Mobilizing Traditional Knowledge, Innovations and Practices in rotational farming for sustainable development

A contribution to the Piloting of the Multiple Evidence Base Approach From the community of Hin Lad Nai, Chiang Rai, Thailand.
This report is part of the outcomes of a collaborative partnership for piloting a Multiple Evidence Base approach to co-generate knowledge and methods for mutual learning across knowledge systems. The project partners are: African Biodiversity Network with Institute for Cultural Ecology (ICE), Kenya and MELCA, Ethiopia; Forest Peoples Programme with Fundación para la Promoción de Conocimiento Indígena (FPPI); Pgakenyaw Association for Sustainable Development (PASD), Thailand; Tebtebba Foundation, Philippines; and SwedBio at Stockholm Resilience Centre, Sweden.

The collaborative partnership emerged from an ongoing dialogue across knowledge systems, involving SwedBio and partners among indigenous peoples and local community organisations (e.g. International Indigenous Forum on Biodiversity, IIIB) and networks of experts from different knowledge systems. All participants are committed to valuing diversity and are engaged in biodiversity management and its links to policy processes from local to global, such as in the Conventions on Biological Diversity (CBD) and the Intergovernmental Panel for Biodiversity and Ecosystem Services (IPBES). The starting point was the window of opportunity emerging from the possible inclusion of indigenous and local knowledge in IPBES, during the years before IPBES was established. See for example the Guna Yala Dialogue from 2012 at www.dialogueseminars.net/Panama, held back with the founding plenary of the IPBES. One of the outcomes of the ongoing dialogue has been the envisioning of The Multiple Evidence Base (MEB) approach that sees indigenous, local and scientific knowledge systems as different manifestations of valid and useful knowledge that generates complementary evidence for sustainable use of biodiversity. MEB emphasizes the importance of equitable and transparent processes for mobilizing knowledge and connecting across knowledge systems, and of maintaining the integrity of each knowledge system throughout the process. This means that evaluations of knowledge occur within, rather than across, the contributing knowledge systems when mobilizing and synthesizing knowledge, for example, in an ecosystem assessment process.

One of the objectives of the piloting of MEB has been to develop methods, procedures and good examples for how evidence can be mobilized for multiple needs, at local to global levels, and across knowledge systems. For example, knowledge that is relevant for feeding into local and national policymaking, as well as in processes such as assessments for the CBD and the IPBES, and other fora where working with synergies across knowledge systems are essential. Additional objectives have included: contributing to changing the views that governments hold about indigenous governance and management systems, towards respect and benefit for indigenous peoples and local communities; strengthening livelihoods and well-being within the communities, based on their indigenous governance systems, and finally, promoting joint learning around this across the participating communities and other partners.

The community research that is part of the piloting has been initiated and conducted by the communities themselves, based on their own needs and priorities. Biodiversity, food and culture were the unifying topics. Most of them have earlier experiences of mobilizing knowledge e.g. to recover lost seeds or to protect and revitalize sacred natural sites and rituals connected to them. Past experiences encourage communities to continue such work. Some communities are mobilizing
knowledge as part of efforts to demonstrate the sustainability of their traditional management and governance systems, as a way of creating an evidence base for policies and decisions at scales beyond the local, that protects rather than counteracts their rights and capacities to manage their ecosystems and resources.

A number of insights have emerged across the five piloting projects. One is the importance and role of mobilizing knowledge before engaging with other knowledge systems. The communities engaged in methods and approaches to mobilizing knowledge that were well suited to the local context and engaged with multiple facets of knowledge, including cultural and spiritual dimensions. How knowledge was mobilized was an important part of building confidence for interactions with other knowledge systems, including authorities. Another insight is the relevance for co-production of knowledge across knowledge systems to connect with interests and needs of all actors involved, including at the local level. For all the communities, mobilisation of knowledge was part of securing territory, authority and rights to govern their ecosystems in a sustainable way. In several communities, the outcomes were well received by local and regional authorities and collaboration has improved.

The project was financed by support from the Swedish Development Cooperation Agency (Sida) through SwedBio at Stockholm Resilience Centre.
Content

Foreword about the background to the collaborative partnership: Piloting the Multiple Evidence Base approach: Connecting across knowledge systems for enhanced ecosystem governance ........................................ 2

1 Introduction to the Hin Lad Nai Community and the project. ........................................ 6
  1.2. Successful collective action for regeneration of the Hin Lad Nai forest ....................... 7

2 A case story on Rotation Farmers’ innovations to improve soil quality in fallow land through reviving the use of P’dav trees in Hin Lad Nai. ................................................................. 9
  2.1 What is P’dav? ............................................................................................................. 9
  2.2 Comparison between farming a P’dav field and a normal fallow field ......................... 10
  2.3 Benefits of the use of P’dav trees ............................................................................. 11
  2.4 Analysis of the P’Dav trees potential for soil and forest recovery, and for biodiversity .... 11

3 The cycle of the fallows in the rotational farming system in Hin Lad Nai ................................ 12
  3.1 Grasses and trees in the 1st and 2nd periods of the fallow ........................................ 12
    3.1.1. Community food areas and herbal medicine areas ......................................... 12
    3.1.2. Foraging areas for domestic and wild animals .................................................. 12
  3.2 The 3rd year fallow, named by Karen communities “Hsgif loovhtauf” ......................... 13
    3.2.1. The 4th year, called “doo yauv ploj” ................................................................. 13
    3.2.2. Food and herbal medicines in the 3rd and 4th year fallow ................................. 13
    3.2.3. Wild animals in the 3rd and 4th year fallow ...................................................... 13
  3.3 The 5th and 6th fallow periods – “doo lax” .................................................................. 13
  3.4 The 7th fallow and beyond ....................................................................................... 14
  3.5 Summary of the benefits of fallow land .................................................................... 14

4 A study of the Hin Lad Nai fallows and its benefits for people and biodiversity ................... 15
  4.1. Background and objective of the study ................................................................... 15
  4.2 Research Methodology ............................................................................................ 15
    4.2.1. Preparation: Select theme or topic, select research team, orientation of the project, training for researchers on methodology, etc. ......................................................... 15
    4.2.2. Review the literature related to the topic, design the matrix forms and questionnaire for data collection on the study of plants and animals in the fallow land ............... 15
    4.2.3. Design methodology for the process of implementation of the field study .......... 16
  4.3 Main findings and results from the study .................................................................. 18
5 Different perspectives on the cycle of Fallow of Rotational Farming in Hin Lad Nai Community
5.1 Interlinked beliefs and practices in the rotational farming cycle
5.2 Rotational and fallow field as sacred sites: Ritual for choosing a plot of fallow land to clear for a new plot for farming
5.3 Philosophy and knowledge behind the short cultivation and long fallow system – why the fallow comes back quickly to become rich fallow land in 6–7 years

6 The study on plants and animals in the different periods of fallow cycle
6.1 Observations about plants and animals in the 1st and 2nd periods of the fallow or the period of hsgifwa (white fallow) and Hsgiftajcaj (young grass fallow)
6.1.1. Community food and herbal medicine areas in the 1st and 2nd period
6.1.2. Domestic Animals
6.1.3. Wild life Animals
6.2 The 3rd and 4th year called “Hsgif bauf” (young trees fallow or bush fallow)
6.2.1. Community food and herbal medicines in the 3rd and 4th year fallow
6.2.2. Animals in the 3rd and 4th year fallow
6.3 The 5th and 6th fallow land periods or “Doo yauv ploj” and “Doo loov htauf”
6.3.1. Vegetation in the 5th and 6th year fallow
6.3.2. Animals in the 5th and 6th year fallow
6.3.3. The 5th and 6th year fallow importance for community food security
6.4 The “Doo pgaj” (Adult trees fallow) in 7th fallow and beyond
6.5 Discussion on the benefits of fallow land to human and animals
6.6 Additional event: Appearance of Bengal Tiger in Hin Lad Nai

7 Knowledge about fallow land expressed through hta
7.1. Fallow as a space of deeply embedded memories
7.2. Karen beliefs and cosmovision

8 Discussion, conclusions and recommendations
8.1. To answer the question “What is fallow system?”
8.2. Karen traditional knowledge and the sustainable management of the land and ecosystem
8.3. Soil generation in fallow land
8.4. Discussion related to diversity in rotational farming practices
1. Introduction to the Hin Lad Nai Community and the project.

The concept behind the Hin Lad Nai community governance system stems from the traditional philosophy of the grandfather of Chai Prasert, the present official leader of Hin Lad Nai. “Land and forest never ends if we know how to take care of it and use it,” the grandfather said. This means that it is not just to preserve and protect your forest, but you also need to know how to use it. E.g. how to become food secure and get income from its use, while conserving it. That’s the philosophy behind the Hin Lad Nai villagers’ successful recovery and maintaining of their forest. The research they are doing, based on their own mobilized knowledge and experiences, as presented in this study, aims at showing not only the richness and sustainability of their rotational farming system as a source for their livelihood, but also its importance for biodiversity conservation.

The Hin Lad Nai community is situated in Northern Thailand, Moo 2, Banpong Sub-district, Wieng Pa Po District, Chiang Rai Province. It is located between the National Forest Reservation Area and the Khun Jae National Park, about 130 km from the city of Chiang Rai. The community land is a hilly forest area throughout which more than 14 small streams flow. Community forest covers 3110 ha, while agricultural land is approximately 570 ha. The community is comprised of: Hin Lad Nai, PhaYuang, Hin and Hin Lad Nok – these 3 settlements are Karen people, or Pgakenyaw in their own language, and Huey Sai Khao is Lahu people.

Photo credit: Nutdanai Trakansuphakon

Photo credit: Nutdanai Trakansuphakon
The rotational farming system practised in Hin Lad Nai is the backbone of the natural resources management system developed by the Karen people. It contains the full range of Karen knowledge and wisdom, including cosmology, spirituality, technical knowledge of conservation practice, as well as values and cultural elements that are needed for any type of bio-cultural diversity management.

The rotational farming provides the broad diversity of food crops. No less than 207 species and varieties are found and used in the rotational system, as the base for a rich, healthy and tasty diet. The rotational farming system is the home of a rich biological diversity of plants, domesticated as well as wild species, and it creates shelter and habitat for a wide range of animals, birds and insects during the different stages of rotation.

The community also has terraced paddy fields that were constructed starting from 60 years ago, based on knowledge and observations gathered by travelling in the lowland. These provide the community with additional sources of rice, but still the rotational farming area is maintaining all the cultural elements that are driving the cultural and food production calendar over the year. The community also grows fruits and other crops, and collects forest products such as wild tea, bamboo shoots, and forest honey. These are the main sources of income for the community. In particular, the rotational farming systems contains an exceptionally rich biodiversity of edible cultivars and semi domesticated crops, which together with the produce in the paddy fields, provide the community with its food security. Breeds of pigs, hens, ducks and cows are held in the community.

1.2. Successful collective action for regeneration of the Hin Lad Nai forest

The forests of Hin Lad Nai are nowadays thick, with tall trees and a wide variety of plants, insects, animals and birds. However, in 1986 the logging company Chiang Rai Tham Mai got a concession from the government to do logging in the area near Khun Jae national park including the Hin Lad Nai community. The concession was given without any consultations with the local communities. The company cut all trees including the communities’ sacred sites such as the umbilical cord forest and the traditional cemetery. All big trees disappeared and also the wild animals, because the workers of the company hunted all animals they could find in the forest. The villagers were shocked, but they joined forces and tried to stop the logging concession by sending an
open letter asking the Chiang Rai governor to consider the devastating impact on their community. However, the governor did not react and nothing happened. Luckily, finally in 1989 the national government declared a stop to all logging concessions in Thailand, and the company had to finish their destructive activities in Hin Lad Nai and surrounding villages.

Immediately after this, the villagers of Hin Lad Nai made a common decision to regenerate their destroyed forest. At that time, their biodiversity and wildlife was heavily degraded from the outside pressures and stress. An important factor contributing to the urgent need to regenerate the forests, were the increased frequency of wildfires, caused by the thick soil cover of branches and leaves from the big trees that were left on the land after the logging. All dry organic material made the whole area, including the remaining forest, very sensitive to outbreaks of wild fire at any place and any time. The inhabitants of Hin Lad Nai decided to prepare a firebreak around their whole community area, and protect it with organized guards from the village at times when there were risks for wildfires. They also started to protect their territories against illegal loggers and hunters that were invading.

By continuously organizing themselves in this way, Hin Lad Nai has, during the last 30 years, managed to recover 80% of their earlier destroyed forested area. At the same time, they have maintained their rotational farming system intact, and developed high value products for cash incomes from the flourishing forest.

In the following chapters, we will first meet the Hin Lad Nai farmer Mr Hsau Weij and his innovative experimentation with P’Dav trees to improve soil quality and work efficiency in the rotational farming system (Chapter 2), and the study conducted by Hin Lad Nai Farmers Research Team, based on their own Karen knowledge, about the rotational farming system contribution to biodiversity conservation.

The research project started on the initiative of the core leaders of Hin Lad Nai, who proposed this research to respond to some questions about rotational farming, particularly on the fallow system, that kept being asked by representatives of the mainstream agricultural system. They were faced with the need to study this area in order to respond to such questions as:

“What is the fallow system?” “What do fallow systems contain, e.g. wildlife, plants, etc.?” “Why have people based their livelihoods on this system?” “What benefits do they gain from this system?” “How does this system benefit biodiversity and the ecosystem?” and “How do these systems make it possible for the people to make sustainable use of their natural resources?”

We hope that this report will contribute to the need for insights and knowledge about the Karen rotational farming system. It also aims at presenting evidence based on the Karen knowledge system and its ways of knowing, gained through continuous practice and innovations and transferred over the generations by songs, poems and intergenerational traditions of working together. The Hin Lad Nai community research team implemented their study as part of a collaboration for piloting the Multiple Evidence Base approach to connect across knowledge systems, based on equity and reciprocity, and usefulness for all involved.11

11 To learn more about the Multiple Evidence Base approach, see: http://swed.bio/stories/a-multiple-evidence-base-approach-for-equity-across-knowledge-systems/
2. A case story on Rotation Farmers’ innovations to improve soil quality in fallow land through reviving the use of P’ dav trees in Hin Lad Nai.

Karen elders said:
“Pgaz mi le plezmaz div iz, pgaz pgaj le plez maz div iz P’ maz paux pgaz mi av bki, P’ maz paux pgaz pgaj av bki P’ meij t’ maz taj div iz, lauz maj moj daw paj av miz”
(The elders use to practice like this, the old man use to implement in this way
We followed the elders’ steps, we followed the old man’s steps
If we do not follow their steps, we will lose the names of our parents and ancestors.)

This bta expresses that the younger generation needs to follow in the steps of their elders, or else they will lose their ancestors’ knowledge and way of living.

The same Hin Lad Nai elders used to transfer their knowledge from generation to generation, in the same way as Hsau Weij’s grandfather and father transferred the knowledge and way of practice about P’Dav to him as a special young man from the views of their parents. Thirty years ago, Mr. Hsau Weij, 59, was one of the Hin Lad Nai Village leaders. His father was Mr. The Ne, one of the original settlers in Hin Lad Nai. Mr. The Ne was worried when he saw that Hsau Weij, his youngest son, was a very small boy with poor health, so he said to him: “My son, you can’t work in rotational farming fields like your other brothers and sisters, because you are small and not so healthy. But there is one solution I would like to suggest to you. Even if you cannot work as the others, there is a way you can get enough produced like the others, your rice will grow well and the fields will not need too much weeding. You will need to select a fallow field which is mostly covered with P’ dav trees12 and do your farming there. Your harvests will be as good as the others’, but you will use less labor than them, which is good for you as a small boy.”

Hsau Weij’s uncle, named Hta Doo, also said to him: “My dear nephew, you may see a lot of wildlife, like birds, squirrels, rats, etc. in an area that is covered with P’ dav trees, but it is not only a good area for wildlife but it is also good for farming. If you would like to work with less effort, but easily get harvests like the others, you need to throw P’ dav tree seeds around your fallow areas. This will help you to get good harvests using less labor because the plants will grow well, but fewer weeds will come up, and they will be easier to control.”

2.1. What is P’ dav?
There are many varieties of the P’ dav tree (Macaranga dentilucata). They can be classified into four groups: 1) P’ dav Caiv; 2) P’ dav gauzhpo (red P’ dav); 3) P’ dav wa (white P’ dav) and 4) P’ dav loz loz (normal P’ dav), which is the most important variety, and the best one for making good soil in fallow areas. P’ dav loz loz (normal P’ dav) is known among the Karen communities for growing in any kind of forest or soil and it is also good for soil regeneration. Compared with red and white P’ dav, P’ dav loz loz is better for regenerating soil, but it is easier to collect the seeds of red and white P’ dav.

People know that P’ dav does not grow well in some areas; this is not because P’ dav seeds do not like the kind of soil there. Normally, P’ dav can grow anywhere, and the reason why very few trees grow in some areas is that animals such as rats and birds like P’ dav seeds and eat them before they have time to germinate. However, like many other plants, P’ dav trees grow better in areas close to the water, or in cooler areas.

[Photo credit: Nutdanai Trakansuphakon]
The leaves of P’dav hold water well when the rain comes and decay quickly and thoroughly to become good, fertile soil. The way we know that the soil has improved is that it is soft, black and full of earthworms when we pick it up. Not only do we know this soil is good and fertile, but also animals such as bamboo rats (genus Rhizomys), other rats, etc. like this soil and make their holes in it. Hsau Weij put his elders’ knowledge into practice through experiments on P’dav planting methods, trees caretaking, and seed collection.

Hsau Weij adapted the experiences that his father The Ne had taught him into his own experimental process. Hsau Weij selected a normal fallow area which was covered with various kinds of plants and grass, particularly some well-known grass varieties which are not good for the soil, e.g. Nauf ne si, Nauf k’seijhsa, k’pohpo, (these are the local names). The name of this fallow area is Hpav lei hki. At first, this fallow looked like any other normal fallow area. But its soil was not good for farming and gave only a low yield of rice. Hsau Weij collected good seeds of P’dav from other places, from trees with an age of 5 to 6 years. He sowed those using different methods.

Hsau Weij carried out practical experiments to reproduce P’dav in the Hpav lei hki fallow. Based on lessons learned from his father The Ne, he started to notice that P’dav seeds ripen in July and can be collected from August to September – that is, after finishing weeding the Nauf moj pgaj (Mother of grass).

A successful method for planting P’dav seeds is to put them into a knife box. Normally, there is a small hole in the bottom of the knife box from which the seeds can fall to the ground. While Hsau Weij was doing the Klauj Nauf hpo (children of the grass) weeding of the Rotational Farming (RF) area, he tied the knife box to his waist. With every step he took, the P’dav seeds fell to the ground along the line where he walked. After a few months, small P’dav seedlings started to come up along the field. This is how the sowing is practiced by many now.

After sowing P’dav it is necessary to remind the people who do further rounds of weeding to be aware of the lines of small seedlings and not to touch any of them directly or indirectly, for instance, during the Klauj nauf li (grandchildren of the grass) weeding. Beautiful lines of P’dav seedlings will then grow rapidly in the field with the heavy rains of August and September, which is also the natural time when P’dav seeds fall to the ground and grow quickly.

2.2. Comparison between farming a P’dav field and a normal fallow field
Mr Somboon Siri, 39, received P’dav fallow land areas from his uncle Mr Yauj Weij and 14 years on, he continues the experiment with P’Dav. Mr Somboon now has 6 fallow lands, 3 with P’Dav and 3 with normal trees. From his experience, farming the P’Dav fallow land requires less weeding effort, compared with the normal trees fallow land. The produce of rice is higher in P’Dav fallow land – 2 tangs\(^{13}\) of rice seeds gave around 70 tangs of rice in P’Dav fallow and around 60 tangs in normal fallow. Therefore, P’Dav fallow land gave 10 tangs more from the same amount of seeds.

Another thing he found is that rice fields with P’Dav have fewer to no damaged plants, pests and weeds compared to normal fields. Plants in the P’Dav field have good health and are stronger than in normal fallow land fields. This means that rice or other crops in the P’Dav fields have more immunity than in normal fallow fields. Last but not least, Mr Somboon added that produce from P’Dav fallow fields is more reliable, while that from normal trees fallow fields is less so, as it changes easily with other conditions e.g. rain, large amount of weeds, plant damage etc.

Summarizing, after two Rotational Farming cycles using P’Dav in the fallow:
1. The soil is better for cultivation than a normal natural fallow.
2. Grass/weeds which are not good for the soil disappear, e.g. Nauf ne si, Nauf k’seij hsa, k’po hpo, etc.
3. Number of plants or crops in the Rotational Farming field increases,
4. Plants are strong and grow well, with good harvests of almost all crops (e.g. rice production increases)
5. More reliable production

Mr Somboon also said that by accident he left a part of a P’Dav fallow field uncultivated. P’dav trees grew there very quickly and the area became similar to a natural P’Dav forest. There are now many big P’Dav trees and it has 13 One tang =10 kg
become a place to collect seeds to be planted in other places or fallows. He also noticed that wildlife (e.g., birds, rat etc.) ate the seeds and dispersed them through their dung in other near and distant fallows. He decided it was a good idea to let them distribute P'Dav naturally instead of having to replant seeds himself.

2.3. Benefits of the use of P’dav trees

The P'Dav tree is characterized by a soft trunk and branching roots that spread at shallow depths around the stump. It only propagates with seeds, and not with shoots from the trunk. P'Dav normally bears large quantities of fruit, which attracts different animals, for instance:

- Birds, such as htof bau lauv (Pycnonotus jocosus), htof bauhpo, bif bei (minivets), Hsau mi (wild chicken), htof bgef (Arborophila diversa), htof giv (pheasant), and at least five different species of dove e.g., hto f lwij bu (rice dove), htof lwij gauz (red dove), htof lwijtrauak (long tail dove), htof lwijqe (dry dove), htof lwijhka (bitter dove). (Direct translation from Karen language)
- Various species of rats and squirrels, as liv lai, yuj lai, liv bau hkaf, liv looj gauz sav, yuj sqow, yuj gauz, yuj hko, and the Palm civet (taj hpo nyau)
- Many species of bees, such as k’nai (Apis dorsata), kwaiw dof (A. cerana), kwaiw hpo (Meliponini) det’yoo (A. florea), etc.

P’dav areas therefore become hunting and trapping spaces for humans. It is good to visit a P'Dav forest to observe the practice of trapping animals. Not only wild, but also domestic animals e.g., buffaloes and cows, like the fruit of P’dav very much. P’dav forests are favored foraging areas for them.

Another benefit becomes evident after the P'Dav trees have grown for 2 to 3 years, as the leaves falling to the ground keep the soil surface cool and hold rainwater. This allows them to become fertilizers and nutrients for the soil. For this reason, the soil under P'Dav fallows becomes black, fertile and suitable for farming earlier than the soil in normal fallows.

People also use P’dav trunks for firewood, as they are easy to dry and get soft and good for making fires. P’Dav trees and branches in rice fields are lightweight and easy to cut into separate pieces for burning.

2.4. Analysis of the P’Dav trees potential for soil and forest recovery, and for biodiversity

Normally, the seeds are collected and distributed in another place. When the P’dav seeds have been collected, they must first be dried. When dry, they can be distributed by hand over the selected area. Another way is to use some instrument such as a catapult (or similar instruments) to shoot them all over the area. P’dav seeds are also distributed through the dung of domestic or wild animals that eat P’dav fruits, including birds, rats, squirrels, etc.

One effect of the use of P’dav trees is that it decreases some biodiversity. In areas with many P’dav trees other plants struggle to survive as they cannot grow as fast as P’dav and are outcompeted by its shadow. This is because P’dav leaves are large and prevent most of the sunlight from getting through to other plants under them.

This effect has created a great deal of debate about P’dav in fallows and whether or not it has impacts on the diversity of trees, or on the fertilization of soils with diverse nutrients from other plants, or on wildlife and their food sources in fallow areas, and so on.

Thus, there is a discussion whether it might be possible to use P’Dav as a technique to recover poor soil after intensive use with cash crop cultivations. The answer to this is not yet proven through experimental processes. Some researchers suggest that we can plant P'Dav as a fast-growing tree in areas with bad soil, previously intensively cultivated with cash crops. For instance, we could try to plant shadow crops (e.g., coffee or tea) under P’Dav. This would give shade but also regenerate the soil in the area. Also, in other areas which need firewood for cooking, P’Dav could be helpful because its branches are good for fire and the tree grows fast (trees are good for firewood after only 2-3 years).

However, one of the most important benefits of using P'Dav, as already proven by Mr Yauvweij and Mr Somboon, is that it is a successful technique for reducing weeding. Less grass grows in P’Dav fallows, crops grow well and have good and more reliable produce. Plants are stronger and have good nutrients in the soil, are less damaged or plagued by insects. Last but not least, farmers say that P’Dav fallows allow an area to be regenerated and farmed again within 5–6 years.

This is an alternative innovation for the rotation farmers to help them to develop rich fallows, with good produce and shorter periods of rotation, for those farmers who want to. At the same time, P’Dav may be used as a tool to solve the problem of soil erosion and degradation caused by cash crop cultivation etc.

However, even though people found that planting P’Dav in fallow land has many positive aspects, as mentioned above, not all farmers are taking up the planting of P’Dav. Possibly, their fallows are still giving them reasonable produce and they do not feel like it is necessary to implement this innovation at this moment.
3. The cycle of the falls in the rotational farming system in Hin Lad Nai

3.1. Grasses and trees in the 1st and 2nd periods of the fallow

Karen people call the first year in the fallow land cycle “hsgif auf mei” which refers to the year of eating rice produced on that fallow land. In this period, the yellow rice stubble is visible in the fields and changes after that into the white colour of grass flowers. The name then changes to “hgifwa” (the white fallow land) this name is kept until it changes into a green colour. The fallow is then full of young grass and new shoots emerging from the old stumps, and named “hsgif taj caj’ or “hsgif bauf pooz”.

The plants that sprout in the 1st and 2nd years are mostly trees from the old stumps – there are around 37 species of trees e.g. hpau kax , hsoov, seif miz, sev dex, kloov muj, kev pauj, t’swij swiv, seif qi, seif hplaiv caij, seif klov bo etc. Each stump gives rise to 3 – 5 outgrowth trees, growing as clumps of trees. The plants growing from seeds are around 9 species. During the first year, trees reach heights of around 170 cm – the size of the trunk is about the same size as a human thumb.

3.1.1. Community food areas and herbal medicine areas

A whole diversity of plant species present is continuously growing throughout the 1st and 2nd year. E.g. chilly eggplant, tomato, yam, taro, bean, the luffa or dishcloth gourd etc. People from the community can harvest all year round. During the first two years, it is prohibited to weed some herbal medicinal plants to keep and use them in the longer term. For example, qauv, soo lei bo, geijhkof etc. are plants that will grow up during the 1st and 2nd years fallow, and people continue to use them in the following years.

3.1.2. Foraging areas for domestic and wild animals

Domestic Animals: During the 1st and 2nd year of fallow, the fields provide very good young grass for domestic animals, e.g. buffaloes, cows and goats etc. These animals keep on eating in these areas also in the following period of the fallow, but it provides the best feed for them in the 1st and 2nd years fallow.
Wild Animals: Wildlife feeding on the fallow in the 1st and 2nd year is usually composed of small species of animals which eat roots of trees, e.g. bamboo rat, rats, boars, wild cats, barking dears, many species of small birds. In 2nd year fallows, there are more and bigger birds coming e.g. wild chicken, partridges, many species of birds which eat insects etc.

3.2. The 3rd year fallow, named by Karen communities “Hsgif loovhtau”
The name is translated as “the standup fallow” meaning that trees can stand up in the fallow and begin covering the grass with their shadow. Pgaz k’Nyau people call this “hsgif” or “regeneration fallow or period of young fallow”. This is the last year, or the 3rd year of fallow. After that, the fallow is named “doo” meaning “land for use or older fallow”, implying that starting from this period, the field changes from regeneration to possible use. This means that if the field is good enough, it is ready to be used.

3.2.1. The 4th year, called “doo yauv ploj”
The name means “young trees fallow”. This is generally not good for farming, but if conditions are good, it can already be used for farming. P’dav fallow (see chapter 2) is an exception because it can be used for farming earlier, as P’Dav trees grow up faster than trees in other fallows. A poem says the following:

“Doo yauv p’dav ay hkof rai, loj bo n’cauv hsgif baf lai?”
“P’dav fallow grow up in a line along fallow land, why do you repeating farm in the old field?” This hta reflects the way of using farming in two contrasting ways. One is based on opening up the good fallow land for farming again, another way is to use the same area over and over again. This hta questions using the same land when the P’Dav fallow grows well and is good for farming.

From the 3rd year fallow, higher trees cover and shade the grass, and the grass species slowly decline. At the same time vine species increase and expand around the higher trees, including bamboo and rattan forming big clumps and increasing the shoots.

3.2.2. Food and herbal medicines in the 3rd and 4th year fallow
Different tree species, rhizome/rootstock species and vines grow in spring, while mushrooms grow over old logs and on the ground, under the trees. 3rd and 4th year fallows become sources of these kinds of food for the whole community (e.g. varieties of mushroom grow on old logs of trees e.g. P’Dav trees, etc.). Other varieties of different species of bamboo shoots, rattan shoots, sedges, flags, orchids, hemp and herbs grow and can be harvested for food and for other purposes.

During these falls there are an increasing number of plants that can be used as herbal medicines. Especially because the vines increase and entwine around the bigger and higher trees. Most of these vines are medicines for different purposes e.g. Ya kaiv muj, t’ sif soo bo, seif pgaj beif, mauv lauv hkof, hti hpaiv hkof etc. These are not the only medicinal plants, trees, particularly outgrowth of trees from the old trunks, also are herbal medicines with different purposes.

3.2.3. Wild animals in the 3rd and 4th year fallow
Species of big animals such as wild boars, barking deer etc. come and stay in the 3rd and 4th fallow year. There is more space in these fallsows as they become more open and clear due to the shadow of trees decreasing the growth of grass. These bigger animals move to a different place for hiding during the 1st and 2nd year.

Observations of animals’ behaviour have not just started during this research period, but were already collected for years in the everyday life of villagers and elders. For instance, these collections are expressed from memories and summarized into poetry and songs called “hta” by Karen.

An example of a description of an animal’s behaviour is a poem about monkeys: “Cu t’ maz hkauf t’ hpiv, htif pgaz taj mauj hswi mauj hswi” meaning “hand not do it, foot not touching, when found things of others, just pick up and put through mouth” which implies that monkeys always behave like thieves.

Another poem reflects the behaviour of gibbons: “Cu t’ hpiv hkauf t’ maz, htif pgaz taj kwaj blav” meaning “hand not pick up, foot not working, when saw things of others, just only watch at it” this reflecting the behaviour of gibbons as gentle animals. This kind of poem reflects the rich knowledge that Karen people have of their surrounding environment, especially of the variety of wild and domesticated plants and animals. This is a collective knowledge system of songs, poetry and storytelling based on everyday life experiences.

Much poultry can be observed on 3rd and 4th year fallow. In the 3rd year fallow we can see medium-sized poultry particularly in the evening and night time e.g. cau t’ ko, htuf qiai, htuf kloz etc. In 4th year falls, we can see bigger poultry particularly in the evening, night time and morning time e.g. sauf gauz, koof cov lov, a variety of species of doves (htoflwj k’ luv, htuf htij htauamaj, htuf lwj bu, htuf lwj gauz, htuf lwj qei, dauv htuf lwj hkaf, htuf wa hklej) and others.

Poultry is present in the 4th fallow because it is a suitable area to roost, with dense tree cover helping them to hide from hunters. Secondly, many of those trees blossom and bear fruit which they eat e.g. P’dav, P’dav, seif hpau bau etc. These areas are therefore not only good places to hide but also sources of food and spaces for nesting and reproduction.

3.3. The 5th and 6th fallow periods – “doo lax”
These periods are named by Karen people “doo lax” which means “land ready, can use it for farming”. This is because the regeneration allows the soil to become rich again, the trees are healthy and the branches and leaves grow fully along the stem of trees.
During these periods, the grass species are almost entirely gone as, in the space under the trees, light is limited. Not only grasses decrease, wildlife does too e.g. wild boars, barking deer etc. This is because the food and hiding spaces for them decrease. Animals move easily to younger fallows with thicker vegetation when the space on the ground of the 5th and 6th fallow diminishes and becomes open.

This shows that not only humans follow the rotational area for farming but animals follow it too for their survival and reproduction.

However, in this period with open spaces, there are varieties of bigger poultry that still dwell there e.g. for perching, hiding, foraging and reproduction. Other animals use those areas as well, such as rats, squirrels.

For humans, these areas still contribute to food security, as a variety of shoots (e.g. rattan shoots, bamboo shoots, loj shoots, taj duf hse shoot… etc.) and a variety of mushrooms can be harvested.

At the same time humans can more easily hunt animals dwelling in and around the trees e.g. squirrels, rats, palm civets, barking deer, wild boars and poultry. Animals are hiding in bush fallow or in younger fallow bush land, and when they are hungry they come out of their hiding place in the bush fallow land and appear in older fallow land which is more open and has more space for running and enjoying themselves.

Humans always know the time that the animals will be outside and they come and wait to hunt them easily at that time. Not only is the hunting and food security aspect a benefit during these fallows, but also the use of wood for construction and fire.

3.4. The 7th fallow and beyond
Trees in this period provide a lot of shade, and therefore exclude the animals mentioned above. While monkeys and macaque appear, wild boars and barking deer disappear, turning to younger fallows where there are soft, young grasses. From the 7th fallow onwards there are a lot of vines which can be used for many purposes e.g. herbal medicine, food for variety of animals etc.

The benefits of these fallow periods are that upon cultivation, the grass will not grow so well the first year of cultivation, meaning that the weeds of rice will be much easier to control.

3.5. Summary of the benefits of fallow land
Without fallows, animals may decrease as they will not have space for hiding and breeding and reproducing because the hunters (both human and animals) will easily hunt them. However, if they did not have fallows for dwelling, they would look for the small fallow around or near the paddy fields, but there is not enough space for them there, and it is not a good area for hiding.

Moreover, if the fallow disappears, there will not be vegetables to collect and many varieties of seeds would be lost, animals would decrease and endangered species would become extinct. As the poem of Karen communities says: “htof loo auf taz saf, pgaz k’nyau loo auf bu wa” meaning, “birds find fruits, human find white rice”. This means that humans and animals can have food – humans use Quv (the year of farming) as main food areas, whilst for animals, the fallow areas are the main food areas.
4. A study of the Hin Lad Nai falls and its benefits for people and biodiversity

4.1. Background and objective of the study
This research project starts from the needs of the core leaders of Hin Lad Nai14, who have proposed their willingness to conduct this research to respond to some questions on rotational farming, particularly on the fallow system.

This is because this area of knowledge contrasts with the mainstream ideas on the need to promote permanent land use as a good solution for farmers—a concept being strongly supported by the government and mainstream agricultural system. This is why fallow systems have become a controversial concept, particularly among forestry officers who wish to stop or shorten the fallow system of rotational farming. Their views are based on a stereotypical discourse that regards shifting cultivation as a cause of deforestation and as a system that uses large land areas in the highlands.

This controversial question posed a challenge for the people of Hin Lad Nai, who have benefited from this system for generations. They were faced by the need to study this area in order to respond to such questions as:

“What is the fallow system?” “What do fallow systems contain, e.g. wildlife, plants, etc.?” “Why have people based their livelihoods on this system?” “What benefits do they gain from this system?” “How does this system benefit biodiversity and the ecosystem?” and “How do these systems make it possible for the people to make sustainable use of their natural resources?”

4.2. Research Methodology
4.2.1. Preparation: Select theme or topic, select research team, orientation of the project, training for researchers on methodology, etc.
A research team that is comprised of a group of core leaders that includes around seven men, women, elders and youth villager researchers together with three persons from PASD15 was selected by the community. The main researchers in the research team are therefore ten persons, and they are assisted by other villagers, who are assistant researchers contributing the data or other matters in their everyday life.

Then we organized a meeting for the research team to conduct an orientation about the research project to help the researchers get a clear picture and understanding of the project, particularly of the research theme, the main questions of the research theme, why we have decided to conduct this research, and what we expect to gain from it. This also included a review of the main objectives of the research and the expectations for the research findings.

We then carried out training for the research team, based on a participatory process using brainstorming to develop the research methodology, e.g. the research questions, questionnaires, etc.

4.2.2. Review the literature related to the topic, design the matrix forms and questionnaire for data collection on the study of plants and animals in the fallow land
The literature review relates to the topics on the fallow system, picking up some of the ideas that have guided us in developing the questionnaire and so on. The design of the forms for data collection, the questionnaires, and the methodology for the survey is based on the content of the research areas and research sites we have selected. Firstly, it was based on different periods and levels as follows: the first to the second years of fallow, the 3rd to the 4th years of fallow, the fifth to the sixth years of fallow and the seventh year and up to the 12th year of fallow. Additionally, we conducted separate surveys on bamboo falls and P’dav falls for comparison with normal falls during the same periods of years.

The design of the matrix forms for the study of the falls was based on two main issues of the study. One was the study of animals in each fallow period through classifying the different types of animals in different periods. At the same time, a methodology for a survey was developed, based on the behaviour of each type of animal, on different spaces and times for each kind of animal. This was then correlated to the different fallow periods. The same was done for the study on plants in different spaces and times of fallow land and in relation to the different species of plants.

The design of the matrix forms to be relevant to the growth of plants and animals in each fallow period, the diversity of plants and animals, and also to study the beneficial and the negative impacts of plants and animals. Lastly, it was necessary to
design the study of the comparative matrix between normal fallows and the additional bamboo and P’day fallows. After that, we tested our forms and questionnaires to see whether or not they were realistic for practical use. After this test, we reviewed the forms and questionnaires and changed some points to finally arrive at the forms and questionnaires for our research team to use in the research project.

4.2.3. Design methodology for the process of implementation of the field study
4.2.3.1. Studying the plants in the fallow land
The research team identified the different fallow periods for the research sites based on the assumption that the research findings would result in good and clear results for comparing the numbers and variety of plants and animals in different fallow areas. To conduct the study on plants in the fallows, we decided to choose only 1 rai (1600 square meters) or 0.62 hectares per plot of fallow land as representative of one plot of fallow land at the study site. The 1 rai area was in the shape of a square and a rope was used to surround this square for the study of the plants.

After surrounding the square at the study site, the first researcher counts the number of each species of trees and the second researcher, an elder, identifies the name of the tree and explains what this tree is used for or what benefits it has. The third and fourth researchers take notes on the names of trees and the associated information, one person is writing down in Karen and the other is writing in Thai. The fifth researcher makes a sign on the bark of each tree to indicate that this tree has already been listed in the study. The sixth researcher takes photos of each tree and measures the size and height of trees that have been studied. All types of trees and other plants are therefore noted in the research notebook. After the survey is completed, the researcher enters all information into the matrix forms.

All sites were treated in the same way and all the information about plants in the different fallow periods was recorded in the forms for later analysis. The study also recorded additional plants, such as grass growing away from the trees and also made the observations of the colour and characteristics of the soil and the geography of the ecosystem, e.g. is the fallow near a stream or far from a river, or the slope of the land? All of this information was collected and recorded for the analytical process that followed.

Whereas the methodology for collecting data in fallow land is similar, the difference is that the second year and the third year fallows have a thicker bush. At the same time, it is also a place where dangerous animals, e.g. various species of snakes, etc. are found and it is necessary to do the work carefully. Even though great care was taken in doing the work, the researchers were almost bitten by green snakes many times, because these snakes hide among the leaves of trees and are the same colour as the leaves. Our eldest researcher needed to guide us by using his long knife to slowly open the bush and allowing others to follow by pulling up the rope for the boundary area of the survey. After that, we were able to start counting the trees, grass and bush in the area. At the same time, we also counted the animals we met during collection of the plant information. It was therefore not necessary to record these kinds of animals again during the survey on animals.

In summary, this process was a little more difficult in the 2nd and 3rd year fallows and took more time than other types of fallow period. In addition, in the personal observations by each researcher, observations were also made of the characteristics of the soil, e.g. the colour, the taste, and the
presence or otherwise of plants useful or beneficial to humans, soil and animals. For the survey in the sixth, seventh year periods and upwards, most of the process was as described above, but measuring the height of trees became a little difficult because the trees were becoming quite high and difficult to measure at this stage. We attempted to measure one tree as an average representative of all the trees in the fallow instead of measuring every tree of the same species.

4.2.3.2. Studying the animals in the fallow land
The research team identified the study sites for studying animals based on the same area of the sites for studying plants. However, to study animals it is necessary to determine larger areas since animals tend to move around from one place to another, depending on the species of animal, e.g. behaviour and season of the year, for each kind of animal. At the same time, they also move around from land that has been fallow for different periods of time. Another aspect is that different species of animals like to settle in different periods or layers of fallow. This means that the researchers needed to design the forms or questionnaires based on the real situation of these animals.

4.2.3.3. The methodology for studying birds and mammal wildlife
The researchers first designed a questionnaire as a matrix form to identify the numbers, sizes, ages, the areas where the birds and animals mostly settled and where people used to see them, as well as the largest number of animals in each fallow period, etc. The local researchers are the main persons conducting the study because they can do it in their everyday life by organizing their team to do the study in relation to the time and spaces where the animals can be observed. The forms help the researchers collect data on the different kinds of bird and mammal wildlife species.

4.2.3.4. Complementary methodology: The official animal survey
Based on the knowledge of people who know their area well, including long experience of hunting and gathering in the area, and the long cultivation of each plot of fallow land we have studied, the villagers have knowledge of the characteristics and behaviour of different species of animals, the times and seasons when they are present, how they search for food, in which areas and at what times, and so on. All this knowledge and experience has been collected to aid the design for data collection on animals.

Researchers have also officially planned to conduct a survey to cover all areas once a month to collect and compare the findings on numbers and the number of species. The method for the official survey is to walk in small groups of 2 to 3 persons per group to observe footprints, the nests, the signs of food consumption, the traps they have developed, the sound of animals, etc. Each group has instruments such as cameras, binoculars, tape recorders for use in different situations for recording the presence of the animals.

The researchers carry out the survey continually for 2 to 3 days until all the areas have been covered. Each time an official survey is conducted, the elders who used to be hunters and who know the animals and areas well, accompany the researchers to clarify all kinds of signs, sounds, and footprints etc. This helps researchers to access in-depth knowledge on the lifestyle of animals. For instance, the elders are able to look at animal footprints and know precisely the kind of animal, the number, size, time of creation of the footprint and so on. The elders also add knowledge about the behaviour, time of breeding, food foraging behaviour, inhabited areas during each season, food preferences and so on. All of this knowledge is noted down by the researchers.

4.2.3.5. Additional complementary methodologies through unofficial animal surveys
In the research, the roles and responsibilities of the researchers have been assigned based on individual expertise. For example, people who are good at and have experience in hunting volunteer to do the recording by waiting for wildlife in the spaces and times where the animals might appear – some animals appear at night, some in the early morning, some in the late daytime, some in the evening. The hunters do the
recording from one area to another based on this knowledge and experience until they have covered most of the areas necessary for the research.

The second method is that the people who are good at trapping develop a trap and collect data through the results of catching animals in the traps. The third method is to organize a research team and arrange a trip to watch animals during the nighttime and stay a night near the research site to observe, listen to the sounds, seeing animals by lighting or by shining a torch and so on. The fourth method is to collect data from neighbours who observe the animals when they walk nearby in their everyday life. This happens by informing neighbours of the survey and then the researchers follow up on their observations every few days. Alternatively, villagers can also inform the researchers when they have information, particularly hunters and people who gather forest products in the area in which the research is being conducted.

In summary, the researchers try as far as possible to create diverse methods of data collection until they believe that they have obtained sufficient data for analysis.

All data are put into a computer and organized there by classification into groups or systems to prepare for analysis.

In the participatory analysis process, elders, core leaders, women and young representatives are invited internally to participate in the analysis of the research data, and a number of academics and researchers in the area who are involved with and support the Indigenous peoples’ struggle in the area are invited externally, making a total of around thirty researchers from different knowledge systems and expertise gathering at Hin Lad Nai Village.

Findings are reported back to Hin Lad Nai Village during the monthly meetings, when more than seventy people in Hin Lad Nai participate, showing that they are happy with the findings.

The findings were presented and discussed at the “International exchange meeting for mobilisation of indigenous and local knowledge for community and ecosystem wellbeing” in Hin Lad Nai in February 2016 between communities from Thailand, Kenya, Ethiopia, Philippines and Panama. All these communities are mobilizing indigenous and local knowledge along with piloting a Multiple Evidence Base approach. This report was finalized after the exchange meeting.

4.3. Main findings and results from the study:

1. Fallow land plays an important role during 1–4 fallow years – it is very important for terrestrial animals to have space to live and breed in these fallows. If there were no fallows, what would happen to these animals?

2. As the trees in the 3rd and 4th fallow years get bigger, animals come back to hide, feed and breed again.

3. The cycle of grass species mostly end up in the 3rd and 4th year fallow period while the standing trees come up clearly in this period. This means there is a natural mechanism controlling each other to balance the ecosystem.

4. In years 5, 6, 7 and up, the fallow becomes a space for housing and breeding other varieties of vine plants and poultry. This again reflects the rights to manage the livelihoods and natural resources e.g. varieties of plants and animals to complement and control each other in a balanced and sustainable process.
5. Different perspectives on the cycle of Fallow of Rotational Farming in Hin Lad Nai Community

5.1. Interlinked beliefs and practices in the rotational farming cycle
Pgaz K’ Nyau people in Hin Lad Nai practice traditional rotational farming called “Quv”. Quv is the traditional occupation and lies at the heart of the way they manage the natural resources. The philosophy of Pgaz K’ nyau people is in this poem that says, “Auf hti k’tau hti, auf kauj k’ tauz kauj” meaning “use water care of river, use land care of forest”. The poem reflects the way of knowing of Pgaz K’Nyau – the way Karen people do the practice of rotational farming is clearly based on this philosophy of using forest with care. It is a practical process of sustainable management based on the concept of coexistence between human and nature.

A study on shifting cultivation in Thailand found that there are 4 types of practice shifting cultivation. The 1st type is short cultivation and short fallow system, the second type is short cultivation and long fallow system, the third type is long cultivation and long fallow system, the fourth type is cultivation integrated with trees in the natural forest area or agro forestry e.g. tea garden etc.17

In Hin Lad Nai, Pgaz K’ Nyau people are practicing the second type that is rotational farming based on short cultivation and long fallow that means they cultivate one year – called “Quv”- and let the area regenerate, “hsgif” (fallow) for 7–10 year.

In this study, the research team classifies fallows into 4 periods as follows, the 1st and 2nd years fallow is the first period in the study, the 3rd and 4th years fallow is the second period, the 5th and 6th years of fallow is the third period and 7thto 10th years is the fourth period of study. The studies focus on plants and animals – both domestic animals and wild animals – that are common and different in each of the four periods outlined for this study.

The details of the rotational system cycle are as follows: Before clearing the fallow, the area is referred to as “doo lax”, which means it’s a fallow that has been through a full cycle of 7–10 years and has soil good enough for cultivation. That year, the rotation farmers come and select the fallow area, called “hsgaf lauz doo lax” (survey for selecting farming plot). They perform rituals and tests based on customary laws or taboos because they believe that after letting the field regenerate as fallow, the land belongs to the spirits of the Goddess. When they need to cultivate again they need to ask permission from the Goddess. If there are any signs from Goddess – they may see or hear the sound of unlucky birds e.g. htof s’pgau, the barking sound of barking deer etc. or a nightmare about fire on the night they’re selecting the plot – all of these signs they will understand as signs of refusal by the Goddess. If there is no sign from the Goddess that she refuses e.g. they dream about flooding, or a crown of elephant etc. that means that the spirits of that fallow give the farmer the right to cultivate this year. After that, the farmers will start to clear the field and in the first day they only clear one fourth (1/4) of a quarter; on the second day, they clear 3/4 of a quarter and on the third day they clear 5/4 of a quarter 18. After the third day, they call this field “Quv” (year of cultivate field). This field now has full rights to be cultivated by this farmer.

After the harvest, at the end of the year, the farmer performs a ritual called “Kauv htauf htof” which means“ call the holy bird back to the sky”. People believe that “Quv” has a holy spirit called ‘Htof bi qaj”. This holy bird will come down to take care of Quv from planting until harvesting and the end of harvesting. People perform the “Kauv htauf htof” or ritual for “Thanksgiving” of “Htof bi qaj” and let htof bi qaj go back to the sky to take a rest there. When the new season starts, they ask her to come down to look after the farm again. After the farmer has performed the “Kauv htauf htof” they replace the calling of “Quv” (farming site) into “hsgif” (fallow) – that means this plot of farming area becomes communal land or belong to the Goddess again.

The term “hsgif” is based on the nature of regeneration of each stage of the practice, starting with the new fallow, called “Hsgifwa” (white fallow). This name comes from the colour of nature in the new fallow - people can see rice straw and white flowers in the field. After approximately 5-6 months, the field of white changes to green because some small trees

17 Kundstarter et.al. 1979
18 According to the Karen system of labour exchange, plots are divided into quarters and farmers help each other to clear fields over several days
and grass flowers become green leaves. People change the name of fallow into “hsgif bauf” (young grass fallow). The fallow is now full of young grass and new shoots emerge from the old stumps. This young fallow becomes bush fallow – full of grass and some small trees. This period is good for wildlife since there is food and they reproduce because they can hide in the thick vegetation.

5.2 Rotational and fallow field as sacred sites: Ritual for choosing a plot of fallow land to clear for a new plot for farming

Not long after the New Year Celebrations, it is time to choose a plot to clear for farming. Hif hkof (the head of the village) goes with members of each household to choose the plots from fallow land. The representative from each household takes the chicken wing bones which were kept after eating the chicken on New Year’s Day. When they arrive at the plot, a divining ritual for choosing the plot is carried out using the chicken bones. Briefly, the ritual starts with selecting a tree with fine branches and leaves and no vine growing on it. This tree is called “hsau qi htoof”, or the “chicken bone tree”. Then, two chicken bones are wrapped together in a leaf with the ends sticking out. A sapling about as thick as a wrist is then dug up, the ends are cut off and one end is sharpened. This sharpened stick is then used to dig a handful of soil out from under the “hsau qi htoof”. This handful of soil is scattered into the forest in the opposite direction to the village, while reciting a prayer. The prayer is spoken while scattering the soil. When the prayer is finished, the chicken bones are inserted into the hole and then pulled out again. Then another prayer is recited. This ritual has important meanings which are that permission is asked to use the plot from “Taj hti taj tau” (the Goddess), who is believed to be the ‘owner’ of nature, and also to ask the Taj hti taj tau and other living things to leave the plot and go elsewhere temporarily before cultivation of the field starts. Carrying out the ritual like this naturally means that there is belief in and trust for the Taj hti taj tau, and also consideration for the impacts of clearing the field on the various living things there. It is thought that this body of knowledge helps the Pgaz K’Nyau to use natural resources carefully and in a secure and sustainable way.

There are still many kinds of things to check when choosing the plot. For example, during the survey for choosing the plot, a close eye is kept on signs of taboo animals e.g. barking deer, python, htof s’ pgau (a kind of bird) etc. These signs show that the Goddess who is the owner of the area does not allow farming in that place. This indicates once again that the system and process of rotational farming is cultural-based, spirituality-based and is sacred for Karen people who practice this traditional system.

5.3 Philosophy and knowledge behind the short cultivation and long fallow system – why the fallow comes back quickly to become rich fallow land in 6–7 years.

The way of cutting a tree is very important for rotational farming. Some of the positive outcomes are based on using techniques including the following:

Firstly, cut trees and leave a long stump around one metre high in the ground. Firstly, this is a symbol of rotational farming, because Karen people believe that Htof bi qaj (the holy bird) only comes down in the service of rotational farming, where the area is full of black stumps after burning the field. That means Htof bi qaj will not come during doo cauv hsgif (This is the reaping of fallow land in the second year in the same place) as happens in the long cultivation system, when cultivation continues in the 2nd and 3rd years or in a permanent farming system such as mono-cropping.

The long cultivation system will destroy the stump and fallow will come back very slowly. Conversely, in the short cultivation system where there is one year of cultivation and then the fallow is left to regenerate again, the stump will not die but comes back with small branches sprouting around the stump.

Secondly, by keeping a long stump – it will not remove any structure of ground in the farming field because the stump is still alive. The roots of the trees will not dry, they maintain the structure of the ground in the rotational field, which means a lower risk of landslides and land erosion – a finding already proved by science from a forestry study.

Thirdly, the stump is important for a quick regeneration of fallow. Old stumps create the new generation trees very well and very quickly - this is the main reason why Karen rotational farmer keep long stumps when they slash the trees. Usually people understand slash and burn in a negative way but in rotational farming it is positive.

19 See also: the study of Somsak Suhakawong, academic on forestry, forestry department Kasetsak University Bangkok Thailand
The study on plants and animals in the different periods of fallow cycle

6.1 Observations about plants and animals in the 1st and 2nd periods of the fallow or the period of hsgifwa (white fallow) and Hsgiftajcaj (young grass fallow)

The plants which shoot in the 1st and 2nd years, are mostly the young trees that sprout from the old stump including grass and small new trees, there are around 37 species of trees sprouting e.g. hpauzkax, hsoov, seijmiz, sevdef, kloovmuj, kevpauj, tevswijswiv, sei qi, seijhplaivcaif, seijklovbo etc. Each stump gives rise to 3–5 outgrowth trees, growing as clumps of trees. There are around 9 species of plants growing from seeds. During the first year, trees reach heights of around 170 cm., the size of the trunk is about the same size as a human thumb. (see Table 1)

6.1.1. Community food and herbal medicine areas in the 1st and 2nd period

The whole diversity of plant species present can continue throughout the 1st and 2nd year e.g. chilly, eggplant, tomato, yam, taro, bean, etc. People from the community can harvest during the whole year.

During the year, in the rice field, in the process of weeding season it is prohibited to weed some herbal medicinal plants in the rice field so that they can be used in the longer term. For example qauv, soo lei bo, geijhkofo etc. – these plants still grow during the 1st and 2nd years fallow, and people continue to use them.

6.1.2. Domestic Animals

During the 1st and 2nd year of fallow, fields provide very good young grass for domestic animals, e.g. buffaloes, cows and goats etc. These animals keep on eating in these areas until the following period of the fallow. Animals go there to forage both in the 1st and 2nd year of the new fallow land. The rotational farming keeps these animals feeding on the fallow while the cycle goes on.

6.1.3. Wild life Animals

Wildlife feeding on the fallow in the 1st and 2nd year is usually composed of small species of animals that eat roots of trees and other part of trees, e.g. bamboo rat, rats, boars, wild cats, barking deer, many species of small birds. In 2nd year fallows more and bigger birds are present e.g. wild chicken, partridges, many species of birds which eat insects etc. in details can see in the table 2.

These poultry mostly appear and sing in the morning and evening time, witnessed by local researchers and villagers who were in the area on a daily basis because they worked around the research sites. They heard the sound of the singing of some of these birds, they saw some of them flying around the fallow sites, some on the branches of trees around fallows and inside the falls, and some of the birds and wild chickens flew around and their prints appeared in these falls.

Around 21 kinds of mammal appear during the 1st–2nd year fallows which are full of food for animals e.g. taro, yam, chilly, egg plants, rattan shoot, sweet potatoes, fern bunch, cassava, lemon grass, ginger, galangal, many species of vegetables, and others growing up by planting or naturally. Therefore, there are a lot of foods for both human and animals in these fallow areas. The animals mostly stay around these falls because they have enough food and varieties of food. (See Table 2)

In summary, the first and second years’ fallow is a place for grass and new shoots of trees growing up, together with small wild life animals. If we didn’t have these young falls, these plants and small wildlife animals would not have space to reproduce and live their life.

6.2. The 3rd and 4th year called “Hsgif bauf” (young trees fallow or bush fallow)

In the 3rd and 4th year fallow, higher trees cover and shade the grass, causing grass species to slowly decline. At the same time, vine species increase and expand around the higher trees, including bamboo and rattan, forming big clumps and increasing the shoots. We have found 50 species of trees in the 3–4 year fallow, that means the number of trees species are increasing in 3rd to 4th years more than grass and vines. (Table 1)

6.2.1. Community food and herbal medicines in the 3rd and 4th year fallow

Different tree species, rhizome/rootstock species and vines grow sparsely, while mushrooms grow over old logs and on the ground, under the trees. 3rd and 4th year fallows become sources of these kinds of food for the whole community (e.g. varieties of mushroom grow on old logs of P’Dav trees). Other varieties of different species of bamboo shoots, rattan shoots, sedges, flags, orchids, hemp and herbs grow and can be harvested for food and for other purposes.
During the 3rd and 4th year there are also an increasing number of plants that can be used as herbal medicines. This is because the vines increase and entwine around the bigger and higher trees. Most of these vines are medicines for different purposes e.g. yakav thrown (diabetes), t' sifsoob (good for healing the body), hpaupgaalaj (good for helping women recover after giving birth) seifphalaj, mavlahkof, hithpaivhkof etc. These are not the only medicinal plants and trees. The outgrowth of trees from the old trunks is also herbal medicines with different purposes.

6.2.2. Animals in the 3rd and 4th year fallow
We found around 23 species of mammal in the 3–4 year fallows (see tables). Half of the mammals during these periods are species of rat, mice and squirrel. The fallow is still a bush fallow and there are a lot of vines along the young trees which makes these a good place for these animals to both live and reproduce. Species of big animals such as wild boars, barking deer etc. come and stay in the 3rd and 4th fallow year. There is more space in these fallows as they become more open and clear due to the shadow of trees decreasing the growth of grass. These bigger animals move to a different place for hiding during the 1st and 2nd year.

There are around 19 species of poultry in the 3–4 year fallow. (see tables) Mostly, they are found early in the morning and in the evening by hunters and farmers who hear the sound of singing, flying around and scrabbling for food. On 3rd year fallow we can see medium-sized poultry particularly in the evening and nighttime e.g. cau t' ko, htofqaiv, htofkloz etc. In 4th year fallows, we see bigger poultry particularly in the evening, nighttime and morning e.g. saufgauz, koocovlov, (a variety of species of dov), htoflij k' luz, htoflijtaunmaij, htoflijbu, htoflijgauz, htoflijqej, dauhtoflijkaf, htofwhaklej and others.

Poultry is present in the 4th fallow because it is a suitable area to roost, with dense tree cover helping them to hide from hunters. Secondly, many of those trees blossom and bear fruit which the poultry can eat e.g. P'dav, p'dai, seifhpaubau etc. These areas are therefore not only good places to hide but are also sources of food and spaces for nesting and reproduction.

6.3. The 5th and 6th fallow land periods or “Doo yauv ploj” and “Doo loov htau”
The 5th year fallow is called “doo yauv ploj”. This means “young trees fallow”. This is not generally good for farming, but if the conditions are favourable, the land can already be used for farming. For example, the P’dav fallow is an exception because it can be used for farming earlier, as P’Dav trees grow up faster than trees in other fallows. A poem says the following:

“Doo yauv p’dav av hkof rai, loj bo n’cauv hsgif baf lai? This translates as: “P’dav fallow grow up with a line along fallow land, why you repeating farm in the old field” meaning there are a lot of good fallows that are ready to farm so why is the same field that was cultivated last year being cultivated this year. This reflects on the permanent, intensive use of land in which farming in the same place or at the same time contrasts greatly with rotational farming.

In the 6th year fallow they change the name into “Doo loov htau”. The name translates as “trees standup fallow” meaning that trees can stand up in the fallow and begin covering the grass with their shadow. Pgaz K’ Nyau people call this “hsgif” or “regeneration fallow or period of young fallow”. This is the last year, or the 6th year of fallow. After that, the fallow is named “doo” meaning “land for use or older fallow”, implying that starting from this period, the field changes from regeneration to use. This means that if the field is good enough, it is ready to be used.

These periods are named by Pgaz K’ Nyau people “doo lax” which means “land ready can use it for farming”. This Kundkunskap”is because the regeneration allows the soil to become rich again, the trees are healthy and the branches and leaves grow fully along the stem of trees.

6.3.1. Vegetation in the 5th and 6th year fallow
We have found 39 species of grass and vines in the 5–6 year fallow. (Table 1) In this fallow period both trees and vines regenerate freely, because the fallow is covered with taller trees and some of the grasses start to disappear, vines are growing up along the trees and under the shadow of trees, some species of fern, rattan, mushroom etc. are growing up, therefore, there are a lot of species of these.

During these periods the grass species are almost entirely gone, as space and light are limited under the trees. Not only grasses decrease, wildlife does too e.g. wild boars, barking deer etc. This is because the food and hiding spaces for them decrease.

6.3.2. Animals in the 5th and 6th year fallow
Animals move easily to younger fallows with thicker vegetation when the space on the ground of the 5th and 6th fallow diminishes and becomes open. This shows that not only humans follow the rotational area for farming but animals follow it for their survival and reproduction.

However, in this period with open spaces, there are varieties of bigger poultry that still dwell there e.g. for perching, hiding, foraging and reproduction. They go out to open areas from the thick younger fallow after finishing their meal, to enjoy themselves by running, breeding etc. That means there are increasing numbers of bird species because it is comfortable for birds perching, looking for food and safe to stay in these areas. Other animals such as rats and squirrels use those areas as well, while bigger animals e.g. boars and barking deer are using these areas more for harvesting food, playing around than sleeping in because these areas are too open, it is not safe enough for them.
6.3.3. The 5th and 6th year fallow importance for community food security

For humans, these areas contribute to food security, as a variety of shoots (e.g. rattan shoots, bamboo shoots, loj shoots, taj duf hse shoot... etc.) and a variety of mushrooms can be harvested. At the same time, humans can hunt because there are more open space than in younger period of fallows, thus humans can more easily hunt animals dwelling between the trees e.g. squirrels, rats, palm civets, barking deer, wild boars and poultry during the thick or younger fallows periods because even these animals hide in the darker fallow land. They also go out sometimes from their living area to look for ripe fruits to feed on.

Humans always know the time that the animals will be outside and they come and wait to hunt them easily at that time. It is not only the hunting and food security aspect that is a benefit during these fallows, but also the use of wood for construction and fire.

6.4. The “Doo pgaj” (Adult trees fallow) in 7th fallow and beyond

Trees in this period generate a lot of shade and therefore exclude the animals mentioned above. While monkeys and macaque appear, wild boars and barking deer disappear, turning to younger fallows where there are soft, young grasses and they can hide there.

From the 7th fallow there are a lot of vines which can be used for many purposes e.g. herbal medicine, food for people and also food for a variety of animals etc. The benefits of these fallow periods are that upon cultivation, the grass will not grow abundantly, meaning that the weeds of rice will be much easier to control.

“Doo pgaj of div t’k’re, taj loj bof lauz klej k’ hte” translates “still left only one adult trees fallow, repeating to preserve it through ritual activity.” This means some of “doo pgaj” or old fallows areas are preserved as forest.

6.5. Discussion on the benefits of fallow land to human and animals

Without fallows animals may decrease as they will not have space for hiding and breeding and reproducing because the hunters (both human and animals) will easily hunt them. However, if they would not have fallows for dwelling, they would look for the small fallow around or near the paddy fields, but there is not enough space for them there, and it is not a good area for hiding.

Moreover, if the fallows disappear, there will not be vegetables to collect and many varieties of seeds will be lost, animals will decrease and endangered species will become extinct. As the poem of Pgaz K’ Nyau people says: “Htof loo auf seifsaf, pgazk’nyau loo auf buwa” which translates: “Birds find fruits, human find white rice”. This poem reflects the need to have fruits for birds to survive as the space of fallow land and human need the delicious rice which comes from their rotational farming field.

There are many kinds of plants that give both flowers and fruits in fallow areas. At different times of the year, the different plants give flowers and fruits in different seasons. For example p’dav, hklej, k’ma, qauj saf, mav na saf, hkwaij hpau give flowers and fruits in the 5–6 years period – during this period there are a lot of birds and some bigger animals are harvesting from flowers and fruits from some of the plants. Therefore, the fruit trees become the main food for...
birds and mammals; animals always know when each kind of plant will give flowers or fruits, and in what season and where.

Not only animals know where to harvest flowers or fruits but humans also know where the animals are harvesting. Therefore, fallow areas become the area for hunting and gathering for the farmers. There are many ways of hunting, for bigger animals, they use the hunting call “laiz qa laj au” (by making a sound in the fallow area). This way of hunting needs a group of people to do the hunting, and is used to hunt bigger animals e.g. barking deer, and wild boar. To hunt smaller animals or birds, people use traps. There are different kinds of traps e.g. htu (log trap) for rats, sparrows, birds looking for food on the ground etc. Some of the traps use rope or string to trap animals called hsai pliz (rope trap). This kind of trap captures animals underground e.g. bamboo rat, guinea pig etc. Some farmers not only use traps but also use the hunting call laiz hkaav taz saf (watching for the fruits) that means when the people know where fruit trees are harvested by animals, people just go there and wait for animals who come looking for fruit.

This shows that fallow land creates a lot of food for both animals and humans, and it also highlights another aspect of the relationship between nature and humans e.g. trees animals and humans depend on each other for food. This is another benefit of fallow areas and also shows that fallow regenerates through a natural process and that this process creates mutual benefits.

Farmers also benefit from plants in fallow areas. During different period of fallow, people benefit from plants in different ways. During the younger fallow, farmers mostly gather the variety of vegetables from the bush fallow e.g. kauz hkaf kau la (small egg plants), nyaf lij dauv, etc. In the 3–6 year period, farmers mostly gather shoots of plants e.g. loj shoot, rattan shoots, bamboo shoots etc. as well as varieties of mushrooms. This also shows that fallow areas are like supermarkets for farmers in the community – they can harvest the products in fallow lands at different times, for different kinds of vegetables. Fallows are a source of food and wood. Farmers collect dry trees for firewood from fallows and when they need some small trees to make a fence, to build huts, they can also pick up the young trees from fallow land.

Last but not least, fallow is the area for raising domestic animals. Cows and buffaloes are always there for grazing in the grass areas, particularly during the young bush fallow period – animals move back to young fallow land for their food every year. This shows many kinds of benefits from fallow areas. Farmers create their food centre through the fallow land – the fallow is not only for the purpose of creating a farming area for the new cycle of rotational farming but through the fallow process fallow land becomes a food centre for animals and humans. Through this natural process, the knowledge of the rotational farmers who know and are known by nature emerges.

6.6 Additional event: Appearance of Bengal Tiger in Hin Lad Nai.
A Bengal tiger came through Hin Lad Nai village in August 2015. The tiger killed one bull, 2 wild boars and one barking deer, and was observed by the villagers.

At that time, fewer people were hunting and gathering in the forest, because they were scared of the tiger. This had a positive impact on the ecology because the wild life increased and ecology was richer because people left it alone for a while. Normally, people believe that the Bengal tigers are the goddess of the forest and mountain. When they appear, people believe that it is their goddess, the owners of nature who come to take care of their nature.

This is a warning to people to carefully follow their customary rules in relation to nature. This means balancing the use and nurturing of nature. Consequently, the daily farming life will not be disturbed by the goddess – this work can be done as usual. Moreover, people believe that the appearance of the goddess will bring them good crops and good yields, instead of being afraid of the Goddess.
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Grasses and bush Trees
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**Grasses and bush**  **Trees**
MULTIPLE EVIDENCE BASE APPROACH

Photo credit: Prasit Siri
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<th>Species name in Karen</th>
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MULTIPLE EVIDENCE BASE APPROACH

Photo credit: Prasit Siri
7. Knowledge about fallow land expressed through hta

People always see fallow land as the space of remembering and memory when people miss each other. Fallow land represents the feeling of love, people recall the place they used to work together, talk to each other, and smile at each other etc. the example of hta as follows:

“N’mei yuj yaz kwaj seif klauz, seif klauz cau cu lauj of htau” translates
(Whenever you miss me, look at the pruned trees, they are the mark of the work of my hand).

As we walk we see a wood pigeon that was feeding in the swidden fly off, and so they say the hta: “N’mei yuj yaz laij soo gwu, cau av k’laz htof lwij bu”.
(Whenever you miss me, go to the swidden field and you will see the wood pigeon who is my spirit.)

When we gather hauf wau (red basin), they say another hta: “N’mei yuj yaz kwaj hauf wau, kwaj le hauf wau av laf bau”.
(Whenever you miss me look at the haufwau, look at the yellow haufwau leaves (I once picked).

This expresses the fact that in the fallow there is still a lot of food, and even if mother does not take a packed lunch of rice with her, she can still rely on the food in the fallow to ease her hunger. Thus, it is very difficult to guess when a person who goes to a fallow without a packed lunch will be back.

“Laiz hsgif pooz t’geiz, seif si seif dauv caj htau keiz”
(If you go to the fallow, do not cry, the tree stumps will put out new shoots and sprigs).

“Pauz lauz kwei kwei hsaf le moo, seif kwaiv coj htau gauz hsgif pooz”
[The light shining from a star illuminates the seif kwaiv coj (name of tree) and the coxcomb in the fallow too].

These hta express a connection between the love and attachment the people have for nature in the fallows land and the relationship between people. It is a relationship that induces people to love the swiddens and the fallows that are resting, to love the various kinds of food in the swidden, to love the forest, to love the natural surroundings, and this makes people want to care for these things and have them exist sustainably.

Another kind of hta expresses the regrowth of fallow as follows: “Laiz le hsgif pooshauf t’geiz, seif si seif dauv caj htau keiz”
(If you go to the fallow, do not cry, the tree stumps will put out new shoots and sprigs).

“Laiz le hsgif pooz hauf wau htau gauz laf qei, kwaj n’mawx sav of neij keiz”
(Going to the fallow I see the red coxcomb flowers, it is like returning to see the face of the one I love.)

7.1. Fallow as a space of deeply embedded memories

The relationship of humans to fallow spaces and their ecosystem is tied to the lifestyle of the rotational farming process which carries value in the form of memory – the memory of the human links to their own fallow land, as a space of human to human connections, as a deep memory held in their heart – and therefore, the memory of the land that provides them is a recurring image created and expressed through hta story telling that recalls the good feeling about their fallow land, the beautiful feeling about their fallow land.

The hta is the memory of people about their fallow land through the romantic feeling of young people to each other. The imagination of fallows through hta is a space of memory about relationships between people as they work side by side, sharing labour, close relationships, experiences of relationships. All of these are carried as memories through
**MULTIPLE EVIDENCE BASE APPROACH**

bta which express all kinds of feelings – love, closeness to each other, missing each other. The following are some examples of the romantic feelings expressed through these bta of fallows:

“laiz hav le doo s’ yuj pooz s’ yuj y’ hswai bskauf t’ boov” means “Come back to space of miss fallows land, I really miss you until I can’t move my leg for walk”

“laiz hav le doo lauj trauj pe, s’ yuj seif klaw kaj t’ qez” means “come back to fallows land, miss the print of cutting down the branch of trees”

“ laiz baf hpau av lauj av klai, s’ yuj le hpauk’caj hai” means “come back to the place you use to being there, really miss you until see the hallucination you be here”

These are just a few examples of bta that express fallow land as the imagination space – there are hundreds of bta on this area. For Karen people fallow land is a space of happiness, a symbol of a happy life. Karen people prioritize rotational farming and the fallows system as a symbol of happiness in life, because this system always focuses on the communal relationship of labour, the role of relationships throughout the whole process.

### 7.2. Karen beliefs and cosmovision

“Paauz lauz kwei kwei hsaif le moo, seif kwaiw coj hpau gauz bsqif pooz”

“The light shining from a star illuminates the young leaves of seif kwaiv coj (name of tree) and the coxcomb young soft leaves in the fallow” – as proof that new leaves always come back in the young fallow.

Even the star in the sky still dares to be evidence that using natural resources in this way causes new life to arise, and brings about security and real sustainability. Karen people believe that some well known stars used to be human beings. When they died, these humans became stars in the sky. The Karen believe that some stars are their concerned and caring ancestors, watching their children working in the field, particularly in rotational fields. That is why new leaves sprouting from the stump are watched by the ancestor star – when the new leaves and branches come out, it is a guarantee for them that fallow land still regenerates and rotational farming still continues and their children who are farmers still continue living their life based on this traditional heritage system; that their ecosystem is being managed sustainably and can be used in the long term.

Another interpretation of the stars and sky, at this time of climate change, comes from a well-known forestry academic, Dr Somsak Sukhawong who tells that fallow land has a green colour when compared with permanent land in a mono cropping system that becomes grey or brown during the dry season. The reason why the colour green is important to this earth, says Dr Somsak Sukhawong, is that when the sun shines on green earth, it reflects back with cool weather, while when it reflects grey or brown from the earth, it becomes warm weather. This is one of the important aspects of the fallow system – during 1 – 10 years period, they always give green colour to this earth. The elders reflect this bta in the relationship between earth and stars and sky – that when the field goes from a period of cultivation to becoming fallow, the stumps of trees and bamboo come back to life and put out new shoots and sprigs all over the fallow and the green fallow impacts the whole cosmos, even stars and the sky see the positive impacts from this cycle of fallow system.

The research findings align with the knowledge of Karen elders, who understand the relationship between this earth and the whole cosmos of sky and this green earth and express their knowledge through bta. The bta tells of the cycle of regeneration in the fallow that comes from the sun shining light on the green fallow and the coolness reflected back to the sky and stars in this cosmos.
8. Discussion, conclusions and recommendations

8.1. To answer the question “What is fallow system?”
Fallow is a space for agriculture, that people use to regenerate in between cultivation seasons. After a season or a year of cultivation by a family, as farming land, called Quv (year of farming) they let the land regenerate naturally for at least 5 years but normally between 7–10 years. It is a natural management process but this concept may become a controversial concept for people using a modern agriculture system based on the practice of permanent land use.

Based on the belief of the Karen, when land becomes fallow, it is immediately common land, meaning that is it owned by the community and no longer by the individual, as the land called Quv. After the harvest and the performance of the ritual “kauv htau htof” (call the spirit of rice back to sky), this land is then called hsgif (fallow) – this means that the fallow land is owned by the spirit, and no longer by a human being – the same idea as communal land ownership. The land is now taken care of by the community or by the spirit – a symbol of communality - until the next farming cycle.

The land comes under individual ownership again when the family performs rituals to ask the spirit of farming for the fallow land. If they get the sign of the green light, the people will come and start cutting the trees and prepare the field for farming. On the third day of slashing the field, the owner can call the land “Quv” again and full ownership rights are restored to the family from that day on.

This implies that the management of rotational farming and their fallow land is strongly based on spirituality – every step is based on sacred rituals and beliefs that are performed at every step. In this way, people are deeply bound to this system because it is a fundamental part in the life of the people who use this farming system. Therefore, rotational farming is not only an agricultural farming system but also a cultural and spiritual system.

8.2. Karen traditional knowledge and the sustainable management of the land and ecosystem
The main philosophy behind the traditional agriculture and ecosystem management for Karen elders is how to manage natural resources in the long term for their children. This is the main reason for managing natural resources in a sustainable way and it extends to conservation, and hunting and gathering. For example, they use appropriate local instruments and methods that are strongly based on a self-sufficient way of living that sustains nature and humans at the same time. This kind of knowledge has been collected over a long period of time. First, these kinds of knowledges begin with a process of trial and error and after that, the knowledge is put to practice and through learning, it develops into knowledge for managing natural resources in a sustainable way and is transferred from generation to generation. Based on rich knowledge of agriculture and ecology management, they develop a system of rotational farming which is based on a “short cultivation and long fallow” system. This means the field is cultivated for one year (which Karen call “Quv”) after which the fallow regenerates in 7–10 years or at least 5–7 years (called “Hsgipooz” by Karen).

Rotation farmers are also farming with the surrounding wild life in mind. The elders always tell their children not to collect everything in the field, that some should be left for animals, birds and others because they believe that biodiversity of animals and plants are important – that humans, animals and plants need to live together on the land. The land is not only for humans but animals and plants need to stay together in this space in harmony – they depend on each other. Without plants and wildlife, humans cannot survive on earth. This concept is expressed through hta (songs /poem story telling) about the feelings of animals and plants. There is a story about a small bird called “Htof hpgiv” this is trying to restore a species of rice that humans have lost because they prioritise money, but of course, they cannot eat money. The humans depend on this bird to help them bring back the rice species so that they can grow it again and that is how we have rice to eat now. Therefore, during the harvest, people let these birds eat rice freely, without disturbing them. This shows that the elders teach sharing the products with the animals around the rice field, both for their survival and, to stay in harmony with human beings in the same ecosystem.

A Karen Poem says that through the sound of the wood pigeon “s’ku kru ku, cei pgaiz kuv bu t’ pgaiz kuv” this translates as “S’ ku kru (sound of a wood pigeon) money full of basket but rice not full basket” meaning “even if you have lots of money but you need rice to eat, you can’t compare the values or cost with money because money never helps you to full your stomach but rice does”.

We can conclude that the system of rotational farming not only responds to the needs of human beings to cultivate their products, but also responds to the needs of the diverse ecosystem, both in “Quv” (field during farming year) and “Hsgipooz” (fallow period cycle). This results in a fallow system that sustains animals and plants in the big forest area. In reality, there are many species of plants and animals that cannot survive or reproduce in the big forest area but need the space that bush fallow provides in order to survive. The
elders understand and know about this and that is why they choose this system to survive and create space for animals and plants to reproduce through the fallow system.

We have found that many wildlife species and even some plants species can’t survive in big forests and without the fallow system, many species cannot thrive and eventually become extinct. That means the fallow system supports many endangered species. In this way too, the rotational system is not only appropriate for humans who settle in the forest, but also supports biodiversity of animal and plant species. This is the knowledge of Karen elders to take care of their ecology in a sustainable way through the system of rotational farming.

Another aspect that the fallow fulfills is giving the space for animals that need both forest areas and bush fallow areas for their full lifecycle. Many western scientists believe that wildlife can survive in big forests but this study shows that animals need other spaces, particularly bush fallow areas, to survive and reproduce. It is thanks to rotational farmers that these refuges for wildlife, particularly endangered species, exist.

### 8.3. Soil generation in fallow land

The fallow system helps regenerate the soil – fields have rich soil again because fertilizer is not used during the farming year. Both animals and plants play an important role in the process of soil recovery. Firstly, different generations of grass, bush and trees help fertilize the soil during the 5–7 years fallows - both leaves and fruits help to fertilize the soil, particularly the P'dav and others, fertilise the soil. The dung and movement of the different animals in different periods of fallow fertilise the soil or field, regenerating it so that becomes rich again and is ready for new cultivation. Farmers classify the good field or poor field indicators e.g. if there are a lot P’dav and bamboo trees, this means that it’s a rich area to farm that year. P’dav and bamboo fallows fertilise the soil well and can lead to shorter fallow periods which presents a challenge because farmers can reduce some of the fallow land in order to increase productivity, if needed. In the future it might be necessary to shorten the fallow period due to bigger families or an increase in households in Hin Lad Nai and the need to farm more plots each year. This is a reason for looking for a new solution for the future, when the situation calls for it.

### 8.4. Discussion related to diversity in rotational farming practices.

There is discussion between rotation farmers about cultivation methods and how to use and manage land in a sustainable way, also between different rotational systems. There is the short cultivation and long fallow system and the long cultivation and long fallow system. Karen farmers in
Thailand are using the short cultivation and long fallow system, as described by the Hin Lad Nai Farmers Research Team in this study.

Useful lessons will emerge about learning to rethink and adapt the system of rotational farming in a way that has the best impacts on aspects of the ecology: the commons and different periods of the fallow cycle; the impact on soil erosion; the change of soil structure; long term sustainability of the ecosystem and adaptation in a dynamic way and, and the food and other products for human livelihood and wellbeing from the rotational farming system.

This research about the deep knowledge of Karen elders on managing the short cultivation and long fallow system, or rotational farming and fallow management system, shows that it incorporates all aspects of managing the whole ecosystem in a sustainable way. This supports the call to scientists and governments to develop a trans-disciplinary approach, along the visions of the Multiple Evidence Base approach, to connect across knowledge systems on equal terms, based on respect and reciprocity and usefulness for all involved, for creating synergies of the investigations. It is important to recognize and understand the deep knowledge of indigenous elders about land and ecosystem management. This could contribute to enhanced policy development and decision-making at local, national and international level, such as in IPBES, CBD and other similar processes that relates to governance and management of biodiversity and ecosystems.

Lastly, farmers from Hin Lad Nai propose more in depth transdisciplinary studies, that includes the mobilisation of indigenous and local knowledge on equal level to science, about rotational farming such as the seven years of fallow followed by cultivation as well as the P’dav fallow.
**About the report**
This report presents the outcomes of a collaborative partnership between Pgakenyaw Association for Sustainable Development, Thailand and SwedBio for piloting a Multiple Evidence Base approach to co-generate knowledge and methods for mutual learning across knowledge systems.

Hin Lad Nai community has regenerated forests destroyed through logging and revived biodiversity through practising their rotational farming system developed by the Karen people. This pilot project was designed and implemented by the community as part of their ongoing systematic work to document and create opportunities for learning about Karen natural resource management which is shaped by their cosmology, knowledge and practices. The aim is to make fully visible its contribution to biodiversity conservation and sustainable use, as a base for enhanced policy development and decision-making at local, national and international levels.

**PASD**
PASD aims at creating networks among indigenous peoples on the issues of rotational farming and natural resource management and to establish education systems and an official curriculum for the indigenous peoples, which integrate the local knowledge.

Another aim is to promote the Karen traditional agroforestry methods – both the technical and cultural dimensions – in a mutually beneficial relationship with forest biodiversity and food security.

**Swedbio**
SwedBio is a knowledge interface at Stockholm Resilience Centre contributing to poverty alleviation, equity, sustainable livelihoods and social-ecological systems rich in biodiversity that persist, adapt and transform under global change such as climate change. SwedBio enables knowledge generation, dialogue and exchange between practitioners, policy makers and scientists for development and implementation of policies and methods at multiple scales.

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