

Assessment of the Requirements of Natural Resources Using the Community Around Khow Noi-Khow Pradoo Non-Hunting Area of Pisanulok Province, Thailand

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Abstract

This study aimed to assess natural resource needs in the Khow Noi-Khow Pradoo non-hunting area (KNKPNHA) to understand the importance of using these natural resources. The assessment was based on local resource funds combined with the quality standards set by environmental agencies. The methodology involved collecting data through group interviews with academics and local stakeholders, along with individual interviews with villagers living in communities around KNKPNHA. Semi-structured interviews, check-lists, questionnaires, and the analysis of conceptual framing were used. KNKPNHA covers an area of 13516.8 hectares. The main land cover types in the area are mixed deciduous forest (major) and deciduous forest (minor). The primary occupation of villagers in KNKPNHA is the collection of wild edible plants from the forest, and is the next most important occupation is tourist services. The villagers can be classified into three categories: (1) those who hold land and utilize the forest; (2) distant has influence on understanding of space application regulations and services; and (3) those whose household income is related to their condition. It was found that villagers in KNKPNHA rely on wild edible plants from the forest. However, the results of the study show that perceptions of the importance of collecting fuel and herbal medicine from the forest is decreasing. Future research should investigate resource use behavior, including conservation management, with the participation of locals in the KNKPNHA and help communities to monitor and safeguard resources alongside government personnel.

Keywords: Natural Resources, Resources Requirements, Needs Assessment, Participation Management, Khow Noi-Khow Pradoo Non-Hunting Area.

INTRODUCTION

In 2021 the United Nations Framework Convention on Climate Change Conference of the Parties (UNFCCC COP), or COP26, was held in Glasgow, Scotland, in the United Kingdom. At the meeting, the Prime Minister of Thailand set out the country's Nationally Appropriate Mitigation Actions (NAMA), under the United Nations Framework Convention on Climate Change. Thailand reduced greenhouse gas emissions in the energy and transport sectors by at least 7% in 2020, and reduced overall greenhouse gas emissions by 17% in 2019, more than twice the set target. Thailand was also one of the first countries to submit a Nationally Determined Contribution (NDC) to the UNFCCC, and also submitted a long-term strategy for low-emission development to UNFCCC, including various plans at both national and local levels (Thai Government, 2021).

Since the community level is where the smallest and most challenging fire extinguishers are located, especially in rural towns, it is necessary to work at several levels of government to fulfill the specified goals. This is because communities are the geographical units that are closest to natural resources and both directly and indirectly utilize them. The effect of this on the local environment is connected to how these resources are used. However, if people do not use these resources their value will depreciate and they will deteriorate; as a result, villagers do not perceive the importance of natural resources and they will not be conserved. This is particularly true for

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those natural resources that are connected to or related to the economic circumstances of the community's residents (Bennett, 1981; Schellens & Gisladdottir, 2018; Kroeksakul et al., 2020).

Planning is necessary for the management of resources and the environment. Especially in communities that are on the border between conservation areas and usage areas for people in the community, it is important to understand community dynamics in order to maintain an awareness of the situation and conditions of resource utilization as well as needs within the community, because when people benefit from these resources and the areas are protected while understanding people's lifestyles, they can adjust their management of the resources accordingly. Local communities and government agencies at the operational level can develop effective resource management methods and improve the quality of the environment (Srichaiwong & Kroeksakul, 2019).

Environmental quality assessment involves the use of surveys and/or indicators of whether the environment in an area is of high quality or not. The results of these assessments are essential for development: they inform the management and planning of conservation or utilization activities. Environmental quality assessments thus need to be clearly framed to facilitate analysis (Li, 2014), and the frameworks of such assessments must be linked to the social aspects of the environment, i.e., the physical, legal, social and economic aspects of the environment (Cheadle, et al. 1992). However, people's perceptions of environmental quality, when considering these indicators, are mainly limited to emotion and information (Kroeksakul et al., 2020). Therefore, assessment based on local resource funds, combined with the quality standards set by environmental agencies, is crucial for environmental management within the community; when combined with the assessment of needs, environmental assessments can inform an understanding of the importance of using these natural resources (Jacobson, 1995), and can be used to plan appropriate development (Madu, 1996). Therefore, such development will take place under conditions of cooperation rather than conflict because the process of creating plans and/or development guidelines will be genuinely based on the needs of the people in the community.

This study focused on communities in the Khao Noi-Khao Pradu non-hunting area (KNKPNHA) in Phitsanulok province, Thailand. The role of the non-hunting zone is to protect wild animals in the area and to maintain and restore natural conditions that are conducive to the livelihood of wild animals. This also means that people can benefit sustainably from the conservation of wildlife and ecosystems in the area. However, the above perspective highlights the need to develop guidelines to improve the quality of life of people in protected areas, including creating opportunities for the development of bio-circular-green (BCG) economic models within the framework of natural resources. This relates to the 13th National Economic and Social Development Plan, which is intended to facilitate a sustainable way of life within the framework of a circular economy and a low-carbon society.

Framework of the study; This study examines villagers' perception of the quality of their environment and their need to utilize natural resources in KNKPNHA. The context of these communities has changed significantly, and the importance of communities' use of forests has decreased (Kroeksakul et al., 2018; Shahi et al., 2022). Rather than direct uses such as natural food sources, energy sources, or income sources, forests are increasingly being used indirectly, for example to purify air, mitigate global warming, etc. (Robson et al., 2020; Mendako et al., 2022). However, many factors are involved in the utilization of forests, such as the logistical and economic status of households (Birben, 2020; Karki & Poudyal, 2021). In this study, environmental quality is assessed by examining KNKPNHA communities' perceptions of the utilization and quality of natural resources, villagers' need to use natural resources in the area, and villagers' need to manage the non-hunting area collectively. The framework of this study is presented in Figure 1.

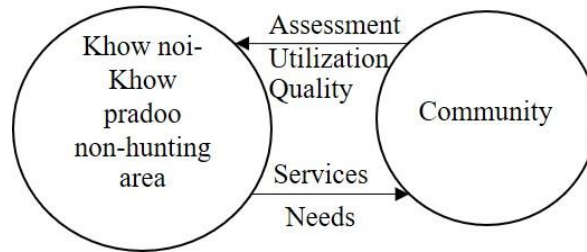


Figure 1. Conceptual framework of this study.

MATERIALS AND METHODS

Study site

The KNKPNHA site is in Ban Yang sub-district, Wat Bot district, Phitsanulok province, in Zone 47 of the Universal Transverse Mercator (UTM) coordinate system at 654538.82 N, 1882620.44 E (Figure 2). The KNKPNHA covers an area of 13516.8 hectares; its northern boundary is shared with the Kansong sub-district of Wat Bot district; the southern boundary is shared with the Wang Nok Nang-ant sub-district of Wangthong district, Phitsanulok province; the eastern boundary is shared with the Klang sub-district of Wangthong district, Phitsanulok province; and the western boundary is shared with the Ban Ban Yang sub-district of Wat Bot district, Phitsanulok province. The area around the KNKPNHA contains agricultural areas which produce rice, cassava, and sugar cane, and there are many villages in the non-hunting area.

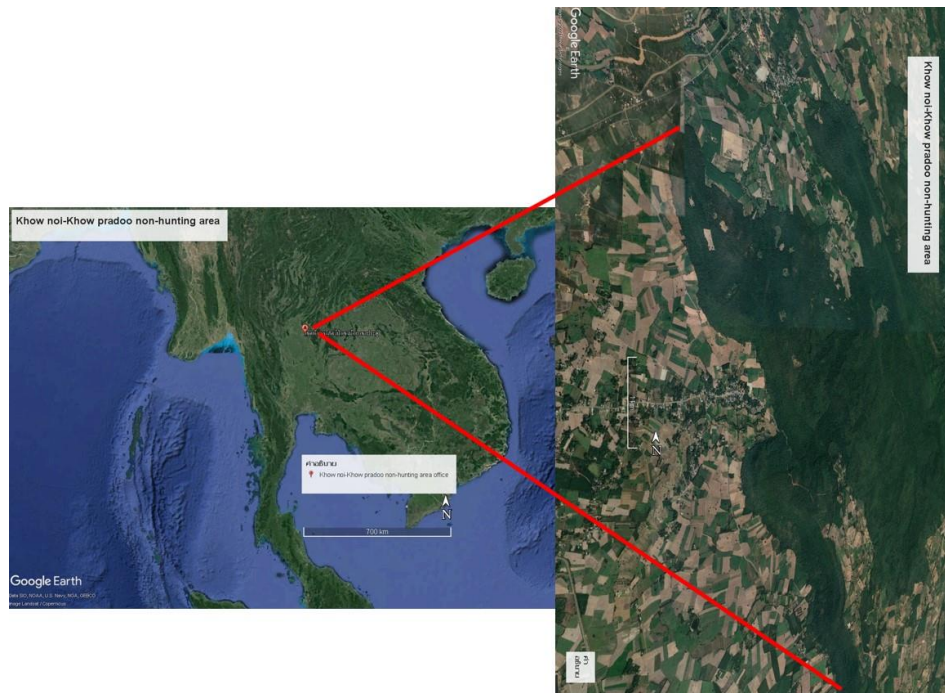


Figure 2. Study site.

Samples and Data Collection

Data were collected using the following methods.

Group Interviews: participants in the discussion included one sub-district headman, 10 village headmen, three key informants with experience of forest utilization around the KNKPNHA, three KNKPNHA officers, and three academics specializing in biology and the management of eco-tourism.

200 Families Participated in Private Interviews; the inclusion criteria were distance from the family home to the KNKPNHA area, awareness of the potential uses of the forest, permanent residence as a household, ease of conversation, and willingness to converse with the researchers.

Household Profile: The interviewees were, on average, 48 (± 15.1) years old. 42% of interviewees were male, and 58% were female. Households averaged 3.08 people per household. Household members were classified in age groups: 0-8, 9-17, 18-60 or over 60 years old (3.9%, 12.9%, 16.9% and 66.3% of interviewees, respectively).

Household Economics: In descending order of prevalence, villagers in the KNKPNHA are employed in agriculture, employ non-agricultural workers, work in commerce, employ agriculture workers, work in the service sector, or are government officers (46% > 28% > 11% > 7% > 6% > 3%, respectively). The highest average income is earned by government officers at 158,000 baht/year (about 4,389 USD, at approximately 1 USD = 36 baht), and the lowest average income is earned by villagers employed in agriculture at about 50,692 baht/year. Villagers working in agriculture, along with agricultural employers, are the most active in these communities. The economic properties of households are presented in Table 1.

Agricultural Land Holdings of Household: The survey classified types of agricultural fields as producing rice, sugarcane, cassava or “other”. Almost 44% of households have no rice paddy field, and 22% own a paddy field of 1-5 rai in size (“rai” is a Thai unit of area: 1 rai = 0.16 hectare). None of the surveyed households had sugarcane fields. However, 44 households owned cassava fields of between 1 and 5 rai in size, and 24 households owned cassava fields of over 10 rai in size. Household agricultural land ownership is presented in Table 2.

Tools Used to Collect Data

Data collection instruments used in this study included semi-structured interviews (SSI) (Simaraks & Suphatera, 1987), topic-based group interviews, and plant check-list inventories.

A questionnaire was also used to collect data. The questionnaire was designed on the basis of data collected through group interviews and a literature review and sent to experts for inspection before being used for data collection.

Data Analysis

When the researcher gathered information through fieldwork or pre-analyzed data from interviewees for cross-checking, if the information was insufficient or contradictory interviews were repeated before drawing any conclusions from the data. The researcher split the data into categories according to subject and then used the triangulation technique to evaluate the data against a literature review. The descriptive statistical data gathered using the was analyzed to determine relationships, factors and needs. This analysis was conducted using Statistical Package for Social Science (SPSS) software (v. 22).

Table1. Economic properties of sampled households.

Occupation	No. of HH	No. workers	Average number of workers per HH	Average Income (baht/year)	Range of income	SD	SIR	Average income (baht/head/year)
Agriculture	124	238	1.9	106758	17000 0	4561 5	100: 0	55621.85
Employer in agricultural sector	19	26	1.4	69368	17400 0	4298 2	100: 0	50692.3
Employer in non-agricultural sectors	75	110	1.5	124000	16000 0	4575 2	32:6 8	84545.45
Commerce	30	42	1.4	136133	25000 0	6158 9	70:3 0	97238.1
Services	15	36	2.4	140000	17000 0	5921 7	40:6 0	58333.33

Government officer	8	10	1.25	197500	28000 0	1175 53	25:7 5	158000
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Note: 1 rai = 0.16 hectare

RESULTS AND DISCUSSION

Context of the KNKPNHA

The KNKPNHA was established on May 28, 1998, and has a mission to protect wildlife and wildlife habitats, whether or not the wildlife is legally protected. The KNKPNHA covers land in seven sub-districts of three districts: Kun Song, Hinlad, and Banyang sub-districts of Wat Bot district; Chaisanam, Wang Nokant, and Banklang sub-districts of Wangtong district; and Dontong sub-district of Maung district. These districts and sub-districts are all in Phisanulok province. The temperature of KNKPNHA between 2011-2020 averaged 27 degrees Celsius, and average rainfall is 1300 - 1400 mm/year, with an average of 104 days of rainfall per year. The KNKPNHA ranges from 100 to 500 meters above sea level, and the soil parent materials are sedimentary rock and Quaternary sediments. The forests in the KNKPNHA are classified as mixed deciduous forest (about 118.22 km²) and dry dipterocarp forest (about 14.79 km²). The wildlife found in the KNKPNHA is summarized in Table 3.

Table 3. Wildlife in the KNKPNHA.

Class	Order	Family	Genus	Species
Mammals	6	13	23	24
Birds	19	51	89	113
Reptiles	2	14	31	38
Amphibians	1	5	8	11
Fresh water fish				22
Invertebrates				
- Crabs (forest and water)				3
- Insects				61

Source: KNKPNHA office, 2023

The Quality of Natural Resources in The KNKPNHA According to Villagers

Information from group interviews about perceptions of the environment quality of the KNKPNHA indicates that the environmental quality issue which has the greatest effect on the quality of life of villagers in KNKPNHA is the smoke generated by forest fires both inside and outside the area. This is a seasonal problem and is most prevalent from around March to early May.

The information on the forest and natural resources in KNKPNHA gathered through the group interviews indicate that the environment is of good quality. Villagers collect wild food seasonally, including *Melientha suavis* (the local name is *phakwān pā*), *Curcuma sessilis* (the local name is *dok kajiew*), bamboo shoots, egg plants, and others. Plant biodiversity is an indicator of environmental health. In the group interview, the KNKPNHA officers classified forests as either mixed deciduous or deciduous.

Mixed Deciduous Forest: Major species include *Xylia xylocarpa* (Roxb.) W.Theob., *Terminalia corticosa* Pierre ex Craib & Hutch., *T. bellirica* (Gaertn.) Roxb., *T. phillyreifolia* (Van Heurck & Müll.Arg.) Gere & Boatwr., *Lagerstroemia venusta* Wall. ex C.B.Clarke, *Dalbergia cana* Graham ex Kurz, *D. oliveri* Gamble ex Prain, *Schleichera oleosa* (Lour.) Merr., etc.

Forest floor cover plants include *Casearia flexula* Ridl., *Cratoxylum formosum* (Jack) Benth. & Hook.f. ex Dyer, *Clerodendrum infortunatum* L., *Vitex scabra* Wall. ex Schauer, *Hibiscus glanduliferus* Craib, *Azanza lampas* (Cav.) Alef., *Ficus hispida* L.f., *Catunaregam spathulifolia* Tirveng., *Meyna pubescens* (Kurz) Robyns, etc.

Deciduous forest: Major species include *Shorea obtusa* Wall. ex Blume, *Pentacme siamensis* (Miq.) Kurz, *Dipterocarpus obtusifolius* Teijsm. ex Miq., *D. tuberculatus* Roxb., *Canarium subulatum* Guillaumin, *Buchanania glabra* Wall. ex Engl., *Lanea coromandelica* (Houtt.) Merr., *Spondias pinnata* (L.f.) Kurz, *Milusa velutina* (DC.) Hook.f. & Thomson, *Holarrhena pubescens* Wall. ex G.Don, *Wrightia arborea* (Dennst.) Mabb.,

Heterophragma sulfureum Kurz, *Fernandoa adenophylla* (Wall. ex G.Don) Steenis, *Bombax anceps* Pierre, *Schrebera swietenoides* Roxb., *Garuga pinnata* Roxb., *Cassia fistula* L., etc.

Forest floor cover plants include *Vietnamosasa ciliata* (A.Camus) T.Q.Nguyen, *V. pusilla* (A.Chev. & A.Camus) T.Q.Nguyen, *Imperata cylindrica* (L.) Raeusch., *Themeda triandra* Forssk., etc.

Forest distribution in the KNKPNHA is presented in Figure 3. Almost all villagers collect wild food at the border between the KNKPNHA and villages or fields, and some villagers enter the KNKPNHA to collect wild food. It is necessary to study the utilization of resources like wild food and fuel to assess the quality of environmental resources (Brown et al., 2011), because villagers will evaluate the quality of natural resources based on their feelings and opinions about using the, (Rantala & German, 2013). This may include replanting or restoring the resources (Cao et al., 2023).

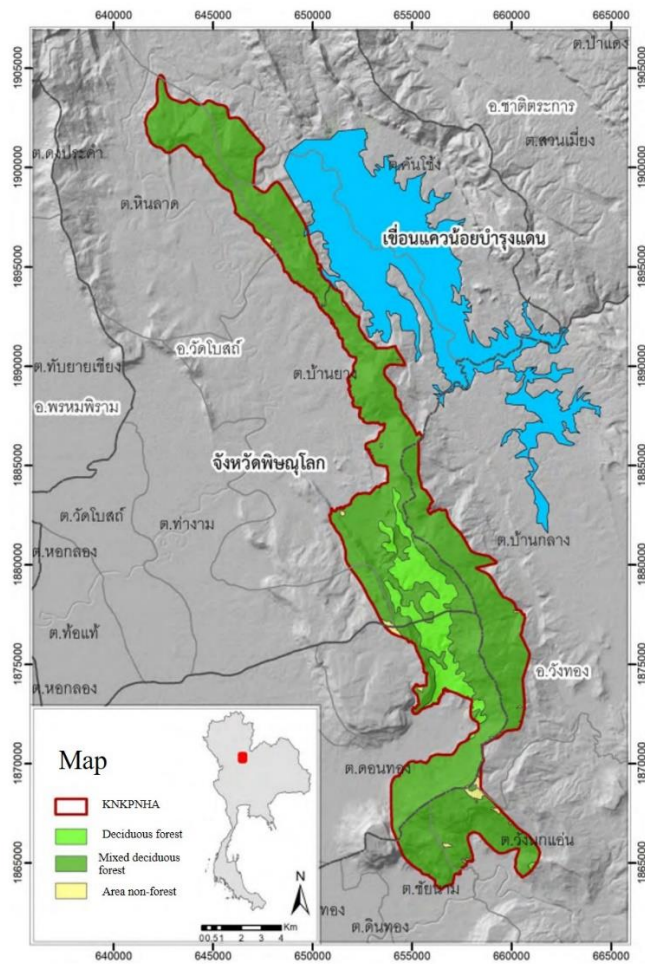


Figure 3. Mapping forest distribution in the KNKPNHA

(Source: KNKPNHA office, 2023)

The Objectives of Villagers' Use of Natural Resources in The Knkpnha

The survey data indicate that 61% of sampled villagers collected wild edible plants in the KNKPNHA. The survey shows that villagers use the KNKPNHA, in descending order, for purposes of wild edible plant collection, tourism, hunting wild animals for food, learning, and conducting seminars (61%, 48%, 15%, 11%, and 2%, respectively, of the surveyed villagers; see Table 4). However, villagers do not utilize the KNKPNHA

to collect wood for fuel, because (as the information gathered in the group interviews shows) at present almost all villagers use a gas stove in their household because these are easy to use and produce no smoke, although some households use firewood because they have easy access to timber in their area. Although medicinal herbs were considered, at present people do not often collect medicinal herbs because in the communities are close to a hospital and a clinic; thus, medicinal herbs were not included in the questionnaire.

The availability of wild food is a major reason for communities settling near forests (Ishiguro, 2018). The types of food found in forests can be classified into two group: (1) edible plants, including nuts and weeds; and (2) edible animals (Jendresen & Rasmussen, 2022). However, the regulations of the KNKPNHA strictly prohibit hunting.

Table 4. The objective of villagers’ use of natural resources in the KNKPNHA.

- Item	- Percentage			- Ranking
	- Yes	- No	- Total	
- Wild food (plants)	- 61	- 39	- 100	- 1
- Wild food (animals)*	- 15	- 85	- 100	- 3
- Raising livestock	- 0	- 0	- 0	- -
- Tourism	- 48	- 52	- 100	- 2
- Learning	- 11	- 89	- 100	- 4
- Seminar	- 2	- 98	- 100	- 5
- Other	- 0	- 0	- 0	- -

Including insects and reptiles

Testing for Correlation and Finding Patterns in The Data

When testing for correlation to find patterns in the data, 10 conditions (Xi) relating to villagers were included, and 14 components relating to the objectives and benefits of using natural resources in the KNKPNHA (Yi) were included, as follows.

Household labor (X1) is the number of workers in the household.

Household income (X2) is the income of the household in Baht/year.

Places of work (X3) are the main occupational areas, classified into areas within the community and areas outside the community.

Paddy field holding (X4) is classified into four groups by area: (1) no paddy field, (2) paddy field of between 1-5 rai, (3) paddy field of between 6-10 rai, (4) paddy field of over 10 rai.

Cassava field holding (X5) is classified into four groups by area: (1) no cassava field, (2) cassava field of between 1-5 rai, (3) cassava field of between 6-10 rai, (4) cassava field of over 10 rai.

Other field holding (X6) refers to orchards, rubber plantations, eucalyptus plantations, etc., and is classified into four groups by area: (1) no field, (2) field of between 1-5 rai, (3) field of between 6-10 rai, (4) field of over 10 Rai.

Distance between home and KNKPNHA (X7).

Understanding of KNKPNHA regulations (X8).

Previous use of services in the KNKPNHA (X9).

Objective for utilization of KNKPNHA resources (note the objective of raising livestock was not included, because no KNKPNHA households raise livestock)

Collecting plants (Y1)

Collecting animals (Y2)

Tourism (Y3)

Biodiversity leaning (Y4)

Seminars/meetings (Y5)

Benefits of the KNKPNHA

Edible wild plants (Y6).

Edible wild animals (Y7).

Collection of a combination of edible plants and animals (Y8).

Medicinal herbs (Y9).

Herbs for animals (Y10).

Raising livestock (Y11).

Tourism (Y12).

Biodiversity leaning (Y13).

Cleaner air (Y14)

Knowledge of KNKPNHA regulations (X10).

Regular promotion of KNKPNHA officers (X11).

Contracts of KNKPNHA officers (X12).

Group A: Positive Correlation Between Xi and Yi

X1 = Y1(r=0.278**), Y8(r=0.358**)

X2 = Y1(r=0.208**), Y8 (r=0.263**)

X3 = Y10 (r=0.140*)

X4 = Y1(r=0.269**), Y4(r=0.242**), Y9(r=0.182**) Y11(r=0.363**), Y12(r=0.325**), Y13(r=0.299**), Y14(r=0.299**)

X5 = Y1(r=0.175*), Y6(r=0.186**), Y8(r=0.172*), Y9 (r=0.233**), Y13(r=0.160*), Y14(r=0.160*)

X6 = Y1 (r=0.156*), Y6 (r=0.166*)

X8 = Y7 (r=0.312**)

X11 = Y8 (r=0.170*)

X12 = Y6 (r=0.167*)

Group B: Negative Correlations Between Xi and Yi

X1 = Y13(r=-0.170*), Y14(r=-0.170*)

X2 = Y4(r=-0.206**), Y11(r=-0.192**), Y12(r=-0.194**), Y13(r=-0.260**), Y14(r=-0.260**)

X3 = Y4(r=-0.169*), Y11(r=-0.221**), Y12(r=-0.231**), Y13(r=-0.217**), Y14(r=-0.217**)

X7 = Y1(r=-0.224**), Y2(r=-0.277**), Y4(r=-0.165*), Y6(r=-0.202**), Y8(r=-0.214**), Y11(r=-0.198**), Y12(r=-0.252**), Y13(r=-0.243**), Y14(r=-0.243**)

X8 = Y2($r=-0.555^{**}$), Y4($r=-0.526$), Y6($r=-0.304^{**}$), Y8($r=-0.266^{**}$), Y9($r=-0.189$), Y12($r=-0.423^{**}$), Y13($r=-0.693^{**}$), Y14($r=-0.693^{**}$)

X9 = Y1($r=-0.399^{**}$), Y2($r=-0.155^{*}$), Y3($r=-0.355^{**}$), Y6($r=-0.309^{**}$), Y7($r=-0.196^{**}$), Y8($r=-0.289^{**}$), Y11($r=-0.340^{**}$), Y12($r=-0.265^{**}$)

X10 = Y1($r=-0.145^{*}$), Y2($r=-0.165^{*}$), Y4($r=-0.195^{**}$), Y11($r=-0.246^{**}$), Y13($r=-0.216^{**}$), Y14($r=-0.216^{**}$)

X11 = Y1($r=-0.197^{**}$), Y2($r=-0.232^{**}$), Y3($r=-0.377^{**}$), Y4($r=-0.242^{**}$), Y7($r=-0.219^{**}$), Y11($r=-0.395^{**}$), Y13($r=-0.254^{**}$)

X12 = Y6($r=-0.197^{**}$), Y8($r=-0.186^{**}$), Y9($r=-0.320^{**}$), Y10($r=-0.150^{*}$)

Group C: Positive Correlations Between Xi and Xi

X1 = X2($r=0.622^{**}$), X3($r=0.349^{**}$), X5($r=0.245^{**}$), X6($r=0.203^{**}$), X7($r=0.220^{**}$), X8($r=0.154^{*}$)

X2 = X3($r=0.690^{**}$), X5($r=0.150^{*}$), X6($r=0.198^{*}$), X8($r=0.209^{**}$)

X3 = X8($r=0.200^{**}$), X11($r=0.203^{**}$)

X6 = X7($r=0.280^{**}$)

X7 = X8($r=0.203^{**}$), X9($r=0.497^{**}$), X11($r=0.266^{**}$)

X8 = X10($r=0.350^{**}$), X11($r=0.143^{*}$)

X9 = X10($r=0.377^{**}$), X11($r=0.431^{**}$)

X10 = X11($r=0.469^{**}$), X12($r=0.285^{**}$)

X11 = X12($r=0.146^{*}$)

Note: ** indicates correlation is significant at the 0.01 level (two-tailed); * indicates correlation is significant at the 0.05 level (two-tailed).

The Group A results show that landholding (X4,5,6) has an influence on villagers' use of KNKPNHA forest resources and the benefits they derive from this; villagers with paddy fields perceive that they benefit from being able to raise cattle in the KNKPNHA (Y11).

The Group B results show that the most important factors in variance between villagers' objectives in using KNKPNHA resources and the benefits they received were the distance between villagers' homes and the KNKPNHA (X7), understanding of KNKPNHA regulations (X8), and having previously made use of KNKPNHA resources (X9).

The Group C results show that household income (X2) is related to many other factors, and the factor of having previously utilized KNKPNHA services (X9) is related to X7,8,11; this shows that villagers are content with utilizing the area and understand the KNKPNHA regulation. The data are presented in Table 1s.

Relationship Between Distance from Knkpnha and Understanding of Regulations

The relationship between the distance from sampled households to the KNKPNHA and villagers' understanding of KNKPNHA regulations was considered. Analysis of variance (ANOVA) demonstrated that there is a significant relationship between these factors ($p<0.05$), as there is for variance between distance and having previously utilized KNKPNHA resources ($p<0.05$); see Table 2s.

It was found that a sampled group that lived between 6-10 kilometers from the KNKPNHA perceived the regulations differently from a group that was more than 15 kilometers from the KNKPNHA ($p<0.05$), and it was also found that groups over 15 kilometers from the KNKPNHA perceived the regulations significantly differently from other groups the same distance from the KNKPNHA if they had utilized KNKPNHA resources previously ($p<0.05$), as presented in Table 3s. Correlation between distance and perceptions of regulations was found to be significant ($r=0.203$; $p<0.01$), as was the correlation between distance and having previously used KNKPNHA resources ($r=0.203$; $p<0.01$), as shown in Table 4s. Distance is the main factor in

villagers' decisions to use a forest (Taedoumg et al., 2018; Kweon, 2019), and the ideal length of time for travelling from the village to the usable forest is between 30 and 40 minutes (Luswaga & Nuppenau, 2021).

The Importance of Villagers' Perceptions of the KNKPNHA

To assess the importance of the area, the issues of firewood and herb collection were included in the interviews. A total of 14 issues were covered in the interviews, as follows: (1) wild food sources (I1), (2) herb collection (I2), (3) wood sources for producing charcoal (I3), (4) wood for construction (I4), (5) tourism or activity spaces (I5), (6) plant learning centers (I6), (7) animal learning centers (I7), (8) plant protection areas (I8), (9) animal protection areas (I9), (10) upstream areas (I10), (11) flood mitigation areas (I11), (12) cleaner air (I12), (13) carbon storage (I13), and (14) other issues (I14). An issue importance scoring system was created by setting the highest level of importance as 5 and the lowest as 1 (this was determined as score = average - SD). The scoring results were I1>I2>I8>I5>I9>I6>I10>I7>I11>I12>I13>I3>I4>I14; see Table 5.

Villagers' Need to Use KNKPNHA Resources

To measure villagers' need to use KNKPNHA resources, 14 issues were defined as follows: (1) wild food sources (I1), (2) herb collection (I2), (3) wood for producing charcoal (I3), (4) wood for construction (I4), (5) tourism or activity spaces (I5), (6) plant learning centers (I6), (7) animal learning centers (I7), (8) plant protection areas (I8), (9) animal protection areas (I9), (10) upstream areas (I10), (11) flood mitigation areas (I11), (12) cleaner air (I12), (13) carbon storage (I13), and (14) other issues (I14). An issue importance scoring system was created by setting the highest level of importance as 5 and the lowest as 1 (this was determined as score = average - SD). The scoring results were I1>I2>I10>I5>I9>I8>I12>I6>I7>I11>I13>I4>I3>I14, as shown in Table5.

Table 5. Scoring of villager perceptions of importance of KNKPNHA resources and the villagers' needs served by these resources.

Items	Importance	Scores		
		Ranking	Needs	Ranking
<i>I₁</i>	3.79	1	3.91	1
<i>I₂</i>	3.69	2	3.53	2
<i>I₃</i>	0.758	12	0.730	12
<i>I₄</i>	0.611	13	0.746	13
<i>I₅</i>	3.02	4	3.04	4
<i>I₆</i>	2.97	6	2.91	6
<i>I₇</i>	2.85	8	2.85	8
<i>I₈</i>	3.14	3	2.96	3
<i>I₉</i>	3.01	5	2.99	5
<i>I₁₀</i>	2.95	7	3.30	7
<i>I₁₁</i>	2.73	9	2.68	9
<i>I₁₂</i>	2.67	10	2.95	10
<i>I₁₃</i>	2.53	11	2.62	11
<i>I₁₄</i>	0	14	0	14

Note: (1) wild food sources (I1), (2) herb collection (I2), (3) wood for charcoal production (I3), (4) wood for construction (I4), (5) tourism or activity spaces (I5), (6) plant learning centers (I6), (7) animal learning centers (I7), (8) plant protection areas (I8), (9) animal protection areas (I9), (10) upstream areas (I10), (11) flood mitigation areas (I11), (12) cleaner air (I12), (13) carbon storage (I13), and (14) other issues (I14).

Villagers' Food Consumption Needs in the KNKPNHA

Our results show that the demand for forest food services is the primary concern for people around the KNKPNHA (I1,2), and is important as both an objective and benefit of the KNKPNHA (Y1,2,8). However, the wild food sources in the forest are seasonal products (Byron & Arnold, 1999; Untarto et al., 2002). At present, the main wild food sources for the villagers in the area include *Melientha suavis* (the local name is phakwān pā), *Curcuma sessilis* (the local name is dok kajiew), Cicadidae (the local name is jakajun), bamboo shoots, mushrooms, eggs, ants, etc. Assessment and discussion of resource quality in terms of the food needs of people around the KNKPNHA indicates that the natural production of food in the KNKPNHA responds to villagers' needs both in terms of duration and quantity of food supply.

Reduced Needs for KNKPNHA Resources

The study indicates that the level of need for, and importance of, firewood and wood for construction in the community has greatly decreased. At present, a large number of rural families have switched to gas stoves, partly to avoid smoke pollution. Furthermore, at present villagers in rural communities prefer to use concrete and artificial wood for construction because these materials are cheaper and easier to find than natural wood. Villagers perceive herbs to be important KNKPNHA resources, indeed as the second most important KNKPNHA they need, but the correlation analysis results suggest that herb collection as an objective and the benefits derived from it are declining. Present demand for herb collection in the forest is completely different from past demand (Walters et al., 2019), as the importance of medicinal plants has been replaced by modern medicine and better access to the public health system.

Emerging Demands in the KNKPNHA

Conservation by management: Factors I8,9 and the present management process factors I5,6,7 reflect villagers' perceptions of the importance of the KNKPNHA and how it can serve their needs. Presently, the concept of conservation is related to utilization, management, and allocation (Kroeksakul & Srichaiwong, 2015; Niesenbaum, 2019; Liu et al., 2022). The KNKPNHA has potential for the development of tourism and learning, but there must be a good management plan with the participation of the surrounding community.

Indirect environmental benefits: Nowadays, people in the community are increasingly concerned about environmental issues such as carbon stocks, clean air, and flood mitigation, especially given the context of PM2.5 dust pollution and forest fires around the community. The villagers are sometimes accused of starting forest fires in connection with finding food in the forest, but in fact most villagers living around the forest are very aware of this problem and help monitor potential forest fires. At present, community representatives coordinate with KNKPNHA officials to prevent such problems.

CONCLUSION

Assessing villagers' requirements for the natural resources provided by the KNKPNHA is important for developing planning and management that reflects the needs of communities around the KNKPNHA. The objectives of the non-hunting area are (1) to protect wild animal species, (2) to protect wildlife habitats, (3) to become a source of natural resource and a subject of environmental research, and (4) to balance the protection and utilization of natural resources. Another important objective of non-hunting areas is to provide a buffer zone around national parks or a wildlife corridor to national parks.

However, in the objectives of non-hunting areas are highly flexible in terms of the use of these areas by the villagers around them. The quantity and quality of natural production in the KNKPNHA responds to the needs of villagers, especially in terms of wild edible plants. Villagers employed in the agricultural sector have low incomes of around 50,692 baht/year, and main agricultural products of the villagers around the KNKPNHA are rice and cassava. The main products of the KNKPNHA are wild food, especially phakwān pā and dok kajiew. Villagers' objectives are changing in response to global trends and new technology; for example, herb and firewood collection in the forest continue to decrease in importance for villagers. The factors impacting the objectives and benefits of villagers utilizing KNKPNHA resources can be classified into three groups: (1) landholding, which influences objectives and benefits of utilizing KNKPNHA resources; (2) distance between the village and the KNKPNHA, which influences understanding of KNKPNHA regulations and previous use

of KNKPNHA resources; and (3) household income, which is related to many conditions, and combined with having previously used KNKPNHA resources also affects villagers' need to utilize KNKPNHA resources. Food consumption is the main goal of people in the surrounding area. At present, the utilization of the forest as a source of wood for construction and fuel is decreasing, and the protection of the forest (along with indirect benefits of protection such as maintaining the forest as a tourist attraction and learning resource) is more in demand by the surrounding people.

Although this study recognizes the needs, and patterns of needs, of people around the KNKPNHA, there remains a lack of understanding of the community's behavior when using forest resources. Therefore, future research should study resource use behaviors, including conservation management, with the participation of people around the KNKPNHA. This will allow communities to monitor and protect resources in co-operation with government officials.

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