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WHAT IS AUTONOMOUS ADAPTION? RESOURCE SCARCITY AND SMALLHOLDER AGENCY IN THAILAND

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ABSTRACT

The concept of autonomous adaptation is widely used to describe spontaneous acts of reducing risks posed by resource scarcity and, increasingly, climate change. Critics, however, have claimed it is unproven, or simplifies the agency by which smallholders respond to risk. This paper presents empirical research in eight Karen villages in Thailand to identify how resource scarcity is linked to adaptive responses including livelihood diversification. The paper argues that autonomous adaptation is driven by how environmental change and scarcity present livelihood risks, rather than physical risks alone. Adaptation planning therefore should acknowledge different experiences of risk, and socio-economic barriers to adaptation.

KEYWORDS: adaptation, livelihoods, resource scarcity, households, Asia, Thailand

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1. INTRODUCTION

'Adaptation' is now widely discussed within development planning as a means of reducing risks posed by resource scarcity, environmental change, and increasingly as the result of climate change (Adger *et al.*, 2007; Adger *et al.*, 2003; Dessai *et al.*, 2007). A key aspect of this discussion is how far planned forms of adaptation can be supplemented by 'autonomous adaptation,' which are actions undertaken by affected people without planned interventions (IPCC, 2007; Smit *et al.*, 2001, p877).

Autonomous adaptation, however, is controversial. Debates within economics have argued that autonomous adaptation, by definition, is inefficient, and might reduce attention to necessary planned interventions (Chambwera & Stage, 2010, p. 9; Eisenack, 2009; Stern, 2007). Analysts have therefore called for more evidence to identify how autonomous adaptation might occur, and connect with planned adaptation (IPCC, 2012, p. 399).

Researchers on environmental adaptation within developing countries, on the other hand, have argued that there is a long history of how poorer societies have responded to resource scarcity and population growth (Boserup, 1965; Head, 2010; Netting, 1993; Tiffen *et al.*, 1994). These debates have also indicated that the term 'autonomous' might be a misnomer because adaptation can reflect pre-existing social practices; the capacity for local adaptation can be planned; and because adaptation might not occur spontaneously in the face of new

environmental changes, but according to how changes impact on local needs and livelihood strategies (Ayers, 2011; Batterbury, 2011; Ribot, 2010; Rigg, 2006).

Accordingly, various analysts have argued that adaptation among vulnerable populations 'should be done with a deeper awareness of the social, economic, cultural, and political factors that frame their actions, incentives, opportunities, and limitations for action' (Christoplos *et al.*, 2009, p. 3), and that 'adaptation always has, and arguably should, refer to more than just responses to climate change' (Sabates-Wheeler *et al.*, 2008, p. 53). Indeed, one of the earliest papers describing a new 'adaptation science' proposed that development planning should assume not predefine the nature of risk and adaptive responses arising from environmental changes or scarcity, but instead ask 'what' is being adapted to (i.e. the experience of risk); 'who' adapts (what are the socio-economic barriers to adaptation); and 'how' (how do these actions, adopted by certain groups, reduce vulnerability to environmental change) (Smit *et al.*, 1999).

This paper contributes to debates about autonomous adaptation in three ways. First, it reviews the tensions within academic and policy debates about the meaning and ways of achieving autonomous adaptation. This discussion especially refers to the differences between interpretations of adaptation under climate change policy, and from pre-existing debates about adaptation to resource scarcity and challenged livelihoods in developing countries.

Second, it presents an empirical study of autonomous adaptation within an ethnic group in Thailand that has been associated with environmental adaptations in the past (the Karen). This study analyzes the differential experience of resource scarcity in eight villages in order

to assess how and for whom adaptive responses are adopted, including livelihood diversification.

Third, the paper then draws lessons from this discussion and study for wider debates about the role of autonomous adaptation in development planning. The paper's key argument is that autonomous adaptation can form an important complement to planned adaptation, but that autonomous adaptation, by definition, is driven by how environmental scarcity and change impact on the availability of livelihoods. Consequently, planned forms of adaptation need to acknowledge the relationships between environmental change and livelihood risk, and how socio-economic barriers limit both livelihoods and adaptive responses. Building adaptation policy on the nature of physical risks alone might fail to acknowledge these linkages to livelihoods, and could even restrict smallholder agency to undertake autonomous adaptation if the actions of planned adaptation inhibit livelihood diversification.

2. RESOURCE SCARCITY AND AUTONOMOUS ADAPTATION

Adaptation has been defined as adjustments to behavior or economic structures that reduce vulnerability of society in the face of scarcity or threatening environmental change (Adger *et al.*, 2007). The term has been used in debates about resource scarcity for some years (Batterbury and Forsyth, 1999; Netting, 1993; Tiffen *et al*, 1994), but is increasingly used in the context of anthropogenic climate change. The Intergovernmental Panel on Climate Change (IPCC, 2007: sections 5.5.1-2), distinguishes between 'planned adaptation,' which results from deliberate interventions, and 'autonomous (or spontaneous) adaptation,' which is 'adaptation that does not constitute a conscious response to climatic stimuli but is triggered by ecological changes in natural systems and by market or welfare changes in human systems.'[1] According to this definition, autonomous adaptation might include

practices such as altering agricultural inputs, introducing water-managing technologies, altering cropping cycles, or diversifying economic activities. They can be based on pre-existing 'risk-management or production-enhancement activities,' but which 'have substantial potential to offset negative climate change impacts and take advantage of positive ones.'

The concept of autonomous adaptation, however, has raised various questions, sometimes because different disciplines understand adaptation in varying ways. Behavioral economists, for example, have interpreted adaptation as the alterations in individual behavior necessary to combat climate change. These economists have argued that adaptation will not happen autonomously (or without government action) because of the lack of market incentives to make private actors change behavior since climate protection remains a public good (where there are no rights to exclude actors who do not undertake changes) (Stern, 2007; Vernon, 2008; World Bank, 2010). Accordingly, some economists have argued that 'little adaptation is observed empirically' and that 'autonomous adaptation is inefficient' (Eisenack, 2009, p. 1). This interpretation of 'adaptation' as changing behavior was also used by Ostrom (2009, p. 8), who wrote 'coping with climate change' implies 'the potential for building a more effective way of reducing greenhouse gas emissions at multiple levels.'

For many other analysts of climate change policy, however, these discussions of adaptation above actually refer to climate change mitigation—or the reduction of greenhouse gas concentrations—rather than the more common definition of adaptation as actions that reduce the impacts of enhanced greenhouse gas concentrations (Adger *et al.*, 2003; Hardee & Mutunga, 2009). But there is disagreement about how to understand these impacts. Burton (2009, p.89), for example, argues that most discussion of adaptation under the United Nations Framework Convention on Climate Change (UNFCCC) has utilized the so-

called 'pollutionist' approach (Burton, 2009 p.89), which seeks to reduce direct harmful impacts of additional greenhouse gas concentrations such as floods and droughts. In contrast, the 'development' approach to adaptation seeks 'to incorporate adaptation to climate in development planning and implementation' including actions such as livelihood diversification, enhancing social safety nets, or integrating adaptation to climate change with disaster risk reduction. This approach draws on older research within cultural and political ecology on adaptation to resource scarcity, which have often distinguished between adaptive processes (the long-term changes faced by societies such as sedentarization or population growth), and adaptive strategies (the shorter-term means by which risk is reduced, such as terracing land or diversifying livelihoods).

Accordingly, various analysts have argued that adaptive responses at the local level are not simply driven by environmental changes *per se*, but in how these changes present hazards for vulnerable people's livelihoods and assets. And similarly, livelihood diversification in itself can be another form of adaptation if it means that people are less reliant on resources that are threatened by environmental changes (Sabates-Wheeler *et al.*, 2008). Research on Sustainable Livelihood Approaches (SLAs), for example, has highlighted ways of diversifying sources of income in order to reduce the risks posed by specific environmental threats such as drought or declining soil fertility through actions such as livelihood diversification, agricultural intensification, and strategies of migration for income (although, as discussed below, the benefits of these strategies can be distributed unequally; and they are not a panacea against all environmental risks).

But these points also pose questions for the concept of autonomous adaptation. If adaptation is seen as a wider process of seeking livelihoods in the face of resource scarcity, adaptation is not just an 'autonomous' response to new physical risks such as floods, but can

be based on pre-existing cultural and economic practices. In turn, the capacity to diversify livelihoods might also be built through processes of planned adaptation. But if planned adaptation only focuses on direct physical risks such as flooding, without assessing how these risks impact upon livelihoods, then development interventions might overlook local causes of social vulnerability to environmental changes, or options for making environmental changes less threatening to livelihoods.. Consequently, there is a need for debates about autonomous adaptation within climate change policy to consider lessons from older debates about adaptation to resource scarcity in order to understand how environmental changes might impact upon livelihoods, and how affected people respond.

3. AUTONOMOUS ADAPTATION AND SMALLHOLDER AGENCY

The term autonomous adaptation implies that individuals or communities can undertake adaptation to environmental risks and scarcity independently of outside intervention. But the agency of smallholders to undertake autonomous adaptation is uncertain and not always apparent. It is commonly claimed that the poorest people are most vulnerable to climate change (Smit *et al.*, 2001), or that they can adapt to global climate change 'with great difficulty and much pain' (Kates, 2000, p. 15). But some analysts have argued there is an apparent paradox that relatively poor groups such as pastoralists in the West African Sahel or smallholder agriculturalists in Bangladesh have demonstrated great resilience to environmental change (Adger *et al.*, 2003, p. 181). One report stated, 'the poor adapt in diverse ways that are usually unnoticed, uncoordinated, and unaided by national governments, development agencies, or international agencies. This autonomous adaptation is often overlooked in international and national efforts to manage the impacts of climate change,' (Christoplos *et al.*, 2009, p. 3).

But how does autonomous adaptation occur? Early analysis of so-called adaptation science identified three questions: 'what' is the risk; 'who' adapts; and 'how'? (Smit *et al.*, 1999). As discussed above, defining 'what' risk is crucial, as autonomous adaptation is not always to environmental or climate change alone, but to what these changes mean for livelihoods. Projected physical changes to climate or in the quality of resources such as forests and soil do not have an equal and predictable impact on all land users. The agency of smallholders for autonomous adaptations is more likely to reflect a combination of how environmental changes impact upon livelihood options, and how far socio-economic variables enhance or limit those options. Some analysts have argued that autonomy, therefore, is an example of a Senian capabilities approach that seeks to identify useful outcomes in terms of what vulnerable people value themselves, rather than defining progress in terms of predefined ideas about scarcity (Alkire & Ibrahim, 2007).

In addition, other debates about smallholder agency have also highlighted the need to identify how individuals and communities can control decisions autonomously of the state and wider market forces (Schneider & Niederle, 2010). In the context of autonomous adaptation to environmental risk, smallholder agency can include a combination of acts relating to the physical impacts of change (such as new property rights to share land and water, or strengthening infrastructure); or acts of livelihood diversification that reduce the impact of risks upon household income.

But transitions to new livelihoods need to be assessed critically. First, livelihood diversification by itself, however, is not a panacea against all projected environmental risks and scarcity (Adger *et al.*, 2009). Moreover, diversification can also be driven by 'distressed' rather than 'progressive' reasons if environmental scarcity reduces livelihoods options and smallholders are forced to develop alternatives (as discussed in northern Laos by Bouahom

et al, 2004). Second, livelihood diversification can bring risks of its own. One possibility is replacing so-called 'type 1' poverty (based on remoteness and limited smallholder agriculture) with 'type 2' poverty (low wages and exploitation in markets) (Rigg, 2006). But also, different communities, households or individuals might benefit unequally from adaptive strategies and new livelihoods, which can sometimes reflect pre-existing wealth and gender relations (Carr, 2008; Nielsen & Reenberg, 2010; Sabates-Wheeler *et al.*, 2008, p.56). Moreover, diversification is usually not a simple transition from one livelihood to another, but a growing reliance on 'pluriactivity' (or diverse activities at different times and places by individuals or household members), which can leave some households or household members dependent on traditional livelihoods (Ellis, 2000b). Livelihood diversification is also constrained by state economic policies and social structures, including the possible intentions and effects of planned adaptation activities (Bryceson, 1999, 2002).

This paper now presents a study of autonomous adaptation within an ethnic group in Thailand that has a long reputation for engaging in community-based natural resource management and adaptations to resource scarcity. The study asks 'what' environmental or livelihood risk is being adapted to; 'who adapts;' and 'how'? The objective is to identify the driving forces for autonomous adaptation, and to draw lessons for its use in contemporary environmental policy.

4. RESOURCE SCARCITY AND ADAPTATION IN NORTHERN THAILAND

Northern Thailand is an appropriate region to study the relationship of resource scarcity and autonomous adaptation because it has been the source of analysis of environmental degradation and the agency of smallholders for years (Kunstadter *et al*, 1978). The region

itself is a mountainous (typically of altitude 500—2000 meters above sea level) with a large upland population of smallholder agriculturalists. Various analysts have predicted ecological collapse in this region because of the alleged impacts of traditional shifting cultivation and population growth on steep slopes and dwindling forests (Ives *et al*, 1980). But there has also been widespread research about the diverse ways that local ethnic minorities manage shifting cultivation and environmental scarcity (Cooper, 1984; Judd, 1964; Forsyth & Walker, 2008; Fox *et al*, 2000). Writing about food shortages in the region in 1972-74, two anthropologists from the USA predicted noted: 'the swidden fields, used with minimum, if any, fallow periods, gave reduced harvests. Some villages lay amid a sterility that approached the stone-dead streets of cities, with uplanders like vagrants, unable to sustain themselves' (Hanks & Hanks, 2001, p. 238). Yet, despite various environmental changes and problems, this region-wide collapse did not occur. The explanation seems to include a variety of planned and autonomous adaptation.

Concerning planned adaptations, the Thai government has intervened to create zones of protected land: since Thailand's National Park Act of 1964, more than 100 national parks have been declared, with over 20 located in the nine northern provinces where they take up over 15 percent of the total land area, and the proportion of the four northernmost provinces now classified under Class 1 watershed protection (the area with the most stringent land use controls) has been estimated at 30 percent (Forsyth & Walker, 2008, p. 26), where the Thai government has stated 'immediate reforestation programs must be undertaken on the abundant shifting [cultivation] area' (Royal Forest Department, 2004).[2] In addition, government and international aid agencies have introduced technologies such as grass strips and nitrogen-fixing crops in order to maintain upland soil fertility (Van Keer *et al.*, 1998), and introduced export crops such as cabbages and strawberries to diversify

livelihoods and replace traditional opium production (Renard, 2001). Non-agricultural and waged income has also been encouraged.

Autonomous adaptation has apparently lain in the willingness of farmers to adopt new livelihoods such as more diverse crops, and employment on farms, or in cities and occasionally via temporary waged work in Taiwan and Japan (Walker, 2009). Irrigated rice terraces are more common on valley bottoms, which enhance food production and the potential for export crops. These transitions also occur against cultural traditions of different ethnic groups. Much anthropological research on environmental management in Thailand divided upland smallholders into so-called 'pioneer' shifting cultivators (such as the Hmong and Mien)—who used land exhaustively for 10-20 years before relocating villages—and 'rotational' cultivators (such as the Karen)—who used land rotationally around semi-permanent villages (Delang, 2003; Grandstaff, 1980). The Karen in particular were noted for their *rai mun wian* swidden system using seven-year fallow periods, and for practices such as protecting tree stumps and forest land to enhance forest regrowth (Chaleo Kanjunt, 2007; Payong Srithong, 2007; Pinkaew Laungaramsri, 2001; Rambo, 2007; Schmidt-Vogt, 1998). Indeed Karen agriculture has been claimed to be an appropriate response to climate change (Northern Development Foundation, 2011).

But at the same time, some analysts have also argued that these explanations of adaptation are based in part on a misplaced explanation of environmental risk in the first place. Research in Thailand since the 1990s has indicated that upland agriculture might not be as environmentally degrading as thought in the 1970s (similar to debates about Nepal: Metz, 1991; Blaikie & Muldavin, 2004). For example, studies have shown that upland farmers undertake various means of reducing risk from soil erosion by reducing cultivation on steep slopes; matching cropping cycles with periods of more or less rainfall in order to minimize

the exposure of bare soil; and using organic and inorganic fertilizers for food production.[3] Moreover, the relationship of upland and lowland degradation has been rethought by research showing that erosion and runoff are also caused by geological gullying (also occurring under forests) and roads,[4] and that the impacts of upland agriculture on lowland water shortages is overstated, in part because not all agricultural slopes lead directly to watercourses (Forsyth, 1996; Turkelboom, 1999, p. 169).[5] Consequently, 'adaptation' has apparently succeeded in northern Thailand partly because analysts overstated the nature and causes of environmental risks in the past.

Similarly, the agency of smallholders in autonomous adaptation has also been questioned. Much discussion about adaptation has suggested that ethnic minorities in villages perceive and respond to environmental risks and scarcities proactively (Pinkaew Laungaramsri, 2001; Northern Development Foundation, 2011). Later research, however, suggests that the debate about smallholder agency overlooks how village populations are increasingly transient or 'owe little allegiance to the land and who have become dependent on work ultimately shaped by forces that lie beyond the area' (Rigg *et al.*, 2010, p. 148).[6] Another concern is that upland agriculture is now substantially commercialized and therefore it is difficult to identify 'Karen' agriculture from mainstream agriculture (Suppakorn Chinvanno, 2011). Some critics have also proposed that government and non-governmental organizations have deliberately portrayed the Karen as an especially conservationist ethnic group in order to influence political debates about community forestry (Hayami, 1993; Walker, 2001). One proposed bill for community forestry in the early 2000s proposed that 'communities' are a 'group of people that live together as a society in the same area and pass down their culture together,' and display a 'culture of coexistence that favors forest protection' (Anonymous, no date). Statements like these, however, define environmental risks as forest loss, and adaptive responses as forest-friendly communities, at a time when

more and more farmers are seeking livelihoods outside of traditional agriculture, and old notions of community are decreasing.

Consequently, there is widespread evidence that upland smallholders exercise considerable agency in adapting to resource scarcity in northern Thailand. But historic debates have tended to represent this process in terms of traditional communities perceiving and responding to changes in landscape that are considered problematic by outsiders, rather than acknowledging the importance of resource scarcity to livelihood strategies and the dynamic nature of household decisionmaking. Instead, there is a need to rethink—in the words of Smit *et al. (*1999)—'what' is being adapted to, by 'whom,' in order to understand 'how' autonomous adaptation occurs, both in Thailand and in general. The following study was therefore undertaken to understand what drives autonomous adaptation among an ethnic group experiencing resource scarcity, and with a reputation for adaptive responses in the past.

5. THE STUDY

The study was based among Karen[7] villages in Mae Hong Son province of northern Thailand. As noted above, the Karen in Thailand are popularly associated with environmental adaptation. Mae Hong Son is the most northwestern province in Thailand, characterized by steep slopes and valleys on the Burmese border that 'frequently endures water related disasters such as flash floods, urban inundations, and slope failures that have caused severe impacts on people's live property and the natural environment' (Anond Snidvongs, 2009). It is one of the poorest provinces in Thailand.

Eight villages were selected in order to investigate experiences of environmental risk and autonomous adaptation. The sample of eight was considered sufficient to reach some level of generalization in the time allowed, and to provide sufficient variety for statistical analysis. Villages were selected in order to represent relatively 'large' and 'small' settlements that were either near or far from market towns. A local NGO's[8] database was used to classify all Karen villages on that side according to size and distance from local market towns (district capitals, or *amphoe*). Villages were then selected randomly from categories above or below the median number of households per village (41), and the median distance to the district capital (35 kilometers) (see Table 1). Villages were only selected from the eastern side of province in order to minimize the influence of the Burmese border on matters such as refugees and military presence.

The resulting eight villages varied between 30 and 80 households; distances of between 5-45 kilometers from markets; and altitudes between 376-1236 meters above sea level. The oldest village (Hua Mae Surin) was claimed by the village head to be 360 years old; the newest (Doi Lam and Huay Rin) were established in the 1940s. One village (Mae La Pa Wai) was relocated to its current site in 1990 following shortage of water, but was established more than a century ago (see Table 2). Villages were not anonymized on the advice of other researchers and village representatives because research did not focus on illegal activities. Individual informants were anonymized.

[TABLE 1 (CLASSIFICATION OF VILLAGES SELECTED) HERE]

[TABLE 2 (CHARACTERISTICS OF VILLAGES) HERE]

The study used qualitative interviews and observation, and quantitative household surveys to identify the experience of resource scarcity and adaptive responses. Forty-nine key

informants (comprising village elders and heads, both men and women) were consulted through semi-structured interviews, and 138 household surveys based on questionnaires were completed (aiming for 40 percent of households in each village), resulting in information about 734 people, including 589 living in villages and 145 away from villages. One of the authors located herself in the villages for three months, assisted by a male Karen interpreter[9] and by shorter fieldwork by the other author. Work was conducted mainly through the interpreter in Karen language, but also in fluent Thai language by both authors.

Villagers were asked to talk about environmental problems and resource scarcity in open-ended terms in order to emphasize local experiences of risk and scarcity. This information was supplemented by quantified measurements of resource scarcity at the household level.[10] These measurements included the availability of irrigated terraced land (*na*), versus non-irrigated sloping land (*rai*) (which is usually less productive, and prone to erosion); as well as the length of fallow for *rai*. *Na* is usually more productive for food crops than *rai* because it is irrigated and flat, whereas *rai* is usually less productive because it is prone to erosion, and requires labor- and time-intensive weeding after some years' use. An index of access to *na* at the village level was calculated by dividing the total kilograms of rice produced on *rai* by the total kilograms of rice produced on *na*. Villages with high levels of *na* therefore had higher scores under this index. This index was useful because it gave a fast indication of the availability of irrigated, productive land, compared with weed-infested, erodible land on hillsides. (Kilograms were chosen because this was the unit most easily discussed by villagers rather than spatial area). Some smaller villagers also described a third category of *suan*, or garden, which referred to small vegetable plots next to houses.

Information about possible adaptive responses was collected by asking villagers about how they responded to scarcity of agricultural land, or other forms of environmental risk such as

floods or landslides. This information also included practices of livelihood diversification or sources of income outside of the village. Market opportunities and livelihood diversification were measured through the existence of non-agricultural income and the numbers of household members who worked employed in various activities. (In turn, these factors were expected to be related to access to *na* because *na* is more productive than *rai*, which in turn might influence availability of labor to apply to non-agricultural activities).

Socio-economic differences between households and individuals were assessed using a system of asset ranking (Clarke, 2006). Households were given scores depending on the material the home was made from; if the household had an electricity supply; how food was cooked (electricity or gas or locally-collected fuelwood); and ownership of high value items such as motorcycles and pick-up trucks. Three categories were created to indicate 'high,' 'medium,' and 'low' asset ranks.[11] This information was also cross-referenced to age and gender or respondents; village size and distance from markets; and any deliberate choices to make institutions governing land use or market access.

The indices and other quantitative information were tested for statistical associations using chi-square tests (because much information relied on categories rather than absolute numbers).[12] This style of analysis was supplemented by more qualitative statements from villagers and other research about longer-term trends. The following analysis combines information about villages in aggregate, and then a more detailed breakdown of which kinds of households might experience risk and adaptive responses.

Information is presented firstly concerning the nature of scarcity and environmental risk; and then the motivations, or agency, for autonomous adaptation.

(a) Resource scarcity and environmental risk: adaptation to what?

The research revealed that the most persistently discussed aspect of resource scarcity and ecological change in all villages was the shortage of productive, irrigated *na* terraces, and the declining agricultural productivity on non-irrigated, sloping *rai* land. These factors were discussed in all villages, and informants explained that they presented livelihood risks to smallholders because they placed limitations on the ability to produce food and tradable crops; and increased the labor needed to prepare *rai* land for cultivation.

The most common explanations from villagers for these shortages were: the growth of populations (and the practice of dividing land between sons); the decline of soil fertility, especially on the sloping *rai* land; and government restrictions on land use, such as planting pine and teak plantations on land that previously had been used for agriculture on both slopes and valley bottoms.[13] These factors were described to be taking place in all villages surveyed.

Various villagers also referred to high-magnitude storms and floods, which—so far—had apparently occurred in Mae Hong Son province every two or so years, and had caused small numbers of fatalities in 2009 and 2011. These events were considered problematic, however, because they damaged irrigated terraces (and their crops), and deposited sediment and boulders on agricultural land, which required time, labor, and tractors to remove.

The experience of environmental risks and resource scarcity, therefore, were almost exclusively defined in terms of what these processes meant for agricultural productivity and

the availability of livelihoods. But resource scarcity was not simply defined by the physical size of available agricultural land, but by the combination of labor, time, and likely profit from cultivating different land. The ratio between *na* (terraces) and *rai* (non-irrigated land) was an important indicator of land scarcity because villagers with more *na* could achieve more reliable agricultural production during both dry and wet seasons (typically, growing rice in the wet summer, and garlic in the dry winter). In the relatively remote villagers (especially Hua Mae Surin and Mae Go Pii), villagers described that there seemed little opportunity to build rice terraces because land was restricted, in part because of forest plantations that were claimed by the government to protect the watershed and soil quality.

But villagers or households with high levels of dependency on *rai* land were more vulnerable to declining soil fertility, and the need for more labor to prepare this land for cultivation because of weed infestations. Farmers who could use both *na* and *rai* could afford to cultivate short-term cash crops on *rai* without investing time or labor into preparing land. Those with only *rai* had to invest more time into preparing land because this was their only agricultural land—unless they could adopt non-agricultural incomes. Together, these factors contributed to the relative absence of the most traditional forms of Karen agriculture in the eight villages. An average of 10 percent of households questioned still practiced *rai mun wian* (traditional rotational cultivation) (ranging from zero to some 25 percent). As predicted, *rai mun wian* was more prevalent in villages with low access to *na.*

Table 3 shows some statistical differences between the eight villages. The index of access to *na* (the relative supply of *na* compared to *rai* per village) varied between 100 and 21 percent (where 100 percent indicates that the amount of *na* equaled the amount of *rai).* Access to *na* was greater on average in valleys closer to market towns (especially Pattana Puku and Huay Rin). This finding was unsurprising as the proximity of markets was often an incentive

to convert land to terraces in order to sell crops; and because market towns tended to be in relative lowlands where land is easier to convert into terraces.

But there were also some unexpected findings. The most remote village (Huay Mak Lang, at an average altitude of 1000m) relied on *na* for nearly 90 percent of rice production—apparently because of government restrictions on using non-irrigated land for agriculture.

Furthermore, villages with limited access to *na* tended not to use *rai* land for growing rice to eat, but instead to cultivate traded commercial crops (such as garlic and cabbage). These people instead bought rice at markets. Consequently, villagers with relatively few irrigated terraces were more dependent on selling crops at markets than those with more irrigated terraces. In Huay Mak Lang, farmers said that the shortage of land encouraged them to grow soybeans because growing rice on *rai* was unattractive and unprofitable because *rai* required so much weeding.

But statistics also revealed that 75 percent of the poorest individuals (those in the lowest asset rank) were smallholders with no individual or household access to *na*. These farmers tended to make a living from various activities comprising agriculture, trade of non-agriculture goods, working on other farms, or through some remittances from family members outside the village. Unsurprisingly, wealthier households in all villages had more access to *na*, and consequently used this land to grow rice.

Accordingly, the experience of environmental problems in the villages was not related simply to the existence of high-magnitude physical hazards such as storms and floods, but to scarcity of productive resources, or degradation of land in ways that required more investment of labor. These challenges were experienced more strongly when villages were

distant from local markets, or where government policies reforested land, or restricted agricultural expansion. The experience of vulnerability as relating to resource scarcity was therefore diverse and influenced by various socio-economic and political factors, rather than physical risks alone. The next section discusses more about the different ways these risks were distributed between households in order to answer 'how' adaptive practices occur, and by 'whom.'

(b) Autonomous adaptation: Who adapts and how?

This section summarizes evidence for the agency for autonomous adaptation—or how (and which) smallholders respond to resource scarcity.

Discussions with villagers showed that the most common forms of autonomous adaptation to scarcity included changes in property rights on land; technological changes such as increasing the use of irrigated terraces and fertilizers; diversifying crops grown and traded; and diversifying livelihoods beyond agriculture. These steps reflect research on livelihood diversification and agricultural intensification elsewhere (Ellis, 1998, 2000a).

(i) Property rights and agricultural intensification

Changing property rights on productive land was an apparently growing form of autonomous adaptation. There was a marked difference in the nature of individual property rights and claims on land between villages more or less dependent on *na*. When land was short in supply, villagers would be readier to claim land was their own (including fallow land), rather than available to the entire village. (This transition has also been noted among

the Iu Mien ethnic group in Chiang Rai province during the 1970s; Forsyth, 1996). Very little land in general was rented out to, or borrowed from, other users. For example, nearly 80 percent of *na* and nearly 90 percent of *rai* used for rice production in all villages was used exclusively by owners (although nearly 30 percent of *na* in all villages was shared between siblings). Villagers explained that this situation differed from some five or more years before when there was more flexible access to *rai* land in particular.

In addition, individuals in villages with lower access to *na* were particularly vocal in stating claims to land *in fallow* (i.e. not currently cultivated) and claimed larger absolute areas of fallow. This result is not surprising, as upland soil fertility depends on maintaining fallow periods. But this result also apparently contradicts the earlier belief that greater competition for land would decrease fallow periods, and instead suggests that social institutions have now developed to protect the length of time for fallow periods. On average, farmers using *rai mun wian* still claimed to have fallow of up to six years. But in villages with higher access to *na*, fallow periods were decreasing at a faster rate. In these locations, more than one individual said they did not use fallow because 'anyone can use anyplace.' Consequently, fallow has broken down where there are alternative forms of agriculture and livelihoods; but farmers still protect fallow when there are no alternatives.

Building terraced land and using agrochemicals were also physical forms of adaptation. Where farmers could build terraced land, they did so. At the time of research, however, most available land had already been converted, and potential additional land usually involved conflict with the Royal Forest Department concerning ownership, with the expectation that land might be reforested. Agrochemicals were widely used as a way to increase production of commercial crops such as soybean and garlic on *na* and *suan* (especially in the larger villagers of Pattana Puku and Huay Rin). Most farmers interviewed

considered chemicals as a usual part of agricultural practice, and used their own funds to purchase them. But, local government officials also provided small amounts of pesticide free-of-charge to farmers who cultivated *rai* (thus blurring the lines between autonomous and government-sponsored adaptation). Fertilizer (as opposed to pesticide and herbicide) was also used in Huay Mak Long because its remoteness and high altitude made specific problems of productivity. Unsurprisingly, the richest households used most agrochemicals in remoter villages, but in villages close to markets all households used chemicals in equal amounts.

(ii) Livelihood diversification

Adaptive responses also included working away from villages, and adopting new activities. Most people 'away' from home were aged between 10-30. Younger teenagers generally attended school, whereas adults undertook diverse activities, including one accountant in a city-based company; workers in a spectacles factory; cleaners, and janitors. Nearly 30 percent of people reported to be 'away' worked in Bangkok; followed by 13 percent in the regional capital of Chiang Mai. (All of these statistics are based on a sample of 40 percent of households in the eight villages). There were also non-agricultural activities for people living in villages such as teachers and drivers. Tourism (such as selling souvenirs or accommodating trekkers) is not a major factor in this part of northern Thailand. Table 3 shows that the proportion of people semi-permanently employed in non-agricultural positions outside of villages ranged from 15 to 28 percent. (The research did not interview Karen people who had already migrated to locations outside the villages, and hence these statistics do not classify migrants into categories such as how much time away, or longer-term intentions) Rigg *et al*, 2010).

Agricultural labor on neighboring farms was also a market opportunity. Most villagers questioned worked on other Karen farms, usually unpaid as part of a reciprocal arrangement for sharing labor. Some also worked on neighboring farms owned or operated by Thai or Hmong farmers (a trend discussed by Cohen, 1984). Only four villages supplied labor to Thai farms, and two to Hmong farms, with proportions ranging from 20–60 percent of adults (Table 3). Unsurprisingly, more people from poorer households worked on Hmong or Thai farms than those from richer households, and were paid daily.

[TABLE 3 (DETAILS OF VILLAGES) HERE]

The research gave some indication for which people (or which kinds of villages) were able to engage in livelihood diversification. The highest proportions of people working 'away' from villages occurred where there was a relatively high access to *na* (irrigated terraces). Equally, the highest concentrations of workers on their own farms were in villages with low access to *na*. These results suggest three possible explanations. First, working on *rai* (non-terraced agricultural land) might demand more labor, and hence restrict other livelihood options. Second, *rai* offers less opportunity for making money that is required to enter many non-agricultural occupations. The third possible explanation is that villages further away from markets also tended to have larger household sizes (an average of 5.7 compared to 4.9), and hence statistically a smaller proportion of these villages might be working 'away.'

There was no simple relationship between the amounts of *na* and *rai* and distance to markets within the eight villages sampled. But it was clear that in some especially remote villages (such as Hua Mae Surin) steep slopes and topography made it hard to convert much land into irrigated terraces: these characteristics also made these villages susceptible to land-use restrictions and reforestation by the government.

There were no obvious trends between household size and access to *na*, and average wealth. But results suggested that villages with smaller levels of *na* had significantly more young people away aged 10-20 than villages with high access to *na*. Some of this trend was explained by schooling—where it is common for young Karen to stay in dormitories to attend district schools—although this is more common for children younger than 10. Instead, discussions with household representatives suggested that young people are likely to migrate to earn money when there is a low access to *na* because working on *rai* is either unattractive or financially unrewarding. This trend also suggests that the farmers who continue *mun rai wian* on non-irrigated slopes are older Karen rather than younger Karen who instead choose to work elsewhere.

The implication of these findings is that there are different types of experience that lead to different adaptive responses. People in villages with relatively high levels of productive land (especially *na*) were more likely to migrate for work, or engage in livelihood activities outside of farm work. Moreover, these people were more likely to be younger. Meanwhile, people in villages with relatively small access to irrigated terraces tended to remain in these villages and worked to produce traded agriculture crops.

There was no evidence linking age of migrants to wealth (asset ranks), but unsurprisingly, households from the richest asset group had the widest diversity of occupations, and a greater proportion of off-farm employment. The proportion of each asset rank 'working 'away' was 13 percent for the first (poorest), 19 percent for the middle rank, and 30 percent for the richest group. It was challenging to gain accurate information about remittances because many villagers were reticent to share information. Research suggested, however, that some 30 percent of people away from villages sent back remittances.

Some gendered trends in livelihood options were also apparent. Female-headed households were more prominent in poorer households (40 percent of the poorest asset rank, 20 percent of the middle rank, and zero of the richest rank). Furthermore, in villages close to markets, or where villages have a small amount of *na*, more young men studied away from the village than women.[14] When women worked on Thai farms, they came from villages with low access to *na*. Consequently, it would seem that men are more likely to benefit from opportunities outside villages.

Consequently, market opportunities and barriers therefore also underlie adaptation strategies. Evidence suggests that access to irrigated, *na* terraces is more important in influencing the agency for livelihood diversification or agricultural strategies than simply proximity to markets.[15] Livelihood diversification and mobility is less likely among smaller villages with reduced access to *na,* as well as older people and women in general.

The agency for autonomous adaptation, therefore, is therefore complicated by diverse experiences of risk, plus various influences on how far different individuals, households, or villages might be able to undertake adaptive responses to these risks. Research scarcity and environmental change are mainly interpreted according to how far they affect different types of productive land. Different access to these types of land influence which parties can change livelihood decisions in order to diversify off-farm activities, or protect the productivity of existing land. Evidence so far from these eight villages suggests that livelihood diversification and new institutions to impose property rights on fallow land are indeed forms of autonomous adaptation that can reduce the risks posed by resource scarcity. But the experience of risks, and the access to responses are unequal. The most likely vulnerable social groups increasingly seem to be older people (especially women), in

villages with little access to irrigated productive land, where (so far) it is relatively difficult to gain access to alternative off-farm livelihoods. In general, older people (who were often defined as people whose children had farming practices and families of their own) lived with their children. But in some cases, these younger generations were away from the village, and therefore the older people lived alone (although these number comprised less than 20 percent of older people interviewed).

6. CONCLUSIONS: SMALLHOLDER AGENCY AND AUTONOMOUS ADAPTATION

This paper has sought to contribute to debates about the concept of autonomous adaptation by looking critically at questions of agency within smallholders' reactions to resource scarcity, and by presenting evidence from a study in Thailand. What are the lessons for understanding autonomous adaptation in development planning?

First, it is clear that different analytical approaches to autonomous adaptation within academic and policy literatures are sometimes semantically different, and use varying implicit models of risk. The arguments of some economists that 'little adaptation is observed empirically' and that 'autonomous adaptation is inefficient' (Eisenack, 2009, p. 1) clearly understand 'adaptation' as conformance with regulations or specific policies, rather than responses that reduce local experiences of risk or scarcity. Yet, 'autonomous' adaptation, by definition, is a response that is driven by local experiences, and there are various studies from developing countries that provide evidence of behavior changes and strategies to reduce risks without official interventions (Adger *et al.*, 2003; Batterbury & Forsyth, 1999; Netting, 1993; Tiffen *et al*, 1994). Accordingly, there needs to be more attention to older research on adaptation to environmental scarcity in developing countries as a guide to

current concerns about adaptation to climate change (Ayers, 2011; Christoplos, *et al*, 2009; Head, 2010).

Second, and related to this initial point, autonomous adaptations should be defined as responses that maintain livelihoods in the face of environmental change and scarcity, rather than actions that control physical hazards without connection to livelihoods. Much planned adaptation under the UNFCCC typically aims to protect against physical risks such as storms and floods. Yet, autonomous responses to these events will reflect how these events impact on the lives and livelihoods of affected people rather than the events in themselves. In turn, these responses also reflect pre-existing structures of social vulnerability and methods of managing resource scarcity (Ribot, 2010; Marino & Ribot, 2012).

There is accordingly a danger that planned adaptation might focus too much on physical changes alone—as though these are the risks themselves—rather than on what these changes mean for vulnerable people. As Christoplos *et al* (2009, p.3, p.33) noted, 'autonomous adaptation is often overlooked in international and national efforts… existing calls for "climate proofing" development should …ensure that development efforts "do no harm" with respect to processes of autonomous adaptation.' The statement of the IPCC (2007) that autonomous adaptation is 'adaptation that does not constitute a conscious response to climatic stimuli but is triggered by ecological changes in natural systems and by market or welfare changes in human systems' apparently gives much emphasis to the role of environmental change in 'triggering' responses. Evidence suggests that autonomous adaptation is driven by more than ecological changes alone.

Consequently, thirdly, a key part of understanding autonomous adaptation is to understand the agency and socio-economic barriers for vulnerable people to participate in responses

that reduce risk or scarcity. Development planning can aim to decrease barriers to autonomous adaptation such as by providing opportunities for livelihood diversification, or for local means of reducing the impacts of declining assets. Yet, it is also important to acknowledge that the experience of risks will vary between people with different levels of livelihood diversification and adaptive practices. Thus, again, planned forms of adaptation need to address various risks, rather than assume that projections of physical environmental changes are an adequate and universal summary of how different people are affected.

These conclusions are demonstrated in the analysis presented from Thailand. The Karen ethnic group has been associated with adaptive practices for years, and live in a zone where declining soil fertility, land shortage, and floods present various hazards. Yet, government plans for environmental management have reflected assumptions about reforestation and community life that local villagers claim increases land shortage, and which generally do not correspond with new trends in how villagers seek livelihoods. Anthropogenic climate change is projected to bring more frequent and extreme floods in this region, and indeed floods have already caused fatalities (Anond Snidvongs, 2009; Yusuf & Francisco, 2010). Although these floods are hazardous, the driving forces for autonomous adaptations to date have been scarcity of livelihood options through quality agricultural land or off-farm livelihood diversification, rather than concern at the floods themselves. Karen villagers have shown various forms of autonomous adaptation, including livelihood diversification and developing new institutions to protect soil fertility. A key controlling factor here seems to be access to irrigated agricultural land and markets.

Planned forms of adaptation need to acknowledge these diverse experiences of risk and work to increase access to adaptation—as well as address risks from high-magnitude events such as floods. Asking the three questions of 'adaptation to what,' 'who adapts,' and 'how'

(Smit *et al*, 1999) provides a means of understanding what role autonomous adaptation can play, and the agency of smallholders in achieving it.

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[1] http://www.ipcc.ch/publications_and_data/ar4/wg2/en/annexessglossary-a-d.html

[2] Much reforestation and resettlement was also linked to controlling security at a time when Thailand was concerned about Communist or other insurgencies.

[3] Some critics have claimed fertilizers might damage soil productivity, although the evidence for these claims is contested (Forsyth & Walker, 2008).

[4] McKinnon (1986: 22) estimated that 30 percent of erosion (and sedimentation) results from road construction. Turkelboom (1999: 169) noted that only 30 percent of agricultural slopes in a research site in Chiang Rai province led directly to watercourses, and consequently could not feed lowland sedimentation.

[5] Turkelboom estimates that some 30 percent of agricultural slopes are disconnected from watercourses in his research site in northern Chiang Rai province. It is also worth noting that the significant floods experienced in Thailand in 2011 were generally blamed on excessive rainfall and poor coordination between reservoirs, rather than on deforestation, indicating a possible further breaking up of old explanations of environmental risk (Walker, 2011).

[6] Rigg *et al*'s (2010) study was near Ayuthaya, central Thailand, a more ethnically uniform and commercialized location than most of northern Thailand.

[7] The Karen (or Kariang) in Thailand are often divided into four subgroups of the Skaw (the most numerous, also known as White Karen, which are called Sgaw in Myanmar); Pwo; Pa-o (or Black Karen); and Kayah (Karenni or Red Karen). This study focused on Skaw alone. (Source: Tribal Research Institute of Chiang Mai; Hinton, 1983).

[8] The Karen Hilltribes Trust http://www.karenhilltribes.org.uk/

[9] The interpreter was recommended by the NGO and was known to all villages. The presence of a female researcher and male interpreter hopefully enhanced access to both genders in the village. Advice was sought from local advisers about respecting gender codes and cultural norms within Karen villages.

[10] Intra-household allocations were not assessed quantitatively in this study.

[11] As noted in other development research, wealth can also come and go unexpectedly. In this study, we found that death of a relative, divorce, or deterioration of health can cause sudden poverty. Sudden wealth could also arise from acquiring new land (typically through marriage), children moving away (decreasing costs at home, and raising possibilities for remittances); and good harvests. Another factor is village-level debt, often inspired by government schemes to help village development (but also linked to populist electoral strategies).

[12] A positive chi-square test was observed when distributions between categories were significantly different (to 90 percent confidence) from what might be expected in the absence of any trends.

[13] At the time of research there was no evidence of government plantations being placed on irrigated rice terraces, although some non-terraced valley bottoms had been reforested; presumably because terraced land was usually built on land with recognized certificates of ownership.

[14] Possibly this finding was caused by the unusual situation in Mae Yuam Luang, a village near to a market and with a low access to na, in which no women were 'away.'

[15] Indeed, the village with most people in the poorest asset rank, Mae Yuam Luang has just 57 percent access to na, but is located very close to Pattana Puku with the richest households, with 100 percent access.

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Distance from Market	Population Size: Small (<41 households)	Population Size: Large (>41 households)
High (>35 km)	Village names: **Hua Mae Surin** **Mae La Pa Wai**	**Huay Mak Lang** **Mae Go Pii**
Low (<35 km)	**Mae Yuam Luang** **Doi Liam**	**Pattana Puku** **Huay Rin**

TABLE 1. CLASSIFICATION OF VILLAGES SELECTED

(Source: the authors)

TABLE 2. KAREN VILLAGES STUDIED IN MAE HONG SON PROVINCE

(Location and elevation confirmed by hand-held GPS; estimated households for 2010)

Village	Tambol (subdistrict)	Amphoe (district)	Changwat (region)	Latitude and Longitude	Elevation /m asl	Total households
Pattana Puku	Mae Oo Kor	Khun Yuam	Mae Hong Son	N 18°50.582 E 097°59.867	659	50
Mae Yuam Luang	Mae Oo Kor	Khun Yuam	Mae Hong Son	N 18°49.638 E 098°02.331	859	20
Hua Mae Surin	Mae Oo Kor	Khun Yuam	Mae Hong Son	N 18°55.237 E 098°05.105	1236	30
Huay Mak Lang	Huay Pong	Mae Hong Son	Mae Hong Son	N 18°58.042 E 098°06.158	1203	50
Mae La Pa Wai	Kun Mae La	Mae La Noi	Mae Hong Son	N 18°34.886 E 098°09.001	752	30
Mae Go Pii	Mae Yuam Noi	Khun Yuam	Mae Hong Son	N 18°42.242 E 098°04.009	770	80
Doi Liam	Mae Hor	Mae Sariang	Mae Hong Son	N 18°06.945 E 098°06.309	883	40
Huay Rin	Mae Noi	Mae La Noi	Mae Hong Son	N 18°22.599 E 097°58.251	376	55

TABLE 3: SAMPLE INDICATORS OF LIVELIHOOD DIVERSITY

Source: fieldwork 2008, 2010, based on survey of 40 percent of households per village

	Hua Mae Surin	Mae La Pa Wai	Huay Mak Lang	Mae Go Pii	Mae Yuam Luang	Doi Liam	Pattana Puku	Huay Rin
Village type	Small, remote	Small, remote	Large, remote	Large, remote	Small, close to market	Small, close to market	Large, close to market	Large, close to market
Access to *na* (%) [1]	22	72	89	21	57	75	100	87
Rice bought at markets (%) [2]	27	0	5	3	0	0	0	17
No. of crops grown [3]	11	14	22	16	8	14	21	17
Average total household size [4]	4.6	6.6	6.0	5.6	5.1	4.7	4.9	4.6
Asset ranks (%) [5]	High:12 Med:71 Low: 17	High:13 Med:70 Low: 17	High:32 Med:76 Low: 2	High: 5 Med:67 Low: 28	High: 6 Med:74 Low: 20	High: 0 Med:90 Low:10	High: 55 Med: 38 Low: 7	High:20 Med:75 Low: 5
Employed off farm semi-permanently (%) [6]	28.2	15.1	16.8	17.9	19.6	21.3	19.8	21.7
Occasionally employed on other farms (%) [7]	Karen: 58 Other: 46	Karen: 100 Other: 0	Karen: 80 Other: 20	Karen: 60 Other: 47	Karen: 40 Other: 60	Karen: 100 Other: 0	Karen: 100 Other: 0	Karen: 80 Other: 20

[1] An index calculated by dividing the total kilograms of rice produced on *rai* by the total kilograms of rice produced on *na* (100% indicates no *rai*, 0% indicates no *na*).

[2] This indicates the proportion of food versus traded crops cultivated in each village.

[3] This is an indicator of crop specialization.

[4] This is the total of all household members, including those away.

[5] Cumulative index of household wealth, averaged for each village, based on number and quality of key assets concerning house, transport, and consumer goods.

[6] This is the proportion of village populations reported to be employed semi-permanently in non-agricultural activities outside villages.

[7] Most respondents worked occasionally on other Karen farms or Hmong or Thai farms.