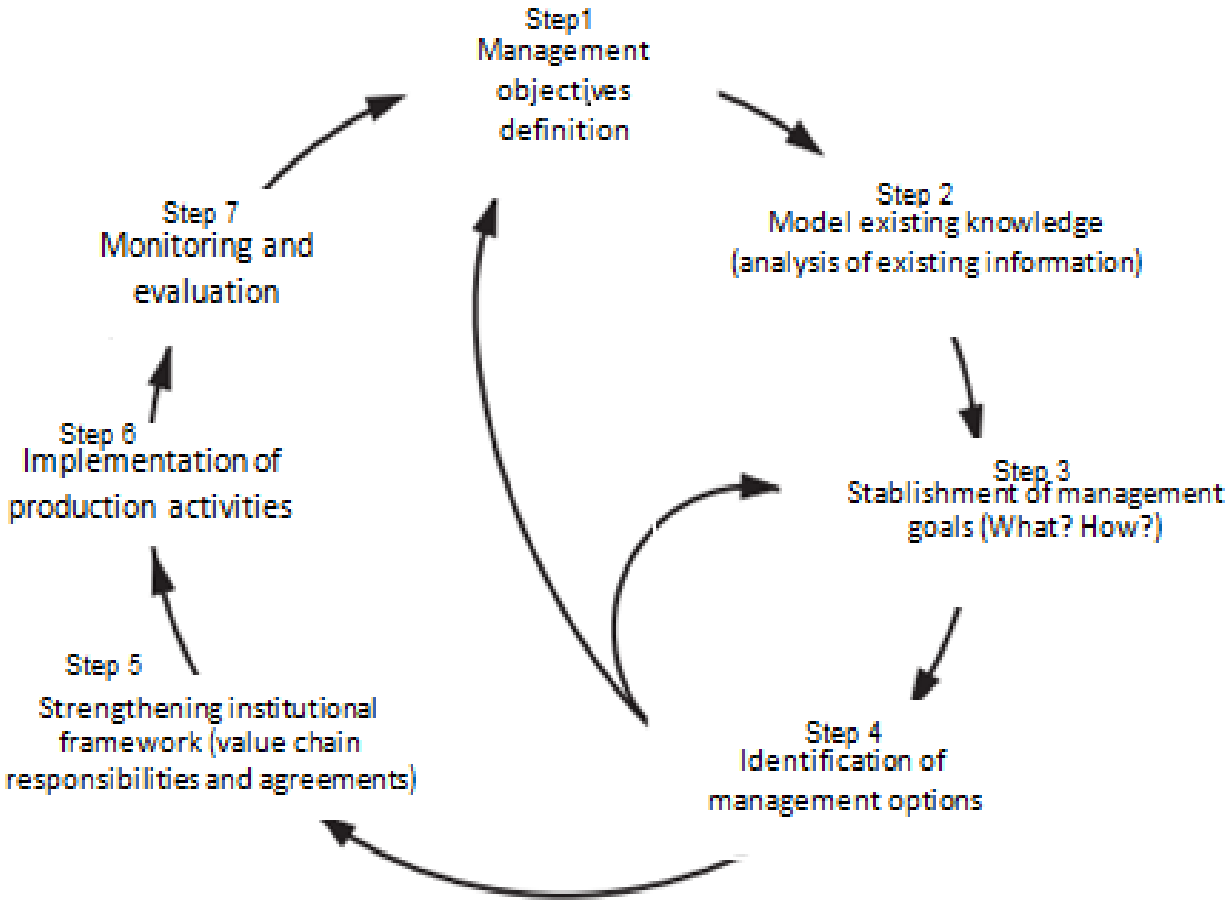
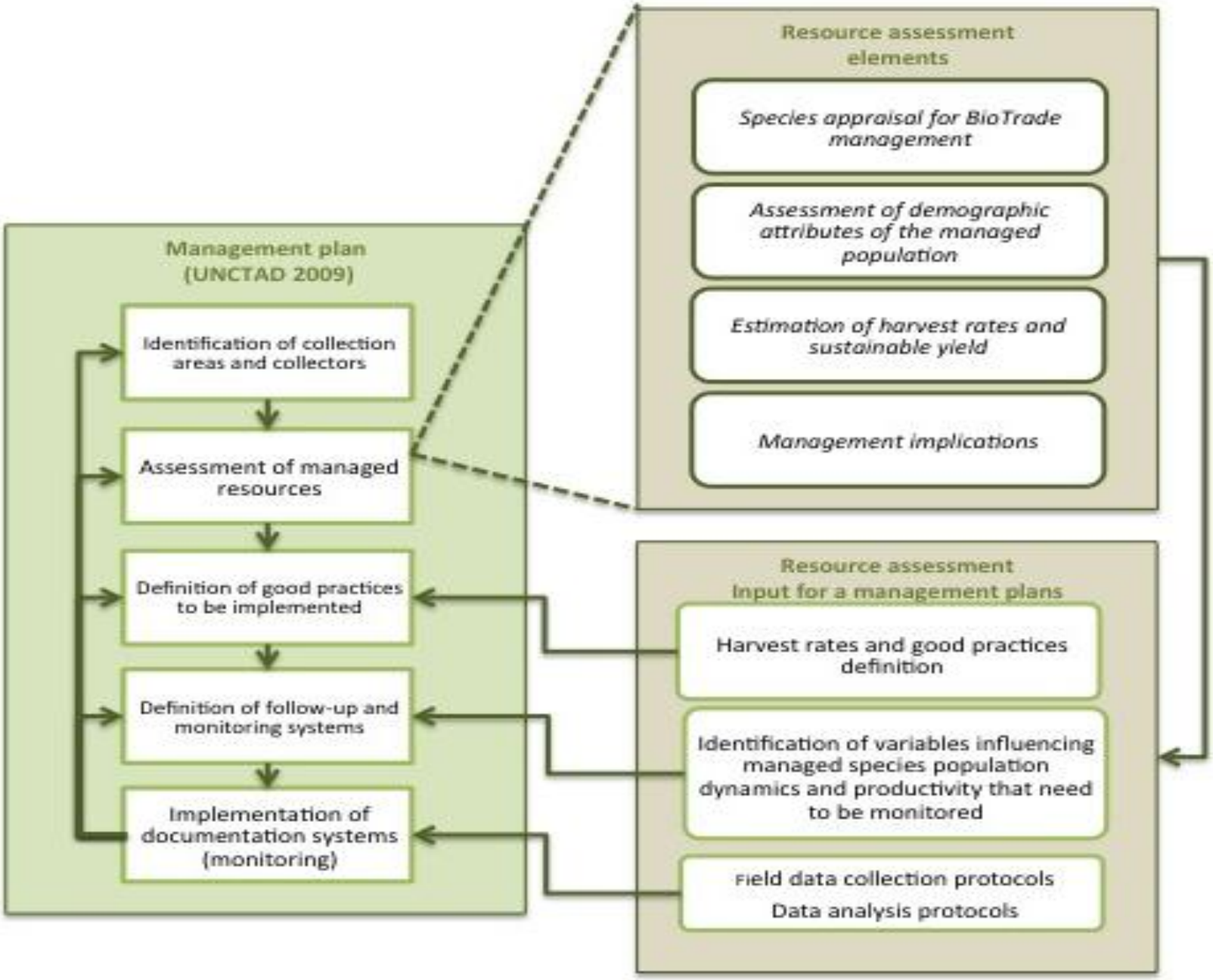
Management plans and resource assessments for BioTrade natural ingredients companies

Adaptive Management Approach




Resource assessment elements
Species appraisal for BioTrade management
Assessment of demographic attributes of the managed population
Estimation of harvest rates and sustainable yield
Management implications
Management plan (UNCTAD 2009)
Identification of collection areas and collectors
Assessment of managed resources
Definition of good practices to be implemented
Definition of follow-up and monitoring systems
Implementation of documentation systems (monitoring)
Resource assessment Input for a management plans
Harvest rates and good practices definition
Identification of variables influencing managed species population dynamics and productivity that need to be monitored
Field data collection protocols
Data analysis protocols

What is a resource assessment?

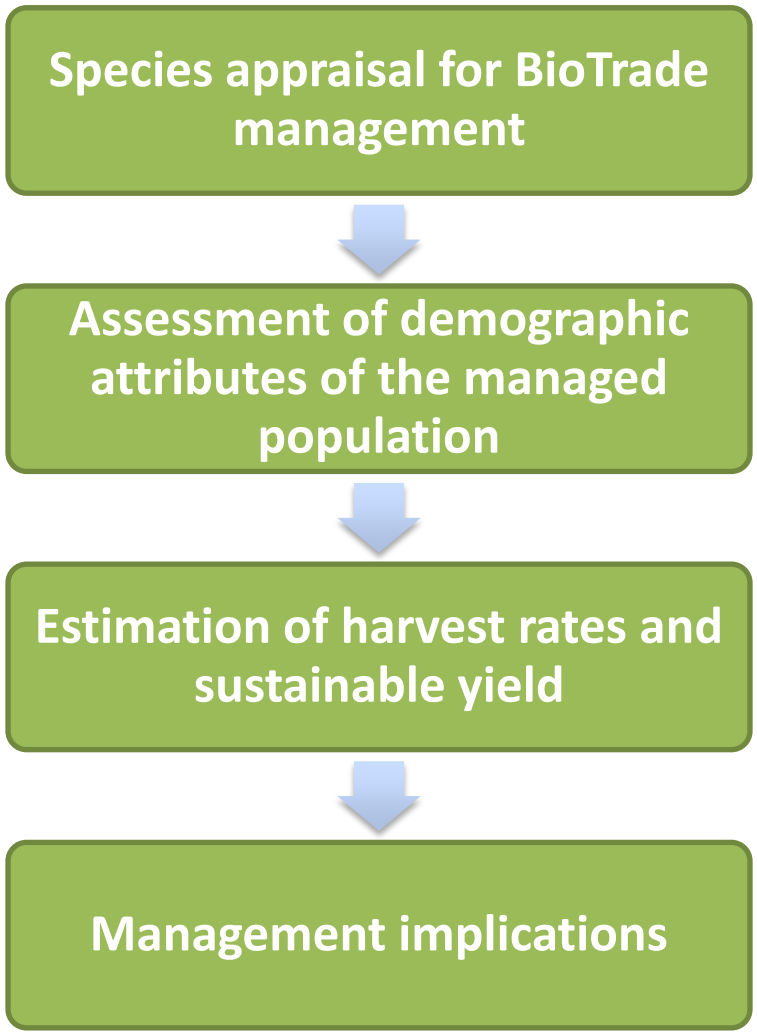
- Process by which resource managers estimate the future production potential of a given product.
- Tho al of a m app ment (Wo
- Resource assessment provides information for identifying information gaps that need to be filled as well as and population attributes that need to be monitored in the long term.
- This approach is focused on the managed-population possibilities and considers those attributes that directly affect the abundance of supply and the potential for sustainable use (Hall and Bawa 1993).

Populations Dynamics

Guidelines for the sustainable management of BioTrade products: Resource assessment

Francisco Cuesta and María Teresa Becerra

Resource Assessment Stages



Stage 1. Species appraisal for BioTrade management

- Appraisal of the available information on the species to be managed.

- Evaluate opportunities and alternatives for sustainable management of the species.

Information GAP analysis

Variable	Information availability	Source	Information gathering tools
Management practices			
Parts used and management practices at local level	Available	Field studies Ecobona Regional Programme	Participatory assessment (local knowledge)
Species biology and population demography			
Reproduction strategies	Incomplete	Secondary sources	Scientific research
Habitats and ecosystems			
Ecosystems and habitats involved	Available	Field studies Ecobona Regional Programme	Participatory assessment

Sustainability Analysis Matrix

a. Life history traits

Variable	Options	Scores	*C. spinosa*	*M. flexuosa*	*N. scrophula.*
Part of the plant harvested	Entire individuals, bark, shots, roots	2	4	2	2
	Latex, flowers, pollen, seeds	4			
	Leaves, fruits	6			

b. Population attributes

Variable	Options	Scores	*C. spinosa*	*M. flexuosa*	*N. scrophula.*
Birth rate	High	2	6	4	6
	Medium	4			
	Low	6			
	Aggregated	4			
	Homogeneous	6			

c. Ecosystem attributes

Variable	Options	Scores	*C. spinosa*	*M. flexuosa*	*N. scrophula.*
Landscape context	Small isolated patches (highly fragmented)	2	2	6	4
	Long and connected patches (fragmented)	4			
	Matrix (not fragmented)	6			
	Average disturbance	4			
	Low disturbance	6			

d. Total score

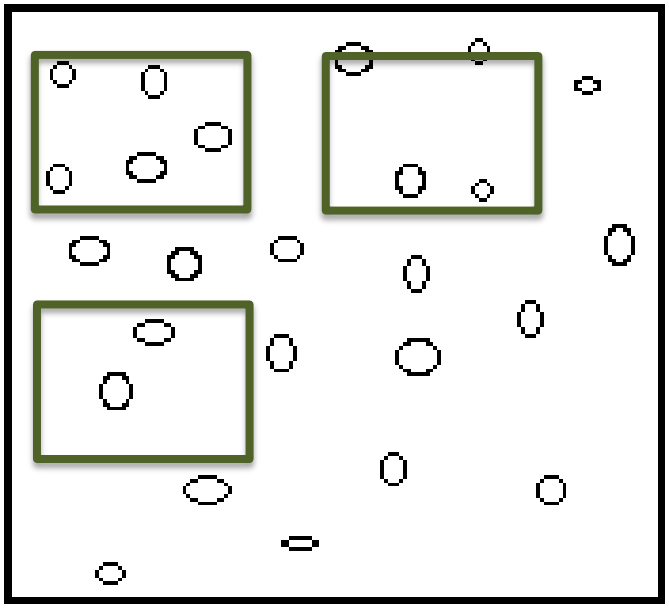
Variable	Options	Scores	*C. spinosa*	*M. flexuosa*	*N. scrophula.*
Score	**Low** (poor management aptitude)	26–38	**52**	**52**	**56**
	Medium (to be used under specific management considerations)	38–64			
	High (High potential of in-situ sustainable use)	65–78			

Stage 2. Assessment of demographic attributes of the managed population

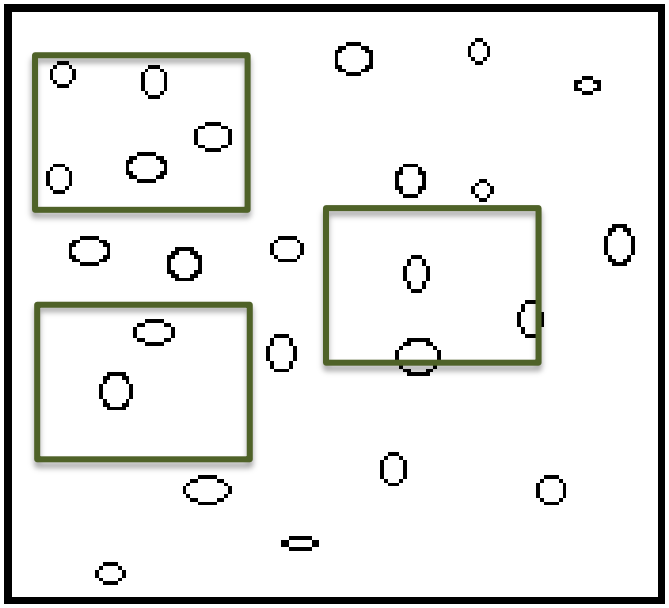
- To establish an ecological baseline for the harvested population by assessing the population size and its conservation status in the management area.

- Identify and fill in existing information gaps to establish a sustainable harvest rate

A. Field inventories to collect data on key population parameters



Area 1



Area 2

Survey design

Question	Example
What is the survey objective?	Evaluate density and population parameters of *C. spinosa*
To what population we want to make inferences?	Community of Perucho (Imbabura, Ecuador)
What is the best sampling method?	Transects
What will be the sampling unit?	Plots
What is the estimated area to be sampled?	50 hectares
What sample design is the best	5 managed forest fragments, 2 control forest fragments 5 transects of 100 m x 20 m in each forest fragments 5 plots of 20 m^2 per transect
What are the variables to be measured?	Number of individuals (all individuals identified as *C. spinosa*) Population size distribution for each individual based on diameter size at breast height Reproductive condition Evidence of mortality causes (diseases, seeds or fruit predation, herbivores, cattle grazing, etc.)
Frequency (specify sampling frequency in case information is needed for monitoring)	Every year before extraction season

B. Data analysis and calculation of demographic parameters

- Population density and structure (size-age classes)

	Number of sampled individuals		
	Transect 1	Transect 2	Transect 3
Plot 1	23	39	25
Plot 2	20	28	28
Individuals/20 m^2	20.4	28	28
Individuals/20 m^2	25.4		
Total density = 1.27 individuals/m^2			

Life Tables

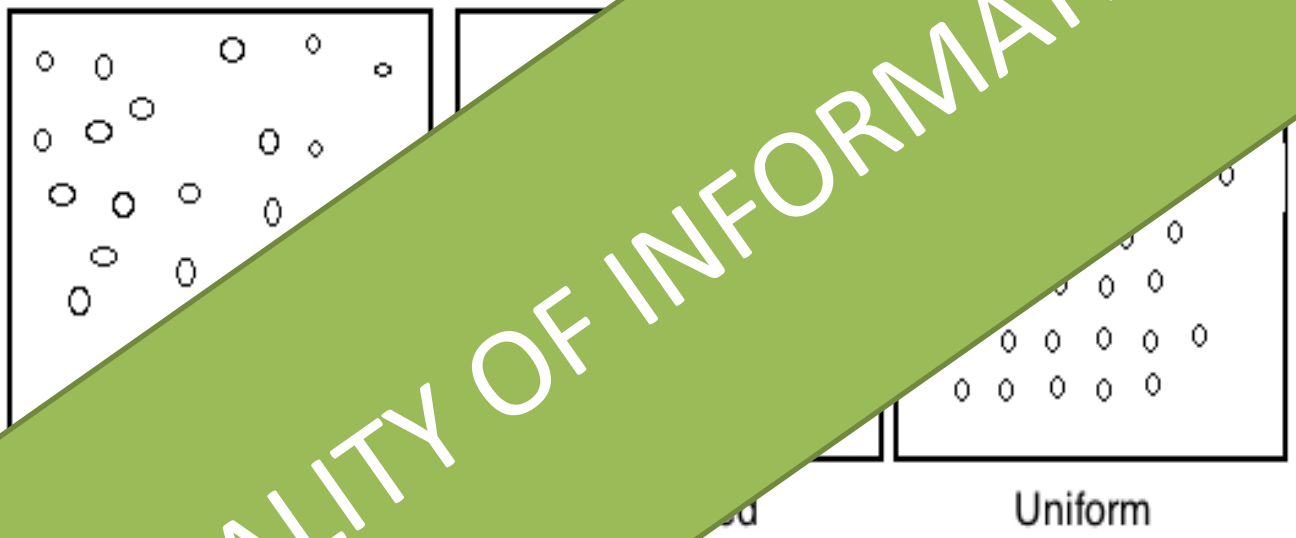
Age class	Characteristics	No. individuals (average plots)	Population (%)
Seedlings	≥1 cm diameter at the base	151	76
Saplings	1–2 cm	13.5	6.82
Young adults	>2–6 cm (from this size harvest starts)	11	5. 56
Adults	> 6–20 cm	25	7.07
Elders	> 20 cm	9	4.55
Total Density		198	100

Reproduction Biology

- Life expectancy and growth time of individuals in each age-size class
- Germination, natality and mortality rates

Species	Sexuality	Management implications
Caesalpinea spinosa	Perennial, produces flowers and seeds every year. Sexual reproduction occurs through cross-pollination by insects (i.e. wasps, honey bees).	In this case it is important to identify the insects that are responsible for the pollination of plants and assure that management practices do not affect pollination.

Distribution



QUALITY OF INFORMATION

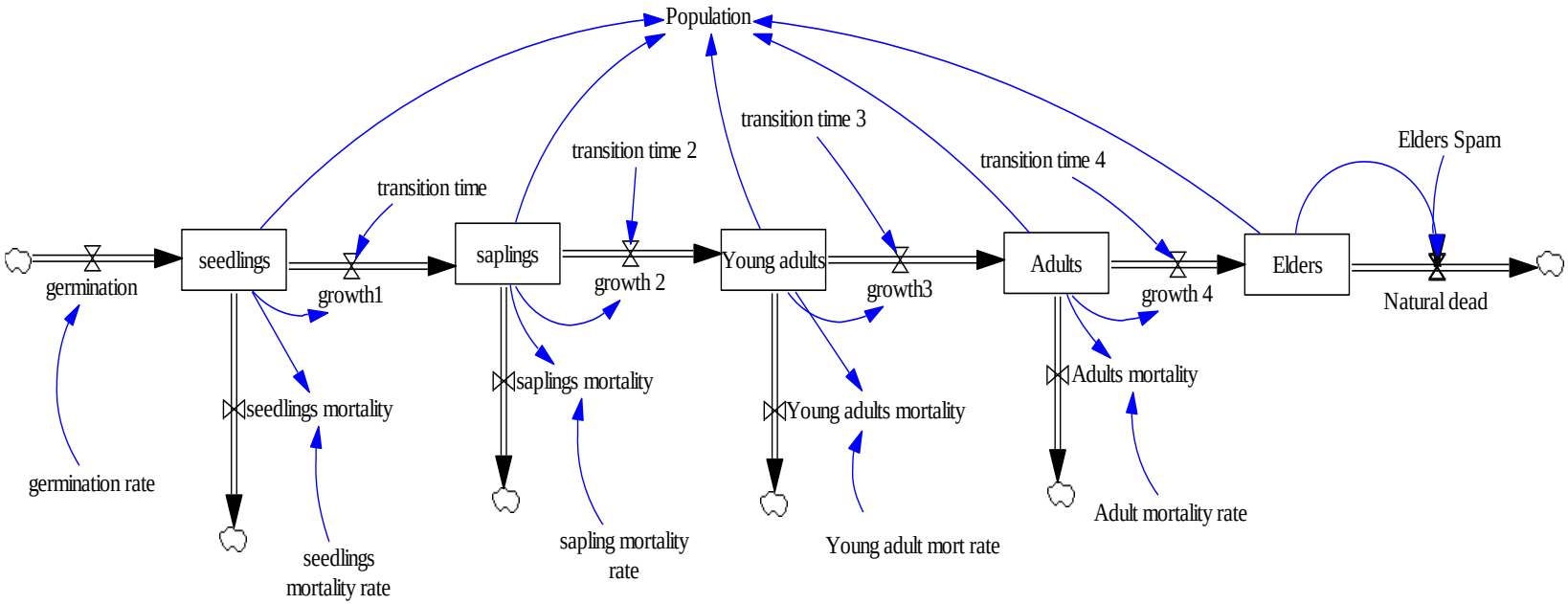
Stage 3. Estimation of harvest rates and sustainable yield

- Analyse population dynamics and harvest implications.
- Identify a suitable harvest rate according to species population dynamics.

How to do it?

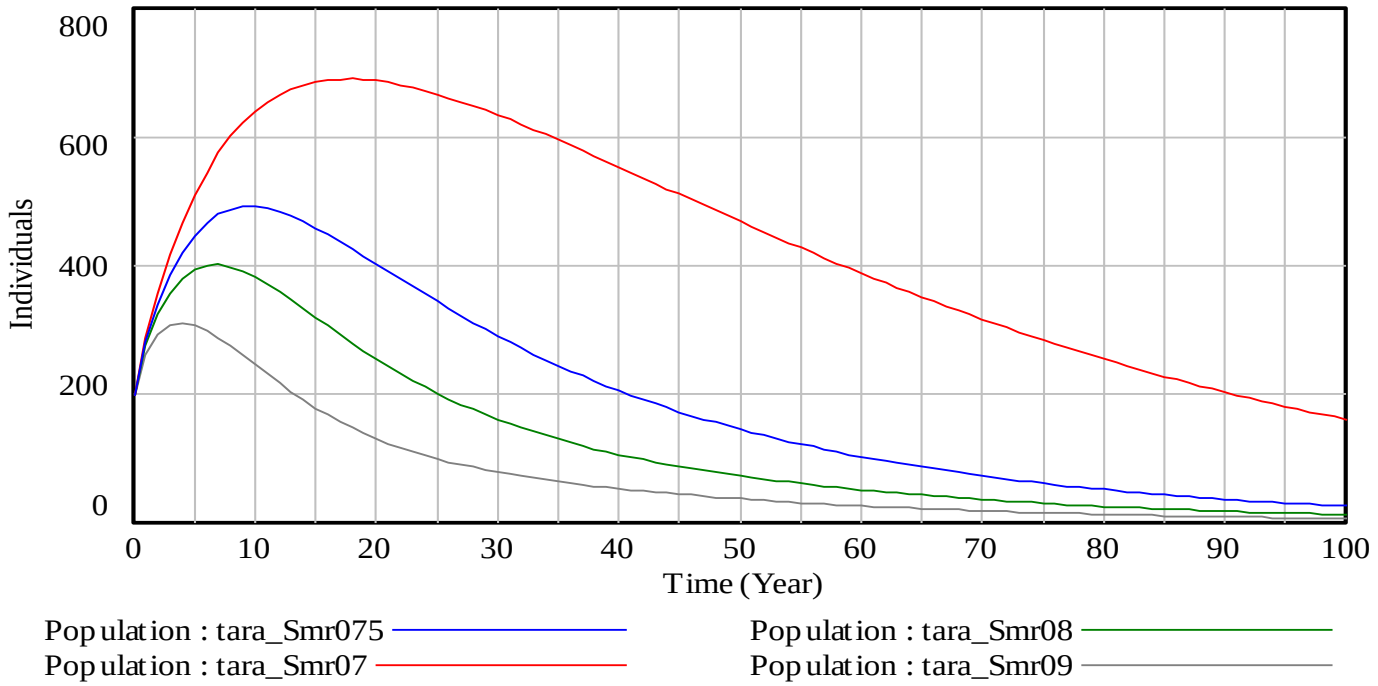
- Harvest rate estimation is developed based on analysis of species and population data.
- Dynamic population models are used as a tool to analyse information and generate management scenarios.
  - Analysis of population dynamics without harvesting.
  - Analysis of the implications of harvesting scenarios.

How does it look like?



What are the outcomes?

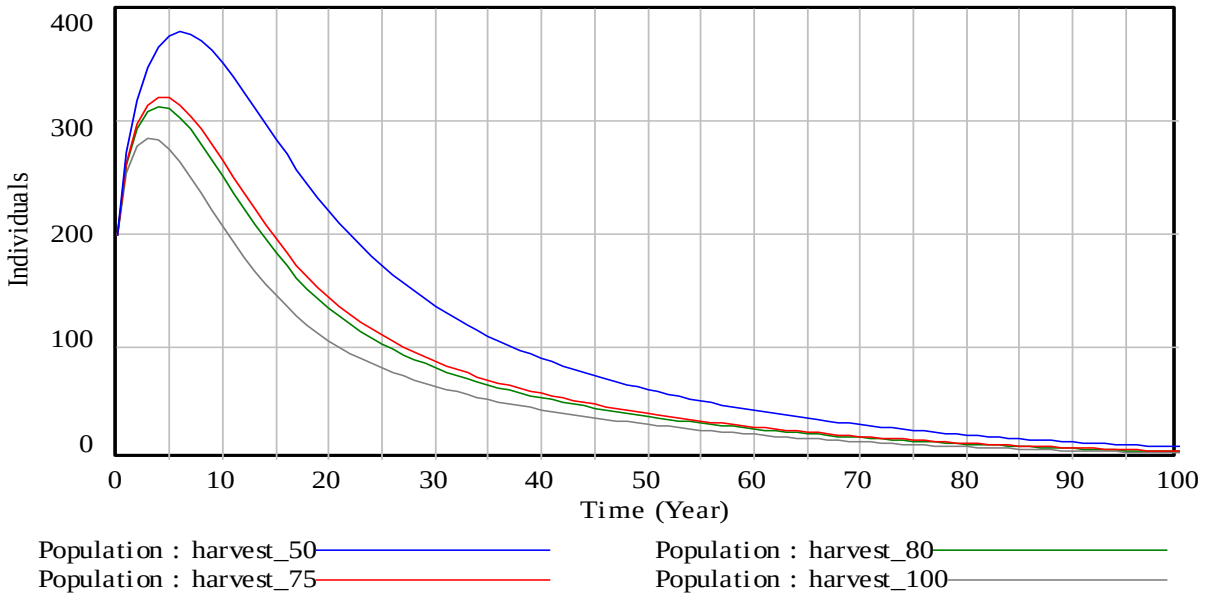
Population dynamics without harvesting



Population size estimated for *Caesalpinea spinosa* for a 100-year period with four seedling mortality rates: 0.90 (grey), 0.80 (green), 0.75 (blue) and 0.70 (red)

What are the outcomes?

Population dynamics four harvesting scenarios



Population size estimated for *Caesalpinea spinosa* for a 100-year period considering a 0.90 seedling mortality rate and four harvesting regimes: 100 (grey), 80 (green), 75 (red) and 50 (blue) per cent of the total fruit production

Stage 4. Management Implications

- Identify good management practices that should be included in the management plan.

- Recognize information gaps and variables that need to be included in the monitoring system of the management plan.

Identification of good practices

Main factors affecting population dynamics	Good practices suggested
C. spinosa population presents high seedling mortality rate caused by cattle trampling and grazing. This affects the population growth in the future and therefore the production of seeds for trade. High regimes of seeds extraction represent the reduction of seeds available in natural habitats to generate new individuals affecting population growth and genetic diversity in the mid-term.	Implement practices to reduce cattle grazing in *C. spinosa* forest remnants. Enrichment of natural habitats by planting seedlings and juvenile individuals if possible. Regulate seed harvest rates and identify a percentage of seeds that should not be harvested in order to increase germination rates. Create a seed bank to monitor germination rates and produce seedlings for habitat enrichment and keep a good representation of species genetic diversity.

a. Impact on the managed resource

Current situation	Variables to be monitored
Cattle grazing is having a negative impact on young individuals' survival. A consequence of this will be a reduction of total population density in the future, and therefore a reduction in production capacity. In this context good practices could be monitored to analyse the reduction of impact of cattle grazing on the population: • Practices to reduce cattle grazing; • Enrichment of natural habitat; • Regulation of seed harvest rates; and • Creation of a seed bank.	Seedling mortality by cattle grazing Forest area affected by cattle grazing. Growth rate of seedling/juvenile individuals planted. Percentage of seeds not collected. Seedling density in natural habitats. Seed germination rate in seed banks

b. Biology of the species

Current situation	Variables to be monitored
Production capacity of *C. spinosa* depends on the following aspects: • Current population density to assure the production of fruits; • Germination rate – collection practices need to assure a good quantity of seeds that could generate new individuals; and • Mortality of young individuals need to be reduced.	Total density – number of individuals of each age class in sampling plots. Germination rate – number of viable seeds produced per kilogramme based on samples of different *C. spinosa* forest remnants. Mortality rate of seedlings and young individuals that, according to the model, have a higher mortality rate.

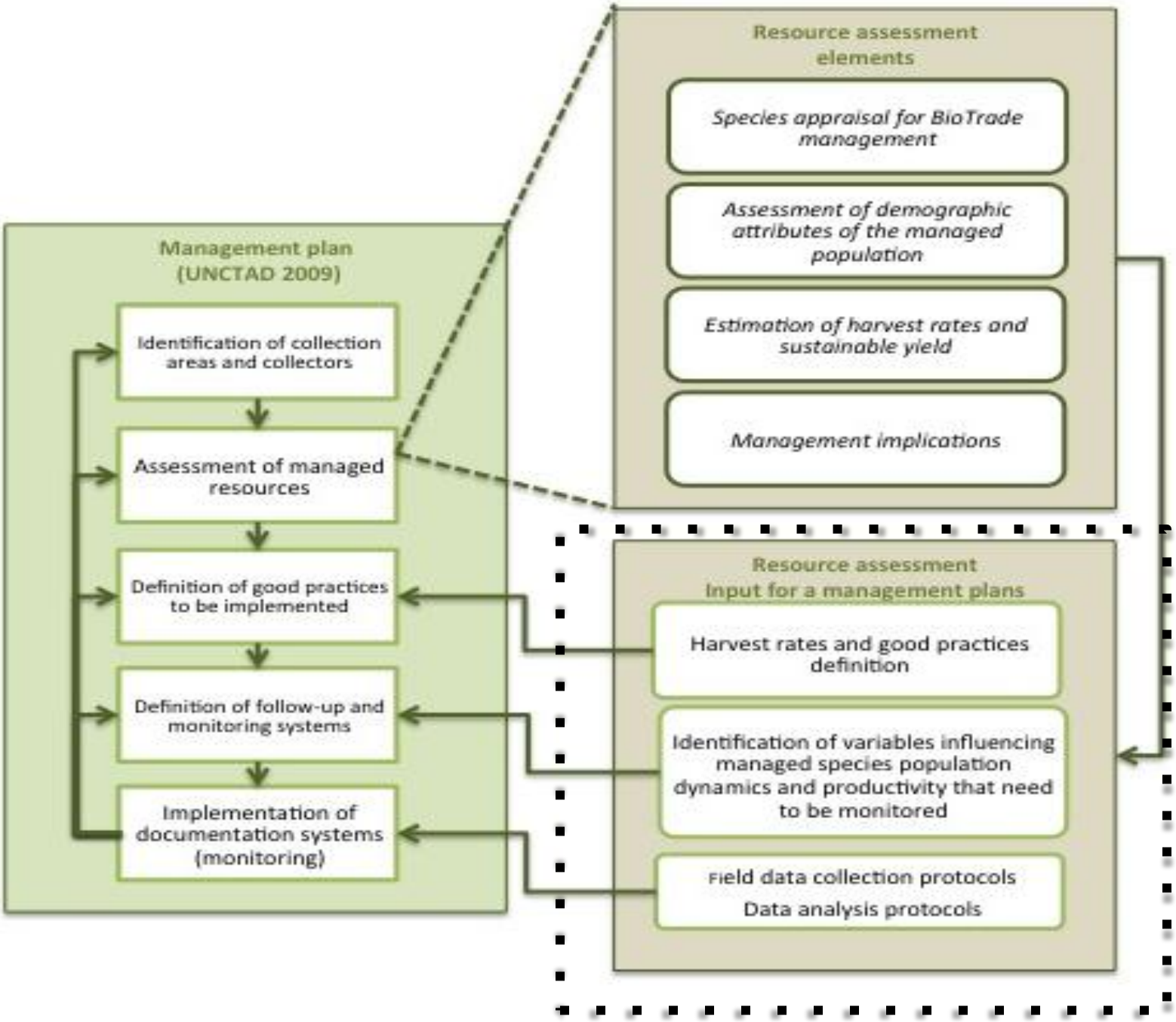
c. Yield

Current situation	Variables to be monitored
Fruits of *C. spinosa* are collected for international markets.	Production of average of fruits per tree. Production of fruits per area.

d. Information gaps

Current situation	Variables to be monitored
There is no information on germination rates. Variation in germination rates affect directly the population growth and the production capacity in the mid-term.	Number of viable seeds produced per kilogramme based on samples of different *C. spinosa* forest remnants. Seedlings density in different forest remnants.

Improving monitoring systems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