Sustainable harvesting

Non-timber forest products

South Xuan Lac Species and Habitat Conservation Area
Cho Don district, Bac Kan province, Vietnam

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People Resources and Conservation Foundation implemented this project in partnership with Fauna & Flora International and the Center for Plant Conservation, Vietnam. The project aims were to improve both the conservation of threatened species and the management of natural resources in the Ba Be / Na Hang Limestone Forest Complex, Tuyen Quang and Bac Kan provinces, northern Vietnam.

This forest complex is an area of high biodiversity significance and full of conservation hotspots. Its biodiversity and ecosystem have been degraded, mainly due to shifting cultivation, hunting, logging, and increasing population density.

The area includes primates such as the critically endangered Tonkin snub-nosed monkey (*Rhinopithecus avunculus*), the endangered Francois' langur (*Trachypithecus francoisi*), and conifer and magnolia species. It also forms part of the restricted home range of the largely unknown White-eared night heron *(Gorsachius magnificus*).

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Disclaimer

Some species listed in this document such as *Nervilia fordii* (Hance) Schultze, *Codonopsis javanica* (Blume) Hook.f.et Thoms are legally protected under Government of Vietnam legislation such as Decree 32.

The inclusion of these species in this document is not intended to encourage harvesting of these species and hence advocate breaking the law. However, they have been included as a proactive means to encourage conservation and sustainable use of the species. At the same time it is recognized that regardless of the legal ramifications of harvesting and selling product of the species, this practice will continue to occur due to both the scarcity and high prices that the harvested product attracts.

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Contents

Part 2. Sustainable harvesting guidelines

1. HOÀNG TINH LÁ CÁCH
2. HOÀNG LIÊN Ô RÔ
3. SẤU
4. TRÁM TRẮNG
5. BÁCH BỘ
6. BẢY LÁ MỘT HOA
7. HUYẾT ĐẰNG
8. BÌNH VÔI ĐỎ
9. CÂY MỘT LÁ
10. SONG ĐÁ
11. CHÈ DÂY (KHAU SẢ)
12. THIÊN NIÊN KIỆN
13. DÂY HƯƠNG (BÒ KHAI)
14. ĐẢNG SÂM
15. CẤU TÍCH
16. SA NHÂN
17. THẢO ĐẬU KHẤU
18. RAU SẮNG
19. CÂU ĐẰNG BẮC
20. GIẢO CỔ LAM

Introduction

Background

The South Xuan Lac Species and Habitat Conservation Area is a small protected area of 1,788 ha located in the Cho Don district of Bac Kan province and the Ba Be / Na Hang Limestone Forest Complex. This conservation area was originally declared in order to protect two primate species (Tonkin Snub-nosed Monkey: *Rhinopithecus avunculus* and Francois' Langur: *Trachypithecus francoisi*), flora (principally non-timber forest products, orchids and hardwood tree species) and general biodiversity. It also serves as a partial corridor between Na Hang Nature Reserve and Ba Be National Park.

Many people living in villages within the buffer zone next to the conservation area supplement their livelihoods from local forest resources found within the protected area, such as non-timber forest products and hardwood timber. People Resources and Conservation Foundation, in partnership with the South Xuan Lac Species and Habitat Conservation Area Management Board, the Forest Protection Department and the local community, are attempting to develop a natural resource and biodiversity governance program. This program recognizes the importance of biodiversity and the role of local people in the management of natural resources.

Non-timber forest products

PRCF field staff have confirmed the importance of a wide variety of non-timber forest products to local forest-dependent communities. These include 20 species with both economic and conservation significance. Their availability varies according to the season and market demand. Harvesting pressure often results in reduced diversity, abundance and quality of some non-timber forest products (Tran Ngoc Hai & Dine, 2007). Reports from key local informants suggest that some species are not as common as they once were. Plants are often harvested opportunistically, regardless of their maturity and size.

Tran Ngoc Hai & Dine (2007) and Dine (2007) suggested that the reduced area and quality of natural forests, coupled with increases in both the demand for and value of many non-timber forest products, have changed the pattern of harvesting during the past 20 years. Although traditional harvesting techniques were often destructive and wasteful, harvesters only extracted enough products to satisfy their immediate needs, so forest areas were able to recover sufficiently without significant long-term impacts. Strong market demand and high prices have created incentives for harvesters to collect anything of market value. This places greater pressure upon the remaining forest resources.

Harvesting techniques

Changes in harvesting patterns have unfortunately not been met with corresponding modifications in harvesting techniques: most are still wasteful and inefficient. Even if some forest species are still abundant, continued unsustainable harvesting practices over the longer term will threaten their survival. Therefore, behavioural change is needed to ensure that harvesters use sustainable harvesting methods in the long term.

This guide describes and assesses current methods for harvesting 20 significant non-timber forest products found within the conservation area and suggests alternative sustainable techniques for longer-term sustainable harvesting. It also provides step-by-step guidelines for local harvesters on how to improve techniques for harvesting non-timber forest products, helping to ensure their livelihoods .

About this guide

Information was gathered through field research with experienced harvesters from local communities who generously shared their extensive knowledge gained through years of harvesting non-timber forest products.

PRCF staff travelled to the forest with local informants who demonstrated the techniques they use to harvest particular species. The harvesting process was photo-documented and assessed for sustainability according to the criteria outlined below.

This guide is divided into two parts.

Part 1:
Description and assessment of current harvesting methods

A technical guide designed to help rangers and technical staff manage the harvesting of important local non-timber forest products. It includes:

- a description and assessment of the harvesting techniques currently employed by local harvesters
- recommendations to improve the sustainability of these harvesting practices.

The following information for each of the selected 20 non-timber forest products is documented:

1. pictures identifying the species and material intended for harvesting
2. botanical nomenclature
3. plant morphology
4. other related information such as plant part harvested, harvesting season, estimated age of reproductive maturity, purpose of the non-timber forest products and demand rating
5. shortcomings of harvesting techniques used
6. sustainable harvesting rating
7. recommendations to improve harvesting techniques.

Part 2:
Sustainable harvesting guidelines

Step-by-step guidelines that aim to help harvesters to improve their harvesting practices. The guidelines for each species are presented on a double-sided page, making them easy to use.

Information includes the part of the plant to be harvested, harvesting season, sustainable harvesting techniques and techniques that should be avoided due to the damage they cause to either the plant or to the surrounding habitat.

Definitions

Demand rating

The level at which the non-timber forest product is in demand for either local use (subsistence consumption), or driven by market forces.

Indicator	Criterion
Low	Limited harvesting from the forest for local household and local consumption only
Medium	Mostly used for local household and local consumption or use with limited stocks sold to traders for external (out of area) sale
High	Very little harvested for household and local consumption or use with most sold to traders for external (out of area) sale)
Very High	Harvesting undertaken for the purpose of external trade only – mostly rare and high economic value species.

Sustainable harvesting rating

A rating system has been devised to determine whether the harvesting techniques currently employed by local people are likely to result in the long-term sustainability of the resource. Three criteria have been developed to help assess the status of these techniques:

- Destruction or serious degradation to the plant
- Ability to reproduce
- Impact upon habitat.

Rating 0 – 3: Destructive

1. Destruction / serious degradation to the plant

- Total removal of the plant from the ground.
- Damaged so badly that there is a high probability that it will die or result in the plant regenerating slowly with significant reduction in productivity.

2. Ability to reproduce

- Harvested before fruit or seed are ripe and dispersed (i.e. wrong season).
- High percentage (above 80%) of all fruit/seed harvested.
- Harvesting of plant parts occurs in seasons that may stop the development of fruit or seed e.g. time of bud development or flowering.
- All plants of the species collected regardless of level of reproductive maturity (age) and size (also relates to quality and quantity).

3. Impact upon habitat

- Microclimate for plant modified significantly. Example: requires deep shade, however, now grows under a much higher level of or direct sunlight.
- Associated vegetation contributing to microclimate and mutualistic associations destroyed or significantly disturbed.

Rating 4 – 6: Partially destructive

1. Destruction / serious degradation to the plant

- Most plant parts removed or damaged particularly those involved with plant growth.
- Damage to the plant results in a long recovery time before it may be harvested from again or is capable of fruiting or seeding.

2. Ability to reproduce

- Harvested prior to ripening or early in the season when fruit or seed commences ripening i.e. not all fruit or seed may be viable.
- 60 – 80% of all fruit or seed harvested from the plant.
- Damage mostly to plants that have the potential to grow into mature trees capable of producing viable seed or fruit or breakages to large branches that hold large volumes of fruit or seed.
- Harvesting occurs often when the plant is not reproductively mature.

3. Impact upon habitat

- Disturbance to surrounding plants affects microclimate or habitat (e.g. temperature and light).
- Some damage to surrounding vegetation and plants through harvesting activities.

Rating 7 – 9: Sustainable

1. Destruction / serious degradation to the plant

- Mostly specific parts of the plant are harvested e.g. fruit, leaves, some branches or part of roots.
- Damage to plant is minimal and is caused mainly by careless harvesting practices and use of inappropriate equipment.
- After harvesting plants recover or regenerate within a season.

2. Ability to reproduce

- Harvesting occurs in the correct season and when fruit or seed is ripe.
- Harvesting from plants occurs when they are reproductively mature.
- Harvesting of product is sufficient to ensure that new plants may grow from seed or fruit or other.

3. Impact upon habitat

- Little change to the required microclimate or habitat of the plant.
- Disturbance to surrounding plants minimal with any damage to microclimate or habitat being temporary; plants recover quickly.

Rating 10: Mostly sustainable

1. Destruction / serious degradation to the plant

- Plant continues to grow unaffected by harvesting of the product.
- Specific parts of the plant are harvested e.g. fruit, leaves, some branches – or parts of roots or tubers.

2. Ability to reproduce

- Harvesting does not damage buds, flowers or seed or fruit.
- Harvest of plant is considered to be sustainable and allows fruit or seed to be dispersed by birds or naturally
- Harvesting occurs during the correct season when fruit or seed is ripe
- Plant species is mature.

3. Impact upon habitat

- Little or no change to the required microclimate or habitat of the plant.
- Disturbance to surrounding plants minimal with little damage; plants can maintain adequate microclimate or habitat.

Conservation status summary

No.	Botanical Name	Common name	Status in Vietnam
1.	*Disporopsis longifolia* Craib	Hoàng Tinh Lá Cách	VU A1 c,d
2.	*Mahonia bealei (Fort.) Carr. 1854*	Hoàng liên ô rô	EN A1 c,d
3.	*Dracontomelom duperrianum* Pierre	Sấu	None
4.	*Canarium album* (Lour) Raeusch	Trám trắng	None
5.	*Stemona tuberose* (Lour)	Bách Bộ	None
6.	*Paris polyphylla* Smith	Bảy lá Một hoa	None
7.	*Sargentodoxa cuneata* (Oliv.) Redh. Et Wils.	Huyết Đằng	R
8.	*Stephania kwangsiensis* H.D.Lo	Bình Vôi Đỏ	E
9.	*Nervilia fordii* (Hance) Schultze.	Cây Một lá	EN A1d+2d Decree 32/CP
10.	*Calamus spp.*	Song Đá	None
11.	*Ampelopsis cantoniensis* (Hook. et Arn) Planch	Chè Dây (Khau Sá)	None
12.	*Homalomena occulta* (Lour)	Thiên Niên Kiện	None
13.	*Erythropalum scandens* Blume.	Dây Hương (Bò Khai)	None
14.	*Codonopsis javanica* (Blume) Hook.f.et Thoms.	Đảng Sâm	VU A1a,c,d. Decree 32/CP
15.	*Cibotium barometz* (L.) J. Sm.	Cẩu Tích	None
16.	*Amomum xanthioides* Wall	Sa Nhân	None
17.	*Alpinia katsumadai* Hayata	Thảo Đậu Khấu	None
18.	*Melientha suavis* Pierre	Rau Sắng	VU B1
19.	*Uncaria rhynchophylla* (Miq) Jack	Câu Đằng Bắc	None
20.	*Gynostemma pentaphyllum* (Thunb.) Makino 1902	Giảo Cổ Lam	EN

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PART 1

Current harvesting methods

1. HOÀNG TINH LÁ CÁCH

Hoàng Tinh Lá Cách older than 3 years

Hoàng Tinh Lá Cách roots

HOÀNG TINH LÁ CÁCH

***Disporopsis longifolia* Craib**

Convallariaceae

Plant part harvested or used: Root, tuber
Harvesting season: Whole year
Age at reproductive maturity: After 2 years
NTFP purpose: Medicine
Consumption or sale: Sold only to traders exporting to China
Demand: High
Sustainable harvesting rating: 0 – 3

Plant morphology

- Plant grows to between 1–1.5 m high with stem diameter of about 1–1.5 cm when mature.
- Leaves are oblong in shape arranged alternatively along the stem with a short petiole joining the stem to the leaf blade.
- Leaf tips are acute (pointed) with some curling upwards.
- Roots are white.
- Flowers are red and tubular.
- Flowers: March – May.
- Fruiting: June – August.
- This species can be propagated vegetatively (sprout, bud).

Harvesting issues

- Whole plant removed from the ground. Harvesting the entire plant and not leaving any plants to reproduce results in limited regeneration potential and recovery.
- Surrounding plant species that provide shade are cleared.
- Roots of all plants in the same vicinity are harvested.
- Plant microclimate is seriously affected and habitat is badly damaged, reducing natural regeneration potential.

How to improve harvesting techniques

- ✓ Minimise damage to surrounding plants by disturbing only the areas necessary to access the plant for harvesting the root.
- ✓ Only select large plants at least 2 years of age.
- ✓ At any one place harvest a maximum of 60 – 70% of the total plants available.
- ✓ Leave some mature plants to repopulate the area harvested.
- ✓ Take ¾ of the root and tuber length and leave the remaining ¼ length nearest to the stem.
- ✓ Replant the stem, root and tuber back in the ground.

2. HOÀNG LIÊN Ô RÔ

Four-year old Hoàng Liên Ô Rô

Long compound leaves

Globular yellow flowers

Harvested stem

HOÀNG LIÊN Ô RÔ

Mahonia bealei (Fort.) Carr. 1854

Berberidaceae

Plant part harvested or used: Stem and branches
Harvesting season: Whole year
Age at reproductive maturity: From 3 years old
NTFP purpose: Medicine
Consumption or sale: Mostly harvested for export to China
Demand: High
Sustainable harvesting rating: 7 – 9

Plant morphology

- Shrub 2 – 3 m with compound 15 – 35 cm long pinnate leaves without phyllodes.
- Both sides of the rachis have 4 – 7 leaflets each 3 – 9 cm long and 2.5 – 4.5 cm wide; sharp serrated
- Leaves are hard and quite thick; wood and roots are yellow.
- Flowers are globular and yellow with a short pedicel extending from stem axis to the flower.
- Fruit contains 1 seed.
- Flowers: October – November
- Fruiting: end of November to February of the following year.

Harvesting issues

- Harvesting results in the entire plant cut very close to the ground.
- Harvesting occurs frequently resulting in little recovery time from the previous harvesting event before they are harvested again.
- Young regenerating shoots are harvested.
- Harvesting of stem and branches occurs before flowering and fruiting occurs.
- Although all the above-ground parts of the plant are harvested, the underground structures of the plant remain intact and coppicing occurs from the base. Although this current harvesting method is partially sustainable, harvesting prior to flowering and fruiting results in no seed being dispersed.

How to improve harvesting techniques

- ✓ Leave at least one stem on each shrub so that seed may be dispersed.
- ✓ Leave a length of 20cm above the ground level from which more coppicing may result.
- ✓ Avoid damaging coppicing regrowth on the stem when harvesting.
- ✓ Avoid making cuts to the stem and wounding the tree.
- ✓ Harvesting of stem or branch should occur from November to February, **after** fruiting and seed dispersal.

3. SẤU

Sấu tree – 5 years old

Sấu fruits harvested for food or sale

SẤU

Dracontomelon duperreanum BL

Anacardiaceae

Plant part harvested or used: Fruit
Harvesting season: August and September
Age at reproductive maturity: Older than 5 years
NTFP purpose: Food
Consumption or sale: Used locally and sold in markets
Demand: Medium
Sustainable harvesting rating: **7** – 9

Plant morphology

Large tree up to 30 m with a 1 – 1.2 m trunk diameter.

Leaves: compound pinnate 30 – 40 cm long; leaflets on average 5 – 7 cm long, 2 – 4 cm wide.

Young flowers: blue or straw-coloured.

Fruit diameter ranges from 1.5 – 2.5 cm. Young fruit turns yellow when ripe.

Flowers: Spring – Summer.

Fruiting: Summer – Autumn.

Harvesting issues

- Trees are often cut down to harvest the fruit.
- If branches are cut, this often damages the trunk, leaving the tree open to disease infestation.
- All fruit from the tree is harvested and none remains for fauna or natural dispersal.
- If the tree is cut down to harvest fruit there is a high likelihood of it dying.
- Cutting of branches results in little permanent damage to surrounding vegetation.

How to improve harvesting techniques

- ✓ Don’t cut the tree down.
- ✓ Minimise cutting of branches. If branch cutting is necessary, use saws on extension poles to minimise damage to the trunk, increase healing time, and decrease disease and insect attack.
- ✓ Use non-destructive seed collection techniques such as placing tarpaulins on the ground and shaking the main trunk, climbing with cleats to harvest or using extension poles to cut fruit or branches from the tree.
- ✓ Don’t collect all fruit. Leave around 20 - 30% on the tree to help with natural seed dispersal.

4. TRÁM TRẮNG

Planted in a home-garden

Natural growing tree

A mature tree with unripe fruit.

Almost ripe fruit

TRÁM TRẮNG

Canarium album (Lour) Raensch

Burseraceae

Plant part harvested or used:	Fruit and resin (from stem)
Harvesting season:	Fruit: July to September; resin: all year
Age at reproductive maturity	Fruit: 5 years or more; resin: after 15 years
NTFP purpose:	Food and material
Consumption or sale:	Fruit used locally; resin sold on by traders
Demand:	High; common food in mountainous areas
Sustainable harvesting rating	7 – 9

Plant morphology

Large tree 15 – 20 m high.

Compound pinnate leaves 30 – 40 cm long; ovoid leaflets 5 – 17 cm long, 2 – 6 cm wide, tapering to the tips; leaf blade is entire.

Fruit approximately 40 mm long and 20 – 25 mm wide and yellow when ripe.

Flowers: May – June.

Fruiting: August – November.

Harvesting issues

- Immature trees are harvested for resin.
- Current methods wound the trunk and injure the tree: incisions are made too deeply into the cambium to tap resin and too many taps are made in relation to the trunk diameter.
- Old taps are not allowed to heal long enough before they are retapped.
- Branches or the whole tree are cut to collect fruit resulting in either no or minimal fruit the following year or death of the tree.
- Product most frequently harvested is fruit for food and some resin is harvested.
- Harvesting does not generally threaten the production of fruit.
- Surrounding vegetation is only temporarily damaged by removal of branches.

How to improve harvesting techniques

- ✓ Resin harvesting should ideally be in Summer from trees with a minimum trunk diameter of 25 cm. Incisions should be made at mean breast height of the tree and taps divided equally and symmetrically around the circumference of the trunk. Trees should produce fruit normally.
- ✓ Do not break off branches or cut down the tree. Use a ladder or rope to climb into the tree to harvest fruit or use a long pole with cutting blade to cut fruit from the branches.
- ✓ Don’t collect all the fruit from the tree. Leave about 20 – 30% of the total.

5. BÁCH BỘ

Bách Bộ 2m years long (2 years or more) at an acceptable level for harvesting

Harvesting Bách Bộ

Bách Bộ roots and tubers

BÁCH BỘ

Stemona tuberosa Lour

Stemonaceae

Plant part harvested or used: Tubers
Harvesting season: September to February the following year
Age at reproductive maturity 2 – 3 years
NTFP purpose: Medicine
Consumption or sale: Limited domestic consumption; most sold for export to China
Demand: High
Sustainable harvesting rating: 0 – 3

Plant morphology

- Climber with a narrow diameter green coloured stem 6 – 8 m long.
- Opposite leaves, cordate-shaped leaves, light green on both sides with prominent parallel venation; petioles are 2 – 3 cm long.
- Each plant has 20 – 30 white swollen roots 15 - 20 cm long and 1.5 – 2 cm in diameter.
- Flowers are yellow or red-coloured; fruit contain four seeds.
- Flowers: March – May.
- Fruiting: July – August.

Harvesting issues

- Total removal of the plant from the ground to harvest tubers.All tubers from the plant are harvested leaving nothing to regenerate.
- Harvesting is opportunistic meaning that when found in the forest at any time of the year tubers are harvested and there is a high likelihood that the plant has not flowered and fruited.
- Harvesting technique results in total destruction of the plant with low likelihood of recovery.
- Large holes dug to harvest tubers results in clearance of surrounding vegetation and modification of microclimate or habitat.

How to improve harvesting techniques

- ✓ Minimise the clearance of surrounding plants; only disturb what is absolutely necessary to harvest the tubers.
- ✓ Select plants with stem diameter of at least 1.5m to collect tubers from.
- ✓ Do not cut stem from tubers when starting to dig tubers from the ground.
- ✓ Leave stem attached to a tuber; leave 1/8 of the total tuber for plant to regenerate from.
- ✓ Replant stem with attached tubers and cover with soil before leaving the plant.

6. BẢY LÁ MỘT HOA

Plant with flower

Unripe fruit

Root and tuber

BẢY LÁ MỘT HOA

***Paris polyphilla* Sm**

Liliaceae

Plant part harvested or used:	Roots, tubers
Harvesting season:	April to November
Age at reproductive maturity:	3 – 4 years
NTFP purpose:	Medicine
Consumption or sale:	Sold locally to traders and in markets as it has high medicinal value in mountainous areas. Most sold for export to China.
Demand:	High
Sustainable harvesting rating:	0 – 3

Plant morphology

Herbaceous perennial 30 – 100 cm high.

Leaf blade is oval-shaped 7 – 17 cm long, 2.5 – 5 cm wide; phyllode of old leaves is 8 – 10 cm and of young leaves is 5 – 6 cm long.

Flowers are yellow, purple.

Fruit is yellow-coloured and succulent with large 3 cm yellow seeds.

Flowers: March – May.

Fruiting: September – November.

Harvesting issues

- The entire plant is removed when harvested.
- Immature, young plants i.e. those with only one node are harvested.
- Total removal of the plant from the ground.
- Plant harvested in the wrong season so recovery is slow.
- Harvesting of the plant causes considerable damage to surrounding vegetation.

How to improve harvesting techniques

- ✓ Harvest plants with a minimum of 3 – 4 nodes.
- ✓ Leave root length of 1 node attached to a short length of stem for plant to regenerate from.
- ✓ Replant stem with attached roots and cover with soil prior to leaving.
- ✓ Harvest roots after fruiting has finished in November and before flowering in March—April (when flowering season starts).
- ✓ Minimise the clearance of surrounding vegetation: only disturb what is absolutely necessary to harvest roots.

7. HUYẾT ĐẰNG

Stem used for medicine

2-year old leaves

HUYẾT ĐẰNG

Sargentodoxa cuneata (Oliv.) Redh. Et Wils

Sargentodoxceae

Plant part harvested or used: Old stem
Harvesting season: September to February the following year
Age at reproductive maturity: 3 years or more
NTFP purpose: Medicine
Consumption or sale: Mostly harvested to export to China
Demand: High
Sustainable harvesting rating: 4 – 6

Plant morphology

- Climber. Roots and old stem yellow.
- Leaves are parallel, 9 – 20 cm long, 4 – 10 cm wide, very hard, ovate-shaped with three main veins.
- Petioles are long, swell out at the base and at the tip.
- Flowers are small, yellow coloured, 30 – 40 mm long.
- Oval-shaped fruit turn yellow when ripe.
- Flowers: March – April.
- Fruiting: July – August.

Harvesting issues

- Small plants with small tubers are harvested despite yielding small product return.
- Entire plant is harvested and plant cut very close to the ground.
- Harvesting of immature/small plants occurs frequently.
- Harvesting occurs at the end of the fruiting season.
- Harvesting of the plant causes some damage to surrounding vegetation.

How to improve harvesting techniques

- ✓ Harvest plant at a minimum of three years of age.
- ✓ Don't harvest all tubers and the vine stem. Leave a 20 – 40 cm length at the base of the vine
- ✓ Harvest after the fruiting season is completed in September.
- ✓ Minimise clearance of surrounding vegetation to what is absolutely necessary to harvest the tuber and old stem.

8. BÌNH VÔI ĐỎ

Over 2 year old Bình Vôi Đỏ (planted)

Leaves close up

Small tuber

Large tuber

BÌNH VÔI ĐỎ

***Stephania kwangsiensis* H.S.Lo**

Menispermaceae

Plant part harvested or used: Tuber, young leaves for vegetable
Harvesting season: August to February young leaves throughout the year.
Age at reproductive maturity: At least 1 year old
NTFP purpose: Medicine
Consumption or sale: Sold to traders for export to China
Demand: Medium
Sustainable harvesting rating: 4 – 6

Plant morphology

- A herbaceous and deciduous vine 2 – 6 m long with dark brown bark; old stems slightly woody at the base.
- Leaves are palmate (triangular-rounded to rotund), length and width subequal, 5 – 12 cm or slightly longer with 10 or 11 veins.
- Leaves are attached to the stem by a 4 – 9 cm petiole.
- Tubers are large, scraped bulbs are slightly pink.
- Flowering: March – April.
- Fruiting: July – August.

Harvesting issues

- Entire plant is removed from the ground leaving nothing to regenerate from.
- Harvesting occurs throughout the year irrespective of fruiting, seeding and flowering seasons.
- All plants at the same location harvested.
- As the entire plant and all plants are removed from the one vicinity throughout the year, regeneration potential is low and regeneration speed is slow, especially when seed is not being produced.
- Digging of large holes to extract the tuber and cutting back of surrounding vegetation causes significant modification to the surrounding microclimate and habitat.

How to improve harvesting techniques

- ✓ Harvest plants older than three years.
- ✓ Harvest from October to February after the flowering and fruiting season are completed.
- ✓ Leave part of a tuber attached at the base of the vine stem and replant, covering with soil, immediately after harvesting.
- ✓ Avoid damage to surrounding plant species that Bình Vôi Đỏ uses to climb into the canopy.

9. CÂY MỘT LÁ

Một Lá leaf

Một Lá root without tuber

Leaf

CÂY MỘT LÁ

***Nervilia fordii* (Hance) Schltr.**

Orchidaceae

Plant part harvested or used:	Tuber and entire plant
Harvesting season:	August
Age at reproductive maturity:	More than 12 months
NTFP purpose:	Medicine
Consumption or sale:	Medicine. Very rare and economically valuable species for traders (all export to China)
Demand:	High
Sustainable harvesting rating	0 – 3

Plant morphology

- Herbaceous perennial with a whitish globose tuber 10 – 15 mm in diameter.
- Leaves are single with a petiole like erect stalk 10cm long, pale green on both surfaces and cordate-ovate, around 8 – 10 cm wide and long.
- Leaf venation is palmate with around 20 main veins. 4 – 5 red/pink flowers.
- Fruit is grey and contains numerous small seeds.
- Leaf senesce during winter and regrow at the beginning of spring.
- Flowers: March – April.
- Fruiting: June – July.

Harvesting issues

- Harvested as soon as leaves are visible and often before the fruiting season (June – July).
- All plants at the same location are harvested regardless of their maturity.
- Harvesting of this ground species often results in trampling of regenerating young plants and leaves re-emerging in spring.
- Harvesters search the understorey for emergent leaf, damaging surrounding plants.
- Entire plant is removed from the ground leaving nothing to regenerate from and no seed to be cast back in the vicinity.

How to improve harvesting techniques

- ✓ Harvest in August after fruiting season has finished.
- ✓ Leave 20% of all plants at any one location.
- ✓ Leave all small plants to encourage natural regeneration.
- ✓ Only clear understorey plants that obstruct searching in the immediate vicinity.

10. SONG ĐÁ

Large Song Đá

Song Đá after bark has been peeled away

SONG ĐÁ

Calamus Spp

Palmae

Plant part harvested or used:	Aerial stems
Harvesting season:	September to June
Age at reproductive maturity	5 years or more
NTFP purpose:	Material for handicraft production
Consumption or sale:	Sold in domestic markets or to sales representatives for handicraft processing
Demand:	High
Sustainable harvesting rating	0 – 3

Plant morphology

- A clustering rattan with a stem of 3 cm – 10 cm in diameter; grows up to 30 m long.
- The 7 cm – 10 cm diameter sheath is green and sometimes striped with white; the yellow spines have long red tips; ocrea is tiny and dry, with no spines or bristles.
- Leaves are 0.6 m – 1.9 m long with a 0.4 m – 1 m cirrus.
  Boat-shaped leaflets are usually 3.5 cm – 5.5 cm long and dark-green, while the leaf stalk is 30 cm – 50 cm long.
- Inflorescence is 0.2 m – 1.4 m long, erect and droops when long.
- Fruit: pale and scaly 0.7 cm – 1.2 cm x 0.7 cm – 1 cm with red edges.
- Fruiting: July – August.

Harvesting issues

- Stems are haphazardly cut more than a metre from the base of the plant, resulting in a large amount of wasted product.
- All stems are harvested intensively and none are kept for the following year.
- Stems are cut while seeds are immature or during flowering.
- Surrounding habitat is severely damage when rattan is pulled from the above canopy.
- Harvest of material occurs from the large part of the aerial stem only (2.5 – 3 m from base).

How to improve harvesting techniques

- ✓ Harvest after fruit has ripened and dropped seed after September.
- ✓ Cut rattan stems once they reach lengths of 5 m or more and minimise damage to multi-stems at the base.
- ✓ Cut stems close to the ground and remove the whole aerial stem from the canopy above.
- ✓ Prune off all dead or diseased stems and leaves to increase plant health and to make it less susceptible to disease.

11. CHÈ DÂY (KHAU SẢ)

Harvested branches

Chè Dây uses surrounding plants to climb on

CHÈ DÂY (KHAU SẢ)

Ampelopsis cantoniensis (Hook. et Arn) Planch

Vitaceae

Plant part harvested or used:	Leaf and stem
Harvesting season:	November to May the following year
Age at reproductive maturity:	9 – 10 months
NTFP purpose:	Medicine (tea)
Consumption or sale:	Used for household consumption and sale
	Medium
Sustainable harvesting rating:	4 – 6

Plant morphology

A woody climber with cylindrical branches; tendrils are opposite with leaves, split into 2 – 3 small branches.

Doubly compound leaves, low serrate margin; 3 – 5 pairs of side-vein.

Big black oval-shaped fruit containing 3 – 4 seeds.

Flowers: June.

Fruiting: October.

Harvesting issues

- Harvesting generally occurs opportunistically.
- All above-ground stem is harvested but roots remain in place to coppice from.
- Year wide opportunistic harvesting results in limiting natural dispersal of seed and hence replenishing natural stocks.
- Disturbance to surrounding vegetation and habitat is minimal.

How to improve harvesting techniques

- ✓ Harvesting should occur in late Autumn to early Winter (after fruiting has finished in October).
- ✓ Do not harvest or cut the entire plant; only harvest old branches and let young branches develop and seed.
- ✓ Give priority to selection of old leaves first and then a maximum of 50% of young leaves.
- ✓ Cut branches from the tree with appropriate cutting equipment e.g. secateurs or small saw; don't break branches off by hand.
- ✓ Care should be exercised to avoid destroying the plants that this species scrambles over.

12. THIÊN NIÊN KIỆN

Harvesting rhizomes

Thiên Niên Kiện (Vạt Hương) leaves

Only harvest the swollen rhizomes

THIÊN NIÊN KIỆN

Homalomena occulta (Lour.) Schott

Araceae

Plant part harvested or used: Rhizome (root)
Harvesting season: September to December
Age at reproductive maturity: 1 year (plants with root length of over 20 cm)
NTFP purpose: Medicine
Consumption or sale: Harvested frequently and sold at farm gate
Demand: Medium
Sustainable harvesting rating: 0 – 3

Plant morphology

- Clump-forming evergreen perennial with mainly heart-shaped leaves 20 – 35 cm long and 15 – 20 cm wide; ocrea-shaped petiole 20-50 long
- Leaves grow directly from the base of the stem.
- Rhizome is cylindrical, long; cross-section has multiple rootlets.
- Flowers are tiny and without petals, enclosed in a usually greenish spathe hidden by the leaves. Berries are red when ripe.
- Flowers: March – April.
- Fruiting: June – August.

Harvesting issues Orchidaceae

- Entire plant is dug out of the ground to extract the rhizome.
- All plants regardless of age or size are harvested.
- Harvested plant dies after harvesting.
- Surrounding vegetation is seriously disturbed to harvest the root.
- Totally removed from the ground with no root left to assist the plant to regenerate.
- Young plants are harvested often without fruiting or seeding.
- Surrounding vegetation and habitat degraded during harvesting.

How to improve harvesting techniques

- ✓ Select plants with root length over 20 cm.
- ✓ Harvest in Autumn and Winter after plants have flowered and fruited (June – August).
- ✓ Leave a 2 – 3 cm length of root attached nearest to the stem and replant upright covering the root with soil before leaving.
- ✓ Restrict clearance of surrounding vegetation to that around the base of the plant.

13. DÂY HƯƠNG (BÒ KHAI)

Dây hương regenerating from seed

Dây hương more than 5 years' old

Leaves collected and sold at markets

DÂY HƯƠNG (BÒ KHAI)

***Erythropalum scandens* Blume**

Erythropalaceae

Plant part harvested or used:	New leaves and stem
Harvesting season:	New leaves: March – October. Stem: November to March the following year.
Age at reproductive maturity:	1 year or more
NTFP purpose:	Food (vegetable) and medicine
Consumption or sale:	Used locally as a vegetable; sold widely at local markets in mountainous areas
Demand:	High
Sustainable harvesting rating:	7 – 9

Plant morphology

- Herbaceous climber with a stem diameter from 2 – 6 cm and strong tendrils 15 – 25 cm long.
- Main stem colour is green when young; brown-yellow at maturity; mouldy-white when old.
- Leaves are alternate, cordate, 9 – 16 cm long, 6 – 11 cm wide with wavy margins, pointed tips and three major veins.
- Flowers are small and grow from leaf axils.
- Oval fruits 1 – 1.5 cm long turning from yellow to red when ripe and one ovoid seed.
- Flowers: April – June.
- Fruiting: June – October.

Harvesting issues

- Ripping leaves from the stem injures the plant.
- Often the entire plant is cut to harvest all the leaves at one time.
- The more this species is harvested the quicker it regenerates, as long as the plant is not killed from overzealous harvesting of the entire plant.

How to improve harvesting techniques

- ✓ Don’t cut the entire plant to harvest the leaves.
- ✓ Leaf harvesting may occur throughout the year, however, care should be exercised to ensure that harvesting leaves from March to October does not have a significant impact upon flowering.
- ✓ If regularly harvesting from a Bò Khai in the forest, cut old branches back in February and March to encourage quick nature regeneration and production of new growth.
- ✓ Select only young light green leaves and young stems with leaves 8 – 10 cm in length.
- ✓ Grow the plant easily in home gardens by taking cuttings or seeds.

14. ĐẢNG SÂM

Đảng Sâm flowers

Đảng Sâm fruit are violet when ripe

ĐẢNG SÂM

Codonopis javanica (Blume) Hook.f.et Thoms.

Campanulaceae

Plant part harvested or used: Tuberous roots
Harvesting season: Autumn and Winter
Age at reproductive maturity: 2 – 3 years
NTFP purpose: Medicine
Consumption or sale: Generally harvested for sale to traders
Demand: Medium
Sustainable harvesting rating: 0 – 3

Plant morphology

- Slender perennial twining herb 2 – 3 m long with green stem, tuberous roots 1.5 – 2.5 cm long with milky juice.
- Leaves opposite, cordate with denticulate margins, 3 – 8 cm long, 2 – 4 cm wide and petiole 2 – 6 cm long.
- Leaves senesce during winter and regrow in spring.
- Flowers ivory-yellow and solitary at the leaf axil.
- Berries are globose, violet 1 – 2 cm in diameter with numerous seeds.
- Flowers: March – October.
- Fruits: October – December.

Harvesting issues

- The stem is cut from the plant and all tubers are harvested.
- Destructive harvesting – whole plant removed from the ground; nothing to regenerate from or to disperse seed.
- All plants found are harvested regardless of age and size; harvesting frequently occurs before fruiting season.
- Damage to surrounding vegetation is high especially to plants above that it climbs into.

How to improve harvesting techniques

- ✓ Select plants at least 2 – 3 years old. Leave small plants to produce fruit before harvesting.
- ✓ Harvest in winter after fruiting finishes in December and stop when new leaves develop.
- ✓ If fruit encountered on the stem, hand disperse seed around the harvesting zone.
- ✓ Do not cut the stem from the plant. When harvesting, leave a small section of tuber (with small roots) attached close to the stem and tuber junction; replant and cover with soil.
- ✓ Minimise damage to surrounding vegetation by only cutting plants around the ground level rather than cutting all the vegetation above.

15. CẨU TÍCH

Young Cẩu Tích

Cẩu Tích more than 3 years' old

Stem cross-section

Harvested roots

CẨU TÍCH

Cibotium barometz (L.) J. Sm.

Dicksoniaceae

Plant part harvested or used: Rhizome
Harvesting season: Whole year
Age at reproductive maturity: 3 years
NTFP purpose: Medicine
Consumption or sale: Local traders purchase and sell on to China
Demand: Medium
Sustainable harvesting rating: 0 – 3

Plant morphology

- A big tree fern that grows to 1.5 – 3 m high with 3 – 5 large fronds 1 – 2.5 m long extending from the main trunk on a hard black-coloured petiole and stalk.
- Spores are located on the lower side of each frond.
- Sporing occurs throughout the entire year.
- The underground structure is characterised by a large rhizome with a 'woolly' appearance.

Harvesting issues

- Rhizomes from immature ferns (i.e. younger than three years old) are harvested.
- Clearance of forest with suitable Cấu tích habitat to plant production forest tree species.
- Entire fern is destroyed when harvested.
- Small and immature plants are harvested resulting in no natural spore dispersal.
- Major disruption to surrounding vegetation when large holes are dug to extract the rhizome.

How to improve harvesting techniques

- ✓ Harvest ferns older than three years to harvest.
- ✓ Harvest 3/4 of roots and leave 1/4 of the rhizome attached to the main stem underground to regenerate.
- ✓ Support of natural regeneration: place spores on a small patch of bare ground from which the spore can establish itself.
- ✓ Minimize clearance of surrounding vegetation and limit to areas where rhizome is harvested from rather than clearing the entire area.
- ✓ Don't cut or remove all Cẩu Tích to replace with other forest tree species.

16. SA NHÂN

Sa Nhân seedlings

Sa Nhân with fruit at roots

Harvesting Sa Nhân

SA NHÂN

Amomum xanthioides Wall

Zingiberaceae

Plant part harvested or used:	Seed and roots
Harvesting season:	Seed: July to October. Rhizome: October to June the following year
Age at reproductive maturity:	1 year
NTFP purpose:	Medicine and spice
Consumption or sale:	Mostly harvested for export to China
Demand:	Medium
Sustainable harvesting rating:	7 – 9

Plant morphology

- Perennial herbaceous plant up to 3 m high; aerial stem grows upward; rhizome root system forms a shallow, dense mat across the ground.
- Leaf is dark green, lance-shaped, 15 – 35 cm long, 4 – 7 cm wide, top of leaves are pointed and the leaf shape is wedge-like at the base.
- Plant population in natural forest is still abundant; surrounding vegetation and habitat experiences little disturbance during harvesting.
- Cluster of flowers 6 – 8 cm high; flowers are sparse and yellow.
- Fruit: red when ripe, oval-shaped, 1.5 cm long, 1.2 – 1.5 cm wide; covered by small curved thorns.
- Flowers: May – June.
- Fruiting: July – October.

Harvesting issues

- During seed collection, harvesters often injure seedlings or plants due to inappropriate use of harvesting tools.
- Unripe seed is frequently harvested.
- Areas with Sa Nhân are often cleared and replaced with other species (land use change).
- All seed are harvested from each plant, leaving no sources of future natural regeneration.
- The plant is totally removed from the ground when the roots are harvested.

How to improve harvesting techniques

- ✓ Harvest seed from strong and mature plants only (plants with ripe fruit).
- ✓ Leave unripe seed on the plant to mature and naturally regenerate.
- ✓ Harvest from August to October
- ✓ Take care to minimize damage caused by trampling seedlings and young plants.
- ✓ Use a knife or other small bladed tools to collect seed to minimize damage to each plant.

17. THẢO ĐẬU KHẤU

Thảo Đậu Khấu with ripe fruit

Thảo Đậu Khấu without fruit

Mature Thảo Đậu Khấu

Young seedling

THẢO ĐẬU KHẤU

Alpinia katsumadai **Hayata**

Zingiberaceae

Plant part harvested or used:	Fruit (yellow)
Harvesting season:	June to October
Age at reproductive maturity:	2 years
NTFP purpose:	Medicine
Consumption or sale:	Widely harvested and consumed in mountainous areas as a local medicine
Demand:	High
Sustainable harvesting rating:	7 – 9

Plant morphology

- Herbaceous perennial 1.5 – 2 m tall with small roots.
- Leaves sessile, growing directly from the stem at ground level, covered by tiny hairs and spathed, distinctive leaf venation.
- White flowers
- Fruit vary in diameter from 0.8 – 2 cm, changing from green to yellow then red when ripe.
- Flowers: Spring
- Fruiting: June to October

Harvesting issues

- Unripe fruit is frequently harvested.
- Harvested plants were not cut close to the base.
- Forest areas containing suitable Thảo đậu khấu habitat are commonly cleared to plant maize, cassava and other forest trees.
- Grows abundantly in the wild and rapidly grows from seed and regenerates so there is a low likelihood of the species becoming extinct, especially if sustainable harvesting methods are adopted now.
- Harvesting has little impact upon surrounding vegetation, however, is susceptible if above canopy is extensively cleared.

How to improve harvesting techniques

- ✓ Harvest yellow or red-colour fruit only and leave green ones on the plant to mature and naturally regenerate.
- ✓ When harvesting, cut plants close to base with a sharp blade to ensure that they regrow free from disease and rapidly.
- ✓ Minimize damage to immature or small plants that have not fruited yet.

18. RAU SẮNG

Seven-year old plant in a home-garden

Rau sắng with unripe fruit

Seeds collected to replant in home-gardens

RAU SẮNG

Meliantha suavis Pierre

Opilliaceae

Plant part harvested or used: Leaves and fruit
Harvesting season: Whole year
Age at reproductive maturity: 3 – 5 years
NTFP purpose: Food (vegetable)
Consumption or sale: Household consumption; some for local market
Demand: Medium
Sustainable harvesting rating: 3 –5

Plant morphology

- A small woody tree 6 – 12 m tall with thick black bark.
- Branches are thin; as they mature they turn from green to white with spots.
- Leaves are alternate, lanceolate to ovoid, 7 – 12 cm long, 3 – 6 cm wide, with an entire margin, green and smooth on both sides. 4 – 6 pinnately opposite veinlets run from the mid vein.
- Flowers: small (10 – 13 mm long), green, globose; grow densely from the leaf axil on old branches (black).
- Fruit are a tapered or ovoid drupe 1.5 – 2 cm long turning white to flaming yellow when ripe; each drupe contains one seed which turn orange when ripe.
- Flowers: February – April.
- Fruiting: June – August.

Harvesting issues

- Branches are broken (ripped) off, wounding branches and trunk.
- All young leaves are harvested; the entire tree is occasionally cut down to harvest leaves.
- Older branches where fruit develop from (axils) are often damaged or ripped off preventing development of fruit.
- Surrounding vegetation and habitat rarely impacted by harvesting activities.

How to improve harvesting techniques

- ✓ Harvest leaves from trees at least three to five years old so that they have developed enough large branches.
- ✓ Avoid cutting the entire tree down to harvest leaves.
- ✓ Avoid cutting branches from trees. Better to remove individual leaves with a sharp knife. If removing branches, avoid cutting all old branches off; only use a sharp cutting tool such as a saw or knife rather than ripping branches off.
- ✓ Species grows well in home gardens. Collect seed and plant for home garden cultivation.

19. CÂU ĐẰNG BẮC

Câu đằng bắc

Opposite leaves and curved thorns

Câu đằng bắc roots

CÂU ĐẰNG BẮC

Uncaria rhynchophylla (Miq) Jack

Rubiaceae

Plant part harvested or used: Fish hook-shaped thorns with adjacent stem; roots
Harvesting season: Whole year
Age at reproductive maturity: 2 years
NTFP purpose: Medicine
Consumption or sale: Mostly sold to traders who export to China
Demand: Medium
Sustainable harvesting rating: 7 – 9

Plant morphology

- Woody climber with opposite ovoid-obovate leaves with prominent leaf venation.
- Main identification feature is the pair of recurved fish hook-like thorns thorns growing with internode; single thorns alternate the pair of dual thorns.
- New leaves are red in colour; petioles are 10 – 15 mm long; flowers are white and spherical.
- Fruit are a long flat capsule containing many winged seeds (achenes).
- Flowers: Summer.
- Fruiting: July – August.

Harvesting issues

- Entire plant is removed from the ground to harvest both roots and stems.
- Cutting of the majority of older stems affects regrowth of the plant.
- Species remains common in local forests at the moment and is unlikely to be threatened in the foreseeable short to medium term; harvesting does not involve significant modification of the surrounding vegetation and habitat.
- Frequent out-of-season harvesting prior to fruiting poses a longer-term sustainability issue.

How to improve harvesting techniques

Root harvesting:

✓ Select strong plants at least two years of age to harvest from.
✓ Avoid cutting the top of the plant to harvest roots.
✓ Leave 25% of the root attached to the plant and replant prior to leaving the site.

Stem (thorn) harvesting:

✓ Select older stem with larger thorns and leave smaller stem to develop for future harvesting.
✓ Use appropriate hand tools such as secateurs and hand saws (for larger stems) rather than ripping stems from the plant.

20. GIẢO CỔ LAM

A two-month old seedling

Fruit

Flowers

GIẢO CỔ LAM

Gynostemma pentaphyllum (Thunb.) Makino 1902

Cucurbitaceae

Plant part harvested or used:	Stem and leaves
Harvesting season:	Young leaves: March to October. Stem: November to May the following year
Age at reproductive maturity:	1 year
NTFP purpose:	Food and medicine
Consumption or sale:	Used as both a household food and medicine and harvested for local sale
Demand:	High
Sustainable harvesting rating:	0 – 3

Plant morphology

Herbaceous vine with tendrils that grow from stem axils and attach themselves to surrounding vegetation for support.

Leaves are palmately compound with three to five small leaves, serrated margin leaflets.

The plant is dioecious (plants exist either as male or female plants).

Flowers are numerous, small, white-yellow in an inflorescence extending from the leaf axis.

Fruit are spherical, 0.5 – 0.6 cm in diameter with 2 – 3 seeds; black when ripe.

Flowers: June – August.

Fruiting: September – October.

Harvesting issues

- Above-ground stems are harvested for consumption as a vegetable and as a medicine.
- Harvesting of all seedlings and immature plants.
- Harvesting occurs in the flowering and fruiting season.
- The entire plant is removed from the ground prior to the flowering and fruiting season.
- Supporting vegetation held by tendrils is damaged when they are ripped from them.

How to improve harvesting techniques

- ✓ Avoid harvesting seedlings and small plants under one year.
- ✓ Harvest stems from November to the following May to avoid the flowering and fruiting season.
- ✓ Use seeds to plant in home-garden.

Harvesting as a vegetable: Collect only 60% of young stems and leave mature stems to seed.

Harvesting as a medicine: Only select older stems from mature plants, to a maximum of 60% of older stems per plant.

PART 2

Sustainable harvesting guidelines

HOÀNG TINH LÁ CÁCH

***Disporopsis longifolia* Craib**

Convallariaceae

Plant part harvested: Root
Harvesting season: Whole year
Minimum harvest age: 2 years

Sustainable harvesting techniques

Select healthy plants at least two years' old to harvest.

Don't collect young plants with immature roots.

Harvest a maximum of 50 – 60% of all plants at one location.

Use sharp knives to harvest roots.

Only harvest ¾ of the root length.

Leave the remaining 1/4 of root length closest to the stem.

Replant root attached to the stem in the ground.

Sustainable harvesting techniques cont.

Dig a hole to a depth of 10cm and place root attached to the stem inside

Cover and flatten soil over the replanted root.

Clear all grass and other plant species in the immediate area of the plant that may obstruct growth of the replanted root once it resprouts.

Unsustainable harvesting techniques DO NOT USE

- × Don't harvest from May to August during flowering and fruiting seasons.
- × Don't harvest from small immature plants less than two years old.
- × Don't harvest entire plant from the ground: leave ¼ of the root length.
- × Don't damage the plants immediately surrounding the plant when harvesting. These plants are necessary to create a good environment for the plant to grow.

HOÀNG LIÊN Ô RÔ

Mahonia bealei (Fort.) Carr. 1854

Berberidaceae

Plant part harvested: Stem and branches
Harvesting season: Whole year
Minimum harvest age: 2 years

Sustainable harvesting techniques

Select healthy plants at least two years old to harvest.

Avoid harvesting young trees and all the branches above ground.

Use sharp knife/blade/saw to harvest stems and branches. Cut flush to the stem.

Leave 20cm long at the base of each stem from where regrowth can re-establish quickly.

Leave a young branch at the base so that the plant can catch sunlight, recover more quickly and seed faster.

Avoid damaging / wounding reshooting coppice buds at the base of stems.

Sustainable harvesting techniques cont.

- ✓ Leaving 20cm at the base of each stem will encourage multi-branching of the stem and more product to harvest.
- ✓ Harvest before flowering season (October – November) and after fruiting season (December – February).
- ✓ Clear only essential vegetation that obstructs harvesting.

Unsustainable harvesting techniques DO NOT USE

- × Avoid harvesting from October to February during flowering and fruiting seasons.
- × Avoid breaking stems or branches with hands and using blunt harvesting tools that promote disease of wounds and insect attack.
- × Do not harvest plants less than two years of age.
- × Do not harvest plants with either flowers or fruit on them.

SẤU

***Dracontomelon duperreanum* BL.**

Anacardiaceae

Plant part harvested: Fruit
Harvesting season: August and September
Minimum harvest age: 5 years or more

Sustainable harvesting techniques

Harvest only from mature trees older than 5 year of age that already bear fruit.

Leave large fruit baring branches on the tree and avoid disturbing the canopy structure especially if it branches widely (broader branching means more fruit).

Use a long pole with pruning scissors or a saw to cut small branchlets holding fruit.

Cut branchlets with fruit flush to the trunk or the main tree branch to avoid creating a serious wound and risk disease infection.

Leave 20 – 30% of the fruit on the tree so that they can drop to the ground and be eaten by birds or other animals and dispersed throughout the surrounding forest.

Prune branches along trunk below the canopy where there is little light to promote canopy.

Sustainable harvesting techniques cont.

- ✓ Clean around the base of the tree with a forest knife to remove vegetation that might encourage attack by pestilent insects.
- ✓ Fruit with yellow skin should be left and scattered around the vicinity of the tree to encourage the growth of more trees.

Unsustainable harvesting techniques

DO NOT USE

Cutting branches during harvesting

Cutting the entire tree down to harvest fruit

- × Do not pick or cut branches that provide fruit in following years.
- × Do not collect all fruit on the tree and leave 20 – 30% for natural dispersal.
- × Do not cut the tree down to harvest fruit.

TRÁM TRẮNG

***Canarium album* (Lour) Raensch**

Buseraceae

Plant part harvested: Fruit and resin (from stem)
Harvesting season: August to November
Minimum harvest age: Fruit: 5 – 7 years. Resin: after 15 years

Sustainable harvesting techniques

Fruit: Choose trees older than 5 years to harvest from.

Resin: Choose trees that are capable of producing resin normally after 15 years.

Cut lower branches to encourage upward growth of the tree and the canopy to broaden

Harvesting fruit

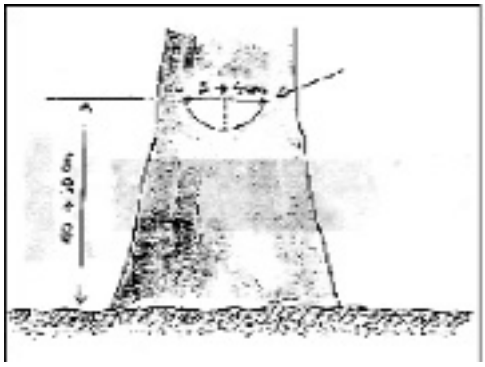
- ✓ Harvest fruit from August to November
- ✓ Use long poles to cut fruit from the tree and reduce damage to fruiting branches
- ✓ Prune lower branches to increase productivity of upper branches where the majority of fruit is found.

Harvesting resin

- ✓ Make clean and well-designed incisions in the trunk with depth less than 0.8 cm (following size of resin extraction tools)
- ✓ Use sharp and clean tools to make incisions in the trunk and regularly clean up the extraction wound
- ✓ Plan for a sustainable harvesting strategy so that resin can be extracted throughout the year and over many years.

Sustainable harvesting techniques cont.

Harvesting resin

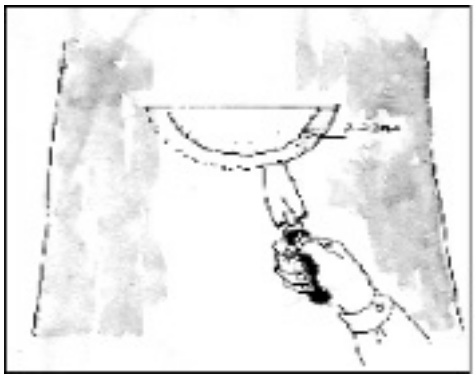


Initial tap should be 40 – 80cm above ground

3 – 4cm incision across the trunk with a 2 – 3cm radius using a sharp blade

Depending on the trunk size cut up to 5 taps evenly spaced around the trunk

After 30 days of the initial tapping resin can be harvested every 2 days



Use a sharp knife to re-incise 2 – 3mm into the bark of the semi-circular incision. Clean out the resin accumulation.

Gradually advance the incision down the trunk

Tapping scars will regenerate a few years after stopping resin harvesting

Unsustainable harvesting techniques DO NOT USE

- × Don’t harvest any products from trees during the flowering season: May to June
- × Don’t cut tree down to harvest fruit or resin.
- × Don’t break branches whilst harvesting fruit as this damages the tree. Instead cut carefully with a saw or forest knife so that the tree can recover quicker.
- × Don’t use poor techniques to extract resin: because they create good conditions for insect attack and disease.

BÁCH BỘ

***Stemona tuberosa* Lour.**

Stemonaceae

Plant part harvested: Roots
Harvesting season: Whole year
Minimum harvest age: 2 – 3 years

Sustainable harvesting techniques

Select plants 2 – 3 years old to harvest

Dig and extract tuber mass with a sharp tool

Clear the soil immediately around tubers

Avoid excessive clearance of the surrounding vegetation – only disturb what is absolutely necessary to harvest tubers

Collect tubers from mature plants with tubers at least 1.5cm in diameter

Sustainable harvesting techniques cont.

Use a sharp knife to harvest roots

Leave stem attached to the tuber mass when digging commences

Use a sharp blade to harvest 7/8 of the total tuber mass

Leave the remaining 1/8 of the tuber mass closest to the stem

Dig a hole to a depth of 10 – 15cm and place root mass attached to the stem inside.

Cover and flatten soil over the replanted tuber mass.

Clear all grass and other vegetation near the plant that may obstruct growth of the replanted root.

Insert a branch in the soil next to the replanted tuber mass for the stem to climb up.

BẢY LÁ MỘT HOA

***Paris polyphilla* Sm.**

Liliaceae

Plant part harvested: Roots
Harvesting season: December – April
Minimum harvest age: 3 – 4 years

Sustainable harvesting techniques

Select plants 3 – 4 years of age with at least three internodes to harvest.

Leave immature plants for another time.

Leave one node attached to the stem and harvest the remainder of the root.

Dig a hole to a depth of 10 – 15 cm and place the stem attached root inside and upright.

Cover and flatten soil over the replanted plant.

This root has five internodes and is acceptable for harvesting.

Carefully dig around the plant base with a sharp blade and temporarily remove the plant from ground.

Take care to cut the root closely to the base of the stem and avoid damaging the rootlets that will feed the plant when it regrows.

Unsustainable harvesting techniques
DO NOT USE

Do not cut the stem from the last node as this will kill the plant

Do not harvest the entire root from the ground

- × Avoid harvesting young plants and all plants found at one location.
- × Avoid harvesting from April to August during the flowering and fruiting seasons.
- × Avoid cutting the stem from the last node as this will power rapid regrowth of the stem after replanting.
- × Don’t trample upon other plants when harvesting.
- × Minimise clearance of surrounding vegetation – only clear what is absolutely necessary to harvest root nodes.

HUYẾT ĐẰNG

***Sargentodoxa cuneata* (Oliv.) Rehd. et Wils. 1913**

Sargentodoxaceae

Plant part harvested: Old stem
Harvesting season: September to February
Minimum harvest age: 3 years

Sustainable harvesting techniques

Select large plants more than three years old to harvest from.

Leave a 20cm length at the base of the stem

Use sharp blade to cut the old stem from the vine and retain the 20 – 40 cm base.

Sustainable harvesting techniques cont.

Cut old stem into even lengths after harvesting

Clear other plant species obstructing regeneration

Leave at least 20cm of tuber attached to the above ground stem

Harvest both old stem and tuber from the one plant

Unsustainable harvesting techniques DO NOT USE

- × Avoid harvesting immature/small plants and all vines found at one location.
- × Don't harvest during flowering and fruiting seasons (March to August) as harvesting during this time will reduce future harvests.
- × Minimise clearance of surrounding vegetation – only clear what is absolutely necessary to harvest the plant as excessive clearance destroys essential habitat for regrowth of the species after harvesting.

BÌNH VÔI ĐỎ

***Stephania kwangsiensis* H.S.Lo**

Menispermaceae

Plant part harvested: Bulb and leaves
Harvesting season: August to February
Minimum harvest age: 3 years (D bulb = 10 cm)

Sustainable harvesting techniques

Select 2 – 3 year old plants to harvest from.

The leaves of the plant in this picture are suitable for harvesting.

Use a sharp knife to cut the young leaves cleanly at the stem.

Carefully dig around the base of the plant to locate the tubers

Sustainable harvesting techniques cont.

Do not cut or rip the stem from the tuber

Use a blade to cut the tuber

Leave a 1 – 1.5 cm length of tuber attached to the stem

Leave the stem with the 1 – 1.5cm section of root attached and replant

Dig a hole to a depth of 10 – 15cm and place the stem attached root inside and upright.

Cover and flatten soil over the replanted plant.

Unsustainable harvesting techniques
DO NOT USE

- × Don’t separate the stem from the plant and do not harvest the entire tuber
- × Avoid harvesting tubers from March to August
- × Avoid damaging surrounding vegetation that the plant uses to climb up

CÂY MỘT LÁ

Nervilia fordii (Hance) Schultze

Orchidaceae

Plant part harvested: Whole Stem, leaves and tuber
Harvesting season: August
Minimum harvest age: Minimum 12 months

Sustainable harvesting techniques

Select mature plants

Select old plants and grow in clusters to harvest

Dig slightly around stump and cover with soil after harvesting plant

Clear vegetation before digging tuber

Sustainable harvesting techniques cont.

Plants are harvested carefully from land

Tuber and root are not broken after harvesting

- ✓ Only harvest in August after fruiting season
- ✓ Select mature, healthy plants in clusters
- ✓ Clear vegetation before digging up tuber
- ✓ Dig slightly around stump; when seeing tuber, harvest carefully to avoid cutting the tuber
- ✓ Cover holes with soil and humus (so that young plants can regrow) before harvesting other clusters.

Unsustainable harvesting techniques DO NOT USE

Don’t harvest whole plants from clusters

Don’t break plant, leaving tuber and root in soil

- × Don’t harvest whole clusters: leave some young plants for replanting.

SONG ĐÁ

Calamus Sp.

Palmaceae

Plant part harvested: Stem
Harvesting season: July to August
Minimum harvest age: 5 years

Sustainable harvesting techniques

Select plants with 15 – 20 cm stem diameter

Leave a stem length from the ground of 30 cm

Clear all other plant species obstructing the growth of plant

Unsustainable harvesting techniques
DO NOT USE

Don’t leave a too long base

Don’t cut close to base to protect roots

- × Avoid harvesting culms until after fruiting season is complete and seed has dropped to the ground
- × Avoid harvesting culms in fruiting and seeding season
- × Don’t leave a stem base of greater than 30 cm as this slows regrowth when stems are poorly pruned back
- × Don’t clear plants for the purpose of land use change or planting other economic species
- × Avoid causing damage to surrounding vegetation by identifying location of rattan stem in the canopy and then attempting to remove with minimal force.

CHÈ DÂY (KHAU SẢ)

Ampelopsis cantoniensis (Hook. et Arn) Planch

Vitaceae

Plant part harvested: Root
Harvesting season: December to March
Minimum harvest age: 3–4 years

Sustainable harvesting techniques

Choose plants older than 1 year to harvest

Only harvest old branches

Let young branches develop and seed

Unsustainable harvesting techniques
DO NOT USE

- × Don’t harvest the entire plant
- × Don’t harvest out of season between June and October
- × Don’t use bare hands to harvest stem and leaf
- × Avoid damaging the surrounding habitat and other plant species that Chè dây can scramble over.

THIÊN NIÊN KIỆN

***Homanomena occulta* (Lour.) Schott**

Araceae

Plant part harvested: Root
Harvesting season: September – Decemberr
Minimum harvest age: 1 year (or with root length more than 20 cm)

Sustainable harvesting techniques: two methods

Method 1

Thiên niên kiện older than one year and ready for harvesting

Remove root from ground by digging around the base of the target plant

Method 2

Use knife to separate the root from the plant leaving a length of 2cm attached to the stem

Cut close to the base leaving a 2cm length of root attached to the stem

Sustainable harvesting techniques: Method 2 cont.

OR: Remove the entire plant from the ground with root intact

Sustainably harvested root

Replant stem with leaves and 2cm length of root

Retained stem is replanted for future harvesting seasons

Unsustainable harvesting techniques
DO NOT USE

- ✓ Don't harvest all year round - restrict to September to February
- ✓ Avoid harvesting immature / young plants
- ✓ Avoid collecting the entire root as this will kill the plant
- ✓ Avoid clearing surrounding vegetation that increases light and impacts growth of the plant

DÂY HƯƠNG (BÒ KHAI)

Erythropalum scandens Blume

Erythropalaceae

Plant part harvested: Young leaves and branch stem
Harvesting season: Young leaves: March to October; stem: November to March
Minimum harvest age: 1 year

Sustainable harvesting techniques

Stem of Dây hương ready for harvesting

Choose young branches to collect

Let young branches develop and seed

Harvest old branches to encourage rapid regrowth of fresh leaves and stem

Sustainable harvesting techniques cont.

- ✓ Harvest new leaves all year round (although growth is slow during winter) and avoid harvesting stem from April to October during the flowering and fruiting seasons
- ✓ Cut back old branches in February and march to encourage quick natural regeneration and high rates of new growth
- ✓ Frequent harvesting of new leaves and stem will result in faster and stronger regrowth
- ✓ Prune branches damaged by insects
- ✓ Cuttings can easily be planted in home gardens

Unsustainable harvesting techniques DO NOT USE

- × Avoid harvesting stem from April to October until after the fruiting and flowering seasons are complete.
- × Avoid over-pruning and cutting back the plant so that the plant is not so badly damaged that it take s along time to recover – suggest cutting back 50 – 60% of the plant maximum.

ĐẢNG SÂM

Codonopis javanica (Blume) Hook.f.et Thoms.

Campanulaceae

Plant part harvested: Roots
Harvesting season: December to March
Minimum harvest age: 2 years

Sustainable harvesting techniques

Vine at least 2 years old ready for harvesting

Dig widely around the base of the plant to remove the plant from the ground

Use a sharp blade to cut the lower 2/3 of root from the upper plant.

Unsustainable harvesting techniques
DO NOT USE

Don’t harvest roots when fruit is ripe

Don’t havest plants with fresh flowers

- × Don’t harvest when flowering or when there is fruit on the plant
- × Don’t harvest the entire plant from the ground and cut the stem from the root
- × Avoid harvesting young plants (below 2 years)
- × Minimise damage to surrounding vegetation by limiting clearance when harvesting to the area immediately around the plant

CẨU TÍCH

Cibotium barometz (L.) J. Sm.

Dicksoniaceae

Plant part harvested: Root and stem
Harvesting season: Whole year
Minimum harvest age: 3 years

Sustainable harvesting techniques

Harvest ferns when older than 3 years

Leave the fern intact when harvesting

Leave ¼ of the rhizome attached to regenerate

Sustainable harvesting techniques cont.

- ✓ Choose plants with the a root weight greater than 1kg to harvest
- ✓ Avoid damaging small plants within the harvesting area
- ✓ Support natural regeneration – distribute spores on bare ground by hand
- ✓ Leave young fern to harvest only when they are mature
- ✓ Ensure that enough rhizome (1/4) is attached to the stem so that it can recover more quickly
- ✓ Only dig up soil where the rhizome is located.

Unsustainable harvesting techniques DO NOT USE

Do not harvest from immature ferns

Exercise care to avoid trampling seedlings

- × Don’t cut the entire plant down to harvest the rhizome
- × Avoid harvesting ferns with small roots as they will grow slowly
- × Don’t dig up the entire forest near the plant.

SA NHÂN

Amomum xanthioides Wall

Zingiberaceae

Plant part harvested: Fruit and roots
Harvesting season: Fruit: July to October
Rhizome: October to June the following year
Minimum harvest age: 1 year

Choose a plant to harvest over one year

Use a knife to lightly clear around the base of each plant and expose the rhizome.

Leave all of the rhizome in the ground when harvesting

Leave the plant in the ground and harvest (cut) a 20 – 30cm length of rhizome from each plant

Only harvest large ripe red fruit containing many seeds

Sustainable harvesting techniques cont.

- ✓ Harvest fruit (seed) from July to August; rhizomes from October to June the following year Leave rhizome attached to plant so that it can regrow
- ✓ Leave immature plants for harvesting the following year
- ✓ Leave 30% of the fruit on each plant so that seed can be dispersed naturally
- ✓ Minimise clearance of surrounding plants so that the dark conditions are maintained
- ✓ Harvest fruit when ripe (large and with many seeds inside)
- ✓ Only harvest rhizome of 60% of plants at one location

Don’t harvest by hand

Don’t pull whole plant up from ground

Unsustainable harvesting techniques DO NOT USE

- × Avoid harvesting rhizome during the fruiting and flowering seasons (May to August)
- × Avoid damaging surrounding seedlings by not carefully clearing around the base of each plant
- × Don’t harvest all the rhizome and leave rhizome attached to the plant
- × Don’t harvest all the rhizome from one plant
- × Avoid harvesting all the seed as there will be less the following year to harvest
- × Don’t damage other plant species that benefit Sa Nhan.

THẢO ĐẬU KHẤU

***Alpinia katsumadai* Hayata**

Zingiberaceae

Plant part harvested: Old fruit
Harvesting season: September to February
Minimum harvest age: 2 years

Sustainable harvesting techniques

Harvest fruit when they are fully ripe and developed - yellow or red colour

Cut fruit from the plant using a sharp knife or scissors

After harvesting fruit cut the plant back to encourage strong natural regeneration

Sustainable harvesting techniques cont.

Clean around the base to create optimum conditions for the plant to recover

Keep small plants or those that have not produced fruit yet

Unsustainable harvesting techniques DO NOT USE

Do not harvest green (unripe) fruit

- × Avoid harvesting small / immature plants or those that have not produced fruit
- × Avoid harvesting before they are ripe
- × Avoid cutting or trampling young / immature plants

RAU SẮNG

***Melientha suavis* Pierre**

Opilliaceae

Plant part harvested: Leaves and fruit
Harvesting season: Leaves: whole year.
Fruit: June to August
Minimum harvest age: 3 – 5 years

Sustainable harvesting techniques

Select mature trees older than 3 years to collect leaves and fruit from

Select young branches and collect 60% of total leaves by hand

Cut old branches down only to harvest leaves

Leave young branches to develop

Sustainable harvesting techniques cont.

Harvest ripe yellow fruit

Use some harvested seed to sow in the forest or home garden to encourage regeneration

- ✓ Cut by hand individual leaves at the petiole
- ✓ Climb into the tree to harvest leaves and fruit rather than cutting tree down or branches off
- ✓ Planting in forest garden or forest
- ✓ Place two seeds in 5 cm deep holes and cover with a thin soil layer.

Unsustainable harvesting techniques DO NOT USE

If possible, avoid cutting branches from the trees to harvest fruit and leaves

- × Don’t cut the entire tree down to harvest the leaves
- × Avoid harvesting leaves from small trees and allow them to grow unhindered by harvesting until they are of adequate size
- × Avoid harvesting all the old branches if harvesting from branches is necessary
- × If branches need to be harvested don’t rip them off a cut with a sharp knife
- × Don’t harvest all the leaves from the tree leaving 60% on each branch
- × Avoid harvesting leaves during the flowering season from February to April.

CÂU ĐẰNG BẮC

Uncaria rhynchophylla

Rubiaceae

Plant part harvested: Branches with fish hook-shaped thorns & roots
Harvesting season: Whole year
Minimum harvest age: 2 years

Sustainable harvesting techniques

Roots

Uncover the roots

Harvest the tip of the root only (3/4 of root)

Leave the section closest to the stem base to allow regeneration

Branches and thorns

Choose old branches to harvest from

Choose large branches with thorns to harvest from

Sustainable harvesting techniques cont.

Branch collection:

- ✓ Use a sharp blade to cut the branch from the tree
- ✓ Don't harvest branches during flowering and fruiting seasons from May to August
- ✓ Don't collect all the branches - leave 25% on each plant to regenerate from

Root harvesting:

- ✓ Number of roots collected depends on how many roots the tree has

Unsustainable harvesting techniques DO NOT USE

Don't cut all roots

Don't cut close to the base

Don't remove all leaves

- × Don't harvest roots and branches during the flowering and fruiting seasons
- × Don't kill the plant by cutting it down to harvest the roots
- × Don't harvest young branches which are less than 1 – 1.5 cm in diameter
- × Don't harvest all branches from the tree
- × Don't rip branches from the tree – use sharp blades instead.

GIẢO CỔ LAM

Gynostemma pentaphyllum (Thunb.) Makino 1902

Cucurbitacea

Plant part harvested: Stem and leaves
Harvesting season: November to May
Minimum harvest age: 1 year

Sustainable harvesting techniques

Giảo cổ lam

Plant with stem longer than can be harvested

Select newly grown stems and leaves for consumption as a vegetable

Use scissors or a sharp blade to harvest new growth up to 30cm long

- ✓ Harvest vegetable: all year round if only harvesting 60% from one plant
- ✓ Harvest medicinae: November to May to avoid flowering and fruiting seasons
- ✓ Leave young plants for the following harvesting seasons
- ✓ Harvest during flowering and fruiting seasons.

Unsustainable harvesting techniques
DO NOT USE

Don’t harvest young plants less than 15cm

Don’t harvest seedlings

× Avoid removing the entire plant from the ground

As medicine:

× Avoid ripping the vine out of the surrounding vegetation which damages habitat
× Avoid harvesting during flowering and fruiting seasons

As a vegetable:

× Don’t harvest all new leaf/stem growth from the plant
× Don’t harvest seedlings and immature plants