowski, Martin; Entwisle, Barbara; Edmeades, Jeffrey; and Faust, Katherine. 2012. Migrant Remittances and the Web of Family Obligations: Ongoing Support among Spatially Extended Kin in Northeast Thailand, 1984–94. *Population Studies* 66(1): 87–104.
- Sawaeng Ruaysoongnern; and Nongluck Suphanchaimart. 2002. Land Use Patterns and Agricultural Production Systems with Emphasis on Changes Driven by Economic Forces and Market Integration. In *Natural Resource Management Issues in the Korat Basin of Northeast Thailand*, edited by S. P. Kam *et al.*, pp. 67–77. Manila: IRRI.
- Shirai, Yuko. 2006. The Urban Agricultural System of Khon Kaen. In Proceedings of the SAFE DANIDA Regional Workshop on Sustainable Agriculture held in Pathumthani Province, July 28, pp. 18–23.
- Shirai, Yuko; and Rambo, A. Terry. 2014. Urban Demand for Wild Foods and Rural Biodiversity in Northeast Thailand: A Survey of Edible Wild and Semi-Domesticated Species Sold in the Khon Kaen Municipal Market. *Ethnobotany Research and Applications* 12: 113–129.
- . 2008. The Economic Value of Edible Wild and Semi-Domesticated Species Sold in an Urban Market in Khon Kaen Municipality in Northeast Thailand. *Khon Kaen Agriculture Journal* 36: 69–78.
- Sirijit Sunanta. 2013. Gendered Nation and Classed Modernity: The Perceptions of Mia Farang (Foreigners’ Wives) in Thai Society. In *Cleavage, Connection and Conflict in Rural, Urban and Contemporary Asia*, edited by T. Bunnell, D. Parthasarathy, and E. P. Thompson, pp. 183–199. Dordrecht, Heidelberg, New York, and London: Springer.
- . 2009. Global Wife, Local Daughter: Gender, Family, and Nation in Transnational Marriages in Northeast Thailand. Doctoral dissertation, University of British Columbia.
- Sirikul Kuleab. 2004. Drinking and Driving Don’t Mix. *WHO Lifeline* (March–April): 14–15.
- Soimart Rungmanee. 2014. The Dynamic Pathways of Agrarian Transformation in the Northeastern Thai–Lao Borderlands. *Australian Geographer* 45(3): 341–354. doi: 10.1080/00049182.2014.930002.
- Somjit Daenseekaew; Somsak Srisontisuk; Earmporn Thongkrajar; and Pirasak Sriruecha. 2005. Mobilizing Communities to Combat Illicit Drug Use in Northeast Thailand. *Thai Journal of Nursing Research* 9(3): 141–154.
- Sorat Praweenwongwuthi; Suwit Laohasiriwong; and Rambo, A. Terry. 2010. Impacts of Rice Combine Harvesters on Economic and Social [sic] of Farmers in a Village of the Tung Kula Ronghai Region. *Research Journal of Agriculture and Biological Sciences* 6(6): 778–784.
- . 2009. Impacts of Adoption of Rice Combine Harvesters on the Economic and Social Conditions of Farmers in Tung Kula Ronghai. *Khon Kaen Agriculture Journal* 37: 349–356.
- Sukaesinee Subhadira; Suchint Simaraks; Manthana Samart; and Viriya Limpinuntana. 1988. Changes in Systems Properties of Ban Hin Lad, a Village Agroecosystem in Northeast Thailand. In *Agro-*

- ecosystem Research for Rural Development*, edited by K. Rerkasem and A. T. Rambo, pp. 79–102. Selected papers presented at the Third SUAN Regional Symposium on Agroecosystem Research, Chiang Mai University Multiple Cropping Centre and SUAN.
- Sukanlaya Choenkwan; Arunee Promkhambut; Fukui, Hayao; and Rambo, A. Terry. 2016. Does Agro-tourism Benefit Mountain Farmers? A Case Study in Phu Ruea District, Northeast Thailand. *Mountain Research and Development* 36(2): 162–172.
- Sukanlaya Choenkwan; Fox, Jefferson M.; and Rambo, A. Terry. 2014. Agriculture in the Mountains of Northeastern Thailand: Current Situation and Prospects for Development. *Mountain Research and Development* 34(2): 95–106.
- Teeraphong Somkhaoyai. 2001. Elderly Living Arrangement in the Rural Villages of Nangrong District, Thailand. Master's thesis, Mahidol University Institute for Population and Social Research, Bangkok.
- Terd Charoenwatana; Aran Patanothai; and Anan Polthanee. 1976a. Growing Field Crops after Rice in Upper Paddy Field. In *Annual Report for 1976 of the KKU-FORD Cropping System Project*, pp. 64–49. Khon Kaen: Faculty of Agriculture, Khon Kaen University.
- . 1976b. Double Cropping of Field Crops with Rice in Lowland Paddy Field. In *Annual Report for 1976 of the KKU-FORD Cropping System Project*, pp. 69–71. Khon Kaen: Faculty of Agriculture, Khon Kaen University.
- Terd Chareonwatana; Viriya Limpinuntana; Aran Patanothai; Attachai Jintawet; K. Bontob; V. Sornwat; V. Pimsawadi; and T. Ubonkerd. 1978a. Growing Field Crops before Rice in Upper Paddy Fields. In *Annual Report for 1978 of the KKU-FORD Cropping System Project*, pp. 74–85. Khon Kaen: Faculty of Agriculture, Khon Kaen University.
- . 1978b. Planting of Field Crops before Rice in Lowland Paddy Fields. In *Annual Report for 1978 of the KKU-FORD Cropping System Project*, pp. 94–96. Khon Kaen: Faculty of Agriculture, Khon Kaen University.
- Thanakorn Lattirasuvan; Tanaka, Sota; Nakamoto, Kenji; Hattori, Daisuke; and Sakurai, Katsutoshi. 2010. Ecological Characteristics of Home Gardens in Northern Thailand. *Tropics* 18(4): 171–184.
- Thongkamkaew, U.; Mahasan, J.; Chasiriyong, S.; and Sopheap, U. 2010. Farmer Management on Corn Production: A Case Study at Baan Nongboa, Nongboa Sub-district, Baan Phang District, Khon Kaen Province. Unpublished case study report, Program on System Approaches in Agriculture, Faculty of Agriculture, Khon Kaen University.
- Thurlow, R. A.; Winichagoon, P.; Pongcharoen, T.; Gowachirapant, S.; Boonpraderm, A.; Manger, M. S.; Bailey, K. B.; Wasantwisut, E.; and Gibson, R. S. 2006. Risk of Zinc, Iodine and Other Micronutrient Deficiencies among School Children in North East Thailand. *European Journal of Clinical Nutrition* 60: 623–632.
- Thurlow, Rosanne A.; Pattanee Winichagoon; Green, Timothy; Wasantwisut Emorn; Tippawan Pongcharoen; Bailey, Karl B.; and Gibson, S. Rosalind. 2005. Only a Small Proportion of Anemia in Northeast Thai Schoolchildren Is Associated with Iron Deficiency. *American Journal of Clinical Nutrition* 82: 380–387.
- Thuttai Keeratipongpaiboon. 2012. Population Ageing: Changes in Household Composition and Economic Behaviour in Thailand. Doctoral dissertation, SOAS, University of London.
- Trébuil, Guy; and Hossain, Mahabub. 2004. *Le riz: Enjeux écologiques et économiques* [Rice: Ecological and economic challenges]. Paris: Belin.
- Viriya Limpinuntana. 2001. Physical Factors Related to Agricultural Potential and Limitations in Northeast Thailand. In *Natural Resource Management Issues in the Korat Basin of Northeast Thailand: An Overview. Limited Proceedings No. 7*, edited by S. P. Kam, C. T. Hoanh, G. Trebuil, and B. Hardy, pp. 3–17. Los Banos: International Rice Research Institute.
- Waewdaw Nambutra; Chung, Bonhee T.; Attasart Wisearsart; and Rambo, A. Terry. 2013. The Jujube

- Production System in Ban Meng Sub-district, Khon Kaen Province, Northeast Thailand. *Khon Kaen Agriculture Journal* 41(2): 199–208.
- Walker, Anthony. 2012. *Thailand's Political Peasants: Power in the Modern Rural Economy*. Madison: University of Wisconsin Press.
- Wanichcha Narongchai; and Dusadee Ayuwat. 2013. Intergenerational Transfers of Economic Capital in Northeast Rural Households, Thailand. In *Proceedings of International Conference on Information and Social Science (ISS2013)*, pp. 926–936. Nagoya: Graduate School of Information Science, Nagoya University, International Academy Institute.
- Watanabe, Moriaki; Patma Vityakon; and Rambo, A. Terry. 2014. Can't See the Forest for the Rice: Factors Influencing Spatial Variations in the Density of Trees in Paddy Fields in Northeast Thailand. *Environmental Management* 53(2): 343–356.
- Wattanavadee Sriwattanapongse; Sukon Prasitwattanaseree; Surin Khanabsakdi; and Supreeya Wongtranngan. 2013. Mortality Rate Model due to Transportation Accidents in Thailand. *Silpakorn University Science & Technology Journal* 7(1): 9–18.
- Wichian Koetsuk วิเชียร เกิดสุข. 2008 (2551). *Rai ngan wichai ruang rahad wit nam phumpanya thongthin lam nam Pathao amphoe Muang changwat Chayaphum* รายงานวิจัยเรื่องระหัดวิดน้ำภูมิปัญญาท้องถิ่น ลำน้ำปะทิว อำเภอเมือง จังหวัดชัยภูมิ [Research report on local knowledge of waterwheels, Pa Thao Stream, Mueang District, Chaiyaphum Province]. Khon Kaen: Khon Kaen University Research and Development Institute.
- Wikipedia contributors. 2015. Thai American. *Wikipedia, The Free Encyclopedia*. http://en.wikipedia.org/w/index.php?title=Thai_American&oldid=639933263, accessed January 6, 2015.
- Wilaiwat Krisanyaphud วิไลรัตน์ กฤษณะภูติ et al. 1986 (2529). *Rai ngan vichai ruang "klum" seuksa chapho karanee baan Hin Laad tambon Bankho amphoe Muang changwat Khonkaen* รายงานการวิจัยเรื่อง "กลุ่ม" ศึกษาเฉพาะกรณีบ้านหินลาด ตำบลบ้านคือ อำเภอเมือง จังหวัดขอนแก่น [Research on "groups": A case study of Hin Lad village, Ban Khor Subdistrict, Mueang District, Khon Kaen Province]. Khon Kaen: Khon Kaen University Farming Systems Research Project.
- Wongba, N.; Thaewongiew, K.; Phathee, K.; Laithavewat, L.; Duangsong, R.; Promthet, S.; and Tangsawad, S. 2011. Liver Fluke Prevention and Control in the Northeast of Thailand through Action Research. *Asian Pacific Journal of Cancer Prevention* 12: 1367–1370.
- Woravimol Krittaphol; Bailey, Karl B.; Tippawan Pongcharoen; Pattanee Winichagoon; and Gibson, R. S. 2006. Low Zinc, Iron, and Calcium Intakes of Northeast Thai School Children Consuming Glutinous Rice-Based Diets Are Not Exacerbated by High Phytate. *International Journal of Food Science and Nutrition* 57(7–8): 520–528.