
Species Diversity and Utilization of Herbal Plant in Community Forest, Phrae Province, Northern Thailand

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Abstract The results showed that 83 herb species in 77 genera and 70 families, had the highest density of 1885 plants/ha, the highest 5 Importance Value Index of significance were *Chromolaena odorata*, *Centotheca lappacea*, *Harrisonia perforate*, *Curcuma sessilis*, and *Amorphophallus paeoniifolius* of 7.52, 6.99, 5.40, 4.87, and 4.87 percent, respectively. The herbs are found 37 species in 35 genera and 21 families in a hillside, middle of the hill are 26 species in 26 genera and 19 families and the ridges found are 20 species in 20 genera and 13 families. The wisdom to utilization, top 10 most widely used herb species in the Maesai community are *Tacca chantrieri*, *Thunbergia laurifolia*, *Acalypha spiciflora*, *Walsura trichostemon*, *Ventilago denticulate*, *Boesenbergia rotunda*, *Tiliacora triandra*, *Butea superba*, *Croton persimilis*, *Ziziphus oenoplia*.

Keywords: species diversity, utilization of herbal plant, community forest

Introduction

The livelihoods of an estimated 300 million people worldwide living close to tropical forests depend on tree or forest products for daily subsistence (Calibre Consultants 2000). The relationship of these people to trees and forests has long been recognised as an opportunity for adopting community or smallholder forestry to improve rural well-being. International organizations like the Food and Agricultural Organization of the United Nations (FAO) and the World Bank began to promote community or social forestry in the late 1970s and early 1980s, respectively. Rural dwellers had earlier been involved in forestry activities by both national and colonial governments, though often as labour force rather than beneficiaries (de Jong 2010). Community forestry pursues multiple objectives, including improved rural welfare, addressing actual and anticipated fuel wood shortages, and mitigating undesired impacts of forest conversion on the environment.

Medicinal plants have been used since the history of mankind (Meaza *et al.*, 2015). Due to the efficacy of traditional herbal medicine, approximately 60-70% of the people in rural areas depend on it for their immediate medical care (WHO 1978, 2013). Many people use traditional medicine derived from plants because of existence of poor health facilities and conventional medicinal services especially in the rural areas (Omwenga *et al.*, 2009). In Thailand, people have continued to rely on medicinal plants because of the belief that traditional therapies are the most efficient ways of treating different ailments. But there are also an increasing number of studies on their effectiveness following the scientific principles.

Maesai Community Forest was registered as community forest in 2006, under the National Reserved Forests of Thailand. In 2010, the Public Health Ministry designated Maesai Community Forest as 1 of 8 medicinal plant protection zones in Thailand (The Nation, 2012). This research aimed to evaluate the biodiversity of medicinal plants and utilization of herbal plant in the community forest management.

Materials and methods

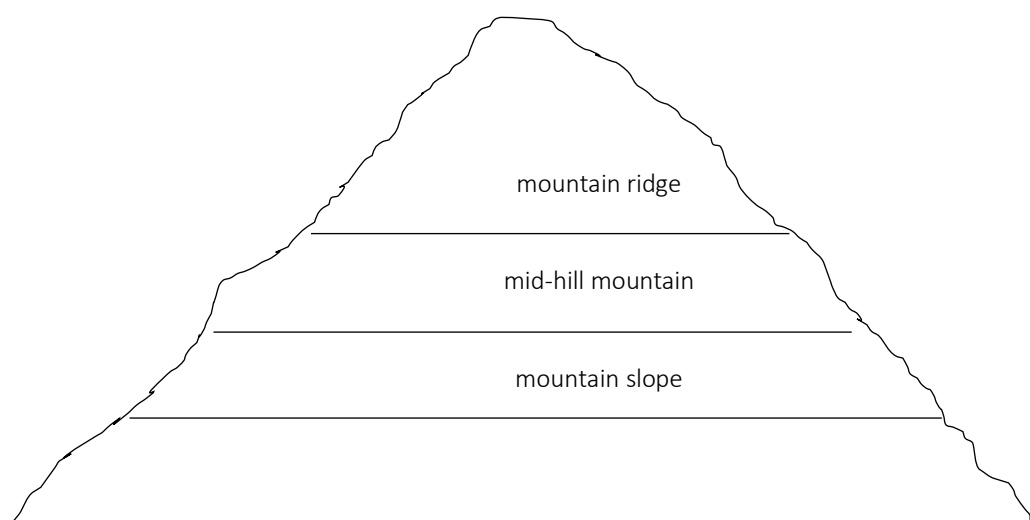
Study site

Maesai community forest is Mixed Deciduous Forest at Mae Sai Sub-district, Rong Kwang District, Phrae Province, North Thailand. There are 4 villages surrounding community forest. Most areas in the community are agricultural land and animal farm surrounded by forests and mountains.

Data collection

1. All three trails were crossed by 1 kilometer along the topography of the area. There are 3 levels of mountain slope, mid-hill mountain, and mountain ridge. There were 3 trails, 1 kilometer each. To explore the medicinal plants that included vines, shrubs, and ginger herbs, etc. (Figure 1)

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There are 3 levels of mountainous terrain, 3 ridges, 1 kilometer

- Coordinates mountain slope 47Q 0641834 UTM 2033807 End 47Q 0641593 UTM 2034454
- Coordinates mid-hill mountain 47Q 0642500 UTM 2035336 Ends 47Q 0642605 UTM 2034437
- Mountain Ridge Coordinates 47Q 0642486 UTM 2035323 End 47Q 0641911 UTM 2034505

Figure 1 Sample plotting area

2. Survey plant species in the sample plot to identify species and numbers by experts. Unidentified plants were categorized by using specimens to compare with plant database at Herbarium. The Department of National Parks, Wildlife and Plant Conservation is responsible for determining the numbers, recording data, and taking photos.

3. Search information and list specimen species, such as common name, scientific name, species, genus and family to know the density, and also find out more about medicinal properties from secondary sources.

4. Medicinal herbs and their utilization were identified by Thai Traditional Medicine .

Data analysis

For assessing the general situation of forest and population structure, density-diameter distribution curves were developed for the trees (dbh \geq 5cm) using the relative number of stems. IVI was calculated as:

$$IVI = RD + RF + RBA$$

where,

IVI = Important value index

RD = Relative density

RF = Relative frequency

Index of Diversity was computed based on Shannon and Wiener's Index) (Shannon & Wiener 1963. The dominant canopy species and other quantitative parameters were calculated for all the sampled plots. The similarity within the plots was assorted using cluster analysis method using a quantitative character relative basal area.

Results

1. Types, quantities and distribution of medicinal plants found in Mae Sa Mai Community Forest.

The results showed that there were 83 herb species in 77 genera and 70 families, the highest density was 1885 plants/ha, the highest 5 Importance Value Index of significance were *Chromolaena odorata* (7.52), *Centotheca lappacea* (6.99), *Harrisonia perforate* (5.40), *Curcuma sessilis* (4.87), and *Amorphophallus paeoniifolius* (4.87). There were herbs 37 herb species, 35 genera, 21 families found at mountain slope. At the mid-hill mountain, there were 26 species, 26 genera, and 19 families. 20 species, 20 genera, and 13 families were found at mountain ridges. (Table 1 and Figure 2)

Table 1 Density (D; plant/ha), Frequency (F; %), Relative Density (RD; %), Relative Frequency (RF; %), and Importance Value Index (IVI; %) of herbs in Maesai Community Forest.

No.	Species	Family	D	F	RD	RF	IVI
1	<i>Chromolaena odorata</i>	Asteraceae	95	100.00	5.04	2.48	7.52
2	<i>Centotheca lappacea</i>	Poaceae	85	100.00	4.51	2.48	6.99
3	<i>Harrisonia perforate</i>	Rutaceae	55	100.00	2.92	2.48	5.40
4	<i>Curcuma sessilis</i>	Zingiberacwae	45	100.00	2.39	2.48	4.87
5	<i>Amorphophallus paeoniifolius</i>	Araceae	45	100.00	2.39	2.48	4.87
6	<i>Homonoia riparia</i>	Euphorbiaceae	45	33.33	2.39	0.83	3.21
7	<i>Ziziphus oenoplia</i>	Rhamnaceae	45	100.00	2.39	2.48	4.87
8	<i>Calycopteris floribunda</i>	Combretaceae	40	33.33	2.12	0.83	2.95
9	<i>Diplazium esculentum</i>	Athyriaceae	35	66.67	1.86	1.65	3.51
10	<i>Pterocarpus macrocarpus.</i>	Fabaceae	35	66.67	1.86	1.65	3.51
11	<i>Phyllanthus amarus</i>	Phyllanthaceae	35	33.33	1.86	0.83	2.68
12	<i>Boesenbergia rotunda</i>	Zingberaceae	35	33.33	1.86	0.83	2.68
13	<i>Solanum indicum</i>	Solanacwae	35	66.67	1.86	1.65	3.51
14	<i>Acalypha spiciflora</i>	Euphorbiaceae	30	66.67	1.59	1.65	3.24
15	<i>Xylia xylocarpa</i>	Fabaceae	30	66.67	1.59	1.65	3.24
16	<i>Vitex peduncularis</i>	Lamiaceae	30	66.67	1.59	1.65	3.24
17	<i>Amorphophallus bulbifer</i>	Araceae	30	66.67	1.59	1.65	3.24
18	<i>Oroxylum indicum</i>	Bignoniaceae	30	66.67	1.59	1.65	3.24
19	<i>Bauhinia saccocalyx</i>	Fabaceae	30	66.67	1.59	1.65	3.24
20	<i>Leucaena glauca</i>	Fabaceae	30	66.67	1.59	1.65	3.24
21	<i>Thunbergia laurifolia</i>	Acanthaceae	30	66.67	1.59	1.65	3.24
22	<i>Lasia spinosa</i>	Araceae	30	33.33	1.59	0.83	2.42
23	<i>Piper sarmentosum</i>	Piperaceae	30	33.33	1.59	0.83	2.42
24	<i>Croton persimilis</i>	Euphorbiaceae	30	66.67	1.59	1.65	3.24
25	<i>Calamus caesius</i>	Arecaceceae	30	33.33	1.59	0.83	2.42
26	<i>Butea superba</i>	Fabaceae	25	66.67	1.33	1.65	2.98
27	<i>Miliusa velutina</i>	Annonaceae	25	33.33	1.33	0.83	2.15
28	<i>Limnocharis flava</i>	Alisimafaceae	25	66.67	1.33	1.65	2.98
29	<i>Caesalpinia mimosoides</i>	Fabaceae	25	33.33	1.33	0.83	2.15
30	<i>Gymnopetalum integrifolium</i>	Cucurbitaceae	25	33.33	1.33	0.83	2.15
31	<i>Colocasia esculenta</i>	Araceae	25	33.33	1.33	0.83	2.15
32	<i>Careya arborea</i>	Lecythidaceae	25	66.67	1.33	1.65	2.98
33	<i>Pandanus odorifer</i>	Pandanaceae	25	33.33	1.33	0.83	2.15
34	<i>Baliospermum solanifolium</i>	Euphorbiaceae	25	66.67	1.33	1.65	2.98
35	<i>Streblus asper</i>	Moraceae	25	66.67	1.33	1.65	2.98
36	<i>Musa acuminata</i>	Musaceae	25	33.33	1.33	0.83	2.15
37	<i>Paederia pilifera</i>	Rubiaceae	20	66.67	1.06	1.65	2.71
38	<i>Stemona collinsae.</i>	Stemonacwae	20	33.33	1.06	0.83	1.89
39	<i>Croton persimilis</i>	Euphorbiaceae	20	33.33	1.06	0.83	1.89
40	<i>Lannea coromandelica</i>	Anacardiaceae	20	33.33	1.06	0.83	1.89

41	<i>Holarrhena pubescens</i>	Apocynaceae	20	66.67	1.06	1.65	2.71
42	<i>Millingtonia hortensis</i>	Bignoniaceae	20	33.33	1.06	0.83	1.89
43	<i>Cassia fistula</i>	Fabaceae	20	66.67	1.06	1.65	2.71
44	<i>Afzelia xylocarpa</i>	Fabaceae	20	66.67	1.06	1.65	2.71
45	<i>Momordica charantia</i>	Cucurbitaceae	20	33.33	1.06	0.83	1.89
46	<i>Litsea glutinosa</i>	Lauraceae	20	66.67	1.06	1.65	2.71
47	<i>Tiliacora triandra</i>	Menispermaceae	20	66.67	1.06	1.65	2.71
48	<i>Canthium parvifolium</i>	Rubiaceae	15	33.33	0.80	0.83	1.62
49	<i>Mucuna pruriens</i>	Fabaceae	15	33.33	0.80	0.83	1.62
50	<i>Spondias pinnata</i>	Anacardiaceae	15	66.67	0.80	1.65	2.45
51	<i>Dioscorea alata</i>	Dioscoreaceae	15	33.33	0.80	0.83	1.62
52	<i>Caesalpinia digyna</i>	Fabaceae	15	33.33	0.80	0.83	1.62
53	<i>Bombax ceiba</i>	Malvaceae	15	66.67	0.80	1.65	2.45
54	<i>Cheilocostus speciosus</i>	Costaceae	15	33.33	0.80	0.83	1.62
55	<i>Luffa cylindrical</i>	Cucurbitaceae	15	33.33	0.80	0.83	1.62
56	<i>Schleichera oleosa</i>	Sapindaceae	15	33.33	0.80	0.83	1.62
57	<i>Ventilago denticulate</i>	Rhamnaceae	15	33.33	0.80	0.83	1.62
58	<i>Oxalis corniculata</i>	Oxalidaceae	15	33.33	0.80	0.83	1.62
59	<i>Zingiber montanum</i>	Zingiberaceae	15	33.33	0.80	0.83	1.62
60	<i>Physalis angulate</i>	Solanaceae	15	33.33	0.80	0.83	1.62
61	<i>Tetrastigma leucostaphylum</i>	Vitaceae	10	33.33	0.53	0.83	1.36
62	<i>Trewia nudiflora</i>	Euphorbiaceae	10	33.33	0.53	0.83	1.36
63	<i>Vitex canescens</i>	Lamiaceae	10	33.33	0.53	0.83	1.36
64	<i>Derris elliptica</i>	Fabaceae	10	33.33	0.53	0.83	1.36
65	<i>Strychnos nux-blanda</i>	Loganiaceae	10	33.33	0.53	0.83	1.36
66	<i>Tacca chantrieri</i>	Dioscoreaceae	10	33.33	0.53	0.83	1.36
67	<i>Dracaena tenuiflora</i>	Dracaenaceae	10	33.33	0.53	0.83	1.36
68	<i>Mangifera caloneura</i>	Anacardiaceae	10	66.67	0.53	1.65	2.18
69	<i>Flacourtia indica</i>	Salicaceae	10	33.33	0.53	0.83	1.36
70	<i>Smilax perfoliata</i>	Smilacaceae	10	33.33	0.53	0.83	1.36
71	<i>Ardisia sanguinolenta</i>	Primulaceae	10	33.33	0.53	0.83	1.36
72	<i>Chukrasia tabularis</i>	Meliaceae	10	33.33	0.53	0.83	1.36
73	<i>Ficus racemosa</i>	Moraceae	10	33.33	0.53	0.83	1.36
74	<i>Dracaena cochinchinensis</i>	Asparagaceae	10	33.33	0.53	0.83	1.36
75	<i>Aegle marmelos</i>	Rutaceae	10	33.33	0.53	0.83	1.36
76	<i>Glycosmis pentaphylla</i>	Rutaceae	10	33.33	0.53	0.83	1.36
77	<i>Crateva religiosa</i>	Capparidaceae	10	33.33	0.53	0.83	1.36
78	<i>Garcinia cowa</i>	Clusiaceae	10	33.33	0.53	0.83	1.36
79	<i>Madhaca stipalacea</i>	Sapotaceae	5	33.33	0.27	0.83	1.09
80	<i>Scleropyrum wallichianum</i>	Santalaceae	5	33.33	0.27	0.83	1.09
81	<i>Walsura trichostemon</i>	Meliaceae	5	33.33	0.27	0.83	1.09
82	<i>Morinda coreia</i>	Rutaceae	5	33.33	0.27	0.83	1.09
83	<i>Siphonodon celastrineus</i>	Celastraceae	5	33.33	0.27	0.83	1.09
Total			1885	4033	100	100	200

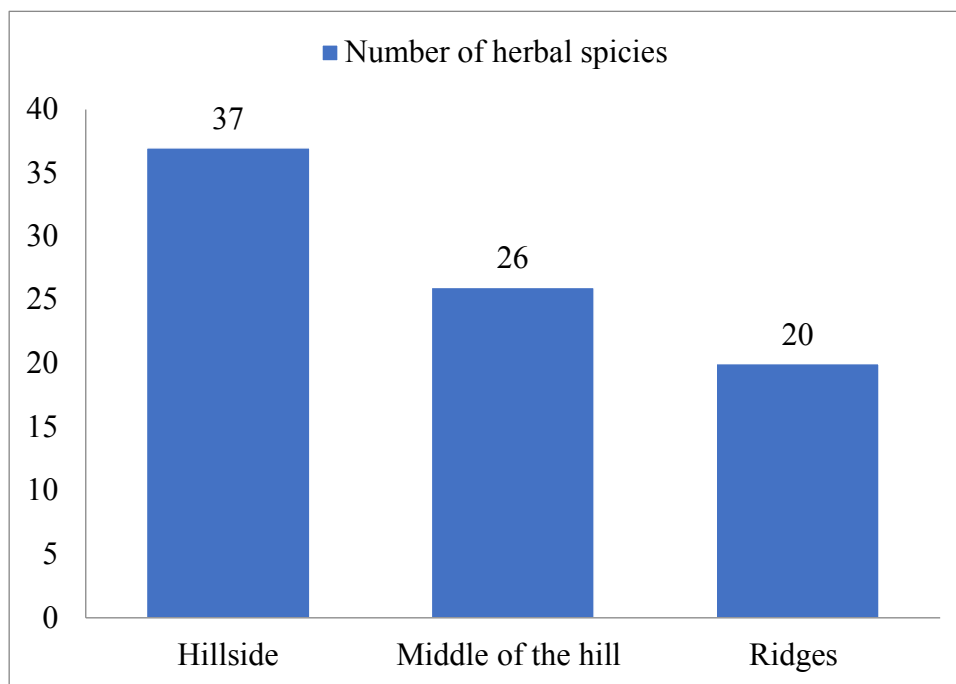


Figure 2 Number of herbal species

2. The local wisdom utilization of medicinal herbs of local herbalists from Maesai community forest.

Data gathered from Thai traditional medicine interviewing showed that 10 most medicinal herbs utilized in Maesai community forest included *Tacca chantrieri*, *Thunbergia laurifolia*, *Acalypha spiciflora*, *Walsura trichostemon*, *Ventilago denticulate*, *Boesenbergia rotunda*, *Tiliacora triandra*, *Butea superba*, *Croton persimilis* and *Ziziphus oenoplia*. These medicinal herbs were used by local herbalists both directly and used as ingredients in traditional medicine. (Table 2)

Number 1 *Tacca chantrieri*. All parts of the plant are usable, but the most used is the rhizome about 150 kilograms per 1 ton per year, using difficult to solve the poisonous substance, or the current cancer, how to use it to wash the chopped 1 inch Dried 4-5 times and then baked with electric oven at 250 degrees Celsius for 5 minutes stored in herbal storage. It is used as a combination of cancer treatment with liver disease, using 20%.

Number 2 *Thunbergia laurifolia*. Its root, vine and leaves are usable. Each store 50 kilograms of storage 4 times a year, properties for the detoxification. The way that traditional Thai medicine is used before the treatment of all patients is to clear the toxins from the body before treatment with other drugs. So, it is used a lot per year. Its leaf and stem (1 inch long) is used. The roots are used but the core of dried roots, and then the chapters are a difficult mixture of treatment and detoxification, use the leaves to drink boiled toxins in the body.

Number 3 *Acalypha spiciflora*. The main uses are root and pomegranate. The amount of storage is 25 kg each. Up to treatment of cancer, liver disease by chopped baking or polished and then mixed with other herbs 20 kinds.

Number 4 *Walsura trichostemon*. The seedlings and roots are stored at 25 kilograms per day. Washed and then chopped 1 inch dried baked to be used as an ingredient in cooking together with good snake and 50 other herbs.

Number 5 *Ventilago denticulate*. The portion used by the vine by January period. Up to February the amount of 1 tonne per year is a hormone that nourishes the prostate, which is dried and crushed with *Boesenbergia rotunda* cooked to nourish the body to improve sexual performance for men.

Number 6 *Boesenbergia rotunda*. The use of head or rhizomes is 100 kg per year. The property is a nourishing prostate nourishing the body and mixed with other herbs.

Number 7 *Tiliacora triandra*. Its leaves and roots are used as tea for reducing blood pressure, fever by drying with 50 herbs.

Number 8 *Butea superba* The roots are collected during January. The amount of 100 kg/year is used to chop dried, grinded and mixed with other medicinal plants for nourish and testosterone.

Number 9 *Croton persimilis*. The application is wood and leaves of 100 kg /year, leaves or wood, bring to eat for the women who give birth blood transfusion makes it easy to walk blood.

Number 10 *Ziziphus oenoplia*. is used as a wood vine 200 kg / year, cut into pieces or chopped 1 inch and then baked with other medicinal plants made into a decoction drink to cure hemorrhoids.

Table 2 top ten ranking of herbal utilization's local wisdom from Maesai Community forest

Rank	Species	Family	IVI
1	<i>Tacca chantrieri</i>	Dioscoreaceae	1.36
2	<i>Thunbergia laurifolia</i>	Acanthaceae	3.24
3	<i>Acalypha spiciflora</i>	Euphorbiaceae	3.24
4	<i>Walsura trichostemon</i>	Meliaceae	1.09
5	<i>Ventilago denticulate</i>	Rhamnaceae	1.62
6	<i>Boesenbergia rotunda</i>	Zingberaceae	2.68
7	<i>Tiliacora triandra</i>	Menispermaceae	2.71
8	<i>Butea superba</i>	Fabaceae	2.98
9	<i>Croton persimilis</i>	Euphorbiaceae	3.24
10	<i>Ziziphus oenoplia</i>	Rhamnaceae	4.87

Discussion

The research results revealed that there were 10 herbs used in the study area, such as *Tacca chantrieri*, with densities of 10 plants/ha, the important value index (IVI) is 1.36. *Walsura trichostemon* densities of 5 plants/ha, the index value (IVI) was at 1.09 and *Ventilago denticulate* with density was 15 plants / ha. The important value index (IVI) was in the order of 1.62, indicating the amount of these herbs. There was a reversal of consumption. Therefore, it should be accelerated to make plans or guidelines for the conservation or propagation of such herbs, such as the conservation of ex situ conservation of plants by the plant propagation by planting in the area, can care from natural origin. (Zobel and Talbert, 1984) Community botanical gardening and community forest development projects in the form of wildlife, food banks, and dissemination of information on herbs to raise public awareness. The sharing of forest resources increases biodiversity to maintain ecological balance, a habitat of medicinal plants. Growing enough to meet the needs of use can develop to pharmaceutical agriculture and industry. This will lead to the participation of people in sustainable local natural resource conservation including the inheritance of local wisdom for next generations. It should be accelerated to make plans or guidelines for the conservation or propagation of such herbs such as herbal garden in the village. The plant propagation by planting in the area and publish herbal information to raise public awareness sharing of forest resources to increase biodiversity and maintain ecological balance, which is the habitat of medicinal plants.

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