Vegetation and Key Floristic Features of Hkakaborazi National Park

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Introduction

Hkakaborazi National Park is the region north of the 27° parallel wherein lies the highest peak of Myanmar, Mount Hkakaborazi, and its environs. It is entirely mountainous and is characterized by broad-leaved evergreen rainforest, sub-tropical and temperate, up to 2,438-2,743m, then broad-leaved, semi-deciduous forest and finally needle-leaved evergreen, snow forest. Above 3,352m the highest forest zone is alpine, different not only in kind from the forest, but different in history and origin.

Within the overall framework of the International Centre for Integrated Mountain Development (ICIMOD) and Myanmar Forest Department's Programme on Regional Collaboration in Conservation of the Hkakaborazi Mountain Ecosystem, a special effort has been made to gather information on mountain flora and vegetation of national parks. The vegetation analysis is the result of an investigation into the spatial and biophysical characteristics of mountain environments by remotely sensed satellite data with a geographic information system (GIS). The data on flora are based on 440 entries collected between 2 March and 14 April on the biological expedition by The Wildlife Conservation Society (WCS). The analysis of flora included previous botany work by F.K. Ward (1914-1957), F.C. Syndam (1961), J. Keenan (1962), and K. Soe (1981).

History of Botany in Northern Myanmar

In 1931 the F.C. Syndam Cutting Sikkim Expedition of the field museum brought back about 25 fern specimens from the Myanmar-Tibet frontier.

The late F.K. Ward collected assiduously from the mountainous and virgin regions of northern Myanmar and discovered numerous novelties and rare plants not known to the world. He published a series of papers on the botany of the region in the 'Journal of the Bombay Natural History Society' and in the UK.

The following summary of northern Myanmar expeditions by Ward is based on the account in a biographical introduction by W.T. Steam, in 'Pilgrimage for Plants' (1960).

- 1914 — North Myanmar, by way of Myitkyina. Described in 'In Farthest Burma' (1921). Collection numbers — 1,000-3,000.
- 1919 — North Myanmar, to Imaw Bum and Hpimaw. Collection numbers — 3038-3721.
- 1922 — Yuman and Szechwan, Tibet and North Burma, by way of Bhamo, Teng Chung, Tali, Yungning, Multi, Likiang, Kari Pass, Beima-shan, Atuntzu, Takala, across the Mekong-

"a great many of the specimens were in the vegetative state and seem to have been impossible to identify"

Salween Divide, Chamutong, across to the Tarom River and the Nam Tamai River, Fort Hertz, Myitkyina. Described in 'From China to Hkamti Long' (1924) and articles in 'The Gardeners' Chronicle' (1922-23). Collection numbers — 5384-5602.

- 1926 — North Myanmar and Assam, by way of Myitkyina, Fort Hertz, Nam Tamai, Seinghhu, Diphuk-la, Lohit (Luhit) Valley, Sadiya. Described in 'Plant Hunting on the Edge of the World' (1930) and articles in 'The Gardeners' Chronicle' (1926-28). Collection numbers — 6605-7698.
- 1930-31 — North Myanmar and Myanmar-Tibet Frontier, by way of Myitkyina, Fort Hertz, Nam Tamai, Adung Valley, Nammi-la, and back by some route to Myitkyina. Described in 'Plant Hunters Paradise' (1937) and articles in The Gardener's Chronicle (1932-33). Collection numbers — 9001-10,239.

"seed or specimens of 118 rhododendrons"

- 1939 — North Myanmar and Tibet, by way of Myitkyina, Fort Hertz, Nan Tamai, Adung Valley, Gamlang Valley, Hkakaborazi, and back by the same route to Myitkyina. Described in 'Burma's Icy Mountains' (1949) and articles in 'The Gardeners' Chronicle' (1938-39) Collection numbers — 12,600-13,573.
- 1930-39 — North Myanmar, by way of Myitkyina, Htawgaw, Imaw Bum, Hpimaw, Panwa Pass, Hpare Pass, back to Myitkyina. Collection numbers — Vernay-Cutting Expedition (1938-39).
- 1953 — North Myanmar, by way of Myitkyina and Sumprabum to Hkinlum and back. Collection numbers – 20,301-21,716 and 22,001-22,100.
- Ward's 1909 – Ten specimens are at the Botany School, Cambridge, UK; those of 1913-22 are at the Royal Botanic Gardens, Edinburgh, UK; those of 1924-28 are at the Royal Botanic Gardens, Kew, UK; those of 1929 are at the Chicago Natural History Museum, those of 1930-38 and 1946-57 are at the British Museum (Natural History), London, UK; those of 1938-39 are at the New York Botanical Gardens, USA with some duplicate specimens in other herbaria, notably those of 1956-57 in Gothenbuzg Botanical Gardens, Sweden,

"107 specimens are in the herbarium of the Royal Botanic Gardens, Edinburgh"

Between November 1961 and April 1962, James Keenan with three Myanmar foresters, carried out a botanical collection on a hitherto scientifically uninvestigated part of north Myanmar. Two attempts were made, the first in December 1961 and the second more successful effort in February 1962. Most of the observations are based on the second trip, and despite a collection number in excess of 1,000, because of the season, a great many of the specimens were in the vegetative state and seem to have been impossible to identify.

In 1920, Reginald Farrer collected Myanmar rhododendrons from northern Myanmar. Farrer collected material, seed or specimens of 118 rhododendrons. Of these, 107 specimens are in the herbarium of the Royal Botanic Gardens, Edinburgh. Of these, 24 have been described as new species discovered by Farrer. The Farrer rhododendron specimens fall into two sets. Only six rhododendrons were found in the expedition around

"24 have been described as new species"

Kansu in 1914-1915, but three of these have been described as new species. All the other specimens were collected in 1919-1920 in northeast Upper Myanmar. In this area Farrer found many of the species previously discovered by Forest and Ward. Moreover, he discovered 21 new species in this region.

In the summer of 1981, Dr Kyaw Soe, then Associate Professor of the Botany Department, University of Yangon, together with two members from his department undertook a botanical expedition to northern Myanmar. They collected nearly as many specimens, especially medicinal plants, which are now deposited in the herbarium of the Botany Department, University of Yangon.

Vegetation

The investigation into the spatial and biophysical characteristics of mountain environments has focused on Hkakaborazi National Park, Kachin State, Myanmar. The National Park is of topographic variability resulting in strong biophysical gradients that shape the vegetation landscape. Its spatial and biophysical complexity and its relative inaccessibility have necessitated the development of an analytical framework that integrates remotely-sensed satellite data with a GIS for spatial analysis.

Our research within Hkakaborazi National Park has been organised around five main objectives.

- Development of a GIS to support spatial and biophysical studies of processes and feature distributions
- Observation of these studies through the manipulation of a GIS database, the identification of new species and evaluation of forest assessment
- Examination of plant biomass and patterns of species
- Preparation of a land-use map of the National Park area using visual interpretation
- Preparation of a map depicting the status of the forest, using remotely sensed satellite data as input, for wildlife management of the National Park

The time provided for the research is very short and the study area is remote. Therefore at the time of writing the ground data collection had not yet been completed.

Study Area

Hkakaborazi National Park is one of the protected areas for biodiversity in Myanmar. The area is hilly with elevations ranging between 1,400 and nearly 6,000masl in the Hindu Kush-Himalayan region. It has an area of about 3,812 sq.km. The highest peak of the Southeast Asian region is 5,891m.

Data used

- Topographic maps from the Survey Department of Myanmar
  Index numbers: 91 H, 91 L, 92 A, 92 E, 92 1
  Scale: 1:250,000 (1" = 6kms)
- Remote-sensing satellite data (Landsat multi-spectral scanning (MSS) data)

Number	Path/row	Date of acquisition
1.	143,040	20 Oct: 1981
2.	142,041	18 Dec: 1973
3.	143,041	6 Dec: 1979
4.	144,041	24 May: 1977

"degraded forest is found mainly near the snow area, along the stream and near the village"

Methodology

The land use of the National Park was examined through the development of a GIS in which satellite data sets were interpreted and integrated with remote sensing. The basic steps in the process are outlined below.

- The National Park boundary, the stream, the village location, the highest point and the administrative boundary have already been traced on topographic maps on a scale of 1:250,000 and have been digitised using Arc/Info Software,
- Classification of satellite (Landsat MSS) data to categorise features for land-cover differentiation in the alpine environment by visual interpretation
- The next important step is the tic point (Ground Control Point) for transforming the digitised image into the world coordinate system.
- Generation of the land-use map from overlay analysis
- Creation of a database of land use, using attribute tables — data analysis was carried out using Microsoft Excel software.

Classification

Manual interpretation is classified as follows.

"on the imagery it is dark grey with a coarse texture. It may be bare, rocky land or agricultural land"

Closed forest area (CF)

This includes MUMD (moist upper mixed deciduous), evergreen, hill forest and alpine forest. These areas are reddish pink on the MSS bands of the 457 colour composites.

Degraded forest area (DF)

Some of this area is whitish pink on the MSS imagery. Degraded forest is found mainly near the snow area, along the stream and near the village.

Cloud and snow area (Cl and S)

These can be distinguished by shadow, the clouds having shadow and the snow without.

Non-forested area (NF)

This area is very near the permanent snow area. Sometimes it can be seen near the village. On the imagery it is dark grey with a coarse texture. It may be bare, rocky land or agricultural land.

Biophysical Study

Closed Forest (CF)

"latitude does make a difference"

In north Myanmar the forest arrays are clearly defined zones, almost entirely dependent on altitude and very little on latitude -- the whole country covers no more than 5° from south to extreme north latitude. Even so latitude does make a difference, and the flora of the Nmai Hkha Valley and ranges to the east differ a good deal from those of the Mali Hka Valley and ranges to the west, at the same altitude. The reason for this is the proximity of an entirely new type of flora – that of China or the

Eastern Asiatic flora. The meeting line of this with the Indo-Malaysian flora is probably along the Ayeyarwaddy. However, the major climatic influence, the Thanlwin Divide, runs north to south, as one might expect, and east to west following the alignment of the high peaks between 28° and 30°.

In north Myanmar, the same conditions may be found at altitudes differing by as much as 610m. Nevertheless the vegetation obviously does change more or less regularly with increasing altitude, as anyone will admit, and the average altitude where one type of forest passes into another type can be identified. Thus at 1,829m, hill jungle with its tropical evergreen trees, its palms and screwy pines, its tree ferns and woody lianas separates from temperate forest with its more familiar northern trees, many of which are deciduous.

When one is faced with what appears to be different types of forests on every mountain, the difficulty of a simple classification is obvious. The best one can do is to achieve some sort of generalisation. Of course an intensive study of all the species and their relative abundance is necessary before one can construct a complete classification of forests. In addition, it is not possible to say, without much study and comparison, what local influence important factors such as light, humidity, and temperature may have in effecting small alternations.

At 27° latitude, the rain forest is not so very different from the equatorial forest nearly 3,218 km away. The watershed between the Malihka and the Mai Hka is formed by multiple ranges all parallel to each other, and roughly, to the streams they separate. The country site is almost uninhabited, and covered with evergreen forest; only in the valleys are there three scattered, small Nung or Daru villages. Real sub-tropical hill jungle becomes apparent at 1,524m and over. Here, crossing the ranges at 1,829m, one can find a great many trees and herbaceous plants not seen before, as well as some common to lower altitude.

Degraded Forest area (DF)

Near villages, much vegetation cover has been reduced to a dense growth of scrub and fern by cutting for firewood.

North Myanmar is almost entirely covered with forest of one kind or another. The several forest climates depend mainly on altitude, which determines temperature and atmospheric humidity as well as rainfall and its seasonal availability. Differences by latitude are so small as to be negligible; but distances from permanent to semi-permanent snow are an important factor.

There are three exceptions to the general statement that the whole of North Myanmar is covered with forest.

<u>The banks of the rivers between low water (winter) and high water (spring-summer)</u>

At Myitkyina the river rises and falls between 9 and 12m (summer and winter), exposing considerable areas of rock and sand. This difference in level decreases steadily as the river divides and sub-divides; but remembering the hundreds of kilometres of waterways, it certainly amounts to a significant area of constant change. The annually exposed areas begin a few hundred feet above sea level, and are still perceptible at 1,829m. Upstream there are always large rocks in the river beds, more exposed in winter.

The river level falls in September. A variety of shrubs form a dense, even impenetrable scrub, at – or below -- high floor level; the flora vary with the nature of the ground-rock sand, pebbles,

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and mud. There are numerous species in the river bed flora which have been seen nowhere else, leading to the conclusion that the river gorges afford a direct link between plains and mountains, open spaces await colonisation, and that plants make use of them for the purpose of migration. They are not by any means one-way streets.

Amongst shrubs which will stand a certain amount of intermittent submergence are *Rhododendron simsii* Planch, *Ficus pyriformis* Hook and Arn, *Phyllanthus* sp. and *Salix* sp. Other important river bed shrubs are *Ligustrum massalogianum Vis, Camellia* spp., *Euonymus* sp. and of course, *Homonoia riparia* which positively enjoys prolonged submergence.

Plants found near or below high-water level vary considerably with the substratum, and so with the force of the currents, which determines it. Such plants reach only a very limited size. An undershrub usually found growing in sand, but not in pebbly beaches, is *Rhabdia lycioides* Mart.

Village sites and clearings

"these clearings are manmade, and were quite recently covered with forest"

These clearings are manmade, and were quite recently covered with forest. Sometimes they are found isolated from the village, completely surrounded by virgin forest, on slopes as steep as 60°. The limit of cultivation is 1,828-1,981m, so that they only affect the sub-tropical to warm temperate belt.

The succession that follows the abandonment of such a clearing is interesting but need not be followed in detail here. The main changes brought about by clearing the forest are loss of shade (only south- and west-facing slopes are cultivated), inability of the slope to retain moisture and impoverishment of the soil. Parasitic and saprophytic fungi gradually appear on the stumps of the trees, though fire must have done a certain amount of sterilisation, including, no doubt, the killing of useful soil bacteria.

The mountaintops above 3,048m

"these mountain tops are covered with scrub and with alpine plants, scattered or in colonies"

The area included, though discontinuous, is far from negligible. A rough calculation suggests that it maybe about 5% of the whole — perhaps more. These mountain tops are covered with scrub and with alpine plants, scattered or in colonies; but there are always many bare patches, which of course increase the limit of flowering plants. To a considerable degree the plants depend on the nature of the terrain, especially below the top-most limit. Cliff faces of igneous rock, which are bare except along and across the joints, which are usually confined to south-facing slopes, have only a few and scattered species; but small areas of meadow carry a rich variety of species, as do most sheltered slopes.

The alpine zone is not only a different vegetation type, but also a different floral region altogether; and the fact that there are two distinct floral regions in North Myanmar — the one superimposed on the other — has

certain implications. They must be of different origin, and are probably of quite different age; and they are in contact in three dimensions, instead of only two as in the plains.

The alpine flora are isolated, in contrast to the forest flora which are continuous and in direct contact with other floral regions. This difference is being slowly intensified all the time. The alpine flora are disarranged, like the chessmen towards the end of a game of chess.

Cloud and Snow area (Cl and S)

North Myanmar gets so much rain and snow, especially during the winter monsoon, because it is not very remote from the sea.

The Hkakarbo snow peaks are not the only snow peaks in North Myanmar, the whole length of the Salween-Ayeyarwaddy Divide for some 322 km north of latitude 26° is sprinkled with snow peaks.

From the top of the Hkakarbo range in fine weather one looks due north, across the gorge of the Tamai River to the Tamai-Dablu Divide, 32 km distant and to the snow-clad mountains at the source of Dablu 32 km beyond that.

The furthest visible range is the massive headland, part of the Tami-Taron Divide, whence spring both the Dablu and Tazu Rivers; and it owes its existence as a separate feature to the curiously erratic course of the Upper Nam Tamai or Adung River. This headland, carved out of the ancient Ayeyarwaddy Plateau, has a uniform altitude of 4,267-4,572m, and is snow covered for 8 or 9 months of the year.

Non-Forested area (N.F)

The high alpine valleys of the far north of Myanmar really look like where plant life comes to an end and where glaciers begin.

Between Pananding and Tazundun, at about 2,438m, a relative alpine top, the whole belt of conifer forest is missing, at least 914m below the level beyond which trees cannot grow, whatever the shelter. There are several reasons for this; because their life process is geared to lower temperatures or to shorter spells of activity or even to a different light intensity or to the absence or presence of actinic rays at high levels. But, whatever the reason, though alpine plants in these mountains will descend far below their normal habitat, they never descend below a certain critical altitude, which here is about 2,743m.

The area for some miles up the Adung Valley, high above the last forest and more than 4,572masl, is under snow for more than half the year.

Flora

A biological expedition was sent to Mount Hkakaborazi an area in the northernmost part of Myanmar, during March and April 1997. That area is still virgin land full of untouched flora and fauna. The arrangements and funds for this venture were jointly provided by Myanmar Forest Department, Ministry of Forest and WCS. The team was composed of an orchidist from Myanmar Floriculturalists' Association, a zoologist, an ornithologist, two survey personnel, a geographer, three foresters, two conservationists from WCS and U. Myo Khin as the representative academician of the Botany Department, University of Yangon.

"a number of peculiar and seemingly rare plants can be found"

The main aim of this expedition was to make a botanical collection in a hitherto scientifically uninvestigated part of northern Myanmar, as well as to record information on geography, climate, forestry, and ethnobotany.

Collection Area and Collection Route

The area studied was from Putao to the Tibetan frontier (N. Latitude: 27.4' 30", E. Longitude: 97.4' 40"-98). Of particular interest were the highest mountain, Hkakaborazi, 5,881m, and its environs.

The route taken from Putao (1,342') was by way of Machanbaw (1,350'), 22 km, to Htanga (2,000'), 22 km. From Htanga, the route taken was in a northeasterly direction along the river to Babaw (1,700'), 48 km. Still going in a northeasterly direction, the route led to Rabbaw (1,750'), 14 km, to Gardhtu (1,750'), 9 km, to Lanser (1,830'), 6 km, to Gawli (2,200'), 12 km; to Shinshanku (4600'), 14 km, to Pangnandim (3,670'), 9 km. From the Pangnandin, the route led in a northwesterly direction along the Meikha River to Lon Nut (3,400'), 12 km, to Ngawa (3,600'), 12 km, to Wangsiwang (4,000'), 14 km, to Gawai (4,350'), 5 km, to Tazungdaung (4,730'), 19 km. From Tazungdam the route divided into two; one led west (the Indian Frontier) and the other went east (the Chinese frontier). The western route from Tazungdam to Guba-Madain (6,667') was 15 km. The eastern route taken from Tazundaung to Tahundam (6,300') was by way of Thlahtu (5,000'), 6 km, Adung Long (5,600'), 8 km and Tazuntu (4,850'), 9 km. From Tahundan (the base camp) the route led to the northernmost part of Myanmar near the base of Hkakaborazi by way of Garman (7,232'), Similar (7,531'), Apikut (8,248'), Naradome (2,324m) and Talihtu (8,021') along the river Adung Long.

"seventy-one specimens were collected in this expedition"

Results from Recent Research

Nearly 500 specimens — including lower plants, ferns, gymnosperms, and angiosperms — were collected from Putao to Talihtu. The specimens were collected almost every day along the road through the hills as well as through the most luxuriant jungle. Examination of the roadside banks rewards the botanists with a good cross section of the hill jungle; a number of peculiar and seemingly rare plants can be found. In all seasons the road is littered with such clues, indicating what trees compose the jungle and often what species a particular tree is. Most of the plants collected were properly pressed, dried and mounted on herbarium sheets. Identification was carried out by matching them with existing specimens from the herbarium of Yangon University and both the multi-volumed 'Flora of India' and 'Flowers of the Himalaya' by Polunin and Stainton (1992) were used to settle most matters of taxonomic uncertainty. All the collected specimens have been deposited at the herbarium of Yangon University.

Ferns and Fern allies

"55 species have already been identified from current literature and 14 new species for Myanmar have been recorded"

Seventy-one specimens were collected in this expedition. Of these, 55 species have already been identified from current literature and 14 new species for Myanmar have been recorded. The remaining unidentified specimens were sent to world fern associations and Kew Gardens, UK, and the results will be announced in the future.

Gymnosperms

Nine species were collected and identified by consulting the literature. Usually firs and other gymnosperms grow widely 3,048m above sea level. The small number of gymnosperms collected was due to the lower altitude of the route, about 2,743m above sea level at its highest.

Monocotyledons and Apetalous

Many specimens were collected and among them 14 monocot species and 17 apepetalous species have been identified. A large number of orchid specimens were collected from this area. But the identification of species proved uncertain and unsatisfactory due to incompleteness of specimens and the nature of the orchid flower. Every botanist who has attempted to examine the flowers of dried specimens of orchids, particularly those of the smaller species, knows how very difficult it is to understand the structure of the column. For, in common with those of so many of the petaloid monocotyledons, the flowers of orchids, owing to the delicacy of their tissues, lose their form during the process of drying, however carefully conducted; and they do not recover it when moistened for study purposes. For this reason only a few of the collected orchids could be identified with certainty.

Apepetalous

Forty-eight species belonging to 35 genera and 23 families were collected.

Sympetalous

Although time for collection was limited, about 170 sympetalous species were collected and identification was carried out at the herbarium of Yangon University. Sixty species belonging to 33 genera and 21 families have been identified.

Analysis of Previous Work

General features

It has been remarked that for each 610-914m of ascent in the Myanmar alps, we enter upon a new zone of vegetation, distinguished not only by different species in different proportions, but also by differences in growth habit, as meadow differs from forest, forest from scrub, broad-leaved forest from needle-leaved forest and deciduous forest from evergreen.

Moreover, in north Myanmar, there are degrees of alpine vegetation. Alpine scrub is a knee-deep tangle of stunted, gnarled bushes, chiefly rhododendrons confined to sheltered slopes where the snow melts gradually. Alpine turf consists of a discontinuous carpet of herbaceous plants and dwarf rhododendron tufts found on more exposed slopes. Alpine scree, though largely naked, also has flora of its own. But the overall impression of the alpine region is dwarfness, whether of woody or herbaceous plants, together with a wide range of variation. There are in fact an astonishing multiplication of species in many alpine genera; witness for example, *Rhododendron, Saxifraga, Gentiana, Meconopsis* and *Primula*. On the other hand, some genera, such as *Diapensia, Omphalogramma, Fritillaria* and *Diplarche*, have few or even one species only. At extreme altitudes, plants are very sensitive to water supply, wind and to protection from direct sunlight. A slight alteration in aspect alters these values, and so alters the vegetation. Not only does snow lie longer on the northern and eastern than on the southern slopes, but also there is an infinite series of gradations between the two extremes. This is reflected in both the type of vegetation and in the flora.

In north Myanmar, above 3,048m, there are actually more plants in flower in October (including late summer flowers, autumn flowers and delayed spring flowers) than there are in June. It is

"in October there are plants flowering up to 4,572m. Even a few early summer rhododendrons open an odd flower or two"

chiefly the red blaze of acres of rhododendrons which makes June appear a month of flowers. There may be more colour in June as wide drifts of *Primula* splash into flower, with molten lakes of rhododendrons and other social plants setting the hillside, but for number of species, October leads. For in June much of the ground above 3,048m is still under snow, while above 3,657m on sheltered slopes and 3,962m on exposed slopes, hardly a plant is in flower, whereas in October there are plants flowering up to 4,572m. Even a few early summer rhododendrons open an odd flower or two, enough to reveal what they are. In the first half of October, nearly a hundred species of rhododendron flowers can be found.

Bamboo, or tree grasses of all kinds, are found in every forest zone in north Myanmar, right up to 3,657m, though the greatest variety occurs between 610 and 1,524m. There are several types of bamboo thicket, which might be classified roughly according to altitude as follow.

- Bamboo of the lower forest (1,219-1,525m)
- Bamboo of the temperate forest
- Bamboo of the moss forest
- Dwarf bamboo (cane brake) everywhere from 2,743m upwards

Both *Ericaceae* and *Vacciniaceae* form an important and conspicuous element in the flora of north Myanmar at all levels above 914m; but it can be estimated that even lumping both families together the number of rhododendrons exceeds that of all other species put together by 2 to 1.

"bamboo, or tree grasses of all kinds, are found in every forest zone in north Myanmar"

Generally speaking, June is the month of flowering shrubs, October the month of herbaceous plants. Many of the former lay down the framework of their flowers in the previous growing season, in the form of resting buds. Only warmth and water are required to complete their development. Herbaceous plants, however, die down to the ground in the winter.

Flora Zone I — between Putao and Pangnandin

From Putao to Pangnandin on the Nam Tamai is about 145 km.

There is always a great variety of herbaceous plants on the road banks during the rain; particularly prominent are the herbaceous species of *Thunbergia*, a dwarf banana with scarlet bracts (*Musa sanguinea*), giant Paris, the enormous solitary leaf of an *Amorphophallus* and various *Impatiens* with brightly coloured flowers. Between the big trees grow clumps of a short slender palm with a stem like a bamboo (*Pinanga*), snake-like prickly climbing palms (*Calamus*), screw pines with saw-edged leaves and many shrubs and hedge herbaceous plants. Clumps of *Begonia* with long falchion-shaped leaves instead of the usual elephant ear grow in the rocky torrent beds. On the next range at 1,829m on the hog's back ridge grows an epiphytic *Begonia* with thin, curiously narrow, heart-shaped leaves. The flowers of both species are white.

"between the big trees grow clumps of a short slender palm with a stem like a bamboo (*Pinanga*)"

In the forest here, at about 914m altitude, grow *Wightia gigante* (an epiphytic tree), *Elaeocarpus* (a beautiful tree bearing huge numbers of thin

white flowers), *Neplelium*, *Carcinia*, *Schima*, *Engelhardtia*, *Bauhinia*, *Michelia* and other *Magnoliaceae*, *Dipterocarpus alatus*, *Unona*, the white trumpet-flowered *Fagraea*, the scarlet-flowered *Aeschynanthus*, mosses, ferns and small orchids. There are also many climbers; the trunks of the trees are almost entirely hidden.

At about 1,524m in hill jungle where oaks, chestnuts, birch, and yew grow, *Altingia excelsa*, *Terminalia myriocarpa*, *Bucklandia populnea* and aromatic laurels, *Litsaea*, and *Cinnanmomum*, are prominent. On the bank grow violets, begonias of several kinds, dwarf *Chirita* with yellow-throated, blue-violet flowers, *Selaginella*, *Impatiens*, *Torenia*, tiny *Sonerila* and the golden-flowered *Lysimachia*. On the summit ridge grow the strange-leafed *Begonia*, the first *Rhododendrons*, *R. vaccinioides*, the larger-leafed *R. dendricola* with trumpet-shaped flowers and the tawny bold tree species *R. stenaulum*, with curiously shaped, delicate-looking, pink flowers.

All along the top a splendid white-flowered *Begonia* grows on the bank; lower down is a species with pale yellow flowers. Altogether there are not less than six species of *Begonia* here; some of them have still not been described. Dense forest clothes the flanks of the ridge, the trees heavily draped with moss, which hangs in festoons from the stumpy malformed branches. Mosses and ferns, gesnerads, gingerworts, aroids and other plants thrive in deep gullies. Woody climbers are rarer in the upper strata of the hill jungle than they are lower down, while the number and variety of epiphytes steadily increases as one ascends, reaching a maximum at 1,829-2,133m in north Myanmar. The reason seems to be that climbers need heat before humidity, while epiphytes need humidity first.

The range crossing from the watershed between the Mali Hka and its tributary the Nan Tisang is the most interesting region hitherto, containing many new species of plants, some of unusual beauty. Of note amongst these are two species of *Eugenia*, shrubs with heads of flowers having the appearance of a rounded bottle brush, deep crimson in one, mauve in the other, a slipper orchid *Paphiopedilum wardii*, *Rhododendron dendricola*, several *Begonias* and *Gesneriaceae*.

On the bank of the Tisang River, or Nan Tisang, grow large clumps of an aggressively armed palm (*Zalacca*) and a ditch by the path side was full of orange and violet flowered *Burmannia*. At less than 610m, it is really the tropical forest region.

Between Noungmun and Pangnandim, ascending through a forest of oaks and chestnuts, are *Magnolia*, *Michelia*, *Ilex*, birch, maple, alder and finally rhododendrons, *Bucklandia*, *Illicium*, and other almost warm temperate trees. It is a little peculiar that *Rhododendron arboreum*, which in the Khasi Hills is common as low as 1,524m, should hardly be found in north Myanmar. The only tree species here is *R. stenaulum*. Below the crest of the ridge, in the newly exposed earth, little saplings, herbs, and shrubs are found. There are many small birch trees, *Bucklandia*, alder and rhododendron, and other competitors such as *Gaultheria*, *Luculia pinceana*, *Rubus lineatus*, *Carex baccans*, *Lycopodium* and the common fern *Gleichenia*. From the top-most stratum descending to lowland tropical rainforest at 1,829m at the Nan Hat Gorge, the notable trees are *Ficus*, *Caryota urens*, *Dysoxylum*, *Terminalia myriocarpa* and *Goniothalamus*.

At Shinhangku, the last and highest range between the Mali Hka and the Nan Tamai, or the real watershed between the eastern and western branches of the Ayeyarwaddy, there is a limestone outcrop where a sleek-leafed Asarum (*A. cordifolium)* and a peculiar *Begonia* grow. A whole grave of *Albizzia* trees has taken possession of the place since the forest was felled. Other trees

"in spite of the altitude and the nearness of the snow-clad mountains, the vegetation of the valley is still sub-tropical"

and shrubs, which spring up in secondary growth at this altitude, are *Ficus cunia*, *F. obscura*, *Callicarpa arborea*, *Saurauja*, *Litsaea* and *Alnus*.

Flora Zone II — between Pangnandin and Tazundun

In spite of the altitude and the nearness of the snow-clad mountains, the vegetation of the valley is still sub-tropical, though temperate pine forest begins to appear in higher valleys and the flanking ranges. Tree ferns (*Alsophila*) grow in the deep gullies and many kinds of bamboo, both large and small, including climbing bamboo, but there are very few erect palms, this being the northern limit of the sago palm on the eastern Ayeyarwaddy.

There is also a falling off in the number and variety of figs; the large strangling species being almost entirely absent. The commonest tree figs are *Ficus cunia* with edible fruits, *F. obscura*, which has curiously lop-sided leaves, *F. hirta* and *F. clavata*, though not growing to a large size. In the rocky river beds the gregarious *F. pyriformis* is a common shrub, and there are a number of other small shrubby and climbing species.

"it is all the more surprising to meet with such temperate plants as forget-me-not"

On rocks above high water *Rhododendron simsii* is still found, with *Ficus pyriformis*, *Astilbe* and a few ferns and grasses. Where a sandy cave occurs above normal flood level, a greater variety is found including *Polygonum capitatum*, *Thalictrum*, *Oxyspora*, *Equisetum*, *Pueraria* and other creeping *Papilionaceae*, *Gnaphalium*, *Carex* and *Neillia thrysiflora*. A little higher up, and well above any likely flood, grow *Albizzia julibrissin*, *Dobinea vulgaris*, *Ficus cunia* and other species of fig, *Rubus*, *Saurauja*, *Luculia* and a number of climbing and scrambling plants like *Vitis*, *Mussaenda* and *Streptolirion volubile*. It is therefore all the more surprising to meet with such temperate plants as forget-me-not, a fern-leafed umbellifer, anemone (*A. Hupahensis sp*), valerian, a small crucifer and the blue pea (*Parochetus*) growing by the path; while under the trees the banks are still covered with pink begonias, *Sonerila*, *Hedyotis* and other sub-tropical herbs.

"up to 3,657m, almost pure conifer forests cover the slopes"

Somewhere between Pangnandim, at a latitude 27° 45' and the Seinghku confluence just north of 28° 0' there is a sharp change in the flora with sub-tropical hill forest giving way to temperate pine forest; here sub-tropical plants, when they occur, are incidental. In a transition zone so dominated by the proximity of high mountains, the flora are bound to dovetail into one another often in the most bewildering way. Pine, in the Tamai Valley, appears at 1,524m, where hemlock occurs in quantity; up to 3,657m, almost pure conifer forests cover the slopes. It is certain that a great variety of temperate species such as oak, maple, birch, chestnut, walnut, and many more occur. A little further south, in the valley of the Nmai Hka, many sub-tropical trees grow by the river. Wherever the path runs through jungle it is fringed with a pretty labiate, *Plectranthus macranthus*, bearing long spikes of slim tubular pink flowers and white anemones (*Anemone tetrasepala).*

A stiff ascent of 610m to the top, through forest with a fairly thick undergrowth of *Arundinaria*, a bamboo of medium height which does not

form clumps but sends up separate halums from its rhizome, was seen. At first the trees were those characteristic of the upper sub-tropical hill jungle. Oaks, chestnuts, and laurels were abundant; *Magnoliaceae* occurred sparingly with *Bucklandia* and many other species. Small epiphytic shrubs were also conspicuous, amongst them *R. nuttallii* and *R. bullatum*, representing a cool, damp atmosphere. From the east towards the main north-south watershed and the peak, the forest was still thick and luxuriant with a great variety of trees, not outwardly very different looking than 914m below. Epiphytic shrubs are more numerous here than lower down, and there is plenty of bamboo undergrowth, and rhododendrons replace shrubs like *Lasianthus, Ardisia* and others, so it is clear that you are changing into another zone of vegetation altogether, sub-tropical and temperate.

Over 2,133m, on a rock outcrop, herbaceous flowering plants are rare in the forest, but wherever rock outcrops, there is no difference between the trees along the ridge and those on the flanks. There is no sign of bush rhododendrons, a sure herald of an approach to alpine conditions. There are many epiphytic shrubs, but rhododendrons seem to be very rare or absent and conifers almost totally absent. Rhododendrons need light and unless they grow on trees, or are themselves trees, they have no chance in such thick forest as on this mountain.

The undergrowth is chiefly a species of *Arundinaria*, dense and impenetrable in places but sometimes very open. Few plants take advantage of the open spaces — small *Impatiens, Lysionotus* on rocks and one or two small orchids, even a *Cymbidium*. The forest is plain temperate evergreen rainforest, but the absence of conifers is puzzling. *Pinus excelsea*, which a little further northwest is plentiful at 1,524m, disappears completely somewhere east of longitude 98°, to be replaced by *P. insularis*, which is found also in the Khasi Hills.

At about 2,438m or a relative alpine top, one considers the wealth of vegetation nearby. There is stunted oak (*Quercus pachyphylla*), a yellow *Impatiens*, a tiny *Panax*, isolated clumps of bamboo and eastwards five species of rhododendron — *R. tephropeplum, R. martirianum, R. megacalyx, R. madennii* and *R. pruniforum*, with *Gaultherias, Vaccinium glaucoalbum, Daphniphyllum, Skimmia laureola* and other shrubs. There is undergrowth of moss, dwarf *Gleichenia* and twining gentian beneath the rhododendron bushes, and below *Clethra delavoyi*, small trees of rowan, crab apple, *Cinnamomum* and several others. But even more surprising than rhododendrons is the discovery, under the bushes, of a creeping dwarf *Cornus*, indistinguishable from the alpine *C. succica* of northern UK and Greenland. Another surprising point is that there seem to be only three conifers in the area. Thus it can be concluded that, between 2,133 and 3,048m in north Myanmar, there is no true alpine belt.

Most of the trees are thickly padded with moss, which covers their trunks and hangs, dripping, from their branches, like bunches of seaweed from a pier when the tide is out. In this sponge mass are embedded the roots and even the stems of epiphytic shrubs, notably species of *Gaultheria, Vaccinium, Rhododendron, Agapetes, Leucothoe* and *Aeschynanthus*. A minute *Utricularia* is also commonly met with on rocks and tree trunks, and a filmy fern. The undergrowth gregarious fern, *Lomaria,* occurs abundantly, with scattered flowering plants like *Sarcopyramis, Arisaema, Globba, Polygonatun* and colonies of *Elatostema*. This moss forest contains a fairly constant assemblage of species, with well-marked characteristics, and may be regarded as a distinct type of local vegetation.

The steep ridge which runs northwards is clothed with bamboo brake, through which mixed shrubs, including some juniper, grow. Both flanks are thickly wooded, and the precipitous east face is covered with a particularly dense growth of small trees, *Quercus pachyphylla*, maples

"in the middle temperate forest at about 1,829m, the most abundant species is bamboo (*Arundinaria* spp.)"

and rhododendron being abundant, together with a large-leafed *Ilex*, willow, *Daphne*, a *Laurus*, *Viburnum*, *Cotoneaster*, white bean, *Enkiantus*, *Daphniphyllum*, *Berberis*, *Hypokerina* and *Sorbu harroviana*. There is no fir forest, and with the exception of juniper and an occasional *Taxus*, no other conifer. Between 2,743 and 3,048m several interesting sub-alpine plants grow, but no exclusively alpine species. There are aromatic-leaved rhododendrons *(R. pruniflorum)*, the gregarious shrub *Gaultheria hookeri*, *Berneuxia thibetica*, with glossy leaves and a compact teasel-life of white flowers, *Vaccinium glaucoalbum*, *V. modestum* and a *Nomocharis* in fruit.

In the middle temperate forest at about 1,829m, the most abundant species is bamboo (*Arundinaria* spp.), with long creeping, not clump-forming rhizomes, the hollow stems bearing a ring of spikes round each node. At about 1,829m, there are several blue pines and through a dense undergrowth of *Arundinaria* the beautifully coloured broad-leaved fern, *Dipteris,* and another fern, *Gleichenia,* crop up. At 1,524m, with *Bucklandia*, there are large-leaved *Castonopsis*, small stemless palms, climbing palms and large root climbers like *Raphidophora.*

"the Tamai Valley is thickly covered with temperate plants"

As far north as Gawai, the Tamai Valley is thickly covered with temperate plants. *Hydrocotyle* is common in marshy places and parsley, *Plantago, Epilobium* and *Valeriana* are other common weeds. There are also a number of small, pea-flowered undershrubs, some of them prostrate, of the genera *Lespedeza, Crotalaria* and *Desmodium.*

From the gully to the point of the forest on the ridge at about 1,829m, there are broad-leaved evergreen trees with an occasional blue pine towering above the canopy, or a graceful juniper. Other trees here are maple, *Machilus*, *Cinnamomum*, *Schima*, *Engelhardtia*, *Bucklandia* and *Eriobotrya.* The appearance of the last two and the disappearance of such trees as *Saurauja*, and the loss of the climbing palms (*Calamus*) and the larger fig trees at about 1,829m, marks a change in the type of forest, from sub-tropical hill jungle to temperate forest and the beginning of conifer forest. Among large-leaved trees, there are *Gamblea ciliata* (tree), *Magnolia rostrata* and two rhododendrons (*R. sinogrande* and *R. sidereum*); also oaks (*Quercus pachyphylla and Q. lanuginasum*) *Illicium*, birch, hemlock, spruce, sorbus, *Ilex*, *Rhododendron neriiflorum* and a species with a tawny bole related to the Chinese *R. irriratum.* (Renanthera orchid) With silver fir ushering in the highest belt of forest, there is a great candelabra of *Rhododendron arizelim*, *Tsuga*, *Acer wardii* and other rhododendrons (*R. chartomallum*, *R. pruniflorum* and *R. megeratum).* However, though such temperate plants as *Roscoea*, *Adenophora*, (campamula family) *Fritillaria*, *Delphinuum*, *Astillbe* and *Rodgersia* (plant) grow here, there is no *Primula.*

"at about 3,200m, there is a silver fir-hemlock forest"

At about 3,200m, there is a silver fir-hemlock forest, mixed with a few broad-leaved deciduous trees such as *Rhododendron arizelum* and *Arundinaria.* The ground is covered with a thick felt-like carpet of moss, soft as a feather bed, in which nestle tiny orchids and a minute chocolate-

flowered umbellifer with linear leaves, dwarf-creeping *Rubus*, *Vaccinium* and *Clintonia alpina*. The tree trunks also are fat with a monstrous sponge-like growth of moss.

At a peak 3,352m high, there is no *Tsuga* but *Abies* grows, and often *Rhododendron arizelum* also grows. Wherever rocks give some protection from the wind, small bush rhododendrons grow in great variety -- the flashy yellow of *R. triflorum*, the crimson of *R. chartomallum*, the purple of *R. tephropeplum* and the deep plum of *R. pruniflorum*. Other common shrubs are species of *Viburnum*, *Pieris*, *dwarf Ilex*, *Pyrus*, *Berberis*, *Juniper* and *Litseae*.

Flora Zone III - between Tazunden and Tahundun

There are many species here, both alpine and temperate. These include *Rhododendron imperator* of which a solitary plant is to be found in the Seinghku Valley, *R. myrtilloides* to be found in the Chawngmaw Valley, *Meconopsis violacea* (a few plants within a small area in the Seinghku Valley), *Paphiopedilum wardii, Meconopsis villosa, Rhododendron fulgens*, the *Sorbus*-like *Zanthoxylum* and *Hypericum*. The forest is composed mainly of broad-leaved evergreen trees, including several *Ficus* (such as *F. cunia* and *F. obscura)*. Ferns particularly revel in the cool, damp atmosphere of the deep Adung Gorge, and occur in great variety. The bird's nest fern (*Aspidium*) is a common epiphyte, together with a yellow brown spotted gesnerad and a fleshy *Peperomia*, and shrubs such as *Aeschynanthus* and the white-flowered *Rhododendron taronense*. Many of the tree trunks are completely concealed by large-leaved climbing plants, which cling close to them; *Pothos* and *Raphidophora* are particularly noticeable.

There are many laurels and figs here, also *Albizzuia julibrissin*, *Eugenia*, oak, maple and alder, mixed with tree ferns and enormous climbers. The rocky river banks below the forest level are in places covered with a moss-like creeping plant with little shining leaves and tiny violet berries (*Rubiaceae*).

Flora Zone IV - between Tahundan and Mount Hkakaborazi

Within the Adung Gorge, the type of forest changes abruptly. This zone is the last hint of tropical vegetation. Most conspicuous is *Rhododendron magnificum* and, together with hemlock spruce, it lines the gorge. The angle of slope in the gorge is about 15°. Dense forest, sombre in colour, lines the river at flood level. But in spring the rising note of the water is matched in melody by the clash and ring of colour of the hot, breathless glow of rhododendron against the faltering greens and brave yellows of unfurling maple leaves, the sharp green bristling larches studded with crimson cones like prehistoric sea anemones and the cold marble white globes of *Magnolia*, which glimmer in the darkness with an unearthly light.

The gullies immediately above the river where alluvial fans spread out into the forest were examined. The forest consists of a mixture of evergreen, broad-leaved, deciduous and coniferous trees, the latter including blue pine, hemlock spruce and yew, with occasional larch and *Picea*. A thousand feet higher up conifers become as common as broad-leaved trees. Deciduous trees include birch, maple, cherry, walnut, ash and *Tetracentron*. Evergreens include species of *Ilex*, several rhododendrons and oaks and *Schima wallichii*, a fine tree with a dark handsome crown. Some of the massive-limbed rhododendrons have been growing for a century; but so close grained and heavy is the timber that they have attained no great size in that time A wide-meshed network of creepers – vines, *Clematis*, *Kadsura*, *Aristolochia* and others – has spread itself over the canopy and dangles long festoons between the tree trunks.

Between the Gamlang and the Adung, across the slope there was a thin forest of hemlock and pine, with occasional larch and *Picea*, but this has been replaced gradually by mixed forest

"at 3,048m, when the snow melts, hundreds of alpine flowers bloom on the alluvial cones"

containing many broad-leaved trees, both evergreen and deciduous. At 2,743m, many small irises (*I. decora*) grow in earth fans. The other species are rhododendrons (*R. sinogrande, R. arizelum* and another) and a welter of small trees and shrubs, the most notable of which are a species of *Euonymus* and the prickly hazelnut, *Corylus ferox*.

At 3,048m, when the snow melts, hundreds of alpine flowers bloom on the alluvial cones, especially *Saxifraga*, *Cyananthus*, *Pedicularis*, *Geranium*, *Primula*, *Mimulus*, *Parochetus*, *Astragalus*, *Gentiana sp*, *Ranunculus* and *Nomocharis*. Some of the slopes are covered with taller herbs one metre high or more, mostly rather coarse, large-leaved plants such as *Rodgersia*, *Astilbe*, *Aconitum*, *Adenophora*, *Lactuca*, *Impatiens*, *Cnicus* and *Artemisia*. Passing through a patch of forest there is a tangle of rhododendrons that overhang the river. Amongst them are several rhododendrons different from any seen before and they appear to be hybrids. It is a remarkable fact that, although rhododendrons hybridise easily, amongst the thousands of square kilometres almost solidly covered by them, cross pollination takes place, interspecific pollination also occurs and allied species are not in flower at the same time; an unmistakable hybrid is rather rare. Other forest plants noticed here are *Panax*, *Podophyllum*, dwarf *Euonymus*, and creeping *Rubus*.

"Galang Valley is like a long, narrow stairway"

At 3,657m the north flank, which is high and steep, is fringed with a band of vivid green vegetation. But the south slope fluxes out thinly to moist earth where hundreds of shabby-looking alpine plants die down as they shed their seeds. This results in the curious spectacle of alpine plants scattering their ripe seeds on one side of the snow bed, and just beginning to open their flowers on the other side, less than a hundred yards away. In this condition are golden *Trollius* (*T. yunnanensis*), sky-blue poppies (*Meconopsis betonicofolia*), *Primula sikkimensis*, *Pedicularis*, *Allium* and several others

"at lower altitudes a carpet of *G. trichophylla* with blackberries occurs"

Galang Valley is like a long, narrow stairway, leading to the conclusion that the abrupt petering out and disappearance of the vegetation at the parting of the stream is more a mechanical than a climatic effect. Various woody plants help to prepare the ground for a more complex society. One of the earliest pioneers is *Rhododendron repens*, then larger species of *Gaultheria*. There seem to be two varieties of the latter, one with dark blue, the other with light blue berries. At lower altitudes a carpet of *G. trichophylla* with blackberries occurs. There may be other different species — two have milk-white berries and one grows as a prostrate mat. Two scarlet-berried *Gaultherias* which also have white berries like hailstones, also grow here. So there are at least five good species, and several varieties or possibly hybrids.

"in the Dandi Valley, mosses grow everywhere"

In the Dandi Valley, mosses grow everywhere. A species of *Saussurea* can also be found, its dark inflorescence enclosed in thin, papery, yellow bracts, giving the impression of a large porcelain lamp globe. Amongst survivors at high altitudes are *Saxifraga*, a grass and a *Luzula*. And by the streams are rosette-shaped composites, dwarf rhododendrons (*R.*

campylogynum) and strangely, orchids. The variety of vegetation on the floor of the valley rapidly increaseds with dwarf rhododendron, *Gaultheria, Ilex, Vaccinium, Cassiope, Salix, Berberis, Lonicera* and *Prunus, and* rock covered with the pink stars of *Diapensia*, the shimmering blue *Corydalis cashmeriana, the* deeper blue *Gentiana wardii* and a crimson-purple *Pedicularis.*

The vegetation by now is pure alpine. In spring the landscape is a mass of colour. Rhododendrons surge everywhere -- *R. cerasinum* and *R. chaetomallum* both with blood-red flowers, *R. pruniflorum* with glaucous purple and *R. selense* with ivory, saffron and sometimes salmon, apricot or cerise. Scattered through the mead, the skeletons of dead June flowers such as *Primula serratifolia, P. muscarioides, P. sikkimensis* and *Omphalogramma souliei* rattle in the wind. Even at this height a few drifts of yellow *Primula melanodonta* delayed by snow shine like clusters of fairy lamps against the soiled snow at the foot of an alluvial fan. Genuine autumn flowers are few but here and there are ripples of the gleaming blue *Gentiana sino-ornata.*

At the Gamlang-Dandi ridge, less than 4,876m in altitude, there are some of the highest flowering plants in north Myanmar, including, besides moss and lichens, dwarf *Rubus, Polygonum, Saussurea gossypiphora* (high altitude plant), a sedge and a *Luzula.* All are widely scattered, though here and there small colonies of *Primula serratifolia* flourish.

Recommendations for Future Research

Hkakaborazi National Park is recognised to be one of the richest areas of biological resources in the world. Extraordinarily rich flora and fauna, ranging from lowland tropical to alpine species, still await proper research and identification. They have barely been studied, and the park remains an excellent centre for field study for students of botany, geology, zoology and geography.

In addition, due to its very wide biological diversity, research should continue to focus on ethnobotany, conservation, and community development. As conservation becomes increasingly oriented towards understanding plant resource management, there will be additional emphasis on forming multi-disciplinary and multi-cultural teams of researchers who can examine local plant use from various perspectives.

Spurred on by the urgency of the conservation issue, there will be a tendency to support rapid participatory ethnobotanical inventories followed by detailed studies on selected resources. Attention will be given to posing hypotheses about the link between resource use and conservation as well as developing an empirical method to test this idea.

Particular support will be given to local ethnobotanical promoters and to scientists who collaborate in the design of resource use studies, because they are in a unique position to apply results to community development and nature conservation. Collaborators in local communities will not be the beneficiaries of these initiatives, but rather full partners in the process. They will participate in the design and implementation of the research as well as the application of the results. In addition to receiving monetary returns, they will expect assistance in analysing and reinforcing their traditional forest management practices and in designing ways of ensuring that knowledge is passed along from one generation to the next.

Conservation organisations (such as WCS) and the general public that supports them will be increasingly perceptive in their assessment of the successes and failures of ethnobotanical exploration. From the perspective of conservation and community development, the way ahead

"the Forestry Department and WCS sponsored the botanical research that has made this work possible"

for ethnobotanists is to follow a path of participatory research guided by explicit research agreements and contracts that define the rights and obligations of all participants at each stage of the project. The potential of ethnobotany to contribute to conservation and community development has been well publicised, but the world is now waiting for results.

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We have made every effort to trace errors, but if we have inadvertently overlooked any, we will be pleased to make the necessary arrangements for correction at the first opportunity.

Bibliography (not necessarily cited in the text)

Beddome, R. (1969) *Handbook to the Ferns of British India.* New Delhi: Today and Tomorrow's Printers and Publishers

Camus, J.M.; Jermy, A.C.; Tomas, B.A. (1991) *World of Ferns.* London: Natural History Museum Publications

Cox, E.H.M (1926) *Forrer's Lost Journey.* London: Dulau and Co. Ltd

Cox, P.A. (1974) *Dwarf Rhododendrons.* Norfolk, UK: Cox and Wyman Ltd

Dallimore, W. (1923) *A Handbook of Coniferae.* London: Edward Arnold Publishers Ltd

Davis, J.H. (1960) *The Forests of Burma.*

Dickoson, F.G (1945) *The Ferns of Burma.* Paper from the Department of Botany, The Ohio State University, USA

Gibbons, B.; Brough, P. (1992) *Wild Flowers of Britain and Northern Europe.* London: Hamlyn

Heywood, V.H. (1985) *Flowering Plants of the World.* England: Croom Helm Publishers Ltd

Hyndley, H.G. (1987) *List of Trees, Shrubs, Herbs and Principal Climbers of Burma* (4th edn). Rangoon, Burma: Swe daw Oo Press

Keenan, J. (1963) *Interim Report on Botanical Collection in North Burma.* Myanmar: The Burmese Forester

Khin, M. (1997) *Floristic Survey in Northern Myanmar. Part 1. Plant Hunting in Hkakaborazi Botanical Treasures.* Myanmar: University of Yangon

King, G.; Pantling, R. (1970) *Orchids of the Sikkim Himalaya.* New Delhi: Today and Tomorrows Printers and Publishers

Kurz. S. (1877) *Forest Flora of British Burma*, Vols 1 and 2. Calcutta: Office of the Superintendent of Government Printing

Martin, W.K. (1974) *The Concise British Flora in Colour.* London: Book Club Associates

Mierow, D.; Shrestha, T.B. (1987) *Himalayan Flowers and Trees.* Nepal: Sahayogi Press

Ohwi, J. (1965) *Flora of Japan.* Washington DC: Smithsonian Institution

Polunin, O.; Stainton, A. (1992) *Flowers of the Himalaya.* New Delhi: Oxford University Press

Rendle, A.B. (1975) *The Classification of Flowering Plants.* London: Cambridge University Press

Shu, C.S.; Young, C.W. (1959) *Flora Republicae Popularies Sinicae*, Vol. 2. Beijing: Pteridophytt Types Academiae Scientiarun Sinicae

Ward, F.K. (1949) *Burma's Icy Mountains.* London: Alden Press

Ward, F.K. (1960) *Pilgrimage for Plants.* London: G. Harrap and Co. Ltd

Yunnanica, F. (1953) *Tomus 1, 2, 3, 4 and 5.* Beijing: Science Press

Herbarium, Department of Botany, University of Yangon
Flora of Hkakaborazi National Park
Checklist Of Identified Gymnosperms

	Scientific Name	Family	Locality	Altitude (m)	Voucher Remark No.
1	*Abies* sp.	Pinaceae	Tahundan to Shanmalar	1,920	MK-013
2	*Abies ciliciea*	Pinaceae	Shanmalar	-	MK-044
3	*Abies* sp.	Pinaceae	Shanmalar	-	MK-045 & X
4	*Abies spectabilis Pseudotsuga forrestii* (Craib)	Pinaceae	Tazundun	-	MK-013
5	*Picea* sp.	Pinaceae	Tazundun to Shanmalar	1,442	MK-011
6	*Picea likiangensis* (Franch)	Pinaceae	Tazundun to Shanmalar	1,920	MK-59
7	*Picea brachytyla* (Franch)	Pinaceae	Talihtu	-	-
8	*Pinus wallichiana* (Jackson)	Pinaceae	Tazundun to Shanmalar	1,920	MK-018
9	*Taxus baccata* (L.)	Taxaceae	Putao	409	MK-G-2

Herbarium, Department of Botany, University of Yangon
Flora of Hkakaborazi National Park*
Checklist of Identified Ferns

	Scientific Name	Family	Location	Voucher Remark No.
1	*Asplenium nidus*	Aspleniaceae	Putao	MK-2
2	*A ensiforme* (Wall.) Var (bifid)	Aspleniaceae	Gaman	MKT-69
3	*Athyrium* sp.	Anthyriaceae	Kaung Mulon	No data
4	*Asplenium heterocarpum* (Wall.)	Aspleniaceae	Shinshaku	MK-161
5	*Antrophyllum latiforum*	Grammitidceae	Shinshaku	MK-154
6	*Angiopteris evecta* (Hoffin)	Angiopteridaceae	Hyanga	MK-82
7	*Alsophila glabra*	Cyatheaceae	Machanbaw	MK-28
8	*Amaranthus tricolor*	Amaranthaceae	Gawai	MK-283
9	*Aspidium polymorphua* (Wall.) ex Hook	Aspidiaceae	Shmshaku	MK-156
10	*Adiantum* sp.	Adiantaceae	Pangnamdm	MK-159
11	*Adiantum* sp.	Adiantaceae	Shiushaku	MK-201
12	*Blachnum orientale*	Blechnaceae	Machanbaw	MK-21
13	*Cyathea spinulasa* (Wall.)	Cyatheaceae	Guba	MK-329
14	*Campteria wallichinana* (Ag.)	Pteridaceae	Talihtu	MK-2
15	*C. biaurita* (L.)	Pteridaceae	Wanshiwan	MK-266
16	*Dipteris wallichii* (Br.)	Dipteridaceae	Putao	MK-8
17	*Dictyopteris tenerifromis* (Hook)	Polypodiaceae	Gaw-Lei	MK-48
18	*Diacalpe aspidioides* (Bl.)	Cyatheaceae	Putao	MK-4
19	*Equisetum arvense*	Equisetaceae	Shinshaku	MK-162
20	*Gymnopteris costata* (Wall.)	Polypodiaceae	Alan	MK-25
21	*Goniopteris prolifera* (Roxb.)	Polypodiaceae	Shinshaku	MK-156
22	*Gleichenia linearis* (Burm.)	Gleicheniaceae	Putao	MK-9
23	*Gleichenia* sp.	Gleicheniaceae	Putao	-
24	*Hemidicryum ceterach* (L.)	Aspleniaceae	Gaman	MK-67
25	*Humata pedata* (Sm.) Var *alpina* (Blume)	Davalliaceae	Pangnandim	MK-203
26	*Leucostegia* sp.	Davalliaceae	Wansiwang	MK-233
27	*Lycopodium carinatum*	Lycopodiaceae	Alanga	MK-57
28	*Lycopodium* sp.	Lycopodiaceae	Alanga	MK-73
29	*Lastrea affuscipes* (Wall.)	Aspidiaceae	Alanga	-
30	*Monogramme* sp.)	Grammitideae	Apikut	TMK-033
31	*Meniscium cuspidatum* (Bt.) Var *longifrons* (Clerk)	Grammitidaceae	Gawle	MK-149
32	*Microlepia majuscula* (Lowe)	Davalliaceae	Putao	MK-6
33	*Merinttosorum* sp.)	Davalliaceae	Putao	-
34	*Niphobolus stigmosum*	Polypodiaceae	Shmshaku	MK-158
35	*Nephrolepis penduncularis*	Nephrolepidaceae	Lon-Ngaw	MK-151
36	*Pleopeltis lehmanni* (Mett)	Polypodiaceae	Lon Nut	MK-204
37	*Polypodium cornigerum* (Baker)	Polypodiaceae	Lon Nut	MK-263
38	*Polystychum ilicifolium* (Don)	Aspidiaeae	Lon Nut	MK-53
39	*Pellia* sp.	Pelliaceae	Pangnandim	MK-272

* Altitudes were not available for this table.

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Identified Monocot And Apepetalous Checklist

	Scientific Name	Family	Locality	Altitude (m)	Voucher Remark No.
1	*Arisaema wattii* (Hook)	Araceae	Putao	409	MKG-001
2	*Castanea* sp. (Tourn)	Fagaceae	Taliltu to Shanmalar	-	MKT-060
3	*Quercus* sp. (L.)	Fagaceae	Taliltu to Shanmalar	-	
4	*Castanea* sp. (Tourn)	Fagaceae	Taliltu to Shanmalar	1,920	T-027
5	-	Fagaceae	Babaw to Rabaw	533	MK-104
6	*Polygonum alatum* (Han.)	Polygonaceae	Shinshaku	1,402	MK-171
7	*Polygonum serrulatum* (Lag.)	Polygonaceae	-	670	MK-142
8	*Polygonum* sp. (L.)	Polygonaceae	Shinshaku	1,402	MK-164
9	*Polygonum* sp. (L.)	Polygonaceae	Langa to Gawlw	670	MK-137
10	*Polygonum alatun* (Han.)	Polygonaceae	Alanga	670	MK-075
11	*Aconogonum molle* (D.Don)	Polygonaceae	Gawai to Tazandom	1,442	MK-262
12	*Polygonum serrulatum* (Lag.)	Polygonaceae	Langa to Gawlw	670	MK-143
13	*Polygonum chineses*	Polygonaceae	A Longa	670	MK-065
14	*Polygonum capitatum* (L.)	Polygonaceae	Machariverban	463	MK-039
15	*Ficus lepidosa* (Wall.)	Moraceae	-	-	-
16	*Picus cunia* (Bush)	Moraceae	Gawai to Tazundaom	-	-
17	*Ficus roxburghii* (Wall.)	Moraceae	Rutao to Machanhow	1,442	MK-269
18	*Ficus lepidosa* (Wall.)	Moraceae	Lunga to Gawle	411	MK-013
19	*Pilea scripta* (Weld)	Urticaceae	-	558	MK-139
20	*Elastostema platyphyllum* (Wedd)	Urticaceae	Ahtanga	-	-
21	-	Urticaceae	Langato Gawle	670	MK-087
22	*Aritolochia* sp. (L.)	Aristolochiaceae	Tazandam to Shanmarlar	558	MK-129
23	*Hatropha* sp. (L.)	Urticaceae	-	1,920	MK-003
24	-	Amaranthaceae	Alanga	670	MK-085
25	*Paris polyphylla* (Smith)	Liliaceae	Smshaku	1,402	MK-168
26	*Engelhardtia spicata* (Blume)	Juglandaceae	-	1,441	MK-273
27	-	Zingiberaceae	Larnut to Ngawar	1,097	MK-218
28	*Setaria* sp. (Beauv.)	Gramineae	Kaumgmulon	-	-
29	-	Gramineae	Talihtu	-	MKT-041
30	-	Gramineae	Gawai to Tazaumdom	1,097	MK-266
31	-	Gramineae	Kaumgmulon	1,441	-
32	-	Gramineae	Tazaumdom to Sharjmalar	1,920	MKT-019
33	-	Gramineae	Lommut to Nyawar	1,097	MK-221
34	-	Gramineae	Gawai to Tazaumdom	1,441	MK-282
35	-	Gfamineae	Kaumgmulon	-	-
36	-	Gfamineae	Gawai to Tazundom	1,441	MK-275
37	-	Gfamineae	Lomlut	1,119	MK-199
38	*Viscum* sp. (L.)	Loranthaceae	Ngawar to Wangsiwang	1,364	MK-234
39	*Castanopsis* sp. (Spach)	Fagaceae	Ngawar to Wangsiwang	-	-
40	*Polygonum* sp. (L.)	Polygonaceae	Ngawar to Wangsiwang	-	-
41	*Polygonum serrulatum* (Lag.)	Polygonaceae	Guba to Madone	2,033	MK-309
42	*Corylopsis (aff) sinensis*	Hammelidaceae	Guba to Madone	-	-
43	*Corylopsis* sp.	Hammelidaceae	Tazjmdom to Shanmalar	1,920	MK-020

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Identified Apopetalous Checklist

	Scientific Name	Family	Locality	Altitude (m)	Voucher Remark No.
1	*Impatiens urticifolia*	Balsaminaceae	Longa to Gawle	558	MK-131
2	*Vitis* sp.	Vitaceae	Gawai to Tazundom	1,441	MK-263
3	*Polygala arillata*	Polygalaceae	-	-	MK133
4	*Elaeocarpus varunua* (Most)	Elaeocarpaceae	Babaw	558	MK-122
5	*Elaeocarpus* sp.	Elaeocarpaceae	Bgawar to Wangsiwang	1,364	MK-245
6	*Chaerophyllum* sp.	Umbelliferae	Tazjmdun	1,478	MK-133
7	*Oxalis* sp.	Oxalidaceae	Taibtu	-	MK-168
8	*Capsella bursopastoris* (L.)	Cruciferae	Taibtu	-	MK-816
9	*Aesculus punduana* (Hern)	Sapindacea	Tazjmdam to Shanmalar	1,920	MK-362
10	*Holboellia latifolia* (Kosi)	Lardizabalaceae	Wamshiwn	1,219	MK-236
11	*Clematis acuminata* (DC)	Ranunculaceae	Guba to Mudone	2,032	MK-311
12	*Berberis wallictriana* (DC)	Berberidaceae	Putao	409	MK-3
13	*Mahonia* sp.	Berberidaceae	Tazundom to Shanmajar	1,920	MK-008
14	*Mahonia nepalensis* (DC)	Berberidaceae	Tazundom to Shanmajar	1,920	MK-009
15	*Albizzia* sp.	Mimosaceae	Alango to Tazundum	-	-
16	*Melastoma normale* (Don)	Melastomaceae	Rabbaw	518	MK-109
17	*Eurya acuminata* (DC)	Theaceae	Gawai	1,326	MK-249
18	*Eurya acuminata* (DC)	Theaceae	Machanbaw to Alonga	463	MK-38
19	*Begonia lociniata* (Roxb.)	Begoniaceae	Gawle to Smsaku	670	MK-179
20	*Begonia* sp.	Begoniaceae	Machanbaw to Alonga	1,402	MK-43
21	*Begonia* sp.	Begoniaceae	Alanga	670	MK-71
22	*Begonia* sp.	Begoniaceae	Gawle to Smsaku	1,402	MK-179
23	*Magnolia campbellii* (Hook)	Magnoliaceae	Tahumdum	1,920	MK-344
24	*Polyalthia* sp.	Annonaceae	Vabaw	533	MK-103
25	*Viola pilosa* (Blume)	Violaceae	Alanga	670	MK-63
26	*Viola pilosa* (Blume)	Violaceae	Putao	411	MK-12
27	*Lindera* sp.	Lindaceae	Ipilcat	-	MK-29
28	*Cinnamomum* sp.	Lauraceae	Babaw	533	MK-100
29	*Cinnamomum* sp.	Lauraceae	Guba	2,032	MK-307
30	*Prunus persicum* (Benth)	Rosaceae	Langa	670	MK-153
31	*Prunus persicum* (Benth)	Rosaceae	Lannut	1,097	MK-217
32	*Fragaria* sp.	Rosaceae	Putao to Machanbaw	411	MK-12
33	*Fragaria nubicola*	Rosaceae	Gawai to Taztmdom	1,442	MK-279
34	*Prunus* sp.	Rosaceae	Tazundom to Shanmalar	1,920	MK-14
35	-	Rosaceae	Gawai	1,326	MK-251
36	*Rosa* sp.	Rosaceae	Wan Shiwon	1,219	MK-237
37	*Neillia* sp.	Rosaceae	Gawai	1,326	MK-257
38	*Rubus alpestris* (Blume)	Rosaceae	Gawai	1,326	MK-250
39	*Hedera* sp.	Araliaceae	Tahundum	192	MK-349
40	*Aralia* sp.	Araliaceae	Machanbaw to Atonga	463	MK-20
41	*Hedera* sp.	Araliaceae	Tohun dum	1,920	MK-248
42	*Schefflera* sp.	Araliaceae	Gawai	1,442	MK-261
43	*Trevesia* sp.	Araliaceae	Longa to Gawiw	558	MK-135

44	*Cardamine* sp.	Brassicaceae	Putao to Machanbow	411	MK-12
45	-	Rosaceae	Tazandom toTasugru	1,478	MK-336
46	-	Sterculiacea	Tazundomto Shanmalar	1,920	MK-363
47	-	Papilionaceae	-	-	-
48	-	Rosaceae	Babaw	533	MK-105
49	*Viola* sp.	Violaceae	Pangnandim to Lormut	1,636	MK-209
50	-	Araliaceae	Guba	2,032	MK-323
51	-	Rosaceae	Babaw to Rabaw	533	MK-104
52	*Cardamine* sp.	Cruciferae	Alangha	670	MK-066
53	*Crotalaria* sp.	Papilionaceae	Machanbow to Atanga	463	MK-033
54	*Dobinea* sp.	Sapindaceae	Gawai toTazundom	1,442	MK-270
55	*Corylopsis sinensis* (aff.)	Hamamelidaceae	Guba to Madone	2,032	MK-309
56	*Corylopsis* sp.	Hamamelidaceae	Tazundomto Shanmalar	1,920	NK-020
57	*Prunus carnesina* (Hera)	Rosaceae		-	MK-020

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Identified Sympetalous Checklist

	Scientific Name	Family	Locality	Altitude (m)	Voucher Remark No.
1	*Symplocos theaefolia* (Han)	Symplococeae	Machanbow to Alonga	463	MK-036
2	*Symplocos paniculata* (Thunb.)	Symplococeae	Rabaw	558	MK-123
3	*Clerodendrum siphonathus*	Verbenaceae	Outao to Machanbow	411	MK-014
4	*Clerodendron* sp.	Verbenaceae	Alanga	670	MK-056
5	*Clerodendron* sp.	Verbenaceae	Alanga	670	MK-064
6	*Edgeworthia gardneri* (Wall.)	Thymelaceae	Gawai	1,219	MK-247
7	*Daphne* sp.	Thymelaceae	Ipikut to Talititu	-	MK-051
8	*Justicia adhatoda* (L.)	Acanthaceae	Kaungmulone	-	-
9	*Rauvolfia rivularis* (Merr)	Apocynaceae	Shinshaku	1,402	MK-147
10	*Crawfurdia speciosa* (Wall.)	Gentianaceae	Wanshinon	1,219	MK-240
11	*Crawfurdia speciosa* (Wall.)	Gentianaceae	Tazundum	1,442	MK-268
12	*Gentianella* sp.	Gentianaceae	-	-	-
13	*Plantago major* (L.)	Plantaginaceae	Alanga	670	MK-061
14	*Lonicera* sp.	Caprifoliaceae	Machanbaw	463	MK-035
15	*Androsace* sp.	Primulaceae	Alanfa to Babaw	670	K-054
16	*Primula geraniifolia* (Hook)	Primulaceae	Takilihtu	-	MK-057
17	*Primula geraniifolia* (Hook)	Primulaceae	Takilihtu	-	MK-065
18	*Buddleia* sp.	Buddleiaceae	Machanbaw	381	MK-030
19	*Buddleia* sp.	Buddleiaceae	Machanbaw	463	MK-031
20	*Buddleia* sp.	Buddleiaceae	Gabato Madone	2,032	MK-326
21	*Wendlandia glabrata* (DC)	Rubiaceae	Machanbaw	463	MK-32
22	*Wendlandia uvarifolia* (Hance)	Rubiaceae	Alaha	670	MK-76
23	*Jasminum* sp.	Oleaceae	Machanbaw to Alanga	463	MK-27
24	*Jasminum* sp.	Oleaceae	Gaba to Madone	2,032	MK314
25	*Jasminum pubescens* (Wild)	Oleaceae	-	-	-
26	*Maesa manipurensis* (Mer)	Myrsinaceae	Langa to Gawle	670	MK-150
27	*Maesa indica* (Roxb.)	Myrsinaceae	Alaha	670	MK-80

28	*Maesa indica* (Roxb.)	Myrsinaceae	Alaha	-	-
29	*Leucas aspera* (Spreng)	Labiatae	Machanbaw	463	MK-34
30	*Gomphostemma* sp.	Labiatae	Alanga to Babaw	670	MK-47
31	-	Labiatae	Pangamandin to Lormut	1,119	MK-208
32	-	Labiatae	Ngawar to Wangsiwang	1,219	MK-243
33	*Oscimum* sp.	Labiatae	-	-	MK-139
34	-	Labiatae	Langa to Gawlw	558	-
35	*Leucas* sp.	Labiatae	Tazandum	1,142	MK-280
36	*Gnaphalium luteolbum*	Compositae	Babaw to F.abaw	533	MK-108
37	*Lactuca longfolia* (DC)	Compositae	Babaw	533	MK-113
38	*Dichrocephala bicolor* (Roth.)	Compositae	Pangnandim to Lonnut	1,119	MK-212
39	-	Compositae	Alanga	670	MK-52
40	-	Compositae	Alanga	670	MK-89
41	-	Compositae	Ngawar to Wangeiwang	1,219	MK-242
42	-	Compositae	Gawai	1,326	MK-256
43	-	Compositae	Alanga	670	MK-70
44	-	Compositae	Gawai	1,326	MK-255
45	-	Compositae	-	-	-
46	*Vernonia* sp.	Compositae	Waskjiwon	1,219	MK-240
47	*Ainsliaea* sp.	Compositae	Gawai	1,326	MK-253
48	*Petasites* aff. *fragrans* (Vill.)	Compositae	Gawai to Tazundum	1,142	MK-278
49	*Gaultheria* sp.	Ericaceae	Gawai	1,326	MK-248
50	*Gaultheria* sp.	Ericaceae	Tazundom toTasuhtu	1,478	MK-342
51	*Gaultheria hookerii* (Clarke) var *hookeri I*	Ericaceae	Ngawar	1,219	MK-246
52	*Gaultheria fragrantissima* (Wall.)	Ericaceae	Gawai	1,326	MK-248
53	*Rhododendron* sp.	Ericaceae	Babaw	533	MK-107
54	*Rhododendron keleticum* (Bulf)	Ericaceae	Alanga	670	MK-66
55	*Rhododendron mucronatum* (Bl.)	Ericaceae	Putao to Machanbaw	411	MK-16
56	*Rhododendron* aff. Neriiflorum	Ericaceae	Talihtu	-	MK-064
57	*Rhododendron* aff. *Strigillosum*	Ericaceae	Gaba to Madine	2,032	MK-304
58	*Rhododendron* aff. *Strigillosum*	Ericaceae	Gaba Madain	2,032	MK-303
59	*Rhododendron* sp.	Ericaceae	Faba Madain	2,032	MK-305
60	*Rhododendron* aff. *yunnanensis* (Franct)	Ericaceae	Takundam Gaba Madam	2,032	MK-302
61	*Rhododendron* (Bl.)	Ericaceae	Bawbaw to Rabaw	533	MK-111
62	*Rhododendron fictolacteum* (Balf.)	Ericaceae	Ipikat	-	MK-032
63	*Rhododendron ctolacteum* (Balf.)	Ericaceae	Ipikat	-	MK052
64	*Rhododendron cariaceum* (Franct.)	Ericaceae	Guab to Madone	2,032	MK-302
65	*Cynoglossum* sp.	Boraginaceae	Gawai	1,326	MK-254
66	*Leycesteria gracilis* (Kurz.)	Caprifoliaceae	Guab to Madone	2,032	MK-317
67	*Viburnum* sp.	Caprifoliaceae	Guab to Madone	-	-
68	*Viburnum* sp.	Caprifoliaceae	Guab to Madone	-	-
69	*Lindernia* sp.	Scrophulariaceae	Guab to Madone	-	-
70	-	Ericaceae	Tazundom to shamnalar	1,920	MK-004
71	-	Ericaceae	Guab to Madone	2,032	MK-315
72	*Vaccinium* sp.	Vacciniaceae	Guab to Madone	2,032	MK-313
73	-	Labitae	Alnaga	670	MK-509
74	-	Scrophulariaceae	Alnaga	463	MK-77,37