Perennials

Working group	Co-chair	CS Presenter	Keynote Speaker	Expert	Rapporteur	Attendance
Adrianne Sinclair	☑	☑	☐	☐	☐	YES
Greg Leach	☑	☐	☐	☐	☐	YES
Colman O'Criodain	☐	☐	☐	☐	☐	YES
David Newton	☐	☑	☐	☐	☐	YES
Danna Leaman	☐	☑	☐	☐	☐	YES
Hiram Ordoñez Chocano	☐	☑	☐	☐	☐	YES
Helle O. Larsen	☐	☑	☐	☐	☐	YES
Mygdalia García	☐	☑	☐	☐	☐	YES
Margarita Clemente	☐	☐	☐	☐	☐	YES
Patricia Ford	☐	☑	☐	☐	☐	YES
Paloma Carton de Grammont	☐	☐	☐	☐	☑	YES
Uwe Schippmann	☐	☐	☐	☑	☐	YES
Zhang Xianchun	☐	☑	☐	☐	☐	NO

Total Participants : 13

International Expert Workshop on CITES Non-Detriment Findings

Cancun,
Mexico,
November
2008

Working Group 2

Perennials

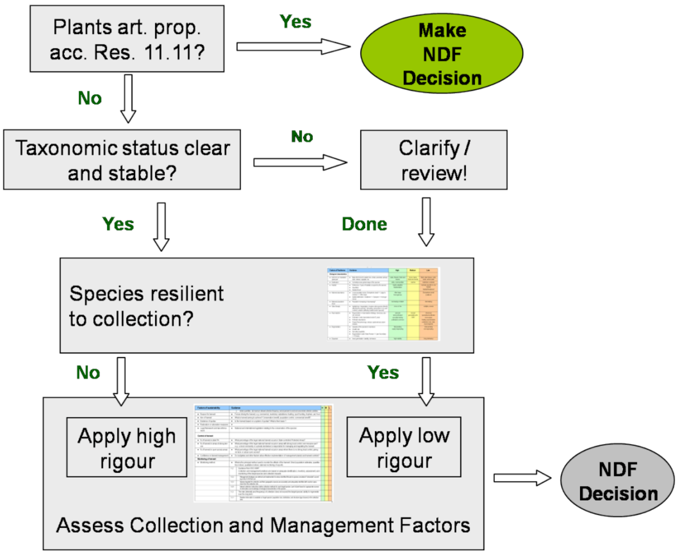
Working Group Summary

The main contribution of the perennial plants working group is a simplified process for making NDFs that is based on currently available guides such as the IUCN checklist and the ISSC MAP. Further, our group offers a method to assess the resilience of perennial plant species to collection and identifies sources, quantity, and quality of data (level of rigor) required for high and low resilient species.

The following references for making NDFs were reviewed which included, as appropriate for perennial plants,: tables 1 and 2 of the Guidance for CITES Scientific Authories (i.e., the IUCN NDF Checklist (2002), the Cancun Workshop Case Study Format (2008); the EU-SRG Guidance Paper; the International Standard for the Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP) (2007), and susceptibility matrices published by Cunningham and Peters. The ISSC-MAP provided guidance for the factors "Management Plan" and "Monitoring Methods" through detailed criteria and indicators.

The guidance provided by the working group may apply to all CITES Appendix-II plant species (requires testing with some tree examples). The following decision tree summarizes the process.

Steps for making a CITES NDF for plants



The process indicates that an NDF decision can be made easily for artificially propagated specimens, provided that the criteria for CITES Resolution Conf. 11.11 is met, and guides Scientific Authorities to treat wild-collected specimens as wild specimens. The importance of clarifying taxonomic status of CITES-listed species is highlighted as an initial step and sources of information are identified. After the taxonomy of the species is checked, the next step is to determine whether a species is more or less resilient to collection using plant life strategy factors and population dynamic information. This guidance indicates the types of information needed and the extent of effort and data gathering necessary. This approach can facilitate making NDF decisions and in many cases can be made with the information readily available. The process helps ensure that the level of data gathering and effort is compatible with the level of species' vulnerability and therefore will result in a more confident decision. Once the level of vulnerability of a species is determined, the Scientific Authority is guided through a table of factors that affect the management and collection of the species (streamlined from the current NDF tools, i.e., the IUCN checklist and ISSC MAP), and identifies a range of data sources needed to evaluate the factors. It is expected, where possible, that greater rigor (e.g., multiple data sources, intensive field study), will be used for those species that are considered less resilient to collection. In general, Scientific Authorities will work with information that is available and seek more extensive information for species considered to be of low resilience. It is also recognized that the source of data considered most reliable will vary depending on the species and specific collection situation. For example, in some cases knowledge of population abundance gained from local harvesters may be very reliable.

The overall result is a simple guiding document of a few pages that will enable a Scientific Authority to make scientifically based NDFs for perennial plant species.

International Expert Workshop on CITES Non-Detriment Findings

Working Group 2

Perennials

FINAL REPORT

1. Information about the target species or related species

List and briefly describe the <u>elements</u> that could be considered when making Non-detriment findings:

Please refer to the Perennial Plants Working Group Annex.

Elements identified in the decision tree are source of specimen, i.e., artificially propagated vs. wild (while noting that specimens from plants grown from wild plants are to be treated as wild) as well as taxonomic status of species.

All other elements are listed in the first columns of the first and second tables in the Annex.

2. Field methodologies and other sources of information.

List and describe examples of field <u>methodologies</u> and other sources of information for monitoring populations and/or regulating harvests which could be utilized to obtain data on the elements described below

Please refer to the Perennial Plants Working Group Annex.

Sources of information are listed in the second column of the second table in the Annex (the table that enables assessment of factors affecting management of the collection).

3. Data integration for NDF elaboration

List and/or describe <u>data integration that could be helpful in formulating the non-detriment finding.</u>

Data integration is built into the guidance (decision tree, evaluation of resilience table, evaluation of data quality and quantity for each factor). For example, an early decision can be made based on whether the specimen is wild or not. Next, there is a table to determine species' level of resilience. Finally, there is a table that provides information sources, with examples that range from quantitative to qualitative. It is suggested that a more rigorous approach, which may imply more data gathering, be applied for less resilient species.

4. List and describe the ways <u>data quantity and quality</u> may be assessed

Data quantity and quality may be assessed by providing a list of information sources, including qualitative and quantitative sources, used to evaluate each factor. Our working group found that data quality may vary depending on the collection situation. For example, harvester interviews, although qualitative, may be a very reliable data source in some cases.

5. Summarize the common <u>problems, error, challenges or difficulties</u> found on the elaboration of NDF.

- Field surveys are very limited.
- It is difficult to establish and enforce quotas
- The lack of knowledge on the size of the present population and trends in population changes
- When management of plant species is multi-jurisdictional, coordinating numerous people involved in the NDF process can sometimes be difficult.
- Budget and time constraints are also significant challenges facing Scientific Authorities and wildlife managers in regards to making NDFs.
- The monitoring of illegal harvest (aside from annual population surveys) is a considerable challenge

6. Summarize the main <u>recommendations</u> that could be considered when making an NDF for this taxonomic group.

- Provided there is sufficient training/ capacity, the IUCN checklist is a useful process to make an NDF; however, the process is simplified as suggested in the Perennial Plants Working Group Annex. We have identified criteria for assessing resilience and factors to evaluate collection and management. Information needed and relevant methodologies are dependent upon the resilience of the species to collection, and some examples are provided.
- The NDF process should be based on a risk assessment, indicating when more data or a more rigorous approach is needed.
- ISSC-MAP is a useful tool to develop an integrated management plan for the species which can either inform or be a management outcome based on the NDF
- Parties can share information on NDFs by posting it on their websites e.g. USA and Canada.
- Parties can share vegetation surveys by posting it on their websites (e.g. Canada)
- Information exchange and cooperation among Parties, stakeholders, government entities, non-governmental organizations, and researchers is essential to share information on the biology, trade and conservation status of CITES-listed species in order to maintain self-sustaining populations and make scientifically based NDFs.
- NDF decisions are based on evaluations that are reviewed and adapted to reflect changing conditions (e.g., invasive species, disease, predators).
- It was recognized that the understanding and application of the Resolution Conf. on Artificial Propagation (Resol. Conf. 11.11) is not always straightforward or easily implemented. The Plants Committee should develop further guidance on the application of the resolution.
- If there is a need for capacity building, experience has shown that expert workshops on NDF techniques can be highly beneficial.

7. Useful references for future NDF formulation

- Rosser & Haywood (2002): Guidance for CITES Scientific Authorities. Checklist to assist in making non-detriment findings for Appendix II exports. - xi+146 pp., IUCN, Gland and Cambridge
- Duties of the CITES Scientific Authorities and Scientific Review Group under Regulations 338/97 and 865/2006. http://ec.europa.eu/environment/cites/pdf/srg/guidelines.pdf
- http://www.floraweb.de/proxy/floraweb/map-pro/Standard_Version1_0.pdf
- CUNNINGHAM (2001): Applied ethnobotany. Earthscan; PETERS (1994): Sustainable harvest of non-timber forest plant resources in tropical moist forest. An ecological primer. - WWF Biodiversity Support Program, Washington.
- ANON. 2007. International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP), version 1.0. Medicinal Plant Specialist Group of the IUCN. Published by German Federal Agency for Nature Conservation. BfN-Skripten 195, 2007

International Expert Workshop on CITES Non-Detriment Findings

Working Group 2

Perennials

FINAL REPORT

Perennial Plants Working Group Annex
Guidance for Scientific Authorities in making a CITES Non-Detriment Finding

This Annex describes a process for making non detriment findings for perennial plant species (and perhaps all CITES Appendix II plants), summarized in a decision tree. It builds upon the IUCN Checklist and other references by incorporating the sources of information and methods that can be used to evaluate certain factors as well as identifying when a more rigorous approach is needed (i.e., when more information and data are needed).

All elements of the following references for making NDFs were reviewed and included as appropriate for perennial plants:

(1) Tables 1 and 2 of the Guidance for CITES Scientific Authorities, IUCN NDF Checklist[1]

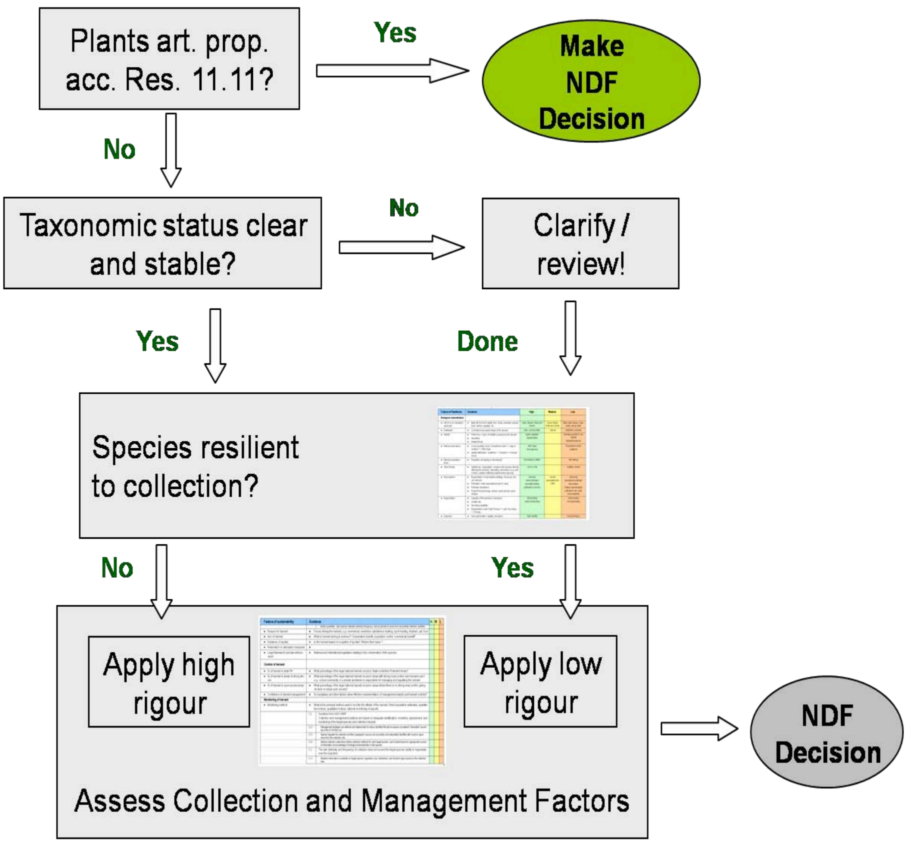
(2) Cancun Workshop Case Study Format[2];

(3) EU-SRG Guidance Paper[3];

(4) International Standard for the Sustainable Wild Collection of Medicinal and Aromatic Plants, ISSC-MAP[4] (ISSC-MAP especially provided guidance for the factors "Management Plan" and "Monitoring Methods" through detailed criteria and indicators); and

(5) Susceptibility matrices published by Cunningham (2001) and Peters (1994)[5].

Steps for making a CITES NDF for plants



The first factor to consider is the source of the plant specimen or material – i.e. whether the source of the specimen proposed for trade is from the wild or artificially propagated. If the specimen was artificially propagated according to Resol. Conf. 11.11[6], a simple NDF is made. If the specimen was grown from a plant collected from the wild (i.e. motherstock is wild), the specimen is treated as wild requiring an NDF to be made.

The next factor to consider is taxonomic status of the species. Assess whether the taxonomic circumscription, including authorities and synonyms, is stable or is dynamic. If the status of the taxon is dynamic, then the taxonomy is usually uncertain (e.g., the taxon may consist of several entities which have to be assessed separately). Sources of information include published floras, CITES checklist, identification guides, and taxonomic experts.

Once the taxonomy is checked, the next step involves evaluating the resilience of species to collection. The evaluation is done by considering factors most indicative of resilience or vulnerability of the particular species to collection. The table does not include an exhaustive list of indicators to consider for high, medium, and low resilience but rather includes examples taken from Cunningham (2001) and Peters (1994). Species are evaluated as having higher resilience i.e. less at risk from collection, if most of the resilience factors are in the higher category. It is expected that judgement will be cautionary, for example, if a species has only a few factors of lower resilience and several deemed higher resilience, the species may still be considered as having a lower resilience to collection.

Assessment of the resilience of the species to collection

Factors of Resilience	**Guidance**	**Higher Resilience**	**Medium**	**Lower Resilience**	Ref
Biological characteristics					
• Life form vs. harvested plant part	• Basic life forms for plants: tree, shrub, perennial, annual, bulb, climber, epiphyte, etc.	Latex, flowers, fruits and leaves Short-lived life forms	Some resins, fruits and seeds	Bark, stem tissue, roots, bulbs, whole plant Long-lived life forms	1, 5
• Distribution	• Currently known global range of the species	wide, cosmopolitan	narrow	restricted, endemic	2, 5
• Habitat	• Preference: Types of habitats occupied by the species • Specificity • Habitat threat	highly adaptable habitat stable		narrowly specific to one habitat habitat threatened	1, 2, 5
• National abundance	• Local population sizes: Everywhere small <> Large to medium <> Often large • Spatial distribution: Scattered <> Clumped <> Homogeneous	often large homogenous		Everywhere small scattered	1, 5
• National population trend	• Population increasing or decreasing?	increasing or stable		decreasing	1
• Other threats	• Habitat loss / degradation; invasive alien species (directly affecting the species); harvesting; persecution (e.g. pest control); pollution (affecting habitat and/or species)	none or low		multiple, severe	1, 2
• Reproduction	• Regeneration or reproductive strategy: dioecious, sexual, asexual • Pollination: biotic (specialised vector?), wind	Asexual wind pollinated annually fruiting pollinators com-	sexual generalist pollinator	Dioecious specialised pollinator monocarpic	2, 5

Factors of Resilience	**Guidance**	**Higher Resilience**	**Medium**	**Lower Resilience**	Ref
	• Pollinator abundance • Flower/Fruit phenology: annual, supra-annual, unpredictable	mon		fruiting unpredictable pollinators rare; bats, hummingbirds	
• Regeneration	• Capacity of the species to reproduce • Growth rate • Sprouting capability • Regeneration Guild: Early Pioneer <> Late Secondary <> Primary	fast growing easily resprouting early pioneer		slow growing not resprouting primary	1, 5
• Dispersal	• Seed germination: viability, dormancy • Seed dispersal strategy • Disperser abundance • Dispersal efficiency	high viability wind and other abiotic vectors		long dormancy Biotic, with specialized vector	1, 5
Harvest characteristics					
• Harvest specificity	• Indiscriminate collection of other species vs. target species easy to identify	target species easy to identify		Indiscriminate collection of other species	5
• Demographic segment of population	• Are mature and immature plants harvested?	collection of all age-classes		highly selective collection of one age-class	1, 2
• Multiple use	• Multiple, conflicting uses vs. single use or non-competing	single use or non-competing		Multiple, conflicting uses	5
• Yield per plant	• With high yield less individuals are affected by collection	High	medium	Low	
• Scale of trade	• Quantitative information on numbers or quantity, if available; otherwise, a qualitative assessment; • Trade level: High – medium – low	Low		High	1, 5

Factors of Resilience	**Guidance**	**Higher Resilience**	**Medium**	**Lower Resilience**	Ref
	• Local, national, international				
• Utilization trend	• Increasing fast <> Slowly increasing <> Stable or decreasing	Stable or decreasing	Slowly increasing	Increasing fast	5

The final step involves assessing factors affecting management of the collection or harvest. Examples of data sources are included for each element. It is expected that where possible, greater rigour, for example, multiple data sources, intensive field study, etc, will be used for species that are considered less resilient to collection. In general, it is expected that Scientific Authorities will work with the information that is available and seek more extensive information for species with very low resilience. It is also recognized that sources of data considered most reliable will vary depending on the species and collection situation. For example, in some cases knowledge of population abundance gained from local harvesters may be the only information available, yet very reliable.

Assessment of factors affecting the management of the collection

Factors of sustainability	**Guidance**	Ref
Biological characteristics		
• Role of the species in its ecosystem	Consider the role of the species in the ecosystem and whether ecosystem processes are interrupted or changed by the collection of the species. Is the species a keystone or guild species, do other species depend on it for survival (e.g., food source)? • Scientific literature • Expert (including collector) knowledge • Field observations	2
Population status		
• National distribution	Range and distribution of the species in the country (whether or not the distribution of the species is continuous, or to what degree it is fragmented): • National distribution map, • Herbarium records, surveys or other vegetation inventories	1, 5

Factors of sustainability	**Guidance**	Ref
	• Expert knowledge (all stakeholders) • Field studies • GIS vegetation coverages • Modelling	
• National conservation status	Conservation status of the species in the country • Species at Risk Lists • Conservation Data Centres • Experts (all stakeholders) • Scientific literature • Herbarium records • Field surveys (locations, population size, etc.)	2
• National population trend	Population increasing or decreasing? To be measured over a time period independent of the harvest • Refer to conservation status • Reported harvests • Experts (all stakeholders) • Field surveys over short term • Field surveys over long term • Demographic studies (population viability analyses)	1
• Global conservation status	Refer to global assessment to compare national situation to global range • Published global assessments (e.g., IUCN Red List, Conservation Data Centres , e.g., Nature Serve) • Consult other range states • Undertake global assessment with other range states	2
• Global Distribution	Refer to global distribution for national context • Published global distribution map • Consult other range states	2, 5
• Global population size and trend	Refer to global population size and trend for national context • Published global assessment • Consult other range states	2

Factors of sustainability	**Guidance**	Ref
Harvest management		
• Regulated / unregulated	"Regulated" refers to a sanctioned (government approved or otherwise official) harvest that is under the full control of the manager • Market reports • Experts (all stakeholders) • Trade volume records (e.g. WCMC CITES trade database; statistics from Customs; National or state permit databases) • Enforcement reports • Field and market surveys	1, 2
• Management history	What is the history of harvest? Is the harvest ongoing or new? • Literature • Experts (all stakeholders, including trade networks)	1, 2
• Illegal harvest or trade	How significant is the national problem of illegal or unmanaged harvest or trade? Assess the levels of both unmanaged and illegal harvest • Market information • Information from traders, collectors, wildlife managers • Compare exports and imports with other Parties • Compare CITES permit data to other export data sources (national trade statistics) • Enforcement reports • Field and market surveys	1
• Management plan	Is there an adaptive management plan related to the collection of the species with the aim of sustainable use? • National and international legislation relating to the conservation of the species • Management plan in place • Plan specifies plant and habitat conservation strategies (may include protected areas) • Collection practices in place • Collection practices specify restoration measures (e.g., planting seed when whole plant is removed)	1, 2, 4

Factors of sustainability	Guidance	Ref
	• Requirement to keep records of collection • Collection records are reviewed and collection monitored • Management plan is reviewed at regular intervals specified in the plan • Limitations on collection (examples include collection seasons, minimum and maximum age / size class allowed for collection based on proportion of mature, reproducing individuals to be retained, maximum collection quantities, maximum allowed collection frequency, maximum allowed number of collectors) • Periods allowed for collection are determined using reliable and practical indicators (e.g., seasonality, precipitation cycles, flowering and fruiting times) and are based on information about the reproductive cycles of target species. • The age / size-classes are defined using reliable and practical characters (e.g., plant diameter / DBH, height, fruiting and flowering, local collectors' knowledge).	
Control of harvest		
• Percent of harvest in state Protected Areas	What percentage of the legal national harvest occurs in state-controlled Protected Areas? • Harvester information or interviews • Enforcement information or interviews • Park manager information or interviews • Compare location information from permit with maps of protected areas • GIS layers of harvesting and land tenure	1
• Percent of harvest in areas of strong tenure	What percentage of the legal national harvest occurs in areas with strong local control over resource use? e.g.: a local community or a private landowner is responsible for managing and regulating the harvest • Harvester information or interviews • Enforcement information or interviews • Landowner information or interviews • Compare location information from permit with maps of protected areas • GIS layers of harvesting and land tenure	1
• Percent of harvest in	What percentage of the legal national harvest occurs in areas where there is no	1

Factors of sustainability	Guidance	Ref
open access areas	strong local control, giving de facto or actual open access? • Harvester information or interviews • Enforcement information or interviews • Compare location information from permit with maps of protected areas • GIS layers of harvesting and land tenure	
• Proportion of range or population protected from harvest	What percentage of the species' natural range or population is legally excluded from harvest? • Compare distribution map with maps of areas excluding harvest • Information or interviews with wildlife managers	1
• Confidence in effectiveness of strict protection measures	Are there measures taken to enforce strict protection? • Information or interviews with protected areas managers	1
• Effectiveness of regulation of harvest effort	How effective are any restrictions on harvesting (such as age or size, season or equipment) for preventing overuse? • Information or interviews with resource managers	1
• Confidence in harvest management	Are there effective implementation of management plan(s) and harvest controls? • Information or interviews with resource managers	1
Monitoring of harvest		
• Monitoring of collection impact and management practices	Is management of wild collection supported by adequate identification, inventory, assessment, and monitoring of the target species and collection impacts? Does the rate (intensity and frequency) of collection enable the target species to regenerate over the long term? • Baseline information on population size, distribution, and structure (age classes) • Records on collected quantities (species/area/year) • Qualitative indices, e.g., discussions with collectors • Quantitative indices, e.g., roots per pound collected as an indication of population size, the quantity of national exports • Identification of target species with voucher specimens from the collection site • Direct population estimates through field surveys, including surveys of popu-	4

Factors of sustainability	Guidance	Ref
	lations before and after harvest (field surveys / data collection program is critical when collected quantities are above potential production)	
• Confidence in monitoring	Are there effective implementation of monitoring and harvest impact controls? • Monitoring confirms that abundance, viability and quality of the target resource / part of plant is stable or increasing	1
• Other factors that may affect whether or not to allow trade	• What is the effect of the harvest when taken together with the major threat that has been identified for this species? • At the national level, how much conservation benefit to this species accrues from harvesting? • At the national level, how much habitat conservation benefit is derived from harvesting?	1, 3

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[1] Rosser, A. & M. Haywood. 2002. Guidance for CITES Scientific Authorities. Checklist to assist in making non-detriment findings for Appendix II exports. - xi+146 pp., IUCN, Gland and Cambridge

[2] NDF Workshop Doc.3, http://www.conabio.gob.mx/institucion/cooperacion_internacional/TallerNDF/Links-Documentos/WebPage%20-%20Format%20-%2023%20May%2008.doc

[3] Duties of the CITES Scientific Authorities and Scientific Review Group under Regulations 338/97 and 865/2006. http://ec.europa.eu/environment/cites/pdf/srg/guidelines.pdf

[4] http://www.floraweb.de/proxy/floraweb/map-pro/Standard_Version1_0.pdf

[5] CUNNINGHAM (2001): Applied ethnobotany. Earthscan; PETERS (1994): Sustainable harvest of non-timber forest plant resources in tropical moist forest. An ecological primer. - WWF Biodiversity Support Program, Washington.

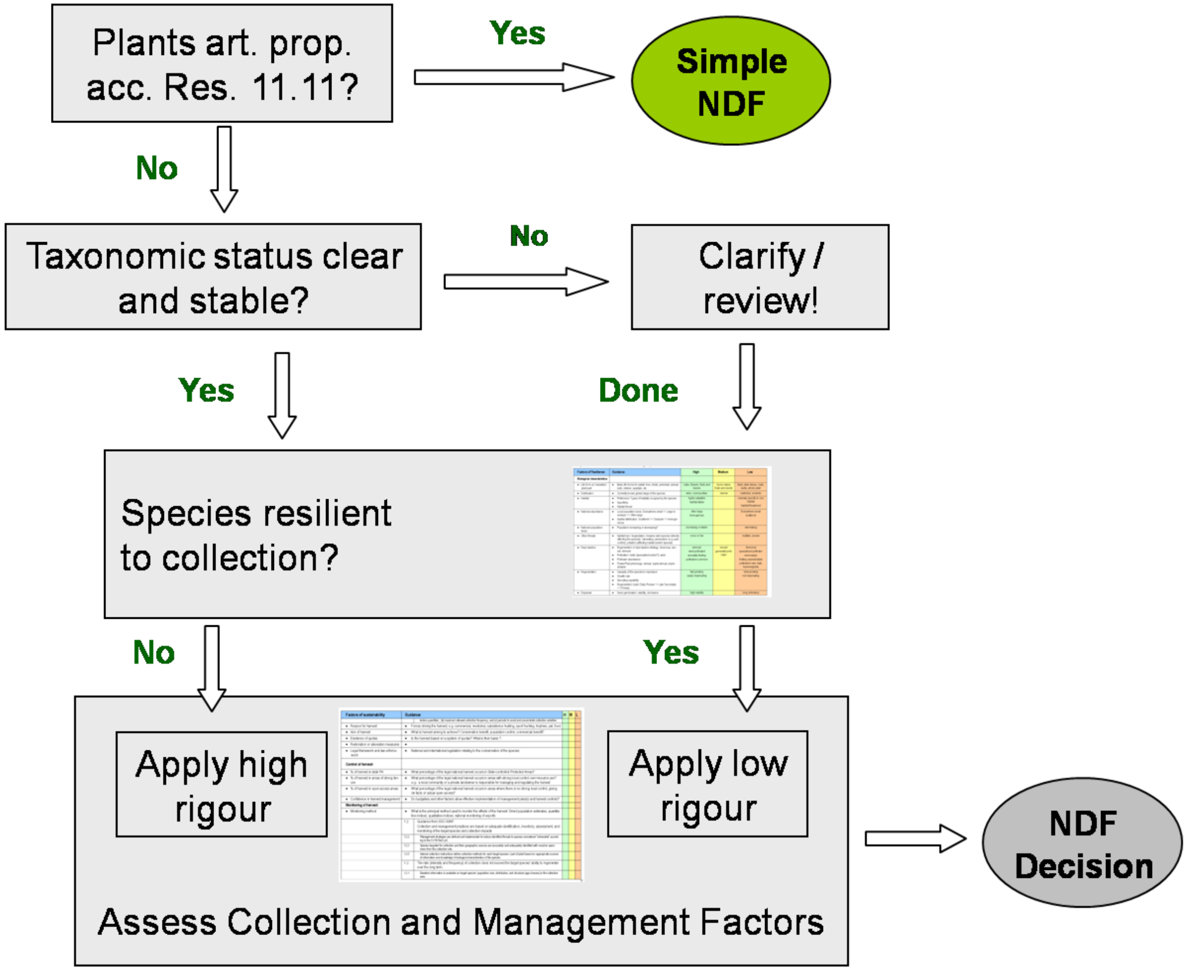
[6] Conf. 11.11 (Rev. CoP14). Regulation of Trade in Plants. (http://www.cites.org/eng/res/11/11-11R14.shtml)

Guidance for Scientific Authorities in making a CITES Non-Detriment Finding

Working Group: Perennials Make NDF Decsion!!!

20.11.2008, Resilience_Check_&_Factors_Vers2.doc

Steps for making a CITES NDF for plants



Plants art. prop. acc. Res. 11.11?

Yes

Simple NDF

No

Taxonomic status clear and stable?

No

Clarify / review!

Yes

Done

Species resilient to collection?

No

Yes

Apply high rigour

Apply low rigour

Assess Collection and Management Factors

NDF Decision

This Annex describes a process for making a non detriment finding for perennial plants and possibly all CITES Appendix II plants, summarized in a decision tree, that builds upon the IUCN checklist and other tools by incorporating the sources of information and methods that can be used to evaluate an element as well as identifying when a more rigorous approach is needed (when more information and data are needed). All elements of the following tools for making NDFs were reviewed and included as appropriate for perennial plants.

(1) tables 1 and 2 of the IUCN NDF Checklist[1] but also takes on board additional elements from other documents, such as:
(2) the Cancun Workshop Case Study Format[2];
(3) the EU-SRG Guidance Paper[3];
(4) the International Standard for the Sustainable Wild Collection of Medicinal and Aromatic Plants, ISSC-MAP[4] (ISSC-MAP especially provided guidance for the factors “Management Plan” and “Monitoring Methods” through detailed criteria and indicators); and
(5) susceptibility matrices published by Cunningham and Peters[5].

The first factor to consider is source material – whether the source of the specimen proposed for trade is from the wild or artificially propagated)as per Resol. Conf. 11.11). If the specimen was artificially propagated, a simple NDF is made. If the specimen was grown from a plant collected from the wild (i.e. motherstock is wild), the specimen is treated as wild requiring an NDF to be made.

The next factor to consider is taxonomic status. Assess whether the taxonomic circumscription, including authorities and synonyms, has been stable in the past or dynamic; the latter bears the risk that the taxon may consist of several entities which have to be assessed separately. Sources of information include published floras, CITES checklist, identification guides, and taxonomic experts.

The next step involves evaluating the resilience of a species to collection and trade. The evaluation is done by considering factors most indicative of resilience or vulnerability of a particular species to collection. The table does not include an exhaustive list of indicators for higher and lower risk but rather includes examples taken from Cunningham (2001) and Peters (1994). Species are evaluated as having higher resilience i.e. less at risk from collection, if most of the resilience factors are in the higher category. It is expected that judgement will be cautionary, for example, should a species have only a few factors deemed lower resilience and several deemed higher resilience, the species may still be considered as having lower resilience to collection.

Assessment of the resilience of the species to collection

Factors of Resilience	**Guidance**	**Higher**	**Medium**	**Lower**	Ref
Biological characteristics					
• Life form vs. harvested plant part	• Basic life forms for plants: tree, shrub, perennial, annual, bulb, climber, epiphyte, etc.	Latex, flowers, fruits and leaves	Some resins, fruits and seeds	Bark, stem tissue, roots, bulbs, whole plant	1, 5
• Distribution	• Currently known global range of the species	wide, cosmopolitan	narrow	restricted, endemic	2, 5

Factors of Resilience	Guidance	Higher	Medium	Lower	Ref
• Habitat	• Preference: Types of habitats occupied by the species • Specificity • Habitat threat	highly adaptible habitat stable		narrowly specific to one habitat habitat threatened	1, 2, 5
• National abundance	• Local population sizes: Everywhere small <> Large to medium <> Often large • Spatial distribution: Scattered <> Clumped <> Homogeneous	often large homogenous		Everywhere small scattered	1, 5
• National population trend	• Population increasing or decreasing?	increasing or stable		decreasing	1
• Other threats	• habitat loss / degradation; invasive alien species (directly affecting the species); harvesting; persecution (e.g. pest control); pollution (affecting habitat and/or species)	none or low		multiple, severe	1, 2
• Reproduction	• Regeneration or reproductive strategy: dioecious, sexual, asexual • Pollination: biotic (specialised vector?), wind • Pollinator abundance • Flower/Fruit phenology: annual, supra-annual, unpredictable	Asexual wind pollinated annulally fruiting pollinators common	sexual generalist pollinator	Dioecious specialised pollinator monocarpic fruiting unpredictable pollinators rare; bats, hummingbirds	2, 5
• Regeneration	• Capacity of the species to reproduce • Growth rate • Sprouting capability • Regeneration Guild: Early Pioneer <> Late Secondary <> Primary	fast growing easily resprouting		slow growing not resprouting	1, 5
• Dispersal	• Seed germination: viability, dormance • Seed dispersal strategy • Disperser abundance • Dispersal efficiency	high viability wind and other abiotic		long dormancy Biotic, with specialized vector	1, 5
Harvest characteristics					
• Harvest specificity	• Indiscriminate collection of other species vs. target species easy to identify	target species easy to identify		Indiscriminate collection of other species	5

Factors of Resilience	Guidance	Higher	Medium	Lower	Ref
• Demographic segment of population	• Are mature and immature plants harvested?	collection of all age-classes		highly selective collection of one age-class	1, 2
• Multiple use	• Multiple, conflicting uses vs. single use or non-competing	Multiple, conflicting uses		single use or non-competing	5
• Yield per plant	• with high yield less individuals are affected by collection	High	medium	Low	
• Scale of trade	• Quantitative information on numbers or quantity, if available; otherwise, a qualitative assessment; • Trade level: High – medium – low • Local, national, international	Low		High	1, 5
• Utilization trend	• Increasing fast <> Slowly increasing <> Stable or decreasing	Stable or decreasing	Slowly increasing	Increasing fast	5

The final step involves assessing factors affecting management of the collection or harvest. Examples of data sources are included for each element and it is expected that greater rigor, for example, multiple data sources, intensive field study, etc, will be used for those species that are considered less resilient to collection where possible. Generally, the rule of thumb is that at minimum, it is expected that a scientific authority works with the information that is available and seeks more information and more reliable information for species with very low resilience. It is also recognized that the source of data considered most reliable will vary depending on the collection situation. For example, in some cases knowledge of population abundance gained from local harvesters may be very reliable.

Assessment of factors affecting the management of the collection

Factors of sustainability	Guidance	Ref
Biological characteristics		
• Role of the species in its ecosystem	Consider the role the species plays in the ecosystem and whether ecosystem processes are interrupted or changed by the collection of the species. Is the species a keystone or guild species, do other species depend on it for survival, • Scientific literature	2
Population status		
• National distribution	Range and distribution of the species in the country (whether or not the distribution of the species is continuous,	1, 5

Factors of sustainability	**Guidance**	Ref
	or to what degree it is fragmented): - National distribution map, - Herbarium records, surveys or other vegetation inventories - Expert knowledge (all stakeholders) - Field studies - GIS - Modelling	
- National conservation status	Conservation status of the species in the country - Species at Risk Lists - Conservation Data Centres - Experts (all stakeholders) - Scientific literature - Herbarium records - Field surveys (locations, population size, etc.)	2
- National population trend	Population increasing or decreasing? to be measured over a time period independent of the harvest - Refer to conservation status - Reported harvests - Experts (all stakeholders) - Field surveys over short term - Field surveys over long term - Demographic studies (population viability analyses)	1
- Global conservation status	Refer to global assessment to compare national situation to global range - Published global assessments (e.g., IUCN Red List, Conservation Data Centres , e.g., Nature Serve	2
- Global Distribution	Refer to global distribution for national context - Published global distribution map	2, 5
- Global population size and trend	- Refer to global population size and trend for national context - Published global assessment	2
Harvest management		
- Regulated / unregulated	“Regulated” refers to a sanctioned (government approved or otherwise official) harvest that is under the full con-	1, 2

Factors of sustainability	**Guidance**	Ref
	trol of the manager • Market reports • Experts (all stakeholders) • WCMC permit database • Trade volume records (e.g. statistics from Customs) • National or state permit databases • Enforcement reports • Field surveys	
• Management history	What is the history of harvest? Is the harvest ongoing or new? • Literature • Experts (all stakeholders)	1, 2
• Illegal harvest or trade	How significant is the national problem of illegal or unmanaged harvest or trade? Assess the levels of both unmanaged and illegal harvest • Market information • Information from traders, collectors, wildlife managers • Compare exports and imports with other Parties • Compare CITES Permit Data to other export data sources (national trade statistics) • Enforcement reports • Field surveys	1
• Management plan	Is there an adaptive management plan related to the collection of the species with the aim of sustainable use? • National and international legislation relating to the conservation of the species • Management plan in place • Plan specifies plant and habitat conservation strategies (may include protected areas) • Collection practices in place • Collection practices specify restoration measures (e.g., planting seed when whole plant is removed) • Requirement to keep records of collection • Collection records are reviewed and collection monitored • Management plan is reviewed at regular intervals specified in the plan • Limitations on collection (examples include collection seasons, collection of certain size classes, maximum collection quantities, maximum allowed collection frequency, maximum allowed number of collectors)	1, 2, 4

Factors of sustainability	Guidance	Ref
	• Periods allowed for collection are determined using reliable and practical indicators (e.g., seasonality, precipitation cycles, flowering and fruiting times) and are based on information about the reproductive cycles of target species. • The age / size-classes are defined using reliable and practical characters (e.g., plant diameter / DBH, height, fruiting and flowering, local collectors' knowledge).	
Control of harvest		
• Percent of harvest in state Protected Area	What percentage of the legal national harvest occurs in State-controlled Protected Areas? • Harvester information or interviews • Enforcement information or interviews • Park manager information or interviews • Compare location information from permit with maps of protected areas • GIS layers of harvesting and land tenure	1
• Percent of harvest in areas of strong tenure	What percentage of the legal national harvest occurs in areas with strong local control over resource use? e.g.: a local community or a private landowner is responsible for managing and regulating the harvest • Harvester information or interviews • Enforcement information or interviews • Landowner information or interviews • Compare location information from permit with maps of protected areas • GIS layers of harvesting and land tenure	1
• Percent of harvest in open access areas	What percentage of the legal national harvest occurs in areas where there is no strong local control, giving de facto or actual open access? • Harvester information or interviews • Enforcement information or interviews • Compare location information from permit with maps of protected areas • GIS layers of harvesting and land tenure	1
• Proportion of range or population protected from harvest	What percentage of the species' natural range or population is legally excluded from harvest? • Compare distribution map with maps of areas excluding harvest	1
• Confidence in effectiveness of strict protection measures	• Do budgetary and other factors give confidence in the effectiveness of measures taken to afford strict protection?	1

Factors of sustainability	**Guidance**	Ref
• Effectiveness of regulation of harvest effort	• How effective are any restrictions on harvesting (such as age or size, season or equipment) for preventing overuse?	1
• Confidence in harvest management	Do budgetary and other factors allow effective implementation of management plan(s) and harvest controls?	1
Monitoring of harvest		
• Monitoring of collection impact and management practices	Management of wild collection is supported by adequate and practical resource inventory, assessment, and monitoring of collection impacts to ensure population will persist. Are the collection and management practices based on monitoring the abundance and the collection impacts of the species? • Baseline information is available on population size, distribution, and structure (age classes) • Assessment and regular monitoring is carried out, documented, and incorporated into the management plan • Consolidated data on collected quantities, periods, and frequency of collection are available (species/area/year) and confirm compliance with collection instructions • Qualitative indices, e.g., discussions with collectors • Quantitative indices, e.g., roots per pound collected as an indication of population size, the quantity of national exports • Direct population estimates (field surveys including regeneration after harvest)	**4**
• Confidence in monitoring	• Do budgetary and other factors allow effective harvest monitoring? • Monitoring confirms that abundance, viability and quality of the target resource / part of plant is stable or increasing	**Ref ?**
• Other factors that may affect whether or not to allow trade	Evaluate the aim of the harvest when making an NDF at the time of import. For less resilient species, a positive NDF may not be made for commercial purposes and only for purposes to benefit conservation of the species. What is the effect of the harvest when taken together with the major threat that has been identified for this species? At the national level, how much conservation benefit to this species accrues from harvesting? At the national level, how much habitat conservation benefit is derived from harvesting?	1, 3

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[1] Rosser & Haywood (2002): Guidance for CITES Scientific Authorities. Checklist to assist in making non-detriment findings for Appendix II exports. - xi+146 pp., IUCN, Gland and Cambridge

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[3] Duties of the CITES Scientific Authorities and Scientific Review Group under Regulations 338/97 and 865/2006. http://ec.europa.eu/environment/cites/pdf/srg/guidelines.pdf

[4] http://www.floraweb.de/proxy/floraweb/map-pro/Standard_Version1_0.pdf

[5] CUNNINGHAM (2001): Applied ethnobotany. Earthscan; PETERS (1994): Sustainable harvest of non-timber forest plant resources in tropical moist forest. An ecological primer. - WWF Biodiversity Support Program, Washington.

NDF WORKSHOP CASE STUDIES
WG 2 – Perennials
CASE STUDY 1
Cibotium barometz
Country – **CHINA**
Original language – English

NON-DETRIMENT FINDING FOR *CIBOTIUM BAROMETZ* IN CHINA

AUTHORS
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I. Background information on the taxa

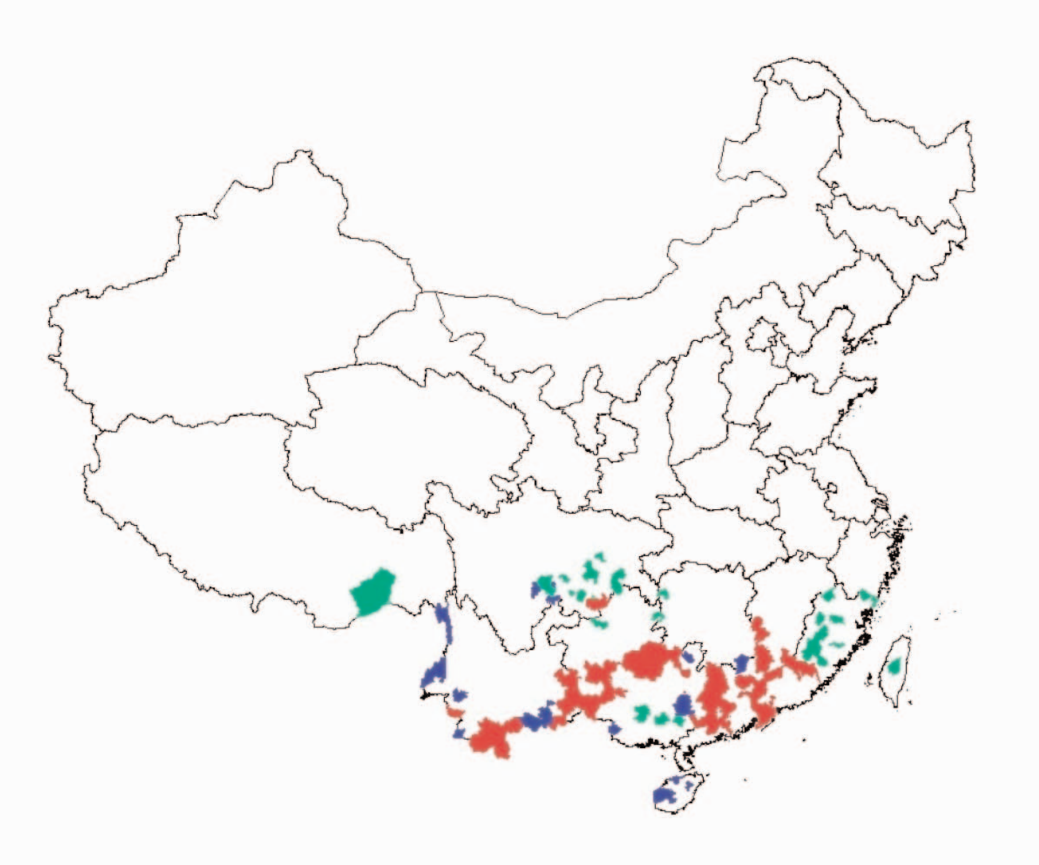
1. BIOLOGICAL DATA

1.1 Scientific and common names

Cibotium barometz, "Jinmao Gou" or "Jinmao Gouji" (Golden Hair Dog Fern, also called Scythian lamb), in Guangdong province it is called "Huanggoutou" (Yellow Dog's Head Fern). It is placed in Cibotiaceae (Smith & al. 2006), formerly in Dicksoniaceae.

1.2 Distribution

Cibotium barometz is a tropical and subtropical plant distributed in China, NE India, Malaysia, Myanmar, Indonesia (from Java to Sumatra), Thailand, Vietnam, and Japan. In China, it is mainly distributed in southern and southwestern regions. Based on information from field observation and herbarium collections, we mapped all the regions where this species is found in China. In China, *C. barometz* is mainly distributed in Guangxi, Guizhou, Guangdong, Yunnan, Sichuan, Chongqing, Hainan, Xizang, Hunan, Zhejiang, and Jiangxi Provinces, and grows in a warm and humid environment, often in



Map 1. Distribution of *Cibotium barometz* in China

valley, forest edges and open places in forest in elevations ranging from (50-) 200-600 (-1300-1600) m. It usually grows with *Alsophila spinulosa*, *Diplopterygium chinense*, and Dicranopteris pedata. This species is an indicator of acid soil in tropical and subtropical areas, and thus is rare in limestone areas in Guangxi, Yunnan, and Guizhou Provinces. The current distribution of Cibotium barometz is rather fragmented (Map 1).

1.3 Biological characteristics

1.3.1 *Provide a summary of general biological and life history characteristics of the species*

Plants of *Cibotium barometz* produce large quantity of spores for sexual propagation. This tree fern forms large populations in valleys. It is observed that old, large rhizomes can produce lateral buds, which grow into a large rhizome. By this asexual propagation, the populations of this fern increase quickly, and are often very large and dense.

It takes several years for an individual plant to grow into a mature spore-bearing individual. This fern is rather tolerant to human disturbance

1.3.2 *Habitat types*

Cibotium barometz is a tropical and subtropical plant. In China, *Cibotium barometz* grows in a warm and humid environment, often in valley, forest edges and open places in forest, at elevation ranges from (50-) 200-600 (-1300-1600) m. It usually grows with *Alsophila spinulosa*, *Diplopterygium chinense*, and *Dicranopteris pedata*. It is an acid soil indicator species in tropical and subtropical areas, but rare in the limestone areas in Guangxi, Yunnan and Guizhou Province. The temperature and soil type are main factors which affect on the distribution of this species. The plants are generally found in elevations below 600 m, and prefer sunning and more or less open areas on acid soils.

1.3.3 *Role of the species in its ecosystem*

In the community dominated by *Cibotium barometz*, it plays an important role in the ecosystem. Normally it forms a very dense population with few individuals of other plant species.

1.4 Population

1.4.1 *Global Population size*

Unknown.

1.4.2 *Current global population trends*

___increasing __X_decreasing ____stable ____unknown

1.5 Conservation status

1.5.1 *Global conservation status (according to IUCN Red List)*

___Critically endangered ___Near Threatened ___Endangered
___Least concern ___Vulnerable X__ Data deficient

1.5.2 *National conservation status for the case study country*

Vulnerable

1.5.3 *Main threats within the case study country*

___No Threats
___Habitat Loss/Degradation (human induced)

___Invasive alien species (directly affecting the species)
X__Harvesting [hunting/gathering]
___Accidental mortality (e.g. Bycatch)
___Persecution (e.g. Pest control)
___Pollution (affecting habitat and/or species)
___Other_______________
___Unknown

2. SPECIES MANAGEMENT WITHIN THE COUNTRY FOR WHICH CASE STUDY IS BEING PRESENTED

2.1 Management measures

2.1.1 *Management history*

Since 1997, Chinese CITES office has not allowed export trade of *Cibotium barometz* until a survey of the resources of this species is made.

2.1.2 *Purpose of the management plan in place*

To achieve sustainable use of the natural resources of this traditional Chinese herb medicine, and to ensure that the export will not be detrimental to the survival of this species in China.

2.1.3 *General elements of the management plan*

Constrain the annual export from China, as well as domestic use by medicinal factories.

2.1.4 *Restoration or alleviation measures*

Propagation by spores has been successful in experiment and hope to cultivate in the fields somewhere in South China area.

2.2 Monitoring system

2.2.1 *Methods used to monitor harvest*

No

2.2.2 *Confidence in the use of monitoring*

No

2.3 Legal framework and law enforcement: Provide details of national and international legislation relating to the conservation of the species

This species is listed in CITES Appendix II. Before 1997, there was no control to the export of *Cibotium baromets* in China, it was exported to South Korea, USA and Canada with more than 500 tons in five years from 1993-1997. From 1998 to 2000, CITES office in Beijing did not issue any permits of export until a survey of the natural resources of *Cibotium* completed (Zhang & al. 2001, 2002). Since 2001, under the guidance of a survey of the natural resources (Jia & Zhang 2001), a quota of 130 tones is permitted to export annually from China. However, the export amount decreases gradually, with only a few thousands of kilograms of export during recent years.

3. UTILIZATION AND TRADE FOR RANGE STATE FOR WHICH CASE STUDY IS BEING PRESENTED

3.1 Type of use (origin) and destinations (purposes)

Cibotium barometz is well valued as a garden plant or a medicinal herb. It is believed that this plant replenishes liver and kidney, strengthenes bones and muscles, expels and eases the joint and for deficiency of liver and kidney manifested as chronic rheumatism, backache, flaccidity and immovability of lower extremities, and frequent enuresis (Yao 1996, Ou 1992). Hairs on the rhizome of this plant have long been used as a styptic for bleeding wounds in China and Malaysia (Holttum 1963). Up to now, there is no artificial cultivation of *Cibotium barometz* in China; all the materials used are collected from wild populations

3.2 Harvest

3.2.1 *Harvesting regime*

The rhizome of *Cibotium barometz* can be dug up throughout the year, but late autumn and winter are the best time to collect it. After the fibrous roots and silky hairs have been removed, the rhizomes are cleaned with water and dried in the sun. Because the rhizomes become too solid to cut when they are dried, it is more often to cut them into slices when they are fresh, and the slices are called raw "Gouji" slices. The rhizomes can also be boiled or steamed in water, and then dried and cut into slices which are called cooked "Gouji" slices. Normally the mature plants with large rhizomes were collected, leaving small plants survival. Only the populations outside nature reserves (including national and provincial nature reserves and forest parks) can be collected under the control of local governments and forestry offices. According to our survey, a rather large proportion of the natural populations of *Cibotium barometz* are located in protected areas.

3.2.2 *Harvest management/control*

Only the populations outside nature reserves can be collected according to regulations of local governments and forest offices.

3.3 Legal and illegal trade levels: To the extent possible, quantify the level of legal and illegal use nationally and export and describe its nature

So far, no illegal trade has been found. The dry sliced rhizomes of *Cibotium* called "Gouji" mainly enter the domestic markets for trade, and the largest consumers are factories for producing pills of "Zhuangyao Bushen Wan", a medicine which is helpful to maintaining the function of kidney. In addition to the above-mentioned markets, some "Gouji" is used by individuals and for export. The main import countries and regions include South Korea, the United States, Hong Kong, and Canada. Since 1997, Chinese CITES office decided that export trade should not be allowed until a survey of the resources of *Cibotium barometz* is made.

II. NON-DETRIMENTAL FINDING PROCEDURE (NDFs)

Provide detailed information on the procedure used to make the non-detriment finding for the species evaluated

1. Is the methodology used based on the IUCN checklist for NDFs?

X__yes ___no

2. Criteria, parameters and/or indicators used

Field plot-survey method was used to estimate the deposit of natural resources of the rhizomes of *Cibotium barometz*. We estimated the biomass of rhizomes in different provinces and districts. For most rhizome-harvested plants, the annual sustained yield is estimated at about 10% of the standing stocks.

3. Main sources of data, including field evaluation or sampling methodologies and analysis used

It is obvious that the distribution of *Cibotium baometz* in China is uneven. We selected sample plots from several provinces and in each province a few counties were selected. By filed plot-survey method, combined with experience of local people, we can estimate the biomass of rhizomes of *Cibotium barometz* in provinces and districts. We then made rather conservative estimations of the quantity of dry rhizome "Gouji" deposits in the major distribution provinces and districts. According to our estimation, there are about 391,400 tons of deposits of "Gouji" in China, mainly distributed in Guangdong, Guangxi, Yunnan, Guizhou, and Sichuan. According to the richness of "Gouji" deposits in different counties, three classes are distinguished. On the distribution map (Map 1), the red color areas represent the highest deposits, blue areas the medium, and green areas represent the lowest deposits. Areas with the highest deposits of "Gouji" are in western Guangdong, northern Guangxi and southern Yunnan. There are some other areas where *C. barometz* is found growing but populations are rather small, such as Xinning and Jianghua counties in Hunan Province, Taishun and Pingyang counties in Zhejiang Province. Deposits of "Gouji" in Medog of Xizang, and Taiwan Province are not estimated because of lack of information.

4. Evaluation of data quantity and quality for the assessment

The estimated deposit of natural resources might not be very accurate because of the difficulty of field survey and the limitation of sampled populations in its vast distribution areas. Also, our field studies were conducted between 1997-1998, and no data were collected afterwards. From our field trips in recent years, we found the natural vegetation are getting better and better in most parts of China because of the forest restoration project. For most rhizome-harvestable plants, the annual sustained yield is estimated at about 10% of the standing stocks. The export quota of 130 tons per year is reasonable.

5. Main problems, challenges or difficulties found on the elaboration of NDF

The plants are widely and unevenly distributed throughout China south of the Yangtze River, our field survey is still very limited. It is hoped that international and national agencies will help with investigation of artificial cultivation, artificially promoting natural regeneration, and new medicinal products in order to reduce the pressure on wild resources of this much exploited species.

6. Recommendations

In future, export of final products rather than raw materials should be encouraged.

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ZHANG XC, JIA JS, and ZHANG GM, 2002. Survey and evaluation of the natural resources of *Cibotium barometz* (L.) Smith in China, with reference to the implementation of the CITES convention. Fern Gazette. 16(6): 383-387.

NON-DETRIMENT FINDING FOR *CIBOTIUM BAROMETZ* IN CHINA

AUTHORS:
Xian-Chun Zhang, Jian-Sheng Jia and Gang-Min Zhang

Cibotium barometz formally member of the Dicksoniaceae, now of Cibotiaceae. The plants of this family are all large tree ferns, and are valued greatly as ornamental garden plants. The whole family was listed as early as 1975 in the CITES Appendix II, the category of controlled trade species. *Cibotium barometz* is listed as Appendix II plants.

Cibotium barometz (L.) J. Smith is a tree fern. The rhizome of this plant is very thick, woody, covered by long soft, golden yellow hairs, hence the name "Jinmao Gouji" (Golden Hair Dog Fern), or "Huanggoutou" (Yellow Dog's Head Fern) in Chinese. It is a famous traditional Chinese herb medicine known as "Gouji" (Cibot Rhizome, Rhizoma Cibotii), and Chinese people have long known its medicinal use. The actions are believed to be to replenish the liver and kidney, strengthen the bones and muscles, expel and ease the joint and for deficiency of liver and kidney manifested as chronic rheumatism, backache, flaccidity and immovability of lower extremities, and frequent enuresis. The hairs on the rhizome have long been used as a styptic for bleeding wounds in China and in Malaysia.

With the increase of trade of *C. barometz* from China, the natural resources of this species have been greatly decreased and this aroused the attention of international and national authorities. In order to achieve sustainable use of the natural resources of this species, and meet the requirements of the CITES convention, a detail survey was made of the distribution, quantity, and status of trade of *C. barometz* in China. Up to now in China there is no artificial cultivation of *Cibotium barometz*; all the materials used are collected from wild populations.

C. barometz is not evenly distributed in China. By filed plot method carried out during 1997 to 1998, combined with experience of local people, we can roughly get the biomass of the rhizome in each province and district. According to the richness of “Gouji” deposits in different counties, three classes are distinguished and mapped.

It is estimated that each year about 3,000 tons of “Gouji” enter the market for trade, and the largest consumers are factories for producing pills of “Zhuangyao Bushen Wan”, a kind of medicine helpful for the function of kidney. Apart from the above markets, some “Gouji” is used in private or for export.

China has the most abundant deposits of “Gouji” in the world, and it is also a country that has the most export trade during the years between 1993 and 1997. The main import countries and regions are: South Korea, the United States, Hongkong of China, Canada and so on.

From 1997, Chinese CITES office decided export trade should not be allowed until a survey of the resources of *Cibotium barometz* is made. In recent years, the export of *C. barometz* was restricted, so the medicinal materials collected mainly circulated through internal markets. Considering all kinds of circulation channels, the whole collection quantity was less or equal to the annual allowed collection quantity.

It is hoped that international and national agencies will help with investigation of artificial cultivation, artificially promoting natural regeneration, and new medicinal products in order to lessen the pressure on wild resources of this much exploited species.

Cibotium barometz in China

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Chinese Academy of Sciences
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Cibotium barometz & CITES

- Pteridophytes
- Cibotiaceae (2006, before Dicksoniaceae)
    - *Cibotium*, ca. 14 species.
    - *Cibotium barometz*, tropical Asia.
    - CITES Appendix II.


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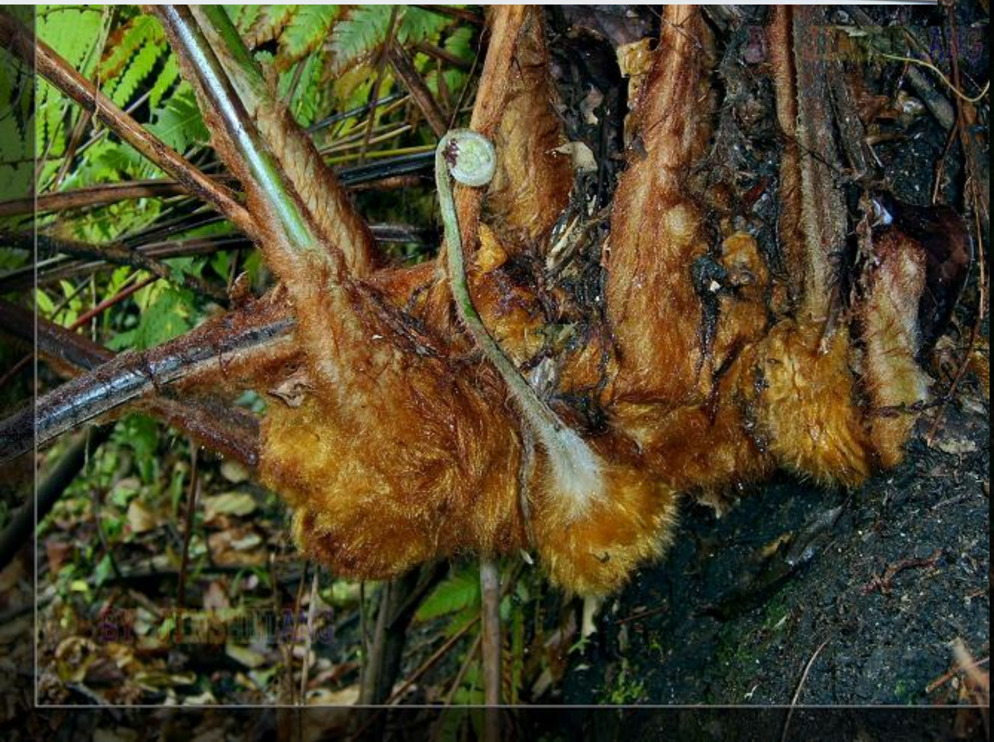
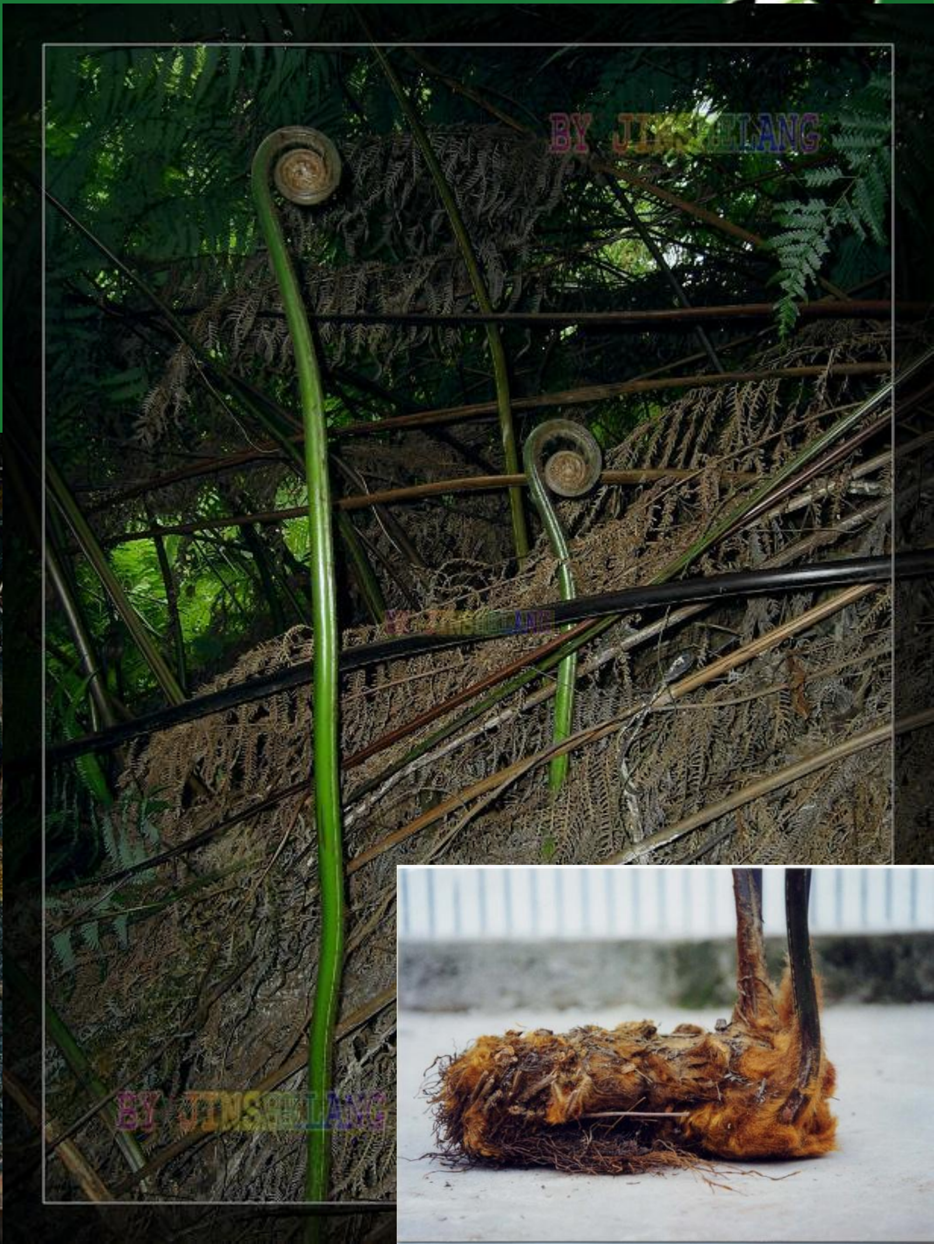




Raw material of *Cibotium barometz* on local market

Local herb market

Dry rhizome “Gouji” in herb market

Product of “Gouji”

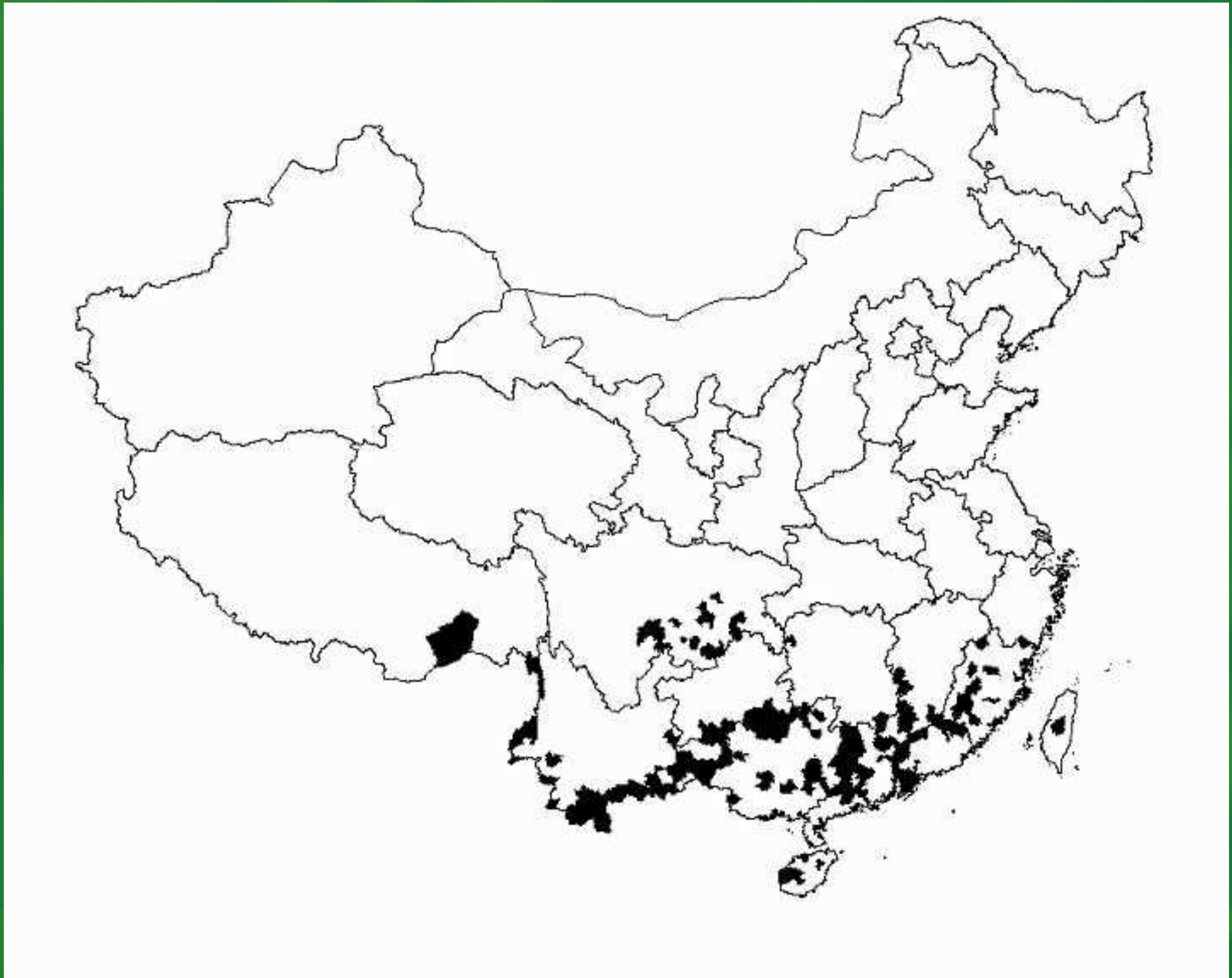
Field plot-survey

- The distribution of *Cibotium barometz* in China is uneven. We selected sample plots from several provinces and in each province a few counties were selected.
- By field plot-survey method, combined with experience of local people, we can estimate the biomass of rhizomes of *Cibotium barometz* in provinces and districts.

Field plot-survey

- We then made rather conservative estimations of the quantity of dry rhizome “Gouji” deposits in the major distribution provinces and districts.
- For most rhizome-harvested plants, the annual sustained yield is estimated at about 10% of the standing stocks.

Distribution of *Cibotium barometz* in China



Field Survey Areas

Guangxi Province

Guangdong Province

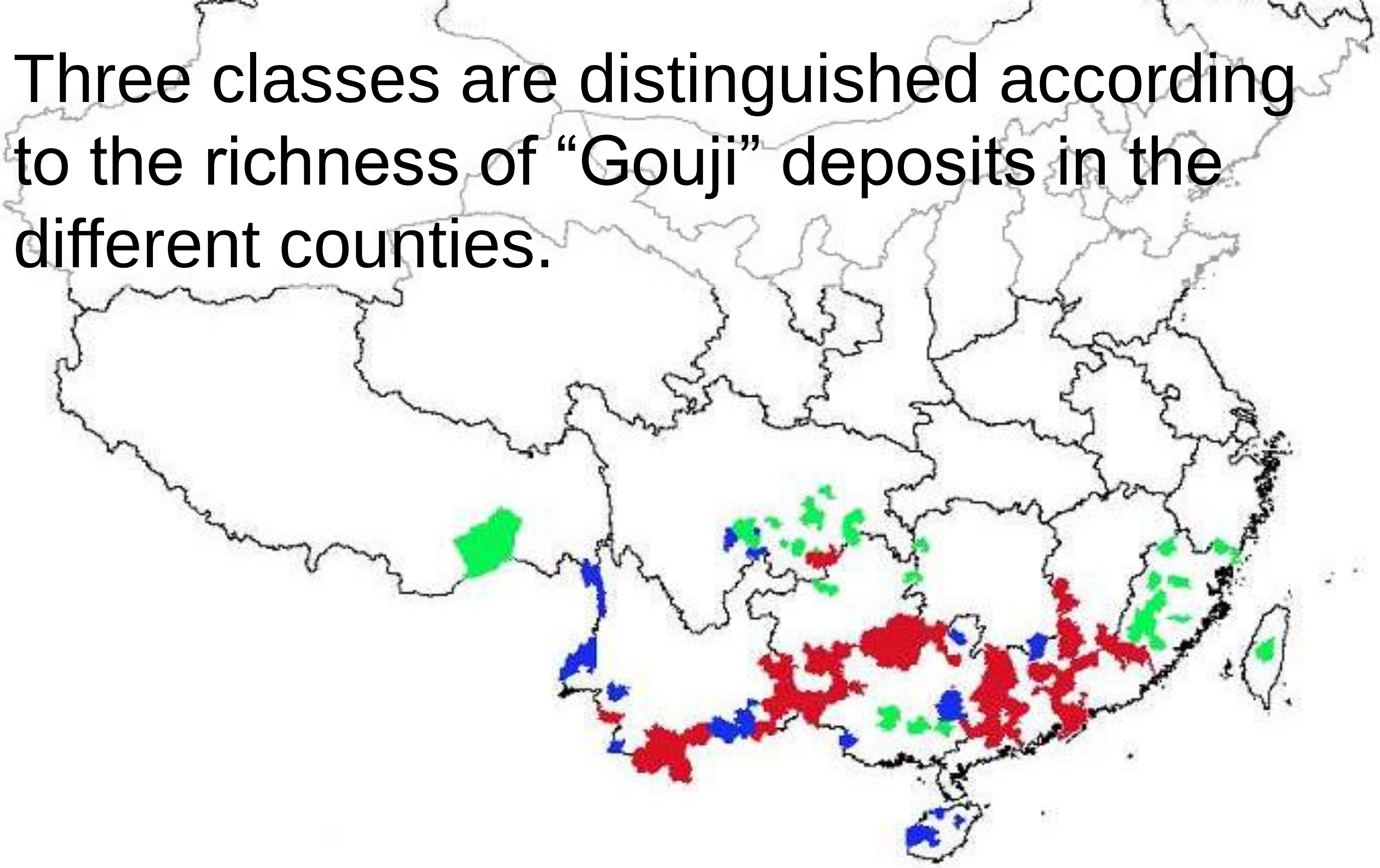
Biomass estimates

- According to our estimation, there are about 391,400 tons of deposits of “Gouji” in China, mainly distributed in Guangdong, Guangxi, Yunnan, Guizhou, and Sichuan.
- Ca. 3 kg fresh rhizome yield 1 kg dry rhizome.

Biomass of the rhizome of *Cibotium* in China

Guangdong	9,820,000 (kg)
Guangxi	9,120,000
Yunnan	7,520,000
Guizhou	6,000,000
Sichuan	3,240,000
Hainan	1,800,000
Fujian	1,100,000
Jiangxi	500,000
Chongqing	40,000
	39,140,000 (kg)

Three classes are distinguished according to the richness of “Gouji” deposits in the different counties.



----- the red color areas represent the highest deposits, blue areas the medium, and green areas represent the lowest deposits. Areas with the highest deposits of “Gouji” are in western Guangdong, northern Guangxi and southern Yunnan.

Export of C. barometz from 1993 to 2004

Year	Mainland (kg)	Hong Kong (kg)	
1993	4,000	0	
1994	35,100	15,000	
1995	292,000	147,000	
1996	13,750	6,000	
1997	0	12,000	
From 1998 to 2000 without export			after 2000, annual export limit to 130,000
2001	0		
2002	18,587		
2003	31,844		
2004	6,817		+ 120 living plants
2005	3,014.5		
2006	21.53		
2007	0		
2008	0		

Evaluation of data quantity and quality for the assessment

- The estimated deposit of natural resources might not be very accurate because of the difficulty of field survey and the limitation of sampled populations in its vast distribution areas.
- Our field studies were conducted between 1997-1998, and no data were collected afterwards.
- From our field trips in recent years, we found the natural vegetation are getting better in most parts of China because of the forest restoration project.
- For most rhizome-harvestable plants, the annual sustained yield is estimated at about 10% of the standing stocks. The export quota of 130 tons per year is reasonable.

Main problems, challenges or difficulties found on the elaboration of NDF

- The plants are widely and unevenly distributed throughout China south of the Yangtze River, our field survey is still very limited.
- It is hoped that international and national agencies will help with investigation of artificial cultivation, artificially promoting natural regeneration, and new medicinal products in order to reduce the pressure on wild resources of this much exploited species.

Thanks 谢谢！

NDF WORKSHOP CASE STUDIES
WG 2 – Perennials
CASE STUDY 2
Pelargonium sidoides
Country – **LESOTHO**
Original language – English

DEVELOPMENT OF A NON-DETRIMENT FINDING PROCESS FOR *PELARGONIUM SIDOIDES* IN LESOTHO

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I. Background information on the taxa

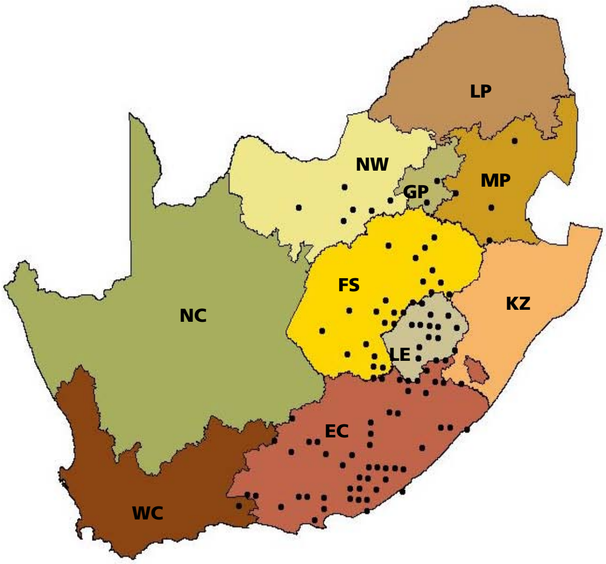
1. BIOLOGICAL DATA

1.1. Scientific and common names:

Pelargonium sidoides (DC)
Common names: Kalwerbossie, T'nami, and Khoaara e nyenyane

1.2. Distribution (Specify the currently known range of the species. If possible, provide information to indicate whether or not the distribution of the species is continuous, or to what degree it is fragmented. If possible, include a map).

P. sidoides distribution is limited to South Africa and Lesotho. In South Africa it occurs in the Eastern Cape, North West, Free State, Western Cape, Mpumalanga and Gauteng provinces. In Lesotho, it occurs predominantly in the more mountainous Southeastern and Northern parts of the country. It has been recorded at altitudes ranging from near sea-level in South Africa to 2746 metres in the mountains of Lesotho (See figure 1).



Key to South Africa's Provinces and Lesotho:
LE = Lesotho
EC = Eastern Cape
FS = Free State Province
GP = Gauteng Province
KZ = KwaZulu-Natal Province
LP = Limpopo Province
MP = Mpumalanga Province
NC = Northern Cape Province
NW = North West Province
WC = Western Cape Province

Figure 1: Distribution Map for *P. sidoides* in South Africa and Lesotho – Each solid black square represents one-quarter degree square (1 square kilometre) where the species occurs. Source: PRE (National Herbarium, SANBI, Pretoria), SAM (South African Museum Herbarium - transferred to NBG in 1956), NBG (Compton Herbarium, SANBI, Cape Town), NMB (Herbarium, National Museum, Bloemfontein), GRA (Selmar Schonland Herbarium, Albany Museum, Grahamstown), NH (KwaZulu-Natal Herbarium, SANBI, Durban), KEI (Herbarium, Walter Sisulu University, Umtata)

and locality data in Lesotho identified during fieldwork for a non-detriment finding.

In Lesotho, prior to the NDF training project, distribution was limited to five PRECIS locations. This number of localities was increased substantially at 20 survey sites ranging from the South East to North West of Lesotho in the Mohale's Hoek, Quthing, Qacha's Nek, Thaba Tseka, Mokhothlong, Butha Buthe and Maseru districts. In addition, to the observed distribution, the total predicted distribution in Lesotho was determined using a GIS-based model as illustrated below in Figure 2.

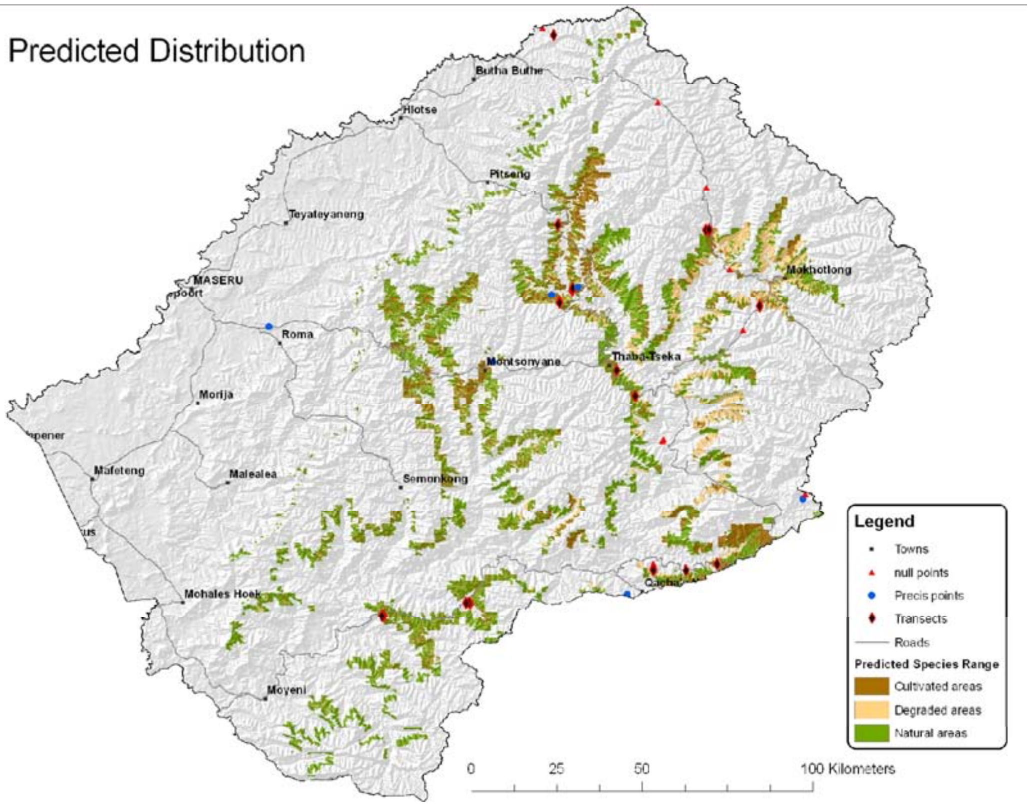


Figure 2: Distribution Map for *P. sidoides* in Lesotho. Actual distribution is based on South African National Biodiversity Institute PRECIS data and transects data gathered during fieldwork for a non-detriment finding. The GIS-predicted range is indicated by the green shading with the brown shading indicating cultivated or degraded areas. Source: Field research conducted by the Lesotho Scientific Authority and TRAFFIC East/Southern Africa, February 2008 and PRECIS database (PRE), National Botanical Institute, Pretoria, December 2003.

1.3. Biological characteristics

1.3.1. *Provide a summary of general biological and life history characteristics of the species (e.g. reproduction, recruitment, survival rate, migration, sex ratio, regeneration or reproductive strategies, tolerance toward humans).*

According to van der Walt (1988), *P. sidoides* is a somewhat aromatic rosette-like plant with crowded, velvety, heart-shaped, long-stalked leaves and a system of thickened underground root-like branches, aerial parts sparsely branched from base, evergreen in cultivation but in nature probably dying back to varying degrees during winter, two hundred to 500 mm tall when in flower. The inflorescence is a branched system of two (rarely up to four or more) pseudo-umbels, each with three to seven (occasionally up to 14) flowers. The flowers are 15 to 17 mm in diameter, the pedicel is usually very short compared to the well-developed hypanthium, and the petals are very dark reddish purple.

1.3.2. *Habitat types: Specify the types of habitats occupied by the species and, when relevant, the degree of habitat specificity*.

Van der Walt (1998), observed that this is an environmentally tolerant species being found in short grassland, sometimes with occasional shrubs or trees, on often-stony soil varying from sand to clay-loam, shale or basalt. In Lesotho, it is found predominantly in Lesotho Highland Basalt grassland. It usually grows in direct sunlight under rather dry conditions and receives summer rain varying from 200 to 800 mm per annum. On the whole it experiences moderate rather than high summer temperatures, and over much of its range it gets winter frost or even snow. The well-developed underground parts are doubtlessly not only an adaptation to survive such unfavourable conditions, but also provide an escape from grass fires which occur almost annually over much of its range. When cut, the insides of the underground parts show bright red, a property commonly associated with *Pelargonium* species used for folk-medicinal purposes and resulting in the colloquial name “Rabassam”. *P. sidoides* is easily propagated by transplanting, from seed, or from basal cuttings. It is a hardy plant that thrives in plentiful sunlight (Van der Walt, 1988). Its preferred habitat appears to be open grasslands. Field observations by Vlok (2003), revealed that bush encroachment on this habitat leads to a decline in the vigour of plants and eventually elimination. The species appears to tolerate and even thrive in partially disturbed habitats where plant competition levels are low but bush encroachment and agricultural activities are not conducive to re-growth and plants are eliminated from such areas.

1.3.3. *Role of the species in its ecosystem*

Apart from the plants use as a medicinal by humans and for treating sick livestock, the role of the species in its ecosystem has not been studied.

1.4. Population:

1.4.1. *Global Population size: (*Population size may be estimated by reference to population density, having due regard to habitat type and other methodological considerations, or simply inferred from anecdotic data*)*

In Lesotho, the predicted "very likely" distribution illustrated in Figure 2 amounts to an area of 2,100 square kilometres (210,000 hectare) out of Lesotho's total land area of 30,532 square kilometres. The average density of plants (or ramets) in this area is estimated from transect data to be approximately 5,000 plants or ramets per hectare (0.5 plants or ramets per square metre). However, given the observed patchy and localised distribution of individual populations across the landscape, a "patchiness" factor of 0.5% was applied to calculate Lesotho's total population at approximately five million plants.

In South Africa, plant densities determined by Vlok (2003) ranged from 0.2 ramets per square metres to 7.7 ramets per square metre. As insufficient survey work has been completed in South Africa it is not possible to provide an estimate of "very likely" distribution and therefore the total population is not known.

1.4.2. *Current global population trends:*

___increasing _X__decreasing ____stable ____unknown

1.5. Conservation status

1.5.1. *Global conservation status* (according to IUCN Red List):

___ Critically endangered
___ Vulnerable
X__ Least concern
___ Endangered
___ Near Threatened
___ Data deficient

1.5.2. *National conservation status for the case study country*

South Africa:

According to the South African Red Data List (2008), this species has a huge distribution range of 480,000 km2; however it is under severe harvesting pressure. Although the plants coppice after harvesting, local extirpations can occur when harvesting takes place too regularly and in the absence of adequate rainfall. The species is undergoing a continuing decline and it is therefore classified as "Least Concern – Declining".

Lesotho

Because no harvesting impact assessments have been completed to date the Red Data List status of this species is not known for Lesotho, however, small clusters of this species occur throughout a relatively large area (approximately 2,100 square kilometres) of the country. As in South Africa the species is under severe harvest pressures and its populations are estimated to be declining.

1.5.3. *Main threats within the case study country*

___No Threats
X_ Habitat Loss/Degradation (human induced)
___Invasive alien species (directly affecting the species)
X_ Harvesting [hunting/gathering]
___Accidental mortality (e.g. Bycatch)
___Persecution (e.g. Pest control)
___Pollution (affecting habitat and/or species)
___Other_______________
___Unknown

2. SPECIES MANAGEMENT WITHIN LESOTHO.

2.1. Management measures

2.1.1. *Management history*

Historically and presently there is no national monitoring framework of biological diversity, including *P. sidoides*, in Lesotho. The Lesotho Highlands Development Authority (LHDA) is however, engaged in flora and fauna monitoring programs within two of its areas, the Malibamatso catchment (Phase 1A) and the Mohale catchment (Phase 1B). The Range Management Division of the Ministry of Agriculture also did some small scale baseline studies for the flora in Pelaneng/Bokong and Malibamatso/Motsuku in 1990/1991 where permanent transects were established, but monitoring of these have been irregular due to limited resources allocated to the projects. The data emanating from these studies has also not been published. The current exploitation of the wild populations of *P.sidoides* is not monitored. The mapping of the populations and studies on regeneration potential are incomplete.

In addition, rangeland degradation in Lesotho has reached a critical level due to overgrazing and poor range management practices. Overgrazing has in turn led to progressive replacement of palatable grasses by invader species such as *Chrysocoma ciliata*. Annual soil loss from rangelands is estimated at 23.4 million tons per year (Chakela.

1981). Frequent droughts and occasional fires also contribute to range degradation in this country.

2.1.2. *Purpose of the management plan in place*

There is no national management plan

2.1.3. *General elements of the management plan*

There is no national management plan.

2.1.4. *Restoration or alleviation measures*

There is no national management plan for restoration or alleviation

2.2. Monitoring system

2.2.1. *Methods used to monitor harvest*

There is no national monitoring system in place

2.2.2. *Confidence in the use of monitoring*

There is no national monitoring system in place

2.3. Legal framework and law enforcement: Provide details of national and international legislation relating to the conservation of the species.

Lesotho lacks comprehensive national environmental laws although an umbrella Conservation Bill that has specific provisions for conservation of biological diversity has been drafted and awaits enactment. Currently, most conservation laws in Lesotho focus on improvement of economic or agricultural benefits rather than direct conservation of flora and ecological processes. Six pieces of legislation directly address biodiversity conservation, namely:

- **THE ENVIRONMENT ACT OF 2001:**

Part V Section 33 (1), of the Environmental Act 2001, states that no person shall operate, execute or carry out a project or activity specified in the Schedule without an environmental impact assessment licence issued by the Lesotho Environment Authority.

Part V Section 33 (2) of the Environmental Act 2001: The Authority may, if it is satisfied that the environmental impact statement is adequate, issue an environmental impact assessment licence on the terms and conditions appropriate and necessary to facilitate sustainable development and sound environmental management.

Part V Section 28 (3) of the Environmental Act 2001: If after considering the project brief, the Authority, in consultation with the Line Ministry is

of the view that the proposed project will not have any significant impact on the environment, it may approve the project or activity.
Section 66. (1) (f) of the Environmental Act 2001.
Prohibit or restrict any trade or traffic in any component of biological diversity.

- **HISTORICAL MONUMENTS, RELICS, FAUNA AND FLORA ACT 41 OF 1967:**

In Lesotho there is no permit system used for the harvesting of and trade in *P. sidoides*. However, there are some pieces of legislation, namely section 10(2) of the Historical Monuments, Relics, Fauna and Flora Act 41 of 1967 that:

I. Requires that written consent for harvesting of floral resources be obtained from the Preservation Commission before such activity can be carried out.
II. Lists plants that are protected under the Act. The Act was amended through LEGAL NOTICE NO. 93 OF 2004 to include more species, including *P. sidoides*.

- **LOCAL GOVERNMENT ACT OF 1997:**

The Local Government Act of 1997 specifies the mandate of the Community Councils that relate to the environment.
Section 5 (1) and Section 5 (2) grants Local Councils control of the following: Natural resources (e.g. sand, stones) and environmental protection (e.g. dongas, pollution), public health (e.g. refuse collection and disposal), land/site allocation, grazing control, markets, streets and public places, parks and gardens, fire, burial grounds, forests (preservation, improving and control of designated forests in local authorities), and water supply in villages. Flora and fauna are not specifically spelled out in this list of natural resources under the Act.

- **THE NATIONAL PARKS ACT OF 1975**, details resource management mandates within National Parks, and,
- **THE MANAGED RESOURCE AREAS ORDER OF 1993**. Further information on this body of legislation was not available during this research.
- **THE TRADE ENTERPRISES ORDER OF 1993**. This legislation provides for the issuance of a Traders' license by the Ministry of Trade, Industry, Cooperatives and Marketing.

Problem areas identified include the quality of environmental legislation and their implementation. Existing statutes governing natural resource management and the protection of the environment are considered inconsistent, inadequate and un-consolidated. They also overlap and are often in conflict with one another. Their implementation is inadequate because they are inaccessible (i.e. out of print, available only in English, and outdated). In addition, they depend on coercive measures, and are often reactive rather than preventive. For instance, if a company wants to harvest *P. sidoides* they require an EIA clearance letter from the NES issued in terms of the ENVIRONMENT ACT OF 2001. This letter is issued when NES receives a satisfactory Project Brief or Environmental Management Plan (EMP) from the company. In addition, in terms of the HISTORICAL MONUMENTS, RELICS, FAUNA AND FLORA ACT 41 OF 1967, the company must obtain a permit from the Protection Preservation Commission (PPC) for harvesting flora listed under the Act. However, the Act does not allow issuance of permits for trade and export purposes, and PPC in its history have not issued any permits for export or trade purposes. To resolve these inadequacies and inconsistencies, the PPC must be re-established and a system for issuing permits for trade purposes must be developed. Without this natural resource management in Lesotho will continue to be ineffective.

Other factors that contribute to poor implementation of environmental legislation include poorly trained personnel, inadequate financial resources, weak administrative and organisational structures, institutional conflicts, scarcity of monitoring equipment and lack of environmental education and public awareness programmes.

Legal reforms were initiated as early as 1989 to address the shortcomings in environmental legislation and in institutional capacity. This has culminated in the drafting of a draft Environmental Bill and in the establishment of the National Environment Secretariat (NES) to spearhead and co-ordinate environmental issues and ensure compliance with international conventions and treaties.

Although Lesotho is a signatory to the Convention on International Trade in Endangered Species (CITES), it does not have many of the required implementation structures, such as dedicated CITES implementing legislation.

Traders in Lesotho are required by law to obtain collection permits from the NES in terms of the Environment Act of 2001. In reality this requirement only applies to large scale operations with many people selling this species on a small scale in urban markets not having permits. The collection of plants from any site in Lesotho also requires permits in terms of the Historical Monuments, Relics, Fauna and Flora Act of 1967 and the less formal process of obtaining permission from the traditional leaders in the particular area.

P.sidoides populations naturally occur on rangelands which are primarily used for livestock grazing. The use of Lesotho's rangelands is the responsibility of Range Management Areas (RMAs)/ Grazing Associations (GA) which are specially designated management units designed to promote sustainable use of Lesotho's rangelands. However RMA's are not common throughout the country. They are found only in certain areas and even many of those that have been established are reportedly barely functional. Most of the rangelands are still controlled by traditional chiefs and the local government councils. Indeed in those areas where RMAs are present, management powers are delegated to them. The areas used for summer grazing in the mountains (animal posts) still remains the exclusive right of the Principal Chiefs without local government involvement.

In conclusion, the current legislative system providing a legal basis for the harvest of *P. sidoides* is unclear, appearing to be work in progress. The lack of transparency in the legislative and administrative requirements is not conducive to a well-managed and legal natural resource industry in Lesotho.

The main issues identified during this research are:

- It is not clear which body of legislation mandates the implementation of CITES in Lesotho.
- There is no one single authority in Lesotho that can authorise harvest of natural resources. This is epitomised by the situation where a trader in possession of a harvest permit issued in terms of the ENVIRONMENT ACT OF 2001 by the National Environmental Secretariat was arrested by police for illegal harvest because they did not have a permit issued in terms of the HISTORICAL MONUMENTS, RELICS, FAUNA AND FLORA ACT 41 OF 1967 and LOCAL GOVERNMENT ACT OF 1997.
- The HISTORICAL MONUMENTS, RELICS, FAUNA AND FLORA ACT 41 OF 1967 legislation relevant to this natural resource management is not implementable since the responsible institutional arrangements are not in place. The body that administers this law, namely, "Protection Preservation Commission of Natural and Historical monuments" was instituted but is currently not functional. In addition, Environmental Impact Assessments are currently not obligatory complicated by the fact that the Act does not cover harvesting for trade purposes, rather for small-scale collections such as research purposes.

3. UTILIZATION AND TRADE FOR RANGE STATE FOR WHICH CASE STUDY IS BEING PRESENTED.

3.1. Type of use (origin**) and destinations (**purposes**) (**e.g. commercial, medicinal, subsistence hunting, sport hunting, trophies, pet, food**). Specify the types and extent of all known uses of the species. Indicate the extent to which utilization is from captive-bred, artificially propagated, or wild specimens**

Pelargonium species in general, have been used in southern Africa as useful medicinal plants for many years providing relief for colic, diarrhoeas and dysenteries (Watt and Breyer-Brandwijk, 1962). *P. sidoides* forms part of a group of *Pelargonium* species with red-coloured fleshy roots also used to treat the above mentioned abdominal upsets. The plants are prepared as decoctions, in water and often with milk (Watt and Breyer-Brandwijk, 1962). In confirmation of this usage, Dold and Sizane (2002), surveyed 15 South African based harvesters and found seven using *P. sidoides/ P. reniforme* to treat stomach aches; four prepared the remedy in milk.

In more recent times the species has become an ingredient in a number of commercially produced medicinal remedies, including one called "Umckaloabo" used to treat bronchitis in both adults and children (van Wyk, *et al*., 1997). Anon 3 (2003), advertises *P. sidoides* for sale in the form of dried sliced root and tinctures for the treatment of sinus, throat and respiratory tract infections.

At the level of more formal medical practice, several scientific trials on extracts of *P. sidoides* have demonstrated positive clinical effects (Koch, E., *et al*, 2002; Bereznoy, V.V., *et al*, 2003), thus providing incentives to continue the harvest of not only this species, with its sought after active ingredient "umckalin"but others that have similar medicinal extracts, such as *P. reniforme*. Although the name "Umckaloabo" is used globally to describe medicines from *P. sidoid*es and *P. reniforme*, the main exploitative pressure is on the former because of its superior "umckalin" content compared to other species. Although the benefit of this remedy has been known for many years it is only since 2001 that large scale commercial wild harvesting commenced in South Africa and more recently in Lesotho, to supply the international market. The dominant export destination for this plant and its products is Germany.

This species are harvested from the wild mainly in the Eastern Cape Province of South Africa and in the South-eastern and North-western districts of Lesotho. Some harvest of agriculturally produced roots occurs in the Western Cape and Free State provinces of South Africa but not thus far in Lesotho. Current legislative measures in South Africa and Lesotho generally require permits for harvest, transport and export. However, legislative and institutional constraints in Lesotho and the lack of effective management systems in both countries has resulted in the issuance of few permits and confusion about the permit issuance procedure. This has led to the situation where a large portion of the harvest conducted to date in both countries has been regarded as illegal.

The main threats to wild populations of *P.sidoides* in Lesotho are habitat loss due mainly to encroachment by human settlements and harvest for commercial use in medicinals.

3.2. Harvest:

3.2.1. *Harvesting regime* (extractive versus non extractive harvesting, demographic segment harvested, harvesting effort, harvesting method, harvest season)

In Lesotho, all *P. sidoides* is harvested from wild populations during the growing season that extends from about September through to April of each year. Harvesters who are paid per kilogram of wet material, harvest the ligno-tubers using spades, pick-axes or other suitable tools. Mature plants with ligno-tubers estimated to be older than seven years old and showing significant levels of secondary "bark" formation and a dark red colour under the bark when injured are the primary target of the industry. Typically, because of its brittleness and tendency to grow under rocks, only part of a ligno-tuber system is harvested. The ligno-tuber stem sections remaining in the soil often resprout within weeks to months after harvest.

3.2.2. *Harvest management/ control* (quotas, seasons, permits, etc.)

In Lesotho, there is minimal national control over harvest management. Apart from the recently conducted non-detriment finding, to date there has been no attenpt to quantify a quota, harvest season, harvest methodologies, rate of resource recovery or other management systems. These activities have been left almost entirely up to individual traders who have voluntarity imposed harvest management system on their own operations. However the effectiveness or appropriateness of such voluntary systems have not been formally assessed.

3.3. Legal and illegal trade levels: To the extent possible, quantify the level of legal and illegal use nationally and export and describe its nature.

Given the fragmented and poorly co-ordinated legislative environment in Lesotho, a large part of the annual harvest volume of approximately that ranges from 17,000 kg to 36,000 kg may be regarded as having been illegally harvested. This is despite the fact that traders may have obtained a harvest permit from one agency but omitted to obtain the necessary permit from another agency also with responsibility for the resource. This legal confusion is possibly the most urgent issue to be resolved if the industry is to be placed on a legal and well-managed footing in Lesotho. In addition, some Basotho citizens harvest over the border in neighbouring South Africa and either import the material back into Lesotho or sell directly to South African-based traders. It is thought that most of this unregulated and largely unquantified cross-border trade is illegal.

II. NON-DETRIMENTAL FINDING PROCEDURE (NDFS)

Provide detailed information on the procedure used to make the non-detriment finding for the species evaluated.

1. IS THE METHODOLOGY USED BASED ON THE IUCN CHECKLIST FOR NDFS?

__Partially, YES

In 2005, TRAFFIC was invited by the National Environmental Secretariat of Lesotho to provide CITES training for its Management and Scientific Authorities as well as law enforcement staff from other government agencies. Subsequent to this invitation, during 2006, TRAFFIC conducted a needs assessment at a workshop convened in Maseru comprising 30 officials from the National Environmental Secretariat, police and other agencies. At this workshop, apart from identifying training needs, a priority list of traded species was identified, the most important being *Pelargonium sidoides*. A project proposal to provide CITES training to the Scientific Authority of Lesotho was compiled and *P. sidoides* was included to facilitate theoretical and field based training in the elements of a non-detriment finding as prescribed in article IV of the CITES.

Having identified the priority species, the following activities were subsequently implemented as part of the non-detriment finding (NDF):

a) Non-detriment findings within the CITES context are generally limited in scope to the guidance provided in article IV of the Convention relating to Appendix II listed species and of Rosser and Haywood (2002). However, as the intent of the NDF in Lesotho was to provide content for an integrated species management plan the research and final report was structured following the principles and criteria of the ISSC-MAP guidelines outlined in Anon (2007) and summarised in Annex 1. Although these guidelines incorporate content required for making a CITES NDF, they additionally include aspects such as benefit sharing, market specifications and worker safety, crucial to ensuring sustainable management of species utilised at an industrial scale.

b) A literature review of mainstream scientific and grey literature for the period 2001 to 2008 was conducted at the South African National Biodiversity Institute, Pretoria and University of Witwatersrand, Johannesburg.

c) On the 21st to 24th January 2008 a CITES training workshop on the role and function of CITES Scientific Authorities (SA's) was conducted with the Lesotho Scientific Authority. During this workshop the non-detriment finding checklist developed by Rosser and Haywood (2002) and the International Standard for the Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP) was utilised to assess the Lesotho SA's knowledge (including threats) of *P. sidoides*, to develop priorities for further field research and interviews and to guide the content of the non-detriment finding report. On the basis of the "Spider" or "Radar" chart generated following Rosser and Haywood (2002) the following information gathering and research priorities were identified (Figure 1 & Table 1).

Figure 1: Radar chart for P. sidoides generated by the LSA according to the non-detriment finding checklist of Rosser and Haywood (2002).

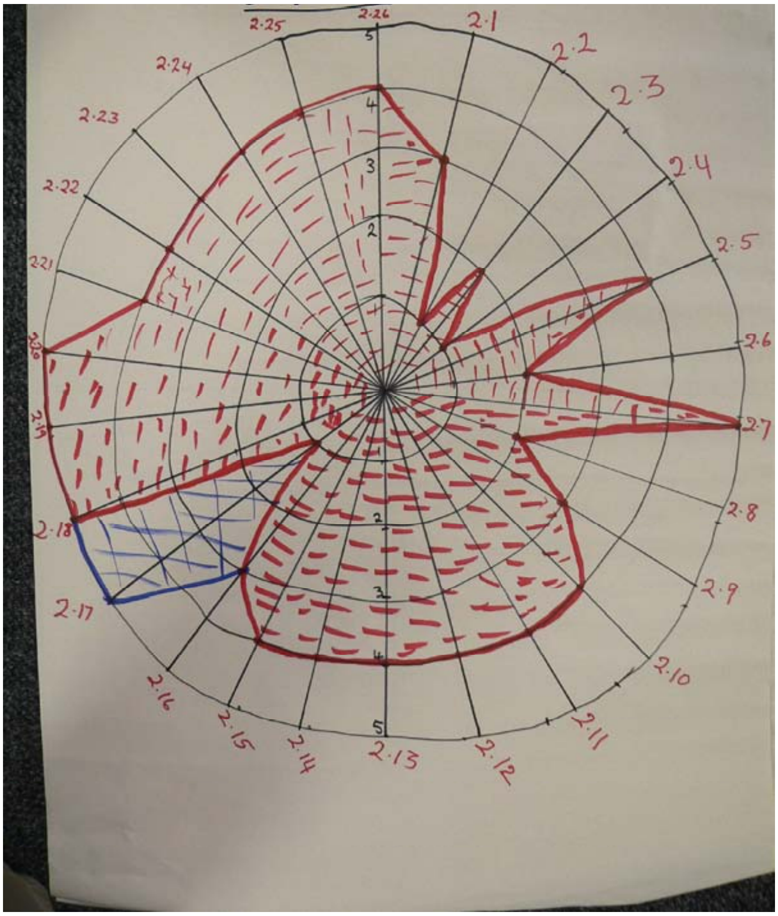


Table 1: Information gathering and research priorities identified following the non-detriment finding guidelines of Rosser and Haywood (2002).

NDF Criterion number according to Rosser and Haywood (2002)	Criterion Description
2.5	Research national distribution
2.7	Research national population trends
2.10	Research illegal harvest or trade
2.11	Research management history
2.12	Identify management plan or equivalent
2.13	Research aim of harvest regime in management planning
2.14	Develop quotas
2.15	Research extent of harvesting in Protected Areas (PA)
2.16	Research extent of harvesting in areas with strong resource tenure or ownership
2.17	Research harvesting in areas with open access
2.18	Establish whether there is confidence in harvest management
2.19	Identify methods used to monitor harvest
2.20	Establish whether there is confidence in harvesting monitoring
2.21	Research the impact of utilization compared with other threats
2.22	Research existence of incentives for species conservation
2.23	Research existence of incentives for habitat conservation
2.24	Research the proportion of plants strictly protected from harvest

Having identified the fact that an integrated management plan was a critical element of future efforts to manage the trade in *P. sidoides*, the LSA were guided through a theoretical introduction to the International Standard for the Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP) (Anon. 2007). The ISSC-MAP provides an integrated approach to species management. Sets of open-ended questions relevant to each section of ISSC-MAP were considered by the LSA (Annex 2) and the answers again provided guidance on priority research activities or information gathering required to compile a species management plan. Knowledge gaps identified in this way included the following:

- Q: Is the collection of the species following specific volume and quality instructions from the buyer?
- A: *"No. We don't know the quality requirements but we can safely say there are no volume restrictions."*
- Q: How are illness, injury, financial losses related to collection of this resource handled, and by whom?
- A: *"No illnesses, no injury, no financial (support). They are not handled at all."*

From the answers provided to the ISSC MAP questions additional priorities were added to those provided in Table 1, for instance:

- Determining whether government and industry on behalf of communities were implementing Access and Benefit Sharing principles, and
- Determining whether traders provide specific volume and quality instructions to traders.

d) On the 17th to 24th February 2008, field-work and interviews aimed at obtaining the information listed in Table 1 and derived from the ISSC-MAP questionnaire, including, distribution, density, trade volumes and harvest methodologies, was conducted at 20 sites in Lesotho. Interviews were conducted with community members and two companies active in the harvest and trade of this species using the same ISSC-MAP questionnaire in Annex 2. At each of the 20 survey sites, five transects were conducted. The transects were prepared by first measuring a 100 metre base-line that ran perpendicular to the direction of the slope. Each of the five 50 metre long individual transects were laid out up the slope. The altitude and GPS coordinate were recorded at the start and finish of each transect. A team of three proceeded to walk up the line of the transect holding a 1.8 metre long pole over the transect line and counting each plant occurring within the poles breadth. Counts were also taken of plants with flowers, holes made during previous harvests and plants re-sprouting from previously harvested holes. A separate team dug out one plant within each transect using a pickaxe. The harvested plants were photographed and labelled with GPS coordinates, altitude, photograph number and locality name. The ligno-tuber fresh and dry weight, diameter, length, and presence of white, pink and red ligno-tuber age-groups were recorded.

e) On the 17th to 20th June 2008, a data analysis workshop was convened by the South African National Biodiversity Institute in Pretoria, South Africa to determine the distribution and density of *P. sidoides* using Arc-GIS to identify areas of habitat, climate and geography suitable for *P. sidoides*. Available distribution and trade data, in conjunction with the results of the GIS analysis were used to determine the maximum possible population available for harvest and whether current harvest volumes were sustainable. Data layers used for this project were SANBI 2006 SA Vegetation Types (Mucina & Rutherford 2006), altitude, aspect, climate (based on frost duration, mean temperature of the coldest month and precipitation), national land cover (NLC) and Lesotho *P. sidoides* coordinate points, which were exported into ArcView 3.2a. as point data. All analysis was done using ESRI's ArcView 3.2a and ARCGIS 9.2 software. Vegetation type was used as a proxy for soil type.

Four GIS models were used to analyse the data, namely.
Model 1: The Rule-based model for distribution modelling was applied based on expert knowledge. This model used vegetation (Lesotho Highland Basalt grassland), altitude (range 2100 to 2500 metres), aspect (32° to 165°), climate and precipitation (based on frost duration, mean temperature of the coldest month and precipitation > 800 mm per annum) as its main parameters. An index between -4 and -3 was established for the climate layer; the lower the value the more frost there is and the lower the temperature.

Model 2: The Climatic-envelope model was based on three of the same variables utilised in the first model namely altitude (2100 to 2500), aspect (32° to 165°) and climate (-4 to –3). The main difference between this model and the first was that the computer programme set the limits of the variables, independently of expert input. The locality of the species is plotted using parameters such as altitude vs. aspect to see if there is a correlation. Within the range there should be at least a 10%: 90% chance that it occurs within that range. The 10% rule will shift the 90% box envelope to the area where 90% of the data points occur.

Model 3: The Distance-based model was a refinement of the Climatic-envelope method. The main difference is that concentric circles ("envelopes") calculated at fixed distances away from an average value of, for instance altitude, are calculated to include areas encompassing the largest number of locality points. The circle does not have to have a regular shape and can be an oval or oblong as long as it encircles the majority of the data. This method is more accurate than the climatic envelop method. The 10% rule does not apply as in model 2 above, only the average value.

Model 4: An ALTERNATIVE INDEPENDENT CLIMATE MODEL was also tested to confirm the validity of the field data. This model made use of nine climatic factors including, the number of growth days per year, soil water stress, frost duration, growth temperature (degrees multiplied by 10), mean temperature of the hottest month, mean temperature of the coldest month and mean annual precipitation. Unlike the previous three models altitude was excluded because *P. sidoides* grows from high altitude to low altitude (almost down to sea level) and realistically this parameter would not always appear to be a good indicator.

Following on from the analysis and given the high degree of overlap between the four models it was decided to conduct two further analyses, namely:

- To overlap each of the models with land use data (distinguishing between natural, agricultural and degraded areas)(NLC) to assess the result.
- To blend all the models above to produce an "average" model and then overlay with NLC.

The results of this work made it possible to select Model 1 as being the most relevant for the dataset. The Model was used to estimate the total population of *P. sidoides* in Lesotho at approximately five million plants. Using interview and field data it was determined that the annual harvest of ligno-tubers ranged from 17,000 to 360,000 plants per annum and that the slow re-growth of the ligno-tubers limited repeat harvesting cycles to at least seven years. The maximum total harvest of plants over this period amounted to approximately 2.5 million plants or approximately half of the country's total population. From this and the fact that tuber re-growth occurs slowly it could be deduced that the current harvest levels are detrimental to the species in Lesotho.

2. CRITERIA, PARAMETERS AND/OR INDICATORS USED

The criteria and principles included in Rosser and Haywood (2002) and the ISSC MAP (Anon. 2007) were used. As the Rosser and Haywood (2002) criteria were limited to non-detriments findings required in terms of CITES Article IV, the ISSC-MAP criteria (Annex 1) were used to identify gaps and compile the information required for developing an integrated species management plan.

3. MAIN SOURCES OF DATA, INCLUDING FIELD EVALUATION OR SAMPLING METHODOLOGIES AND ANALYSIS USED

See above

4. EVALUATION OF DATA QUANTITY AND QUALITY FOR THE ASSESSMENT

See above

5. MAIN PROBLEMS, CHALLENGES OR DIFFICULTIES FOUND ON THE ELABORATION OF NDF

Although it was possible to determine average plant density, predicted total population and make an assessment of detriment based upon trade volumes, it was not possible to calculate an accurate quota because of inadequate information on ligno-tuber re-growth rates. For management purposes a quota was determined using a simple percentage estimate of total harvest, in this case 10%. However, this estimate is regarded as an interim quota useful for managing the resource until more detailed field data on resource recovery is available.

6. RECOMMENDATIONS

The main recommendation stemming from the non-detriment finding work in Lesotho is that the process be expanded to enable the development of an integrated management plan for the species. To simply identify trade that is detrimental is only the start, the next logical step is to develop a management plan that lays out a process of conservation action into the future. The use of the ISSC-MAP to prioritise the gathering of information required to conserve medicinal plants, forms a useful basis for such a plan.

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NDF WORKSHOP
WG 2 – Perennials
CASE STUDY 2 SUMMARY
Pelargonium sidoides
Country – **Lesotho**
Original language – English

DEVELOPMENT OF A NON-DETRIMENT FINDING PROCESS FOR *PELARGONIUM SIDOIDES* IN LESOTHO

AUTHORS:
NEWTON, D., LETSELA, T., LIJANE, T., MAFATLE, N., MANYAMA, P., NAHA, S., NTLOKO, B., NTSOHI, R., PAETZOLD, B., PIRES, A., POLAKI, M., RAIMONDO, D., ROUGET, M., T'SELE, T., WISTEBAAR, N., AND ZIMUDZI, C.

Pelargonium sidoides (DC) is a medicinal plant species used to treat various digestive and respiratory tract complaints in both humans and livestock. The species occurs at altitudes ranging from near sea level to almost 3,000 metres in Lesotho and in habitats ranging from short grassland, sometimes with occasional shrubs or trees, on often-stony soil varying from sand to clay-loam, shale or basalt to Lesotho Highland Basalt grassland. The species is tolerant of a wide range of climatic and environmental conditions ranging from extreme cold (snow and frost), high summer temperatures, low rainfall, stony soils, fire and disturbance caused by human and livestock. It is a resilient plant able to regenerate from ligno-tuber sections and seed. However, observations that this species is popular in trade and evidence that too regular return harvesting leads to decline in populations, led to concerns that the species may be under threat in the wild. To determine the level of threat, if any, to the population a non-detriment finding (NDF) was conducted in Lesotho. The NDF procedure involved five steps to cater for the particular circumstances prevalent in Lesotho at the time, as follows.

Step 1: TRAFFIC conducted a needs assessment for the CITES Scientific (SA) and Management Authority (MA) of Lesotho to identify priority training needs and species in trade. In this manner *Pelargonium sidoides* was selected. A project proposal to provide CITES training to the SA and MA of Lesotho was compiled and *P. sidoides* was included to facilitate theoretical and field-based training in the elements of a non-detriment finding as prescribed in article IV of the CITES.

Step 2: A literature review of mainstream scientific and grey literature relevant to *P. sidoides* over the period 2001 to 2008 was conducted.

Step 3: A CITES training workshop on the role and function of CITES SA's was conducted with the Lesotho SA. During this workshop the non-detriment finding checklist developed by Rosser and Haywood (2002) and the International Standard for the Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP) was utilised to assess the Lesotho SA's knowledge of *P. sidoides*, to develop field research priorities,

to guide and populate the non-detriment finding report and to provide baseline information for inclusion in a species management plan.
Step 4: Fieldwork and interviews to obtain the priority data, including distribution, density, trade volumes and harvest methodologies, and required for the NDF and ISSC MAP management plan was conducted in various locations throughout Lesotho.
Step 5: Using field data, an Arc-GIS based data analysis workshop estimated the distribution, density, and the total estimated population of the species. The GIS model estimated the total Lesotho population of *P. sidoides* to consist of approximately five million plants. Comparing this to the **maximum** estimated harvest of approximately 2.5 million plants over seven years (being the minimum estimated time required for a ligno tubers to recover to a commercially valuable dimension) it can be shown that approximately half of the country's total population is subject to harvest.

From this sequence of activities it can be deduced that the current harvest levels are detrimental to the species in Lesotho. This is regarded as a preliminary estimate of impact that requires further research, specifically into the ligno-tuber recovery rate, and periodic review as provided for in the ISSC-MAP based management plan currently under development.

DEVELOPMENT OF A NON-DETRIMENT FINDING PROCESS FOR *PELARGONIUM SIDOIDES* IN LESOTHO

Presented by David Newton

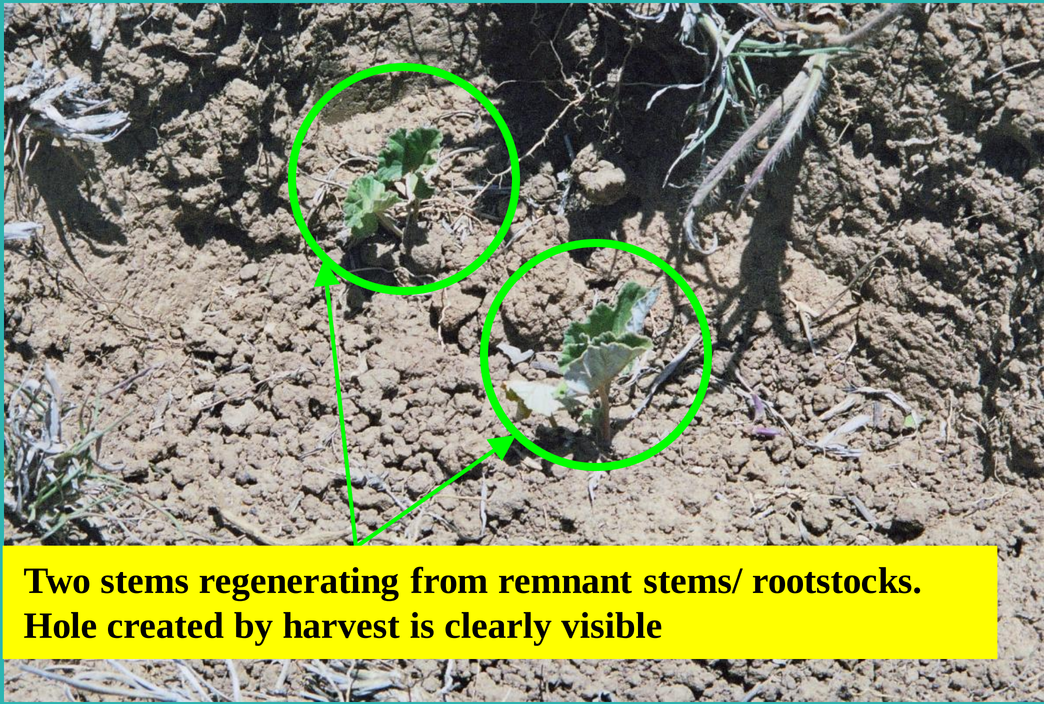
05/12/2008

Content of NDF Case Study

- A brief history of the *Pelargonium sidoides* project
- NDF Methodology
- Field work and results of resource assessment
- Further NDF research required
- Status of management plan development
- Recommendations

History…..

- Large scale commercial use in South Africa and Lesotho
- No formal monitoring or management plans for harvest
- Preliminary research for ZA conducted in 2003/ 4, identified ligno-tuber recovery as bottleneck.
- Minimal information on trade in LE and request for CITES training.



NDF Methodology

- Phase 1: Situation Analysis workshop
- Phase 2: CITES SA training workshop using IUCN and ISSC MAP criteria to ID bottlenecks and research priorities
- Phase 3: Field work and interviews
- Phase 4: Analysis of field research (including GIS-based analysis)
- Phase 5: Management plan and feedback loops

Phase 1: Situation Analysis workshop

CITES Training requirements

Priority species list

H. odorotisimum
A. polyphylla
Pelargonium spp.
Marxmuelera?

P. sidoides
H. odorotisimum
A. polyphylla
M. drakenbergensis
P. caffra

H. odorotisimum
A. polyphylla
A. ferox

A. polyphylla

A. aristata
A. polyphylla

A. polyphylla

Baboons
Antelope spp.

Springbuck
Maloti minnow

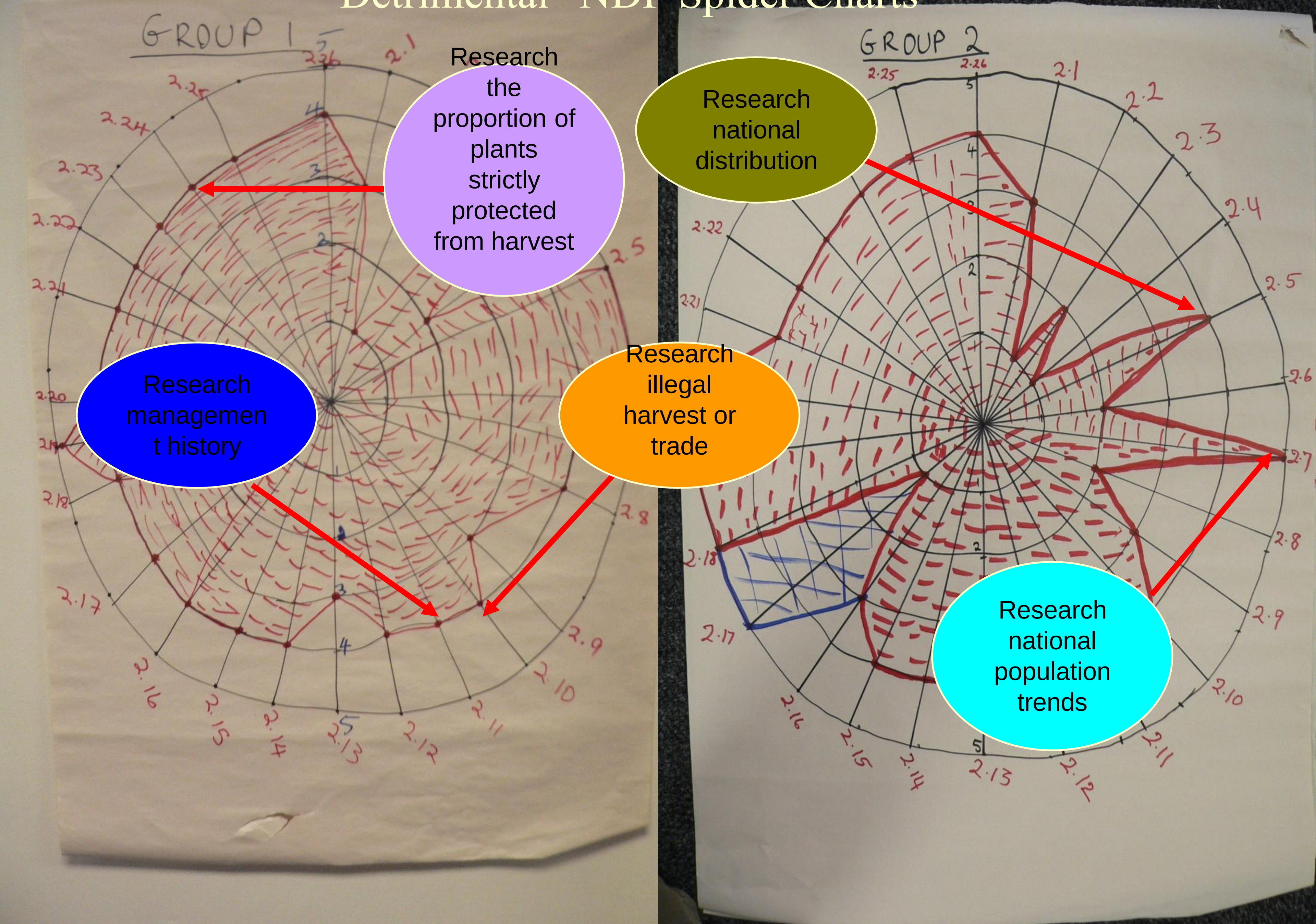
A. polyphylla
P. sidoides
African potatoe

Pelargonium spp.
A. ferox

Phase 2: CITES SA Training and NDF Research prioritization workshop

- CITES SA Training course included the following actions:
  - The IUCN NDF Guidelines were used to train SA staff by:
    - Through debate and discussion clarifying state of knowledge,
    - Determining **“qualified” (precautionary)** “detriment” or “non-detriment”,
    - Identifying knowledge gaps, and
    - Identifying research priorities at a CITES specific level.

"Detrimental" NDF Spider Charts



Research the proportion of plants strictly protected from harvest

Research national distribution

Research management history

Research illegal harvest or trade

Research national population trends

CITES SA Training and NDF Research prioritization workshop in Lesotho

- From IUCN NDF it was possible to say trade was detrimental, BUT, could not say much about physical or quantitative nature of impacts or how to manage them.
- Therefore, to include all resource management aspects, the ISSC-MAP Situation Analysis Questionnaire was used to identify additional knowledge gaps and priorities, for instance,
  - Q: Is the collection of *P. sidoides* following specific volume and quality instructions from the buyer?
  - A: "No. We don't know the quality requirements but we can safely say there are no volume restrictions."

Phase 3: The Field-Based NDF

- Using ISSC MAP questionnaire the following priority data gaps were filled:
  - *P. sidoides* distribution;
  - Plant density and population;
  - Tuber age classes harvested;
  - Total harvest volumes;
  - Post-harvest plant recovery rates;
  - Harvest and post-harvest methods;
  - Ligno-tuber or resource recovery rates;
  - Illegal/legal trade volumes, and
  - Trader views and perspectives

Resource assessment methodology


Survey method

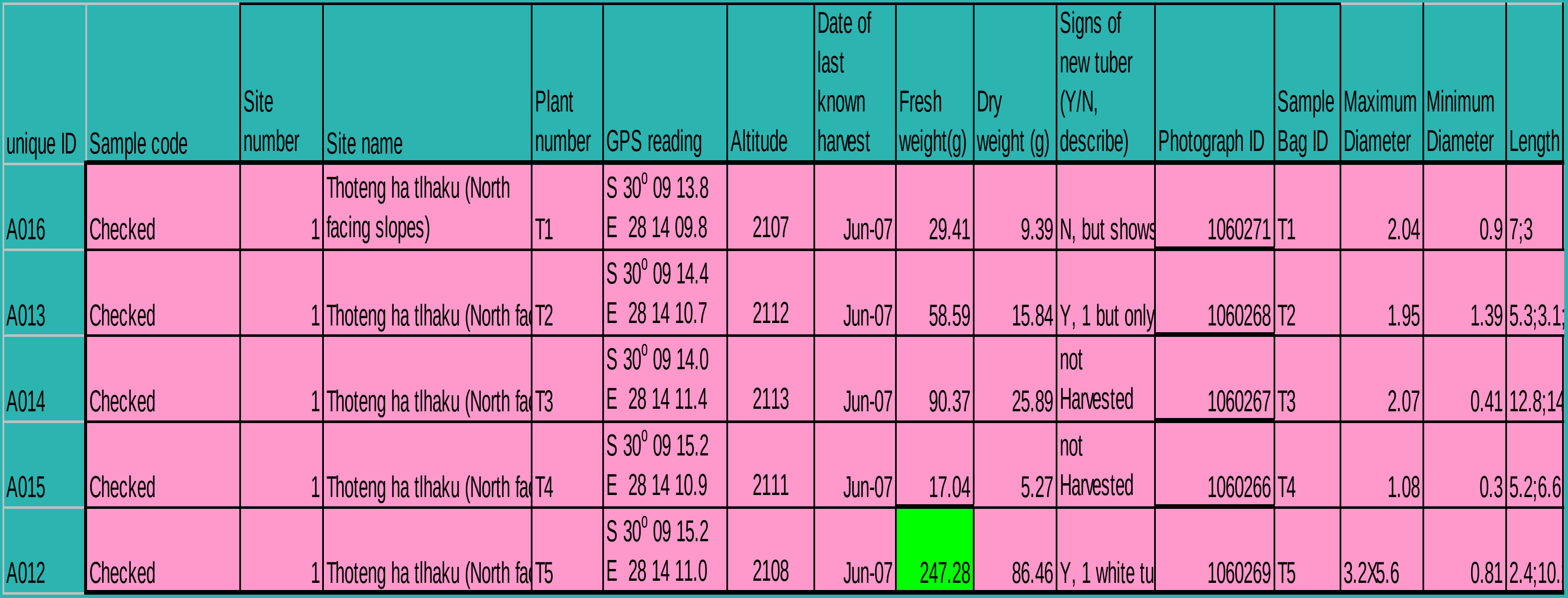

“White” tuber


Consultation and “lessons”


One sample per transect

“Pink” tuber

Data Sheet

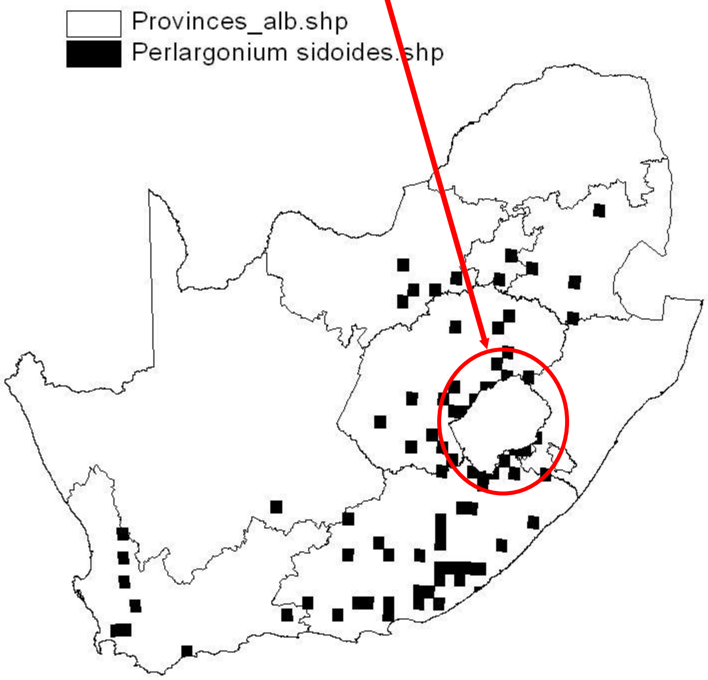


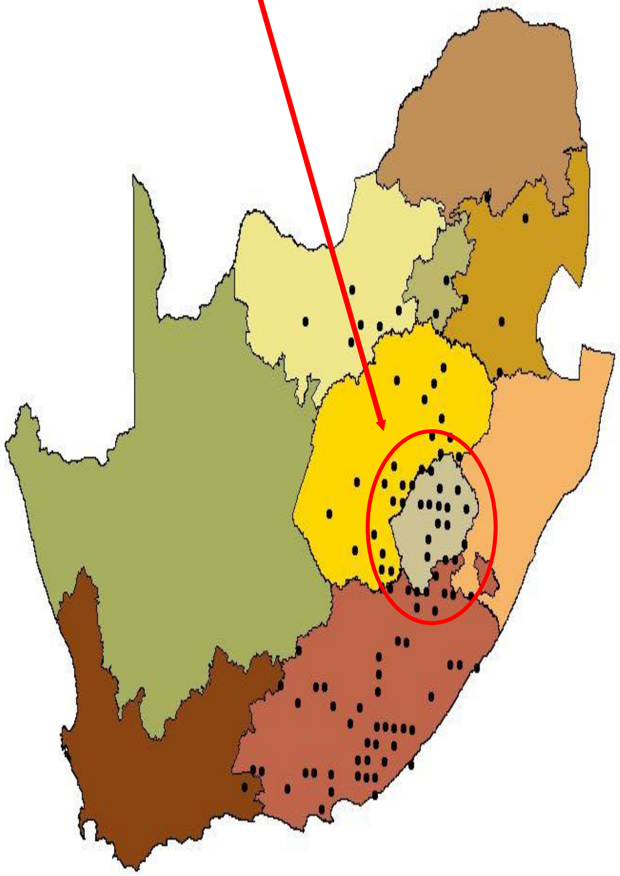
unique ID	Sample code	Site number	Site name	Plant number	GPS reading	Altitude	Date of last known harvest	Fresh weight(g)	Dry weight (g)	Signs of new tuber (Y/N, describe)	Photograph ID	Sample Bag ID	Maximum Diameter	Minimum Diameter	Length
A016	Checked	1	Thoteng ha tlhaku (North facing slopes)	T1	S 30^{0} 09 13.8 E 28 14 09.8	2107	Jun-07	29.41	9.39	N, but shows	1060271	T1	2.04	0.9	7;3
A013	Checked	1	Thoteng ha tlhaku (North fa	T2	S 30^{0} 09 14.4 E 28 14 10.7	2112	Jun-07	58.59	15.84	Y, 1 but only	1060268	T2	1.95	1.39	5.3;3.1;
A014	Checked	1	Thoteng ha tlhaku (North fa	T3	S 30^{0} 09 14.0 E 28 14 11.4	2113	Jun-07	90.37	25.89	not Harvested	1060267	T3	2.07	0.41	12.8;14
A015	Checked	1	Thoteng ha tlhaku (North fa	T4	S 30^{0} 09 15.2 E 28 14 10.9	2111	Jun-07	17.04	5.27	not Harvested	1060266	T4	1.08	0.3	5.2;6.6
A012	Checked	1	Thoteng ha tlhaku (North fa	T5	S 30^{0} 09 15.2 E 28 14 11.0	2108	Jun-07	247.28	86.46	Y, 1 white tu	1060269	T5	3.2X5.6	0.81	2.4;10.

Used distribution, dry/wet weight mainly; new tuber data inconclusive; diameter and length data yet to be used.

Distribution 2007

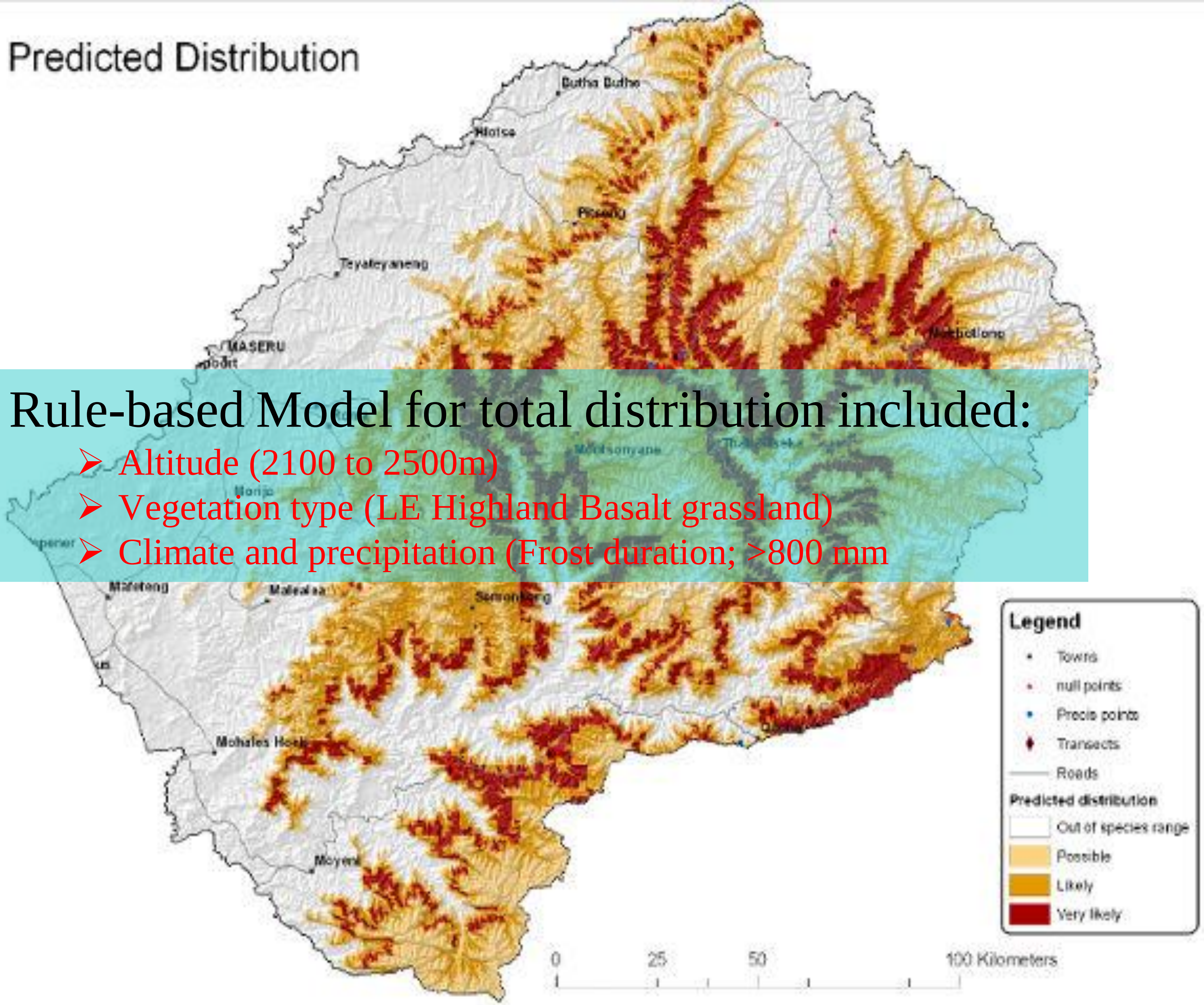
Distribution 2008





Phase 4: The Analysis of Field data

- Joint SANBI/TRAFFIC/ LE SA GIS modelling workshop. Objectives were to:
    - Model the total distribution of *P. sidoides* in Lesotho;
    - Use predicted distribution, field density data and a "patchiness" factor to estimate Lesotho's total population.
    - To assess whether total harvest represented a detrimental impact on *P. sidoides*.

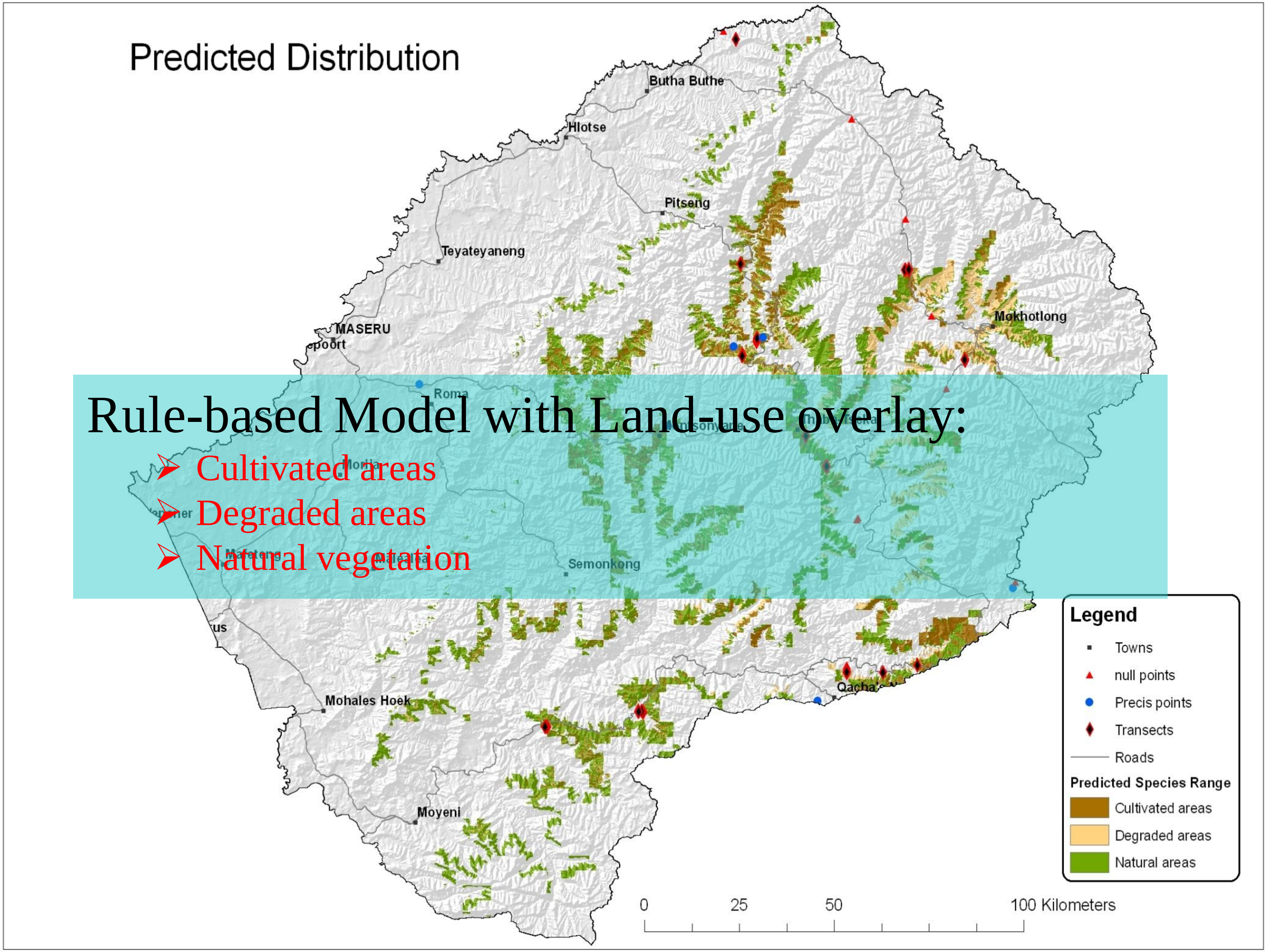


Rule-based Model for total distribution included:

- Altitude (2100 to 2500m)
- Vegetation type (LE Highland Basalt grassland)
- Climate and precipitation (Frost duration; >800 mm

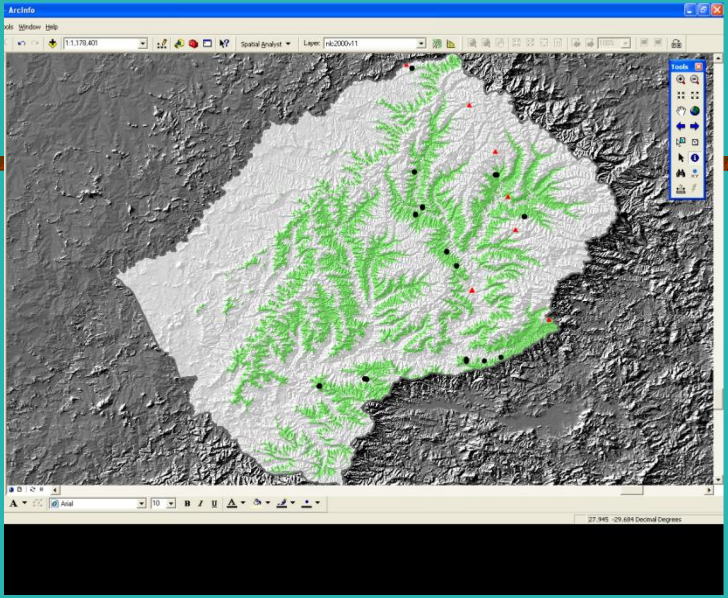
Rule-based Model with Land-use overlay:

- ➢ Cultivated areas
- ➢ Degraded areas
- ➢ Natural vegetation



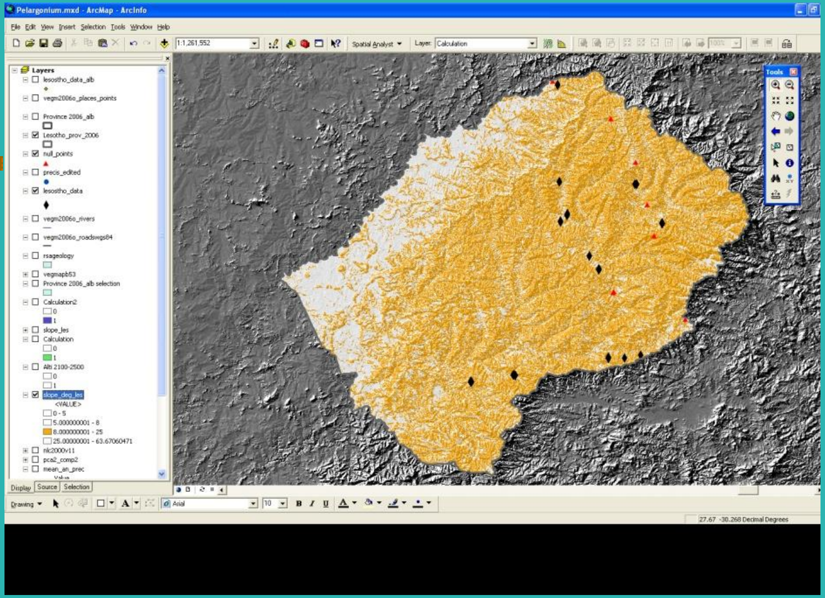
EXPERT RULE-BASED - Altitude 2100-2500

74/100 Transects included



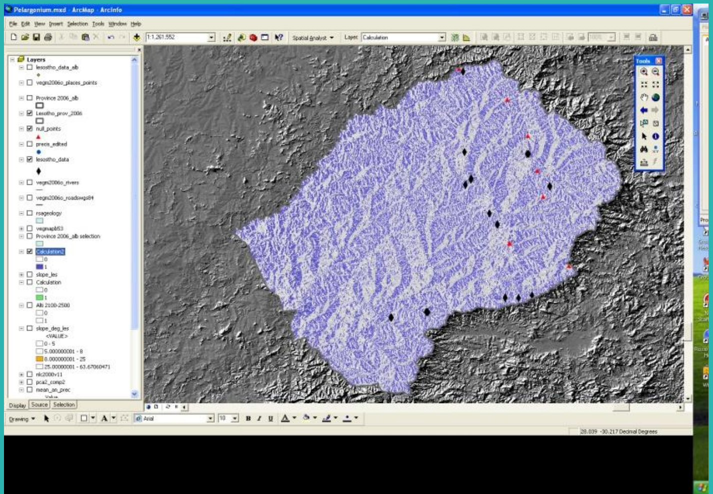
EXPERT RULE-BASED - Slope between 8 and 25 degrees

73/100 Transects included



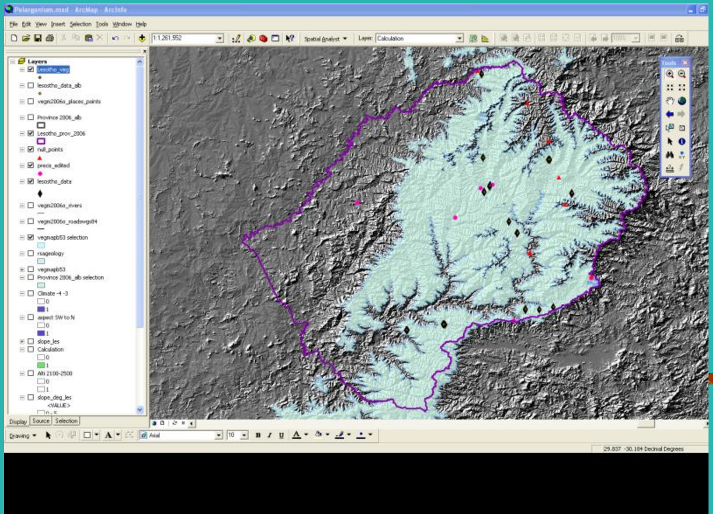
EXPERT RULE-BASED - Aspect (SW to N) – between 225 and 360

43/100 Transects included



EXPERT RULE-BASED - Vegetation type: Lesotho Highland Basalt Grassland

All Transects included



Status of NDF and management plan for *P. sidoides*.

- Have completed draft NDF for LE in 2008
  - Total predicted area is 2100 square km
  - Total population approximately 5 million plants based on estimated 0.5% patchiness factor
  - Total harvest every seven years is approximately 50% of total population.
  - Research priorities into tuber recovery & harvest methods for M.Sc student
- Draft assessment for ZA due in 2009
  - To be completed by SANBI/ TRAFFIC during ISSC MAP field work in 2009
- ISSC MAP management plan complete in 2009

Recommendations

- Although trade deemed detrimental the following shortfalls apply:
  - Determine more accurate patchiness factor – currently estimated from field observations rather than field data - due to selective sampling.
  - Quota difficult to determine without tuber recovery rate estimate – further work and guidance on quota setting required
  - More transects required - Sample size small (100 transects)

Thank You

NDF WORKSHOP CASE STUDIES
WG 2 - Perennials
Case STUDY 3
Nardostachys grandiflora
Original Language - English

TOWARDS VALID NON-DETRIMENTAL FINDINGS FOR *NARDOSTACHYS GRANDIFLORA*

AUTHORS

Helle O. Larsen
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Forest and Landscape Faculty of Sciences, University of Copenhagen.

I. BACKGROUND INFORMATION ON THE TAXA

Nardostachys grandiflora DC belongs to the Valerianaceae. It is the only species within its genus, and it only occurs in the Himalayan region. *N. grandiflora* is a perennial herb growing in forests and alpine meadows from 3300m up to about 5000m, with known slow recovery after harvest of the traded product, the rhizomes. The non-processed rhizomes are exported in large quantities from Nepal, and to a smaller extent Bhutan, to India. The status of the plant population is not known but it is suspected to be declining due to commercial trade. *N. grandiflora* was listed on CITES appendix II in 1997. At present no purposeful management of the species is taking place.

1. BIOLOGICAL DATA

1.1 Scientific and common names

Scientific name: *Nardostachys grandiflora* DC.

Synonyms: *Nardostachys jatamansi*, *Nardostachys chinensis* (Mulliken and Crofton, 2008).
Common names: jatamansi (India, Nepal, Pakistan), balchhad (India, Nepal), bulthe (India, Nepal), mushkbala (Pakistan) (Mulliken and Crofton, 2008).

1.2 Distribution

N. grandiflora is confirmed to occur between 3,300 and 5,200 m in the Himalayas: Kashmir (India), Uttar Pradesh (India), Nepal, Sikkim (India), Bhutan, South-West China including Tibet, Yunnan and southwest Sichuan. There is conflicting information regarding its occurrence in Myanmar, Afghanistan and Pakistan. Records from the two latter countries may have confused *N. grandiflora* with *Valeriana jatamansi* Jones (Mulliken and Crofton, 2008).

1.3 Biological characteristics

N. grandiflora is an erect perennial herb of 10–60 cm. It has a stout rhizome, by some described as relatively short, but it can reach lengths of up to 60 cm. The rhizome is covered in a mantle of fibrous dead petioles. Leaves develop from both rootstock and stem. Basal leaves in rosettes are 15-18 cm long and 2.5 cm wide, longitudinally veined; leaves on stem in opposite pairs are about 7.5 cm long and 2.5 cm wide, sessile. The inflorescence may have one or in rare cases 2-3 terminal capitate clusters. Flowers are pale pink or blue. The growing season extends from May to early October, flowering June – July and fruiting from August (Weberling, 1975; Amatya and Sthapit, 1994; Ghimire *et al.*, 2005; Mulliken and Crofton, 2008). The essential oil content of rhizomes is reported to vary from 0.57 up to 2.9% of the rhizome dry weight (Mulliken and Crofton, 2008).

1.3.1 *General biological and life history characteristics*

Reproduction is through vegetative means (clonal growth) and seeds, where pollinators are likely small insects, e.g. flies (Eriksen, 1989). Seed germination rates between 10-20% (Nautiyal *et al.*, 2003), 60% (Regmi, 2000, cited in Mulliken and Crofton, 2008) and 80% (Nautiya and Nautiyal, 2004, cited in Mulliken and Crofton, 2008) have been reported. A study from Dolpo, Nepal found survival rates of adults to be high (88-100%), while lower for juveniles and seedlings (68-90% and 46-78%, respectively) (Ghimire *et al.*, 2008). The growth of seedlings to reproductive size may take 3-4 years (Nautiyal *et al*, 2003). Population growth rates are reported significantly higher in meadow habitat compared to rocky-outcrop habitat; this due to differences in flowering frequency, seed mass, and seedling recruitment (Ghimire *et al.*, 2008).

1.3.2 *Habitat types*

The typical habitat type is rocky outcrops, but also alpine meadows, Juniper scrub, dwarf Rhododendron forest, and open pine forests (Weberling, 1975; Amatya and Sthapit, 1994; Ghimire *et al.*, 2005). Alpine meadows in Central Nepal have been phytosociologically examined and the occurrence of *N. grandiflora* determined at the plant community level (Olsen, 1996). Positive correlations of density with altitude and density with shady conditions have been found (Airi *et al.*, 2000).

1.3.3 *Role of the species in its ecosystem*

N. grandiflora is s small plant growing in clusters/patches that may cover the ground where it appears very dense. It is generally not very frequent in any of the habitats where it is found, but no studies have been conducted to document this.

1.4 Population:

1.4.1 *Global population size*

There have been no inventories estimating the global population size, and only fragmented data is available. In a study estimating the total national Nepalese commercial collection of medicinal plants *N. grandiflora* was reported collected in all of 5 randomly selected districts for study (Olsen and Larsen, 2003), and is as such probably not an intrinsically rare plant in the alpine habitat. The Pokhara CAMP workshop in 2001 estimated *N. grandiflora* to occupy more than 2,000 km^2 within an extent of occurrence larger than 20000 km^2 (Anon., 2001).

1.4.2 *Current global population trends*

___ increasing _X___ decreasing ____ stable ____ unknown

The global population size is assumed to be declining primarily due to human induced habitat loss and degradation (India) and overharvest (Nepal), but actual data are missing. Recent (from 1997 onwards) Conservation Assessment and Management Plan (CAMP) workshops in India reported observed population declines of 75-80% and classified *N. grandiflora* as Endangered (Arunachal Pradesh, Sikkim and Himachal Pradesh) and Critically Endangered (Uttaranchal) according to the IUCN Red list criteria (Mulliken and Crofton, 2008). In Nepal *N. grandiflora* populations were assessed to have been reduced by more than 30% within the previous 10 years, and although spatially and temporally systematic monitoring data is lacking the large trade of rhizomes to India is assumed to be causing overharvest. This is supported by the observed slow recovery of populations after harvest (Ghimire *et al.*, 2008; Larsen, 2005) that is often indiscriminately removing juvenile and mature plants (Larsen, 2005; Pandit and Thapa, 2004).

1.5 Conservation status

1.5.1 *Global conservation status (according to IUCN Red List)*

___Critically endangered
___Endangered
___Vulnerable
___Near Threatened
___Least concern
___ Data deficient

There has not been any IUCN assessment at the global scale. There have been some regional assessments (see 1.4.2).

1.5.2 *National conservation status for the case study country*

N. grandiflora was assessed to be vulnerable at a CAMP workshop in Nepal in 2001 (Anon, 2001).

1.5.3 *Main threats within the case study country*

___No Threats
_X_Habitat Loss/Degradation (human induced)
___Invasive alien species (directly affecting the species)
_X_Harvesting [hunting/gathering]
___Accidental mortality (e.g. Bycatch)
___Persecution (e.g. Pest control)
___Pollution (affecting habitat and/or species)
___Other_______________
___Unknown

The largest threat to the *N. grandiflora* population in Nepal is without doubt the commercial trade, i.e. harvesting. Another influence, grazing in the alpine meadows, is considered a minor stress factor and is in some places reported minimised through rotational grazing practices (Ghimire *et al*., 2004).

Olsen (2005) estimate that some 19,000 households obtain 18-30% of their annual cash income from harvest and sale of *N. grandiflora* and *Neopicrorhiza scrophulariiflora*. Olsen (1998) report that a high proportion of households living at high altitudes in Nepal rely on medicinal plant collection for cash income and given the relatively poor growth performance of the Nepalese economy, combined with distributional aspects, the reliance on medicinal plants is not expected to decline much in the short to medium term. The threat is therefore likely to persist.

2. SPECIES MANAGEMENT WITHIN THE COUNTR

FOR WHICH CASE STUDY IS BEING PRESENTED

2.1 Management measures

While no comprehensive management plan exists, some regulatory mechanisms are in place. Commercial collection of medicinal plants requires a licence (collection permit) specifying collection area, period of harvest, species, quantities, and methods of harvest (Mulliken and Crofton, 2008). District Forest Officers have the authority to issue the license, verify the harvest, collect a fee and issue a transport permit for passing the harvest out of the district of origin (HMG, 1995). Furthermore, export of unprocessed rhizomes of *N. grandiflora* is banned (HMG, 1995).

2.1.1 *Management history*

International trade in medicinal plants is very old and records indicate that *N. grandiflora* has been traded to the Middle East and to Europe for millennia (Dalby, 2000), and from Nepal for centuries (Kirkpatrick, 1811; Regmi, 1988). The magnitude of this historical trade is not known. Given that global medicinal plant trade is rising rapidly (Kate and Laird, 1999), it is assumed that this influences also the Himalayan plant populations. It is hypothesised that while earlier harvest rates may have been sustainable the current high levels are not (Shrestha and Joshi, 1996; Chaudhary, 1998; Mulliken and Crofton, 2008).

2.1.2 *Purpose of the management plan in place*

There is at the moment no national plan for the management of the *N. grandiflora* resource. The purpose of current regulations (collection license, transport permit, banned export of unprocessed rhizomes) appears to be collection of fees (Larsen *et al.*, 2005).

2.1.3 *General elements of the management plan*

Not applicable.

2.1.4 *Restoration or alleviation measures*

Cultivation of *N. grandiflora* has been attempted on a small scale by non-governmental organisations such as the Canadian Centre for International Studies and Co-operation (CECI).

2.2 Monitoring system:

2.2.1 *Methods used to monitor harvest*

The required collection licences and transport permits are argued by forest authorities to fulfil the purpose of providing district level monitoring data (Larsen *et al.*, 2005). Also custom data would theoretically allow for monitoring of harvest levels.

2.2.2 *Confidence in the use of monitoring*

In practice, traders bulk the medicinal plant material and get collection and transport permits at the same time, meaning that location of collection can at best be established at district level. Moreover, national monitoring data is persistently lower than independently collected data (Mulliken and Crofton, 2008) likely partly due to the practice of circumventing the official license system through rent-paying (documented in Jumla by CECI, 1999). Currently, among the actors involved in medicinal plant harvest and trade in Nepal only District Forest Office personnel have faith in the monitoring information provided by the license data (Larsen *et al.*, 2005).

2.3 Legal framework and law enforcement

N. grandiflora was included in CITES Appendix II in 1997, after having been proposed for inclusion by India in 1989, 1994 and 1997 (India, 1989, 1994, 1997). The original listing annotated 'whole and sliced roots and parts of roots, excluding manufactured parts or derivatives such as powders, pills, extracts, tonics, teas and confectionary (ref Annotation 3). This was changed in 2007 to 'all parts and derivatives except: a) seeds and pollen; and b) finished products packaged and ready for retail trade (CITES, 2007). The change meant that the mentioning of 'roots' rather than 'rhizomes' was removed.

The CITES Management authority in Nepal is the Department of Forest (Ministry of Forests and Soil Conservation). Until recently the Scientific Authority was the Department of Plant Resources (Ministry of Forests and Soil Conservation) but currently it is the Department of Forest, as it is believed that the District Forest Officers are best positioned to assess the status of plant populations through their direct contact with harvesters and traders.

Medicinal plant harvest and trade from forests in Nepal is regulated by the Forest Act of 1993 and the Forest Regulations of 1995. Alpine meadows where *N. grandiflora* occurs are legally categorised with forest land. Export of *N. grandiflora* was banned in 1995 as specified in the Forest Regulations. An amendment in 2001 allowed export of processed plant material, provided the processing had taken place in Nepal and was authorised by the Department of Forest (advised by the Department of Plant Resources and Herbs Production & Processing Co. Ltd. – a company started by the Nepalese government in 1981 to pioneer commercial cultivation of medicinal plants). Collection of medicinal plants is not allowed in National parks, conservation areas and protected areas according to the National Parks and Wildlife Conservation Act (1973).

The de facto implementation of the forest law regarding export of medicinal plants in Nepal is weak: customs officers are unable to distinguish rhizomes from various species (Aryal, 2004; Mulliken and Crofton, 2008), deputed forest rangers are not actually working at customs offices (Aryal, 2004) and forest and police officers reportedly extract rents for letting medicinal plant consignments pass the control posts (CECI, 1999). Additionally, the rhizomes are easily confused with those of *Valeriana jatamansi* Jones.

In conflict with CITES, a bilateral treaty of trade between Nepal and India grants preferential treatment for the import into India of certain goods from Nepal, including forest products that have not undergone processing. The treaty is valid until March 2012. This directly undermines the requirement of export permits from the country of origin for species listed on CITES Appendix II (Mulliken and Crofton, 2008).

3. UTILIZATION AND TRADE FOR RANGE STATE FOR WHICH CASE STUDY IS BEING PRESENTED

3.1 Type of use (origin) and destinations (purposes)

N. grandiflora is reported used in Nepal to treat several illnesses, for example, in brain and uterine tonics, stimulants, external pain killers, antiseptic, for epilepsy, hysteria, convulsions, heart palpitations, high blood pressure, and insomnia. It is used in Ayurvedic and Amchi medicines as well as in modern herbal preparations. Rhizomes from *N. grandiflora* are also used to produce essential oil and incense (Mulliken and Crofton, 2008). While there is thus some ideas of end uses, there are no systematic or comprehensive studies of demand factors; it is therefore not possible to estimate future demand trends using existing demand-side studies.

More than half of the national collection of *N. grandiflora* is estimated to be exported to India (Olsen and Larsen, 2003). All collection is from the wild with only negligible cultivation taking place. In India, 80% of the imported *N. grandiflora* rhizomes are consumed locally (in processed form), while the rest is exported as manufactured medicines (Mulliken, 2000). The Indian market is supplied primarily from Nepal, with some products from Bhutan and India (Olsen, 2005).

3.2 Harvest:

3.2.1 *Harvest regime*

Historically, it seems that rights to harvest medicinal plants have been linked with rights to alpine grazing areas. While access rights to grazing areas continue to be well defined, medicinal plants are at present often assumed to occur in areas subject to open-access conditions. There is little evidence available on actual access restrictions to the alpine medicinal plant collection areas. Cases of local management systems have been reported (Hertog, 1995; Larsen, 2002), but whether such rules are common practice, and whether they can continue to withstand current market pressures, is not known.

Harvest of *N. grandiflora* is extractive as the traded product is the rhizome. Available information indicates that commercial collection includes mature and juvenile individuals (Ghimire *et al*., 2008; Larsen, 2005). Harvest is undertaken by digging with a hand tool, typically harvesters make trips exclusively for harvest or harvest while herding in the alpine meadows. The harvest season is from August to October, but may start earlier depending on the number of harvesters and the economic needs of harvesters. What former rules (e.g. agreed starting dates after seed fall, allowed tools, exclusion of outsiders) may have been in practice are now assumed to have disappeared due to increasing potentials for commercialisation (Bhattarai, 1997; Pandit and Thapa, 2004).

3.2.2 *Harvest management/control* (quotas, seasons, permits, etc.)

Harvest is not managed by the national authorities, no quotas or maximum amounts are specified. In practice, traders bulk the harvested rhizomes and apply for collection license and transport permit at the same time, meaning that officially recorded data is valid at the district level at best.

Local harvest management is typically reported to be based on a fixed starting date rather than maximum amounts. Concern for the plant population as well as distributional aspects seem to be the basis for the rules, and whether these are generally observed in practice is not clear.

3.3 Legal and illegal trade levels

Olsen (2005) estimated annual trade level of air-dry *N. grandiflora* rhizomes from Nepal at 100 – 500 tonnes, with trade in 1997/98 of 350 – 400 tonnes. Official records for the same year put national harvest at only 97 tonnes *N. grandiflora* rhizomes (DoF, 1999). Illegal medicinal plant trade has also previously been reported to be significant (Malla *et al*. 1995), and legal trade can in some areas be as little as 12% of the total trade (Hertog, 1995; Olsen, 2005).

An increasing export from Nepal to India and overseas destinations of essential oil produced from *N. grandiflora* rhizomes is reported by Mulliken and Crofton (2008) on the basis of data from the Nepalese Customs Department. Export of 21 tonnes essential oil from the years 2000/01 and 2001/2 is reported, and it is mentioned that Nepal imported between 50 and 100 tonnes *N. grandiflora* rhizomes per year between 2001/2 and 2003/4 from Tibet for this production.

II. NON-DETRIMENT FINDING PROCEDURE (NDFS)

1. IS THE METHODOLOGY USED BASED ON THE IUCN CHECKLIST FOR NDFS?

__yes _X__no

2. CRITERIA, PARAMETERS AND/OR INDICATORS USED

Not applicable (but see section 6.1)

3. MAIN SOURCES OF DATA, INCLUDING FIELD EVALUATION OR SAMPLING METHODOLOGIES AND ANALYSIS USED

Not applicable (but see section 6.1)

4. EVALUATION OF DATA QUANTITY AND QUALITY FOR THE ASSESSMENT

Not applicable (but see section 6.1)

5. MAIN PROBLEMS, CHALLENGES OR DIFFICULTIES FOUND IN THE ELABORATION OF NDF

There are two major problems in relation to the elaboration of NDF:

1. The lack of knowledge on the size of the present population and trends in population changes of *N. grandiflora*. Without such data speculations abound, and there is no way of knowing the rate of resource decline (or if decline is taking place).

2. The Management Authority at present has no control over harvest and management. The licence system in place captures only a relatively small part of the commercial harvest, and it effectively discourages official registration of harvested amounts both through antagonizing harvesters and allowing circumvention of the rules due to rent-seeking.

6. RECOMMENDATIONS

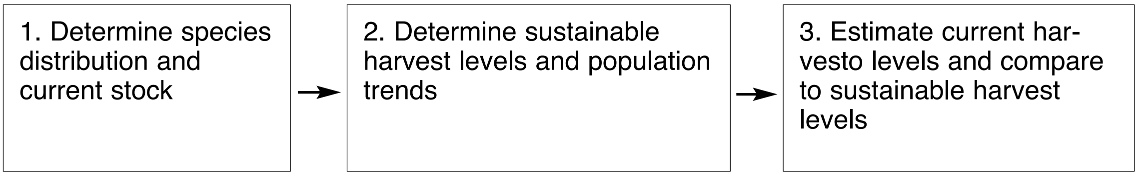
It should be of high priority to collect data on the population size at national and local levels. If actual inventories are not possible proper implementation of the permit system would be a good start. (For this to happen, however, fundamental shifts in the regulating policy and its implementation need to occur). However, trade monitoring does not on its own provide sufficient information to determine whether harvest levels are sustainable, e.g. if trade levels decline this could be due to either overexploitation or decreasing demand.

For example, potentials for sustained production of rhizomes through rotational harvest could be facilitated through supporting legislation, whereas currently export of cultivated rhizomes is subject to the same licences as wild collected plant material. Ghimire *et al.* (2008), on the basis of studies from Dolpa District, suggest that with harvest of mature plants at the end of the growing season harvest levels of 10% with rotations of 5 years in rocky outcrop habitats and harvest levels of up to 25% in meadows with rotations of 5 years may be appropriate. Harvest intensities of 25% in outcrop habitats are predicted to result in population extinction within 15 years.

6.1 Towards an approach to generate data to allow valid NDF statement

This section outlines an approach to generate data that will allow valid NDF statements for commercially collected perennial plant resources (the issue of priorisation of species for investigation is not addressed) at meso and macro levels. That is, the purpose of the approach is to generate non-local data. An overview of the approach is presented in figure 1.

Figure 1. A three-step approach to generating meso and macro level data that allow valid NDF statements for perennial plant resources



In the first step, species distribution is determined at the relevant spatial scale (e.g. regional or national) and the stock level is estimated. This would typically involve collection of both qualitative and quantitative data, e.g. eliciting knowledge of species occurrence from botanists with field experience and conducting inventories. Secondly, sustainable harvest levels are estimated as are population trends. This would, probably for all species, involve a significant amount of field work in representative sites. Thirdly, current harvest levels should be estimated and compared to the already estimated limits for sustainable harvest.

In Table 1 below, we break down each step into a number of distinct data requirements and the associated activities. For some plant species part of the information will be already available, while for other species (probably most) substantial data collection will be necessary. Determining what activities must be conducted, i.e. where no available information exists or can be used for developing suitable indicators, requires in-depth knowledge of the relevant literature and the species specific context.

Table 1. A general step-wise procedure to generate meso and macro level data that allow valid NDF statements for perennial plant resources

Data need	**Method**	**Comments**
Step 1. Determine species distribution and current stock		
Step 2. Determine sustainable harvest levels and population trends		
1.1 Geographical occurrence	1.1.1 Workshop with experts	Workshop purpose: extract all existing-knowledge on species distribution. By invitation only; invite 10 most knowledgeable persons with extensive
1.2 Distributional parameters (altitude, exposition, habitat of species, soil types, etc.)	1.2.1 Workshop with experts	
1.3 Triangulation	1.3.1 Review of available herbarium vouchers	Workshop distribution estimates should be confirmed by existing voucher specimens. Collect this information prior to workshop; discuss and explain deviations at workshop
1.4 Distribution map and area estimates	1.4.1 Data from 1.1 – 1.3 used to create map 1.4.2 Map used to calculate area estimates	Use GIS databases, that allow inclusion of key parameters from workshop (such as vegetation types and their distribution), to generate map and calculate area data (e.g. distribution area broken down according to relevant parameters such as administrative units or vegetation types)
1.5 Current stock estimate	1.5.1 Select area for pilot survey 1.5.2 Conduct pilot survey	Calibrate pilot study area map using aerial photos and harvester focus group interviews. Choice of inventory technique species' dependent. Calibration of chosen technique in pilot survey. Key

	1.5.3 Conduct meso or macro level survey	parameters for inventory registration of perennials include presence-absence and no. of individuals; as part of inventory necessary to establish average amount of (fresh and dry weight of) traded product per individual, possibly per main type of vegetation

As an example, the required information to reach valid NDF state-

2.1 Sustainable harvest levels	2.1.1 Demographic studies and modelling of harvesting effects	Stage-based population projection matrix modelling (Lefkovitch, 1965) to estimate demographic parameters in main vegetation types. Determine harvesting treatment in collaboration with local harvesters. Estimate sustainable harvest level based on above.
2.2 Population trends	2.2.1 Continuous studies of population viability	Long term monitoring of plots (set up as above) across vegetation types and treatments.
Step 3. Estimate current harvest levels and compare to sustainable harvest levels		
3.1 Current harvest levels	3.1.1 Local trade studies 3.1.2 National/regional trade studies	Conduct marketing chain analysis for pilot study area. Scale up and conduct at national/regional level.
3.2 Sustainable harvesting guidelines	3.2.1 Synthesise data collected and write guidelines	Document and synthesise above process. Compare amount extracted per unit area (from maps and trade study) with estimated sustainable harvest levels.

ments for Nardostachys grandiflora in Nepal is presented in Table 2.

Table 2. The specific step-wise procedure to generate national-level data for making valid NDF statements for Nardostachys grandiflora in Nepal

Data need	**Method**	**Comments**
Step 1. Determine species distribution and current stock		
Step 2. Determine sustainable harvest levels and population trends		
1.1 Geographical occurrence	1.1.1 Workshop with experts	Shortlist 10 experts (INGOs, NGOs, university, ministries). Convene one-day workshop in Kathmandu. Generate hard copy district-level distribution map. Reach agreement on distributional parameters, including vegetation types.
1.2 Distributional parameters (altitude, exposition, habitat of species, soil types, etc.)	1.2.1 Workshop with experts	
1.3 Triangulation	1.3.1 Review of available herbarium vouchers	Collect voucher specimen distribution information from herbaria in Kathmandu and the wider region. Compare list to expert distributional parameters at workshop and discuss.
1.4 Distribution map and area estimates	1.4.1 Data from 1.1 – 1.3 used to create map 1.4.2 Map used to calculate area estimates	Obtain copy of the databases used to construct the map of potential vegetation types in Nepal (Lillesø et al. 2005). Enter workshop distributional parameters and generate country-level distribution map. Use data base to calculate maximum distribution area at district level.
1.5 Current stock estimate	1.5.1 Select area for pilot survey 1.5.2 Conduct pilot survey 1.5.3 Conduct meso or macro level survey	*N. grandiflora* appears to be collected in all high altitude districts. Pilot surveys to be conducted in Nuwakot and Mustang Districts as these represent the extremes of harvesting pressure: unpublished background data for Olsen and Larsen (2003) show that harvest per potential distribution area unit, a figure that can be interpreted as harvest pressure, is highest in Nuwakot District (large amounts collected in small area) and lowest in Mustang District (also a conservation area). Stock estimates (and harvesting rates) per unit area should be lower in Nuwakot than in Mustang. Pilot study: district level distribution

		area maps (from above databases) calibrated using aerial photos and local knowledge elicited from harvesters during focus group interviews. Revised map used to group occurrences based on logistics (to minimise costs); a small number of groups randomly selected. Random sampling within each group using transect walks; registration along lines of area of occurrence, number of individual plants/area, collection of rhizomes to estimate average fresh and dry weight of rhizome/main vegetation type. National level study: if pilot study findings indicate the need (significant differences between stock and harvesting pressure per unit area in Nuwakot and Mustang), use pilot study experiences (frequency of observations per transect unit, time per transect unit) as basis for designing scope of national study. Use potential distribution area units to group districts; randomly select district in each group; calibrate district distribution map as per pilot study; randomly lay out transect lines (km dependent upon resources available and experiences from pilot study).
REFERENCES		
2.1 Sustainable harvest levels	2.1.1 Demographic studies and modelling of harvesting effects	Larsen (2005) and Ghimire et al. (2008) provides basic information on N. grandiflora. Sufficient for initial NDF assessment.
2.2 Population trends	2.2.1 Continuous studies of population viability	Set up system of permanent sample plots; selected and treated based on mapping above, Larsen (2005) and Ghimire et al. (2008).
Step 3. Estimate current harvest levels and compare to sustainable harvest levels		
3.1 Current harvest levels	3.1.1 Local trade studies 3.1.2 National/regional trade studies	Can be extracted from existing case studies and unpublished databases; new data is, however, desirable and the study by Olsen and Larsen (2003) should be repeated.
3.2 Sustainable harvesting guidelines	3.2.1 Synthesise data collected and write guidelines	Present at national workshop

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NDF WORKSHOP
WG 2 - Perennials
CASE STUDY 3 SUMMARY
Nardostachys grandiflora
Original Language - English

TOWARDS VALID NON-DETRIMENTAL FINDINGS FOR *NARDOSTACHYS GRANDIFLORA*

AUTHORS:
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Nardostachys grandiflora DC belongs to the Valerianaceae. It is the only species within its genus, and it only occurs in the Himalayan region. *N. grandiflora* is a perennial herb growing in forests and alpine meadows from 3300m up to about 5000m, with known slow recovery after harvest of the traded product, the rhizomes. *N. grandiflora* was listed on CITES appendix II in 1997. The non-processed rhizomes are exported in large quantities from Nepal to India (annually between 100 and 500 tonnes) without issuance of non-detrimental finding statements. The status of the plant population is not known but it is suspected to be declining due to increasing commercial demand and indiscriminate wild harvest of mature and juvenile individuals alike.

The largest threat to the *N. grandiflora* population in Nepal is without doubt the commercial trade, i.e. harvesting. A high proportion of the rural collectors living at high altitudes rely on medicinal plant collection for cash income and given the relatively poor growth performance of the Nepalese economy, combined with distributional aspects, the reliance on medicinal plants is not expected to decline much in the short to medium term. The threat is therefore likely to persist.

At present no purposeful official management of the species is taking place, and cultivation has only been undertaken on a small scale by non-governmental organisations. Harvest of *N. grandiflora* for commercial purposes requires a permit from the Nepalese forest authorities specifying amount and location of collection, and export needs to be recorded by customs authorities. Unfortunately, the quality of the recorded information is poor and it can therefore not be used to assess the size of the national harvest or export. Local management systems reported include agreed starting dates for harvest after seed fall, allowed tools, and exclusion of outsiders. The commonness and strength of such local management systems is not known.

A three-step approach to generating meso and macro level data that allow valid NDF statements for perennial plant resources is proposed: 1. Species distribution is determined at the relevant spatial scale (e.g. regional or national) and the stock level is estimated. 2. Sustainable harvest levels are estimated as are population trends. 3. Current harvest levels should be estimated and compared to the already estimated limits for sustainable harvest.

For *N. grandiflora*, where little information is available on distribution and population trends, production of data for a valid NDF statement would imply production of a distribution map, current stock estimates, population trends, sustainable harvest levels and current harvest levels. Methods for collecting the necessary data would include: 1. Collection data on occurrence and distribution from experts and herbarium voucher specimens, use of GIS database for producing distribution map and area estimates, and data on current stock based on resource inventories, 2. Demographic studies of the effect of harvest (conducted in collaboration with local harvesters) on representative plant populations in permanent sample plots, and 3. Surveys of current regional trade based on information from collectors and traders at various levels of the market chain.

FACULTY OF LIFE SCIENCES
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Towards valid non-detrimental findings for *Nardostachys grandiflora*

Helle Overgaard Larsen and Carsten Smith Olsen

NDF Workshop case studies, WG 2 – Perennials
Mexico, November 2008

Towards valid NDF for *N. grandiflora*

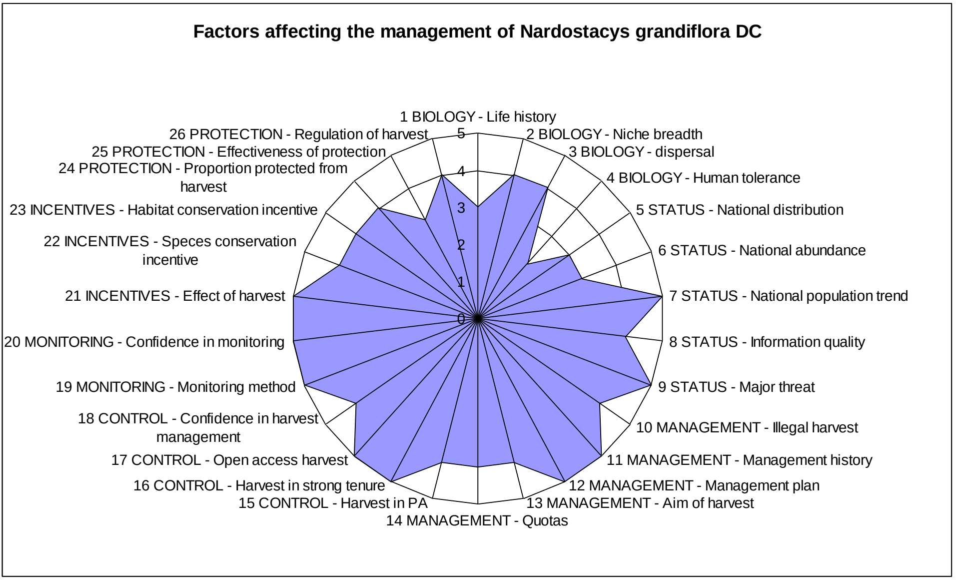
Structure

1. Species overview
   - What do we know?
2. An approach to generate valid NDF data
   - Current stock
   - Sustainable harvest level
   - Sustainability assessment

Towards valid NDF for *N. grandiflora*

Species overview – what do we know?

- Alpine herb, rhizome traded from Nepal to India in large amounts
- Slow recovery after harvest, that often includes juvenile plants
- No functioning monitoring of population or harvest (no NDF statement when traded to India)
- Harvest contributes to the livelihoods of rural collectors
- Population assumed threatened



Factors affecting the management of Nardostacys grandiflora DC

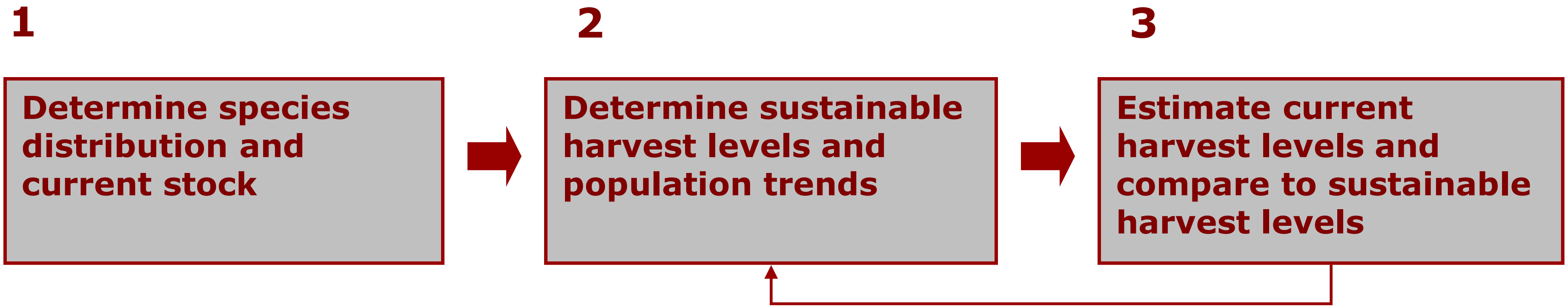
Towards valid NDF for *N. grandiflora*

Generating NDF data – moving into unknown territory …

> *In any moment of decision, the best thing you can do is the right thing, the next best thing is the wrong thing, and the worst thing you can do is nothing.*
>
> Theodore Roosevelt

Towards valid NDF for *N. grandiflora*

Three-step approach to generate valid NDF data at meso and macro levels



1

Determine species distribution and current stock

2

Determine sustainable harvest levels and population trends

3

Estimate current harvest levels and compare to sustainable harvest levels

Towards valid NDF for *N. grandiflora*

Step 1 – Species distribution and current stock

Data need	Method
1.1 Geographical occurrence	1.1.1 Expert workshop
1.2 Distributional parameters	1.2.1 Expert workshop
1.3 Triangulation	1.3.1 Review of vouchers
1.4 Distribution map and area estimates	1.4.1 Use above to create map
	1.4.2 Use map to calculate area estimates
1.5 Current stock estimate	1.5.1 Select areas for pilot study
	1.5.2 Conduct pilot study
	1.5.3 Conduct meso/macro level survey

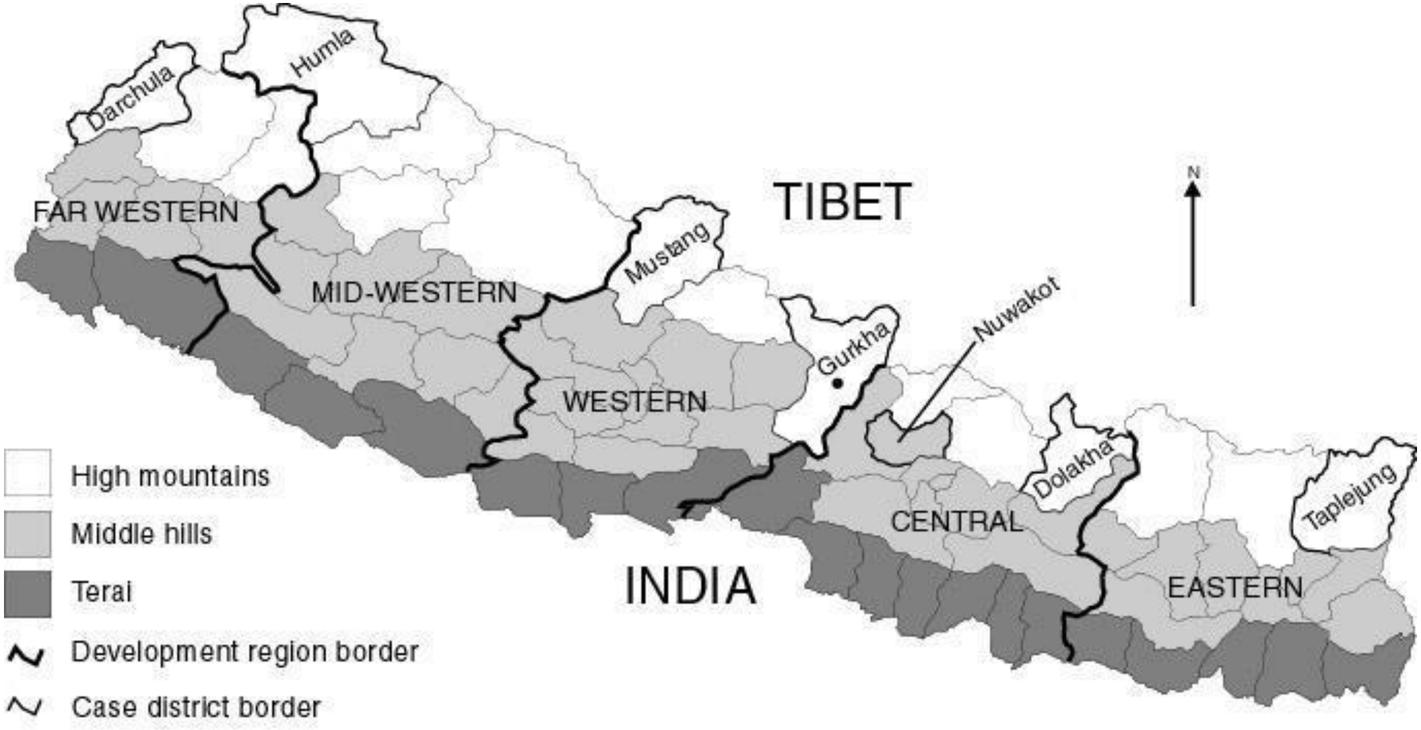
Towards valid NDF for *N. grandiflora*

Step 1.5 Current stock estimate

Method	Activities
1.5.1 Select areas for pilot study	1. Selection criteria: min-max harvesting pressure ⇨ Mustang and Nuwakot Districts
1.5.2 Conduct pilot study	1. Calibrate district level distribution using aerial photos and harvester focus group interviews 2. Revise distribution area map; distinguish distribution according to main vegetation types 3. Randomly select areas across vegetation types for field investigation (no. dependent on resources available) 4. Random placement of transect walks in randomly selected areas 5. Field data collection 6. Calculation of current stock
1.5.3 Conduct meso/macro level survey	1. Review of pilot data resource requirements 2. Review of pilot data findings 3. Design of survey; implementation; calculations

Towards valid NDF for *N. grandiflora*

Altitudinal zones of Nepal, randomly selected high-altitude districts for trade study



Towards valid NDF for *N. grandiflora*

Step 1.5 Current stock estimate

Method	Activities
1.5.1 Select areas for pilot study	1. Selection criteria: min-max harvesting pressure ⇨ Mustang and Nuwakot Districts
1.5.2 Conduct pilot study	1. Calibrate district level distribution using aerial photos and harvester focus group interviews 2. Revise distribution area map; distinguish distribution according to main vegetation types 3. Randomly select areas across vegetation types for field investigation (no. dependent on resources available) 4. Random placement of transect walks in randomly selected areas 5. Field data collection 6. Calculation of current stock
1.5.3 Conduct meso/macro level survey	1. Review of pilot data resource requirements 2. Review of pilot data findings 3. Design of survey; implementation; calculations

Towards valid NDF for *N. grandiflora*

Registration in 10 m wide transects

Transect lines systematically located across slopes

Distance between transects depends on desired accuracy and time (funds) available

Where present: area of occurrence, number of plants/area, wet & dry weight rhizome/plant for different vegetation types

Towards valid NDF for *N. grandiflora*

Step 2 – Sustainable harvest levels and population trends

Data need	Method
2.1 Sustainable harvest levels	2.1.1 Data for initial NDF assessment can be extracted from available literature (Larsen 2005; Ghimire et al. 2008) 2.1.2 In plots from 2.2.2 conduct long-term harvest treatment experiments to document regeneration rates after harvest
2.2 Population trends	2.2.1 Use data from step 1 to identify main habitats 2.2.2 Plan system of long term plots for demographic studies of population viability across main habitats 2.2.3 Fund and implement system 2.2.4 Use findings to revise sustainable harvest levels

Towards valid NDF for *N. grandiflora*

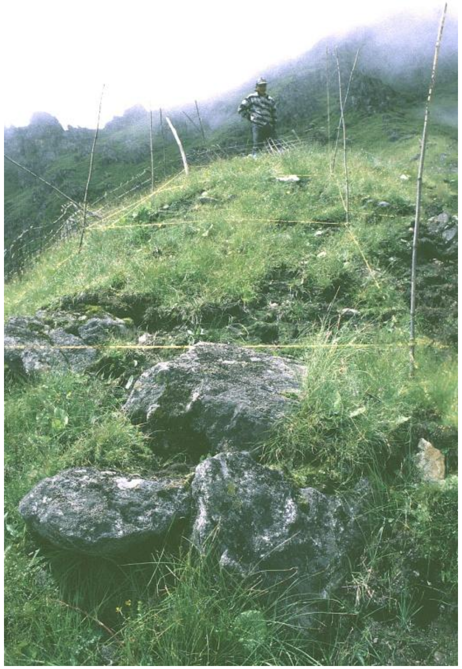
Step 3 – Current harvest levels and sustainability assessment

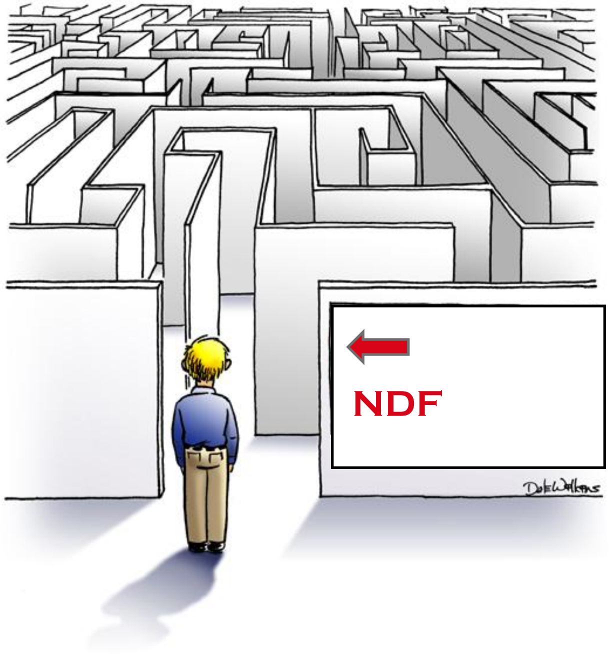
Data need	Method
3.1 Current harvest levels	3.1.1 Local marketing chain analysis as part of pilot study (using existing data collection instruments) 3.1.2 National level marketing chain analysis (using existing data collection instruments)
3.2 Sustainable harvesting guidelines	3.2.1 Document and synthesise all of above 3.2.2 Compare trade data and sustainable harvest estimates 3.2.3 Prepare sustainable harvesting guidelines

Towards valid NDF for *N. grandiflora*

If I have ever made any valuable discoveries, it has been owing more to patient attention, than to any other talent

Isaac Newton





Towards valid NDF for *N. grandiflora*

Conclusions

- **Collecting data to generate valid NDF is difficult but possible**
- **Species-level funding requirements will vary but remain unclear**
- **Multidisciplinary teams are required, e.g. to do inventories, population ecology studies and marketing chain analysis**

MEXICO
2008

NDF WORKSHOP CASE STUDIES
WG 2 – Perennials
CASE STUDY 4
ISSC-MAP
Original language – English

THE INTERNATIONAL STANDARD FOR SUSTAINABLE WILD COLLECTION OF MEDICINAL AND AROMATIC PLANTS (ISSC-MAP)

ELEMENTS OF ISSC-MAP RESOURCE ASSESSMENT GUIDANCE RELEVANT TO CITES NDF

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Overview and background

The International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP)[1] has been developed to meet the needs of industry, governments, certifiers, resource managers, and collectors to understand whether wild collection activities for medicinal and aromatic plants (MAP)[2] are sustainable, and how to improve collection and resource management operations that are detrimental to the long-term survival of these resources. The ISSC-MAP is itself a generic set of principles and criteria intended for use in a wide range of circumstances.[3] The focus of the ISSC-MAP is on the ecological sustainability of wild plant populations and species in their natural habitat, but it also addresses the social and economic context of sustainable use.

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[1] Medicinal Plant Specialist Group (2007): International standard for sustainable wild collection of medicinal and aromatic plants (ISSC-MAP). Version 1.0. - Bundesamt für Naturschutz, Bonn (BfN-Skripten 195). Retrieved from www.floraweb.de/proxy/floraweb/map-pro/.

[2] Definitions of use of plant species often overlap. In this document, the term "medicinal and aromatic plants (MAP)" includes plants used to produce pharmaceuticals, dietary supplement products and natural health products, beauty aids, cosmetics, and personal care products, as well as some products marketed in the culinary/food sector.

[3] ISSC-MAP has been prepared by the Medicinal Plant Specialist Group of the IUCN-SSC in collaboration with the German Federal Agency for Nature Conservation (BfN), WWF Germany, and TRAFFIC, based on consultations with more than 150 experts from diverse backgrounds. Version 1.0 was published in 2007 and was introduced to the 16th meeting of the CITES Plants Committee (PC16 Inf. 9).

Table 1: ISSC-MAP consists of six Principles:

1. Maintaining wild MAP resources
2. Preventing negative environmental impacts
3. Complying with laws, regulations, and agreements
4. Respecting customary rights
5. Applying responsible management practices
6. Applying responsible business practices

Pilot projects applying the ISSC-MAP to a range of species, countries, and implementation strategies are currently underway in China, Cambodia, Nepal, India, Ukraine, Bosnia and Herzegovina, Brazil, and Lesotho.

Elements of ISSC-MAP relevant to CITES NDF

Application of the ISSC-MAP in the framework of CITES is one of the priority implementation scenarios identified for ISSC-MAP in the context of legal adoption and policy. Principles 1 and 2, and partly also Principles 3 and 5, correspond with the mandate for CITES NDF as laid down in articles IV 2.a and IV 3. The criteria and indicators underpinning these principles and their applicability for the CITES NDF will be demonstrated and discussed during the Cancun workshop.

Medicinal plants in CITES

More than 300 species of medicinal and aromatic plants are included in CITES Appendices I and II. Only 63 of these species have been included specifically because of the impact of wild collection for international trade based on their medicinal use.

Non-detriment findings have been carried out and published for some CITES-listed medicinal and aromatic plant species, including:

- *Prunus africana*, Bioko Island (PC16 Doc. 10.2.1)
- *Aquilaria* spp. and other wood-producing taxa (PC17 Doc. 17.2)
- *Guaiacum sanctum* L., Mexico (PC17 Doc. 17.1.3)

The breakdown into the four plant working groups (WG) at the Cancun workshop is done by lifeforms (trees; perennials; succulents; geophytes). Plants used as medicinals are cross-cutting and will be addressed there in the case studies in three of the four plant WGs, including:

- *Guaiacum sanctum, Aquilaria* spp., Prunus africana, Taxus spp. (Tree WG)
- *Pelargonium sidoides, Cibotium barometz, Panax quinquefolius* (Perennials WG)
- *Hoodia gordonii*, Aloe spp. (Succulents and Cycads WG)

ISSC-MAP Resource Assessment Guidance relevant to CITES NDF

The structure, content, and implementation of ISSC-MAP may contribute to CITES NDF for medicinal and aromatic plants as well as for a broader range of commercially important wild-collected plant species traded internationally for use in non-timber products.

Resource assessment guidance[4] developed to facilitate implementation of ISSC-MAP Principle 1 ("Maintaining wild MAP resources") provides a useful methodological framework for field-based studies intended to support CITES non-detriment findings. This guidance elaborates five basic steps needed to design and carry out a resource assessment and monitoring process that meets the requirements of ISSC-MAP, using participatory and adaptive management approaches. These five steps will be explained in and discussed at the Cancun meeting:

- Step 1. SITUATION ANALYSIS to gather and evaluate existing knowledge about target or candidate species and the collection situation;
- Step 2. BASE-LINE INVENTORY to understand how much of the target/selected species is present within the collection area;
- Step 3. YIELD AND REGENERATION STUDIES to understand how much of the desired raw material / plant part(s) the target species produces under natural conditions, the time required for seedlings to replace harvested individual plants and size-classes, and how productivity and regeneration vary across the collection / management area;
- Step 4. ASSESSMENT OF HARVEST IMPACTS to determine whether current harvest levels and controls are resulting in adequate resource regeneration and productivity; and
- Step 5. PERIODIC MONITORING AND HARVEST ADJUSTMENTS to revise the harvest protocol if the intensity, frequency, timing, and methods of harvest are not sustainable.

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[4] Leaman, D.J. & Cunningham, A.B. (2008): Resource assessment. A guide to implementing Principle 1: Maintaining wild MAP resources.– Draft for review and comment.

WG2-CS4 Annex

International Expert Workshop on CITES Non-Detriment Findings
Perennial Plant Working Group (Ornamentals, Medicinal and Aromatic Plants
Cancun, Mexico, November 2008

THE INTERNATIONAL STANDARD FOR SUSTAINABLE WILD COLLECTION OF MEDICINAL AND AROMATIC PLANTS (ISSC-MAP)

Elements of the Standard Relevant to CITES NDF

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15 August 2008

1. OVERVIEW AND BACKGROUND

The International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP)[1] has been developed to meet the needs of industry, governments, certifiers, resource managers, and collectors to understand whether wild collection activities for medicinal and aromatic plants (MAP)[2] are sustainable, and how to improve collection and resource management operations that are detrimental to the long-term survival of these resources. MAP resources include many different types of plants in a wide variety of habitats. The ISSC-MAP is itself a generic set of principles and criteria intended for use in a wide range of circumstances. The focus of the ISSC-MAP is on the ecological sustainability of wild plant populations and species in their natural habitat, but it also addresses the social and economic context of sustainable use.

Implementation of the ecological elements of ISSC-MAP in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is one of the priority implementation scenarios identified for ISSC-MAP. The intersessional period between CITES CoP14 and CoP15 provides an opportunity to do so. CITES Decision 14.135, adopted at the 14th meeting of the Conference of the Parties (The Hague, 2007), directs the Plants Committee to: "a) develop principles, criteria and indicators for the making of non-detriment findings for wild specimens of high-priority taxa such as timber species, *Prunus africana* and other medicinal plants".[3] At its 17th meeting (April 2008), the CITES Plants Committee established three intersessional working groups to address non-detriment findings for medicinal plants (working group 6), agarwood (working group 7), and timber species, including *Prunus africana* (working group 8).[4] Working group 6 agreed to consider the ISSC-MAP, together with other CITES documents and case studies (including those prepared for the International Expert Workshop on CITES Non-Detriment Findings), as "a starting point for identifying elements for NDF making for medicinal plants."[5]

2. DEVELOPMENT OF THE ISSC-MAP

Medicinal and aromatic plants have been an important resource for human health care from prehistoric times to the present day. According to the World Health Organization (WHO), the majority of the world's human population, especially in developing countries, depends on traditional medicine based on MAP (WHO 2002). Between 50,000 and 70,000 plant species may be used in traditional and modern medicinal systems throughout the world (Schippmann et al. 2006). About 3,000 MAP species are traded internationally (Lange and Schippmann 1997), while an even larger number of MAP species are found in local, national, and regional trade.

Relatively few MAP species are cultivated, however. The great majority of MAP species in trade are wild-collected (Lange and Schippmann 1997; Srivastava et al. 1996; Xiao

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[1] The ISSC-MAP has been prepared by the Medicinal Plant Specialist Group of the Species Survival Commission (SSC), the International Union for Conservation of Nature (IUCN), in collaboration with the German Federal Agency for Nature Conservation (BfN), WWF Germany, and TRAFFIC, based on consultations with more than 150 experts from diverse backgrounds. Version 1.0 of the ISSC-MAP was published by BfN in 2007 (MPSG 2007). The text of the ISSC-MAP was introduced to the 16th meeting of the CITES Plants Committee (PC16 Inf. 9).

[2] Definitions of use of plant species often overlap. In this document, the term "medicinal and aromatic plants (MAP)" includes plants used to produce pharmaceuticals, dietary supplement products and natural health products, beauty aids, cosmetics, and personal care products, as well as some products marketed in the culinary/food sector.

[3] PC17 Doc 17.1.1

[4] PC 17 Summary Record

[5] ibid.

Pen-gen 1991). This trend is likely to continue over the long term due to numerous factors, including:

- Little is known about the growth and reproduction requirements of most MAP species, which are derived from many taxonomic groups for which there is little or no experience of cultivation.
- The time, research, and experience leading to domestication and cultivation are costly, and relatively few MAP species have the large and reliable markets required to support these inputs.
- In many communities where wild collection of MAP is an important source of income, land for cultivation of non-food crops is limited.

Moreover, cultivation may provide fewer environmental, social, and economic benefits than wild collection of some MAP species. Wild collection of MAP secures valuable income for many rural households, especially in developing countries, and is an important factor in the source countries' local economies (Schippmann et al. 2006). Wild collection also can provide incentives for conservation and sustainable use of forests and other important plant areas.

However, over-harvesting, land conversion, and habitat loss increasingly threaten a considerable portion (estimated 15,000 species, or 21 per cent) of the world's MAP species and populations (Schippmann et al. 2006). For these reasons, approaches to wild MAP collection that engage local, regional, and international collection enterprises and markets, along with governments and healthcare providers, in the work of conservation and sustainable use of MAP resources are urgently needed.

There are many challenges to meet in developing and applying a standard set of principles and good practices leading to support of sustainable wild collection of MAP resources. These challenges include:

- Circumstances of ecology, habitat, and pressures on resources are unique for each species, requiring management plans that are specific to each MAP collection operation and area.
- The dependence of local communities on MAP resources for health and livelihood security is largely unassessed and unrecorded.
- Little research on harvesting techniques has been directed toward understanding how to collect wild MAP species sustainably.
- Maximum quotas for wild-collection of MAP species are often based on overly simple and untested assumptions about the relationship between available supply and regeneration of MAP resources.
- Products, uses, and markets based on MAP species are numerous and diverse, with similarly numerous and diverse entry points for practices supporting sustainable use.
- There is a wide proliferation of labels and claims, such as organic and fair trade, which imply but do not provide a means of verifying sustainable wild collection.
- Long and complex source-to-market supply chains make tracing a product back to its source extremely difficult.

Existing principles and guidelines for conservation and sustainable use of medicinal plants address primarily the national and international political level, but only indirectly provide governments, the medicinal plant industry and other stakeholders, including collectors, with specific guidance on sustainable sourcing practices. For example, the revised Guidelines on the Conservation of Medicinal Plants (WHO/IUCN/WWF/TRAFFIC forthcoming) and the WHO Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants (WHO 2003) provide general recommendations addressed primarily to governments and other political stakeholders, NGOs, IGOs and businesses world-wide. These guidelines call for, but do not provide, concrete principles and criteria for the conservation and sustainable use of medicinal plants. The ISSC-MAP provides a practical interface between the general recommendations set out in these Guidelines, and management plans that must be developed for particular species and specific situations.

Other existing or proposed standards for the sustainable collection of non-timber forest products (NTFP) provide useful models for MAP. Models for sustainable harvest of NTFP that may be particularly useful for MAP include the certification systems of the Forest Stewardship Council (FSC), the International Federation of Organic Agricultural Movements (IFOAM), and Fairtrade Labelling Organizations International (FLO).[6] Other important models include natural resource co-management agreements with indigenous communities, and access and benefit sharing arrangements between genetic resource users and providers.

The ISSC-MAP builds on existing principles, guidelines, and standards, but expands and extends these to provide principles and criteria more relevant to the sustainable wild collection of MAP resources[7]. Implementing the ISSC-MAP will benefit ecological resources or area managers, industry, and local collectors by providing a reputable standard of good practice for sustainable wild collection against which local performance can be designed and monitored with criteria and verified with indicators relevant to MAP resources. Harmonization with appropriate ecosystem, fair trade, production, product quality, and other relevant standards is considered an important avenue for developing and implementing the ISSC-MAP.

3. STRUCTURE AND CONTENT OF THE ISSC-MAP

The purpose of the ISSC-MAP is to ensure the continued use and long-term survival of MAP species and populations in their habitats, while respecting the traditions, cultures and livelihoods of all stakeholders.

The **objectives** of this Standard are:

- To provide a framework of principles and criteria that can be applied to the management of MAP species and their ecosystems;
- To provide guidance for management planning;
- To serve as a basis for monitoring and reporting; and
- To recommend requirements for certification of sustainable wild collection of MAP resources.

The ISSC-MAP primarily addresses wild collection of medicinal and aromatic plant materials for commercial purposes, rather than for subsistence or local use. The Standard focuses on best ecological practices but also aims to support responsible social standards and business practices that affect collectors and collection operations, because these elements in turn affect the management of collected species and collection areas (Table 1).

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[6] For a summary and analysis of efforts that have been made in the past to consider the relevance and application of various models aimed at certification of sustainable wild collection see: Shanley, Pierce, Laird, & Guillen 2002.

[7] Text of the standard available online and as CITED PC document.

Table 1. ISSC-MAP Principles and Criteria

SECTION 1: WILD COLLECTION AND CONSERVATION REQUIREMENTS

Principle 1. Maintaining Wild MAP Resources

Wild collection of MAP resources shall be conducted at a scale and rate and in a manner that maintains populations and species over the long term.

1.1 Conservation status of target MAP species

The conservation status of target MAP species and populations is assessed and regularly reviewed.

1.2 Knowledge-based collection practices

MAP collection and management practices are based on adequate identification, inventory, assessment, and monitoring of the target species and collection impacts.

1.3 Collection intensity and species regeneration

The rate (intensity and frequency) of MAP collection does not exceed the target species' ability to regenerate over the long term.

Principle 2. Preventing Negative Environmental Impacts

Negative impacts caused by MAP collection activities on other wild species, the collection area, and neighbouring areas shall be prevented.

2.1 Sensitive taxa and habitats

Rare, threatened, and endangered species and habitats that are likely to be affected by MAP collection and management are identified and protected.

2.2 Habitat (landscape level) management

Management activities supporting wild MAP collection do not adversely affect ecosystem diversity, processes, and functions.

SECTION II: LEGAL AND ETHICAL REQUIREMENTS

Principle 3. Complying with Laws, Regulations, and Agreements

MAP collection and management activities shall be carried out under legitimate tenure arrangements, and comply with relevant laws, regulations, and agreements.

3.1 Tenure, management authority, and use rights

Collectors and managers have a clear and recognized right and authority to use and manage the target MAP resources.

3.2 Laws, regulations, and administrative requirements

Collection and management of MAP resources complies with all international agreements and with national, and local laws, regulations, and administrative requirements, including those related to protected species and areas.

Principle 4. Respecting Customary Rights

Local communities' and indigenous peoples' customary rights to use and manage collection areas and wild collected MAP resources shall be recognized and respected.

4.1 Traditional use, access rights, and cultural heritage

Local communities and indigenous people with legal or customary tenure or use rights maintain control, to the extent necessary to protect their rights or resources, over MAP collection operations.

4.2 Benefit sharing

Agreements with local communities and indigenous people are based on appropriate and adequate knowledge of MAP resource tenure, management requirements, and resource value.

SECTION III: MANAGEMENT AND BUSINESS REQUIREMENTS

Principle 5. Applying Responsible Management Practices

Wild collection of MAP species shall be based on adaptive, practical, participatory, and transparent management practices.

5.1 Species / area management plan

A species / area management plan defines adaptive, practical management processes and good collection practices.

5.2 Inventory, assessment, and monitoring

Management of MAP wild collection is supported by adequate and practical resource inventory, assessment, and monitoring of collection impacts.

5.3 Transparency and participation

MAP collection activities are carried out in a transparent manner with respect to management planning and implementation, recording and sharing information, and involving stakeholders.

5.4 Documentation

Procedures for collecting, managing, and sharing information required for effective collection management are established and carried out.

Principle 6. Applying Responsible Business Practices

Wild collection of wild MAP resources shall be undertaken to support quality, financial, and labour requirements of the market without sacrificing sustainability of the resource.

6.1 Market / buyer specifications

The sustainable collection and handling of MAP resources is managed and planned according to market requirements in order to prevent or minimise the collection of products unlikely to be sold.

6.2 Traceability

Storage and handling of MAP resources is managed to support traceability to collection area.

6.3 Financial viability

Mechanisms are encouraged to ensure the financial viability of systems of sustainable wild collection of MAP resources.

6.4 Training and capacity building

Resource managers and collectors have adequate skills (training, supervision, experience) to implement the provisions of the management plan, and to comply with the requirements of this standard.

6.5 Worker safety and compensation

MAP collection management provides adequate work-related health, safety, and financial compensation to collectors and other workers

The ISSC-MAP is designed to be applicable to the wide array of geographic, ecological, cultural, economic, and trade conditions in which wild-collection of MAP resources occurs (Figure 1).

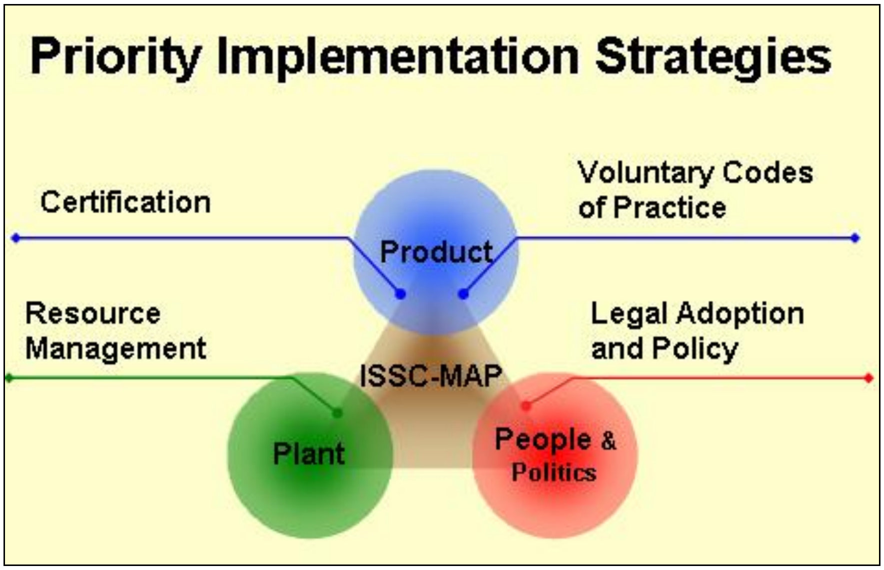

Figure 1. Priority implementation strategies for the ISSC-MAP

Pilot projects applying the ISSC-MAP to a range of species, countries, and implementation strategies are currently underway in China, Cambodia, Nepal, India, Ukraine, Bosnia and Herzegovina, Brazil, and Lesotho. The project underway in Lesotho is specifically focused on the application of ISSC-MAP to a CITES non-detriment finding for *Pelargonium sidoides* (DC).[8]

4. ELEMENTS OF THE ISSC-MAP RELEVANT TO CITES NDF

Application of the ecological elements of ISSC-MAP to CITES non-detriment findings for medicinal and aromatic plants is considered a priority for implementing the ISSC-MAP through legal adoption and policy. Approximately 300 species of medicinal and aromatic plants are included in CITES Appendices I and II. Only 25 of these species have been included specifically because of the impact of wild collection for international trade based on their medicinal use (Schippmann 2001 and pers. comm.). Many less significant medicinally-used species are included in Appendix II because they are members of whole-family listings of orchids, cacti, and other succulents.

Significant trade reviews and non-detriments findings have been carried out and published for some CITES-listed medicinal and aromatic plant species, including:

- *Prunus africana*, Bioko Island (PC16 Doc. 10.2.1)
- *Aquilaria* spp. and other wood-producing taxa (PC17 Doc. 17.2)
- *Guaiacum sanctum* L., Mexico (PC17 Doc. 17.1.3)

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[8] Perennials Working Group, Case Study 1: Development of a Non-Detriment Finding process for Pelargonium sidoides in Lesotho. David Newton, TRAFFIC Africa Region.

- *Cistanche deserticola*; *Dioscorea deltoidea*; *Nardostachys grandiflora*; *Picrorhiza kurrooa*; *Pterocarpus santalinus*; *Rauvolfia serpentina*; *Taxus wallichiana* (Mulliken and Croften 2008)

Other CITES-listed MAP species will be addressed in the case studies for this International Expert Workshop on CITES Non-Detriment Findings[9], including:

- *Cibotium barometz*, China (Case Study 4, Perennials Working Group)
- *Panax quinquefolius*, Canada and the United States (Case Study 3, Perennials Working Group)
- *Hoodia gordonii*, Southern Africa (Case Study 1, Succulents and Cycads Working Group)
- *Aloe* spp., East and Southern Africa (Case Study 3, Succulents and Cycads Working Group)

The structure, content, and implementation of ISSC-MAP may contribute to CITES NDF for medicinal and aromatic plants, as well as for a broader range of commercially important wild-collected plant species traded internationally for use in non-timber products. Elements of this contribution currently being investigated include principally:

- Articulation of guiding principles for formulating NDFs, which take into account the exporting countries' experience, use the IUCN Checklist[10], and build on different approaches followed by Scientific Authorities (for example, type of ecological and management data included, monitoring approaches, treatment of lethal versus potentially non-lethal extraction methods, assessment of degree of harvest control, and the basis for annual quotas).
- Identification of optimal and minimal information necessary for formulating CITES NDF for medicinal, aromatic, and other useful non-timber plant species; and
- Definition of minimum requirements for resource assessment methods to be carried out in the field, drawing upon the relevant documents that have been prepared in the framework of ISSC-MAP.[11]

The objectives of this resource assessment guide are to help ISSC-MAP users:

- understand what information needs to be collected, monitored, and considered to conduct a resource assessment within the collection management process;
- determine the appropriate degree of resource assessment and monitoring accuracy and precision based on the actual project situation and target species;
- identify professional capacity, training, equipment, methods, and other information resources needed to design and implement resource assessments and management plans; and
- meet ISSC-MAP requirements for resource assessment, in particular Principle 1 and related criteria (Box 1).

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[9] Recommendations to implement a Review of Significant Trade (RST) for *Prunus africana* will be discussed during a workshop hosted by the CITES Secretariat in Nairobi, Kenya, early in September 2008.

[10] [Rosser, A. & Haywood, M. (2002): Guidance for CITES Scientific Authorities. Checklist to assist in making non-detriment findings for Appendix II exports. - xi+146 pp., IUCN, Gland and Cambridge. Retrieved from http://iucn.org/THEMES/SSC/our_work/wildlife_trade/citescop13/CITES/guidance.htm

[11] Resource assessment guidance

Box 1. ISSC-MAP resource assessment and management requirements

Principle 1	Maintaining Wild MAP Resources Wild collection of MAP resources shall be conducted at a scale and rate and in a manner that maintains populations and species over the long term
Criterion 1.1	Conservation status of target MAP species The conservation status of target MAP species and populations is assessed and regularly reviewed.
Criterion 1.2	Knowledge-based collection practices MAP collection and management practices are based on adequate identification, inventory, assessment, and monitoring of the target species and collection impacts.
Criterion 1.3	Collection intensity and species regeneration The rate (intensity and frequency) of MAP collection does not exceed the target species' ability to regenerate over the long term.

Resource assessment is an essential component of an adaptive management process. Resource assessments enable collectors and other resource managers to:

- estimate sustainable harvest limits for a specific resource within a particular collection area;
- observe and understand the impact of current harvest protocols (specific methods, often with agreed limits) on the recovery of the target resource; and
- make the needed adjustments in harvest protocols to maintain the target resource at sustainable levels.

These tasks therefore need to be included in the project or operation management plan. The management plan should:

- state the specific management purpose and the steps taken to achieve it (including the assessment and monitoring plan);
- clearly identify priority issues, species, and the appropriate management scale;
- incorporate and build the capacity of collectors, local communities, and other stakeholders to manage MAP resources sustainably;
- enable enforcement of management rules (such as collection limits);
- support the contributions of MAP resources to social, economic, health, and other local community goals;
- be reliable and sufficiently accurate; and
- be affordable in terms of time and other costs.

This guide gives an overview of five (5) basic steps needed to design and carry out a resource assessment and monitoring process that meets the requirements of the ISSC-MAP, and uses participatory and adaptive management approaches (Figure 2).

Step 1. Situation analysis to gather and evaluate existing knowledge about target or candidate species and the collection situation;

Step 2. Base-line inventory to understand how much of the target/selected species is present within the collection area;

Step 3. Yield and regeneration studies to understand how much of the desired raw material / plant part(s) the target species produces under natural conditions, the time required for seedlings to replace harvested individual plants and size-classes, and how productivity and regeneration vary across the collection / management area;

Step 4. Assessment of harvest impacts to determine whether current harvest levels and controls are resulting in adequate resource regeneration and productivity; and

Step 5. Periodic monitoring and harvest adjustments to revise the harvest protocol if the intensity, frequency, timing, and methods of harvest are not sustainable.

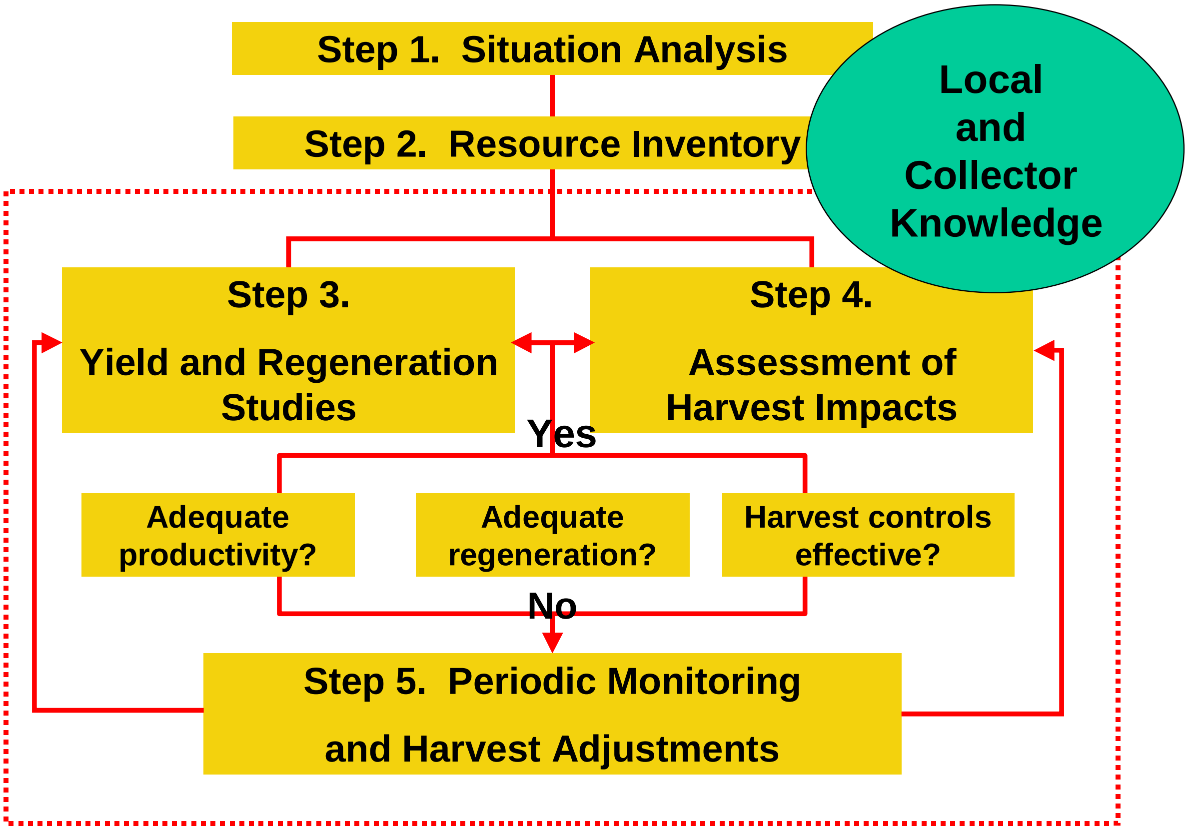

Figure 2. Resource assessment framework for ISSC-MAP within an adaptive management process

Each specific collection situation might involve a different starting point for designing a resource assessment and management plan (Box 2).

Box 2. Starting points for resource assessment

Planning a resource assessment may be considered from several distinct starting points:

A. A target species and collection area have already been identified (selected), and commercial wild-collection already exists in response to an existing market demand. The main resource assessment questions to be answered in this situation are:

- Does current demand exceed supply at sustainable levels of wild collection?
- Does the current collection operation meet resource management requirements for sustainable wild collection?
- If not, what changes are needed and possible, within limitations of time, effort, and capacity?

B. The target species identified (selected) is not yet wild-collected at commercial levels, but commercial collection is desired (a commercial level of demand exists or is likely). The main resource assessment questions to be answered in this situation are:

- Is sustainable wild-collection at commercial levels likely for the target species?
- If so, what resource management conditions are needed and possible, within limitations of time, effort, and capacity to meet requirements for sustainable wild collection?

C. A target species has not yet been identified (selected). Assuming that the relevant questions concerning market demand are also being addressed, the main resource assessment question to be answered in this situation is:

- For which species is wild collection at commercial levels most likely to be sustainable, least complex, and least costly in time and effort?

Management of wild plant resources, including medicinal and aromatic species, is complex and characterized by high levels of uncertainty about population size, growth rates, variation in yields and, not uncommonly, even the correct identity of the medicinal plants being harvested. There are great variations in the time and effort required for resource assessment depending on factors such as the terrain, species diversity, and expertise available in each situation. It is therefore very important, during the situation analysis, to carefully consider the impact of these factors on the costs and complexity of resource assessment and management (Box 3). Considering these impacts will lead to more effective design and implementation of resource assessment and monitoring as part of an adaptive management planning process, and therefore to more effective resource management outcomes. An adaptive management plan provides the foundation for developing a programme of sustainable use to reach a balance between resource demand and resource supply.

Box 3. Questions to ask yourself before you start

The costs and complexity of adaptive management plans for medicinal plants increase rapidly with increasing diversity of species and uses, larger number of harvesters or quantities harvested. Before designing a resource assessment and monitoring process within the overall management plan, you need to ask yourself several questions:

- What is the overall objective (e.g., maintaining a viable population of a target species; maintaining biodiversity values within the habitat, or maintaining ecological function, such as hydrology)?
- What resource assessment questions are you trying to answer? (See Box 2)
- What is the control? (For example, is the assessment comparing heavily harvested to unharvested sites?)
- What other factors are affecting the same resource (and how can these be distinguished from what you are monitoring)?
- At what spatial and temporal scales will you be working (i.e. what is the scale of change, how big, and where)? (See Box 4)
- How precise do you want (need) your surveys to be (e.g., precision of 5%, 10% or 20%) and what is the trade-off between cost and precision?
- Who will do the work, how participatory do you need to be, and what training needs are required before you start?
- Who will analyse the data?
- Who will act on the results (and who will translate the results into a suitable format for decision-makers)?
- How long will it be before decisions on resource management options will be made?

(Source: Cunningham, 2001)

Choices will need to be made concerning the degree of rigour needed to meet ISSC-MAP requirements (and compliance levels for ISSC-MAP) and who will do the monitoring (see Box 4). The main choices are: professional monitoring, participatory (collector / community) monitoring, or no monitoring at all. These choices imply different levels of precision, cost, and complexity. Decisions need to be carefully made, as assessment and monitoring can divert scarce resources away from conservation or other priorities while being of little management value (Sheil, 2001). On one hand, if the costs of a highly rigorous approach are unaffordable, then implementation is unlikely to happen, even at the basic survey stage, let alone relocation of a large sample size of randomly located plots. On the other hand, there is little management value in collecting anecdotal data.

Box 4. Participatory processes and "data-less management"

> *The results of inadequate monitoring can be both misleading and dangerous not only because of their inability to detect ecologically significant changes, but also because they create the illusion that something useful has been done*. (Legg and Nagy, 2006)

There are successful cases that bridge the gap between scientific rigor and the need for local participation for resource management action. There are two common "bridges" over this gap. First, through participatory research, supported by good scientists, leading processes that retain stakeholder ownership of indicators, while improving the accuracy, reliability and sensitivity of data collection (Reed et al., 2006). Second, through expert scientists partnering with local people to develop precautionary approaches through combined knowledge – a process termed "data-less management" (Johannes, 1989). What Johannes (1989) pointed out for the complex marine systems he studied is as valid for adaptive management of medicinal and aromatic plants:

> *Data-less management does not mean management without information. Even in the remotest un-researched areas…it comes from two sources. The first consists of the knowledge gained from research on other, similar systems. The second source…is the knowledge possessed by fishers concerning their local marine environments and fisheries. This knowledge can be extremely useful for management purposes; in some areas it has proven to be encyclopedic.*
>
> *Conventional biological training has focused our attention so single-mindedly on the rigorous quantitative description of … resources before committing ourselves to managing them, that we are liable to feel guilty if we diverge from this track – and worse still, may even criticize others who do so. But when vital resources are rapidly degrading…we often have neither the time nor the resources for such data-gathering. The choice is not between giving perfect or imperfect advice to managers. It is between giving imperfect advice or none at all.*
>
> *Data-less and data-poor management are, under the circumstances, not just valid alternatives. They are an imperative. It may be argued that such activities are not science. But surely this is immaterial. Doing them well will not be easy, and success will depend heavily on good scientists helping … communities and government management agencies to plan objectives and controls.*

Table 1 summarizes some of the methods used to enable the participation of local communities and collectors in resource assessment, with some notes on the contributions and advantages, as well as the challenges associated with these methods.

Table 1. Contribution of local knowledge and practices to resource assessment

Methods	**Contributions / advantages**	**Challenges**
Overall process Participation of local resource users / collectors in resource assessment and management	• Motivates and stimulates interest of local users / collectors • Reduced need for professional field staff and time in field • Local employment opportunities	• Need appropriate equipment, training, and compensation • Literacy and numeracy obstacles
Situation analysis Participatory mapping	• Mapping collection area • Mapping resource distribution	• Interface with “official” area maps
Situation analysis, assessment design Participatory Rural Appraisal	• History and general trends of resource use, collection, harvest impacts • Prediction of likely impacts of harvest levels and practices • Causes and history of other non-collection disturbances	• Participation of local communities / collectors in deciding what questions are important • Making local / collector engagement worth their time and effort
Harvest impact assessment and monitoring Local user / collector observations to collect field data	• Resource users perceptions as to why scarcity has arisen • Identify alternative harvest practices • Reassessment of local decisions on land-use options	• Setting quotas and human carrying capacities if appropriate • Development (or reassessment) of local rules which set limits on who or how many people will harvest from a set area and on harvest methods
Yield studies and monitoring	• Greater awareness of resource limits compared with demands • Change in harvest methods more readily understood and adopted.	• Use of local systems of measurement (with calibration to a more universal standard) • Development or reassessment of local rules / limits on harvest (e.g., number of harvesters per area)
Regeneration studies and monitoring	Local knowledge indicators • Change in distribution • Change in time required to collect a specific quantity	• Locate plots where a long history of collection has changed population structure, and at the resource frontier where the least collection has occurred.
Field work, record keeping Use of field computers / palm pilots to record observations	• GPS-linked data/records • Can overcome literacy and numeracy obstacles • Facilitates quick and easy data processing, storage, retrieval for analysis: ○ Large amounts ○ Over large areas ○ Over long time • Can also be low-tech, e.g., dbh rulers using visual rating system and size-class symbols rather than a number scale.	• High cost of equipment vs paper • Need strong technical support • Regular access to electricity, batteries, main computer to download data • May be most appropriate for conservation programmes and rural development projects • Use symbols or icons rather than numbers. E.g., icons need to illustrate rating systems, e.g., of harvest impacts

Source: Cunningham (2001)

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STEP I. SITUATION ANALYSIS

The situation analysis provides a foundation for later steps in the resource assessment process. The situation analysis should address not only the ecological factors that influence the sustainable use of a specific resource, but also social, legal, economic, and broader environmental factors[12]. The situation analysis contributes to:

- selection of target species with good potential for sustainable wild collection;
- information about the target species biology and what drives species population dynamics (see Box 5);
- correct identification of target species (even when collection is underway, local names or trade names may in fact cover several species in the same genus) (see Box 6);
- understanding and reducing the potential impact of resource assessment and monitoring methods on the target resource itself, on other species, and on the habitat;
- identification of gaps in knowledge and capacity; and
- understanding the level of effort and precision required in resource assessment methods and for ongoing resource management for the target species.

Box 5. Scale of disturbance and influence on medicinal plant resource management

Achieving sustainable harvest and effective management of medicinal plants requires us to deal with complex socio-ecological systems and in some cases, to support policy reform processes. Dealing with social, cultural and policy processes may seem complex enough – but we also have to realise that the factors driving the increase, maintenance, or decrease in plant populations may be beyond the species-population level. Dealing with factors causing habitat fragmentation is an obvious example. What is also required in many cases is to understand the disturbance requirements of species within particular habitats (fire, grazing, mowing). Forty years ago, as a last resort to save declining populations of *Orothamnus zeyheri* (Proteaceae), an endangered plant in the Cape region of South Africa, conservation staff used fire as a disturbance tool to stimulate germination from seed. In Europe, alpine pastures and meadows traditionally managed for hay have a high plant species diversity and high conservation significance (Myklestad and Sætersdal, 2004). In Switzerland, for example, viable *Arnica montana* populations are managed through maintaining grasslands by mowing, a disturbance regime that suits this species (Ellenberger, 1999). In temperate forest, the under storey medicinal shrub *Arctostaphylos uva-ursi* resprouts vigorously after the habitat is burnt or cut (Calvo et al., 2002). In forests, light demanding tree species grow best when canopy gaps form, or along forest margins, with some species geared to large-scale disturbance events (e.g.: due to hurricanes) (in “coarse-grained” forests), while others are suited to small gaps due to tree falls (“fine-grained”). This understanding is crucial for resource management plans.

At a global scale, even climate change through global warming can have serious implications for habitat-specific alpine medicinal plants. While it is not possible to deal with global warming in the short term, it is crucial to invest time in understanding what influences the population biology of medicinal plants at different spatial and time scales, so that we use appropriate tools to deal with each species.

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[12] These include other environment and habitat factors (ISSC-MAP Section I), legal and ethical factors (ISSC-MAP Section II), as well as management and business factors (ISSC-MAP Section III) that influence whether the target species / resource can be collected in a sustainable manner from wild populations. (Medicinal Plant Specialist Group, 2007).

Box 6. Know your species

Knowing exactly what species you are dealing with is crucial for design of a resource assessment within an adaptive management plan. This may seem obvious, but often it is not. Trade names and local names may, in fact, cover several species in the same genus or even different genera, each with different responses to harvest, different habitat preferences, and different conservation status. The popular Chinese medicine *duhuo,* for example, refers to several *Heracleum* species. Conversely, many local names may refer to a single species. The southern African medicinal tree *Curtisia dentata*, for example, has eight different Zulu names. In addition, rising scarcity often results in substituting one herbal product for another, such as aphrodisiac bark from *Pausinystalia johimbe* being mixed with bark from *P. macroceras*, or *Ocotea bullata* bark substituted with bark from *Cryptocarya latifolia* or *C. myrtifolia*. To make sure you get the correct needed for a resource assessment, make sure you know which species you are dealing with. Good quality herbarium specimens identified at a national or international herbarium provide a good start. (See, for example, Lawrence and Hawthorne, 2006.)

The type of information that needs to be gathered, analysed, monitored, and considered within the collection management process will be different for each target species and collection operation. Procedures for carrying out a situation analysis are summarized in Table 2. The principal output based on the situation analysis should be a situation report.

Table 2. Summary of procedures for situation analysis

	Task	Notes on methods / related guidance
1.	*Planning* Select target species for ISSC-MAP application.	• In many cases, the target species has already been selected, based on existing or demonstrated potential for commercial wild collection. • In cases where target species are not yet selected, evaluation of conservation status (see Box 7 and Task 4 in this table) and the potential for sustainable wild collection (See Task 5 in this table, and Table 3) should be undertaken for candidate species, along with appropriate market studies.
2.	*Field work* Ensure correct identification of target species	• Voucher specimens (with flowers, fruit, seed) from the collection / management area, authenticated by a taxonomist / botanical institution. • Field herbarium including identification aids (e.g. dried specimens, field guides, photographs, local knowledge of taxonomic indicators) for o target species in each stage of the life cycle (e.g., juveniles, bark and non-reproductive structures) o any other species that might be confused with the target species by the resource assessment team / collectors. • Training for resource assessment team / collectors. See Lawrence and Hawthorne (2006)
3.	*Desk and field work* Gather relevant information about the	• The ISSC-MAP principles, criteria, and indicators define much of the information required for the situation analysis. A

	Task	Notes on methods / related guidance
	target species and collection area.	questionnaire template based on the ISSC-MAP is provided in Annex 1. This template can be adapted for specific project situations. • Information sources should include: ○ Published scientific sources ○ Experts (ecologists, taxonomists, resource managers) familiar with the target species and the collection area ○ Local community and collector knowledge and expertise (participatory processes, open-ended interviews) • Information about the target species should include: ○ Conservation status (if known – see Box 7) ○ Parts collected and related market requirements / quality preferences ○ Current collection protocols (parts collected, preferred age/size-classes, methods, frequency and intensity ○ Estimated volume/per area, history of collection ○ Importance of the species for the company and collectors community ○ Special functions in the ecosystem (e.g., ecological or cultural keystone species). • Information about the collection area should include: ○ Ownership / resource tenure ○ Ecological and social description of the area ○ Identification of sensitive / protected species ○ Protected or sensitive sites ○ Maps ○ Sites within the collection / management area not suitable for collection ○ History of land use and management (e.g., wild plant collection, forestry, grazing, fire).
4.	*Analysis* Assess the conservation status of the target species	• The relevance of assessing conservation status according to IUCN Red List categories and criteria is summarized in Box 7. The IUCN Red List categories can be found in Annex 2 of this guidance document, and the complete categories and criteria in IUCN (2001). • To determine whether the global conservation status of the target species has been evaluated according to the IUCN Red List categories and criteria (version 3.1,2001): consult the website http://www.iucnredlist.org/search/search-basic and search for the target species (typing the Latin name in the text search box). • To determine whether the conservation status of target species has been evaluated according to national or sub-national (e.g., provincial) level criteria, consult the relevant species protection authorities of your country (e.g., national / provincial threatened species lists). • Collection must comply with any existing international, national, or sub-national requirements for protection. • Target species that do not appear on any of these lists may be threatened, but have not yet been assessed. These must be evaluated, at minimum, using IUCN RapidList

	Task	Notes on methods / related guidance
		(http://www.ramas.com/RapidList.htm), and preferably according to the full IUCN Red List global categories and criteria (IUCN, 2001). • Expertise in IUCN Red List assessment will likely be required (e.g., from the IUCN/SSC Medicinal Plant Specialist Group). In some countries, the botanical expertise required to complete conservation status assessments is available from botanic gardens, herbaria, and other research institutions. • For most ongoing collection operations, the collectors and resource managers will be able to contribute much of the information required on trends in population distribution and size required for conservation status assessment.
5.	*Analysis* Estimate the potential for sustainable wild collection.	• Information gathered during the situation analysis about the target species and the collection area can be used to make a preliminary estimate of the likelihood for sustainable wild collection (see the decision matrix in Table 3). • This information can also be used to estimate the levels of accuracy and precision likely to be required to conduct an adequate resource assessment and to monitor impacts of harvest. • This information can also be used to estimate the relative cost and complexity of resource assessment, monitoring, and management for target species. • These estimates are useful for selecting target species for commercial wild collection (Task 1 in this table), as well as for designing appropriate management plans.
6.	*Evaluation and reporting* Prepare a situation report	The situation report should include: • Descriptions of the target species and the collection area • Maps defining the boundaries of the collection / management area, key populations of the target resource, conservation or other sensitive areas for protection, trails and roads, communities, overlap with other management areas. • Proposed objectives of the resource assessment • Appropriate methods for resource assessment, including monitoring plans, levels of accuracy and precision • Available knowledge and capacity, as well as gaps in knowledge and capacity • Partners needed • Bottle-necks and critical interventions needed

Box 7. Conservation status assessment and the IUCN Red List

The IUCN Red List Categories and Criteria are intended to be an objective and widely applicable system for estimating and classifying the risk of extinction to species at the global level. This system for evaluating conservation status of species can be applied consistently by different people in different situations.

A Red List assessment can answer questions relevant to sustainable use of wild-collected resources, such as:

- How threatened is a particular species relative to other species?
- What are the threats to a species?
- How important are specific populations to the overall conservation status of the species?
- How do different factors (e.g., trends in population size and distribution) affect the risk of extinction?

Extinction is a chance process. Thus, a listing in a higher extinction risk category (see Annex 2) implies a higher expectation of extinction, and over the time-frames specified more taxa listed in a higher category are expected to go extinct than those in a lower one (without effective conservation action). However, the persistence of some taxa in high-risk categories does not necessarily mean their initial assessment was inaccurate. It may mean that they are receiving the careful and informed assessment, monitoring, and management needed to enable their survival.

The pre-assessment matrix in Table 3 outlines a number of conditions / factors of plant species and populations, many of which can be learned from the situation analysis. Using this knowledge, the pre-assessment matrix can be used to:

- assist projects in selecting species appropriate for ISSC-MAP applications (i.e., to give a rough indication of the likelihood of sustainable wild collection);
- identify important information gaps for conservation status assessment and resource assessment
- assist projects in determining the amount of accuracy and precision that will be needed to adequately assess and monitor the sustainability of harvest volumes and practices in the context of the ISSC-MAP; and
- estimate the relative cost and complexity of resource assessment, monitoring, and management for the target species and the collection area.

Table 3. Pre-assessment matrix for ISSC-MAP target or candidate species

Condition/factor			
***Geographic Distribution**	Wide	Limited	Restricted
***Habitat Specificity**	Broad (more even distribution)		Very specific (patchy distribution)
***Local Population Size**	Large	Medium to large	Always small
***Growth Rate**	Fast	fairly rapid	slow
***Part of Plant Used**	leaves, flowers, fruit	exudates, sap, dead wood *	whole plant, bark, roots, bulbs, apical meristems
***Single vs Multiple Use**	single or non-competing	few, low conflict between uses	multiple-use species
Single vs multiple groups of users	One company or community of collectors	More than one company / community collects, but with clear management agreements	More than one company / community collects without management agreements
Reproductive Biology			reseeders, weak resprouters
• **pollination**	wind, abiotic, asexual	common biotic (birds, insects)	highly specific (beetles, bees, bats) Australia/So. Africa
• **dispersal**	wind, water	common generalists (birds, small mammals)	large mammals and large birds
***Ecosystem complexity**	vegetation dominated by few species (<5)	low diversity (e.g., savannah) (<10 tree spp./ha)	high diversity systems
***Conservation status and value**	Collector knowledge and other indicators suggest stable and surplus species abundance, distribution, or quality		Collector knowledge and other indicators suggest reductions in species abundance, distribution, or quality
Phylogenetic distinctiveness	Large genus (e.g., *Astragalus*)	Medium – large genus	Monotypic family or genus (e.g., *Nardostachys*)

Likelihood of Sustainable Wild Harvest	**HIGH**	**MEDIUM**	**LOW**
Precision, accuracy required for inventory, monitoring, and management	**LEAST**	**MEDIUM**	**GREATEST**
Costs and complexity of monitoring and management	**LOW**	**MEDIUM**	**HIGH**

Based on Cunningham (2001) and Peters (1994).

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STEP 2. RESOURCE INVENTORY

The central question for a resource inventory, in the context of the ISSC-MAP, is:

How much of the target species is present within the collection area?

An inventory provides information about the quantity (sometimes called the "standing stock") of the target resource by estimating both resource density (number per unit area) and abundance (total number in a specified area).

An inventory of the target resource provides a base line for monitoring changes in resource quantity in the collection as a result of collection management or other impacts. Resource inventory results can also be used to:

- locate the most efficient and effective collection / management areas for a target resource (combined with information from vegetation and land-use mapping);
- define appropriate management and monitoring scales (e.g., population, species, habitat)
- estimate the sustainable harvest limit of the target resource (combined with yield study and recovery time data); and
- examine the population structure and dynamics of the target species (combined with regeneration and demographic study data).

A summary of procedures used for carrying out a resource inventory is outlined in Table 4. Appropriate methods and approaches for collecting baseline inventory data must be selected case-by-case, depending on characteristics of the target species, the collection site, and the collection operation that have been examined and documented during the situation analysis (Step 1). Important things to consider include:

- collector / community participation enables community members to plan and conduct the inventory, and to compile, own, and use the inventory results. Non-community members might be involved as facilitators, advisors, or trainers.
- using local knowledge and skills, as well as existing research capacity and skills;
- location and arrangement of sampling sites for inventory and subsequent monitoring (There are many factors to consider in the location and arrangement of sampling sites for inventory and monitoring. These are summarized in Annex 3.); and
- appropriate accuracy and precision versus costs/ time and budget constraints (e.g., equipment, expertise, time and labour, combining one study with other studies, ease of access to target resource collection area / terrain – see Box 8).

Table 4. Summary of procedures for base-line inventory

	Task	Notes on methods / related guidance
1.	*Planning* Define the focus and scope of the inventory	Purpose, area, target resources/populations, other data (e.g. habitat, landscape) – see Stockdale (2005), pp 146-7.
2.	*Planning & field work* Establish / select sample populations of the target	• Selection of appropriate sites for evaluation of harvest impacts; location of control plots If target species are

	Task	Notes on methods / related guidance
	species in plots or transects.	collected from different areas / habitats under different types of environmental pressures, it is important to assess these different conditions. • See Annex 3 on location and arrangement of sampling areas (plots, transects)
3.	*Planning* Determine minimum age/ size-class of individuals to be included in the inventory.	• Less abundant species → use smaller diameter age / size-class or plant height as cut-off = greater rigor/more precise inventory • Rules of thumb: o large canopy trees: ≥ 10 cm DBH o Understory trees: 5 cm DBH o Shrubs, small palms: 50 cm age classes or • Take the interval between largest and smallest individuals, divide by the number of size-classes desired / required (e.g., 6-10) to obtain size/age class intervals. • The smaller the minimum size, the greater the time and costs involved in the inventory. • See Box 9 on age / size-classes and recovery after harvest, and Box 10 on age / size-classes for bulbs.
4.	*Field work* Count or estimate the number of individual plants in the target population(s) within the defined collection area [sample populations] and, when counting, measure size	• Some methods suitable for different plant life forms and types of resources are summarized in Annex 4 (e.g., diameter-at-breast-height (dbh) for trees, height for herbs, smaller woody species). • Care is needed to select methods suitable for patchiness of species distribution and habitat/vegetation types in collection area.
5	*Field work* Other observations	• Habitat, vegetation type • Soil type, conditions (degradation) • Impacts of other / outside harvesters can affect species and size-class selection. • Impacts of other uses (browse, fire, management for other uses) can have a larger affect on population dynamics than harvest.
6.	*Analysis* Calculate estimated resource abundance and density (and precision)	According to habitat type, age/ size-class, other relevant relationships.
7.	*Reporting* Prepare an inventory report	Data results tables, purpose and objectives of inventory, methods, results, conclusions.
8.	*Analysis* Use size and number data to determine population structure/ size-class distribution of target species	Plot data as a histogram for collection area, or different habitat types in collection area (see Figure 4). Few data are available for size-class distributions of wild populations

Box 8. Precision and costs of resource inventory

In one of the few studies of the time costs of resource inventories for management planning and monitoring, a 23% decline in a rattan population was the minimum rate that could be detected with a 95% confidence by two surveys a year apart, each with a precision of 10% (Evans and Viengkham, 2001). Given that even further declines are likely before management action may take place, it is a serious concern that the low precision in detecting major population declines are so difficult to detect. The level of effort for this level of precision is very high, however, requiring a team of 6 people 55 days for transect surveys for a single rattan species in 10 km^2 of forest. In this case, the survey time costs made surveys with greater than 20% precision unaffordable. A precision level of 5% would detect a 1% population decline, but would require an even greater level of effort – 158 days for a team of six people to undertake transects in 10 km^2 of forest. In many cases, medicinal plant harvesters use far larger areas in very rugged terrain. This extent of effort is just not practical in many countries. Careful consideration therefore needs to be given to inventory and monitoring methods.

Box 9. Plant age, rotation times, and recovery after harvest

Being able to age medicinal plants is of great value for understanding recruitment, the time taken to shift from one size class or stage to another and in developing matrix models of plant populations. Slow growing plants take much longer to make the transition from one size-class to the next and how low yields. The first size classes regenerate either from seed or through vegetatively as clones from the parent plant. Information on how a plant population is regenerating provides valuable data for resource management purposes and is widely used in management planning for sustained-use management.

Although techniques have been developed for ageing plants (see Cunningham, 2001, Chapter 4), this is unknown for most lowland or montane tropical species. Therefore, in contrast with life-tables for animal populations, which are usually based on age, studies of plant populations are generally based on size-class distributions. Measurements of stem diameter (or length) are made on the basic assumption that stem diameter (trees, bulbs or corms) or stem height (palms, tree ferns) reflects plant age. One of the reasons for making this assumption is that accurately ageing plants is difficult for most species, particularly in the tropics and sub-tropics. Tree stems, bulbs and corms get thicker as these plants grow older and diameter size classes are therefore used as the most appropriate measure for grouping them into size classes. Most palms and tree ferns have an apical meristem, growing upwards (longer) as they grow older more than they increase in diameter. For these reasons, stem length rather than stem diameter is a more accurate measure for assessing the population structure of palms, cycads, grass trees and tree ferns. Plants within a sample population are then grouped into size classes based on stem diameter (trees, bulbs) or stem length (palms, tree ferns). Indications of population structure indicate the chance of plants in one size class have in surviving into the next size class. These are used as a tool to understanding plant population dynamics, most commonly for trees.

Information on the age of harvested plants is a key to many issues in resource management. It also leads to a better understanding plant life histories. Where it is possible to age perennial plants, this provides valuable information for resource users, managers and researchers in predicting yields, understanding recovery times after harvest, and appropriate harvest rotations that reflect how long a harvested population takes to recover before it can be harvested again.

Slow growing, slow reproducing plants are known to be vulnerable to over-exploitation, yet we rarely know how old individual plants are or how long they live. This information is not only of great interest in developing resource management programmes, but also to local resource users, who often underestimate the age of slow growing (and therefore vulnerable) plant species.

Box 10. Medicinal bulbs: how old is what's sold?

Harvesting of medicinal corms, bulbs or tubers results in the whole plant being dug up. The impact of this destructive harvesting at a plant population level depends on size-class selection of the corm, bulb, or tuber and on the reproductive strategies of the species. The size-class of geophytes that are harvested and the proportion of the population removed have an important influence on recruitment of young plants (as larger, older plants produce more seed). Size also influences the ability of the species population to survive fires or drought.

Few data are available for size-class distributions of wild populations of medicinal plants harvested for bulbs or roots. This can be a very useful measure of population size-class distributions in sample populations, using bulb or lignotuber diameter, just as diameter at breast height (dbh) is applied in resource assessments and management of medicinal tree populations.

One of the few studies of medicinal bulb age for resource assessments showed that bulbs of Blue Squill (*Merwilla plumbea* (formerly *Scilla natalensis*) take at least 15 years to get to the preferred harvestable size (Williams et al., 2007). Bulbs with known ages, up to 25 years old, were examined. Some individuals probably live more than 50 years, yet in 2006, nearly 2.1 million wild-harvested *M. plumbea* bulbs were sold. This recent study showed that accurate age estimates can be derived from counting persistent bulb scales. Where land and resource tenure is weak, frequent harvest has a high impact on *M. plumbea* populations. Although this endemic southern African species is still abundant along the Drakensberg Mountain escarpment in South Africa, there are conservation concerns about this species at the margins of its range in Swaziland and in Lesotho. With increasing trade in herbal medicines, the complex interplay of harvest impacts, fire ecology and tenure need to be faced if viable wild populations are to be maintained in the long-term.

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STEP 3. YIELD AND REGERNERATION STUDIES

Yield and regeneration studies, together, estimate the <u>sustainable harvest yield</u> of a target resource. The central question for these studies, in the context of the ISSC-MAP, is:

> **How much of the target resource (quality and quantity) can be harvested season after season without damaging the long-term stability of the target species populations?**

<u>Yield studies</u>

The central question for yield studies, in the context of the ISSC-MAP, is:

> **How much of the desired raw material (quality and quantity) does the target species produce under natural conditions?**

Yield studies estimate the <u>total harvestable yield</u> -- the average amount of the target resource that <u>can</u> be collected from the collection / management area in one harvest (or one season, for plants that regenerate the harvested material).

Yield study results can also be used to:

- provide a baseline needed to balance demand with supply of the target resource (see Box 11);
- monitor the ecological impacts of collection (and other factors) on population structure and regeneration of the target species;
- delineate management zones (e.g., for rotating harvests of approximately equal yield) by providing information about different levels of the target resource yield across the collection /management area (combined with resource inventory data).

A summary of procedures for carrying out yield studies is outlined in Table 5. As for resource inventories (Step 2), appropriate methods and approaches must be selected case-by-case, depending on characteristics of the target species, the collection site, and the collection operation. Methods that promote community participation and the use of local knowledge and skills, and that allow appropriate levels of accuracy and precision, should also be considered. Advantages and disadvantages of combining yield studies with other studies and harvest activities are summarized in Annex 3.

Table 5. Summary of procedures for resource yield studies

	Task	Notes on methods / related guidance
1.	*Planning* Define the focus and scope of the yield studies.	• Resources / species to be studied • Size-classes included in the studies (e.g., only the size-classes of resources that would be harvested in a commercial operation). • Specify a standard harvesting method for the yield studies. • Define the type of “yield” to be studied: 　○ Harvested yield = actual amount of resource harvested,

	Task	Notes on methods / related guidance
		or - Potential yield = amount possible to be harvested (but not actually harvested in the study)

2.	*Planning*
	Select sample populations to reflect variables likely to affect yield.
		- Age / size-classes as defined through analysis of inventory results (Step 2)
		- Vegetation / habitat types (identified during the resource inventory, Step 2)
		- Objective system of sample selection (random or systematic)
		- Samples drawn from across the collection / management area
		- For long-lived species, mark the sample individuals (e.g., with paint) so that they can be included in the monitoring
		- Accuracy and precision considerations:
		  - minimum of 3-5 individuals per size/age class and vegetation type (but same number of individuals from each)
		  - maximum of 6 age / size-classes
		See Annex 3 on location and arrangement of sampling areas (plots, transects)

3.	*Field work*
	Measure or estimate the target resource yield of each individual included in the sample.
		- Direct measurement requires actually harvesting the target resource. For resources considered too valuable to harvest during a yield study, yield may be estimated.
		- Local / collector participation: for species currently harvested, collectors can weigh, count, measure the actual amount collected during the harvest season, and estimate the amount of the resource left unharvested.
		- Measurements should be appropriate to the resource type and the primary user of the information (see Annex 4). Options include:
		  - Counting (e.g., fruits, leaves)
		  - Standard measurements of mass, volume, weight
		  - Local measurements (e.g., arm-span)
		- Sampling may differentiate (observe or measure) relevant quality classes or resource grades (e.g., size, colour, flavour, shape)

4.	*Field work* Include observations that enable examination of relationships between yield and relevant factors, e.g., environmental.	Information about the forest type, topography, soil type and condition may already have been gathered during the resource inventory (Step 1). If not, they should be included in the yield study.
5.	*Analysis* Calculate or estimate the total harvestable yield (number of target species individuals in each age/size class x productivity)	Total target resource quantity of collection site: (i) The yield of the target MAP plant part for each plot (e.g., yield of 1 plot) = number of individuals of 1st size class x average weight of plant part of 1st size class (g or kg) + number of

	Task	Notes on methods / related guidance
		individuals of 2^{nd} size class x average weight of plant part of 2nd size class (g or kg) + etc. (ii) (Maximum) yield of the target resource in the collection site = $\frac{\text{sum of the yield of all plots (kg or tonnes) x size of collection area (m}^2\text{ or ha or km}^2\text{)}}{\text{size of 1 plot x number of plots (m}^2\text{ or ha)}}$ Other useful calculations using yield data: • relative yield per hectare, indicates vegetation types (or locations in the collection / management area) with the highest / lowest yields of the target resource • relative yield per age / size-class, indicates the most / least productive age/size classes in the collection / management area Stockdale (2005) describes these calculations.
6	*Ongoing field work and analysis - monitoring* Repeat yield studies over several years. Use multi-year data to construct an average yield curve.	• Yield can vary from year to year (season to season), depending on weather and other variables. • Use data collected over several years to produce a yield curve (see Figure 3). • Yield curves can predict estimated annual production of harvested products according to plant size-class or on yields on a standing biomass/area basis.

Sources: Cunningham (2001), Peters (1994, 1996), Stockdale and Corbett (1999), Stockdale (2005), Wong et al. (2001).

Box 11. Factors affecting yield

In trying to reach a balance between demand and resource supply, it is important to know how much of a resource is produced within a known area. In the long-term, yields are influenced by the regeneration rate of the medicinal plant populations, which are influenced in turn by other factors such as the effects of harvest, seed predation or animal browsing.

Methods described elsewhere (Cunningham, 2001) for measuring plant size (diameter, length), volume, age, stem or foliage biomass, bark volume or directly counting annual leaf or fruit production are useful tools in this process. The study area would usually have been mapped on the basis of information from harvesters and an inventory of selected species carried out. In even-aged stands of fast growing species with annual aboveground production, such as *Cymbopogon* grass, an estimate of annual yield can be a relatively simple task, particularly when there is just a single use or where harvest impacts do not conflict with one another. In most cases, however, yield assessment is more complex, requiring measurement of yields of products from marked plants in different size-classes and plant density and size-class data from inventories to extrapolate annual yields to an area basis (eg: tonnes/ha/yr).

Yields often vary from year to year as well as with site differences in addition to variation with plant size (or age) class. For this reason, yields need to be measured over several years. Yield curves can then be developed to predict estimated annual production of harvested products according to plant size-class or on yields on a standing biomass/area basis. This information is of great practical value in making resource management decisions. Involving local harvesters in yield assessments can usefully lead to a greater awareness of the limits to resource yields compared to demand. This in turn can lead to development (or reassessment) of local rules which set limits who or how many people will harvest from a set area, on harvesting methods. In common with stakeholder participation in other forms of monitoring, local participation in yield studies requires motivated people back up by training and good export advice (see Pilz et al., 2006).

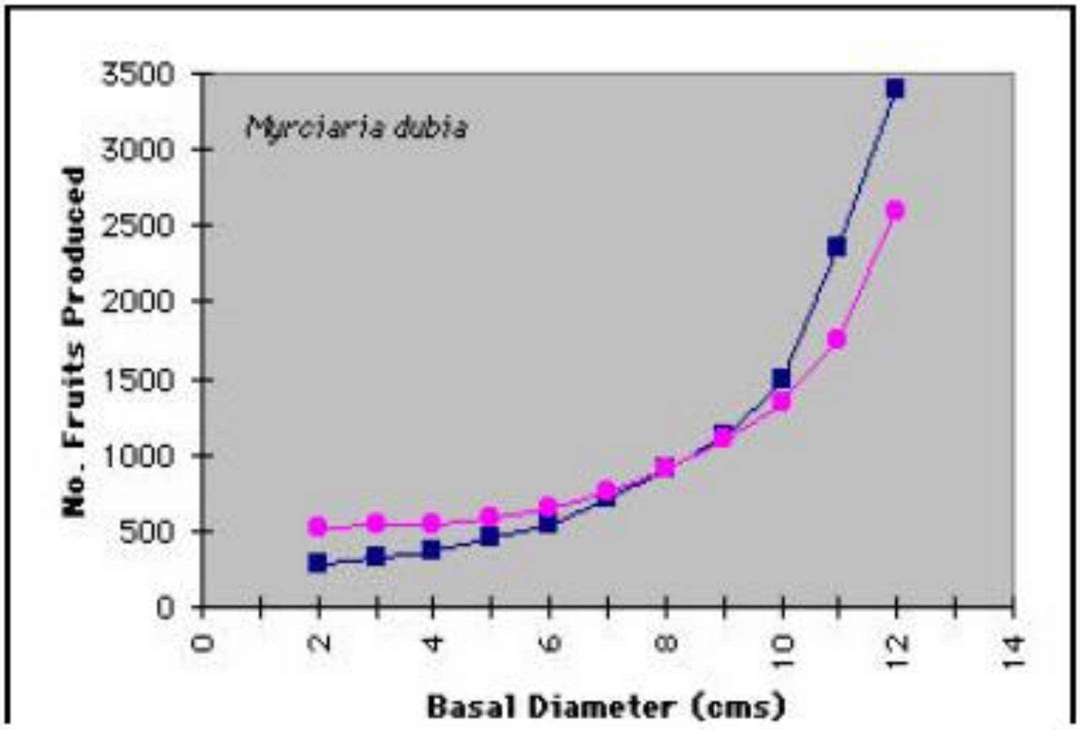


Figure 3. An example of yield curves showing annual fruit production as related to tree size for *Myrciaria dubia* plants growing in the lowlands of Peruvian Amazonia. Two years of fruit production data are shown. (Source: Peters, 1994)

<u>Regeneration studies</u>

The central questions for regeneration studies, in the context of the ISSC-MAP, are:

How does harvest affect recruitment of young plants into the population?

What is the regeneration rate of harvested populations / individuals?

Combined with resource inventory and yield data, regeneration studies estimate the <u>sustainable harvest limit</u> of the target resource. Regeneration studies can also be used to:

- compare the impact of different harvest treatments or management practices on target resource populations;
- monitor changes in population size and structure of a target resource; and
- estimate recovery time (the time taken for new plants to grow from seed to harvestable size);

Regeneration studies provide information about the impact of harvest on the long-term productivity and quality of the target resource by:

- detecting changes in the size-class distribution of the target species populations;
- monitoring the rate of establishment of new seedlings in the target population; and
- monitoring the density of seedlings and saplings in the target resource populations.

A summary of procedures for carrying out regeneration studies is outlined in Table 6. As for resource inventories and yield studies, appropriate methods and approaches must be selected case-by-case, depending on characteristics of the target species (see especially differences between "reseeders" and "resprouters", Boxes 12 and 13), the collection site, and the collection operation. Methods that promote community participation and the use of local knowledge and skills, and that allow appropriate levels of accuracy and precision should also be considered. To reduce field time and effort, regeneration studies can be undertaken together with resource inventories and harvest impact assessments.

Table 6. Summary of procedures for regeneration studies

	Task	**Notes on methods / related guidance**
1.	*Planning and field work* Establish a network of permanent regeneration plots throughout the collection / management area.	• Number of plots depends on current abundance of seedlings and samplings in different parts of the collection area. • High density populations require a smaller number of plots; scattered low-density populations require a more intensive sample. • Permanently mark each plot, map its location, or describe in sufficient detail to enable re-location. Forestry or plant ecology expertise may be needed to lay out an appropriate network of plots.
2.	*Field work* Observations and measurements	• In each plot, count and record the number of seedlings/saplings that are smaller than or equal to the minimum age/size class included in the inventory (Step 2). • Correct identification of young age classes of the target species is essential, and may require assistance of a taxonomist and training for field team members. • Data collection will be easier and faster if plants can be tallied according to size-class rather than measuring every individual included in the sample (e.g., group tree seedlings and saplings into height classes 0-50 cm, 50-100 cm, 100-150 cm, 150-200 cm; diameter classes 1-10 cm, etc.) • Smaller size-classes will be needed for herbs, shrubs, smaller trees, etc.
3.	*First analysis* Prepare a size/age class structure histogram and compare with inventory (baseline) results.	• Group plot results into the different vegetation types in the collection area and average the measurements for each size-class. • Estimate density and abundance for each combination of factors, e.g., vegetation type, size-class. • Combine these results with inventory data to construct a

	Task	Notes on methods / related guidance
		size-class histogram, providing a complete picture of population structure from seedlings to large adults (see Figure 4).
4	*Analysis* Assess current regeneration status of target resource	Use histogram to evaluate whether the number of young individuals in the target population(s) = the number of adults that will need to be replaced due to collection, natural death, other impacts.
5	*Ongoing field work and analysis - monitoring* Re-inventory regeneration plots periodically and compare with previous results.	• Re-inventory regeneration plots to monitor change in the number of seedlings and saplings recruited every approx. 5 years (or more frequently for recovery time studies). • Observations should include the survival or death of individual plants, and the size of the surviving plants. • Reduced rate of seedling establishment can be an indicator of over-harvest amongst obligate reseeders (see Boxes 12, 13) • Other factors (such as lack of disturbance, for example fire) may also play a role (as for *Orothamnus* described in Box 5). • If seedling/sapling numbers are declining (below base-line regeneration rates), harvest levels/practices are not sustainable and need to be reduced (see Figure 5). • If seedling/sapling densities remain above the base-line regeneration rate, the current level of harvest is likely sustainable. (Population structure and regeneration – see Stockdale 2005, p. 67)

Box 12. Regeneration surveys

Regeneration surveys add to the knowledge required for sustainable harvest. Harvesting roots, bark, exudates or stems from adult trees can result in reduced flower and fruit production. If this occurs, then the number of young plants in the population may decline. Even the efficient collection of an excessive numbers of large seeds from trees that produce relatively few large fruits can have a long term impact. The way in which plants reproduce therefore needs to be taken into account in better understanding resilience or vulnerability. Categorising plant species in terms of where they are on the continuum from "reseeders" (which regenerate primarily from seed) to "resprouters" (which reproduce clonally through production of new shoots) (Appendix XX), gives useful insights into the potential for sustained yield harvest and for the design of regeneration studies.

An investment of time and effort in long-term regeneration surveys monitoring the fruit harvesting impacts may be very appropriate in tall tropical forest, for example, where many canopy trees regenerate from seed (Peters, 1994). Medicinal seed harvests of *Carapa guineensis* would be a good example. A similar focus on regeneration from seed would not be a priority for long-lived medicinal species that are vigorous resprouters, as relatively few seedlings may bear no relation to frequency of those species in the forest or thicket canopy.

Regeneration is generally studied through establishing a series of plots scattered throughout the harvested area. Seedlings and saplings of focal species are counted within each plot. Where the focal species are medicinal trees, these young plants are usually tallied into height classes. For medicinal bulbs and corms, diameter size classes are used. Regeneration plots are then periodically re-assessed. Depending on the time and resources available, separate samples of young seedlings can be tagged to assess survivorship. Where possible, particularly in cases where medicinal species are not yet exploited, it is important to locate plots within unharvested areas for comparison. In many circumstances, this isn’t feasible, but if it is possible, comparisons between harvested and unharvested sites are the most straightforward way to assess harvest impacts. Many factors can lead to population decline, so careful studies are needed to assess harvest impacts in relation to other factors.

Box 13. Characteristics across a continuum: long-lived reseeders vs. resprouters

Reseeders

- examples are common in the Proteaceae, Pinaceae, Ericacae and Podocarpaceae
- regenerate from seed, some maintaining canopy seed-banks ("serotiny")
- are single-stemmed, not multi-stemmed. Examine smaller shrubs closely. Some reseeders are single stemmed, but branch off close to the ground, giving the incorrect impression that they are multi-stemmed reseeders.
- don't resprout when the stem is cut
- usually are self-pollinated or have diverse pollinators
- vulnerable to extinction if dependent on specialist pollinators or seed dispersers
- seeds often germinate faster than those of reseeders
- produce abundant seedlings (a large "seedling bank")
- have higher growth rates than resprouters, as they allocate nutrient resources into growing upwards, rather than into underground storage organs. As a result, reseeder species in a particular vegetation type tend to be taller than resprouters.
- most short-lived compared to clonal resprouters
- often are habitat specialists (wetlands, moist montane sites, cool temperate forests)
- annual reproductive output is generally higher than in resprouting species

Resprouters

- maintain "bud-banks" rather than seed-banks, regenerating clonally by sprouting rather from seeds
- often multi-stemmed, some shedding stems as they get older
- produce new stems from buds which are above or below ground level (basal or upper trunk sprouting)
- cut stems show obvious signs of resprouting (but be careful here : resprouting vigour declines when trees are cut low down and with tree size or age)
- may have large underground storage organs (rhizomes, tubers, ligno-tubers) or lateral runners (eg: many forest lianas)
- recruitment from seed is infrequent and irregular
- may be pollinator limited, but can still maintain long-lived clonal populations consisting of a genetically identical clonal organism (the **genet**) which is made up of **ramets**, sprouted from buds each of which has the potential to grow and reproduce as independent, individual plants.
- few seedlings in the population, most small plants are ramets;
- grow slower than reseeders, as they have to put resources into underground storage organs and into protection and production of buds
- usually generalists, found in a wide variety of habitats, rather than habitat specialists

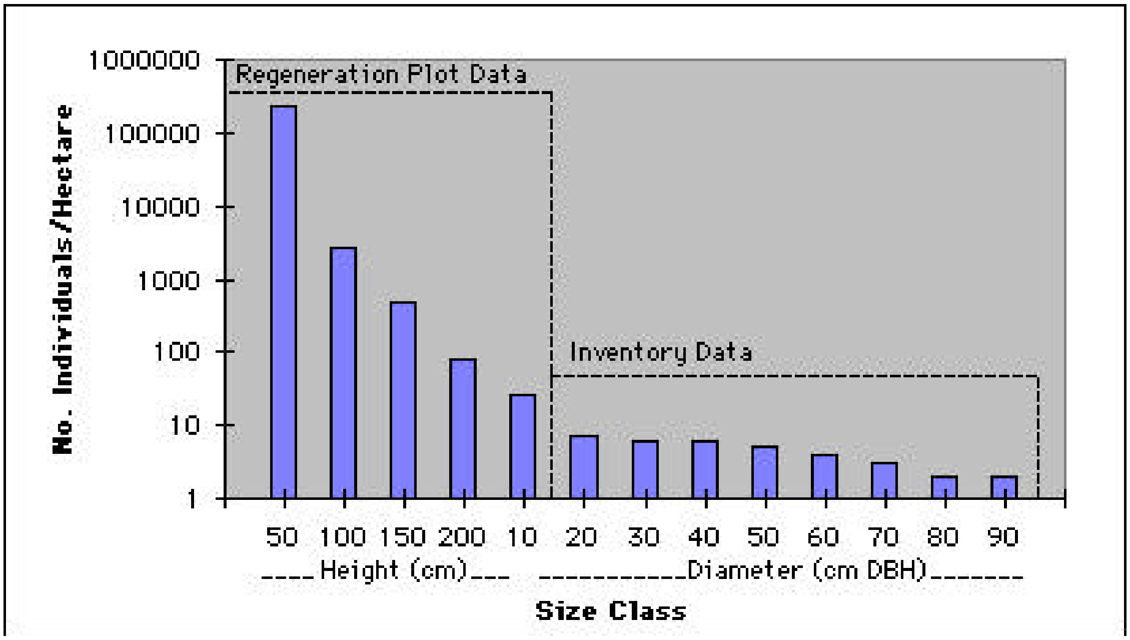


Figure 4. **Size-class histogram for *Shorea atrinervosa* population illustrating the use of both height and diameter classes. Data from regeneration plots have been grouped into four 50 cm height classes and one 1.0 - 10.0 cm diameter (DBH) class. Inventory results are divided into eight 10 cm (DBH) diameter classes. Numbers shown along x-axis represent the upper size limit of each class. Note compressed, logarithmic scaling of y-axis due to the large range in values (e.g. from 3 to 250,000). (Source: Peters, 1994)**

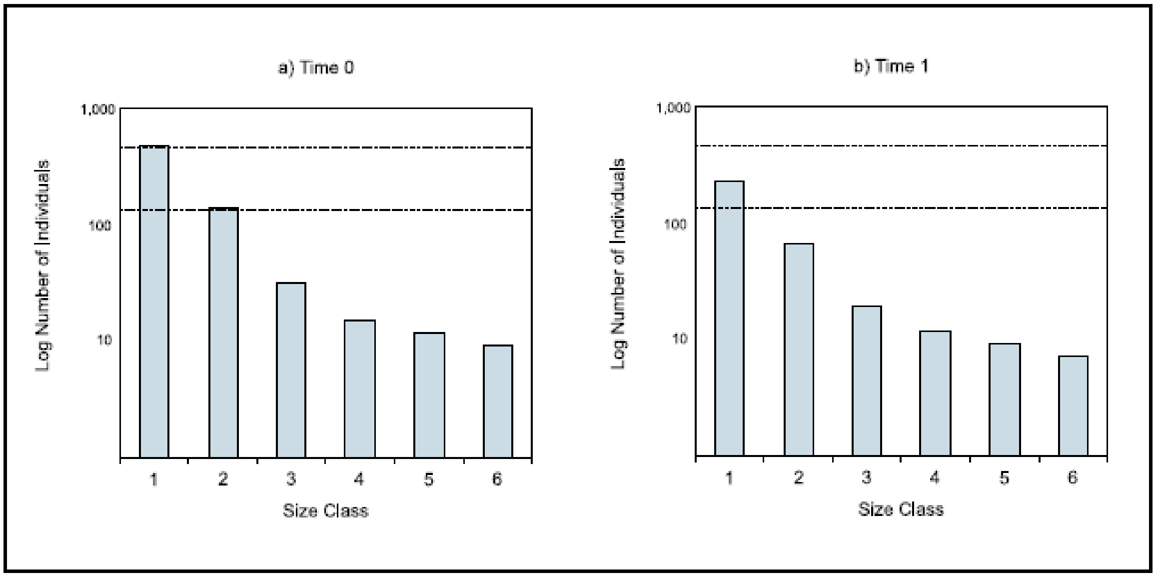


Figure 5. The regeneration size class structure at: a) the time of the first study; and b) five years later (adapted from Peters, 1996, by Stockdale, 2005). In this example, the number of young plants has dropped, indicating over harvesting.

STEP 4. ASSESSING HARVEST IMPACTS

The central questions for assessing harvest impacts, in the context of the ISSC-MAP, are:

> **What is the impact of the current harvest protocol on the target population and ecosystem?**

A harvest impact assessment provides information about the effect of specific harvest treatments (different intensities, frequencies, and methods) on the target resource (reproduction, growth, survival, vigor, yield, quality). This information is needed to define a sustainable harvest protocol for the target resource that takes into account site-specific variables.

Harvest impact assessments can also be used to:

- evaluate whether current harvest protocol is more or less successful in maintaining the target resource than alternative harvest treatments;
- evaluate the costs in time, money, and equipment of different harvest treatments;
- provide a visual appraisal of productivity and quality of target resource during ongoing harvest activity, enabling early detection of negative impacts, before a reduction in the rate of seedling recruitment occurs; and
- improve management practices (adaptive management).

Harvest impact assessments need to consider Important variables that influence harvest impact, including:

- nature, frequency, and intensity of harvest;
- whether harvest methods are destructive or non-destructive. (It can’t be assumed that all harvest of fruit, for example, does not damage individual plants or the resource population. Often branches are removed or whole trees felled to harvest fruit.);
- recovery and regeneration time (see Step 4);
- climate and other environmental factors (e.g., temperate species may be more vulnerable to over-harvest than tropical species); and
- management practices (use of additional management techniques) and scale of management (individual, population, species, collection area, community / ecosystem).

A summary of procedures for carrying out harvest impact assessments is outlined in Table 7. Appropriate methods and approaches must be selected case-by-case, depending on the characteristics of the target species and the nature of the harvest. Local (collector) knowledge and skills can provide important insights to identify relevant harvest variables to test, and to design efficient test methods that can be carried out by harvesters during the normal harvest period.

Table 7. Summary of procedures for assessing harvest impact

	Task	Notes on methods / related guidance
1.	*Planning* Define the resource population to be sampled.	Some assessments may need to focus on more than one species or more than one plant part. Most assessments of harvest impact should focus on individuals in the age /size-classes considered harvestable.
2.	*Planning* Define the harvest practice or practices/treatments to be tested, and the impacts on individual plants and populations to be examined.	Individual plants: effects of seasonal timing of harvest, timing of harvest in the plant life cycle, nature / frequency / intensity of harvest, size of individuals harvested on rates of growth, survival, reproduction; vigour, yield, quality. Populations: effects of seasonal timing of harvest, timing of harvest in the plant life cycle, nature / frequency / intensity of harvest, size of individuals harvested on population structure and dynamics. Include among experimental treatments: • practices actually used by collectors • non-harvested control individuals / populations, if available, or • harvesting along an intensity / frequency/ etc. gradient, most to least.
3.	*Planning & field work* Select appropriate sampling units and design (random, systematic)	Permanently marked resources (impact on target resource individuals) • Best for testing harvest impacts on resource growth, survival, vigour, yield, quality • Only useful for resources non-destructively harvested • May be less costly in time and effort or Permanent plots in the collection area (impact on target resource populations) • Best for testing harvest impacts on population structure, regeneration • Can be used for destructively or non-destructively harvested resources • May be more costly in time and effort (however, plots established for yield studies can be used for harvest assessments, because they include a representative sample of different size-classes and vegetation types in the collection area). High density populations require smaller number of plots; lower density, scattered populations require a larger number of plots For species that require more rigor and precision, caution, etc.,

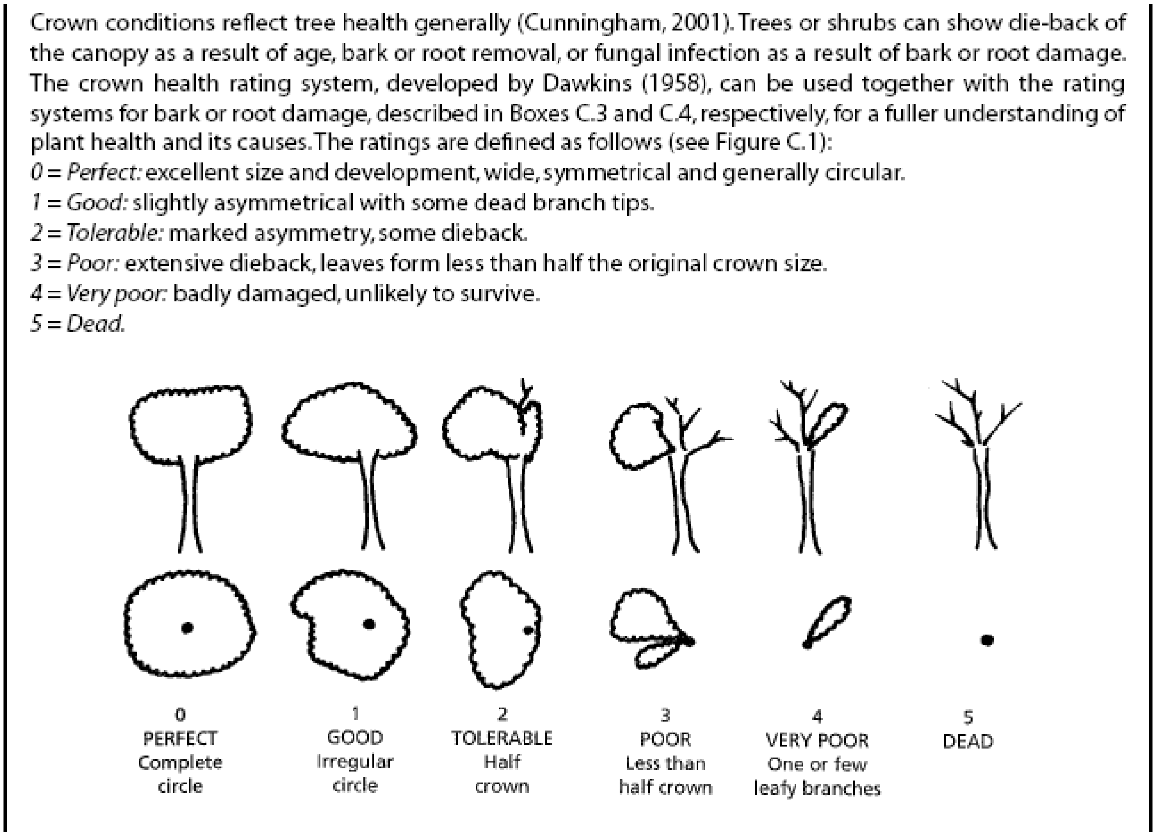
	Task	Notes on methods / related guidance
		an experienced ecologist should be engaged to assist in laying out the plot network.
4.	*Training* Pilot assessments, trials to ensure consistency and accuracy of observations.	Hold field-based workshops to ensure that collectors and other members of the monitoring team understand and properly record the specified observations.
5.	*Field work* Record harvest impact observations for individuals or plots selected.	Observations of harvest impact can be made during the regular harvest period. Visual rating systems for some types of harvest impact (e.g., crown health, bark removal, and root damage) facilitate involvement of collectors in making and recording these observations (see Box 14 and Figures 6-8). <u>Individual plants</u> • Survival and vigour o Signs of mortality / sickness o Evidence of harvest (cut stumps or leaves, bark or root removal) (See Figures 6-8) • Reproduction (number of seeds, fruits produced per individual; aborted flowers, fallen young fruits) • Yield of target resource (e.g., fruit production) by long-lived individuals (periodic monitoring) • Growth rates / growth increments (diameter, length, height, number of stems per clump, percentage ground cover, etc.) • Retrospective observations (Cunningham, 2001, p. 133) • Simulated harvest (control vs increasing, successive levels of harvest, e.g., 25, 50, 75, 100% / 30, 60, 100%) <u>Populations</u> of the target species • Demographic changes in the sample populations. • Shifts in regeneration. • Shifts in yield curves. Plant <u>communities</u> / <u>habitat</u> • Trampling of seedlings, damage to other plants • Changes in species composition, relative abundance and density. • Observed population level changes for: o Pollinators, frugivores, granivores who rely on the target species o Alien and invasive species.
6.	*Field work* Other observations potentially relevant to harvest impact response of target species	Use of additional management techniques vs individual and population growth rates: • Sparing of individuals • Size restrictions • Overstory light management • Thinning • Transplanting • Coppicing

	Task	**Notes on methods / related guidance**
		• Replanting plant parts (seeds or vegetative) Kinds and levels of anthropogenic pressure: • Forest cutting (creation of secondary forest) • Frequency, intensity, time since burning • Types of timber extraction practiced in conjunction with harvest of target species Other pressures: • Fungal / pathogen infestation • Insect attack • Browsing Management of habitat: • Agroforestry • Enrichment planting Impacts on communities • Effects of fruit, seed, and flower harvest / enrichment planting on composition and diversity of frugivores, granivores, pollinators • Creation of habitat for invasive species and other changes in species composition Impacts on ecosystems • Biomass removal and soil nutrient levels • Plant harvest (esp. roots) and soil erosion Costs of different treatments in time, effort, money.
7.	Estimate sustainability of current level of harvest	Data from harvest records (± level of precision), compared with sustainable harvest limit (Step xx). These data can be broken down into different quality classes, different users, different uses, if these data have been recorded. These data can be helpful in distributing the resource harvest equitably among different harvesters.
8.	Monitor harvest impact	Compare data from harvest records with previously collected data. • Destructively harvested resources: yield per unit area a good indicator of resource quantity in the study area. • Non-destructively harvested resources: yield in combination with resource quality, reproduction, growth, survival, vigour indicates harvest impact.
9.	Carry out long-term studies	Some species reallocate stored reserves to growth and reproduction after defoliation and other harvest stress. Short-term studies will therefore not adequately assess harvest impacts over the longer term.

Box 14. Harvest impact assessment methods

Ideally, the effects of harvesting need to be studied on the same sample population over time in established permanent plots, which are periodically resurveyed. In many cases there have been no previous field studies of focal medicinal species and consequently no permanent plots for comparative work. It is useful to establish permanent plots, but harvest protocols can also be developed through assessing harvest impacts along a gradient from places where harvesting impacts are high to where they are low (or absent).

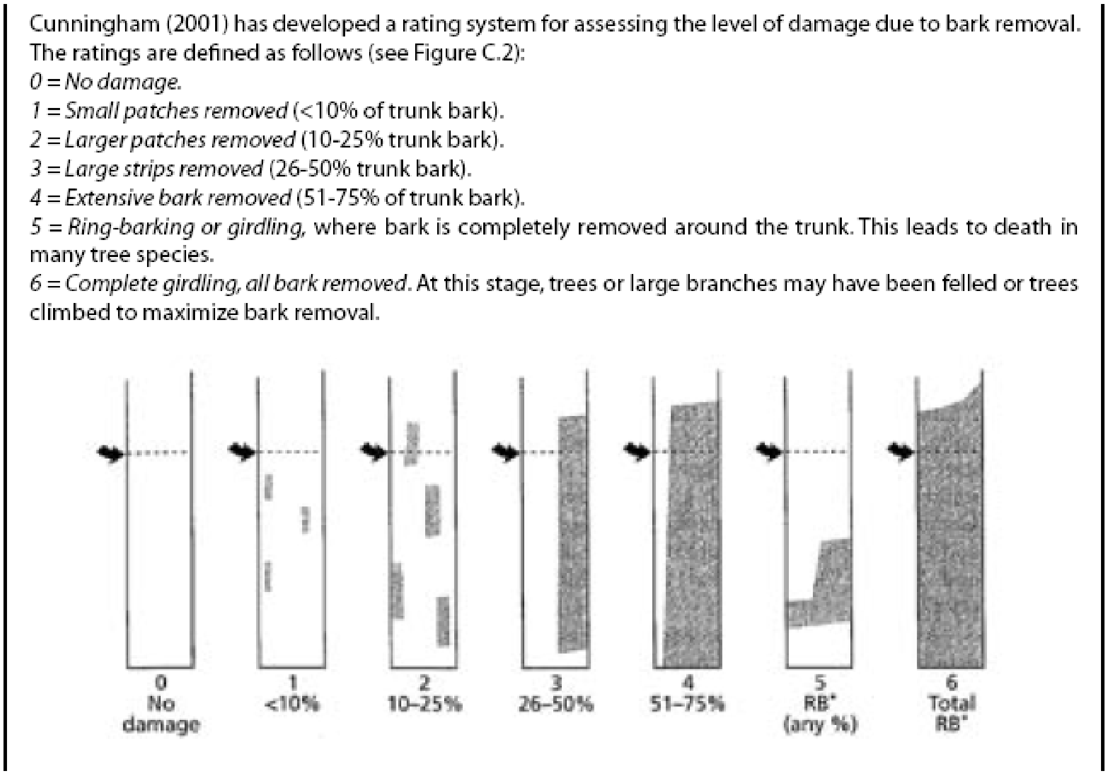
It is often useful to combine quantitative botanical or forestry methods with methods that incorporate the insights of local people, but this can influence your choice of sampling method. If local resource users are involved in resource inventories or monitoring impacts, then it can be worthwhile using systematic sample plots along transects rather than randomly located plots, which local resource users often feel "waste time" (due to the time required to set up the plots). The limitation that this places on statistical analysis due to lack of random plots is often repaid by the insights of local resource users during joint fieldwork. Issues such as size-class selection can be linked to the practical field assessments of stem and leaf harvesting, root removal, bark damage or tree crown condition.



Crown conditions reflect tree health generally (Cunningham, 2001). Trees or shrubs can show die-back of the canopy as a result of age, bark or root removal, or fungal infection as a result of bark or root damage. The crown health rating system, developed by Dawkins (1958), can be used together with the rating systems for bark or root damage, described in Boxes C.3 and C.4, respectively, for a fuller understanding of plant health and its causes. The ratings are defined as follows (see Figure C.1):

0 = Perfect: excellent size and development, wide, symmetrical and generally circular.
1 = Good: slightly asymmetrical with some dead branch tips.
2 = Tolerable: marked asymmetry, some dieback.
3 = Poor: extensive dieback, leaves form less than half the original crown size.
4 = Very poor: badly damaged, unlikely to survive.
5 = Dead.

Figure 6. A visual rating system for tree crown health. (Source: Stockdale, 2005, from Cunningham, 2001, based on Dawkins, 1958).



Cunningham (2001) has developed a rating system for assessing the level of damage due to bark removal. The ratings are defined as follows (see Figure C.2):

0 = No damage.

1 = Small patches removed (<10% of trunk bark).

2 = Larger patches removed (10-25% trunk bark).

3 = Large strips removed (26-50% trunk bark).

4 = Extensive bark removed (51-75% of trunk bark).

5 = Ring-barking or girdling, where bark is completely removed around the trunk. This leads to death in many tree species.

6 = Complete girdling, all bark removed. At this stage, trees or large branches may have been felled or trees climbed to maximize bark removal.

Figure 7. A visual rating system for bark damage (Source: Stockdale, 2005, from Cunningham, 2001).

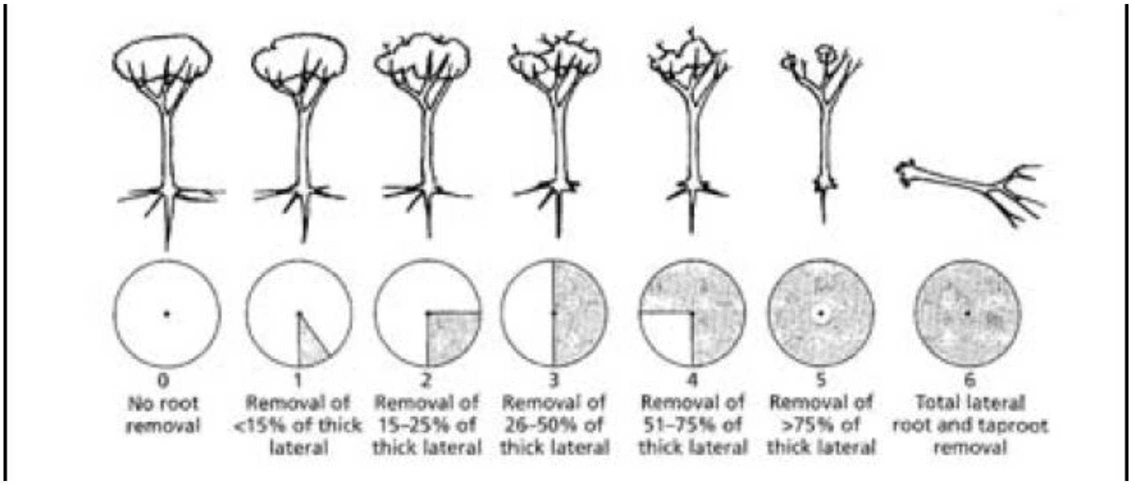


Figure 8. A visual rating system for root damage. (Source: Stockdale, 2005, from Cunningham, 2001).

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STEP 5. PERIODIC MONITORING AND HARVEST ADJUSTMENTS

The central questions for monitoring and harvest adjustments, in the context of the ISSC-MAP, are:

> **Is the management action (harvest protocol) successful in sustaining harvest quality and quantity?**
>
> **Is the target resource maintaining base-line yields and population regeneration?**
>
> **What adjustments can / should be made to allowed harvest protocols to maintain resource quality and quantity for future collection cycles, and to avoid undesired impacts on the target resource and the environment?**

Monitoring provides periodic qualitative and quantitative information about:

- yield, growth, and vigor of harvested (long-lived, non-destructively harvested) individuals in response to harvest and other impacts;
- yield and regeneration of the target resource population in response to harvest and other impacts; and
- sustainability of the collection operation using the current harvest protocols.

Caution: if conservation status assessment of the target species (see Step 1) indicates that the species is threatened (small or declining populations, increasing fragmentation and habitat degradation, etc.), the base-line inventory, yield, and regeneration data cannot be treated as those of stable and self-sustaining populations. Adjustments of harvest protocols and other management interventions must have reducing harvest impacts and increasing yields / regeneration to sustainable levels as their principal objectives.

A summary of procedures for periodic monitoring and making harvest adjustments is outlined in Table 8. Important things to consider include:

- the purpose of monitoring;
- participatory monitoring by the harvester community (see Box 15); and
- third-party monitoring for certification / consumer assurance.

Table 8. Summary of procedures for periodic monitoring and harvest adjustments

	Task	Notes on methods / related guidance
1.	*Planning* Design a monitoring plan	• Define monitoring objectives • Select monitoring indicators • Decide on methods for measuring and monitoring indicators • Develop a plan for monitoring and evaluation activities
2.	*Field work* Monitor target resource individuals and	• Focus on target resources (individuals) included in normal harvest activities

	Task	Notes on methods / related guidance
	populations	• Include any additional target resource populations selected for monitoring
3.	*Field work* Monitor and record relevant environmental conditions	Keep site-specific records of: • Temperature and rainfall • Fire, grazing, and other disturbances
4.	*Paper work* Keep harvest records	Harvest records should include: • Amount of targeted resource harvested (% of yield) • Quality of target resource • Harvesting practices used • Observations of harvest impacts <u>Destructively harvested resources</u>: • Yield per unit effort: quantity harvested vs time spent looking for harvestable individuals or distance walked between harvestable individuals <u>Non-destructively harvested resources</u>: • Permanently marked resources, monitored for harvesting practices, yield, quality, reproduction, growth, regeneration / survival, vigour.
5.	*Analysis* Estimate current harvest level	Relevant information includes: • Quantity requested by buyer • Quantity harvested (different sites, age & size-classes, etc.) • Quality of material harvested (size, colour, flavour, shape, etc.) (different sites, age & size-classes, etc.) • Quantity/quality sold • End use(s)
6.	*Adaptive management* Make adjustments to the harvest protocol if required	Given the following conditions, current harvest levels and protocols can be considered sustainable: • The global and local populations of the target resource are not threatened (See Step 1, IUCN categories and criteria) • Regeneration studies and monitoring indicate that seedling / sapling densities remain equal to or above baseline levels • Yield studies indicate that availability of the target resource is not decreasing • Harvest assessments indicate that vigour, productivity, and other factors are not a concern If any of the above conditions are negative (loss of vigour, decreased productivity, reduced regeneration or yield), adjustments must be made in the frequency, intensity, and/or manner of harvest. Possible adjustments include: • Reduce the number or alter the size-class of harvested individuals; • Reduce the proportion of the collection area harvested in a given season;

	Task	Notes on methods / related guidance
		• Adjust harvest methods to make them less damaging to individual plants or the surrounding habitat.
7.	*Monitoring, field work* Carry out long-term studies	• Some species reallocate stored reserves to growth and reproduction after defoliation and other harvest stress. Short-term studies will therefore not adequately assess harvest impacts over the longer term. • Changes in other factors (settlement, land-use changes chance events such as fire, annual climate variations and climate change, etc.) can also affect yield and regeneration.

Box 15. What ecological, economic conditions favour participatory monitoring?

There are many cases where a long history of medicinal plant harvest is reflected in traditional / local collector knowledge of the resource (an example involving *Nardostachys grandiflora* and *Neopicrorhiza scrophulariiflora* is described by Ghimire et al., 2004). This knowledge represents a useful resource for participatory monitoring as well as the option of "data-less management" (Johannes, 1989). These may provide cost-effective alternatives to professional monitoring, but will require expert evaluation for verification that the ISSC-MAP criteria are being met. To help with decision-making on the effectiveness of participatory monitoring programs compared with options such as harvest closure or unmonitored exploitation, Hockley et al (2005) developed a framework for determining when stakeholders could be expected to adopt monitoring programs and how much they may be expected to contribute. In doing so, they asked several key questions, which are equally relevant to medicinal plant monitoring and management:

- Under what ecological and economic conditions will local communities want to manage and monitor their resources?
- If these conditions are met, are local communities are able to establish institutions to undertake monitoring and management?
- When is it desirable that local stakeholders should monitor (i.e., not just when people will have the incentive to monitor)?

The main factors influencing stakeholder "Willingness to Contribute (WTC)" were: **resource values** (cultural values and the lost opportunity costs of sustainable harvests (or not harvesting) compared to over-exploitation), **security of resource tenure**, **vulnerability to overexploitation**, **ease of monitoring** and finally, whether monitoring and management did improve yields (i.e.: **what benefits were there**?). Resilient resources benefited little from monitoring and management. Nor was there WTC to monitoring and management of highly vulnerable resources with low sustainable yields that required intensive monitoring and management. In testing their decision framework on a high value (freshwater crayfish) resource harvested by local people in Madagascar, Hockley et al (2005) found that a monitoring programme with sufficient statistical power to detect declines would be extremely costly in terms of local people's effort. As a result, they concluded that stakeholders WTC was unlikely to be high enough to make direct monitoring crayfish populations a viable option. Catch Per Unit Effort (CPUE) methods, on the other hand, could yield useful results, but were poor at detecting declines and could be misleading. Similar conclusions are likely for medicinal plants: what is most likely to succeed is participatory monitoring of high value, less vulnerable species that are relatively easy to monitor. (See Table 3)

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CONCLUSION: RESOURCE ASSESSMENT AND MANAGEMENT PLANNING

Resource assessment is an essential part of managing a sustainable wild-collection project or commercial operation. Resource assessment supports the development of collection protocols that do not deplete harvested populations of the target resource or damage their long-term survival.

Some wild-collection operations may need to develop stand-alone management plans. In many cases, however, a management plan for a target resource will need to connect with a larger management framework, such as an existing multi-species area management plan. Within any scale of management framework, however, the resource assessment should:

- document and define sustainable yield, regeneration, and harvest levels
- describe the methods used to determine these values, as well as their accuracy and precision;
- specify sustainable collection protocols, including collection limits, frequency, intensity, and methods;
- describe how specified protocols will be adopted, encouraged, or enforced;
- set out a schedule of monitoring and review of collection protocols;
- document harvest adjustments made over time, and why; and
- assign responsibilities, including those of local communities and collectors, for each part of the resource assessment process
- estimate the associated costs and provide a financial mechanism to cover them.

A management plan that fulfills these expectations will need to be written down. For most organized commercial operations, this will be essential. Commercial wild-collection that relies on a large number of small-scale collector groups or individual collectors will find a written management plan to be a larger challenge. Local harvesters rarely make formal written management plans. However, there can be advantages for them to do so. Developing a management plan enables stakeholders to communicate their planned management approach to people not as actively involved in the decision-making process (a third-party certifier, for example). However, recording a plan in a written document may challenge traditional ways of transmitting knowledge and alter power relations in favour of those with a formal education. Moreover, developing a management plan may prove too challenging for the existing resources or capacities in the community. Developing and implementing a management plan that meets requirements for sustainable wild collection under these circumstances will require participatory methods, financial support, and long-term commitment from all involved.

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GLOSSARY

Bark (stem / twig)	overlaying wood as the outer layer of stems, branches and roots of woody plants, namely trees. It usually consists of three layers: cork, phloem and vascular cambium
Collection area	= management area
Cryptic species	a cryptic species complex is a group of species which satisfy the biological definition of species, that is, they are reproductively isolated from each other, but they are not morphologically distinguishable (or at least are not readily or reliably distinguishable on a morphological basis)
Dioecious species	Male and female flowers on separate plants
Exudates	include gums, rubber, resin, balsam, and plant sap; exudates extracted from plant parts after harvest are treated as the respective plant part or plant part group
Geophyte	Plants with underground storage organs
Herb	refers to the aerial plant part of herbaceous MAP, and to (annual) vegetative, green or soft shoots of woody MAP
Leaf	above-ground plant part used for photosynthesis; plant organs of respiration and transpiration
Method	A means or manner of procedure, especially a regular and systematic way of accomplishing something. Orderly arrangement of parts and steps to accomplish an end.
Monocarpic species	Plant species that flowers and sets seed only once during its life cycle.
Monoecious species	Male and female flowers on different parts of the same plant
Population structure	Size-class distribution of a population
Procedure	A method or manner of proceeding; a way of performing or effecting something.
Protocol	A plan, as for a scientific experiment; or a code of conduct.
Recovery time	The time required for plants to grow from seed to a specified (e.g., harvestable) size.
Recruitment	Addition of new individuals to a population (for plants, by growth and reproduction)
Regeneration	Replacement or repair of tissues or organs lost through damage (e.g., harvest); used commonly to refer to vegetative propagation in plants.
Reproductive parts	include all organs and parts of inflorescences and flowers at all different stages from flowering to fruiting; e.g., calyx, petal, stamen, pistil, fruit, and seeds
Resource abundance	The total number of resources in a specified area.
Resource density	The number of resources per unit area.
Resource inventory	An estimate of the quantity of a resource population in a specified area.
Size-class	A division or group within a sample population defined by a size range (e.g., diameter, height)
Strategy	A plan of action intended to accomplish a specific goal.
Stratagem	A clever, often underhanded scheme for achieving an objective.
Underground parts	depending on harvesting methods, it is further divided into two groups: (1) partial harvest possible (e.g. rhizomes), and (2) partial harvest impossible (e.g. often in the case of bulbs)
Whole plant	includes the aerial and the underground part of a plant
Wood (stem / twig)	solid material derived from the stems, branches, and roots of woody plants, namely trees and shrubs; wood is mostly secondary xylem and consists of cellulose, hemi-cellulose and lignin

ANNEX 1.
SITUATION ANALYSIS QUESTIONNAIRE FOR ISSC-MAP IMPLEMENTATION

The following sets of questions are related to each section, principle, and criterion of the ISSC-MAP (MPSG, 2007).

- These questions indicate the scope of the situation analysis needed to prepare for management planning, including the elements of management planning that address conservation status assessment and resource assessment.
- Each project may adapt this approach to the specific project situation.
- Some of these questions may be answered through literature reviews. Others will likely require interviews with resource management authorities / government officials, traders, collectors, and affected communities.
- Participatory processes are encouraged.
- These questions provide a useful framework for a situation analysis report for implementation projects.

SECTION 1: WILD COLLECTION AND CONSERVATION REQUIREMENTS

Principle 1. Maintaining Wild MAP Resources

Wild collection of MAP resources shall be conducted at a scale and rate and in a manner that maintains populations and species over the long term.

1.1 Conservation status of target MAP species

The conservation status of target MAP species and populations is assessed and regularly reviewed.

- What is the conservation status of this species (national, regional or global)?
- How recent is this assessment?
- Have any population assessments been conducted (collection area, national, regional or global)?

1.2 Knowledge-based collection practices

MAP collection and management practices are based on adequate identification, inventory, assessment, and monitoring of the target species and collection impacts.

- What collection and management practices are in place for this species (this must capture any formal and community based management systems whether functional or defunct)?
- How is this species identified (need to find out if there is any taxonomic confusion)?
- Have any inventories or assessments of this species been conducted (e.g. is the collection area well defined)?
- Is there any ongoing monitoring of this species?

1.3 Collection intensity and species regeneration

The rate (intensity and frequency) of MAP collection does not exceed the target species' ability to regenerate over the long term.

- Is the harvest volume known and monitored (e.g. trade studies, harvest monitoring results)?
- Is there any known illegal/unmonitored trade
- Have any species regeneration assessments been conducted?
- Have any assessments into the long-term sustainability been conducted?

Principle 2. Preventing Negative Environmental Impacts

Negative impacts caused by MAP collection activities on other wild species, the collection area, and neighbouring areas shall be prevented.

2.1 Sensitive taxa and habitats

Rare, threatened, and endangered species and habitats that are likely to be affected by MAP collection and management are identified and protected.

- Are current collection practices known to negatively impact on other species or habitats?
- Does the collection area contain or overlap with any protected species (i.t.o. national, regional or international laws)?
- Does the collection area contain or overlap with IUCN Red List species?

2.2 Habitat (landscape level) management

Management activities supporting wild MAP collection do not adversely affect ecosystem diversity, processes, and functions.

- Are current collection practices known to negatively impact on the functioning of the MAP eco-system?

SECTION II: LEGAL AND ETHICAL REQUIREMENTS

Principle 3. Complying with Laws, Regulations, and Agreements

MAP collection and management activities shall be carried out under legitimate tenure arrangements, and comply with relevant laws, regulations, and agreements.

3.1 Tenure, management authority, and use rights

Collectors and managers have a clear and recognized right and authority to use and manage the target MAP resources.

- What is the land tenure regime in the areas where this species is being harvested (e.g. communal land, private land, etc)?
- Who is carrying out the harvesting (e.g. local people in the communal areas, employees of landowners, external traders etc.)?
- Who has the authority to authorise and manage collection?

3.2 Laws, regulations, and administrative requirements

Collection and management of MAP resources complies with all international agreements and with national, and local laws, regulations, and administrative requirements, including those related to protected species and areas.

- What is the permit system used for the harvesting of and trade in this species?
- Are there any problems with the current permit system?
- Are there any ways in which the permit system could be improved?
- Is there any unmonitored, unregulated or illegal harvest and trade?

Principle 4. Respecting Customary Rights

Local communities' and indigenous peoples' customary rights to use and manage collection areas and wild collected MAP resources shall be recognized and respected.

4.1 Traditional use, access rights, and cultural heritage

Local communities and indigenous people with legal or customary tenure or use rights maintain control, to the extent necessary to protect their rights or resources, over MAP collection operations.

- Are there any customary rights of access to the species (what are they)?
- If so, are these protected or honoured in the existing management or harvest regime (describe)?
- Are there any conflicts in relation to these customary rights (describe)?

4.2 Benefit sharing

Agreements with local communities and indigenous people are based on appropriate and adequate knowledge of MAP resource tenure, management requirements, and resource value.

- Are there any use (e.g. harvest, commercial, research or traditional) agreements in place with local communities?
- If so, what is the legal basis for these agreements (e.g. national, provincial, municipal or traditional)?

SECTION III: MANAGEMENT AND BUSINESS REQUIREMENTS

Principle 5. Applying Responsible Management Practices

Wild collection of MAP species shall be based on adaptive, practical, participatory, and transparent management practices.

5.1 Species / area management plan

A species / area management plan defines adaptive, practical management processes and good collection practices.

If answer to Q.1.2 confirms that there is a management plan then:

- Describe the management plan? (make sure answer includes reference to adaptive, practical and GCP’s!)

5.2 Inventory, assessment, and monitoring

Management of MAP wild collection is supported by adequate and practical resource inventory, assessment, and monitoring of collection impacts.

- Describe the resource inventory and monitoring systems in place for this species?

5.3 Transparency and participation

MAP collection activities are carried out in a transparent manner with respect to management planning and implementation, recording and sharing information, and involving stakeholders.

- Who is involved in the management planning process and its implementation?
- Describe how these management plans are reviewed and revised?
- How do stakeholders participate in the day-to-day implementation of the management plan (need to find out specifically how affected communities, collectors, middlemen are involved)?

5.4 Documentation

Procedures for collecting, managing, and sharing information required for effective collection management are established and carried out.

- What are the procedures for collecting and sharing information required for implementing the management plan.

Principle 6. Applying Responsible Business Practices

Wild collection of wild MAP resources shall be undertaken to support quality, financial, and labour requirements of the market without sacrificing sustainability of the resource.

6.1 Market / buyer specifications

The sustainable collection and handling of MAP resources is managed and planned according to market requirements in order to prevent or minimise the collection of products unlikely to be sold.

- Is the collection of the species following specific volume and quality instructions from the buyer?
- If not, how do collectors decide how much and what quality of material required
- Further questions you could ask:
    - How is processing carried out by the harvesters before the material is sold?
    - What is the quality sold by the collectors?
    - Are there any problems with quality (e.g., insufficiently dried, dirty, includes taproots, confusion with other species during collection)?
    - How are these problems currently dealt with?

6.2 Traceability

Storage and handling of MAP resources is managed to support traceability to collection area.

- Are the main stages in the commodity chain from harvesting to export or sale known and documented (e.g. harvesters in the communal areas sell to buyers, who export directly, or sell to exporters)?
- Identify the main actors in the commodity chain (e.g. harvesters in North West Province, harvesters sell to company X or company Y.)
- Can the processed medicinal product in the market place be traced back to its point of collection?

6.3 Financial viability

Mechanisms are encouraged to ensure the financial viability of systems of sustainable wild collection of MAP resources.

- What are the current arrangements for purchasing the target resource from harvesters?
- What are the prices received by collectors / middle traders / wholesalers/exporters?
- Is it possible for collectors to ask higher prices for better managed and higher quality material in the current market situation? (e.g, are there very few sources of the material for the buyers, or do the collectors have to compete with many other collection sources?
- How is the price determined?

6.4 Training and capacity building

Resource managers and collectors have adequate skills (training, supervision, experience) to implement the provisions of the management plan, and to comply with the requirements of this standard.

- What are the strengths and weaknesses / gaps in the current knowledge and skills of resource managers (resource management authority, collection operation) in:
    - Resource assessment and monitoring?
    - Adaptive management process?
    - Participatory processes (working with collectors to assess and monitor harvest impacts)?

6.5 Worker safety and compensation

MAP collection management provides adequate work-related health, safety, and financial compensation to collectors and other workers

- What are the working conditions of the collectors?
- Are there health, safety, and economic risks associated with collection of this resource? What are they?
- How are illness, injury, financial losses related to collection of this resource handled, and by whom?

ANNEX 2. IUCN RED LIST CATEGORIES

EXTINCT (EX)

A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.

EXTINCT IN THE WILD (EW)

A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.

CRITICALLY ENDANGERED (CR)

A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Section V), and it is therefore considered to be facing an extremely high risk of extinction in the wild.

ENDANGERED (EN)

A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V), and it is therefore considered to be facing a very high risk of extinction in the wild.

VULNERABLE (VU)

A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Section V), and it is therefore considered to be facing a high risk of extinction in the wild.

NEAR THREATENED (NT)

A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

LEAST CONCERN (LC)

A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.

DATA DEFICIENT (DD)

A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available.

In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.

NOT EVALUATED (NE)

A taxon is Not Evaluated when it is has not yet been evaluated against the criteria.

Source: IUCN (2001)

ANNEX 3. LOCATION AND ARRANGEMENT OF SAMPLING SITES FOR RESOURCE ASSESSMENT AND MONITORING

Sampling option	Relevant tools & methods	Advantages	Disadvantages (cautions)	Supporting guidance and information sources
Type of sampling area	Plots: square, rectangular, or circle	More efficient in capturing / characterizing diverse vegetation types or varied vegetation Easier to create larger sample sizes	Frustrating to local resource users / collectors participating in inventory and monitoring – individuals of the target species left out of sample plots Plots on sloping ground – location and measurements need to corrected for slope – the distance along a slope is greater than the corresponding horizontal distance)	Campbell 1989 Durr et al., 1988 In: Cunningham, 2001, pp. 163-64
	Square / rectangular		More plot perimeter (edge) effects per unit area sampled Greater chance of bias / error in deciding which individual plants on the border are "in" or "out" Measurements need to be taken more carefully	Peters 1996
	Circle plots	Least edge effects		

Sampling option	Relevant tools & methods	Advantages	Disadvantages (cautions)	Supporting guidance and information sources
	Transcripts • Belt transects allow sampling of vegetation at equal distances on both sides of a transect line	More habitats covered Inventory more representative of study area – cover a wider spectrum of microhabitats, allowing detection of subtle changes density or structure of sample populations Widely used method Accessibility: Narrow transects at right angles to a forest path Apparently preferred by local resource users	Edge effects Less efficient: sample size = 1 Need more short transects rather than a few long ones to enable statistical analysis	Cunningham, 2001, p. 161
	Point-centred quarter (PCQ) – determines patterns of species distribution from analysis of associated plants within patches = near-neighbour analysis	Enables sampling of micro-habitats Efficient in characterizing vegetation Minimizes damage to forest understory	No permanent plots or transects, therefore does not cover an exact area each time. Species richness is not related to area sampled Only 4 trees/sampling interval Labour intensive if large sample sizes are needed for statistical analysis	Cunningham, 2001, p. 162 / fig. 5.7a Campbell 1989
Arrangement of sample plots / transects Size of plots / length of transects	Random – selected by drawing numbers from a hat, using a random number table	Avoids bias Better for statistical analysis	Time consuming to locate, esp. in rough, forested terrain	Cunningham, 2001, p. 162

Sampling option	**Relevant tools & methods**	**Advantages**	**Disadvantages (cautions)**	**Supporting guidance and information sources**
	Systematic – arranged at regular intervals following a set pattern	Quicker and easier to locate for resampling	Acceptable for statistical analysis in situations where the individual plants are randomly distributed, but this rarely occurs in nature. Statistical assessment of precision or sampling error is not possible.	Peters 1996
	Stratified random			
	Depends on size and abundance of species and individuals in the target populations			
	Larger number of small plots / transects (more replicate plots)	Better for sampling target species in which small size-classes are preferred / collected Small plants with low populations density Better for statistical analysis	Labour intensive Greater chance of error in estimates of plant density If plots are too small, may get many plots without any individuals of the target species	
	Fewer but larger plots / transects	Better for target species in which the minimum cut-off size-class for sampling is relatively large (larger dbh) e.g., large trees Less time consuming Less error	Less statistical accuracy If plots are too large, too much time is required to sample all individuals of the target species in the relevant size-classes.	

Sampling option	**Relevant tools & methods**	**Advantages**	**Disadvantages (cautions)**	**Supporting guidance and information sources**
	Tiered plots (combine larger plots with smaller sub-samples within each plot)	Smaller diameter size classes can be more readily included Allows for equal amount of time spent sampling each of the relevant size classes.		Alder and Synott 1992
Sampling intensity – number of sampling units	Less intense (e.g., forest surveys, 5-10 % common)	Less precise	May not achieve appropriate level of precision	
	More intense	More precise	May not be required to achieve appropriate level of precision Require a random sampling design	Philip 1994 Peters 1996
Combining different types of studies requiring sampling	Inventory + yield studies • All relevant resources of harvestable size included in yield study • Systematic sub-sample included in yield study	Can save time, effort, and other costs if well planned	Yield study samples may not be: • objectively drawn from the sample resource population (systematic or random) enumerated in the inventory • evenly distributed across the management area • drawn in equal numbers from the relevant age / size-classes, vetation types, etc.. Additional sampling for yield study may be needed after the inventory is completed	Stockdale (2005)

Sampling option	**Relevant tools & methods**	**Advantages**	**Disadvantages (cautions)**	**Supporting guidance and information sources**
	Yield studies + on-going harvest of target resource	• Harvested resources are not wasted • Real-life harvesting practices are used	• Too many resources may be sampled from locations, age / size-classes, etc., and not enough from others. • Sampling may not be evenly distributed across the management area; • Additional sampling may be needed.	Stockdale (2005)
Statistical analysis		•		Sokal and Rohlf (1987); Zar (1998)

Source: Cunningham (2001) chapters 2 & 6

ANNEX 4. MEASUREMENTS USED FOR DIFFERENT RESOURCE TYPES AND PLANT FORMS

Resource type / plant part	Age	Size-class	Yield	Impacts of harvesting	"Typical" harvest protocols
Leaves	Time to die-off of marked / tagged new leaves	Length Petiole width		Experimental defoliation: effects of defoliation levels (eg., control, 30, 60, 100 percent) on growth rates (e.g., leaf size and production rate) of different size-classes. (Cunningham, 2001)	Specified % of the average annual biomass production of the individuals of each size class every xth year..
Fruits, flowers, seeds				Population level - of most concern for commercial harvest of reseeder plants that are dioecious or monocarpic Population level if whole plant is removed (of most concern for tall, difficult to reach) Individual level effects if branches are pruned. Philips (1993)	Monocarpics: seeds, fruit, flowers are allowed to be harvested from <u>specified % of all flowering individuals</u> every year; or specified % of seed, fruit, flowers produced in 1 year can be harvested
Exudates (gums, resins, latexes)				• Few studies • Bark and root tapping: Individual level, damage to bark layer, growth rates under different tapping frequencies and intensities, reproduction • Fruit: population level	
Bark	See woody trees	See woody trees	Thickness	• Point-scale rating of visible bark damage vs dbh.	Specified % of the average annual biomass production of

Resource type / plant part	**Age**	**Size-class**	**Yield**	**Impacts of harvesting**	**"Typical" harvest protocols**
				(Cunningham, 2001)	the individuals of each size class each xth year.
Stems / branches				Regeneration rates from seed, resprouting	Specified %of the average annual biomass production of the individuals of each size class each xth year.
Whole plant / apical meristem					Target plant parts of individuals ≥ minimum age class are allowed to be harvested Target plant parts of specified % of each size class are allowed to be harvested, every x years; x = time to reach minimum age class
Roots, bulbs, tubers, corms	Annual rings in perennial corms Leaf-base counts from longitudinal sections of bulbs Spent remains of annual corns and stem tubers	Diameter (growth is outward with age)		Few studies Field rating scale for root damage (recent harvest) vs dbh.	Specified % of the average annual biomass production of the individuals of each size class each xth year.
Woody trees	Annual rings in wood cores	Diameter at breast height (dbh) = 1.3 m from ground (but see Cunningham, 2001, on tough		Rating scale for crown die-back (effect of bark or root damange) Non-destructive sampling methods in woody trees (Swart, 1980).	

Resource type / plant part	Age	Size-class	Yield	Impacts of harvesting	"Typical" harvest protocols
		customers) Canopy diameter			
Palms, cycads, grass trees, tree ferns, grasses	Leaf scars + known leaf production rate Stem height, length indicate plant age, but also growing conditions	Height, length (apical meristem grows upwards)		Palms well studied Retrospective counts of harvested leaves (Cunningham, 2001)	
Climbing palms, grasses		Length (rather than height, as much of the growth may be horizontal) Bamboo: diameter at a specific internode (e.g., 5th internode from the base) and height	Rattan: estimate of total length, converted to total wet weight using size-class specific conversion factors (Stockdale et al., 2003)		
Lianas / vines		Length and diameter			
Shrubs		Height and dbh			
Herbs		Height (most common)			Annuals: Target plant parts are allowed to be harvested from specified % of the total harvestable yield every year.

Resource type / plant part	**Age**	**Size-class**	**Yield**	**Impacts of harvesting**	**"Typical" harvest protocols**
					Biennials: Target plant parts are allowed to be harvested from <u>specified % of the total harvestable yield</u> every second year.
Special cases: clonal species, monocarpics, Fungi, etc.		Clonal species: clumps, stems, outer diameter, etc (Sutherland, 1996) in Stockdale 2005			Monocarpics: seeds, fruit, flowers are allowed to be harvested from <u>specified % of all flowering individuals</u> every year; or specified % of seed, fruit, flowers produced in 1 year can be harvested.

Sources: Cunningham (2001), Stockdale (2005), Lange (unpublished)

ANNEX 5. EQUIPMENT AND CAPACITY NEEDED FOR RESOURCE ASSSESSMENTS

Main skills required (Cunningham, 2001):

- Understanding what you see in the field
- Understanding what you hear from local resource users/harvesters
- Knowing key measurements needed to predict supply and monitor impact

(Source: Stockdale 2005)

Equipment and skills	**Situation analysis**	**Base-line inventory**	**Yield studies**	**Regeneration studies**	**Harvest assessments**	**Monitoring**
To establish and mark permanent plots and plants						
Scale map of the collection / management area	X	X		X	X	X
GPS recorder	Opt	Opt		Opt	Opt	Opt
Compass		X		X	X	X
Clinometer (to correct for slope)	Opt	Opt		Opt	Opt	
Surveyor's chain or nylon rope (30-50 m, marked in decimeters and meters)		X		X	X	
Compass staff and survey sticks		X		X	X	X
Bush knife	X	X		X	X	X
Durable wooden posts with metal tags (or metal stakes, PVC plastic pipes, or concrete beacons)		X		X	X	
Exterior grade emulsion (water-base) paint and/or metal alloy tags attached with metal wire (copper) or corrosion-resistant alloy nails		X		X	X	X
To measure plants						
Exterior grade emulsion (water-base) paint to mark the point of measurement		X			X	X
3 meter diameter at breast height (dbh) tape		X			X	X
Calipers (to measure the diameter of small stems)		X		X	X	X
Telescopic height stick (or long pole, marked in decimeters and meters)		X		X	X	X
Meter tape (10-30 m long)		X		X	X	X
Ruler (to estimate height)		X			X	X
Clinometer (to estimate height)		Opt			Opt	
Weighing scales		X			X	X
Binoculars		X			X	X
To record data						
Pencils and notebooks (or clipboards with data sheets)	X	X		X	X	X
To analyze data						
Calculator		X		X	X	X
Computer with spreadsheet software		Opt		Opt	Opt	Opt
Skills						
Planning and designing plots and tests		X		X	X	X
Statistical survey design and analysis		X	X	X	X	X
Taxonomy	X	X		X		
Plant ecology	X	X	X	X	X	X
Participatory research methods	X	X	X	X	X	X

NDF WORKSHOP
WG 2 – Perennials
CASE STUDY 4 SUMMARY
ISSC-MAP
Original language – English

ELEMENTS OF ISSC-MAP RESOURCE ASSESSMENT GUIDANCE RELEVANT TO CITES NDF

AUTHOR
Danna J. Leaman

Overview and background

The International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP, www.floraweb.de/proxy/floraweb/map-pro/) has been developed to understand whether wild collection activities for medicinal and aromatic plants (MAP) are sustainable, and how to improve collection and resource management operations that are detrimental to the long-term survival of these resources. The ISSC-MAP is itself a generic set of principles and criteria intended for use in a wide range of circumstances. The focus of the ISSC-MAP is on the ecological sustainability of wild plant populations and species in their natural habitat, but it also addresses the social and economic context of sustainable use. Pilot projects applying the ISSC-MAP to a range of species, countries, and implementation strategies are currently underway in China, Cambodia, Nepal, India, Ukraine, Bosnia and Herzegovina, Brazil, and Lesotho.

Elements of ISSC-MAP relevant to CITES NDF

Principles 1 and 2, and partly also Principles 3 and 5, correspond with the mandate for CITES NDF. The criteria and indicators underpinning these principles and their applicability for the CITES NDF will be demonstrated and discussed during the Cancun workshop.

ISSC-MAP Resource Assessment Guidance relevant to CITES NDF

The structure, content, and implementation of ISSC-MAP may contribute to CITES NDF for medicinal and aromatic plants as well as for a broader range of commercially important wild-collected plant species traded internationally for use in non-timber products.

Resource assessment guidance developed to facilitate implementation of ISSC-MAP Principle 1 (“Maintaining wild MAP resources”) provides a useful methodological framework for field-based studies intended to support CITES non-detriment findings. This guidance elaborates five basic steps needed to design and carry out a resource assessment and monitoring process that meets the requirements of ISSC-MAP, using participatory and adaptive management approaches. These five steps will be explained in and discussed at the Cancun meeting:

- **Step 1.** Situation analysis to gather and evaluate existing knowledge about target or candidate species and the collection situation;
- **Step 2.** Base-line inventory to understand how much of the target/selected species is present within the collection area;
- **Step 3.** Yield and regeneration studies to understand how much of the desired raw material / plant part(s) the target species produces under natural conditions, the time required for seedlings to replace harvested individual plants and size-classes, and how productivity and regeneration vary across the collection / management area;
- **Step 4.** Assessment of harvest impacts to determine whether current harvest levels and controls are resulting in adequate resource regeneration and productivity; and
- **Step 5.** Periodic monitoring and harvest adjustments to revise the harvest protocol if the intensity, frequency, timing, and methods of harvest are not sustainable.

THE INTERNATIONAL STANDARD FOR SUSTAINABLE WILD COLLECTION OF MEDICINAL AND AROMATIC PLANTS (ISSC-MAP)

Elements of ISSC-MAP Resource Assessment Guidance Relevant to CITES Non-detriment Findings

International Expert Workshop on CITES Non-Detriment Findings

Cancun, Mexico, 17-22 November 2008

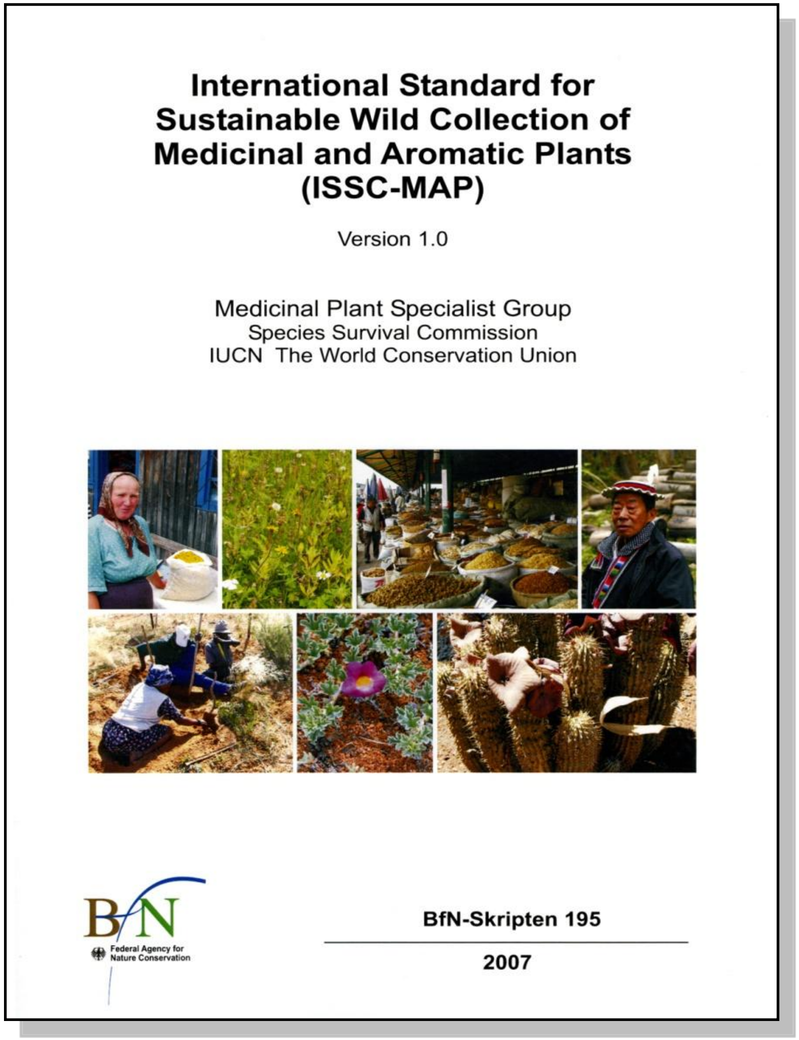
Danna J Leaman
Chair, IUCN SSC Medicinal Plant Specialist Group

Overview

- Background of ISSC-MAP
- Synergies between CITES NDF and ISSC-MAP
- Resource Assessment
  - 5 steps proposed and revised

Background of ISSC-MAP

International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP)



International Standard for
Sustainable Wild Collection of
Medicinal and Aromatic Plants
(ISSC-MAP)

Version 1.0

Medicinal Plant Specialist Group
Species Survival Commission
IUCN The World Conservation Union

BfN
Federal Agency for Nature Conservation

BfN-Skripten 195

2007

Wild collection and conservation requirements:

Resource and habitat assessment and management

Legal and ethical requirements:

Resource tenure, access and benefit sharing

Responsible management and business practices

International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants

BfN Bundesamt für Naturschutz
WWF
TRAFFIC the wildlife trade monitoring network
IUCN
Silphion
MEDICINAL
PLANT
SPECIALIST
GROUP
FRLHT
control IMO
Traditional Medicinals

ISSC-MAP Version 1.0

6 Principles + Criteria and Indicators

Main focus

Maintaining Wild Map Resources

Preventing Negative Environmental Impacts

Wild collection and conservation requirements

Compliance with Laws, Regulations, and Agreements

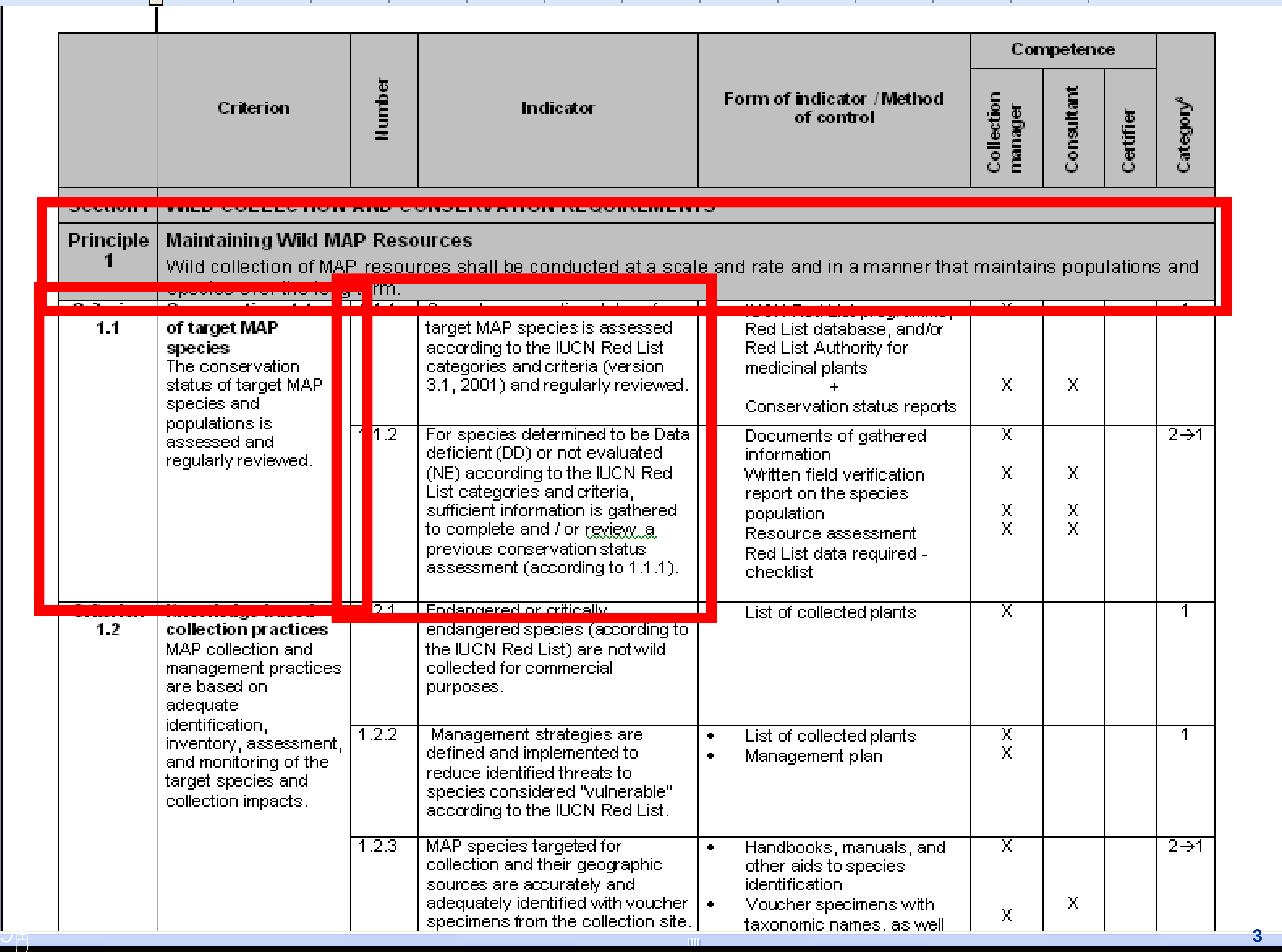
Respecting Customary Rights

Legal and ethical requirements

Applying Responsible Management Practices

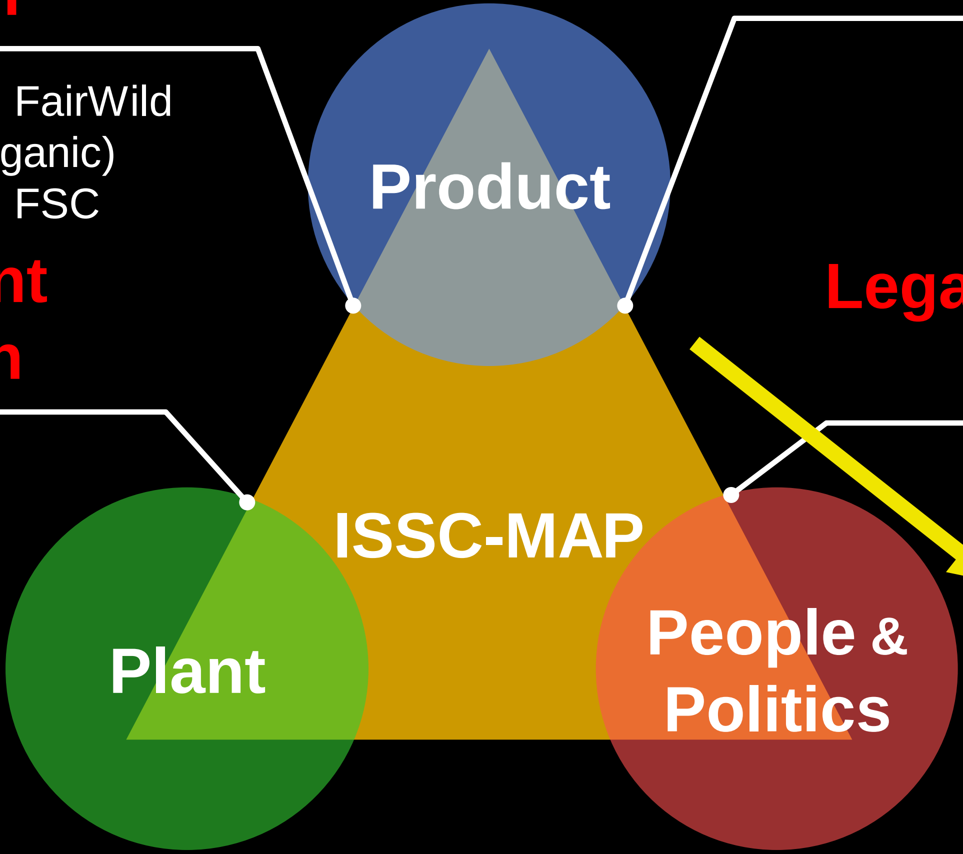
Applying Responsible Business Practices

Management and business practices



	Criterion	Number	Indicator	Form of indicator / Method of control	Competence			Category
					Collection manager	Consultant	Certifier	
Section I	WILD COLLECTION AND CONSERVATION REQUIREMENTS							
Principle 1	**Maintaining Wild MAP Resources** Wild collection of MAP resources shall be conducted at a scale and rate and in a manner that maintains populations and species over the long term.							
Criterion 1.1	**Conservation status of target MAP species** The conservation status of target MAP species and populations is assessed and regularly reviewed.	1.1.1	The conservation status of target MAP species is assessed according to the IUCN Red List categories and criteria (version 3.1, 2001) and regularly reviewed.	IUCN Red List programme, Red List database, and/or Red List Authority for medicinal plants + Conservation status reports	X X	X		1
		1.1.2	For species determined to be Data deficient (DD) or not evaluated (NE) according to the IUCN Red List categories and criteria, sufficient information is gathered to complete and / or review a previous conservation status assessment (according to 1.1.1).	Documents of gathered information Written field verification report on the species population Resource assessment Red List data required - checklist	X X X X	X X X		2→1
Criterion 1.2	**Knowledge-based collection practices** MAP collection and management practices are based on adequate identification, inventory, assessment, and monitoring of the target species and collection impacts.	1.2.1	Endangered or critically endangered species (according to the IUCN Red List) are not wild collected for commercial purposes.	List of collected plants	X			1
		1.2.2	Management strategies are defined and implemented to reduce identified threats to species considered "vulnerable" according to the IUCN Red List.	• List of collected plants • Management plan	X X			1
		1.2.3	MAP species targeted for collection and their geographic sources are accurately and adequately identified with voucher specimens from the collection site.	• Handbooks, manuals, and other aids to species identification • Voucher specimens with taxonomic names, as well	X X	X		2→1

ISSC-MAP is intended for use in a wide range of scenarios



Certification

- Cooperation with FairWild (Fairtrade and organic)
- Cooperation with FSC

Development Cooperation

- BMZ
- GTZ
- EC
- GEF

Voluntary Codes of Practice

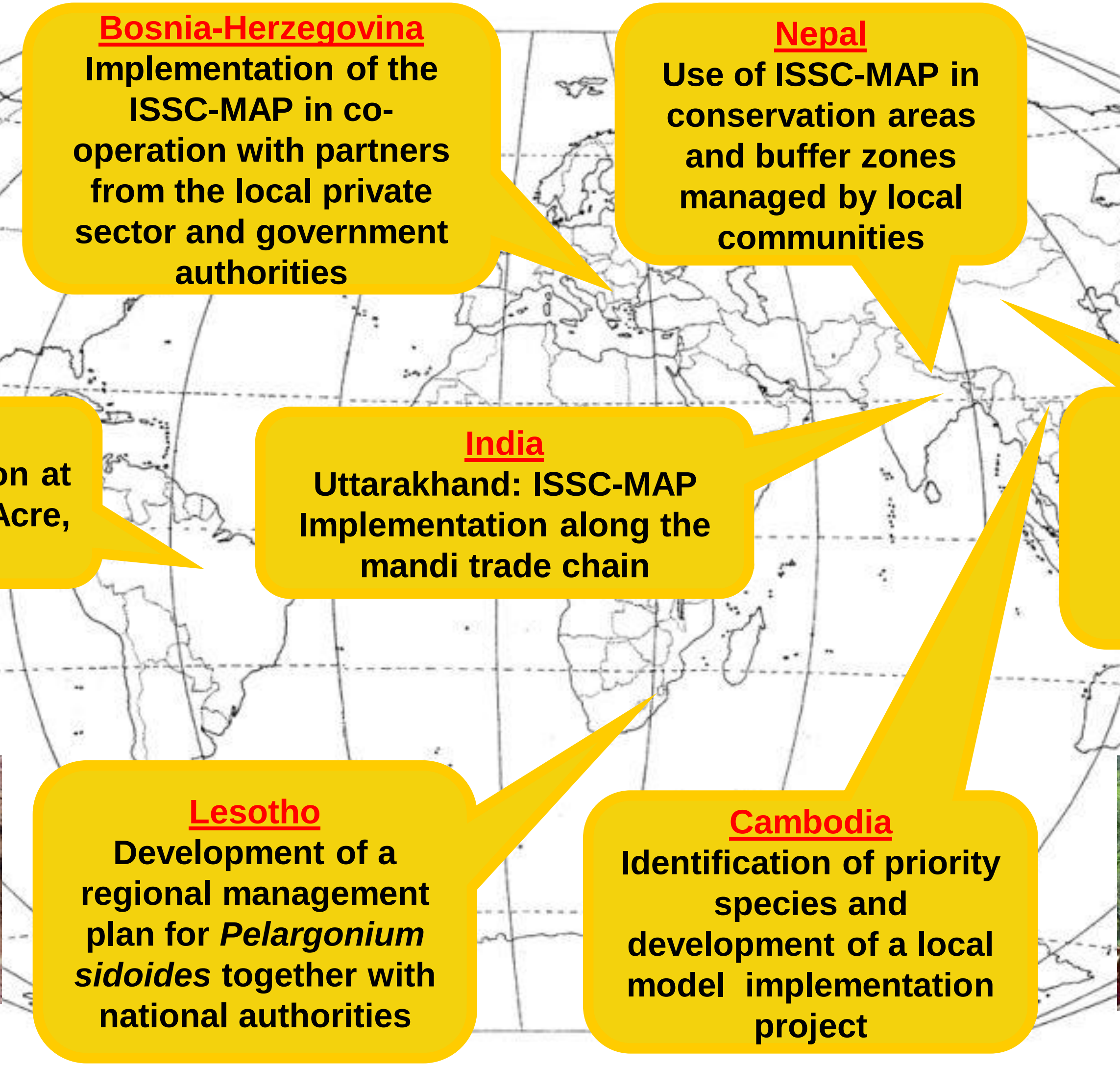
- Industry commitments
- GACP
- GMP

Legal Adoption and Policy

- EU Organic Farming Regulation
- CITES: NDF
- CBD: GSPC, ABS

Current Implementation Projects

ISSC-MAP



Bosnia-Herzegovina
Implementation of the ISSC-MAP in co-operation with partners from the local private sector and government authorities

Nepal
Use of ISSC-MAP in conservation areas and buffer zones managed by local communities

Brazil
Model implementation at community level in Acre, Amazon

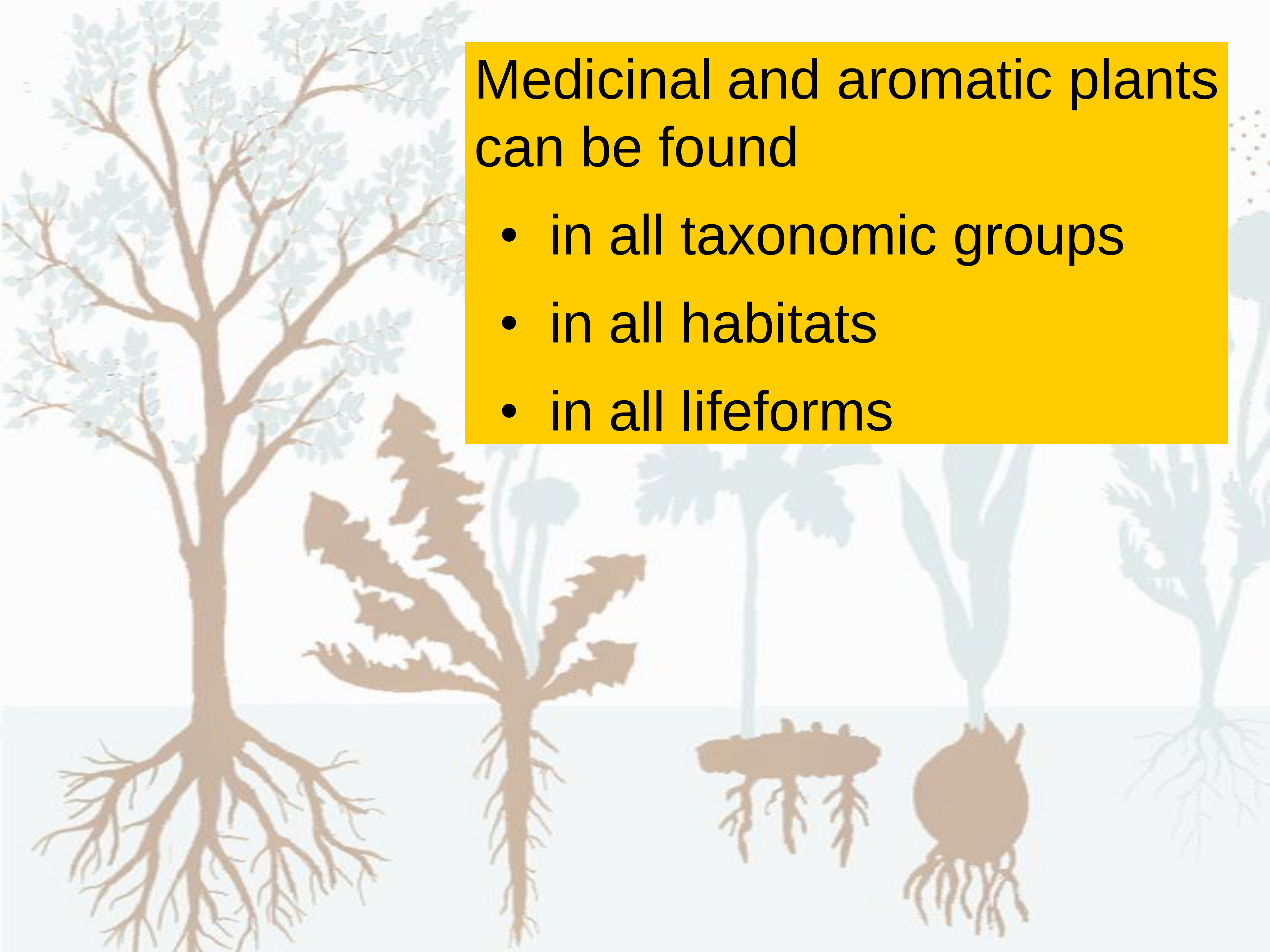
India
Uttarakhand: ISSC-MAP Implementation along the mandi trade chain

China
Inclusion of ISSC-MAP into the development of regional resource management

Lesotho
Development of a regional management plan for *Pelargonium sidoides* together with national authorities

Cambodia
Identification of priority species and development of a local model implementation project

Synergies between CITES NDF and ISSC-MAP



Medicinal and aromatic plants can be found

- in all taxonomic groups
- in all habitats
- in all lifeforms

Qualitative and Quantitative Data

Assessing the sustained yield of medicinal plants
requires two levels of data:

- Biological data

Species specific

qualitative

- Population data

Site specific

quantitative

Resource Assessment Questions

Questions to be answered through a sound resource assessment in the collection area:

- How many are there?
- How old are they?
- How much do they produce?
- How quickly do they regenerate?
- How many do they reproduce?

Inventory

Yield

Recovery

Focus on Vulnerable Life Forms & Plant Parts

Trees	Wood, bark
Perennials	Live plants, roots
Succulents & cycads	Whole plants, live plants, bark, leaves, seeds
Geophytes & epiphytes	Live plants

Applications of ISSC-MAP Relevant to CITES

- Provide criteria & methods to identify and support wild collection where it is sustainable – for socio-economic and conservation values
- Provide criteria & methods to identify and limit wild collection where it is NOT sustainable
- Contribute to keeping sustainably harvested species in international trade off CITES appendices
- Prevent CITES Appendix II species from eligibility for App I

Resource assessment

Focus of ISSC-MAP Resource Assessment

Principle 1: Maintaining Wild MAP Resources

"Wild collection of MAP resources shall be conducted at a scale & rate and in a manner that maintains populations & species over the long term"

Criterion 1.1. Conservation status of target MAP resources

"The conservation status of target MAP species and populations is assessed and regularly reviewed".

Criterion 1.2. Knowledge-based management practices

"MAP collection and management practices are based on adequate identification, inventory, assessment, and monitoring of the target species and collection practices".

Criterion 1.3: Collection intensity and species regeneration

"The rate (intensity and frequency) of MAP collection does not exceed the target species' ability to regenerate over the long term".

Focus of ISSC-MAP Resource Assessment

Principle 5: Applying Responsible Management Practices

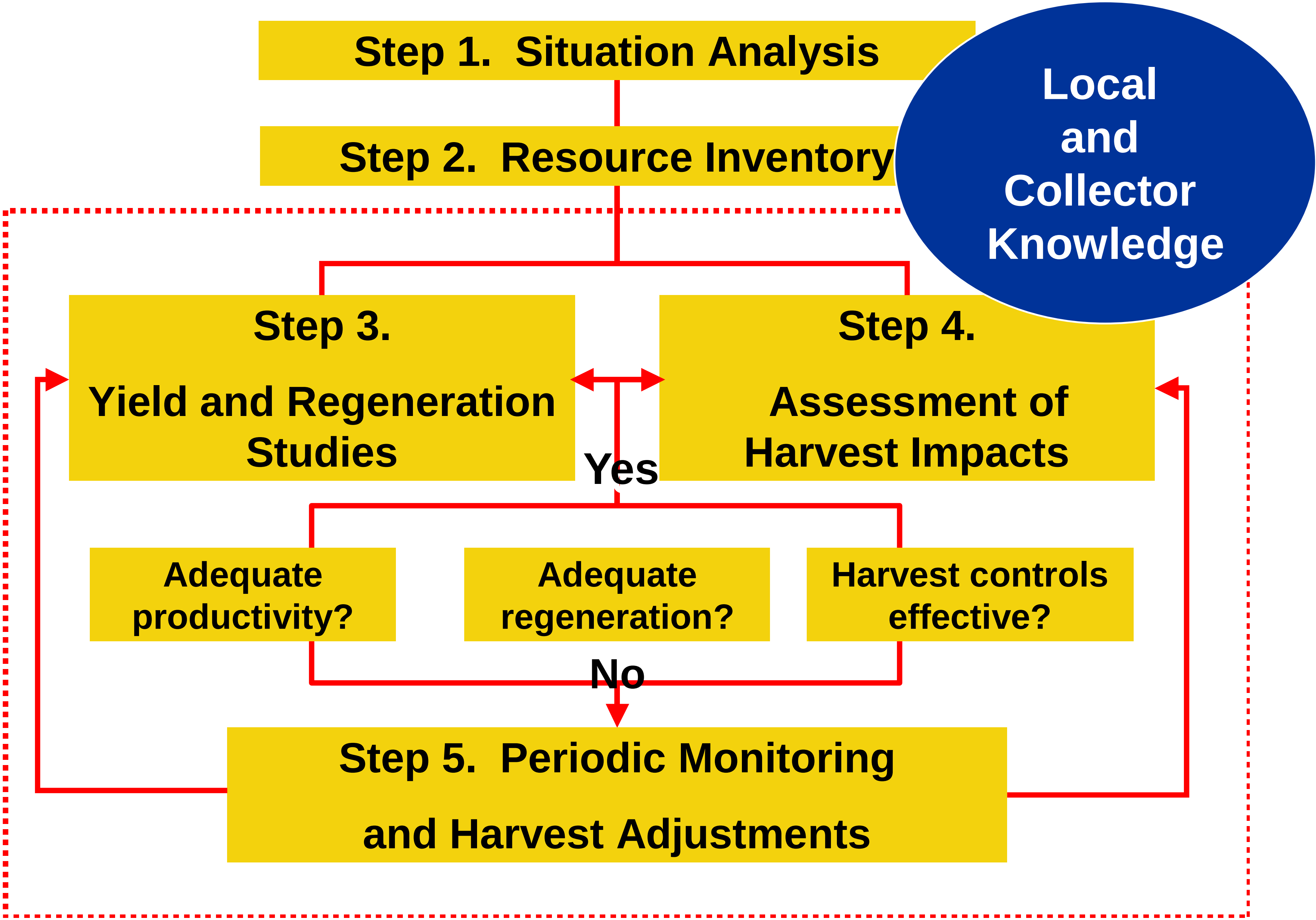
“Wild collection of MAP species shall be based on adaptive, practical, participatory, and transparent management practices”

Criterion 5.1. Species / area management plan

“A species / area management plan defines adaptive, practical management processes and good collection practices”.

Criterion 5.2. Inventory, assessment, and monitoring

“Management of MAP wild collection is supported by adequate and practical resource inventory, assessment, and monitoring of collection impacts”.



Step 1. Situation Analysis

Step 2. Resource Inventory

Local and Collector Knowledge

Step 3.

Yield and Regeneration Studies

Step 4.

Assessment of Harvest Impacts

Yes

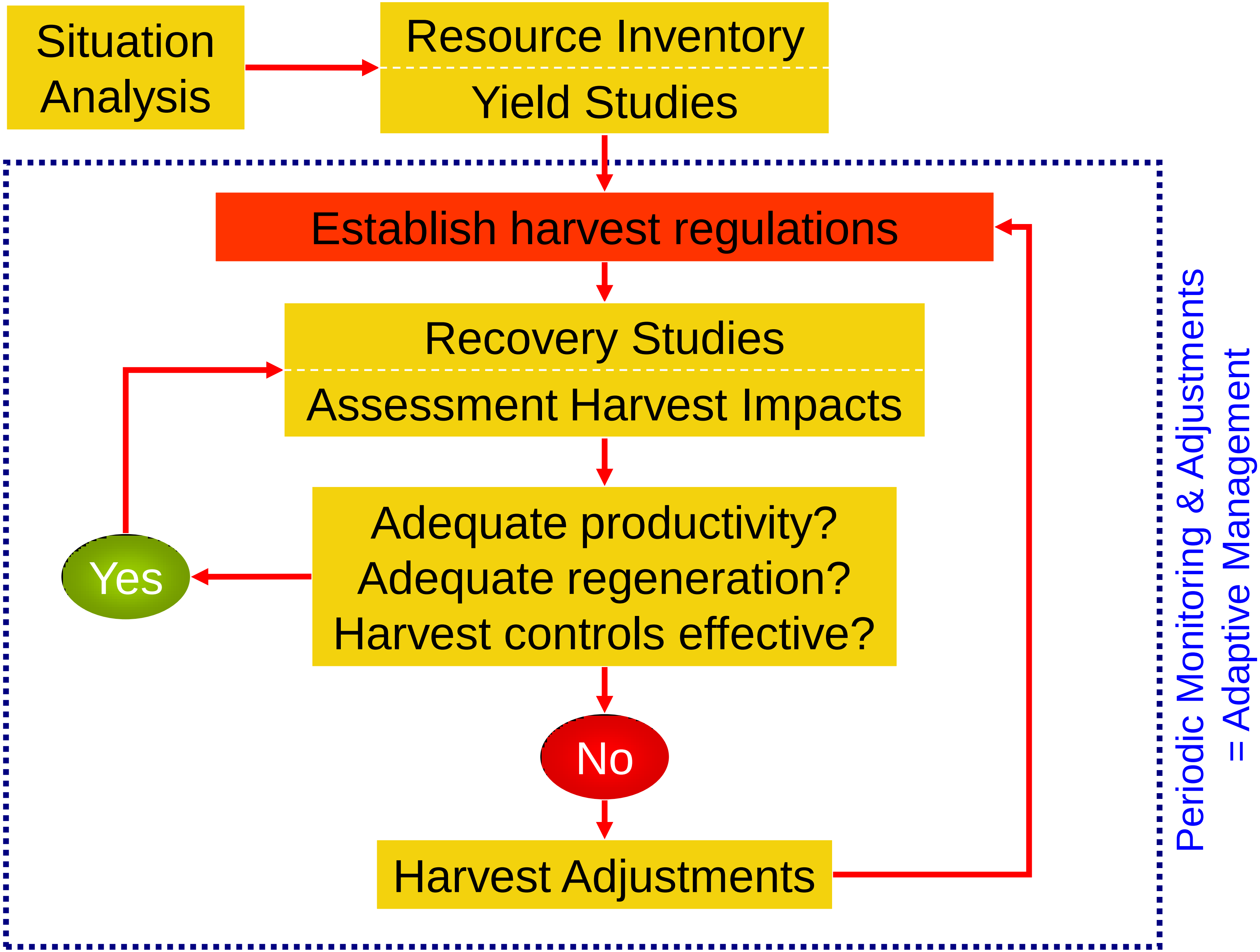
Adequate productivity?

Adequate regeneration?

Harvest controls effective?

No

Step 5. Periodic Monitoring and Harvest Adjustments



Situation Analysis

Resource Inventory

Yield Studies

Establish harvest regulations

Recovery Studies

Assessment Harvest Impacts

Adequate productivity?
Adequate regeneration?
Harvest controls effective?

Yes

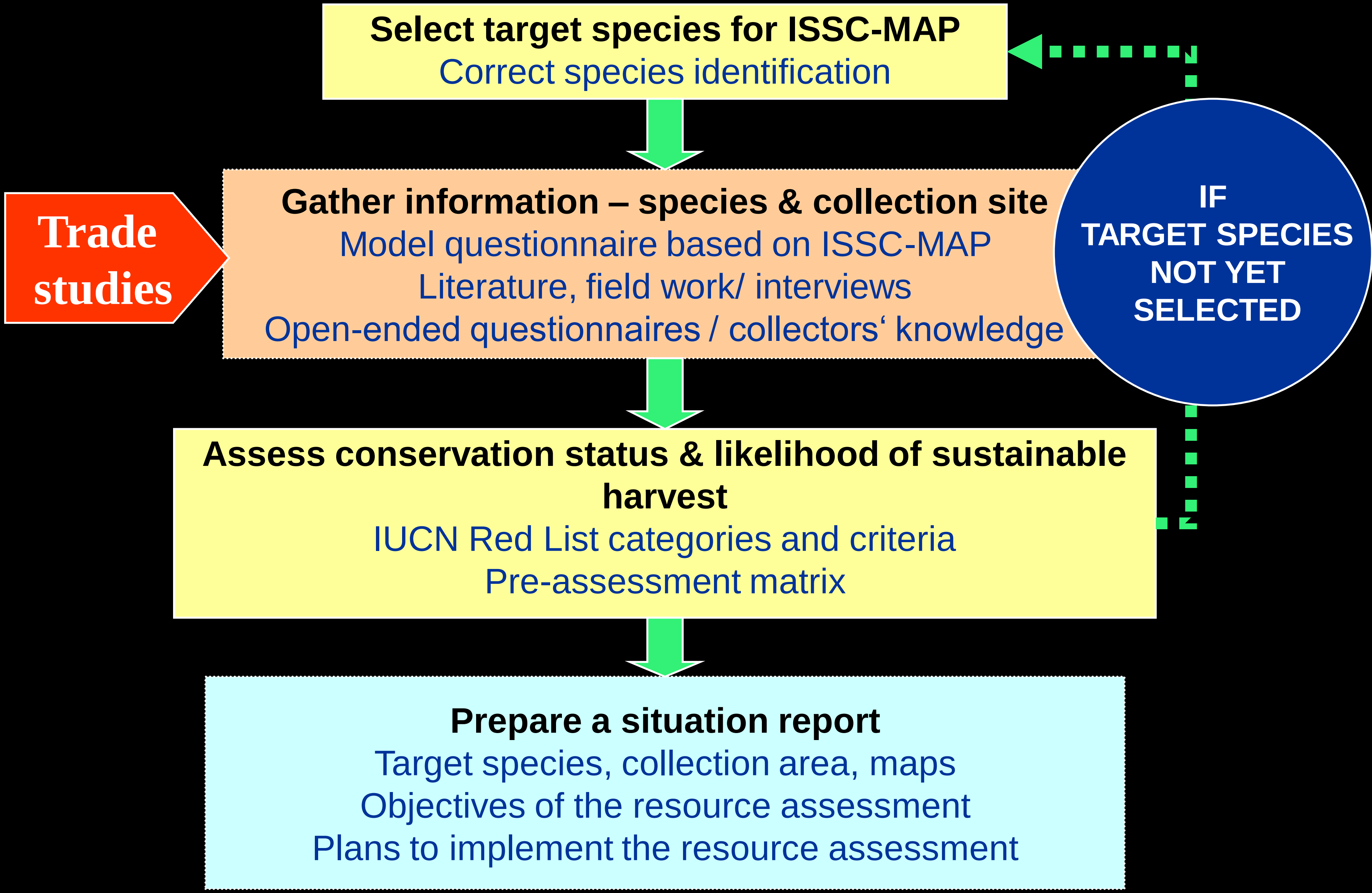
No

Harvest Adjustments

Periodic Monitoring & Adjustment
= Adaptive Management

Step 1
Situation analysis

Situation Analysis



Select target species for ISSC-MAP
Correct species identification

Trade studies

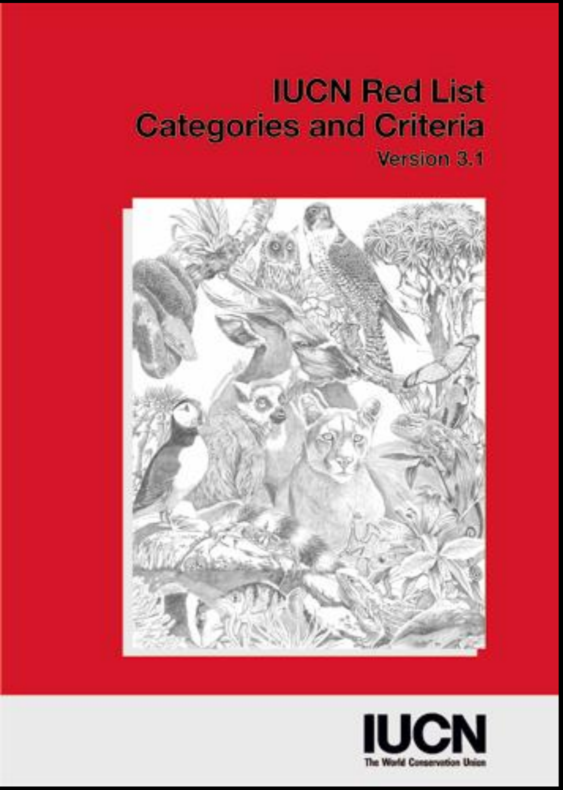
Gather information – species & collection site
Model questionnaire based on ISSC-MAP
Literature, field work/ interviews
Open-ended questionnaires / collectors‘ knowledge

IF TARGET SPECIES NOT YET SELECTED

Assess conservation status & likelihood of sustainable harvest
IUCN Red List categories and criteria
Pre-assessment matrix

Prepare a situation report
Target species, collection area, maps
Objectives of the resource assessment
Plans to implement the resource assessment

Assess Conservation Status



Global status (species, over entire range)

- IUCN Red List
- Accepted global standard for categories and criteria
- Links importance of target populations / collection area to survival of the entire species

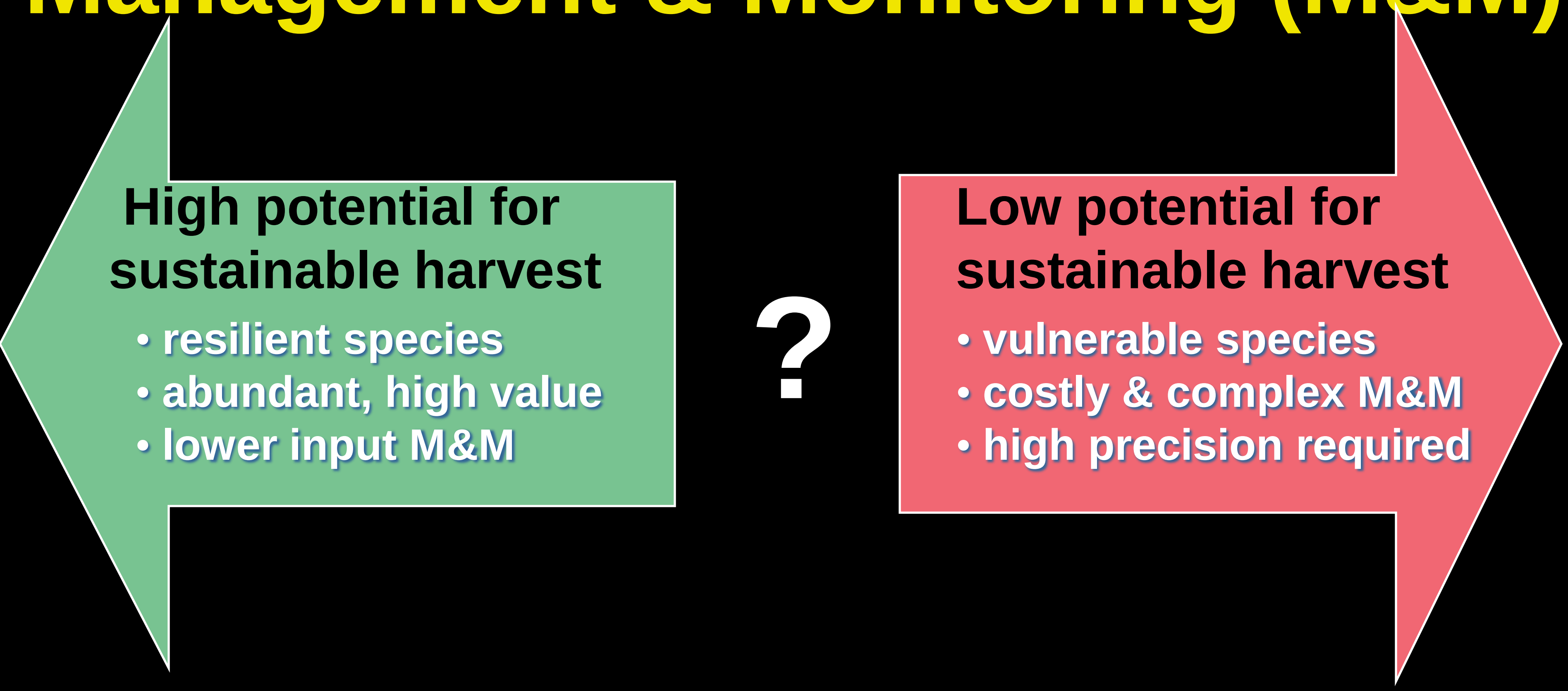
National or regional status

- National, provincial / state Red Lists, Threatened Species Lists
- Widely different standards for categories and criteria
- Unknown importance of target populations / collection area to survival of the entire species (for non-endemics)

Special considerations for conservation

- Endemic species
- Phylogenetic distinctiveness (monotypic family /genus / species; small genus (2-6 spp)
- Keystone species (ecological, cultural)

Make Strategic Choices for Management & Monitoring (M&M)



High potential for sustainable harvest

- **resilient species**
- **abundant, high value**
- **lower input M&M**

?

Low potential for sustainable harvest

- **vulnerable species**
- **costly & complex M&M**
- **high precision required**

Potential for sustainable use influences how much time and effort the collectors & other managers need to put into management

Factors that increase likelihood of sustainable wild collection

- **Low intensity & frequency of harvest**
  - Species abundance & resource / land tenure therefore important

- **Single use rather than multiple use**
  - Less complex to assess, monitor, manage sustainable collection

- **Part harvested**
  - Leaves, flowers, seeds, fruits …not bark, roots, bulbs or whole plants

- **Growth & reproduction**
  - Fast growing species
  - Resilience to harvest (eg: vigorous resprouters, no disease when damaged)
  - Produce many offspring & locally abundant
- **Distribution & habitat preferences**
  - Ecological generalists, tolerate a wide range of conditions (common, wide distribution, rather than habitat specific)

Factors that make a species vulnerable to over-collection

- High demand
- Multiple-use species (more than one use, more than one part used…eg: highly palatable plant parts)
- Destructive harvest (roots & bulbs, bark, whole plant …)
- Commercial trade: high value, long-shelf life, easily transportable

Use and trade

- Slow growing (& parasitic)
- Obligate re-seeder (does not reproduce vegetatively)
- Disperser: large (edible) animal
- Pollinator: highly specific mutualism
- Dioecious (separate male & female plants)
- Susceptible to disease when damaged (eg: *phytopthora* – root-rot fungus)

Species biology

- Habitat specific: high diversity, low density; unusual soil type (eg: serpentine, nickel) (habitat:“globally outstanding”)
- Land-use: higher rainfall, highly arable soils, flat land, arid/semi-arid
- Accessible: road, riverine & alluvial areas

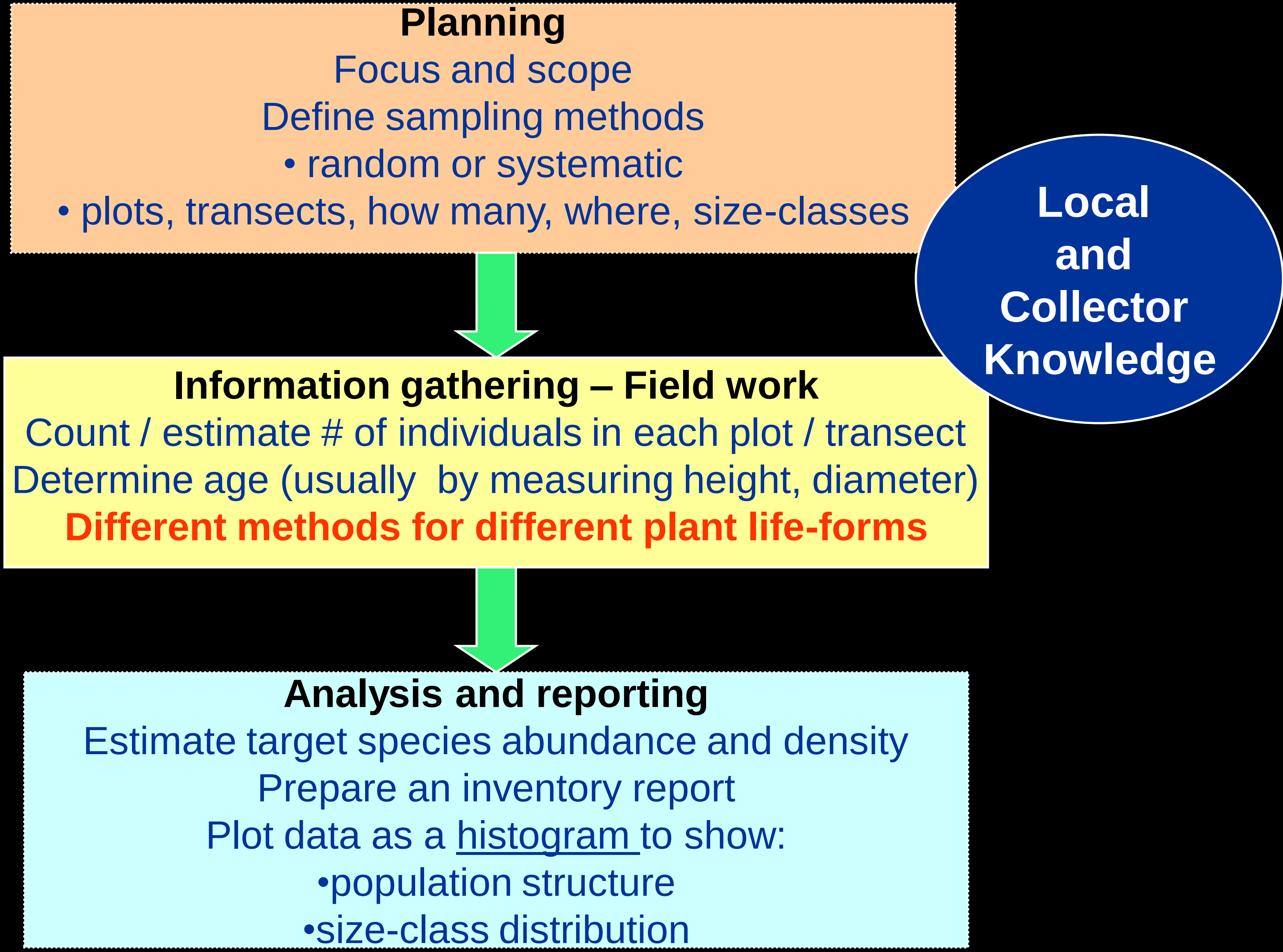
Habitat

Step 2
Resource inventory
Yield studies

How much of the target species is present within the collection area?

How much of the desired raw material (quality & quantity) does the target species produce under natural conditions? ~*K*, carrying capacity

Resource Inventory



Planning

Focus and scope

Define sampling methods

- random or systematic
- plots, transects, how many, where, size-classes

Local and Collector Knowledge

Information gathering – Field work

Count / estimate # of individuals in each plot / transect

Determine age (usually by measuring height, diameter)

Different methods for different plant life-forms

Analysis and reporting

Estimate target species abundance and density

Prepare an inventory report

Plot data as a histogram to show:

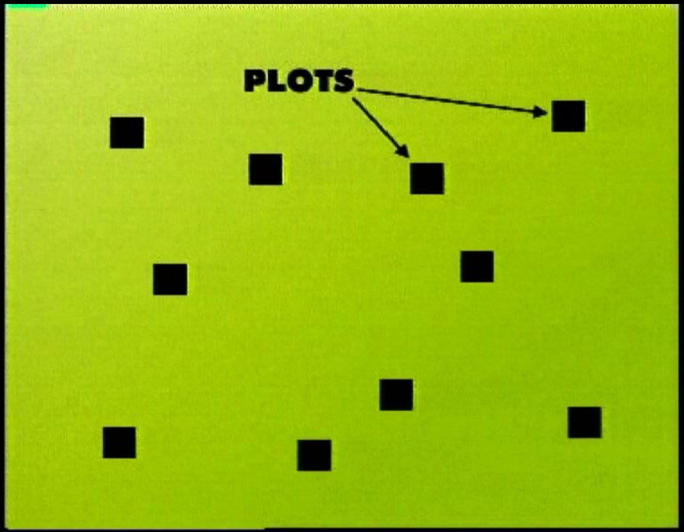
- population structure
- size-class distribution

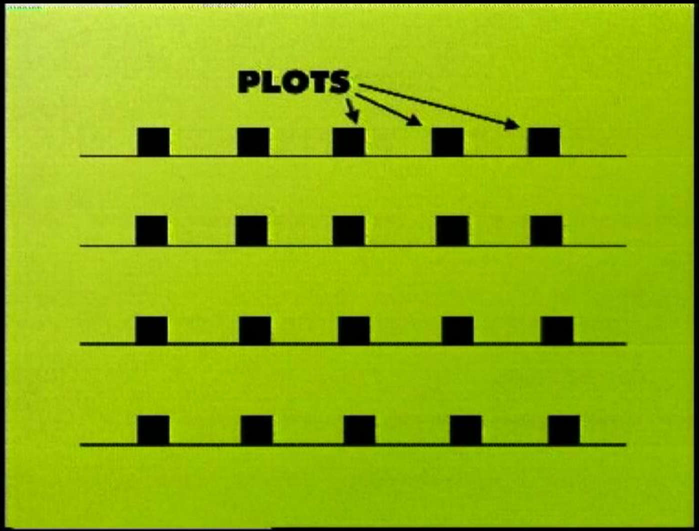
Use appropriate precision

Random plots
- preferred by statisticians
- eliminate bias

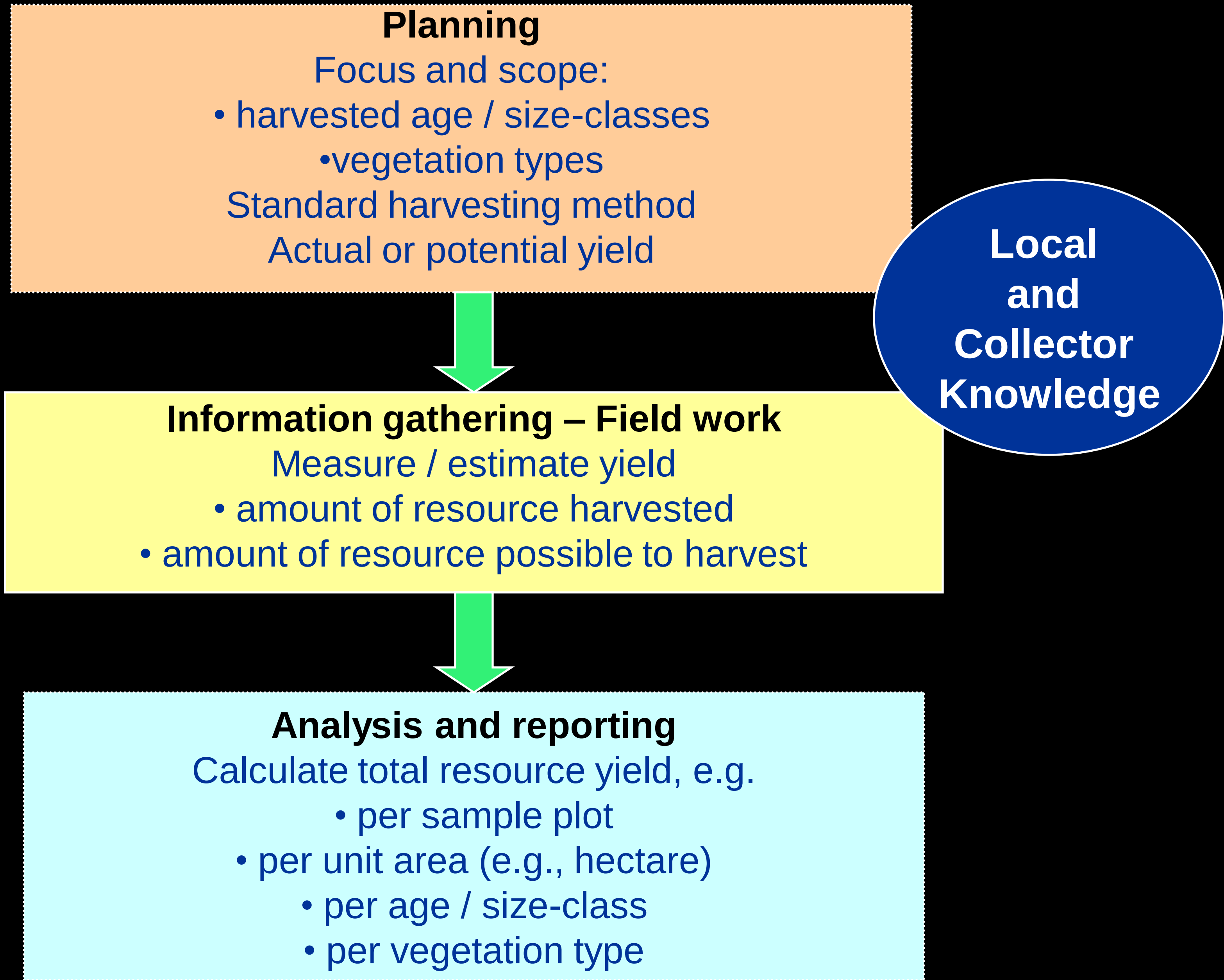
Systematic sampling
- preferred by collectors & communities
- eliminates bias

Replication (minimum 3-5 samples per treatment)
- improves precision
- reduces chance effects





Yield Studies



Planning

Focus and scope:

- harvested age / size-classes
- vegetation types

Standard harvesting method

Actual or potential yield

Local and Collector Knowledge

Information gathering – Field work

Measure / estimate yield

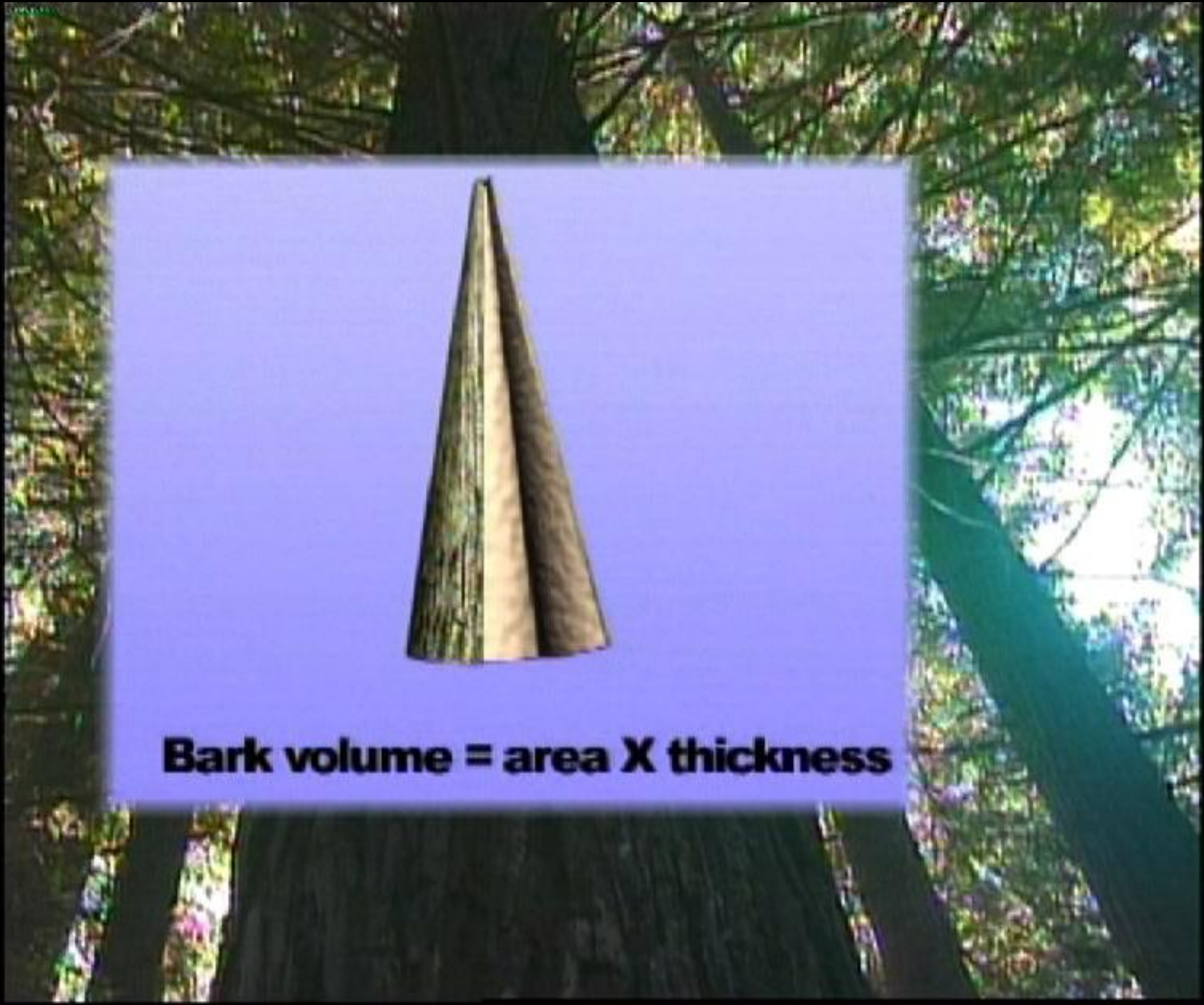
- amount of resource harvested
- amount of resource possible to harvest

Analysis and reporting

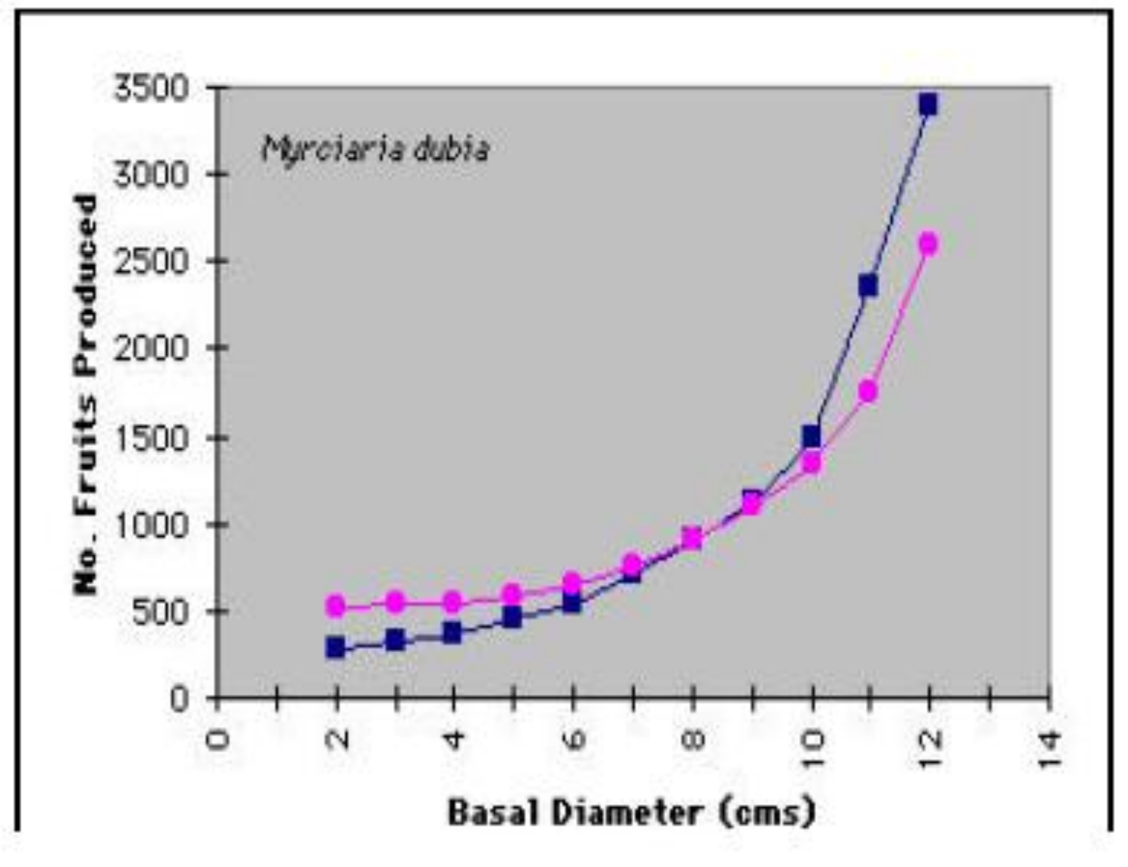
Calculate total resource yield, e.g.

- per sample plot
- per unit area (e.g., hectare)
- per age / size-class
- per vegetation type

Calculate the “standing stock”



Yields vary from season to season



Yield curves showing annual fruit production as related to tree size for *Myrciaria dubia* plants growing in the lowlands of Peruvian Amazonia.

Two years of fruit production data are shown.

(Source: Peters, 1994)

Step 3
Harvest regulations

New!

Harvest regulations (thinking about plants…)

- Estimate current harvest volumes and define current harvest practices
- Estimate unmanaged harvest volumes and define unmanaged harvest practices
- Compare current harvest levels with estimated sustainable yield
- Compare current harvest practices with “best practice”

→ Define precautionary / potentially sustainable harvest regulations. These become the working hypothesis for monitoring.

Harvest regulations (thinking about plants…)

- Constant number / volume = quota
- Constant effort: e.g., collection season
- Constant proportion of population / proportion of collected part per individual plant
- Other plant collection protocols (e.g., bark and tuber removal, season and age-class restrictions)

Step 4
Periodic monitoring

Recovery studies: What is the regeneration rate of harvested populations & individuals?

Assessment of harvest impacts: What is the impact of the current harvest protocol on the target population and ecosystem?

Recovery / Regeneration Studies

Planning / Field work

Establish permanent regeneration plots

Information gathering – Field work

Count & measure seedlings / saplings

Local and Collector Knowledge

Analysis and reporting

Estimate density & abundance of seedlings / saplings

Combine results with (Step 1) inventory data

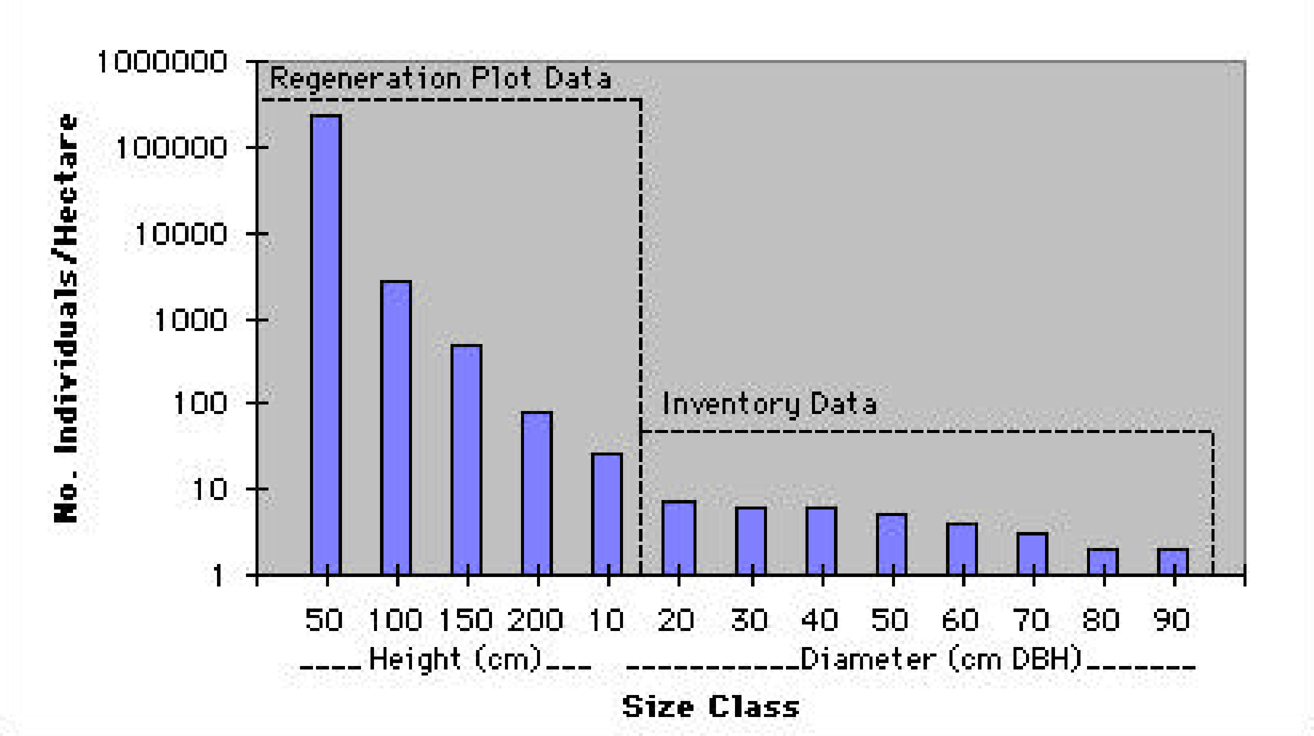
Prepare size-class histogram + inventory results

Assess current population regeneration status

Repeat periodically & compare with previous results:

- seedling/sapling density > base-line → harvest likely sustainable
- seedling/sapling density < base-line → harvest not sustainable

Inventory + Regeneration Data



Size-class histogram for *Shorea atrinervosa* population illustrating the use of both height and diameter classes. Data from regeneration plots have been grouped into four 50 cm height classes and one 1.0 - 10.0 cm diameter (DBH) class. Inventory results are divided into eight 10 cm (DBH) diameter classes. Numbers shown along x-axis represent the upper size limit of each class. Note compressed, logarithmic scaling of y-axis due to the large range in values (e.g. from 3 to 250,000). (Source: Peters, 1994)

Reseeders vs Resprouters

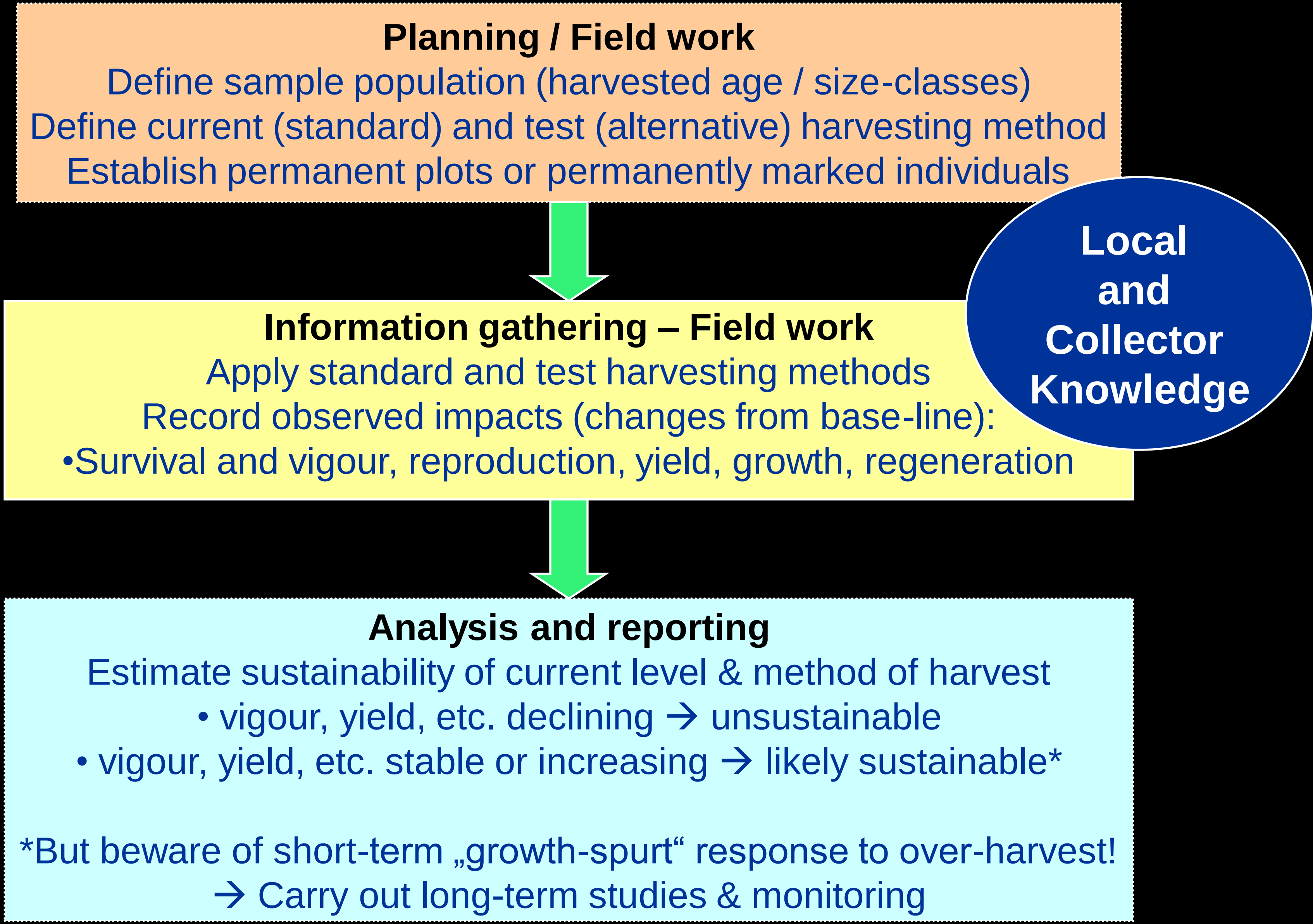
- Regenerate from seed, seed-banks
- Abundant seedlings
- Single-stemmed
- Self-pollinated or diverse pollinators
- Fast-growing, short-lived
- Habitat specialists

→ Regeneration surveys likely useful & important

- Regenerate from buds, bud-banks
- Few seedlings
- Multi-stemmed
- Pollinator-limited
- Underground storage organs
- Slow-growing, long-lived
- Habitat generalists

→ Regeneration surveys may not be very useful

Assessing Harvest Impacts



Planning / Field work

Define sample population (harvested age / size-classes)
Define current (standard) and test (alternative) harvesting method
Establish permanent plots or permanently marked individuals

Information gathering – Field work

Apply standard and test harvesting methods
Record observed impacts (changes from base-line):
•Survival and vigour, reproduction, yield, growth, regeneration

Local and Collector Knowledge

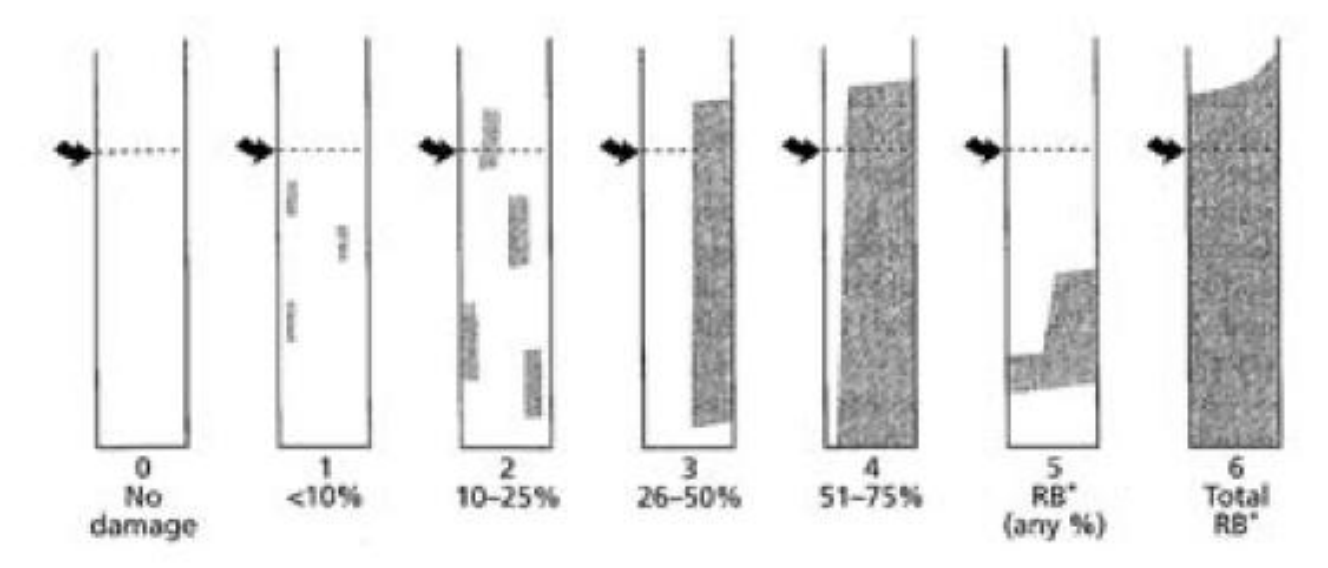
Analysis and reporting

Estimate sustainability of current level & method of harvest
• vigour, yield, etc. declining → unsustainable
• vigour, yield, etc. stable or increasing → likely sustainable*

*But beware of short-term „growth-spurt“ response to over-harvest!
→ Carry out long-term studies & monitoring

Effects of Harvest Vary

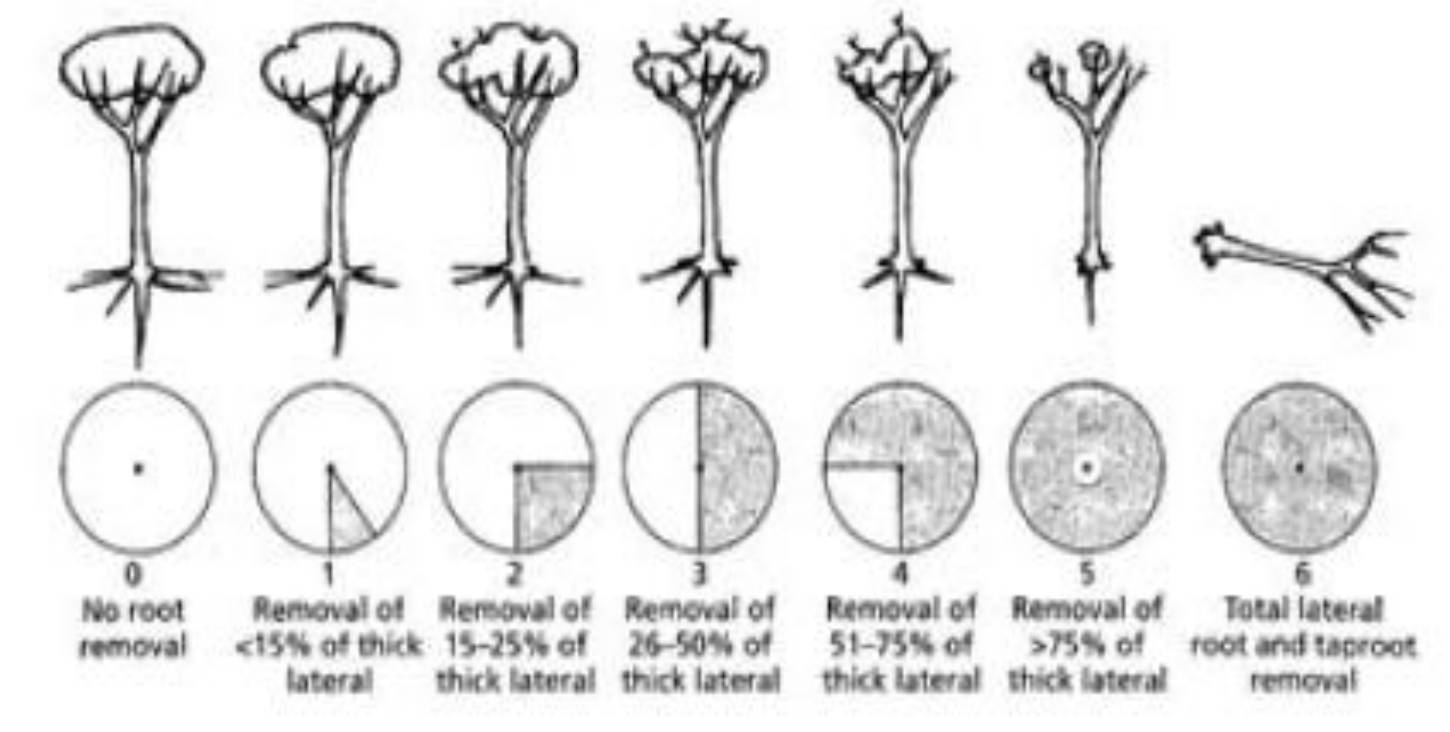
Assessing Bark Damage



Cunningham, 2001

0 = no damage
1 = small patches removed (<10% of trunk bark)
2 = larger patches removed (10-25% of trunk bark)
3 = large strips removed (26-50& of trunk bark)
4 = extensive bark removed (51-75% of trunk bark)
5 = ring-barking or girdling (leads to death in many species)
6 = complete girdling, all bark removed (certain death)

Assessing Root Harvest



Cunningham, 2001

Direct evidence of root damage is often buried, but it is sometimes possible to evaluate the extent of damage.

Step 5
Harvest adjustments

Is the management action successful?

What adjustments can / should be made to allowed harvest protocols to maintain resource quality & quantity for future collection cycles & to avoid undesired impacts?

Periodic Monitoring & Harvest Adjustments

Planning / Field work

Define monitoring objectives

Select monitoring indicators and methods

Develop a plan

Local and Collector Knowledge

Information gathering – Field work

Focus on target resources included in normal harvest activity

Add samples (plots, individuals) to answer relevant questions

Keep good records

Analysis and reporting

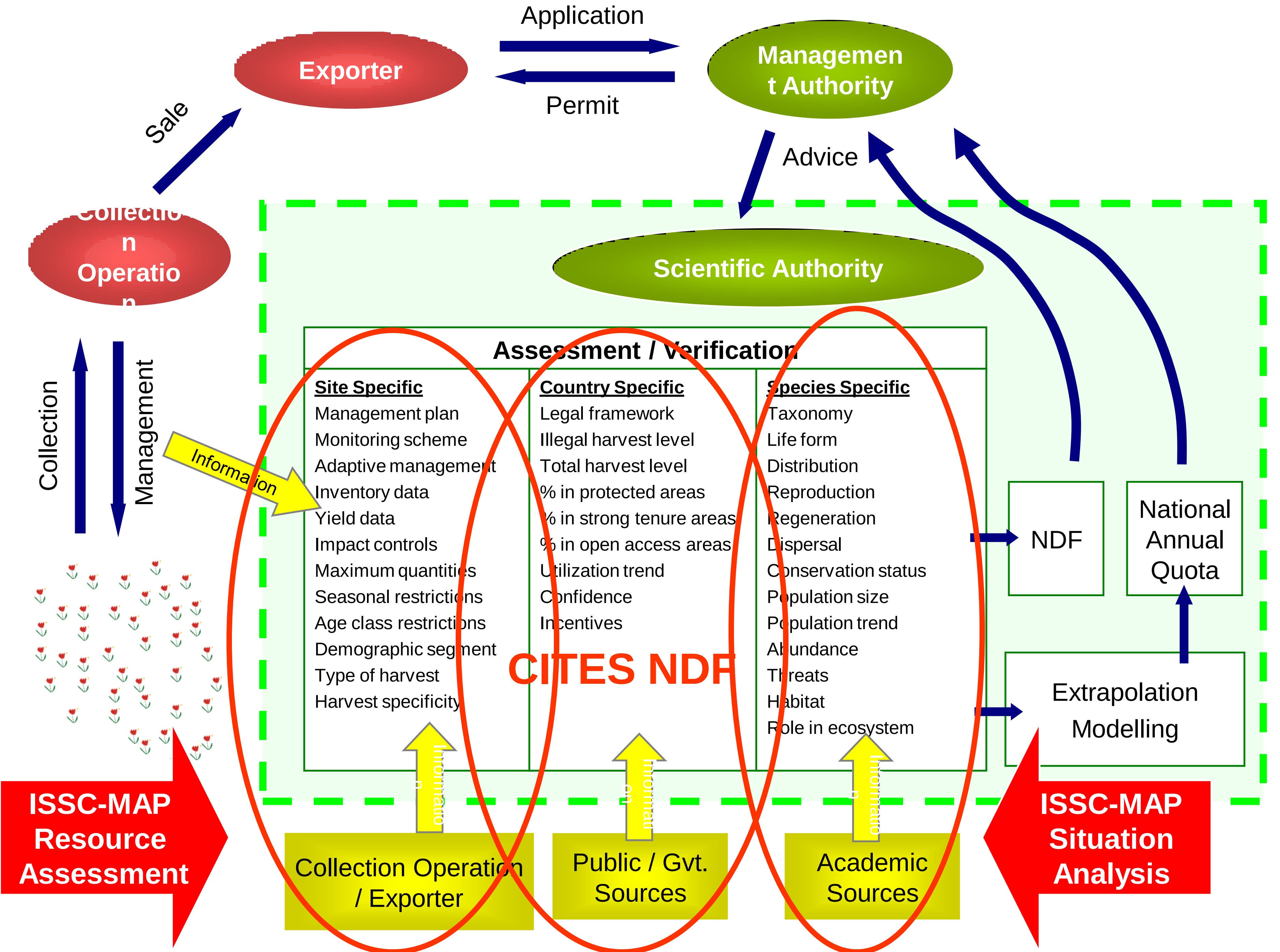
Estimate current harvest level

Monitor impacts on yield, regeneration, vigour, productivity, etc.

Adjust harvest levels, methods if needed:

intensity, frequency, timing, management methods

Quick Summary:
ISSC-MAP & CITES NDF



Assessment / Verification

Site Specific
Management plan
Monitoring scheme
Adaptive management
Inventory data
Yield data
Impact controls
Maximum quantities
Seasonal restrictions
Age class restrictions
Demographic segment
Type of harvest
Harvest specificity

Country Specific
Legal framework
Illegal harvest level
Total harvest level
% in protected areas
% in strong tenure areas
% in open access areas
Utilization trend
Confidence
Incentives

Species Specific
Taxonomy
Life form
Distribution
Reproduction
Regeneration
Dispersal
Conservation status
Population size
Population trend
Abundance
Threats
Habitat
Role in ecosystem

ISSC-MAP Project website: www.floraweb.de/map-pro

Decision Board:

Danna J. Leaman (IUCN-SSC Medicinal Plant Specialist Group) (MPSG)
Susanne Honnef (WWF Germany and TRAFFIC)
Uwe Schippmann (German Federal Agency for Nature Conservation)
Giridhar A. Kinhal (Foundation for the Revitalization of Local Health Traditions, India)
Rainer Bächi (Institute for Market Ecology IMO, Switzerland)
Josef Brinckmann (Traditional Medicinals Inc., USA)
Ximena Buitrón Cisneros (IUCN MPSG)

Secretariat:

Britta Pätzold, Susanne Honnef (WWF Germany and TRAFFIC, Johann-Wolfgang-Goethe University Frankfurt)

International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants

BfN Bundesamt für Naturschutz
WWF
TRAFFIC the wildlife trade monitoring network
IUCN
Silphion
MEDICINAL PLANT SPECIALIST GROUP
FRLHT
control IMO INSTITUTE FOR MARKETECOLOGY
Traditional Medicinals®

NDF WORKSHOP CASE STUDIES
WG 2 – Perennials
CASE STUDY 5
Panax quinquefolius
Country – **CANADA**
Original language – English

PANAX QUINQUEFOLIUS (AMERICAN GINSENG) IN CANADA: A CASE STUDY

AUTHOR:
Adrianne Sinclair
* Canadian Wildlife Service Environment Canada

I. BACKGROUND INFORMATION ON THE TAXA

1. BIOLOGICAL DATA

1.1 Scientific and common names:

Panax quinquefolius
(American ginseng; Canadian ginseng; five-fingers; occidental ginseng; sang; seng)

1.2 Distribution

Ginseng is widely distributed in Eastern North America from Québec to Minnesota and South Dakota; south to Georgia, Louisiana, and Oklahoma. In Canada, ginseng occurs in low abundance in the southwestern province of Québec and the southern portion of the province of Ontario with its occurrence infrequent and fragmented throughout its range.

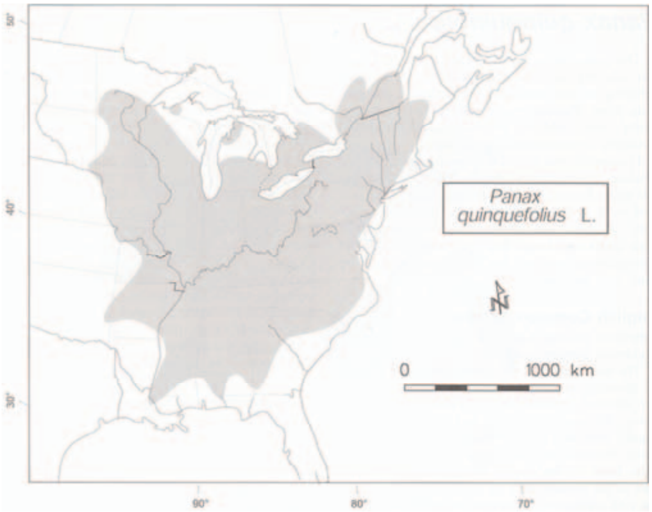


Figure 1. North American distribution of ginseng (*Panax quinquefolius*) (Small & Catling, 1999).

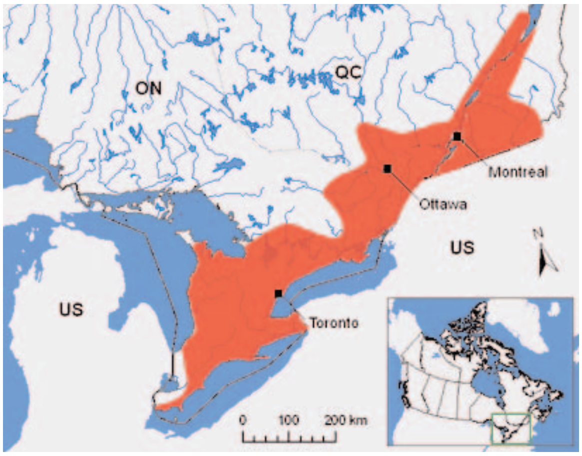


Figure 2. Distribution of ginseng (*Panax quinquefolius*) in Canada (Canadian Wildlife Service, 2004).

1.3 Biological characteristics

1.3.1 *General biological and life history characteristics of the species*

Ginseng is an herbaceous, long-lived forest perennial with slow population growth. Plants take approximately five to eight years to mature and are usually 20-70 cm tall with a whorl of three or four palmate leaves, each generally with five large leaflets. The flower is borne in mid-summer and 6-20 small, yellowish-white flowers emerge on a short stalk from the centre of the whorl. This species utilizes exclusively sexual reproduction to proliferate and is usually pollinated by generalist insects. Ginseng is considered to have a poor dispersal efficiency.

Fruits begin to ripen at the end of July and mature to a deep red colour. Seeds require approximately an 18-month dormancy period prior to germination and recruitment is low due to high levels of seed predation and high seed mortality rates (~ 70-90%). Ginseng seeds have only a 0.55% probability of reaching maturity.

1.3.2. *Habitat Types:*

Ginseng prefers rich, shady, moist, undisturbed and relatively mature deciduous woods in areas of limestone or marble bedrock soils. Habitat is generally dominated by sugar maple (*Acer saccharum*), white ash (*Fraxinus americana*), hickory (*Carya spp*.) – especially bitternut hickory (*C. cordiformus*), and basswood (*Tilia americana*). Ginseng colonies are often found near the bottom of gentle slopes facing southeast to south-west, where the microhabitat is usually well-drained and species rich.

1.3.3 *Role of the species in its ecosystem*

The vegetative parts of ginseng and also the seeds are predated by deer, and the berries and seeds are often eaten by small mammals. Deer are not considered dispersers of ginseng but small animals may play a minor role. The flowers of ginseng plants are visited by generalist insects, and a few species of small bees are considered the most important pollinators.

1.4. Population:

1.4.1. *Global Population Size:*

Ginseng occurs fairly frequently in the major portions of its range (i.e. the Appalachia and the Ozark region of the United States) and although population numbers are often low, the total number of individuals may be in the millions. In Canada, abundance is low and only 49 of 418 recorded populations are considered viable (i.e. >172 plants); at least 369 of the 418 known populations are either extirpated, unviable, or in decline.

1.4.2. *Current global population trends:*

___increasing __X_decreasing ___ stable ___unknown

The global population trend of ginseng is decreasing according to NatureServe (2008). Similarly, the population trend of ginseng in Canada is also decreasing.

1.5. Conservation status

1.5.1. *Global Conservation Status (according to IUCN Red List):*

___Critically endangered
___Endangered
___Vulnerable
___Near Threatened
___Least concern
___ Data deficient

Ginseng has not yet been assessed by IUCN and is currently not on the Red List. NatureServe (2008) has evaluated ginseng as vulnerable to apparently secure across its range, with an overall declining trend.

1.5.2. *National conservation status for the case study country*

Ginseng is considered endangered in Canada both nationally and in its provincial jurisdictions of Ontario and Québec.

1.5.3. *Main threats within the case study country*

___No Threats
_X_Habitat Loss/Degradation (human induced)
___Invasive alien species (directly affecting the species)
_X_Harvesting [hunting/gathering]
___Accidental mortality (e.g. Bycatch)
___Persecution (e.g. Pest control)
___Pollution (affecting habitat and/or species)
_X_Other__ Recreation (i.e. trails)__
___Unknown

Historically, ginseng populations were lost and/or reduced as a result of trade and habitat loss; decline in this species continues today. Primary threats are harvest and logging activities, and to a slightly lesser extent habitat loss/degradation/alteration and recreation. Threats to ginseng in Canada are severe. Harvest is considered unsustainable, dramatically reducing the reproductive potential of this declining species. A 5% root harvest has been shown to be sufficient to bring a viable ginseng population toward extirpation.

2. SPECIES MANAGEMENT WITHIN THE COUNTRY FOR WHICH CASE STUDY IS BEING PRESENTED

2.1 Management measures

2.1.1. *Management history*

Management of wild ginseng in Canada consists of prohibitions on trade:

- The international export of wild ginseng roots and/or derivatives from Canada has been prohibited since 1989.
- Harvest and trade in wild ginseng in Québec (whether imported or not) has been prohibited since the species was listed on Appendix II of CITES in 1973.
- As of July 2008, harvest and trade in wild ginseng is prohibited in

Ontario. Prior to July 2008, these activities were only prohibited in provincial Parks and Conservation Reserves.

2.1.2 *Purpose of the management plan in place*

The goal of the prohibition on international export of wild ginseng roots from Canada, as well as the ban on harvest and trade domestically in wild specimens from the provinces of Ontario and Québec, is to conserve remaining populations and enable population regeneration. Preventing removal of reproducing plants and allowing young plants to mature and reproduce aims to contribute to the establishment of seedlings and potentially stabilize/increase population numbers.

2.1.3. *General elements of the management plan*

The management plan for wild ginseng in Canada consists of the prohibitions on international export of wild roots as well as harvest and trade in wild specimens in the provinces of Ontario and Québec. A recovery strategy has also been developed.

2.1.4. *Restoration or alleviation measures*

A national recovery strategy is in place for ginseng as required for species listed on the federal *Species at Risk Act.* Public outreach initiatives have raised awareness of the endangered status of ginseng and its vulnerability to minimal levels of harvesting.

Surveys have been conducted to identify remaining wild populations of ginseng, their status, and any local threats. Landscape-level and site-specific protection and recovery plans have be determined. Populations are monitored annually to track the effectiveness of conservation measures.

The relocation of trails in parks and reserves, as well as the relocation of plants away from trails has been attempted. Researchers and landowners are collaborating to prepare and implement detailed plans to protect key ginseng populations that are located on private property.

The possibility of reintroduction is being investigated and the results of studies looking into specific ginseng habitat requirements are being applied to identify sites which may be suitable. The possibility of illegal harvest is considered when selecting potential reintroduction sites. Ginseng propagation techniques have been successfully developed and ginseng is being grown at a scientific institution to facilitate future reintroductions. Propagated ginseng has already been used to augment ten wild populations that were considered at risk of extirpation.

2.2. Monitoring system

2.2.1 *Methods used to monitor harvest*

There is no legal harvest of wild ginseng in Canada. However, populations are surveyed annually by species experts in the provincial jurisdictions in order to monitor population status and to identify the incidence of illegal harvest. Growth rates, harvesting impacts, and a minimum viable population size for ginseng have been calculated using projection matrix models.

Population estimates are made available in species status reports generated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and also via consultations between the Scientific Authority and wildlife managers/species experts in the provincial jurisdictions. Baseline population data is available for the province of Ontario since 1987 and for the province of Québec since 1994.

2.2.2 *Confidence in the use of monitoring*

Wild harvest of ginseng continues despite prohibitions on international export from Canada as well as provincial bans on harvest and trade. Confidence in monitoring is moderate with the current levels of funding and researchers/staff, but challenges exist in documenting illegal harvest of ginseng (e.g. frequency required to be effective, the size of the geographical area in which ginseng occurs, the number of populations to monitor, and the ease of access to populations).

2.3. Legal framework and law enforcement

Ginseng was listed on the Canadian *Species at Risk* Act in 2003 which affords protection to the species on federal lands.

Québec listed ginseng as threatened (the highest risk category) on the *Loi sur les espèces menaces ou vulnerables* in 2001 which affords protection from harvest and trade in wild specimens, as well as ginseng habitat.

Ontario listed ginseng as endangered on the *Species At Risk in Ontario* list in 2008 and thus collection and trade in wild ginseng is now prohibited throughout Ontario under their *Endangered Species Act*.

3. UTILIZATION AND TRADE FOR RANGE STATE FOR WHICH CASE STUDY IS BEING PRESENTED

3.1. Type of use (origins) and destinations (purposes)

Ginseng has been used in Asian medicine for as long as 5000 years and is said to be an effective treatment for a wide variety of disorders and ailments. As a result, it is harvested exclusively for medicinal and/or therapeutic uses. Trade in ginseng can be for either commercial or personal purposes.

In Canada, ginseng is grouped into four different categories based on the level of human-intervention: wild, wild-simulated, woods-grown, and field-grown. Wild ginseng grows naturally without human intervention of any kind. Wild-simulated ginseng is grown under a natural forest canopy in what would be considered suitable wild ginseng habitat and the seeds are cast by the grower without any cultivation or other interventions (e.g. removal of rocks, weeds, application of fertilizers or pesticides). Wild-simulated ginseng roots, despite being considered artificially propagated maintain the characteristics of a wild ginseng specimen and are therefore worth a high monetary value. Woods-grown ginseng is also grown under a forest canopy but is afforded a range of human interventions. Field-grown ginseng is grown under artificial shade structures and is subject to intense human intervention and cultivation.

The majority of export is of artificially propagated field-grown roots, usually in whole or sliced form, but also in powder or finished products (e.g. teas, capsules, extracts, confectionary, etc.). No legal trade in wild ginseng specimens from Canada exists.

3.2. Harvest:

3.2.1 *Harvesting regime*

Harvest of ginseng is destructive in that the whole root is taken and the vegetative portion of the plant is generally discarded. The harvest of wild roots involves the digging of individual plants, however artificially propagated field-grown ginseng is usually mechanically harvested using specialized machines. There is no season for collecting wild ginseng in Canada as harvest of this species is prohibited.

3.2.2 *Harvest management/ control*

In Canada, there is a zero quota for wild ginseng (i.e. no harvest or export of wild ginseng roots). Harvest of wild ginseng in Canada cannot be considered non-detrimental.

Exports of wild-simulated and/or woods-grown ginseng are currently assessed on a case-by-case basis by the Scientific Authority. To date, no Canadian export permits have been granted for wild-simulated or woods-grown ginseng due to concerns related to habitat disturbances associated with site preparation and maintenance, the introduction of seed-borne pathogens that are common in cultivated seed sources, and the potential for genetic contamination of wild ginseng populations. Also of concern is the difficulty in differentiating between the roots of wild, wild-simulated, and woods-grown ginseng. Depending on the extent of human intervention during the growing period, the roots may resemble wild specimens or have characteristics similar to field-grown ginseng.

Harvest and export of artificially propagated field-grown ginseng is allowed, however all shipments must be accompanied by valid CITES documentation. CITES export permits may be issued for personal (< 4.5 kg) and commercial shipments (> 4.5 kg) depending on quantity. Field-grown roots have physical characteristics that make them easily distinguishable from ginseng roots grown by other means.

3.3. Legal and illegal trade levels

Legal harvest of ginseng in Canada exists primarily of artificially propagated field-grown specimens and is a lucrative industry with the export market value estimated at approximately $65 million annually. Approximately 2.5 million kilograms of dried roots are exported from Canada annually, primarily to the Asian market.

Although harvest and trade of wild specimens is prohibited in Canada, the potential for illegal trade is high. Wild roots are considered to be significantly more valuable than those that are field-cultivated. It has been determined that illegal harvest has contributed to the decline and/or extirpation of wild ginseng populations in Canada. However, the exact amount of illegal harvest is difficult to quantify.

II. Non-detriment finding procedure (NDFs)

For wild ginseng in Canada there is currently a negative NDF (i.e. harvest of wild ginseng is considered detrimental to the species in the wild).

1. IS THE METHODOLOGY USED BASED ON THE IUCN CHECKLIST FOR NDFS?

_X_ yes ___no

2. CRITERIA, PARAMETERS AND/OR INDICATORS USED

In Canada, the IUCN Checklist for non-detriment findings is followed closely when making an NDF. All elements of tables 1 and 2 are considered by wildlife managers/species experts in the provincial jurisdictions and the information is provided to the CITES Scientific Authority. When the Scientific Authority reviews and finalises the Checklist, consideration is given to the primary experience of managers/experts in the management and research of wild populations, as well as to any additional sources of information that are available (e.g. scientific journal articles, technical reports, and consultations with additional experts, wildlife management boards, species-specific committees/associations, etc).

3. MAIN SOURCES OF DATA, INCLUDING FIELD EVALUATION OR SAMPLING METHODOLOGIES AND ANALYSIS USED

Wildlife managers, who collaborate with species experts, in the provincial jurisdictions are responsible for the management of wild ginseng populations. The Canadian CITES Scientific Authority relies on these managers and experts to provide it with up-to-date information on wild ginseng populations, primarily in the form of the IUCN Checklist, but also through consultations, when making an NDF.

Growth rates, harvesting impacts, and a minimum viable population size for ginseng have been calculated using projection matrix models. Annual population surveys are carried out by species experts in the provincial range jurisdictions and the data is compared to baseline information to determine the trend of populations both individually and in Canada as a whole. Annual surveys are also used to monitor of illegal harvest and help to determine whether it is an actual or potential threat. Population surveys are useful for the identification of other potential threats to populations besides illegal harvest. Review of the primary literature is also conducted.

The Canadian CITES Scientific Authority itself does participate in field evaluations or surveys of wild ginseng populations. All population surveys are conducted by the wildlife managers/species experts in the provincial jurisdictions using species-specific field techniques.

4. EVALUATION OF DATA QUANTITY AND QUALITY FOR THE ASSESSMENT

Given that all jurisdictions have mandates to protect wildlife within their jurisdictions, and have the scientific and management information and expertise that contribute to the making of an NDF, the data and information provided to the Scientific Authority is assured to be of a high standard. It should be noted that the conservation and management of wild species is multi-jurisdictional in Canada, falling under the authority of various provincial, territorial, and federal acts and legislation related to wildlife management.

The details provided by the experts in the range jurisdictions are reviewed by the Scientific Authority to ensure that all the necessary information is complete. Whether trade will be detrimental to the species in the wild is determined based on the information provided by the wildlife managers/species experts in the jurisdictions.

5. MAIN PROBLEMS, CHALLENGES OR DIFFICULTIES FOUND ON THE ELABORATION OF NDF

Since management of wildlife in Canada is multi-jurisdictional, coordinating the numerous people involved in the NDF process can sometimes be difficult. Budget and time constraints are also significant challenges facing the Scientific Authority and the wildlife managers in regards to making NDFs.

The monitoring of illegal harvest (aside from annual population surveys) is a considerable challenge considering the frequency of visits required for monitoring to be effective, the geographical area in which ginseng occurs, and the number of populations to monitor. Eliminating the threat of illegal harvest to the survival of ginseng in the wild is problematic due to its greater market demand and value.

6. RECOMMENDATIONS

The Canadian CITES Scientific Authority has had great success in using the IUCN Checklist, either formally or via consultations, as a method to gather the information that is required to make an NDF. The IUCN Checklist covers a wide scope of the parameters that may be considered when developing an NDF and the format is useful in terms of focusing our approach for gathering information, recognizing gaps in information or management, and identifying the vulnerabilities for the species in question. Collectively it ensures a thorough analysis of the status and management practices currently in place for a species, regardless of taxa. It is recommended that Parties consider the IUCN Checklist when developing NDFs.

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NDF WORKSHOP
WG 2 – Perennials
CASE STUDY 5 SUMMARY
Panax quinquefolius
Country – **Canada**
Original language – English

PANAX QUINQUEFOLIUS (AMERICAN GINSENG) IN CANADA: A CASE STUDY

AUTHOR:
Adrianne Sinclair.

Ginseng (*Panax quinquefolius*) is an herbaceous, long-lived forest perennial with slow population growth and is considered to have poor dispersal efficiency. Plants take approximately five to eight years to mature, at which time they proliferate exclusively via sexual reproduction. Seed recruitment is low due to high levels of seed predation and high seed mortality rates (~70-90%).

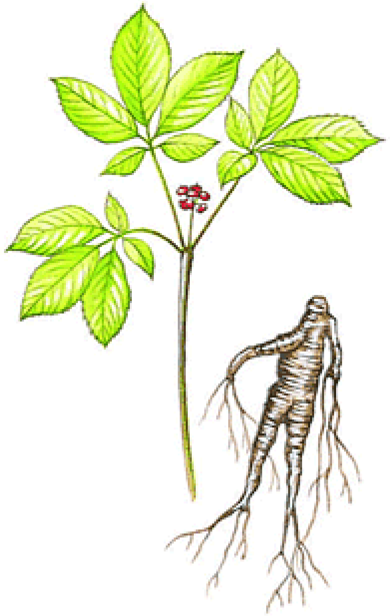
Ginseng is widely distributed in eastern North America and occurs frequently within the major portions of its range (i.e. the Appalachia and the Ozark regions of the United States). However in Canada, ginseng occurs in low abundance with its occurrence infrequent and fragmented throughout its range. Only 49 of 418 recorded populations are considered viable and at least 369 of the 418 known populations are either extirpated, unviable, or in decline. The global and Canadian trend of ginseng is decreasing. Ginseng is considered endangered in Canada both nationally and in its provincial jurisdictions of Ontario and Québec; national and provincial legislation is in place which affords protection to wild ginseng populations.

Primary threats to ginseng are harvest and logging activities and, to a lesser extent, habitat loss/degradation/alteration and recreation. Threats to ginseng in Canada are severe and harvest is considered unsustainable. Harvest and trade (including international exports) of Canadian wild ginseng is prohibited. The prohibitions on harvest and trade of wild ginseng aim to conserve the remaining populations and enable population regeneration.

Growth rates, harvesting impacts, and a minimum viable population size for Canadian ginseng have been calculated using population matrix models. Annual population surveys are conducted and compared to baseline data to monitor illegal harvest and identify any additional threats to populations.

Wildlife managers, in collaboration with species experts in the provincial jurisdictions, are responsible for the management of wild ginseng in Canada. The Scientific Authority relies on these managers/experts to provide it with up-to-date information on wild ginseng populations primarily in the form of the IUCN Checklist for Non-Detriment Findings, but also via consultations, when making an NDF.

Case Study:
Panax quinquefolius
American Ginseng
Canada



©Associated Ginseng Growers of BC

Adrianne Sinclair, CITES Scientific Authority, NDF Workshop, November 18, 2008

Wildlife Management and CITES in Canada

Canadian responsibilities for wildlife management are divided between Federal and Provincial/Territorial governments

Wildlife Management and CITES in Canada

Federal Government Departments:

- overall implementation of CITES, wildlife management/enforcement within federal jurisdiction

Provincial/Territorial Governments:

- Wildlife management (including enforcement) of indigenous species within P/T boundaries, CITES Scientific and Management Authorities

Aboriginal constitutional rights:

- Rights to participation in land, water, wildlife and environmental management and guaranteed wildlife harvesting rights within various land claim acts

Making an NDF in Canada

- NDFs are made for individual exports based on knowledge of P/T management systems in place
- Standing NDF reports are being developed for frequently traded indigenous species
  - Based on IUCN Checklist
  - National document summarizing biology, status and management practices of all range jurisdictions for a species
  - Collaborative approach
    - Federal leadership/coordination
    - Provincial/Territorial participation
    - Species experts (management and conservation)

Making an NDF in Canada

- Role of Canadian Scientific Authorities is to make an NDF (a decision) based on an **evaluation of information** about a species
- For example with respect to management:
  - Is there a plan or practices at P/T level?
  - Is the plan and/or practices based on regular appropriate assessment of species populations?
  - Is there some evidence that plan/ practices are responsive to changes in species trends?, etc.

Making an NDF in Canada

Main Sources of Data

- Wildlife managers who collaborate with species experts in P/Ts
- Scientific literature (population matrix models, MVPs)
- Technical reports (status reports, recovery strategies, action plans)
- Annual surveys/field studies

Making an NDF in Canada

Evaluation of Data (quantity/quality)

- Data from published papers subjected to peer review and the SA compares and summarizes data from the literature review
- Data collected under jurisdictional mandates to protect species, employing management and species experts
- Mandates derived from national F/P/T agreements to protect species
- National agreements provide strong frameworks to ensure species protection
- Information is reviewed by the national Scientific Authority Network

Making an NDF in Canada

NDF Process - Challenges

- Coordination (given multi-jurisdictions)
- Budget, time constraints
- Monitoring illegal harvest

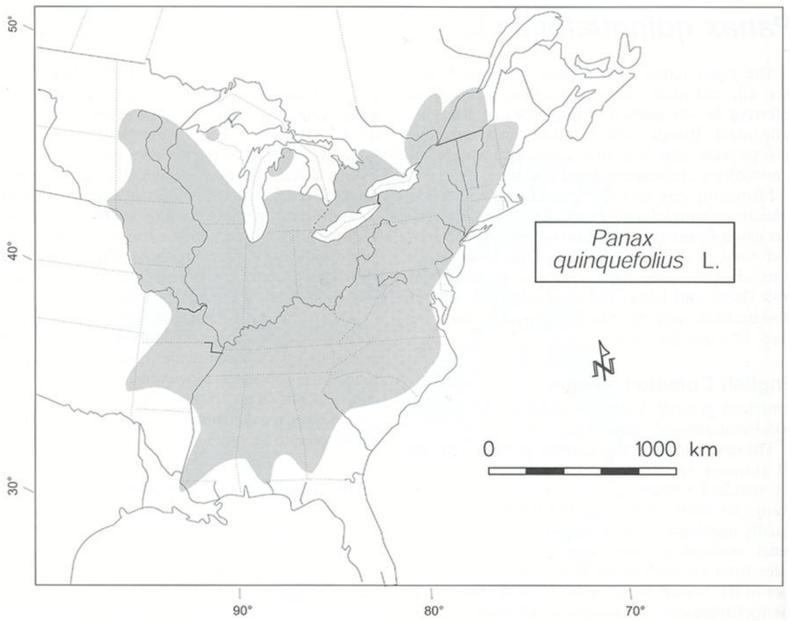
Making an NDF in Canada

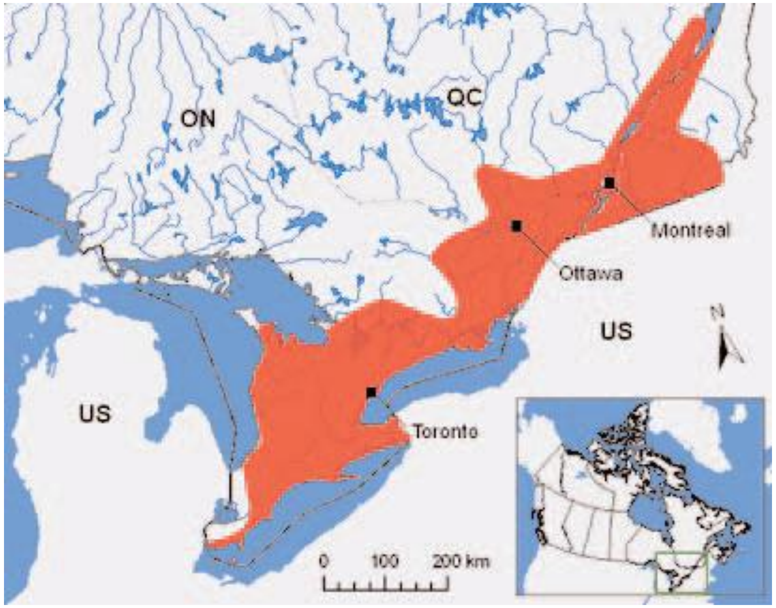
Recommendation

Consider the IUCN Checklist when developing NDFs.

American Ginseng NDF

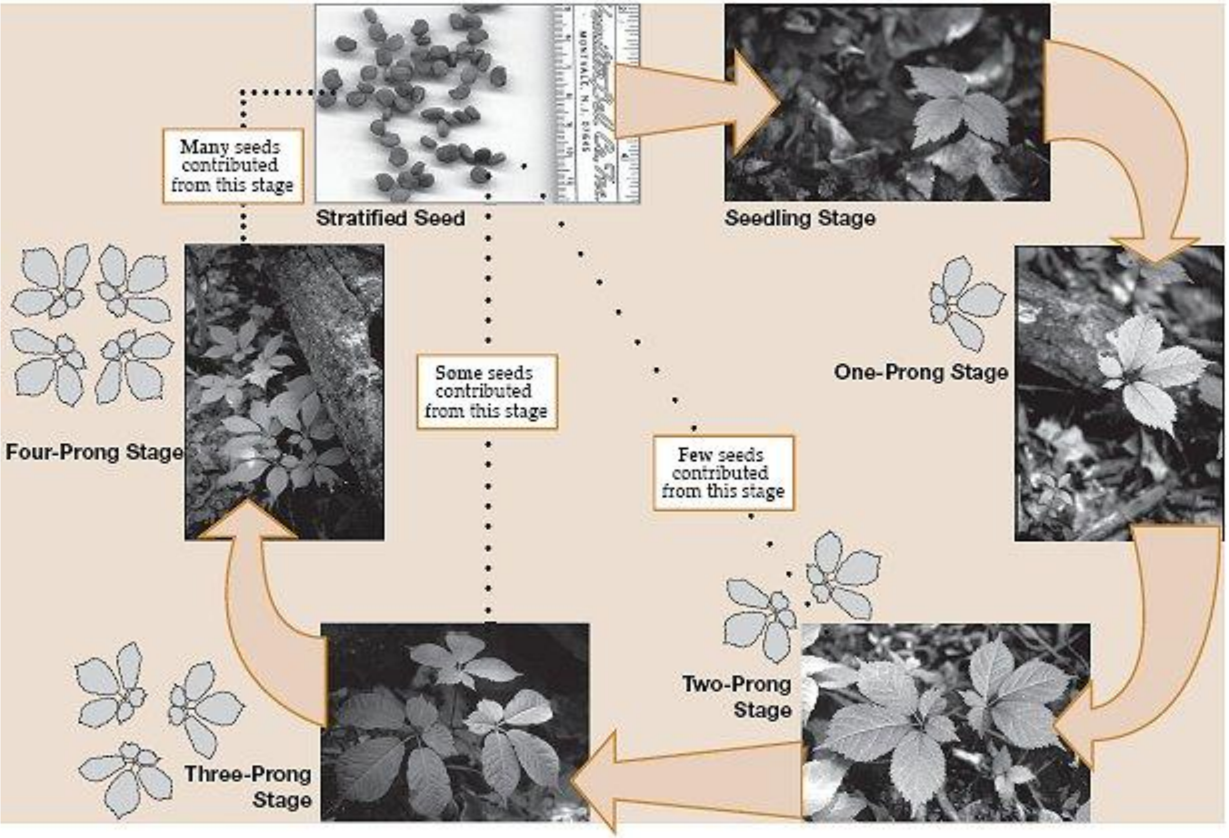
Distribution





American Ginseng NDF

Biological Characteristics

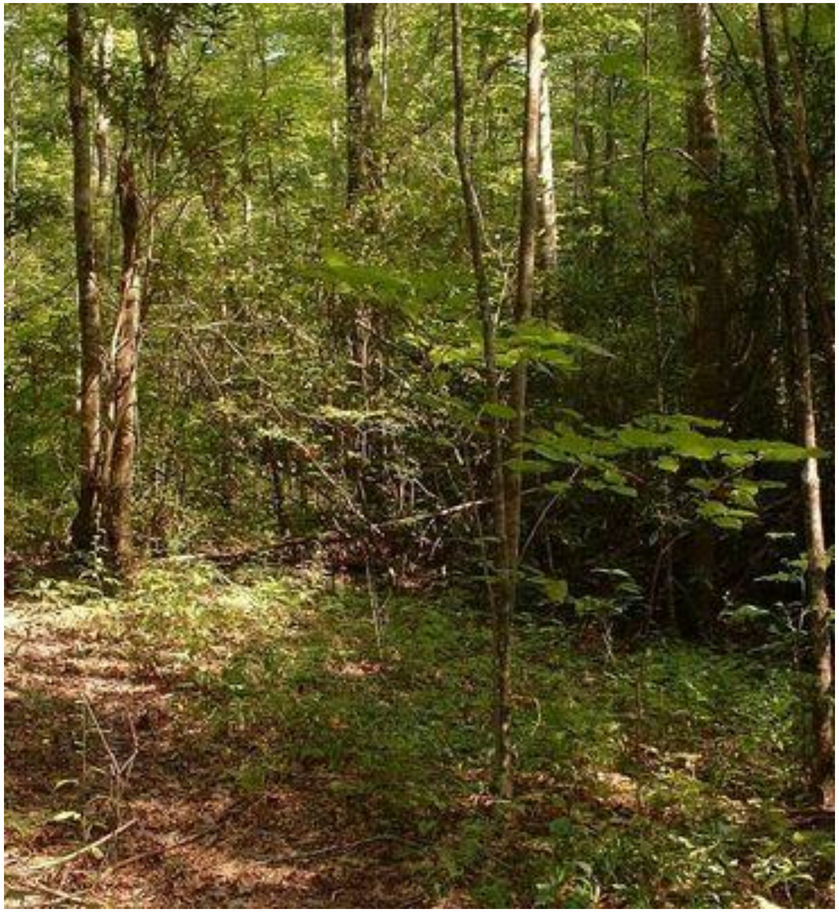


Developmental stages of ginseng

(Pennsylvania Department of Conservation and Natural Resources)

American Ginseng NDF

Habitat



American Ginseng NDF

- **Current global population trend:** X decreasing

- **Status - Global**
  Not yet assessed by IUCN

  NatureServe (2008):
  Global Status: G3G4 (last reviewed Jun2005)
  Rounded Global Status: G3 - Vulnerable

  United States **National Status:** N3N4
  Canada **National Status:**N2N3

- **Status - Canada:** END (SARA) END (Ontario)
  END (Quebec)

American Ginseng NDF

Main Threats

___No Threats

_X_Habitat Loss/Degradation (human induced)

___Invasive alien species (directly affecting the species)

_X_Harvesting [hunting/gathering]

___Accidental mortality (e.g. Bycatch)

___Persecution (e.g. Pest control)

___Pollution (affecting habitat and/or species)

_X_Other: Recreation (i.e. trails)

___Unknown

American Ginseng NDF

Trade

- Use – Medicinal purposes
- Parts - Roots, whole or sliced
- Types – wild, wild simulated, woodsgrown, and field cultivated
- Exported to Hong Kong, China
- Legal trade – field cultivated roots, $65 million, 2.5 million kg annually
- Illegal trade – ???

American Ginseng NDF

Harvest

- Lethal
- Zero quota for wild ginseng

Management

- Prohibitions on:
  - international export since 1989
  - harvest and trade in Quebec since 1973
  - harvest and trade in Ontario since July 2008
- Recovery strategy (federal Species at Risk Act)
- Wild-simulated/woodsgrown permitted on case-by-case basis
- Enforcement – Difficult
- Wild harvest continues

American Ginseng NDF

Non-Detriment Finding/Decision:

Export of wild American ginseng roots is considered detrimental.

NDF WORKSHOP CASE STUDIES
WG 2 – Perennials
CASE STUDY 6
Panax quinquefolius
Country – **UNITED STATES**
Original language – English

THE YIN AND THE YANG OF GINSENG – MAKING A NON-DETRIMENT FINDING FOR PANAX QUINQUEFOLIUS: A CASE STUDY WITH TWO PERSPECTIVES (UNITED STATES OF AMERICA AND CANADA).

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I. Background information on the taxa

1. BIOLOGICAL DATA

1.1. Scientific name: *Panax quinquefolius* L. (family Araliaceae).

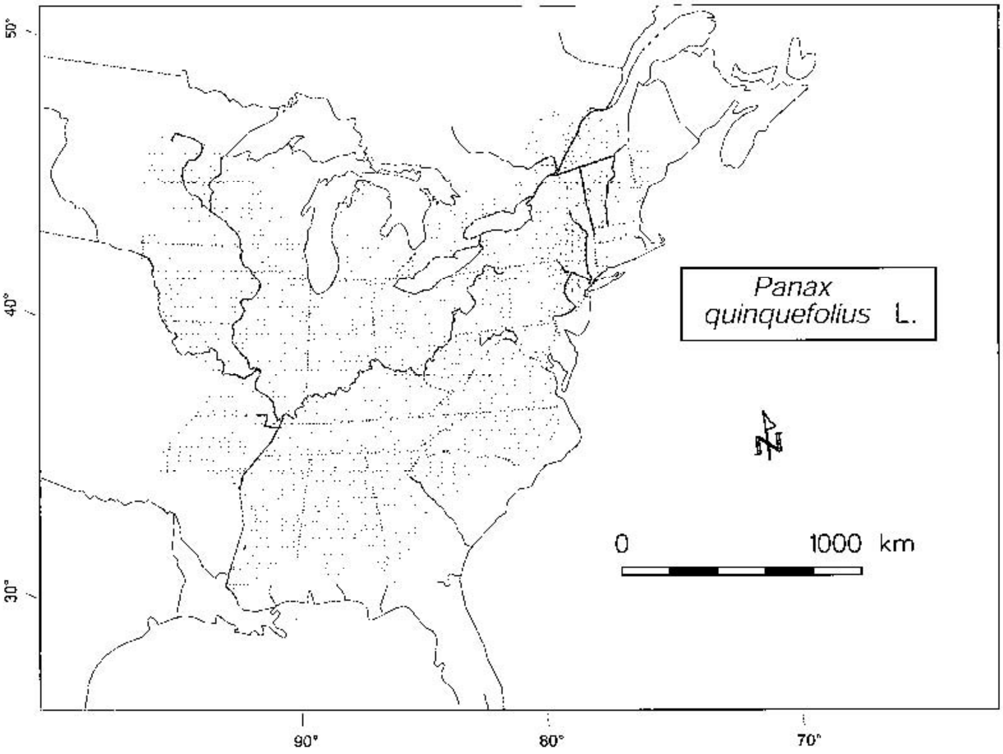
Common names: English: American ginseng, Canadian ginseng, sang, five-fingers; French: Ginseng d'Amérique; and Spanish: Ginseng americano.

1.2. Distribution (Specify the currently known range of the species. If possible, provide information to indicate whether or not the distribution of the species is continuous, or to what degree it is fragmented. If possible, include a map).

Panax quinquefolius is endemic to Eastern North America between 30° and 50°N (Small and Catling 1999). The species' range extends from southern Canada (Ontario and Quebec) south to the United States of America. In the United States, the species' range covers 34 States; from the Canadian border south to Georgia, and from the Midwest States to the east coast (Kartesz 1999). The primary range of *P. quinquefolius* in the United States is the southern Appalachian Mountains (Kentucky, North Carolina, Tennessee, Virginia, and West Virginia) and the Ozark Plateau region (Arkansas, Kansas, Missouri, and Oklahoma) (NatureServe 2005).

In the United States, *P. quinquefolius* occurs primarily as small populations that are broadly distributed across extensive forest habitat (McGraw et al. 2003; NatureServe 2005). Unoccupied suitable habitat for P. quinquefolius exists throughout the species' range.

Distribution Map of *Panax quinquefolius* (Small and Catling 1999).



1.3. Biological characteristics

Panax quinquefolius is a slow-growing, long-lived herbaceous perennial geophyte (i.e., an herbaceous plant with an underground storage organ) with a life expectancy of more than 20 years once established (Anderson et al. 1993; Carpenter and Cottam 1982; Lewis and Zenger 1982). The species exhibits low reproductive potential because of a relatively long pre-reproductive period of 3 years or more, slow growth rate, low fecundity, and high seed and seedling mortality (Carpenter and Cottam 1982; Charron and Gagnon 1991; Dunwiddie and Anderson 1999).

Plants of *P. quinquefolius* produce a single unbranched stem, 20-40 cm tall (Gagnon 1999) that terminates with a whorl of 1-4 palmately compound leaves with 3-4 leaflets (Radford *et al.* 1981). The aerial stem appears after the forest canopy has fully developed in late spring (Charron and Gagnon 1991). *P. quinquefolius* progresses through a series of growth stages in which leaf number is closely associated with size (Carpenter and Cottam 1982; Charron and Gagnon 1991; Anderson *et al*. 1993). Plants have been classified into four stage classes based on their numbers of leaves: seedlings (1 leaf with 3 leaflets), juveniles (2 leaves with 3-5 leaflets), small adults (3 leaves with 3-5 leaflets), and large adults (3 and 4 leaves with 3-5 leaflets) (Anderson et al. 1993; McGraw and Furedi 2005). A plant with two or more leaves usually produces an inflorescence, although it may not produce fruit (Charron and Gagnon 1991; Lewis and Zenger 1982; Schlessman 1985).

Plants can produce the same number of leaves for multiple years, decrease or increase the number of leaves produced, or not produce leaves for one or more growing seasons (Charron and Gagnon 1991; Farrington 2006; McGraw and Furedi 2005). Leaves of plants can senesce (a natural die-back of the plant) due to drought or other factors (Carpenter and Cottam 1982). However, the determinate growth pattern of *P. quinquefolius* prevents the production of additional leaves during the growing season.

Below ground, a plant's root system consists of a primary storage root that is joined at its apex to a vertical rhizome. From the rhizome grows a single aerial stem per growing cycle (Charron and Gagnon 1991; Lewis and Zenger 1982). The rhizome is characterized by permanent scars that form as a result of the annual abscission or accidental loss of the aerial stem (Anderson et al. 2002; Charron and Gagnon 1991; Lewis and Zenger 1982). The stem scars can be counted to calculate the number of years a plant has produced an aerial stem, which roughly equates to the age of the plant. The number of leaves that a plant has and the size of the plant can be good estimators of the root biomass underground (Anderson et al. 1993).

The inflorescence is a solitary umbel of greenish-white flowers that bloom during the summer; an individual flower produces a 1–3-seeded fruit (i.e., drupe) (Gleason and Cronquist 1963; Radford *et al*. 1981). The flowers are perfect, having both stamens (male) and carpels (female) (Carpenter and Cottam 1982; Lewis and Zenger 1982; Schlessman 1985). *Panax quinquefolius* has a mixed-mating breeding system of self-fertilization and cross-fertilization (Carpenter and Cottam 1982; Lewis and Zenger 1983; Schlessman 1985). Recent research has reported that the genetic profile of *P. quinquefolius* is consistent with a predominant life-history strategy of self-pollination, which results in low genetic variation within populations, but high genetic variation among populations (Grubbs and Case 2004).

Fruit production increases with age and size of plants (Anderson *et al*. 1993; Carpenter and Cottam 1982; Lewis and Zenger 1982; Schlessman 1985). Although fruit maturation is variable across the species' range, typically it begins in mid to late summer with fruits turning red at maturity in late summer to early fall (Charron and Gagnon 1991; McGraw *et al*. 2005). Natural dispersal of fruits is passive with fruits falling beneath the parent plant (Anderson *et al*. 1993; Lewis and Zenger 1982).

The seeds exhibit morphophysiological dormancy (Baskin *et al*. 1995) that prevents seeds from germinating for up to 22 months (Anderson *et al*. 1993, 2002; Lewis and Zenger 1982). To germinate, seeds require an after-ripening process and cold-stratification period (i.e., warm-cold sequence of seasonal temperature changes) to allow the embryo to fully develop and then to break seed dormancy (Charron and Gagnon 1991; Lewis and Zenger 1982; Schlessman 1985). Seed mortality of *P. quinquefolius* can be significant and the species is not known to form a long-term seed bank (i.e., over 4 years) (Van der Voort 2005). The most vulnerable stages of the life cycle of *P. quinquefolius* appear to be seed germination and seedling establishment (Carpenter and Cottam 1982; Charron and Gagnon 1991; Lewis and Zenger 1982).

1.3.1. *Habitat types:* Specify the types of habitats occupied by the species and, when relevant, the degree of habitat specificity.

Panax quinquefolius occurs in mid- to late-successional deciduous forests, in moist sites of low evapotranspiration loss with 70-90% shade (Anderson *et al*. 1993, 2002). Plants prefer well-drained soils rich in organic matter and with moderate to high calcium content, on slopes from 10-40% (Anderson et al. 1993, 2002). Availability of suitable habitat is not a limiting factor for the continued viability of the species.

1.3.2. *Role of the species in its ecosystem*

Panax quinquefolius is a long-lived late-successional understory species that occurs in stable habitats (Gagnon 1999). The species is adapted to grow in low light conditions characteristic of mature forests (Anderson et al. 2002). Fruits are eaten by small mammals and wild turkeys (*Meleagris gallopavo*); leaves and fruit are browsed by white-tailed deer (*Odocoileus virginianus*) (Farrington 2006; Furedi and McGraw 2004; McGraw and Furedi 2005); and small halictid bees and syrphid flies pollinate its flowers (Carpenter and Cottam 1982; Lewis and Zenger 1983; Schlessman 1985).

1.4. Population:

1.4.1. *Global population size*: (Population size may be estimated by reference to population density, having due regard to habitat type and other methodological considerations, or simply inferred from anecdotic data).

According to NatureServe (2005), a U.S.-based non-profit organization that compiles and assesses data on plants, animals, and ecological communities collected by State Heritage Programs in the United States and associated entities in Canada, the population of *Panax quinquefolius* is perhaps a billion plants.

In Canada, population abundance of *Panax quinquefolius* is low (Environment Canada 2000). In the United States, the species is widely distributed, with hundreds if not thousands of occurrences, typically having few plants per occurrence, primarily in the major portions of its range (i.e., Appalachian Mountains and Ozark Plateau region) (NatureServe 2005).

1.4.2 *Current global population trends*

___increasing __X_decreasing ____stable ____unknown

Populations of *P. quinquefolius* have declined in the past two centuries from historic levels. Because range-wide surveys have not been conducted in the United States, we do not have the empirical data to report the overall population trend in more recent times. However, *P. quinquefolius* is currently managed to maintain current population levels through regulation of harvest and trade.

1.5. Conservation status

1.5.1. *Global conservation status* (according to IUCN Red List):

___Critically endangered
___Endangered
___Vulnerable
___Near Threatened
___Least concern
___ Data deficient

- *Panax quinquefolius* has not been categorized by the IUCN.

1.5.2. *National conservation status for the case study country.*

According to the conservation status ranking system used by NatureServe, the conservation status of *P. quinquefolius* in the United States is "vulnerable to apparently secure" (N3N4). This ranking is not a legal designation, but is based on a variety of biological factors (e.g., species' abundance and distribution, population trends, threats, and number of protected and managed occurrences) (NatureServe 2005). NatureServe defines vulnerable as: A species is vulnerable in the state due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation; apparently secure is defined as: Uncommon but not rare; some cause for long-term concern due to declines or other factors.

1.5.3. *Main threats within the case study country*

___No Threats
___Habitat Loss/Degradation (human induced)
___Invasive alien species (directly affecting the species)
X__Harvesting [hunting/gathering]
___Accidental mortality (e.g. bycatch)
___Persecution (e.g. pest control)
___Pollution (affecting habitat and/or species)
X__Other- herbivory by native white-tailed deer (*Odocoileus virginianus*)
(Farrington 2006; Furedi and McGraw 2004; McGraw and Furedi 2005)
___Unknown

2. SPECIES MANAGEMENT WITHIN THE COUNTRY FOR WHICH CASE STUDY IS BEING PRESENTED.

2.1. Management measures

2.1.1. *Management history*

With the exception of populations of *P. quinquefolius* that occur on Federal lands, the management of the species is under the jurisdiction of State regulatory agencies. (The federal government of the United States is the centralized U.S. governmental body; a state is any one of the fifty subnational entities of the United States of America that share sovereignty with the federal government.) Nineteen of the 34 States within the range of the species have promulgated laws and regulations for the harvest and sale of roots of *P. quinquefolius*. These States have designated specific natural resource or agricultural agencies that are responsible for implementing the States' laws and regulations for *P. quinquefolius* within their jurisdictions.

Fifteen States do not allow the harvest of wild roots of *P. quinquefolius*. Of those States, five have formally designated *P. quinquefolius* as either endangered or threatened within their jurisdictions due to declines in populations in those States. Eight States have designated the species as a "species of concern," "rare," or on their "watch list"; harvest is prohibited or is discouraged due to the status of *P. quinquefolius* within those States. Two of the 15 States have no special designation for the species.

In addition, two Federal agencies, the U.S. Forest Service (USFS) and the National Park Service (NPS), manage the species on their respective lands. The USFS allows the harvest of roots of *P. quinquefolius* on certain National Forests, whereas harvest is prohibited on other National Forests. No harvest is allowed on NPS lands.

The U.S. CITES Authorities in the U.S. Fish and Wildlife Service rely to a large extent, but not exclusively, on other State and Federal agencies to provide information on the legal and illegal harvest of roots of *P. quinquefolius*, the status of the species in the wild, and population trends. The U.S. Scientific Authority makes its non-detriment findings for *P. quinquefolius* by using information received annually from the 19 States that allow harvest as well as information from various other sources (including other Federal and State agencies, industry representatives and associations, other non-governmental organizations, and researchers) on the status and biology of the species

2.1.2. *Purpose of the management plan in place*

To be approved for export of *P. quinquefolius*, a State must provide to the U.S. CITES Authorities documentation that its management program is designed to monitor and protect populations of *P. quinquefolius* from over-harvest. Currently, 19 States are approved for the export of wild-harvested roots. For those States, the U.S. Scientific Authority makes a programmatic non-detriment finding on a State-by-State basis, rather than requiring individual applicants to provide the information on a permit-by-permit basis. These findings have generally been made on an annual basis, but in 2006, the finding was made to cover a 3-year period. This change was made to recognize that population trends cannot be measured in annual increments, and significant new information is not likely to arise every year. Provision exists, however, for the finding to be rescinded and modified if significant new information suggests that it is prudent to do so.

2.1.3. *General elements of the management plan*

According to U.S. Federal regulations (50 Code of Federal Regulations, Part 23.68), for a State to be approved to export roots of *P. quinquefolius* it must provide certain biological and regulatory information to the U.S. CITES Authorities. States must provide an assessment of the condition of the population and trends of *P. quinquefolius* in their State, including a description of the types of information on which the assessment is based. States must provide an assessment of the historic, present, and potential distribution of wild ginseng on a county-by-county basis, and also information on the flowering and fruiting periods of *P. quinquefolius* in their State.

States must have regulations in place to ensure that exported roots are from plants that were at least 5 years of age or older at the time of harvest (i.e., with at least 4 bud-scale scars on the rhizome) and have personnel to determine the age of roots of all wild-collected *P. quinquefolius* harvested in their State.

States approved for the export of roots of *P. quinquefolius* must annually submit to the U.S. CITES Authorities a report with detailed information on the previous harvest season and any changes to the State regulatory procedures over the past year. State reports include the following information on *P. quinquefolius* that is used by the U.S. Scientific Authority in making its non-detriment finding:

- The weight of the total amount of wild-harvested roots;
- The average number of roots per pound; and
- Trends in abundance and distribution of populations.

The majority of the 19 States that allow the harvest of wild roots of *P. quinquefolius* require harvesters to plant the seeds of harvested plants near the vicinity of where plants are removed. Most States prohibit the harvest of roots on State-owned lands. States require that all harvested roots intended for sale be inspected and certified by the appropriate State authorities.

On lands managed by the USFS, the harvest is based on the status of *P. quinquefolius* on National Forest lands. National Forests that allow the harvest issue collection permits for specified weight limits of roots (e.g., 0.45-0.91 kg). No harvest is allowed on National Forests that classify the species as uncommon or rare.

2.1.4. *Restoration or alleviation measures*

In most States, harvesters are required and encouraged to plant seeds of harvested plants near the vicinity of where plants are growing (e.g., within 30 m). Seeds that passively fall from plants are vulnerable to predation and desiccation. The most vulnerable stages of the life cycle of *P. quinquefolius* appear to be seed germination and seedling establishment (Carpenter and Cottam 1982; Charron and Gagnon 1991; Lewis and Zenger 1982). Seeds planted by harvesters at the recommended depth of 2 cm experience higher rates of germination and emergence than seeds scattered on the forest floor (Farrington 2006; McGraw 2000). Computer simulation models have shown a 72% increase in population growth rate when seeds of mature fruits are planted at a depth of 2 cm.

Most States prohibit the harvest of roots on State-owned lands and harvesters are discouraged from planting cultivated seeds of *P. quinquefolius* on such lands. The USFS has established harvest moratoriums on certain National Forests and also prohibits planting of cultivated seeds on its lands. To discourage poaching on NPS lands and on USFS lands where harvest is not allowed, some roots of *P. quinquefolius* are permanently marked with silicon microchips and color-coded phosphorescent dyes. Marked roots have resulted in the successful prosecution of poachers and have deterred the incidence of poaching.

2.2. Monitoring system

2.2.1. *Methods used to monitor harvest*

States are required to report to the U.S. CITES Authorities the total weight of roots harvested for resale in each county of the State (a county is a geographic entity that performs State-mandated duties). County harvest data are used to monitor regional fluctuations in harvest levels, which may indicate a change in the abundance of *P. quinquefolius*. County harvest data can also be used to detect discrepancies between levels of harvest authorized by the USFS and actual amounts reported by the State, since even roots of *P. quinquefolius* harvested on Federal lands within a State is reported by the State. Such discrepancies could indicate illegal harvest on Federal lands. States are also required to report the average number of dried roots per pound calculated for each harvest season. This information is used to monitor whether root weights are decreasing, remaining stable, or increasing, which can indicate the effect of harvest on populations of *P. quinquefolius*. An increase in the number of roots per unit weight could indicate that smaller roots are being harvested and that larger plants may be less abundant.

2.2.2. *Confidence in the use of monitoring*

The harvest data obtained and reported by the States provide reliable information to monitor trends over time. A recent study initiated by the U.S. Scientific Authority found a positive relationship between State county harvest data and predicted abundance levels of *P. quinquefolius* based on field census data and availability of suitable habitats (Thatcher et al. 2006).

Greater populations of *P. quinquefolius* may occur on private lands than occur on Federal and State lands, although access to survey populations on private lands is usually restricted and therefore not quantified. Furthermore, we believe a portion of the wild roots exported annually may actually be “wild-simulated” roots (i.e., roots from plants derived from cultivated seeds planted in a natural forest environment and tended with minimal care so that roots retain a wild appearance) harvested from plants on private lands.

Although State certificates for inspected roots of *P. quinquefolius* are reviewed at the port of export by inspectors from the U.S. Department of Agriculture-Animal and Plant Health Inspection Service (USDA-APHIS) to ensure that root weights as reported on State certificates match the weights on the CITES export permits, and to ensure that wild roots are not being exported as artificially propagated roots, wild-simulated roots are typically visually indistinguishable from truly wild roots. Copies of the State certificates that have been cleared by USDA-APHIS are sent to the U.S. CITES Authorities to further monitor the exports of *P. quinquefolius*. However, States do not have reporting mechanisms or regulations in place to accurately track and report quantities of wild-simulated roots separate from wild roots. Therefore, the U.S. Scientific Authority is unable to quantify the amount of wild-simulated roots of *P. quinquefolius* reported as "wild."

2.3. Legal framework and law enforcement: Provide details of national and international legislation relating to the conservation of the species.

NATIONAL: Nineteen States with approved CITES programs have established laws and regulations for the harvest and sale of roots of *P. quinquefolius* within their respective jurisdictions. The U.S. Forest Service and the National Park Service have regulations for the management and conservation of the species on their respective lands.

Panax quinquefolius is subject to protection under the U.S. Lacey Act. Under the Lacey Act, for any species listed under CITES or protected by State law, it is prohibited to import, export, sell, receive, acquire, purchase, or engage in the interstate commerce of any plant taken, possessed, or sold in violation of any law, treaty, or regulation of the United States, any Indian tribal law, or any law or regulation of any State.

Panax quinquefolius is designated as "Endangered" in Canada (the other range country); the export of wild-harvested ginseng roots is prohibited (Canadian Wildlife Service).

INTERNATIONAL: *Panax quinquefolius* was listed in Appendix II of CITES in 1975. In addition to whole live or dead specimens, the listing includes whole and sliced roots and parts of roots.

3. UTILIZATION AND TRADE FOR RANGE STATE FOR WHICH CASE STUDY IS BEING PRESENTED.

3.1. Type of use (origin) **and destinations** (purposes) (e.g. commercial, medicinal, subsistence hunting, sport hunting, trophies, pet, food)**. Specify the types and extent of all known uses of the species. Indicate the extent to which utilization is from captive-bred, artificially propagated, or wild specimens.**

The root of *P. quinquefolius* is prized for its medicinal and aphrodisiac properties (Van Wyk and Wink 2004). The aromatic root has been used in East Asia for over 200 years for a wide variety of health concerns caused by stress, overwork, poor diet, sleep difficulties, traumatic injuries, and aging (Small and Catling 1999; Howell 2006). *Panax quinquefolius* contains the bioactive chemical constituents collectively known as ginsenosides (Van Wyk and Wink 2004).

The main destination for U.S. exports of roots of *P. quinquefolius* is Hong Kong, with minor amounts exported to Singapore, Taiwan, and other East Asian countries (U.S. Management Authority annual CITES reports). In Hong Kong, roots are sorted, graded, and shipped to China and other destinations for further sorting and processing (Novelli 2003).

Wild-harvested roots are exported as whole intact roots. Specimens of artificially propagated plants include whole roots and parts thereof, including ground roots. Roots from artificially propagated plants are used for capsules and liquid extracts, and also for the manufacture of teas and other products such as chewing gum, candy, cigarettes, and soft drinks (Robbins 1998). Cosmetics, soaps, cologne and perfumes are also reported to contain extracts from roots (Robbins 1998). Seeds, which are not covered by the CITES listing of the species, are exported for cultivation purposes.

3.2. Harvest:

3.2.1. *Harvesting regime* (extractive versus non-extractive harvesting, demographic segment harvested, harvesting effort, harvesting method, harvest season).

The 19 States that allow harvest of roots of *P. quinquefolius* require plants to have a minimum of 3 leaves, which is considered an adult plant (i.e., 5 years of age or older). The whole root with its attached rhizome is harvested, thus killing the plant. The harvest season begins in late summer to early fall; the specific harvest season in each of the 19 States is designated by State law. All but three States require harvesters to plant seeds at the same location or nearby vicinity of where roots are harvested.

3.2.2. *Harvest management/control (quotas, seasons, permits, etc.).*

Although harvest regulations vary by State, the 19 States with approved CITES programs have established laws and regulations for the harvest and sale of roots of *P. quinquefolius* within their respective jurisdictions. Harvested roots must be certified by State Government officials, and most States prohibit harvest on State-owned lands. The requirement for harvesters to have a permit varies by State; some States require harvesters to obtain a permit whereas other States do not.

Harvest on USFS lands requires the issuance of a harvest permit by the USFS. Collection permits are generally limited to a specified weight of roots (e.g., 0.45-0.91 kg), and harvesters must follow State harvest regulations (i.e., harvest season, age of plants, and planting of seeds).

Since 1983, the U.S. CITES Authorities have required that all roots of *P. quinquefolius* to be exported be certified as either wild or artificially propagated. In 1999, to further protect wild populations, the U.S. Scientific Authority determined that only wild roots of *P. quinquefolius* of 5 years of age or older (i.e., with at least 4 bud-scale scars on the rhizome) can be exported. None of the 19 States have nor have the U.S. CITES Authorities implemented an annual harvest quota for *P. quinquefolius*.

3.3. Legal and illegal trade levels: To the extent possible, quantify the level of legal and illegal use nationally and export and describe its nature.

LEGAL TRADE LEVELS: From 2000 to 2007, following implementation of the 5-year minimum-age restriction, the average annual legal export of wild-harvested roots was 29,660 kg (65,389 lbs). In the previous 5-year period (1995 to 1999), the average annual export was 44,275 kg (97,610 lbs) (U.S. Management Authority annual CITES reports). For the period 2000 to 2007, an average of 250 roots per pound, at a one-to-one ratio of root to plant, indicates that the average annual harvest removed 16,347,250 individual plants from the wild (based on annual State harvest data submitted to U.S. CITES Authorities).

ILLEGAL TRADE LEVELS: The rate and intensity of illegal harvest is difficult to quantify and fluctuates annually depending on local economies and the price paid for roots. Illegal harvest occurs to varying amounts on private, State, and Federal lands. To discourage poaching on National Park Service lands and on Forest Service lands where harvest is not allowed, some roots of *P. quinquefolius* are permanently marked with silicon microchips and color-coded phosphorescent dyes. Buyers of *P. quinquefolius* roots are informed to not purchase suspicious roots, which could be seized by State and Federal law enforcement officials. Marked roots have resulted in the successful prosecution of poachers and have deterred the incidence of poaching.

In recent years a greater emphasis by law enforcement officers in identifying illegal harvests, falsification of records, and unlawful transactions of *P. quinquefolius* has resulted in apprehending more harvesters and buyers (dealers) in violation of State and Federal laws. Undercover operations have been and will continue to be used to identify illegal activities and prosecute violators. Violations include: harvesting, selling, and purchasing prior to the lawful season; purchasing without a dealers license; harvesting without a permit; harvesting under-age roots; exporting without a permit; and falsifying transaction

II. NON-DETRIMENTAL FINDING PROCEDURE (NDFS)

Provide detailed information on the procedure used to make the non-detriment finding for the species evaluated.

1. IS THE METHODOLOGY USED BASED ON THE IUCN CHECKLIST FOR NDFs?

__yes _x__no

2. CRITERIA, PARAMETERS AND/OR INDICATORS USED

The U.S. Scientific Authority uses a wide range of information to ensure that the species remains at healthy population levels throughout its range and to determine whether export of roots will not be detrimental to the survival of the species. The status of *P. quinquefolius* is assessed by direct means, such as ongoing research studies, field inventories, population assessments, and scientific literature, and through indirect means, such as monitoring State harvest levels, and State and Federal conservation and protection efforts. State officials and academic and government researchers are routinely consulted to obtain the latest information on the status and biology of the species.

3. MAIN SOURCES OF DATA, INCLUDING FIELD EVALUATION OR SAMPLING METHODOLOGIES AND ANALYSIS USED

The U.S. Scientific Authority uses a wide range of information to evaluate the status of *P. quinquefolius* and to determine whether the export of roots will not be detrimental to the survival of the species. To be approved for export, States must provide to the U.S. Scientific Authority sufficient information to determine that their management and harvest programs are appropriate to ensure that populations of *P. quinquefolius* within their jurisdictions will not be over-harvested, and that there are procedures in place to minimize the risk that wild-harvested plants would be reported as cultivated.

States are required to report the total weight of roots purchased in each county of the State, which is used to detect trends in harvest levels and changes in species' abundance. States are also required to report the average number of dried roots per pound calculated for each annual harvest season. This information is used to determine whether root weights are decreasing, remaining stable, or increasing, which can indicate the effect of harvest on populations of *P. quinquefolius*.

The U.S. Fish and Wildlife Service (designated as the CITES Management and Scientific Authorities for the United States of America) has funded field research and/or obtained funding for research by other entities to examine various aspects of the species' biology and population status. Current research includes a multi-State study by the Biological Resources Discipline of the U.S. Geological Survey to assess the genetic diversity and population abundance of *P. quinquefolius*.

The U.S. CITES Authorities host meetings, biennially or triennially, with State program coordinators, other Federal agencies, researchers, industry representatives, and the general public to provide a forum to present current research and field studies on *P. quinquefolius* to improve the collective knowledge base of the species.

4. EVALUATION OF DATA QUANTITY AND QUALITY FOR THE ASSESSMENT.

The information contained in the State annual reports submitted to the U.S. CITES Authorities is used by the U.S. Scientific Authority to evaluate State programs, monitor harvest levels, assess impacts of harvest on populations, and determine whether the export of roots will be detrimental to the survival of the species. The U.S. Scientific Authority also uses ongoing research studies, field inventories, population assessments, and peer-reviewed scientific literature in making its non-detriment findings. A recent study initiated by the U.S. Scientific Authority found a positive relationship between State county harvest data and predicted abundance levels of *P. quinquefolius* based on field census data (Thatcher et al. 2006).

5. MAIN PROBLEMS, CHALLENGES OR DIFFICULTIES FOUND ON THE ELABORATION OF NDF.

- More robust and uniform field monitoring of populations throughout the States that allow harvest, particularly on private lands, would provide useful information.
- The inability to quantify the amount of wild-simulated roots of *P. quinquefolius* that is reported as "wild."

6. RECOMMENDATIONS

Scientifically-based non-detriment findings should be based on species' biology, life history traits, distribution and abundance, harvest regime, and other pertinent factors as necessary.

Its important to stay abreast of current research (including published and unpublished); maintain communications and share information with stakeholders and local and national authorities; have the ability to assess illegal and legal harvest levels; and monitor the effects of international trade on species.

Information exchange and cooperation among stakeholders, government entities, non-governmental organizations, and researchers is essential to share information on the biology and trade status of CITES-listed species in order to maintain self-sustaining populations and make scientifically based non-detriment findings.

In order to ensure that the harvest is sustainable and does not impact the long-term viability of the species, an adaptive management approach that provides flexibility for relevant institutions and stakeholders to react to changing conditions (e.g., invasive species, disease, predators) is useful so that adjustments can be made in a timely manner (e.g., revise harvest regulations, restrict exports, establish annual quotas, or etc.).

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NDF WORKSHOP
WG 2 – Perennials
CASE STUDY 6 SUMMARY
Panax quinquefolius
Country – **United States**
Original language – English

THE YIN AND THE YANG OF GINSENG – MAKING A NON-DETRIMENT FINDING FOR *PANAX QUINQUEFOLIUS*: A CASE STUDY WITH TWO PERSPECTIVES (UNITED STATES OF AMERICA AND CANADA).

AUTHOR

Patricia Ford

Panax quinquefolius L. (family Araliaceae), common names include American ginseng and Canadian ginseng, is endemic to eastern North America, from southern Canada south to the United States of America. The species is a slow-growing, long-lived herbaceous perennial geophyte found in mid- to late-successional deciduous forests. The roots of plants are harvested, thus killing the plant.

The root of *P. quinquefolius* closely resembles the root of the Asian species, *Panax ginseng*, which has been used in traditional medicine for perhaps 5000 years. Following the discovery of *P. quinquefolius* in 1716 in Canada, large volumes of roots were harvested and shipped to China. By the mid 1700s as plants became increasingly scarce in Canada, the harvest shifted south to the American colonies, what is now the United States of America. In 1975, *P. quinquefolius* was listed on Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). In addition to whole live or dead specimens, the annotation includes whole and sliced roots and parts of roots.

Approximately 90–95% of the wild roots of *P. quinquefolius* harvested in the United States are exported to East Asia, primarily Hong Kong. To ensure that the harvest does not impact the long-term viability of the species, in 1999 the U.S. CITES Scientific Authority determined that only wild roots of 5 years of age or older can be exported. As a result of the age-based restriction on the export of roots, exports decrease by 14,615 kgs (32,221 lbs) (based on 5-year averages).

In United States of America, the management and conservation of native species is the responsibility of the States. To be approved for export of *P. quinquefolius*, a State must provide to the U.S. CITES Authorities documentation that its management program is designed to monitor and protect populations of *P. quinquefolius* from over-harvest. Currently, 19 States of the 34 States within the range of the species are approved for the export of wild-harvested roots.

The 19 States regulate the harvest and sale of roots within their respective jurisdictions. Harvested roots must be certified by State Government officials and harvesters and buyers must meet certain State licensing and reporting requirements.

States approved for the export of roots of *P. quinquefolius* must annually submit to the U.S. CITES Authorities a report with detailed information on the previous harvest season and any changes to the State regulatory procedures. State reports include status information on *P. quinquefolius* that is used by the U.S. Scientific Authority in making its non-detriment finding. The U.S. Scientific Authority makes a programmatic non-detriment finding on a State-by-State basis, rather than requiring individual applicants to provide the information on a permit-by-permit basis. In United States, we have found that information exchange and cooperation among stakeholders, government entities, non-governmental organizations, and researchers is essential to share information on the biology and trade status of the species in order to maintain self-sustaining populations and make scientifically based non-detriment findings.

International Expert Workshop on CITES Non-Detriment Findings

Cancun, Mexico, November 17 to 21, 2008

Working Group - Perennials

Case Study: *Panax quinquefolius*

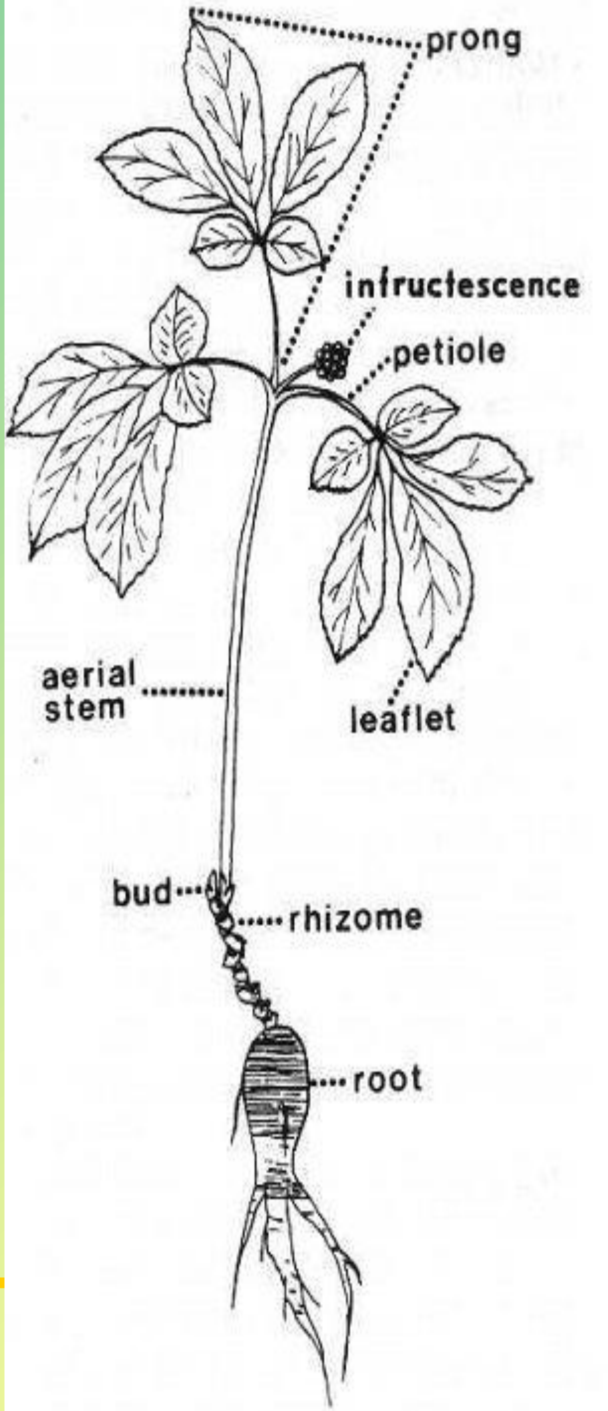
CITES Scientific Authority
for the United States

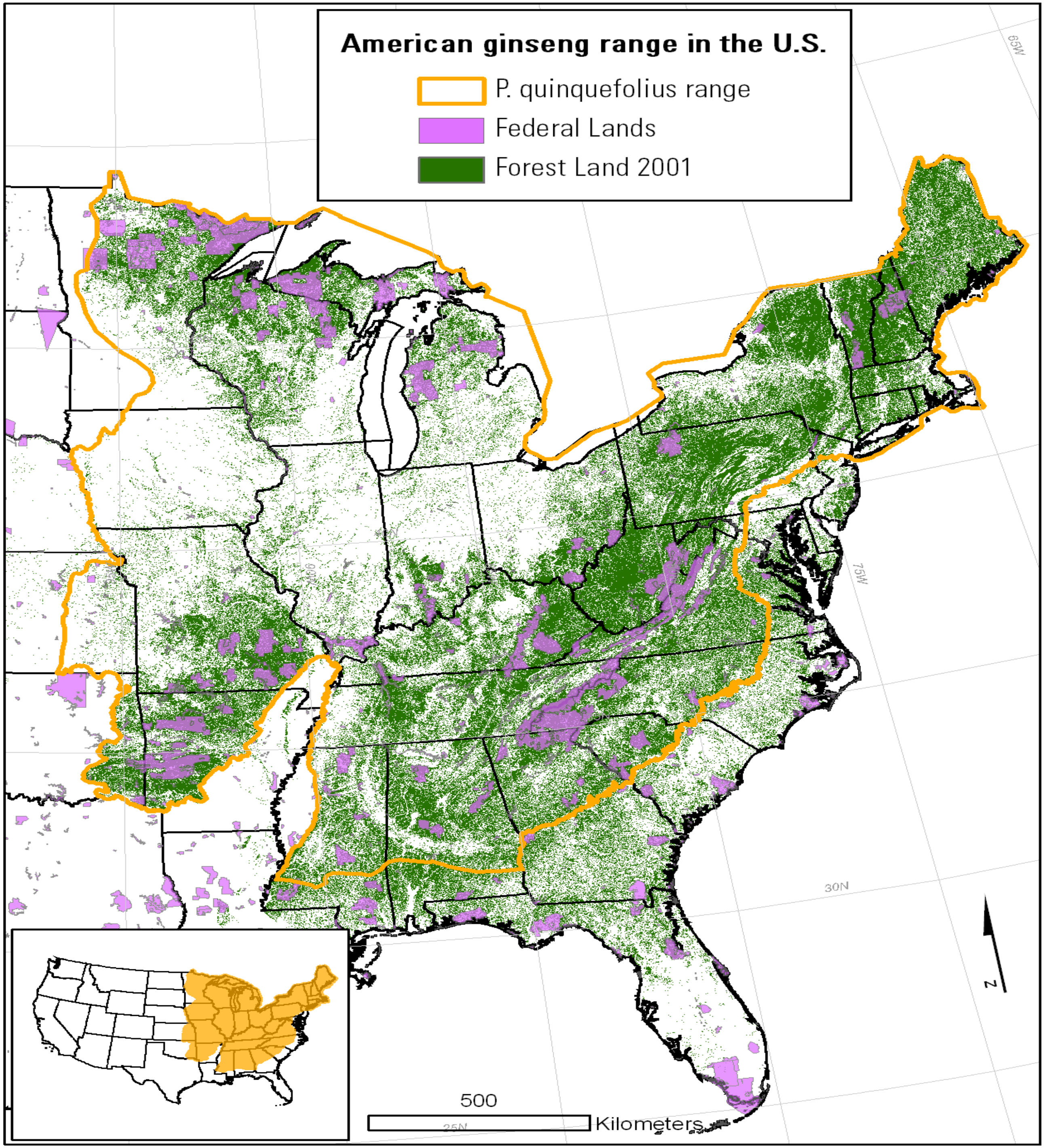
U.S. Fish and Wildlife Service
Division of Scientific Authority
Patricia Ford

Panax quinquefolius
American ginseng

Listed in Appendix II of CITES on July 1, 1975

Morphology of *Panax quinquefolius*




American ginseng range in the U.S.
P. quinquefolius range
Federal Lands
Forest Land 2001
65W
75W
90W
30N
25N
N
500
Kilometers

Habitat for *Panax quinquefolius* in the USA.

United States non-detriment finding for *Panax quinquefolius*

- **The U.S. Scientific Authority makes a programmatic non-detriment finding on a State-by-State basis.**

- **Not on a permit-by-permit basis for individual applicants.**

19 U.S. States are approved for the export of wild-harvested roots

- Alabama
- Arkansas
- Georgia
- Illinois
- Indiana
- Iowa
- Kentucky
- Maryland
- Minnesota
- Missouri
- New York
- North Carolina
- Ohio
- Pennsylvania
- Tennessee
- Vermont
- Virginia
- West Virginia
- Wisconsin

U.S. CITES Authorities Export Program for States

- **States must have promulgated laws and regulations for the harvest and sale of ginseng roots.**

- **States must have a management program designed to monitor and protect populations of *P. quinquefolius* from over-harvest.**

U.S. CITES Authorities
Export Program for States

- States must provide an assessment of its population and trends;
- Distribution of the species on a county-by-county basis;
- Information on the phenology of the species in their State; and
- Description of the types of information used to make the assessment.

U.S. Non-detriment finding for *Panax quinquefolius*

- The 19 approved States must submit an annual harvest report with current species' status information;
- The weight of the total amount of wild-harvested roots;
- Total amount harvested on a county-by-county basis;
- The average number of roots per pound; and
- Trends in abundance and distribution of populations.

Information the U.S. S.A. considers for making a NDF for *Panax quinquefolius*

- Biological life history characteristics of the species (e.g., reproductive strategy, recruitment rate, survival rate, regeneration requirements);
- Status of the species in the wild;
- Population structure, size, and trends;
- Genetic diversity;

Information the U.S. S.A. considers for making a NDF for *Panax quinquefolius*

- Areas of harvest and non-harvest;
- Habitat distribution (e.g., continuous, fragmented);
- Habitat availability and quality;
- Role of the species in its ecosystem;

Information the U.S. S.A. considers for making a NDF for *Panax quinquefolius*

- **Main threats to species;**
- **Management and harvest practices;**
- **Trade data: legal and illegal trade levels; and**
- **State legislation and regulatory requirements, and law enforcement practices.**

Sources of Information

- State annual reports
- Published and unpublished scientific literature
- Species experts/researchers
- Other government agencies
- CITES documents and trade data
- Private enterprises and non-governmental organizations (NGOs)
- U.S. Code of Federal Regulations 50 Part 23

U.S. Non-detriment finding for *Panax quinquefolius*

- Since 1999, only roots harvested from plants that are 5-years of age or older can be exported.
- Harvest has remained relatively stable overall.

Age Determination of *Panax quinquefolius*

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NDF WORKSHOP CASE STUDIES
WG 2 – Perennials
CASE STUDY 7
Tillandsia xerographica
Country – **GUATEMALA**
Original language – Spanish

CASE STUDY: TILLANDSIA XEROGRAPHICA

AUTHORS:
Mygdalia García
Hiram Ordóñez Chocano

I. Background information on the taxa

1. BIOLOGICAL INFORMATION ON THE SPECIES

1.1. Scientific and common names.[1]

Kingdom: Plantae
Division: Magnoliophyta
Class: Liliopsida
Order: Poales
Family: Bromeliaceae
Genus: Tillandsia
Species: T. xerographica Rohw
Common names: Gallito, Clavel del Aire

Scientific synonyms: *Tillandsia kruseana Matuda*
Tillandsia tomasellii DeLuca, Sabato & Balduzzi
Tillandsia xerographifica Rohw form viariegata Moffler is found from Mexico to El Salvador. It is characterized by its non-chlorophyllic longitudinal sections on the leaves. It is commonly known as Tillandsia marítima.[2]

Similar species: *Tillandsia fasciculata*

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[1] CITES, Manual de Identificación de Especies, Especies de Flora, *Tillandsia xerographica*.

[2] Flora Mesoamericana, www.mobot,org

1.2 Distribution[3, 4, 5]

Species endemic to the Mesoamerican Region, restricted to the semiarid area, mainly in the subtropical dry forest, very dry forest, and subtropical thorn scrub ecosystems, in southern Mexico, Guatemala, El Salvador and Honduras. It spreads at altitudes between 140 and 600 masl, with average temperatures that fluctuate from 22 to 28 degrees Centigrade, annual precipitation ranging from 550 to 800mm, relative humidity from 60 to 72 %, and evapotranspiration within a range from 600 to 800 mm per year.

In Guatemala, such region comprises the departments of El Progreso, Zacapa and Chiquimula, in the center and northeast of the Country, particularly within the semiarid region of the valley of the Río Motagua, which has an approximate surface of 928 Km^2 (200,000 ha). It is located at the base of the Sierra de las Minas, which acts as a natural barrier to moisture originating in the Atlantic causing the extreme dry condition that makes it one of the driest regions in Central America. Due to these conditions, its xerophytic vegetation is unique in the region and, therefore, it is considered to be an area of high endemism.[6]

At the present time, these ecosystems are extremely fragile and fragmented as a result of the expansion of the agricultural frontier to produce export crops (melon, tomato, egg plant, cucumber, peanut, okra, and citrus fruits), extensive cattle raising and urban and peri-urban sprawl in the region.

1.3 Biological characteristics of the species

Species Description[7]

Vegetative State: Epiphytic or lithophytic, acaulescent plant, from 20 – 60 cm in height. Blooming plants can reach up to 100 cm. Several leaves arranged in spiral forming a 60 – 90-cm-dense rosette, with a pseudobulbous base. Leaf blades are 15 – 75 cm long and 6 cm wide at the base, narrowly triangular, sharp to tapered, decurved, undulate and grooved with smooth margins and sometimes pink tinted. It is distinguished by being one of the gray Tillandsias of bigger size. The gray coloration of its foliage is produced by the scales that densely cover it,

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[3] CITES, Manual de Identificación de Especies, Especies de Flora, *Tillandsia xerographica*.

[4] Pérez, S., *Tillandsia xerographica* en el Valle del Motagua.

[5] Schürman, Gouda & Hromadnik, Report of a short Study of *Tillandsia xerographica* in Guatemala.

[6] Nájera, A. La conservación del monte espinoso y bosque seco del Valle del Motagua, Guatemala: promoviendo la protección de una ecorregión única.

[7] CITES, Manual de Identificación de Especies, Especies de Flora, *Tillandsia xerographica*.

which enable it to absorb moisture from the air. Scales are round with diameter of 0.3 -0.5 mm.

Inflorescence: Scape erect, 20 – 40 cm in height. Scape bracts imbricated, leaf shaped. Blades are up to 30 cm high and 1 cm wide and densely covered by scales. Inflorescence 30 cm long, formed by 9 – 30 spikes of 5-15 cm long and 1-2 cm wide, arranged in spiral, with 5-15 applanate flowers. Primary bracts are red and densely covered by scales, shorter than those of the spikes. Floral bracts are 2 – 5 cm long, green or yellowish red and densely imbricated. Flowers are 6 – 8 cm long, pale lilac and narrow tube-shaped. Stamen and style yellow, exserted. Superior ovary turns into dry dehiscent capsule.
The plumose seeds are dispersed by the wind. The plants bloom only once in their life, but the flowers last several months.

1.3.1 *Life history of the species*[8]

It is a xerophytic species of a very slow growth in nature. It takes between 12 to 18 years to develop from seed to flower, although the asexual sprout can reach maturity in fewer years. Through its management by controlled methods or assisted reproduction in nurseries through the application of fertilizer, hormone and bloom booster the period can be significantly shortened to obtain extra large plants in about 6 to 8 years, and with the use of bloom boosters they can bloom at any age.

Reproduction
Its reproduction may be sexual or asexual.

Sexual reproduction: To succeed in its ovule fecundation T. xerographica requires cross pollination. It begins as from the age of 12 years and it is mainly carried out by birds and insects, hummingbirds, butterflies, moths and some species of bees and bumblebees. That is why it is important that plants are located at a short distance from each other.[9]

Natural asexual reproduction: In the wilderness it occurs after the flower falls and the seeds mature. It consists in the production of sprouts (asexual sprouts, shoots) from buds that develop in the axil of some leaves. The development period of sprouts in the wild is at least one year before the plant produces another sprout. An adult plant can

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[8] CITES, Manual de Identificación de Especies, Especies de Flora, *Tillandsia xerographica*.
[9] Gouda, E & Feldhoff, H., Personal comments.

naturally produce a maximum of three sprouts or shoots before deteriorating and dying. It means that after blooming a mother plant deteriorates and dies in approximately four years.

Asexual reproduction with controlled methods (assisted reproduction): The production of axillary buds in nurseries may be induced or enhanced through Biotechnology, including the application of hormonal products, nutrients, and by cutting the scape. The development of a new shoot can be boosted by removing the first bud, sprout or shoot, when it reaches certain size. In Guatemalan nurseries, up to 6-8 sprouts have been obtained from one mother plant before it dies.

This way, the mother plant or maternity can produce a greater number of sprouts during the survival years. This process can even increase the lifespan of the mother plant up to six years after flowering.

Germination rate in the wild is unknown, though it is estimated to be very low mainly because of the loss of host species; therefore, the survival and recruitment rate is very low. However, in the long term, the plants that manage to germinate assure their survival through the production of sprouts, although genetic variability is not guaranteed.

The loss is smaller in nurseries. The rate of assisted germination of seeds in nurseries is estimated to be about 50 – 60 %, whereas the survival and recruitment rate is as much as 95%. As for assisted reproduction or reproduction through controlled methods, the number of sprouts produced per mother plant may even double and their harvest presents higher survival than in the nature.[10]

T. xerographica is a highly adaptable plant to management in nurseries, which has resulted in the increase of its commercial production; as it can be observed below through the voluntary annual quotas accepted by CITES.

1.3.2 *Habitat types*[11, 12]

Because *Tillandsia xerographica* is an epiphyte, it directly depends on the existence of an arboreal substrate. Host species are usually trees or mature shrubs, older than 20 years, with wrinkled bark and DAP greater than 05 cm.

The host tree species with a larger quantity of *T. xerographica* ranked in order of importance are the following:

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[10] Chacon, O. & Cruz Corzo, J. Personal comments.

[11] Pérez, S., *Tillandsia xerographica* en el Valle del Motagua.

[12] Schürman, Gouda & Hromadnik. Report of a short Study of *Tillandsia xerographica* in Guatemala.

Caraño *(Juliana adstringens Schl.*)
Guayacán *(Guaiacum sanctum L.*)
Manzanote *(Pereskia autumnalis (Eichlam) Rose* and *Pereskia lychnidiflora DC.*)
Roble *(Bucida machrostachya Stadl.)*
Cruz de mayo *(Apocinaceae)*,
Morro (*Crescentia alata HBK*)
Tamarind *Tamarindus indica L.*

According to the assessment reports on the manzanote (*Pereskia spp*), it has been confirmed that *T. xerographica* settles on the middle parts of the branches, where accumulation of thorns or crotches occur. The species tendency to solitary growing has also been reported; when there is an aggregate it comprises no more than 2 or 3 individuals which usually come from a single mother plant. In spite of its solitary tendency, *T. xerographica* tolerates surviving or developing next to other Tillandsia species; it has been observed that it grows next to *T. ionantha* and *T. scheidiana*.

One of the major problems for the survival of *T. xerographica* in the wild is deforestation. Guatemala has an annual deforestation rate of 73,148 ha /year, which is equivalent to 1.43% of the national territory, Zacapa and Chiquimula are among the top five departments with greater loss of forest cover in the Country.[13] In addition, there are other threatening factors such as habitat degradation and introduction of exotic forest species. Not only do these agents cause a lack of substrate but also pollination problems, because if trees containing this species of plants are located very far from each other, pollination is not achieved since pollinators have very short flying ranges.

Unfortunately, substrate species for *Tillandsia xerographica* are not considered priority species; hence, they are not included in reforestation programs.

1.3.3 *Role of the species in its ecosystem*

In the nature, *Tillandsia xerographica* feeds from the decay of organic matter heaped up on the axils of its leaves, said process is important for obtaining proteins and nitrogen. The species also accumulates water in the axils, which is used by several animals, such as birds, tree frogs, insect larvae, aquatic insects, and small beetles. Insects commonly found in the species are: Formicidae - ants 92.2%, Blattidae – cockroaches, 3%, Reduviidae – bugs, 2.5%, Blaberidae – giant cockro-

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[13] IARNA. Perfil Ambiental de Guatemala.

aches, 2.2 %, Gryllidae – crickets, 0.1% and Acrididae – grasshoppers, 0.1%.[14] The plant roots are covered by a special tissue that condenses environmental moisture. The flowers produce nectar to feed several nectariferous species that in turn pollinate the plants.

Due to its high photosynthetic capacity through the C-4 cycle, Tillandsia xerographica is regarded as capable of absorbing larger amounts of CO2, mainly considering that the cycle is produced under water stress and high rates of light intensity. This cycle has developed principally in tropical plants occurring in dry habitats with high environmental temperatures such as T. xerographica.[15]

1.4 Population

1.4.1 *Global population size.*[16, 17, 18]

The estimated size of a normal and sound population of *Tillandsia xerographica* according to different experts is the following:
> 2,000 plants / Km^2 (Véliz)
> 5,000 plants / Km^2 (Gouda)
> 30,000 plants / Km^2 (Feldhoff)

In the "Report of a Short Study of *Tillandsia xerographica* in Guatemala", performed by Chris Schürmann, Eric Gouda and Lieselote Hromadnik, in January 2004, a population of 125 plants per Km^2 was recorded, leading the authors to the conclusion that the species may be considered biologically extinct.

In the paper CARACTERIZACIÓN ECOLÓGICA DE *Tillandsia xerographica* EN EL VALLE SEMIÁRIDO DEL MOTAGUA, prepared by Selvin Pérez from Fundación Defensores de la Naturaleza in 2004, the figure of 140 plants /ha in little disturbed natural areas was reported.

Meanwhile, at October 2008, the five nurseries that propagate the species report a total inventory of 11298,020 plants with a production of 2 to 4 shoots per mother plant a year, depending on their management. Only two of the five nurseries have a commercial quota for the species. Together, the two nurseries report a 11288,02- plant-inventory for the same date.

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[14] Monroy, et All. Triatoma ryckmani (Hemiptera: Reduviidae) in the epiphyte Tillandsia xerographica (Bromeliaceae) in the semiarid region of Guatemala.

[15] R.G.S Bidwell, Fisiología Vegetal.

[16] Schürman, Gouda & Hromadnik. Report of a short Study of Tillandsia xerographica in Guatemala.

[17] Pérez, S., *Tillandsia xerographica* en el Valle del Motagua

[18] CONAP. Inventarios 2008.

1.4.2 *Current global population trends*

___increasing _X__decreasing ____ stable ____unknown

a. The trend of the *Tillandsia xerographica* population spread throughout the natural forests is to decrease as a result of the above mentioned factors.

b. The trend of the nursery population propagated through asexual reproduction systems with controlled methods is to increase.

1.5 Conservation status

1.5.1 *Global conservation status. (IUCN Criteria)*

___Critically endangered
___Endangered
___Vulnerable
___Near Threatened
___Least concern
___Data deficient

Was classified as Threatened by UICN (1997).[19]
Currently not listed in the IUCN Red List (www.redlist.com)

1.5.2 *Conservation status in Guatemala*[20]

The species is listed on Criterion 1 of the List of Threatened Species from Guatemala (LEA, Spanish acronym). It means that free export and trade of specimens collected from the wild are banned, even if used for scientific or reproductive purposes. *Only specimens that are part of or are derived from plants reproduced through proven methods may be commercialized.*

1.5.3 *Major threats in Guatemala*

___No Threats
_X_Habitat Loss/Degradation (human induced)
_X_Invasive alien species (directly affecting the species)
_X_Harvesting [hunting/gathering]
_X_Accidental mortality (e.g. Bycatch)
___Persecution (e.g. Pest control)
_X_Pollution (affecting habitat and/or species)
_X_Other: *road expansion, forest fires, wind effects, natural disasters.*
_X_Unknown (pests or diseases)

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[19] Schürman, Gouda & Hromadnik. Report of a short Study of Tillandsia xerographica in Guatemala.

[20] Lista de Especies Amenazadas de Guatemala –LEA-.

2. MANAGEMENT OF THE SPECIES WITHIN THE COUNTRY FOR WHICH THE CASE STUDY IS PRESENTED

2.1 Management measures

2.1.1 *Management history*

In Guatemala, Tillandsias or gallitos have been traditionally used, especially in local festivals; though Christmas season is when its commercial exploitation for national consumption is the greatest. Commercial exploitation of plants of the genus *Tillandsia* for export purposes began in the 1960s, when CITES did not even exist.[21] Then, the relevant authority was the National Forestry Institute (INAFOR Spanish acronym). For its exploitation, said agency had a register of collectors and would issue collecting permits without any kind of evaluation of the population. Some years later, the INAFOR disappeared, and the General Forestry Directorate (DIGEBOS, Spanish acronym) was created instead. The new institution followed the guidelines of its predecessor.[22]

In 1980, when CITES came into effect, the DIGEBOS initiated a register of the companies dedicated to reproduction and commercialization of this genus plants as well as other species which were directly exploited from the wild. Sustainable management procedures were then incipient.

It was not until 1989, with the approval of Decree 4-89, Law on Protected Areas, and the creation of the National Council of Protected Areas (CONAP, Spanish acronym), that the current exploitation system received attention and the reproduction and management of CITES-regulated species was stressed. The process started by making the DIGEBOS registers official and by legalizing the nurseries which propagated Tillandsias and which had not been registered so far. ,However, their exploitation had not been regulated yet, monitoring systems had not been implemented, and statistical information on the exploited species had not been provided either.[23]

In 1994, after assessing the exploitation conditions of these species, the Department of Wildlife of CONAP, *made the decision of totally banning their exploitation when removed from the wild*. The official list of collectors was cancelled as well as the issuing of collecting per-

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[21] García, M. Informe sobre Tillandsia xerographica para la Decimocuarta Reunión del Comité de Flora.

[22] Ponciano, I. Interview , 2005.

[23] García, M. Pesonal experience.

mits. A Resolution adjusted to current legislation was passed, which stated that nurseries that wished to be registered for reproducing and commercializing Tillandsias, had to acquire the breeding stock from authorized nurseries. Besides, registered nurseries and those to be registered were requested to submit a management plan for the species of concern, as well as being assisted by a professional technician foreman, recognized and registered by CONAP.[24]

Between 1994 and 2001, the technicians from the CONAP´s Department of Wildlife supported by the Service for the Protection of Nature of the National Civil Police of Guatemala (SEPRONA, Spanish acronym) (now Division for the Protection of Nature, DIPRONA) failed in their attempt to stop the illegal removal of Tillandsias. Checks along the roadways were implemented so as to look for collectors and to monitor the nurseries in order to prevent the purchase of illegal products. The first concrete results of this struggle were not achieved until 2001.

In November 2001, CITES authorities from The Netherlands informed the management authorities of Guatemala that from 1999 to 2001 several shipments of *Tillandsia xerographica* were intercepted with specimens that did not comply with the requirements established for plants cultivated under controlled methods as specified in Resol. Conf. 11.11. Their characteristics suggested their wild origin: they were very large, dirty, accompanied by dead organic matter, with evidence of insect damage on the leaves, bark pieces, spider webs, and dead insects on the roots. However, all the shipments were supported by their corresponding CITES Export Permits and were properly approved (signed and sealed) by the CITES Management Authority in Guatemala who had certified the reproduction method. Due to the lack of reply from Guatemalan authorities to their claims, Dutch authorities started the cancellation of authorizations for *Tillandsia xerographica* import shipments and urged the authorities of other countries to do the same.

In 2002, the CITES Management Authorities from Guatemala were substituted. The position was taken by a civil servant with large experience in the subject. By the end of that year, the 12th Meeting of the Conference of the Parties to CITES (November 3-15, Chile) was held, and Guatemalan officers used it to start conversations with representatives from The Netherlands who provided the necessary guidelines to start the corresponding negotiations.

In early 2003, rapprochement with Dutch authorities began. As part of the process, said authorities sent an e-mail with pictures of the

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[24] CONAP. Acuerdo Gubernativo 759-90.

plants from the shipments of concern. Definitely, those were wild plants. Meanwhile, during the 13th meeting of the Plants Committee of CITES held on August 12-15 in Geneva, Switzerland, and in the Meeting of the Plants Committee of the European Union on October 9, 2003 in Brussels,[25] Holland made official the banning of exports of this species from Guatemala.

As negotiations progressed, authorities from Holland realized the good intentions of the new Guatemalan authorities. Therefore, a visit of a group of scientific experts from the European Union was agreed for assessing the management of the species. The visit was sanctioned by CITES Plants Committee Chair Dr. Margarita Clemente, who personally provided follow-up on the case. The visit was scheduled for January 2004.[26]

While the experts were on their way from Europe, the CONAP began to approach the producing companies through the Non-Traditional Product Exporters Association– AGEXPRONT- (currently AGEXPORT). Several meetings were held with the companies' legal representatives who, on their own initiative, started the arrangements before the Plants Committee in order to prevent the European Union from canceling all imports of the species. With this aim, they prepared and sent the Committee a paper explaining the production system used in the Country. In addition, the companies created the Organization for the Investigation, Protection and Conservation of Phytogenetic Resources (CONREFI, Spanish acronym), which played an important role in the reopening of the *Tillandsia xerographica* European market.[27]

After the experts' visit, and upon request of the Committee Chair, the *Tillandsia xerographica* case was presented at the 14th Meeting of the Plants Committee, held from February 16 to 20, 2004 in Windhoek, Namibia. During the event Guatemala was congratulated by the Chair because it was the first time that both parties of a member country, the regulatory party and its private counterpart, attended the forum so as to work together for the conservation, protection, and sustainable use of a species.[28]

The report of the expert group that visited Guatemala with the aim of observing the species management (Report of a short study of

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[25] Jacobs, R. Informe de Participación en la PC14.

[26] Schürman, Gouda & Hromadnik. Report of a short Study of Tillandsia xerographica in Guatemala.

[27] Jacobs, R. Informe de Participación en la PC14.

[28] Jacobs, R. Informe de Participación en la PC14.

Tillandsia xerographica in Guatemala.)[29] was also presented and approved during the event. Later, recommendations made in the paper became the basis for the preparation of *"Proceso de control para el cumplimiento de las regulaciones CITES en relación al cultivo, propagación y exportación sostenible de Tillandsia xerographica" (Control Process for the compliance with CITES regulations regarding sustainable cultivation, spread and export of Tillandsia xerographica)*, by CONREFI. The latter was subsequently sanctioned by the Plants Committee and made official through Resolution 05-06-2004 of the Honorable Board of CONAP.[30]

The document includes official procedures for the exploitation and sustainable management of Tillandsia xerographica, which are still being applied up to date with minor modification.

2.1.2 *Purpose of the management plan*

The main purposes of the management plan for Tillandsia xerographica are its conservation, protection and sustainable management through the regulation of its commercial exploitation.

2.1.3 *General elements of the management plan for Tillandsia xerographica are*

To set up Plant Reproducing Companies:[31]

- General information on the company and its legal representative
- Reproduction aims
- Basic knowledge on the species biology
- Available area
- Environment conditions
- Nursery infrastructure (preferably a plan)
- Breeding stock acquisition way (purchase in a nursery, import or collection from the wild)
- Production and reproduction process
- Scheduling of management stages
- Technical information on the registered Professional Technician Foreman
- EIA

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[29] Schürman, Gouda & Hromadnik. Report of a short Study of Tillandsia xerographica in Guatemala.

[30] Resolución No.05/06/2004 del Consejo del CONAP.

[31] CONAP. Formato de Solicitud para Registro de Personas Individuales o Jurídicas que se dedican a la Reproducción de Especies Silvestres.

To set up a Plant Trading Company:[32]

- General information on the company and its legal representative
- Species suppliers (must be authorized and registered companies)
- Plant management for exportation
- Type of Packing

Observation: The CONAP has forms that only require to be filled in and relevant papers to be attached.

2.1.4 *Breeding stock or parental breeding stock acquisition way*

- Breeding stock purchase
  It is performed when purchased from CONAP authorized and registered nurseries.
- Breeding stock import
  In the case of *Tillandsia xerographica* it is not customary, though it is known that some nurseries might be bringing illegal plants from neighboring countries.
- Collection from the wild
  This breeding stock acquisition way comprises two different possibilities:

Case No.1. When the breeding stock is directly obtained from the wild

In this case, what is stated in Article 48 of the Regulation of the Law on Protected Areas, Governmental Accord No. 759-90[33] is implemented. The requirements of the application are the following:

a. To prove through certification from the Registro de la Propiedad Inmueble (Registry of Real Property), the right of property, possession, and usufruct on the piece if Real Estate where exploitation is intended to be performed. Should it not have registration, evidence given by the relevant authority must be presented to the satisfaction of CONAP.

b. To prove expressed consent of all individual or legal persons who for any reason should have registered on their behalf any right on the piece of Real Estate.

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[32] CONAP. Formato de Solicitud para Registro de Personas Individuales o Jurídicas que se dedican al Comercio de Especies Silvestres.

[33] CONAP. Acuerdo Gubernativo 759-90.

c. *To attach the inventory of the species subject of the request, whose content could be proven by CONAP´s Executive Secretariat.*
d. *To present the management plan to which the plant and animal species intended to be exploited will be subject to. Both the inventory and the management plan should be prepared by a related professional or by a specialist qualified technician approved by CONAP Secretariat.*
e. *A Professional Technician Foreman, registered in CONAP, who will be in charge of implementing the management plan, will be suggested.*

Case No. 2. When the breeding stock is directly obtained from the wild through the special harvesting system:

Art. 36 of Decree 4-89, Law on Protected Areas[34] states:

In forest harvestings legally authorized by the INAB, plants and animals may be collected upon prior permit from CONAP. INAB and CONAP shall keep close and permanent coordination regarding these activities. (Examples: housing urban development, road urban development, energy development, extended agriculture and/or land use change).

At the present time, collection of wild plants to be exported is not allowed in Guatemala. The Law specifies that only plants reproduced by controlled methods as from the second generation may be exported. This assures conservation, protection, and sustainable use of the species as well as the quality of the exported specimen, thus, preventing wild plant exportation.

2.1.4 *Restoration or mitigation measures*

As it is explained below, depending on the breeding stock acquisition way, mitigation measures will or will not have to be implemented.

- Breeding stock purchase → no mitigation measures are required.
- Breeding stock importation → no mitigation measures are required.
- Obtained from the wild (only for special harvestings) → EIA and mitigation measures are required.

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[34] CONAP. Acuerdo Gubernativo 759-90.

Suggested mitigation measures:

- Reforestation projects,
- Management of collected species, seed included,
- Reintroduction programs,
- Population enhancement projects,
- Environmental education programs for social awareness on the value of the species and its ecosystem

2.2 Monitoring system

2.2.1 *Methods used to monitor harvest*

When removal of the wild is authorized, visits are carried out prior to the project, during the removal and after the removal. Subsequent visits to the nurseries are performed periodically so that the management can be monitored, the scheduling of activities can be followed up, and the production can be verified. In fact, these monitoring visits are performed in all the nurseries, regardless of the breeding stock acquisition way.[35]

2.2.2 *Confidence in the monitoring*

There is confidence in the monitoring because the procedures legally established are performed.

2.3 Legal framework and law enforcement

To provide details of national and international legislation relating to the conservation of the species

- Legislative Decree 4-89, Law on Protected Areas and its Reforms, Decrees No. 18-89, 110-96 and 117-97 of the Congress of the Republic
- Governmental Agreement 759-90 and its Reform, Government Agreement No. 263-92
- Legislative Decree 63-79, CITES Ratification
- Guatemala List of Threatened Species– LEA-
- Resolutions of CONAP´s Honorable Board

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[35] Chacon, O. & Cruz Corzo, J. Personal comments.

3. UTILIZATION AND TRADE WITHIN THE COUNTRY IN WHICH THE CASE STUDY IS PRESENTED

3.1 Type of use (origin) and destination (purposes)

As per the Sub-commission for Ornamental Plants, Foliages and Flowers of the Guatemalan Exporters Association (AGEXPORT, Spanish acronym) *Tillandsia xerographica* is mainly exported for ornamental purposes. In importing countries it is used as an indoor and outdoor ornamental plant.

Nowadays, 100% of the plants authorized for export are obtained from asexual reproduction by controlled methods (assisted) in CONAP authorized and registered nurseries. However, the existence of clandestine nurseries has been reported to CONAP´s Wildlife Department. Such nurseries exploit several species of the same genus; therefore, some shoots of wild plants recovered in the nurseries are likely to be within the shipments. Unfortunately, there is no methodology for recognizing the difference between the latter and those reproduced through assisted reproduction.

3.2 Harvest[36]

3.2.1 *Harvesting regime*

(Extractive or non-extractive,, demographic segment harvested, harvesting effort, harvesting method, harvest season)

The harvesting regime for *Tillandsia xerographica* is non-extractive. In general, the sprouts produced by the mother plants (maternity) are harvested after flowering. Depending on the type of management, from 3 to 4 sprouts per mother plant per year can be produced. They are harvested twice a year, but only the larger spout is separated. The rest, one or more, of smaller size are left on the mother plant until reaching a proper size for being cut. Exported sizes are small, medium and large. In order to avoid the introduction of wild plants in shipments, exportation of extra-large-size specimens has been prohibited. Such plants are set apart for maternity.

As for *Tillandsia xerographica* management, four cultivation systems (asexual reproduction) through controlled methods (assisted) are known.

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[36] CONREFI. "Proceso de control para el cumplimiento de las regulaciones CITES en relación al cultivo, propagación y exportación sostenible de Tillandsia xerographica.

A. Natural system, without the use of chemicals nor treatments for increasing asexual production. Usually, upon reaching a medium or large size sprout are cut.

B1. It is similar to the above-mentioned system, but in this one the sprouts are cut at a small or even shorter size. These nurseries must have a larger area in comparison to the nurseries of the previously explained system because they have to cultivate the small plants, which takes one or two years.

B2. It has the same components of the prior two systems, but this one uses chemicals and another process for the cultivation of small plants. It also uses products to induce flowering so that mother plants can produce sprouts soon. It requires a larger area and greater infrastructure than the previous system.

B3. It is very similar to the others, but this system uses chemicals and processes or treatments to increase the number of asexually-produced sprouts. The infrastructure required is similar to infrastructure of system B2.

3.2.2 *Harvest management or control (quotas, season, permits, etc.)*[37]

According to what is stated in the paper *"Proceso de control para el cumplimiento de las regulaciones CITES en relación al cultivo, propagación y exportación sostenible de Tillandsia xerographica" (Control Process for the compliance with CITES regulations regarding sustainable cultivation, spread and export of Tillandsia xerographica),* the steps to control management and harvest of Tillandsia xerographica are the following:

1. In the first step, every nursery must present a report including information on infrastructure, number of benches and enclosures available, plant inventory, and cultivation process. This will allow verification of the reproduction process, as well as the later physical confirmation of the inventory. In addition, it will confirm the number of mother plants and, based on this and on their reproduction process, the production capacity of each nursery will be determined.
2. The second step consists in a document and plant inventory review for each nursery (including breeding stock) aiming to corroborate that they are legally authorized and registered. It will be performed by CONAP.
3. The third step consists in an annual visit to each nursery on behalf of the technical inspectors of the Agricultural and Environmental

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[37] CONREFI. "Proceso de control para el cumplimiento de las regulaciones CITES en relación al cultivo, propagación y exportación sostenible de *Tillandsia xerographica*.

Integral Protection Program – PIPAA- which has been accredited by the Guatemalan Ministry of Agriculture, Livestock, and Food, with the purpose of corroborating truthfulness of inventory-related information given to CONAP (this visit is independent from the visit performed by technicians from CONAP´s Wildlife Department.)

4. The fourth step involves the calculation of the annual quota for each nursery. It is carried out by implementing the program developed by CONREFI and authorized by CONAP and CITES. The procedure is carried out by technicians from PIPAA, an unbiased entity, in order to guarantee the data will not be manipulated. Results of the calculation are reported to CONAP, who will authorize and notify each nursery.

Through implementation of this program it is also established the minimum obligatory retention of plants that every nursery must have according to its own particular cultivation method in order to keep its breeding stock over time, which will determine whether the nursery will have an exportation quota or not in the future.[38]

This process is completed with the shipment inspection, a procedure through which the quantity and quality of exported plants are verified. It is performed by CONAP´s shipment inspectors prior to export authorization.[39]

Table. 1 Schedule of the calculation process for the commercialization quota of Tillandsia xerographica.

STEPS	**JAN**	**FEB**	**MARCH**	**APRIL**	**MAY**	**JUNE**	**JULY**	**AUG**	**SEPT**	**OCT**	**NOV**	**DEC**
Presentation of information on the nurseries								X				
Document review									X			
Information verification										X		
Quota calculation and report to CONAP											X	
Officialization of quota and information to CITES												X
Information for the nurseries												X
Quota execution	X	X	X	X	X	X	X	X	X	X	X	X

Seed management

When the plants set apart for maternity produce fertile seed it can be managed in two different ways:

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[38] CONREFI. "Proceso de control para el cumplimiento de las regulaciones CITES en relación al cultivo, propagación y exportación sostenible de *Tillandsia xerographica.*

[39] CONAP. Manual de Procedimientos del Departamento de Vida Silvestre.

a. It is left in the mother plant scape until germination. Later, it is taken to a wire mesh frame so it can continue developing.
b. Or the seed is removed from the mother plant being dampened and placed in a plastic fabric frame for germination and later growth.

Regardless of the germination system used, development of the newly germinated plant is extremely slow, just like in the wild. But as it grows it will be set apart and/or classified according to the size it has reached. When it gets the proper size, it will be earmarked for exportation; though most experts consider it would br better to use it as a mother plant.

National support and authorization[40]
The papers which must accompany legal shipments for authorizing exports are the following:
a. Permit / CITES Certificate, issued by CONAP, CITES Management Authority of Guatemala
b. Certificate of Origin for export issued by the Professional Technician Foreman
c. Phytosanitary Certificate granted by the Ministry of Agriculture, Livestock and Food (MAGA)
d. Export License issued by the Export Authorization Office (VUPE, Spanish acronym) of the Ministry of Economy.
e. Export Policy issued by the Tax Administration Office (SAT).

3.3 Legal and illegal trade levels

Next, information on *Tillandsia xerographica* legal export in the last 10 years is presented. It shows the years of sanction from the European Community.

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[40] CONAP, Ventanilla Única.

Table. 2[41]

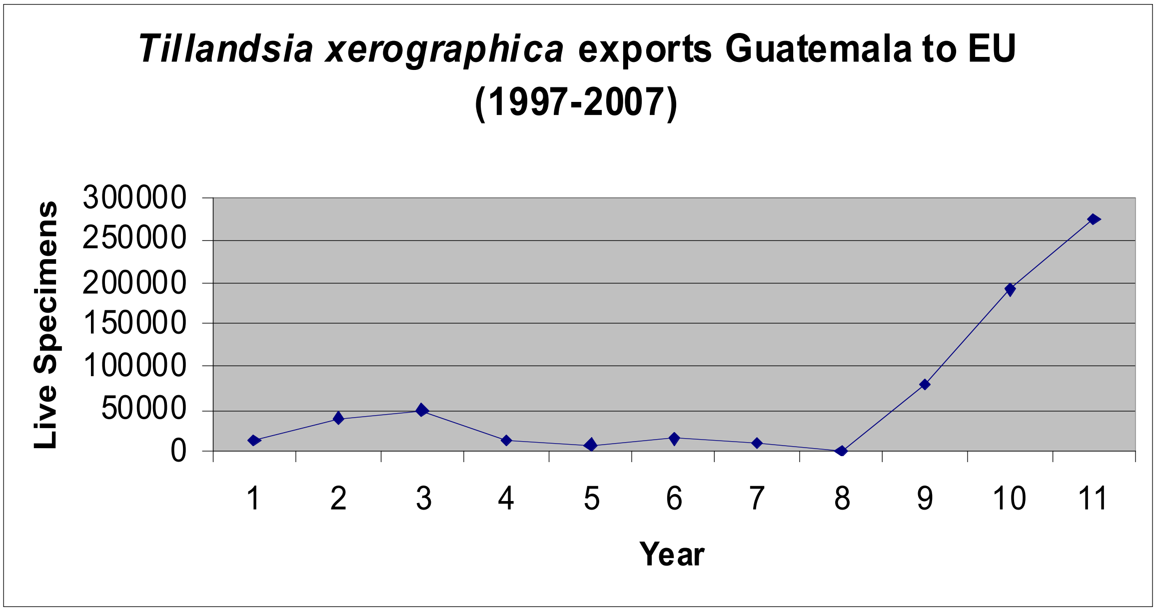

Table. 3. Authorized export quotas for Tillandsia* xerographica 2005 - 2008:[42]

Year	Country of Origin	Quota	Notes
2008	Guatemala	1011152	artificially propagated live plants, www.cites.org, Updated: 01/04/2008
2007	Guatemala	828560	artificially propagated live plants, www.cites.org, Updated: 30/03/2007
2006	Guatemala	829397	artificially propagated live plants, www.cites.org, Updated: 20/03/2006
2005	Guatemala	699983	artificially propagated live plants, www.cites.org, Updated: 21/03/2005

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[41] Ordóñez, H. Informe sobre Tillandsia xerographica.
[42] Ordóñez, H. Informe sobre Tillandsia xerographica.

II. NON-DETRIMENT FINDING PROCEDURE (NDFS)

Provide detailed information on the process used to make the non-detrimental finding for the species evaluated.

1. IS THE METHODOLOGY USED BASED ON THE UICN CHECKLIST?

__Yes _X_ No

For the case of *Tillandsia xerographica*, no NDF has been performed, just as it is explained throughout the paper.

2. CRITERIA, PARAMETERS AND/OR INDICATORS USED

The parameters used for establishing the ban were the following:
- Inventories
- Number of maternity plants versus amount of exported plants
- Management system
- Number of plants found in detained trucks
- Amount of wild plants found among nursery wastes and in nurseries as maternity
- Quality of exported plant (with wild characteristics)

3. MAIN DATA SOURCES, INCLUDING FIELD EVALUATION, SAMPLING METHODOLOGIES AND ANALYSIS

- Reports of technicians from the Department of Wildlife
- Results of field monitoring in reproduction nurseries
- Accusations
- Retentions made by Police
- Shipment inspections
- Refused collection request

4. EVALUATION OF DATA QUALITY AND QUANTITY FOR THE EVALUATION

Most of the information was provided by trustworthy personnel. Besides, during some visits of the technicians to the nurseries trucks containing wild plants were observed. Likewise, workers of some nurseries could be observed cleaning and placing the plants in the enclosures.

5. MAIN PROBLEMS, DIFFICULTIES AND CHALLENGES FOUND ON THE IMPLEMENTATION OF THE BANNING

Problems or difficulties with the nurseries
There was a great deal of opposition from the nursery staff. Sometimes they did not allow personnel from the Wildlife Department to enter the premises. In some nurseries it was necessary to inform long time in advance about the technicians' arrival, and moreover, they were received by armed guards. In one occasion the technicians were retained for more than six hours by the nursery employees.

Problems or difficulties with the police
When a truck transporting a plant was retained, an officer with the order of liberating the shipment would arrive. The officers were never identified. These events discouraged the police from doing their job.

Problems of the technical staff
The authority of the technical staff was not recognized by officers from other agencies such as the District Attorney (Ministerio Público), the Ministry of Agriculture, the SAT, and the Police; therefore, many difficulties arose when looking for support. Besides, (and so far) the judges are not familiar with specific laws, they do not accept technical assessments, and hence obtaining a search warrant is proved to be very difficult. Even CONAP´s legal department, which accompanied the technicians in the cases they were following up, showed little support. For these reasons, few cases reached a legal process.

6. RECOMMENDATIONS

- To perform a study on the species in order to determine the actual status of the population in Guatemala and make the NDF
- To promote certification of Tillandsia xerographica cultivation
- To prioritize areas for the conservation of the species
- To train the technical staff from the management authority in recognition and identification of T. xerographica in all phases

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NDF WORKSHOP
WG 2 – Perennials
CASE STUDY 7 SUMMARY
Tillandsia xerographica
Country – **Guatemala**
Original language – Spanish

CASE STUDY: *TILLANDSIA XEROGRAPHICA*

AUTHORS:
Mygdalia García and Hiram Ordóñez Chocano

Species: *T. xerographica Rohw*.

Common name: Gallito, Clavel del Aire.

Tillandsia xerographica is a slow-growing xerophytic epiphyte. It is native and endemic to Central America and restricted to semi-arid regions, mainly dry and very dry subtropical forest and subtropical thorn scrub in the south of Mexico, Guatemala, El Salvador and Honduras. It grows at elevations between 140 and 600 m, with average temperatures ranging from 22 to 28 degrees Celsius, annual rainfall between 550 and 800 mm, relative humidity from 60 to 72% and annual evapotranspiration between 600 and 800 mm.

In Guatemala, this region is represented by the Departments of Progreso, Zacapa and Chiquimula, in the center and northeast of the country, and especially in the semi-arid region of the Motagua River valley. This area covers an approximate surface of 928 Km^2 (200,000 ha) and contains a type of vegetation with unique features. The survival of *Tillandsia xerographica* directly depends on the existence of host trees, mainly mature trees or shrubs over 20 years old with a rough bark and a DBH greater than 5 cm.

Deforestation is one of the greatest threats to the survival of *T. xerographica* in the wild; Guatemala loses approximately 73,148 ha to deforestation every year, which amounts to an annual deforestation rate of 1.43%. Moreover, the Departments of Zacapa and Chiquimula are among the five with the greatest loss of forest cover in the country. The species is considered Threatened by the IUCN and is listed as a Criterion 1 species (Endangered) by CONAP (the National Council for Protected Areas) in Guatemala. Current population estimates are 125 plants/Km^2 according to Schürmann, Gouda and Hromadnik, and 140 plants/ha according to Pérez – both reports published in 2004 – so the species is considered to be biologically extinct. Only 1371 ha of forest in the habitat of the species are protected – in nine private protected areas and three municipal protected areas. The species is mainly used as an ornamental plant.

Although the commercial harvest of *Tillandsia xerographica* in Guatemala is not permitted, there are specific regulations in place for the harvest of parental stock, in Article 36 of Decree 4-89 of the Law on Protected Areas and Article 48 of Government Agreement 759-90, Regulation of Decree 4-89.

<u>Case No. 1.</u> According to Article 48 of the Regulation, obtaining parental stock directly from the wild is subject to an application including an inventory of the species. The inventory must be prepared by a Professional Technician hired by the applicant and serves as the basis for the necessary field verifications and technical and legal advice.

Depending on the results obtained, up to 50% of adult plants existing in the area reported may be authorized for collection.

Case No. 2. Parental stock may be obtained directly from the wild through a procedure for Special Uses laid down in Article 36 of Decree 4-89 of the Law on Protected Areas. This type of application is usually made when there is a Licence for Forest Use, authorized by the National Forest Institute of Guatemala. In this case, the procedure is the same as in Case No. 1, with the additional requirement that the application for the harvest authorization must also include an authenticated copy of the Licence for Forest Use explaining the type of use planned (clear cut logging, selective logging, opening of tracks, etc.). The harvest of all the plants is only authorized once the inventory has been verified.

Over the last fourteen years, the harvest of *Tillandsia xerographica* from the wild has only been authorized on two occasions, always through the procedure for Special Uses. Given the considerable decline of the populations of the species in its range, it is very unlikely that any harvests will currently be authorized through the first system. In the procedure for Special Uses, the harvest is considered to be a case of salvage.

Regardless of the system through which harvest from the wild is authorized, monitoring visits always take place before, during and after the harvest; besides, the plant harvested is only authorized for use as parental stock.

Internationally traded specimens of *Tillandsia xerographica* are the offspring or shoots produced by parental stock held in registered nurseries. Since 2005, the Guatemalan authorities have established voluntary quotas for trade in the species to ensure its sustainable management and avoid the introduction of wild plants into nurseries.

Presidencia de la República de Guatemala.

Consejo Nacional de Áreas Protegidas.

Tillandsia xerographica

NDF

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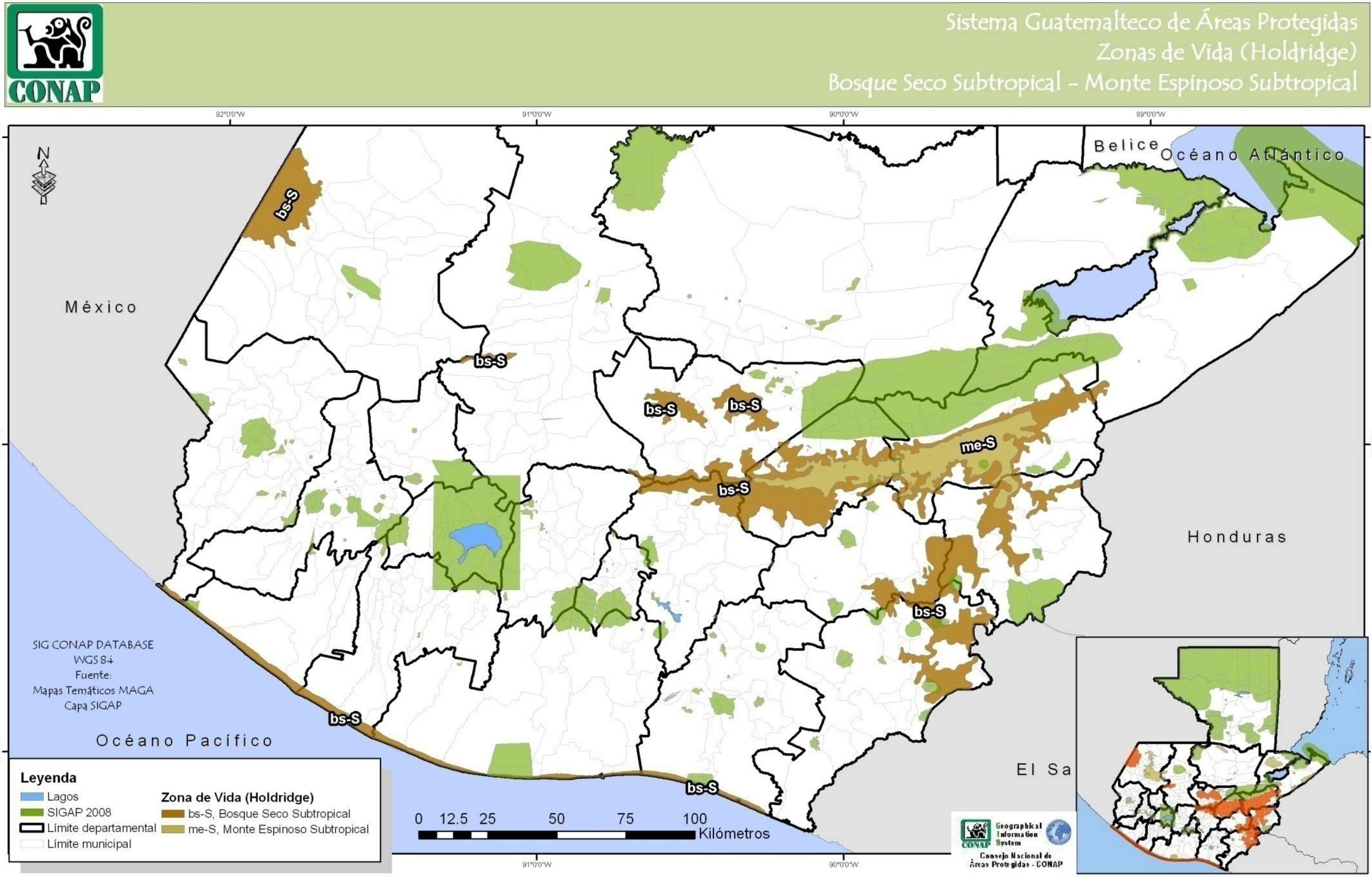
- MGR , Noviembre 2008-

Tillandsia xerographica estado natural

Tillandsia xerographica – Generalidades.

- Especie xerofita, epífita, de crecimiento lento, endémica de la Zona Semiárida de Mesoamérica.
- Ecosistemas de Bosque Seco y Muy Seco Subtropical y Monte Espinoso Subtropical, al sur de México, Guatemala, El Salvador y Honduras.
- En altitudes que van desde 140 – 600 msnm.
- Temperaturas promedio que varía de los 22 a los 28 grados C.
- Precipitación de 550 a 800 mm anuales.
- Humedad relativa de 60 a 72%.
- Evapotranspiración en el rango de los 600 a 800 mm al año.
- Región representada en Guatemala en los Departamentos de El Progreso, Zacapa y Chiquimula.
- Con una superficie aproximada de 928 Km^2 (200,000 ha)

Tillandsia xerographica – Distribución.



SIG CONAP DATABASE
WGS 84
Fuente:
Mapas Temáticos MAGA
Capa SIGAP

Tillandsia xerographica – Reserva Municipal de Niño Dormido.

Solamente existen 1, 371 hectáreas de bosque protegido..

Tillandsia xerographica – Generalidades.

- Principales especies hospederas.

Caraño (*Juliana adstringens Schl.*)

Guayacán (*Guaiacum sanctum L.*)

Manzanote (*Pereskia autumnalis (Eichlam) Rose* y *Pereskia lychnidiflora DC.*)

Roble (*Bucida machrostachya Stadl.*)

Cruz de mayo (Apocinaceae),

Morro (*Crescentia alata HBK)*

Tamarindo *Tamarindus indica L.*

- Tamaño actual de la Población.

125 plantas por Km^2 (Schürman, Gouda & Hromadnik)

140 plantas /ha (Pérez, S.)

- Estado de Conservación.

Criterio UICN: Amenazada.

Criterio LEA- Guatemala: Criterio 1.

- Manejo en viveros.

Cinco viveros registrados para reproducción de la especie.

Dos viveros poseen cuota autorizada para comercialización.

Inventario de especímenes en vivero a octubre de 2008 = 1$_1$516,244.

SU USO PRINCIPAL ES COMO PLANTA HORNAMENTAL

Tillandsia xerographica – Colecta.

En Guatemala, existe veda desde 1994 para la colecta comercial de especímenes de las especies del Género *Tillandsia*, por esta razón solamente se autoriza la comercialización de plantas reproducidas en viveros.

Las Licencias de Colecta solamente se autorizan para colecta de Pié de Cría o Plantel Parental.

Para la obtención de Pié de Cría o Plantel Parental existen tres formas autorizadas:

1. Compra en viveros autorizados.
2. Importación.
3. Colecta del Medio Silvestre.

La Colecta del Medio Silvestre se puede autorizar de dos formas:

- ✓ A través de la aplicación del Artículo 48 del Reglamento del Decreto 4-89, Ley de Áreas Protegidas, Acuerdo Gubernativo 759-90.
- ✓ A través de la aplicación del Artículo 36 de la Ley de Áreas Protegidas.

Tillandsia xerographica – Autorización de Colecta.

Requisitos para solicitar la Colecta:

1. La empresa deberá estar registrada en la Autoridad Administrativa CITES de Guatemala – Consejo Nacional de Áreas Protegidas – CONAP.
2. La empresa deberá contar con el Respaldo de un Técnico Profesional Regente, que implementará el manejo de la especie.
3. Deberá presentar el Formulario de Solicitud correspondiente con todos los documentos de respaldo de acuerdo al sistema a utilizar.
4. Justificación.

Tillandsia xerographica – Autorización de Colecta.

Caso No.1. Cuando el Pié de Cría o Plantel Parental se obtiene directamente de la naturaleza, a través de la aplicación del Artículo 48, del Reglamento de la Ley de Áreas Protegidas, Acuerdo Gubernativo No. 759-90.

Los requisitos de la solicitud son:

a. *Acreditar con certificación del Registro de la Propiedad Inmueble, el derecho de propiedad, posesión o usufructo sobre el inmueble en el cual se pretende efectuar el aprovechamiento. Si no tuviera inscripción, deberá presentarse constancia de la autoridad competente a satisfacción del CONAP.*

b. *Acreditar el consentimiento expreso de todas las personas individuales o jurídicas que por cualquier causa, tuvieran inscritos a su favor derecho sobre el inmueble.*

c. *Adjuntar el inventario de la o las especies motivo de la solicitud, cuyo contenido podrá ser comprobado por la Secretaría Ejecutiva del CONAP.*

d. *Presentar el plan de manejo a que serán sometidas las especies de flora y fauna que se pretenda aprovechar. Tanto el inventario como el plan de manejo, deberán ser elaborados por un profesional afín o por un técnico especialista calificado y aceptado por la Secretaría del CONAP.*

e. *Se propondrá un Técnico Profesional Regente, registrado en el CONAP, quien se hará cargo de la ejecución del plan de manejo.*

Tillandsia xerographica – Autorización de Colecta.

Caso No.1. Cuando el Pié de Cría o Plantel Parental se obtiene directamente de la naturaleza, a través de la aplicación del Artículo 48, del Reglamento de la Ley de Áreas Protegidas, Acuerdo Gubernativo No. 759-90.

El TPR realiza el inventario inicial por medio de cualquier método de muestreo.

El resultado se expresa en densidad de plantas por hectárea.

Este resultado se incluye dentro de la solicitud de Colecta presentada al CONAP.

Monitoreo Pre Proyecto.

Los Técnicos del Departamento de Vida Silvestre del CONAP, verifican la información y elaboran un dictamen .

Previo pago de Q.61.00 ($8.00) por millar de plantas.

Con base a los resultados del inventario y el plan de manejo se puede autorizar hasta un máximo del 50% de las plantas para maternidad.

La Empresa o la persona autorizada procede a la Colecta de las Plantas.

Monitoreo Colecta.

Los Técnicos del Departamento de Vida Silvestre del CONAP, verifican la planta colectada y su manejo en el vivero.

Monitoreo Post Proyecto.

TIEMPO DE SOLIDARIDAD

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Tillandsia xerographica – Autorización de Colecta.

Caso No. 2. Cuando el Pié de Cría o Plantel Parental es obtenido directamente de la naturaleza a través de la aplicación del Sistema de Aprovechamientos Especiales.

Artículo 36 del Decreto 4-89, Ley de Áreas Protegidas, el cual dice:

En los aprovechamientos forestales, legalmente autorizados por el Instituto Nacional de Bosques – INAB-, se podrá hacer colecta de plantas y animales siempre que previamente se obtenga el permiso del CONAP. El INAB y el CONAP, mantendrán una coordinación estrecha y permanente respecto a estas actividades.

(Ejemplos: Desarrollo urbano habitacional, desarrollo urbano vial, desarrollo energético, agricultura ampliada u otra actividad para cambio de uso de suelo).

Los requisitos son los mismos del caso anterior, pero en lugar de los documentos de los incisos a y b, se presentará la copia autenticada de la Licencia Forestal emitida por el INAB. Se paga Q61.00 ($8.00) millar de planta colectada.

LA UNICA DIFERENCIA CON EL CASO 1, ES QUE POR ESTE MÉTODO SE AUTORIZA LA COLECTA DE TODOS LOS ESPECÍMENES, YA QUE ESTE SE CONSIDERA UN TIPO DE SALVAMENTO.

Tillandsia xerographica – Autorización de Colecta.

DURANTE LOS ÚLTIMOS 14 AÑOS, A PARTIR DE LA FECHA EN QUE SE DECLARÓ LA VEDA PARA LA ESPECIE, SOLAMENTE SE HAN AUTORIZADO DOS LICENCIAS DE COLECTA.

AMBAS LICENCIAS HAN SIDO AUTORIZADAS POR MEDIO DEL SISTEMA DE APROVECHAMIENTOS ESPECIALES. (Caso 2)

Tillandsia xerographica .

SITUACIÓN ACTUAL DEL BOSQUE SECO.

Fotos:
Defensores de la Naturaleza.
Ing. Julio Cruz.
Lic. Mygdalia García

Mapa:
SIG – CONAP.

MONITOREO DE VIVEROS TRIMESTRAL

INSPECCION DE EMBARQUES PARA EXPORTACION