2.2 Assessment of the role of Karen's ecological knowledge to sustain biodiversity, ecosystems and ecosystem services in northern Thailand

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b) Summary

The Karen indigenous people have lived on a mixed agroecosystem centered on traditional rotational farming (RF) for over 300 years in mountainous northern Thailand. Over generations they have accumulated local knowledge on species and ecosystems that has enabled them to provide for their livelihood needs while managing the land and natural resources sustainably. However, the government blames their traditional agroecosystems for extensive forest loss and has introduced forest protection policies to minimise forest use as well as national agricultural targets that encourage the conversion of land under RF to intensive monocrop agriculture.

The Institute for Global Environmental Strategies (IGES), Japan (Dr. Jintana Kawasaki and co-researchers), in partnership with the Indigenous Knowledge and Peoples Foundation (IKAP), Thailand (Dr. Prasert Trakansuphakon) jointly conducted a study in 2015 to document the role of Karen's indigenous and local knowledge (ILK) in their management of the land and natural resources, with a view to enhance the policy recognition of the importance of Karen's ILK for the sustainability of biodiversity, ecosystems and cultural heritage of the Karen people. Data were collected from a field survey and interviews of 55 villagers in three Karen communities, conducted from 11-21 December 2015. The surveyed villages were Hin Lad Nai Village, Chiang Rai Province; Mae Yod Village, Chiang Mai Province; and Mae Um Pai Tai Village, Mae Hong Son Province. The three villages share similar geographic and climatic conditions, and while their patterns of land use are different, in all villages, RF is the dominant land use.

Previous studies of Karen traditional land use management in northern Thailand found rich biodiversity and the maintenance of ecosystem services on Karen land. For example, more than 90 types of food plants were found in Hin Lad Nai community [1,7], while 17 rice varieties (five glutinous and 12 non-glutinous) were found in Tee Cha community [4]. Moreover, the long fallow periods of the Karen's RF system were found not only to contribute to high levels of biodiversity and food for the subsistence of the communities, but also resulted in relatively high per hectare carbon stocks. The above-ground carbon stock on land under RF was estimated at 152 ton/ha in the Hin Lad Nai community, which

employs a 10-year rotational cycle [1,7], 46 ton/ha for the 8-year cycle in Mae Lan Kham community [5], and 97 ton/ha for the 6-year cycle in Tee Cha community. This compares with a carbon stock of 62 ton/ha for permanent fields in the Tee Cha community.

The information gathered from the IGES/IKAP survey on Karen's ILK, RF practices and their implications for biodiversity and ecosystem services are organised below:

(1) Agrobiodiversity – conservation of local varieties and wildlife relatives of valuable crop species: The study observed that RF continues to be practiced for subsistence food and cash crop production using domesticated and native plant species. The survey confirmed earlier observations of high plant species diversity in these systems. More than 60 types of native plants were found in the RF systems, including 15 types of native rice (three glutinous and 12 non-glutinous), 15 varieties of beans, and more than 40 species/varieties of vegetables and herbs. Some of the native rice varieties are now difficult to find in the lowland. Recognizing the high diversity of native rice varieties cultivated by the Karen communities, scientists at Chiang Mai University [4, 10] concluded that land under traditional Karen management can be viewed as one of Thailand's indigenous rice genetic centres. RF provides not only food, but also fuel wood and herbal medicines, such as *Chor Tum Mae* (local name), which is used to treat wounds, and *Top KadWa* (local name) for treatment of snake bites.

(2) Forest conservation and high carbon stock: The Karen methods of RF minimise damage to the forest stands surrounding cropping areas and promote natural forest regeneration during fallow periods. In preparation for opening-up fallow forests for seed sowing, trees and bamboos are cut at certain heights to allow stumps to sprout and quickly regenerate. Before burning, firebreaks are created around the fallow area to stop the fires spreading. With these, and as noted in earlier studies, the carbon stock of Karen RF systems is high. We used average above-ground carbon stocks (ton/ha) of RF from previous studies [1,6,7] and a set of land-use map data for 2015 from the Karen Network for Culture and Environment, Chiang Mai Province to estimate total carbon stocks of the land under various fallow cycles. We found that with the rotational farming system, total above-ground carbon stock was 96 ton/ha for the 1-year cycle, 121 ton/ha for the 8-year cycle, and 152 ton/ha for year 10-12 year cycle. Total carbon stocks of rotational farming land were about 220, 090 tons.

(3) Limited negative impacts on biodiversity and ecosystem services – no synthetic chemical inputs: Small tree branches and leaves are scattered over the ground to encourage burning and to produce a higher amount of charcoal and ash, which enhance soil nutrients. The survey found that the RF maintains high land productivity because yields of upland rice in the RF (3.66 ton/ha) were higher than yields of paddy rice (1.85 ton/ha). In addition to that, the Karen communities continue to apply organic pest control methods, using homemade bio-pesticides,

which are generally made from insect pests collected from fields, such as grasshoppers and ants. Physical weeding methods such as gently piercing the soil surface not only avoid the use of herbicides but also maintain rainfall permeability into soils and thus mitigate soil erosion. These traditional practices enable high crop productivity without the use of synthetic chemicals such as pesticides, herbicides and synthetic fertilizers that damage biodiversity and deteriorate ecosystem functions such as clean water supply.

(4) Sustainable land and resource management, and biocultural diversity: The study found that traditional RF practices contribute to strong social cohesion among the community members through frequent exchanges of food and other products, and labour sharing between the households. Their sharing of the knowledge they accumulate on farming constitutes an important part of Karen social life. Their songs and folktales are mediums for passing on knowledge from old to young on how the land and natural resources should be managed. Many of their songs with folktale lyrics include norms relating to natural resource use. The *Kauz Klaif* song, for example, warns that severe consequences may arise from breaking the taboos and norms relating to RF practices. When working outside on their RF, the Karen communities often sing this type of song and senior villagers pass on folklore about conserving nature to youngsters. One folklore often told when vegetation is being cleared for rice planting in areas under RF is "Do not prune all the branches, leave some for the fire birds to perch on."

(5) Ecosystem services trade-offs – traditional rotational farming vs. competing land use for intensified monocrop agriculture: Despite the importance of Karen's traditional RF system and associated ILK for biodiversity and ecosystem services in the studied areas, traditional RF systems are increasingly threatened by conversion to commercial crop production, particularly in Mae Yod Village. Employing trade-off analysis of land use change with a 20-year timeframe, the study found that Azuki bean production provides relatively highest short-term cash gain of 1,601 USD/ha/year, followed by maize production (491 USD/ha). It explains why conversion is taking place, but at the price of biodiversity loss and the degradation of ecosystem services. The net present value (NPV) of Azuki bean, maize and paddy rice were estimated from annual harvest, the NPV of RF from non-market values of upland rice, and the NPV of forest land from values of non-timber forest products. Using the results we estimated that conversion of an RF area into a maize field in Mae Yod Village will gain in the net present value of yearly income per ha of USD 306/year, but average carbon stocks of maize (65 ton/ha) is lower than that of RF (106 ton/ha).

c) Key points/messages of the case relevant to IPBES

The case study carries rich implications that can be referred to in different chapters of the IPBES regional assessment for Asia and the Pacific.

Agrobiodiversity associated with rotational farming demonstrates how Karen people benefit from managing a wide variety of traditional crops (related to **Ch2** of the regional assessment), and how their ILK is associated with the richness of cultivated plant varieties (**Ch3**).

Forest conservation and limited biodiversity impacts of traditional rotational farming practices can be referred to in **Ch4 on drivers**, where agriculture is widely discussed as one of the major negative drivers.

An analysis on **ecosystem services trade-offs** contrasts ILK-based traditional agriculture with modern monocrop agriculture. While rotational farming interrupts natural ecosystem to a certain extent, it enables Karen people benefitting from various ecosystem goods and services, and contributes to enhancing ecosystem heterogeneity as well. Modern monocrop agriculture focuses on production for the highest possible income while eliminating biodiversity in cropping areas and sacrificing other ecosystem services. **Ch5 on scenarios and modelling** would be recommended to look into different trajectories of agricultural development, taking into account the importance of traditional and ILK-based agriculture for BES sustainability.

ILK is embedded in **land and resource management system, traditional institutions and the worldview** in Karen communities. The section demonstrates the importance of relational value of BES for Karen communities (**Ch2**). It also underscores the importance of ILK for sustainable land and resource management, which would be better recognised under formal governance system and statutory laws (**Ch6**).

d) Website or other sources of information.

1) Video of Karen traditional rotational farming systems in northern Thailand can be viewed at **https://youtu.be/DjY6BOE4_WI** (published on 2 September 2016)
2) Conference paper on “Opportunity cost analysis of land use changes in Karen indigenous community in Thailand”, presented at the 26th Annual Meeting of the Japan Society Tropical Ecology, 18 June 2016, Tsukuba University, Japan. Available at **http://pub.iges.or.jp/modules/envirolib/view.php?docid=6665**

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f) Literature cited in the text, relevant documents, videos or other recorded sources of information.

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g) About the ILK described in your recommended references

7) Trakansuphakon P. 2015. Changing strategies of shifting cultivators to match a changing climate. In M. F. Cairns (ed.) *Shifting cultivation and environmental change: Indigenous people, agriculture and forest conservation*. Routledge, New York, USA, pp 335-356.
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10) Rerkasem B. and Rerksasem K. 2002. Agrodiversity for *in situ* conservation of Thailand's native rice germplasm. Chiang Mai University Journal of Natural Science. Vol 1(2): 129-148.