REPORT

FUNCiTREE is a research cooperation project funded by the EU 7FP – KBBE

FUNCiTREE – Final conference presentations

Session IV: Ecosystem services and biodiversity at the local level

www.funcitree.nina.no

REFERENCE:
FUNCiTREE. Final Conference : «The role of functional diversity for ecosystem services in multi–functional agroforestry», Trondheim 23-25 May 2013

DATE : May 28th 2013

COVER PICTURE:
Graciela M. Rusch

KEYWORDS:
Plant functional traits, ecosystem services, ecological functions, Bayesian networks

CONTACT INFORMATION
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Local knowledge about how ecosystem services and biodiversity conservation are related to trees in silvopastoral systems

FunciTree Final Conference

Trondheim, Mali May 25th 2013

Ditter MOSQUERA, Carlos CERDAN
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Outline

- Why did FUNCiTREE study local knowledge?
- How did FUNCiTREE study local knowledge?
- What are the main results FUNCiTREE found?
- How useful (or not) results are?

Starting points

- **Local people know best**
  - Local people have some useful knowledge that is complementary to science (e.g. phenology of tree species). This can be more efficiently and effectively used in design of AFS than attempting to collect the same information scientifically.

- **Scientists know best**
  - Local people have gaps in knowledge with respect to the role of trees in the provision of ecosystem services. Identifying and then targeting these gaps in FUNCiTREE outputs will make the outputs more effective than designing them without evaluating what people already know.

- **Talk the talk**
  - Analysis of how local people understand and communicate their knowledge can improve the design and effectiveness of FUNCiTREE outputs.

- **A local voice**
  - Documentation and analysis of what local people know can ensure that local knowledge is used to plan FUNCiTREE activities and so improve their local relevance.

- **What is transferable?**
  - Comparative analysis of local knowledge across FUNCiTREE regions will allow a rigorous analysis within and between countries of the degree of transferability of knowledge about the role of trees in ecosystem service provision and livestock production, enabling more effective targeting of future research and development initiatives.

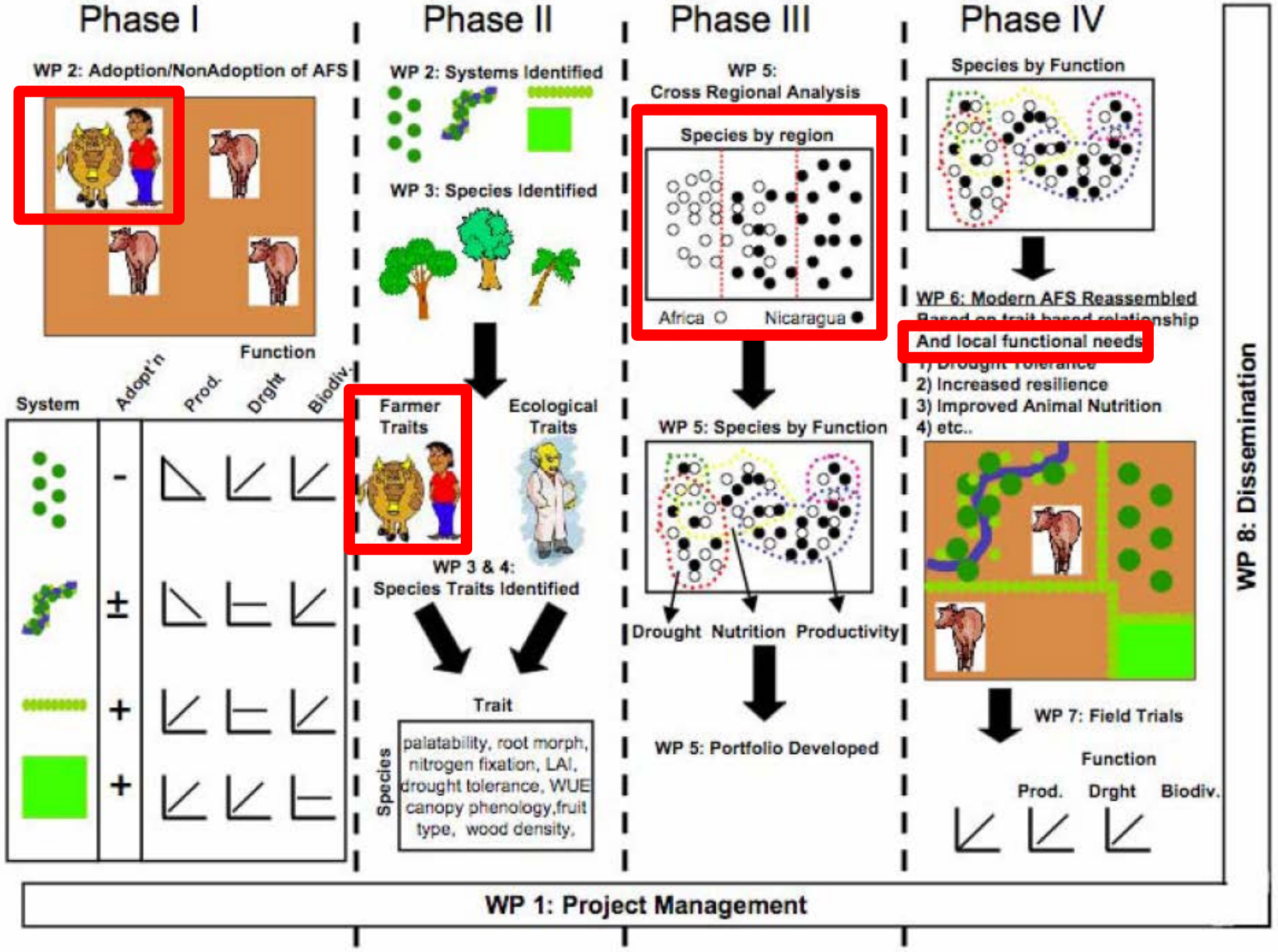


Illustration of Barton (2009)

Local knowledge within FUNCiTREE

- **WP3 Farmers perception of AFS tree species and their traits**
  - Task 3.2 Local knowledge of species traits (use of AKT)
- **WP2**
  - What are the critical ecosystem functions that farmers desire?
  - What are farmers hoping to get out of AFS implemented on their farms?
  - Task 2.1 Farmers production goals (Community capitals framework)
- **WP6**
  - Task 6.4 Causal network using Bayesian belief network to determine cause-effect relationships with predictive models
- **WP5** Cross regional analysis of Species, traits and classifications

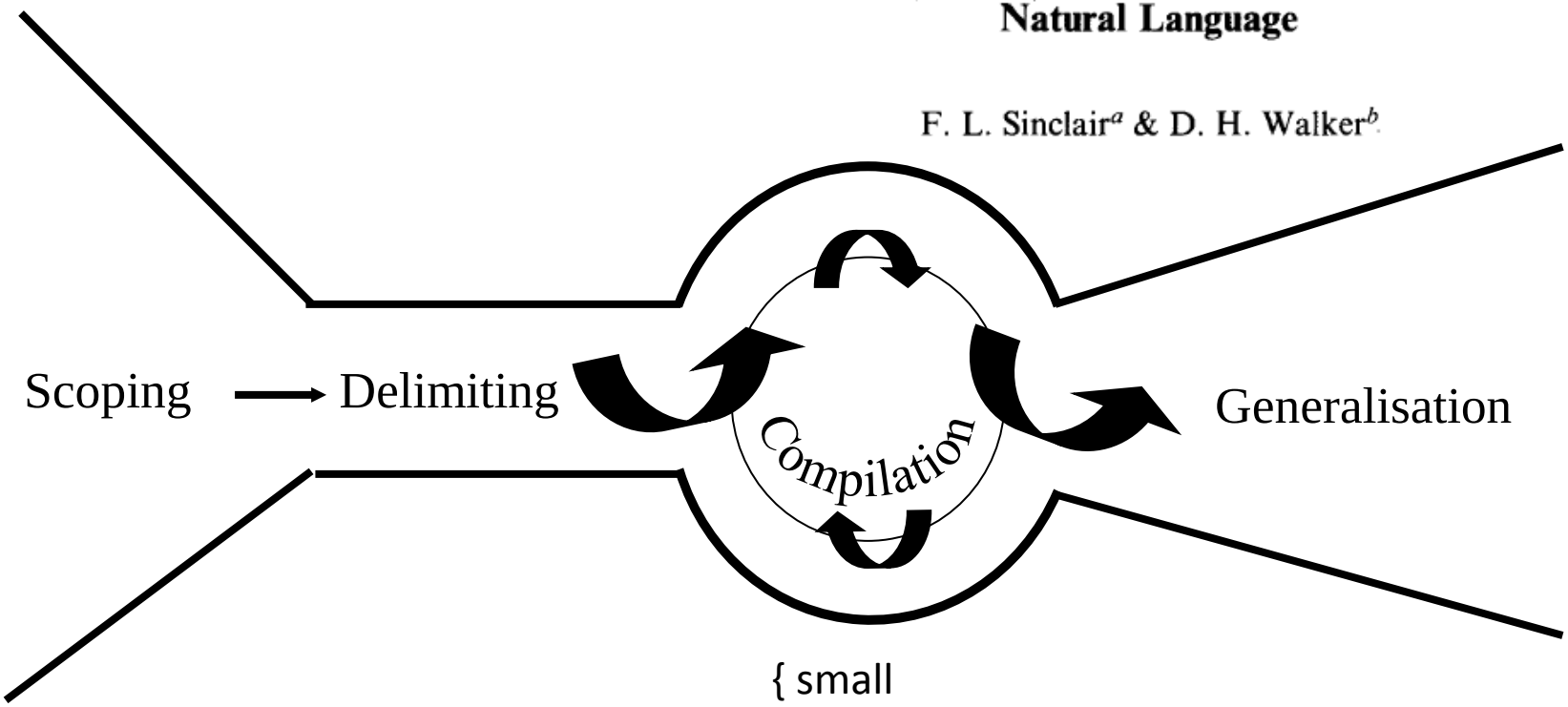
ELSEVIER
Agricultural Systems, Vol. 56, No. 3, pp. 341–363, 1998

PII: S0308-521X(97)00048-6 0308-521X/98 $19.00 + 0.00

AKT methodology

Acquiring Qualitative Knowledge About Complex Agroecosystems. Part 1: Representation as Natural Language

F. L. Sinclair[a] & D. H. Walker[b]



Secondary data
Key informants
Reconnaissance

Sample { small
{ stratified
{ purposive
Semi-structured interviews
Iterative, triangulated
Qualitative

Sample { large
{ stratified
{ random
Questionnaire
Quantitative analysis

http://akt.bangor.ac.uk/References.php?menu=4&catid=5371&subid=0#publish

Text only version | Jump to Page Content | Bangor Home

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SEARCH

The Agroecological Knowledge Toolkit

- Home Page
- Who's using AKT?
- News
- Software
- Manual
- Technical issues
- References and Readings
- Contacts, Links and Questions

»Bangor Home »The Agroecological Knowledge Toolkit »References and Readings

AKT5 Reading materials

- Knowledge bases for published articles
- Key references for AKT5
- Guide book

Knowledge bases for published articles

Waliszewski, W.S., Oppong, S., Hall, J.B., and Sinclair, F.L. (2005) Implications of local knowledge of the ecology of a wild super sweetener for its domestication and commercialisation in west and central Africa . Economic Botany.

Also see the Ego guide book

Thaumatococcus daniellii (Benn.)Benth. a rhizomatous herb with a natural range extending through the Guineo-Congolian rain forest . It is a robust forest herb, usually forming extensive colonies with petioles to 3 m long arising from the subterranean rhizome. It has long been used as a non timber forest with stems being used to produce mats and leaves used for roofing aps it is most well known as a food wrapper in markets of the region .

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A total of 429 tree Species!

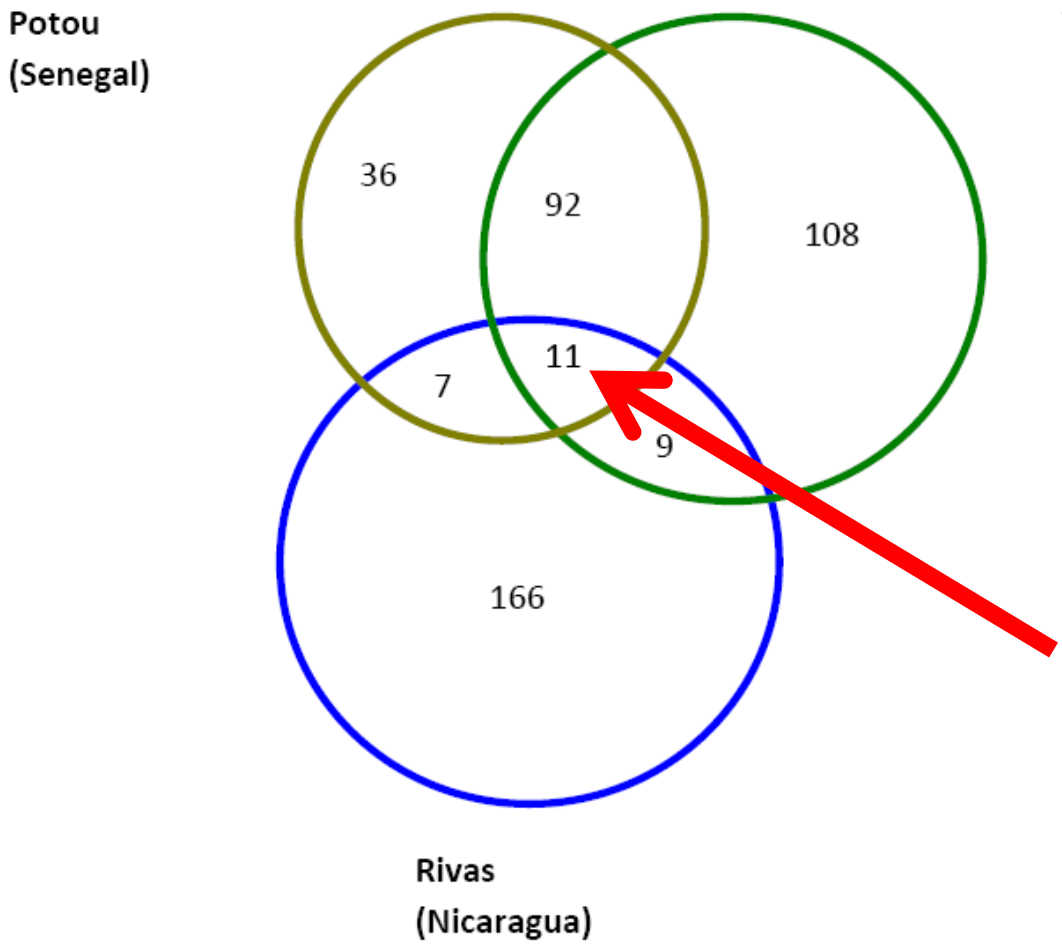


Illustration of Ickowicz (2010)

No.	Species Name
1	*Azadirachta indica*
2	*Calotropis procera*
3	*Citrus limon*
4	*Gliricidia sepium*
5	*Jatropha curcas*
6	*Mangifera indica*
7	*Prosopis juliflora*
8	*Psidium guajava*
9	*Tamarindus indica*
10	*Tecoma stans*
11	*Ximenia Americana*

Increasing our knowledge regarding the complexity of local knowledge

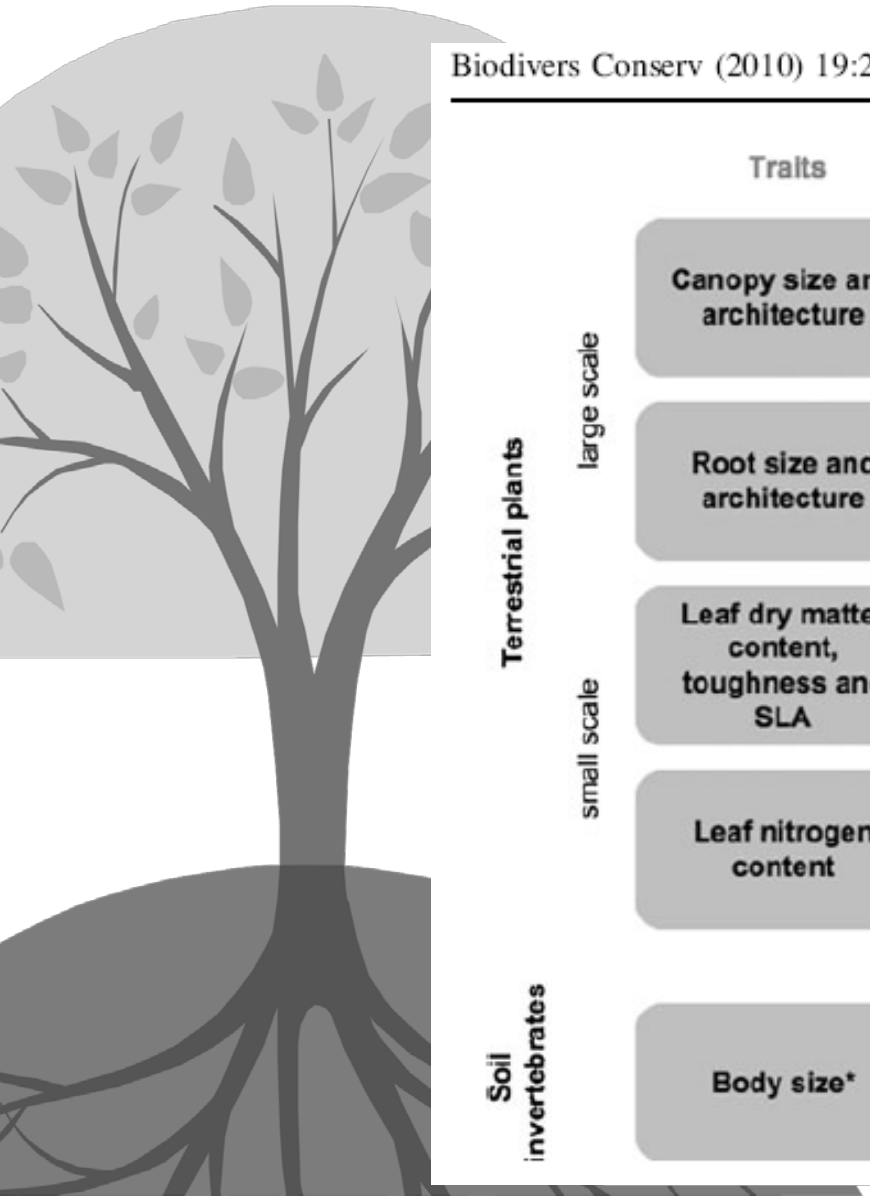
Tree uses
Firewood
Fodder
Food
Medicinal (humans)
Medicinal (animals)
Timber
Fences

Tree functions
Soil formation
Drought tolerance
Stream protection
Biodiversity hosting
Cultural (Mali)
SHADE

These classifications are regarding to tree attributes
Height
Canopy phenology
Crown openness
Leaf size
Leaf thickness
Root abundance

Example from Nicaragua:		
Shade (pastures)	Narrow crown, deciduous	Guanacaste, Genizaro, Guacimo, Acacia, Jicaro
Wind protection	Tall tree, dense crown, deep roots	Guanacaste, Eucalipto, Mango, Espavel, Pochote, Jabillo

Most common tree attributes related to ecosystem functions



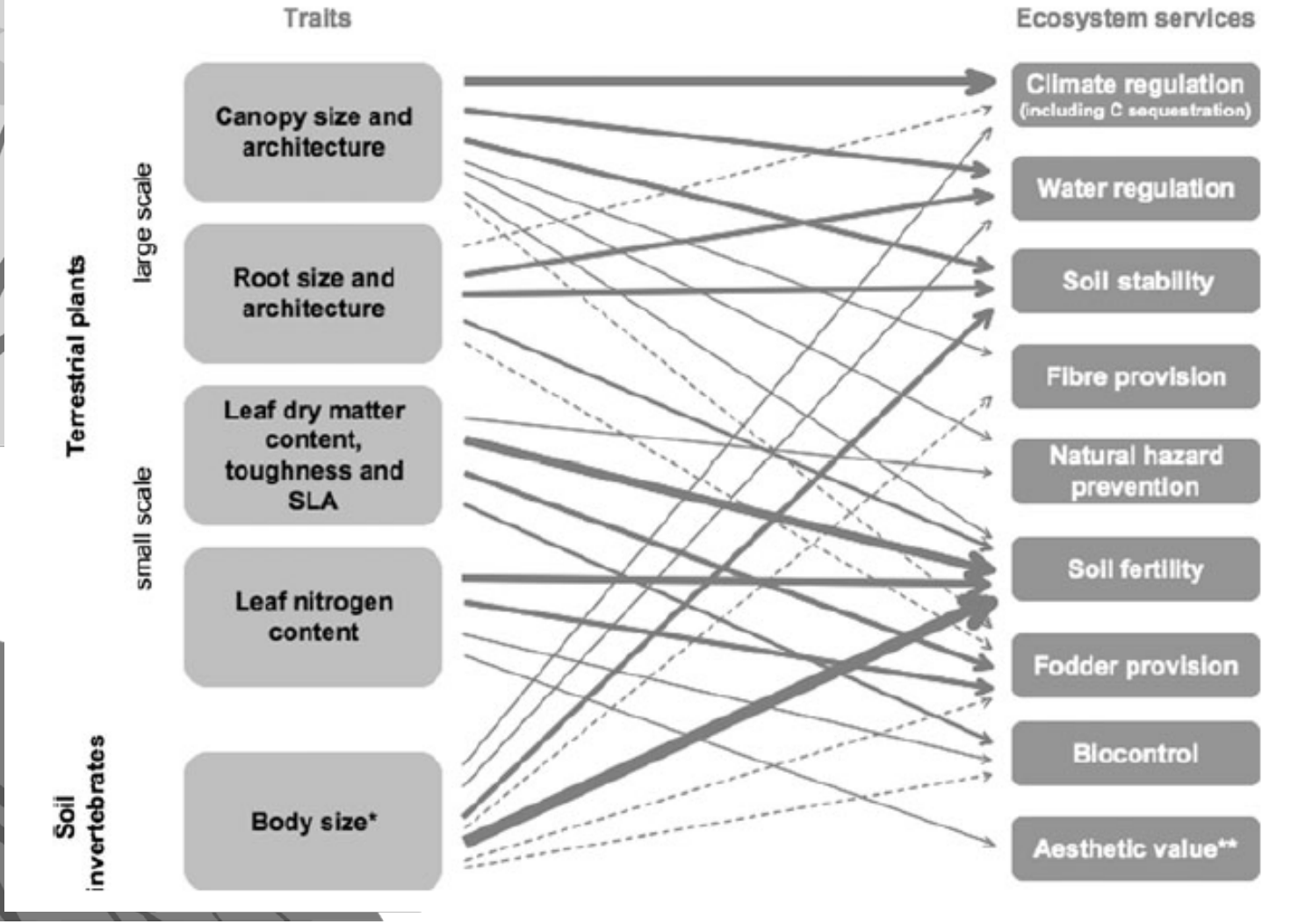
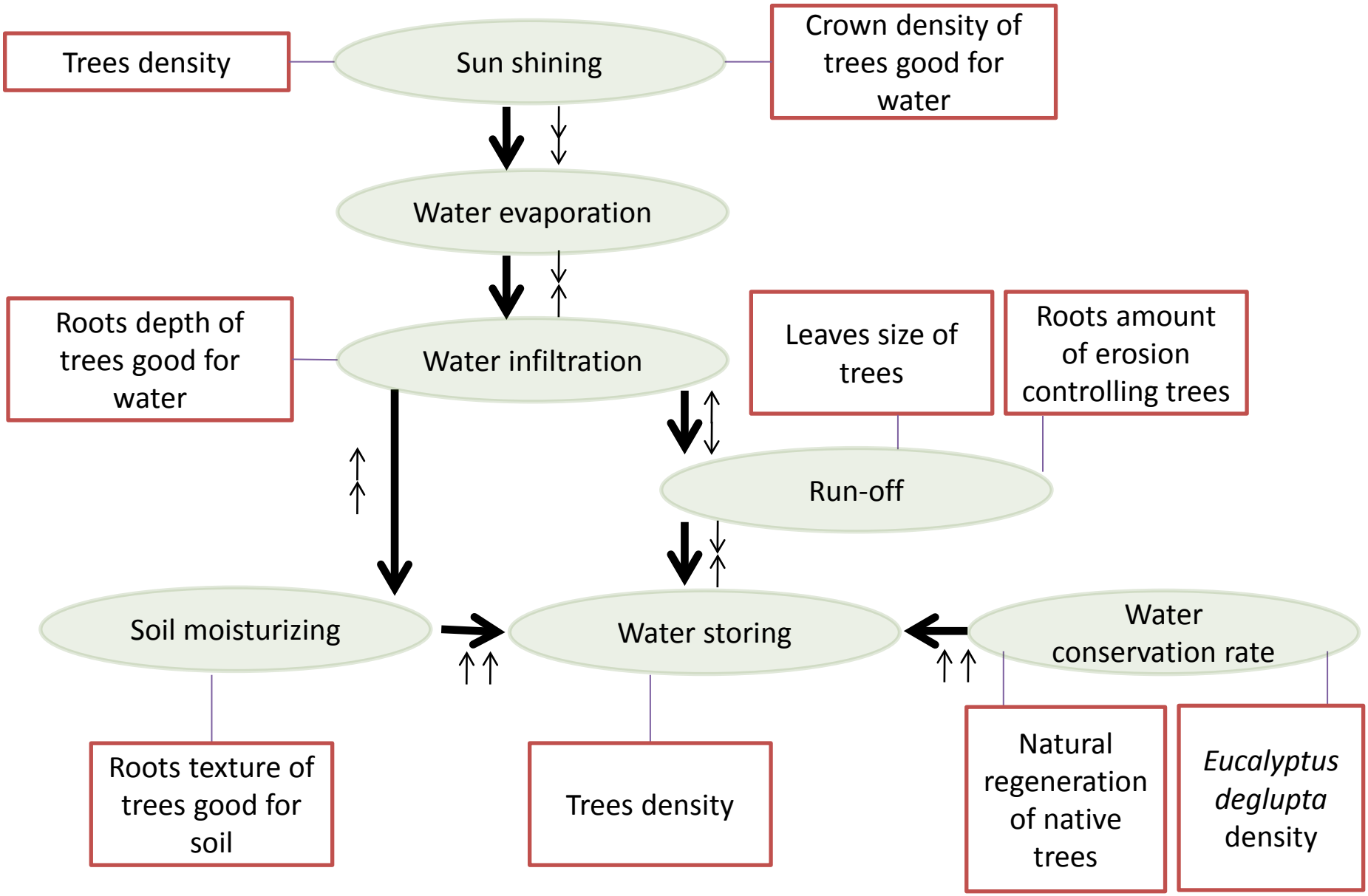


Illustration from Cerdan (2012), inspired by De Bello *et al* (2010)



Complex (Nicaraguan) farmers' knowledge related to the relation among trees and water

Outline

- Why did FUNCiTREE study local knowledge?
- How did FUNCiTREE study local knowledge?
- What are the main results FUNCiTREE found?
- **How useful (or not) results actually are?**

Utility of the results for FUNCiTREE

- **WP3 Farmers perception of AFS tree species and their traits**
  - Task 3.2 Local knowledge of species traits (use of AKT) ✓
- **WP2**
  - What are the critical ecosystem functions that farmers desire? ✓
  - What are farmers hoping to get out of AFS implemented on their farms? X
  - Task 2.1 Farmers production goals (Community capitals framework) ✓
- **WP6**
  - Task 6.4 Causal network using Bayesian belief network to determine cause-effect relationships with predictive models ✓
- **WP5** Cross regional analysis of Species, traits and classifications +-

Utility of the results for us

How much multiple ecosystem services are important to farmers? (Sean)

Guasimo greather than Jicaro as fodder, shading livestock, interacting with pasture (Marcel)

Can we relate physiological traits (Scientifics) to agroforestry functions (farmers)? (Philippe)

How can be local knowledge better used (IPBES)? (Nina Vik)

Examples of synthesis of local and scientific knowledge (Hubert)

Shape, size and density of crown in forage Species (Hubert)

Integration of local knowledge in agroforestry engineering (Alexandre presented and Mariel asked how to do it)


Thank you !
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Constraints, development priorities and the farmers' perceptions of the functions of tree and shrub species in the Segou Region, Mali

Final FunciTree Project Meeting

23-25 May 2013, Trondheim, Norway

IER Team: Youssouf Cissé, Ibrahima N'Diaye, Bocary Kaya and Harouna Yossi

Constraints, development priorities and the farmers' perceptions of the functions of the tree and shrub species in the Segou Region, Mali

Introduction

- A number of agroforestry technologies have been introduced for large scale diffusion by research and extension services in the study area

- However, despite of their potentialities, these technologies have had a very limited impact on the livelihood of the beneficiary populations

Introduction (ct'd)

- Reasons for this low impact on the agrsisilvopastoral productions are, among others, the non integration of the constraints, needs and traditional knowlegde of the beneficiary populations

Introduction (end)

- Thus, it is necessary to know the needs and expectations of the rural populations as well as a deep understanding of their perceptions of the functions of the different tree and shrub species
- This research was undertaken to shed light in these aspects

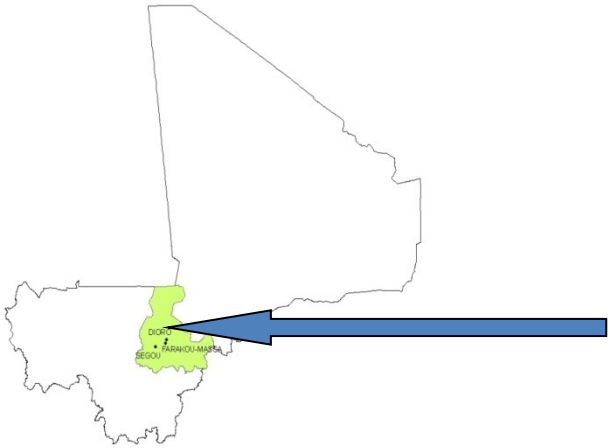
Objectives

- Identify the constraints and development priorities of the households for a better understanding of the functioning of the agroforestry systems

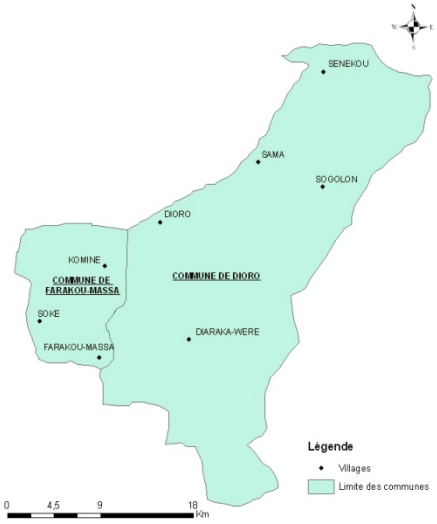
- Determine the households perceptions of the functions of the tree and shrub species in their localities

Materials and methods

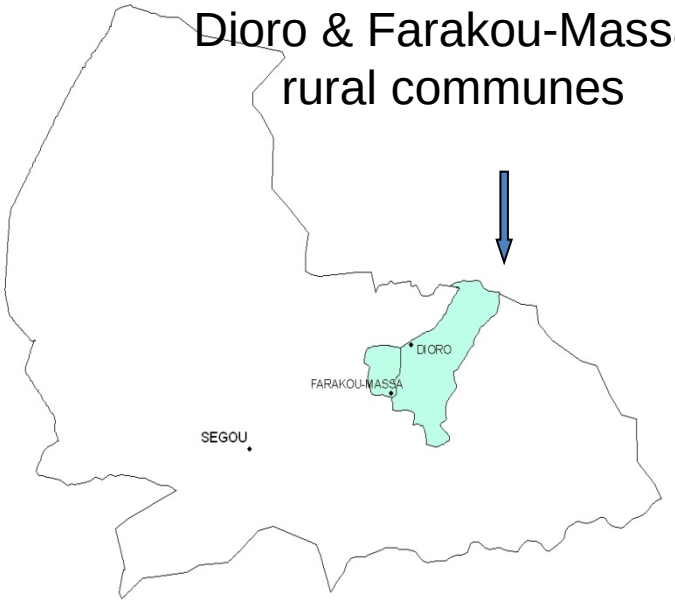
Localisation of the study area



Region of Ségou



Dioro & Farakou-Massa rural communes



Methods

- The Segou MVP is made of 39 villages
- Study was carried out in 15 villages made of 8 research villages and 7 extension villages

Constraints and development priorities of the populations

- Semi-structured plenary sessions at village level
- At these sessions, each village as selected three different focus groups (Farmers, Animal rearers and Women)
- Field surveys were then carried out with each focus group using a questionnaire

Constraints and development priorities of the populations

- Pair-wise matricial classification was adopted for data analysis

- This simple technique permits to determine and compare constraints and priorities of members of a given community

Households perceptions of the functions of tree and shrub species

- Questionnaire Field surveys performed in 15 villages using 17,5% sampling rate of the households, i.e. 302 households

- Each of the households belongs to one of the focus groups defined earlier

Households perceptions of the functions of tree and shrub species

- Pair-wise matricial classification was adopted for the ranking and appreciation of the roles or functions of tree and shrub species at household level focus group wise

Results

The develpopment constraints are completely different from one focus group to the other with no possibilities of grouping them

However, though the development priorities are so different from one focus group to the other, they have a common feature:

the need to improve production to achieve food security and generate revenues for the needs of the households

Functions of tree and shrubs species

- 10 to 16 different tree and shrub species functions were identified by the focus groups in the Segou MVP study area

- The main functions were ranked per priority by the focus groups

Priority functions by the populations of the Segou MVP study area

Functions	Scores per Focus Groups			Totals
	Farmers	Animal rearers	Women	
Human food	7	10	10	27
Fuelwood	9	8	8	25
Fodder	8	7	6	21
Traditional medicine	5	8	8	21
Shade	6	7	6	19

Functions of tree and shrubs species

- Tree and shrub species already frequently utilized by the populations to satisfy priority functions were listed

Some tree and shrub species listed and their functions

Species	Priority Functions				
	Human food	Fuelwood	Fodder	Tradit. medicine	Shade
Adansonia digitata	X				
Vitellaria paradoxa	X	X	X	X	X
Tamarindus indica	X			X	X
Combretum glutinosum		X		X	
Anogeissus leiocarpus		X	X	X	
Faidherbia albida	X		X		
Ficus gnaphalocarpa	X		X		
Guiera senegalensis		X		X	
Combretum micranthum		X		X	
Diospyros mespiliformis	X				X

Conclusion

- Taking into consideration the identified priority functions, the development objectives and the traits of the tree and shrub species can help to better target the ones to be promoted and to improve the adoption of the various agroforestry technologies

Factors affecting the adoption of agroforestry practices by farmers in the Dioro and Farakou-Massa rural communes in the Segou Region, Mali

Final FunciTree Project Meeting

23-25 May 2013, Trondheim, Norway

IER Team: Youssouf Cissé, Ibrahima N'Diaye, Bocary Kaya and Harouna Yossi

Structure of the presentation

- The study area
- The aim of the study
- The agroforestry technologies and practices
- The methodology
- The results of the analyses
- Recommendation from the study

Presentation of the study area

Aim of the study

The aim of our study is to determine factors affecting the adoption and non adoption of the agroforestry technologies disseminated in the Dioro and Farakou-Massa communes in the region of Segou, Mali

Main Agroforestry technologies concerned in the study

- Food Banks
- Protection Live fences
- Village/communal Woodlots
- Individual/Private Woodlots
- Delimitation fencing

A Live fence made of *Euphorbia balsamifera*

A Dead fence

Methodology

- Selection of 15 sample villages out of the 39 MVP villages, i.e. a 38.5% sampling rate
- Selection of 302 households out of 1732 households in total giving a 17% sampling rate
- Data collected at the village and household levels using structured and non structured questionnaires
- The Logit model used to analyze the data

The independent variables

In rural Mali, many factors can affect the adoption of new technologies.

Some characteristics of the head of household

The level of prosperity
The age of the head of household
The level of man power or active workers in the household
The affiliation to an association or cooperative at the village level
The contact with/access to extension agents

Some characteristics of the village

The distance between the village and the nearest urban setting
The access to land resources;
The extent of soil erosion;
The accessibility of the village during the rainy season;
The size of the livestock population in the village.

Independent variables	Food bank	Live fence for protection	Tree planting at the village level	Tree planting at the household level	Delimitation of the land plot
Household's characteristics					
Age	0.0105978 (0.98)	-0.0030846 (-0.31)	-0.0067563 (-0.68)	0.0054283 (0.47)	-0.0114736 (-0.96)
Level of prosperity 1 (Rich)	0.5465788 (1.55)	-0.1668412 (-0.55)	-0.1747463 (-0.54)	0.6141468* (1.80)	-0.1889909 (-0.51)
Level of prosperity 2 (Not Rich not poor)	0.8646187** (1.97)	0.1282537 (0.35)	-0.004899 (-0.01)	0.8392038** (2.04)	-0.0954284 (-0.22)
Active lworkers	-0.0481893* (-1.89)	-0.0097188 (-0.38)	-0.0072534 (-0.29)	-0.0070926 (-0.28)	-0.0184507 (-0.67)
Association membership	0.3209512 (0.70)	0.1445533 (0.34)	-0.3217798 (-0.79)	0.0424431 (0.10)	0.9493936* (1.68)
Extension services	0.4439205 (1.54)	0.6522487** (2.55)	0.3557726 (1.32)	1.050875*** (3.76)	0.1992544 (0.65)
Access to land resources	0.5879354** (2.04)	0.8505231*** (3.15)	-1.118878*** (-3.68)	0.6034021** (2.10)	1.071686*** (3.20)
Characteristics of the village					
Distance	-0.0191224 (-0.54)	-0.0905388*** (-2.63)	0.0664877** (2.41)	-0.0718224** (-2.07)	-0.0349021 (-1.09)
Extent of soil erosion	0.8088751* (2.11)	0.6240369* (1.82)	0.556757* (1.94)	0.9088975** (2.44)	0.231498 (0.65)
Village accessibility during the rainy season	1.646241*** (4.44)	0.9750005*** (2.66)	-1.530052*** (-3.80)	0.2750357 (0.76)	0.2585387 (0.65)
Livestock size at the village level	-1.579678*** (-3.08)	-1.466168*** (-3.14)	1.678296*** (3.32)	-1.171248** (-2.36)	-0.9416389* (-1.87)

Is the overall model per technology and practice statistically significant?

Statistics	Agroforestry Technolgoies/practices				
	Food Bank	Live Fence for protection	Village/communal woodlot	Individual/private woodlot	Delimitation planting
% Correct predictions	76.09	69.36	71.72	72.73	80.81
Log likelihood	- 150.95	- 175.83	- 168.72	-157.03	- 136.34
Probability Chi^2 (5%)	0.000	0.0002	0.0002	0.0001	0.0364

Factors to consider in introducing Agroforestry Technologies and Practices in Dioro and Farakoumassa: Factors found to significantly affect farmer's decision to adopt agroforestry technologies and practices in the communes of Dioro and Farakoumassa

- The access to land resources;
- The size of livestock at the village level;
- The extent of erosion at the village and household levels;
- The accessibility of the village during the rainy season.

Tree Domestication: Let trees work for people

THANK YOU VERY MUCH FOR YOUR ATTENTION

Is the overall model statistically significant? (Suite)

- **The overall model per technology and practice is significant at the 5% level according to the Model chi-square statistics. The model predicts more than 60% of the responses correctly under each technology;**

- **The Maximum Likelihood (ML) is a way of finding the smallest possible deviance between the observed and predicted values (The best fit known as " -2Log Likelihood"). The Loglikelihood will always be negative, with higher values (closer to zero) indicating a better fitting model.**

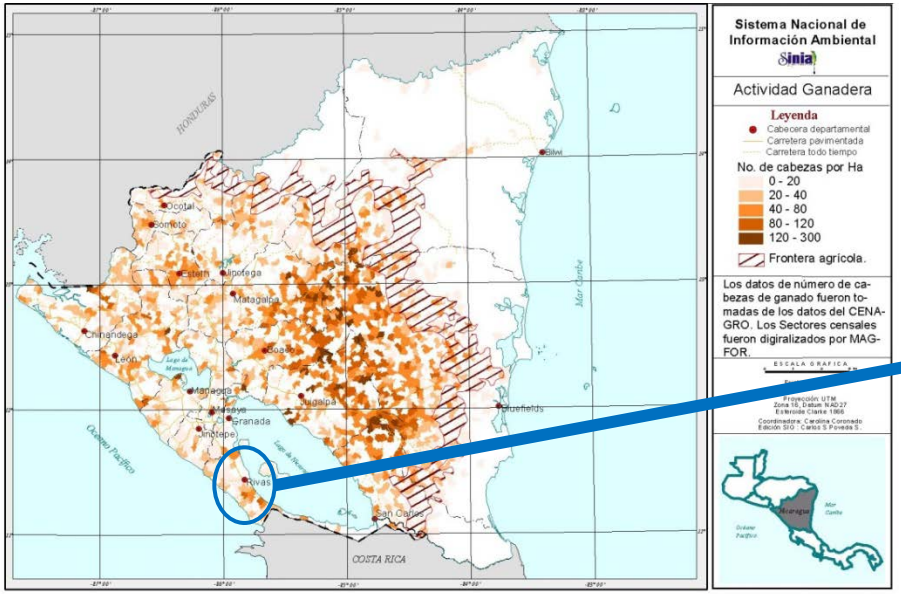
Establishment of demonstration plots on multifunctional silvopastoral systems to promote their adoption in the dry tropics of Nicaragua

Cristóbal Villanueva, Dalia Sánchez, Muhammad Ibrahim, Graciela M. Rusch, David Barton

Outline

- Context
- How to work with farmers?
- What is the impact of the demonstration?
- How change can be encouraged
- Lessons learned

Context



Semi-natural grasslands

3.68 million ha of cattle pasture (Inventario Forestal 2007 – 2008).

Conventional systems, degraded, low productivity and sensitive to climate variability.

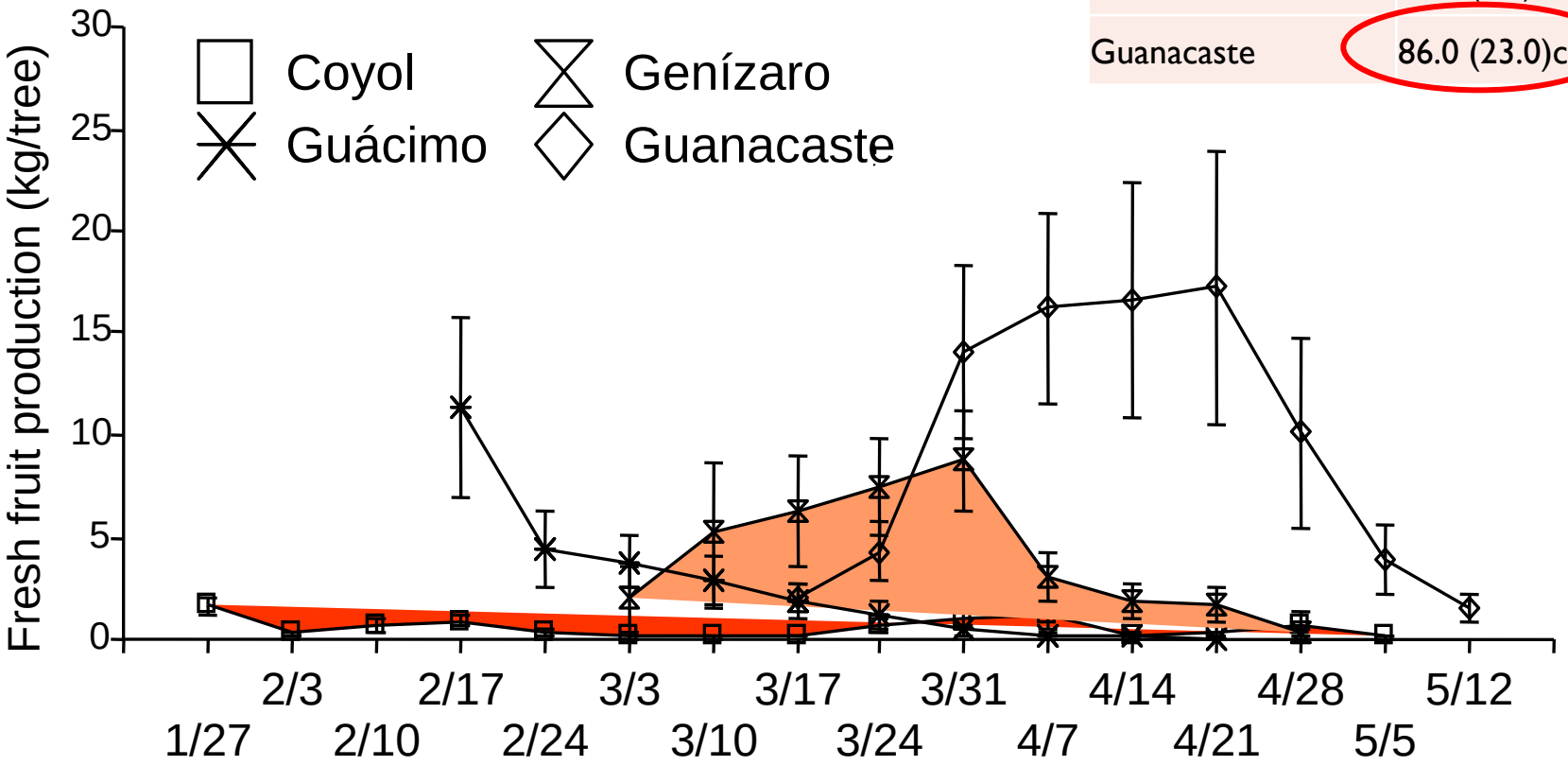
Context (continued)



Furthermore, farms have several woody species that continue to grow during the dry season, making them potential options for cattle feed in the form of leaves and fruits.

Potential for woody species to provide fruit during the dry season

Total fruit production (kg/ árbol^{-1})	
Coyol	8.6 (2.7)a
Guácimo	26.4 (7.7)ab
Genizaro	36.1 (8.1) b
Guanacaste	86.0 (23.0)c



Source: Esquivel 2007

Species diversity increases the availability of fruits that can be used as cattle feed during the dry season.

Has explored throughout the feasibility of several woody species in relation to:

- Fodder quality
- Cattle preference
- Shoot growth after pollarding
- Use of adapted and high productivity herbaceous fodder species

Establishing the plots

Farmer preference is used to establish multi-functional silvopastoral demonstration plots in which the results and lessons from the FUNCiTREE-sponsored research are put into practice.

The fodder and fruit-producing woody species introduced into the silvopastoral systems complement the already existing functions of woody species as live fences and individual trees in pastures.

The process

- Use of field trips to communities where the promoted practices were already being employed.

- Selection and design occurred in conjunction with the farmer in accordance with the specific benefits sought by that farmer.

- Use of incentives (e.g. seeds, labour, technical assistance).

- Local research:

- Local knowledge regarding goods and services provided by tree and shrub species in cattle production systems (Mosquera 2010).
- Functional characteristics that determine the nutritional value and preference for woody fodder for their inclusion in cattle feeding systems in dry regions (Pérez 2011) .
- Evaluation of the availability of biomass and shoot production among woody fodder in pastures (Lombo 2012).

The process (continued)

- Farmer willingness to offer farm land and provide labour for establishing and maintaining the plots.
- Easy access to facilitate visits to watch other farmers.
- Farmers who are forthcoming and committed to collaborate with other projects and groups of farmers.
- Farmers interested in implementing silvopastoral practices on their farms to mitigate the effects of drought.

Case study: Cut-and-carry fodder bank using individual trees in pastures, natural regeneration as well as Cratylia (*Cratylia argentea*) and Madero Negro (*Gliricidia sepium*)

Steps

- Area: A total of 0.7 ha (7,000 m^2) equally distributed between *Cratylia* and *Madero Negro* (3,500 m^2 each).
- Selection and design: In conjunction with the producer, providing opportunities to build farmers' decision-making skills and ability to adapt information to his/her own needs.
- Potential benefits: Fodder during the dry season, fuel wood, fruit for human consumption and timber.
- Siting: Near to the enclosure for handling and feeding cattle in order to maximize efficiency for cutting, carrying, transporting, chopping and feeding and to facilitate the flow of manure from the corral to the fodder bank.
- Characteristics of the fodder species: Adapted to Tropical Dry regions, shoot production during the dry season, ample seed production, species that establish themselves quickly.

Factors facilitating adoption

- Availability of seeds of fodder species.
- Cost of establishing 0.7 ha is US $756.36 (equal to US $1,080.51/ha), of which 88% was covered by FUNCiTREE and 12% by the farmer.

Risks related to adoption

- The need for capital and labour and a relatively long wait time while the fodder bank becomes established.

Impact of the demonstration work

- The plots established by the project emphasized cut-and-carry fodder banks and biologically diverse silvopastoral systems, both of which are important options for meeting the need for diverse food sources during the dry season in this region.

Impact of the demonstration work

- The plots can be integrated into participatory learning processes promoted by the extension program from the International Agriculture and Livestock School, located in Rivas, groups of farmers from Rivas that work with MAGFOR, neighbouring farmers and national universities providing the opportunity for more farmers to successively adopt this technology.

- The demonstration plots are representative of the conditions in the region and can generate motivation and interest among other farmers and promote the adoption of novel systems.

Encouraging change

- Scale-up from plot to entire farms.
- Identify farms with pastures that are highly multi-functional.
- Farmers need to see concrete examples in order to trust new technologies (Cordero y Boshier 2003).
- It is important to recognize farmers' priorities, needs and access to resources.
- Use of co-existing crops during the tree establishment period.

Lessons learned

- The transition from research to experimentation has positive outcomes with regard to demonstrating that more trees in pastures leads to increased benefit provision all year long.

- The adoption process is slow and gradual, but farmers recognize the value of the trees and the services they provide to the farm.

- There is growing interest among farmers to retain and manage trees in pastures, both as individual trees in pastures and as live fences.

Thanks!!

Photos: Barton, D; DeClerck, F; Garcia, F; Lombo, F; Miranda, J; Ramírez I; Sánchez, D; Zapata, P

http://funcitree.nina.no/

FUNCiTREE

Response to Impact of Climate Change through Community Managed Forests in Nepal: Is REDD+ Panacea for Community?

Ashok Baniya

MSc. in NRM, NTNU

Supervisors

Pro. Haakon Lein,NTNU

Dr. Graciela M. Rusch,NINA

Outline

- Introduction
- Research Questions
- Methods
- Results
- Conclusions

Background:

- Warming is **unequivocal**
- Of the 12 warmest years recorded, 11 years fall between 1995 and 2006 (IPCC, 2007)
- Green house gas emissions caused by a**nthropogenic activities** is behind the rise in global warming (IPCC, 2007).
- The **magnitude of effect** is skewed : LCD- Nepal more vulnerable but a least contributor to the emission of green house gases (Huq et. al 2003)
- **Forest** as a **source** of carbon emission : **17% -** human caused gas emission (IPCC,2007)

Role of Forest in Mitigation: REDD+

- Role of forest : **carbon sink**. Forest absorbs carbon through **photosynthesis** and **sequester**s it as biomass so is significant in global carbon cycle

- Amount of carbon absorbed in the soil and vegetation amounts to **between 0.9 and 4.3 Gt** annually (FAO, 2008).

- Realizing the importance of forest 'role in climate change mitigation, **COP 13** held in Bali-Indonesia (2007) explicitly mention the need to address REDD to mitigate GHCs

.

Concepts

- Climate change (public good)- Green House Gas (GHG) emission is biggest market failure (Stern, 2003).
- REDD as **market based** new liberal economic approach
- REDD - **standing trees** (avoided deforestation and degradation) **reduce emission of Green HG**
- REDD+ as **co-benefits - Global Payment to Environment Services potential** for encouraging communities to become involved in forest management:

  Forest (local) → Carbon credit → Int'l market

- REDD+ is **cheap and quickest way** to reduce carbon emission (Angelsen, 2012)

Research problems context

- 14,000 community forests - 1.1 million ha - 1.6 million HHs , deforestation rate in the hills reduced considerably (Acharya,2000), positive impacts on bio-diversity conservation (Jackson and Ingles, 1994), improved forest condition (Malla, 1997), and increased forest products (Kanel, 2004)

- But the **role of community managed forests** in mitigation, and enhancing the resilience capability of forest dependent community is **not fully understood**

- Though CMF through REDD+ is the **best effective way** to reduce carbon emission the questions like how and under which condition carbon trade is beneficial is not known properly

Research questions

Main Research question :

Is the existing **REDD+ mechanism beneficial** (value add) to local community?

Hypothesis :

Carbon trade is beneficial to the community only when the access to usual consumption of forest products is allowed to

utilize : **Scenarios**

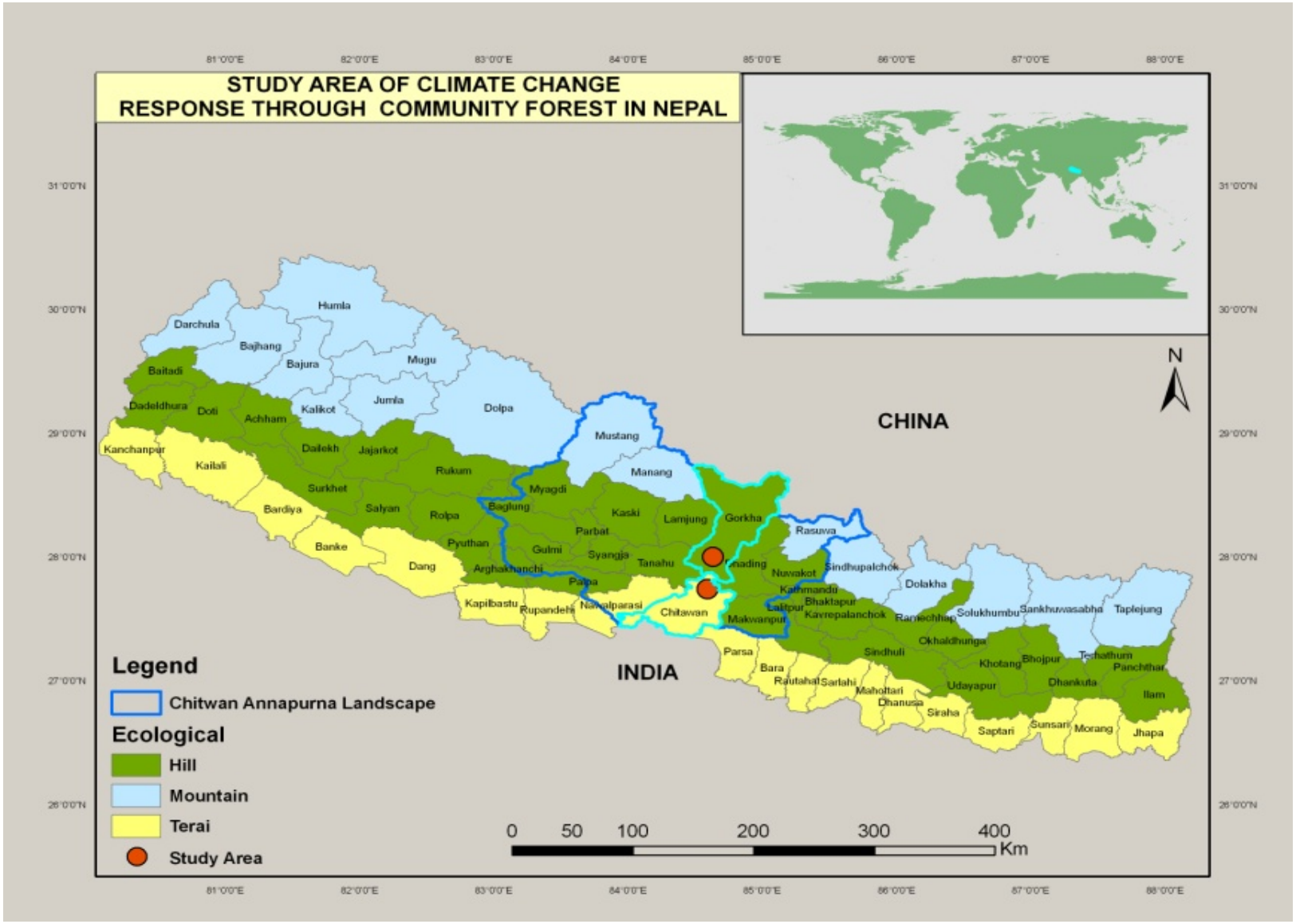
1. No carbon trade- status quo (scenario 1)
2. With carbon trade (scenario 2)
3. Only carbon trade (scenario 3)

Methods (Carbon data + Socioeconomic data)

Tools	Sources						
	Households (Primary)		Others				
			ICIMOD	ANSAB	FECOFUN	WWF	REDD cell
Survey questionnaire	√	√					
Structured conversation			√	√	√	√	√
Group Discussion/KI	√	√			√		
Professional consultation			√	√	√	√	√
Carbon data collection (secondary)	√	√	√	√			
Publication /statistics			√	√	√	√	

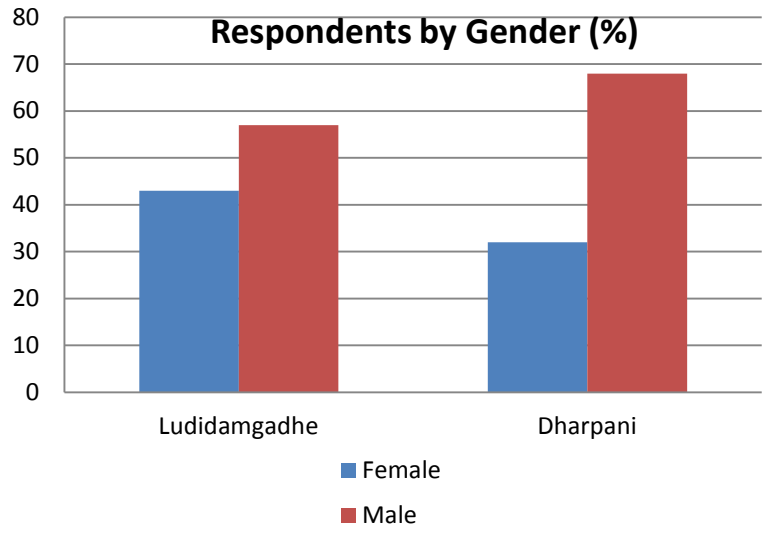
Representative photos showing applying methods in the fIeld

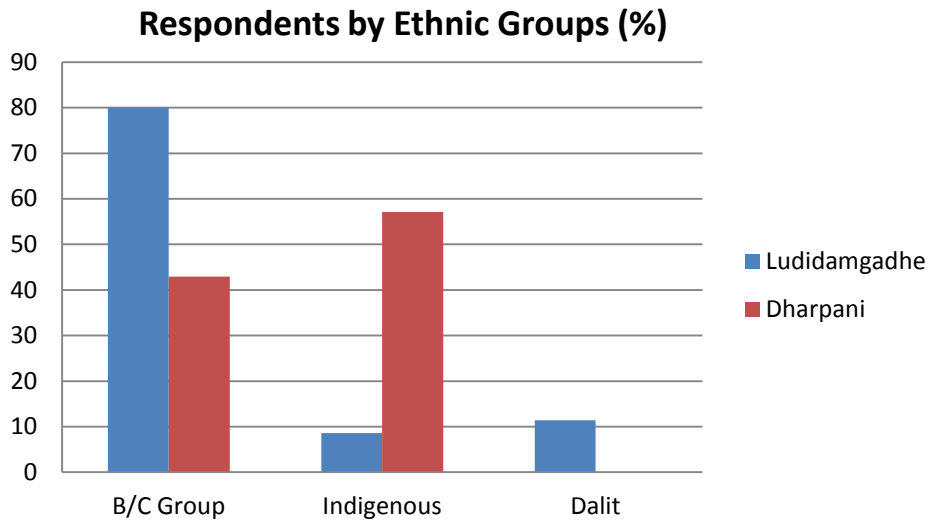
Study site


STUDY AREA OF CLIMATE CHANGE
RESPONSE THROUGH COMMUNITY FOREST IN NEPAL
CHINA
INDIA
N
Legend
Chitwan Annapurna Landscape
Ecological
Hill
Mountain
Terai
Study Area
0 50 100 200 300 400
Km
Humla
Darchula
Bajhang
Bajura
Mugu
Baitadi
Dadeldhura
Doti
Achham
Kalikot
Jumla
Dolpa
Mustang
Manang
Kanchanpur
Kailali
Dailekh
Jajarkot
Rukum
Surkhet
Salyan
Rolpa
Myagdi
Baglung
Kaski
Lamjung
Gorkha
Parbat
Gulmi
Syangja
Tanahu
Bardiya
Banke
Pyuthan
Dang
Arghakhanchi
Palpa
Nuwakot
Rasuwa
Sindhupalchok
Dolakha
Kathmandu
Lalitpur
Bhaktapur
Kavrepalanchok
Ramechhap
Solukhumbu
Sankhuwasabha
Taplejung
Okhaldhunga
Khotang
Bhojpur
Tehathum
Panchthar
Ilam
Dhankuta
Udayapur
Sunsari
Morang
Jhapa
Saptari
Siraha
Dhanusa
Mahottari
Sarlahi
Rautahat
Bara
Parsa
Chitawan
Makwanpur
Nawalparasi
Rupandehi
Kapilbastu

Sample Characteristics

District Name	Ecological region	Selected CFUGs	Total HHs	Sample HHs	% HHs sampled	Area (ha) No of plots
Chitwan	Sub-tropical	Dharpani	111	35	31	172 (15)
Gorkha	Lower temperate	Ludidamigadhe	522	35	7	241 (23)
Total			601	70	11.65	413





Data anlysis

Data Analysis : descriptive and inferential with SPSS 20.0 version/GIS

Bivariate : with and without REDD+ comparison within the FUGs and among the ecological zones

Total carbon and carbon sequestration rate calculation

C(LU) = C(AGTB) + C(AGSB) + C(BB) + C(LHG) + SOC

C (LU) = *Total carbon stock in given land use category ($tha^{-1}yr^{-1}$)*

C(AGTB)= *Carbon in above ground tree biomass ($tha^{-1}yr^{-1}$)*

C(AGSB) = *Carbon in above ground sapling biomass ($tha^{-1}yr^{-1}$)*

C(BB)= *Carbon in below ground biomass ($tha^{-1}yr^{-1}$)*

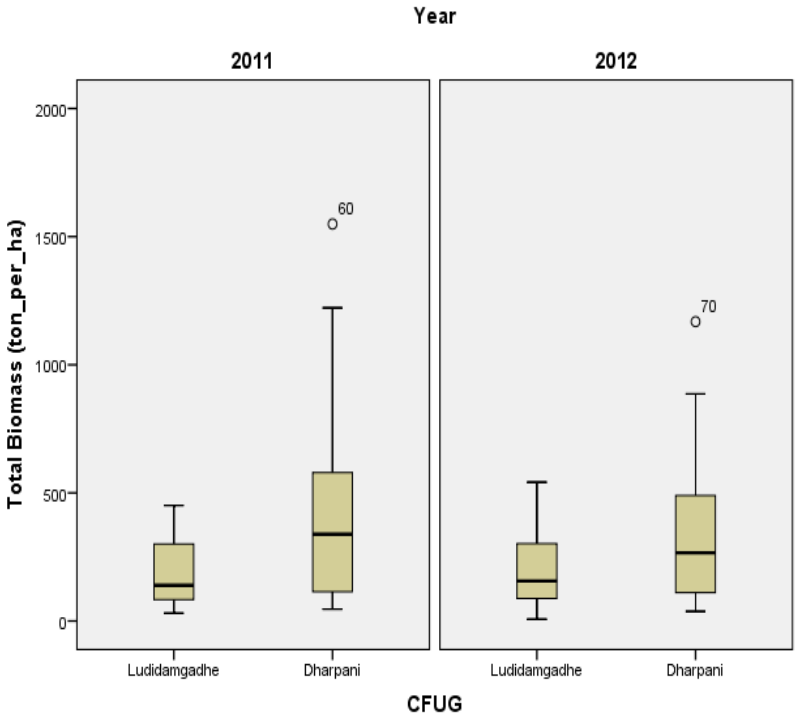
C(LHG)= *Carbon in leaf, herbs and grass ($tha^{-1}yr^{-1}$)*

SOC = *Soil organic carbon*

Carbon sequestration : Change in biomass given year

- $\Delta Yr = Yr_2 - Yr_1$ is change in biomass and 47% of this change in biomass (Yang et. al,2005, IPCC 2006) – carbon sequestration

Results (biomass and Carbon sequestration)



AGTB = 139.2 tha^{-1} (+13.79) in Ludi, 377.70 tha^{-1} (-15.76 tha^{-1}) in Dharpani

BB = 20 % of the AGTB

AGSB =6.84 tha^{-1}(-1.41) in Ludi, 6.47 tha^{-1}(-1.01) in Dharpani

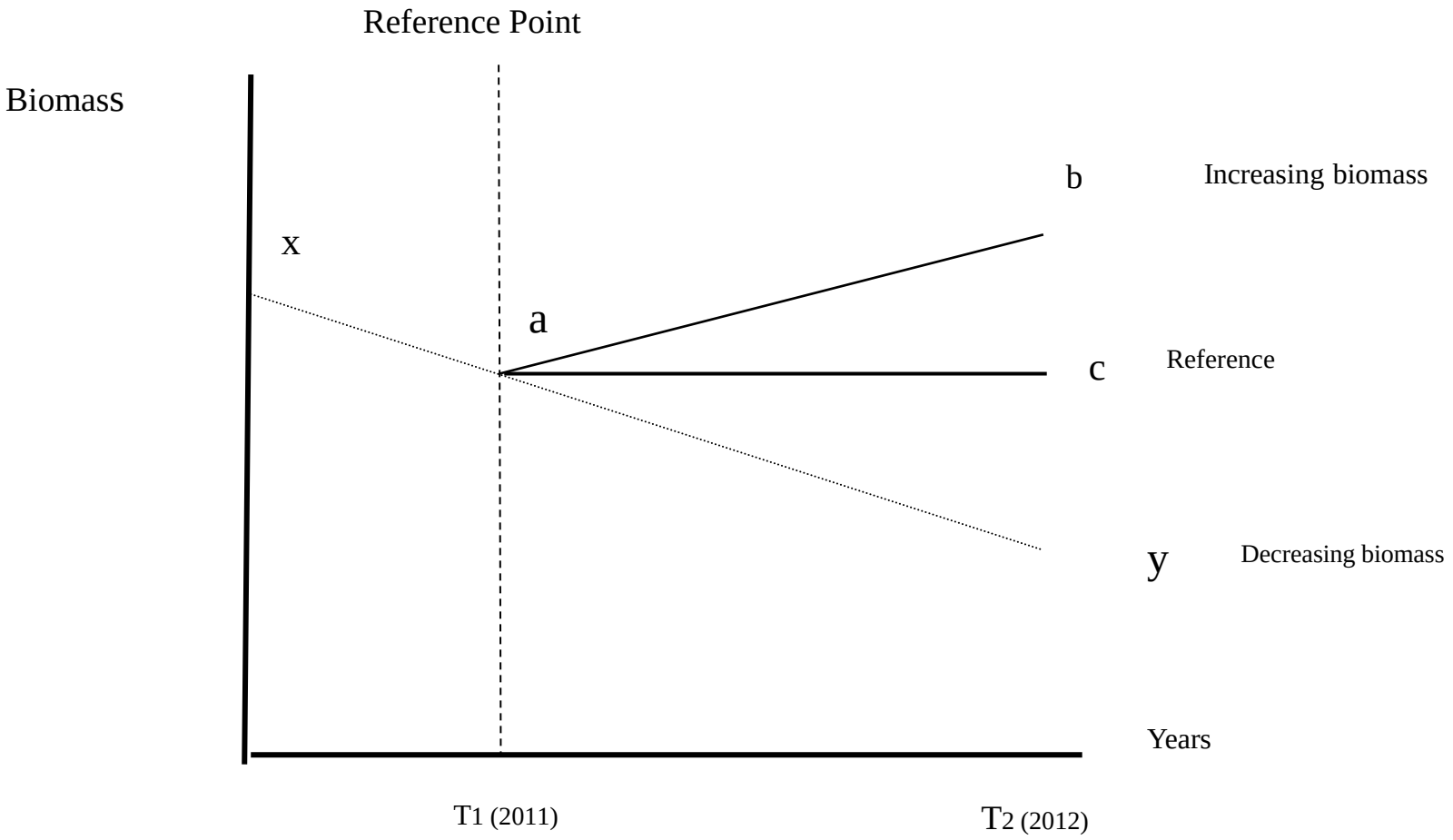
GHB = 0.53 tha^{-1} (no change) Ludi ; 0.14 tha^{-1} (+0.13)

SOC = 96.50 tha^{-1} in Ludi, and 109.60 tha^{-1} in Dharpani

Total biomass (Ludi)= 183.60 tha^{-1} (+9.43 $tha^{-1}yr^{-1}$ sequestration)= 4.43 $tha^{-1}yr^{-1}$ carbon=16.22 CO_2 $tha^{-1}yr^{-1}$

Total biomass (Dhr)= 465 tha^{-1} (-93.31 $tha^{-1}yr^{-1}$)

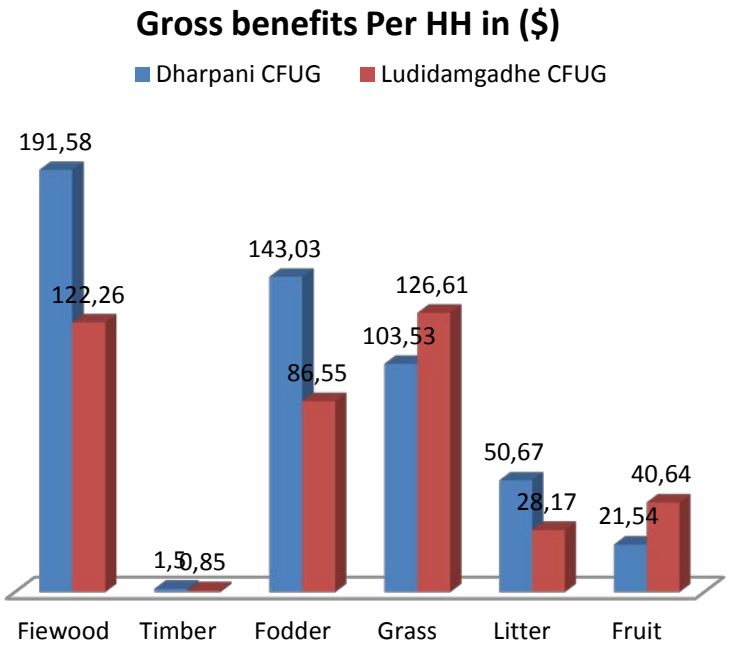
Results (carbon sink and source)



Adapted from Karky et. al (2010)

Results : Benefits and cost

	Scenario1 (no Carbon trade)	Scenario 2 (with carbon trade)	Scenario3 (Only carbon trade)
Benefits	Fuelwood Fodder Litter Grass Fruits	Scenario 1 + Carbon revenue	Carbon revenue (carbon sequestration plus carbon saved from fuel wood consumption)
Cost	-Labor and cash contribution on forest management and protection -Fee for paying forest products	Scenario 1 + -Carbon project preparation -Carbon measurement -Carbon monitoring -Marketing and verification	Scenario 2 + <u>Opportunity Cost</u> -Fuel wood (foregone) -Fodder(foregone) -Litter(foregone) -Grass(foregone) -Fruits(foregone)



Fodder only $p<0.018$

CF Name	Cost ($) HH^{-1} Yr^{-1}
Dharpani	97.17
Ludi damgadhe	31.85

Cost $p<0.050$

Results (Scenario analysis)

US$ (Net gain)	Yr 2012
Ludidamgadhe CF: net gain	1,77,406
Ludidamgadhe CF: net gain per HH	339.86
Dharpni CF: net gain	37,308
Dharpani CF: net gain per HH	336.11

Scenario 1 (business as usual-no carbon trade)

Net Gain (forest products +carbon revenue)US $	US $ 1 per tCO_2	US $ 10 per tCO_2
Ludidamgadhe CF: net gain	1,75,260.74	2,10,441.92
Ludidamgadhe CF: net gain per HH	335.74	403.14
Ludidamgadhe CF: net carbon revenue	3,909.02(2.15% of the total gain)	39,090.02 (18 % of the total gain)
Ludidamgadhe CF: net carbon revenue only per HH	7.47	74.88

Scenario 2 With carbon trade (p<.0002)

Net gain carbon revenues only US $	US $ 1 per tCO_2	US $ 10 per tCO_2
Ludidamgadhe :net gain	-177342.5	-116306
Ludidamgadhe :net gain per HH	-339.74	-222.81

Scenario 3 Only carbon

Main Conclusion

Q1 # Is existing **REDD+ mechanism** beneficial (attractive) to local community ? **Yes** but only in certain condition (Scenario 2-allow to use forest products and sell carbon @ $10.

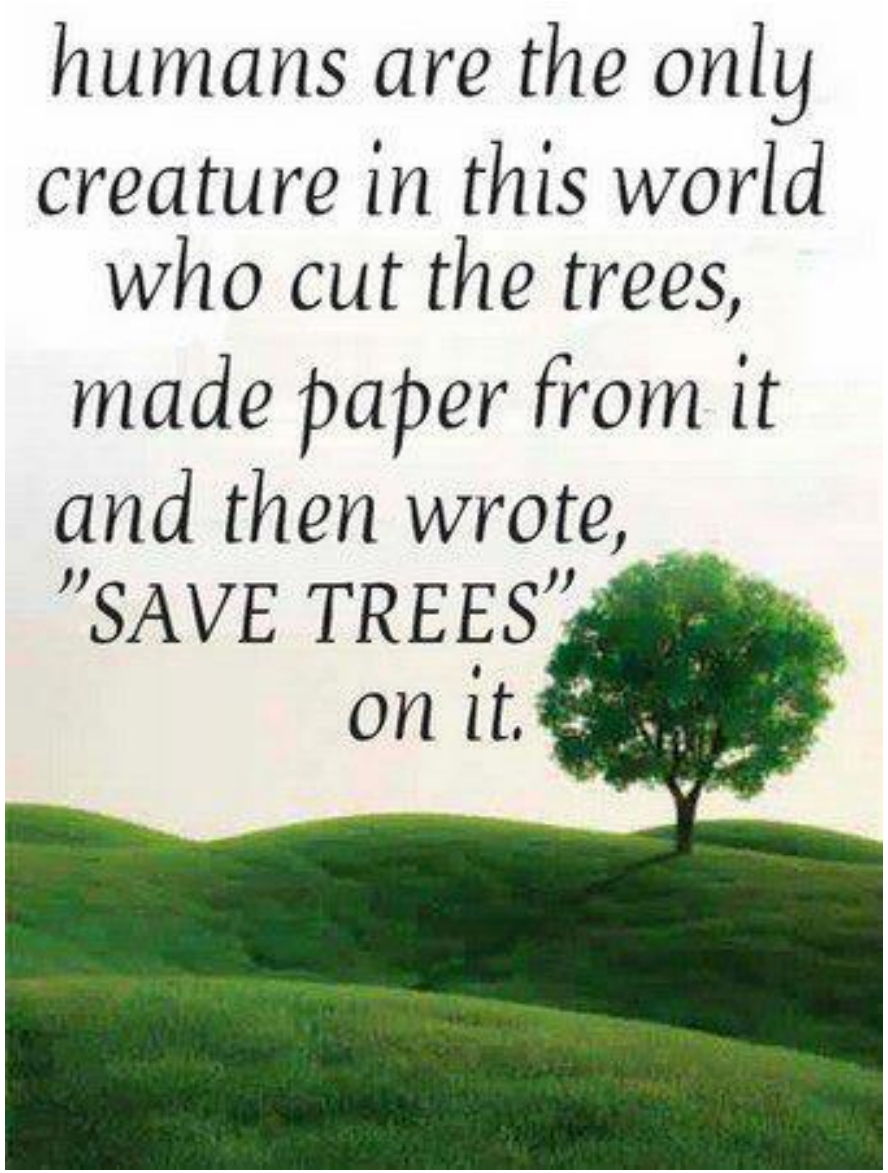
Study Prospects

Policy implication : New insight and better inform

Carbon as a conditional not blanket economic incentive for community to conserve forest without jeopardizing their right to access to forest product so the carbon is only the "value add" to their effort

Communicative importance :

Forest user groups, academicians, students, climate change and development agents and workers



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DET KGL. NORSKE VIDENSKABERS SELSKAB
ICIMOD 30 THREE DECADES FOR MOUNTAINS AND PEOPLE
ANSAB Rich Biodiversity and Prosperous Communities

Traditional nomadic tending of trees in the Red Sea Hills

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The ACACIA project

- *” Interaction among human interference, climate and the viability and dynamics of contracted acacia populations in the Eastern Sahara”*

- **Norwegian research council / FRIMUF 2010-2013**
- **Partners:**
  - Uni Miljø – PI
  - Swansea University, Wales
  - Universitetet i Bergen
  - University of Missouri, US
  - Red Sea University, Sudan
  - *Egyptian Env. Affairs Agency, Egypt*
  - *Associated:*
  - *Norwegian Inst. of Public Health*
  - *Poznan radiocarbon laboratory*

The Acacia project

- *“Is it possible that the withdrawal of nomads from what was once a savannah forest, far from relieving it from the stresses of human pressure, will deprive it of the maintenance that sustains it in its contracted state?”*

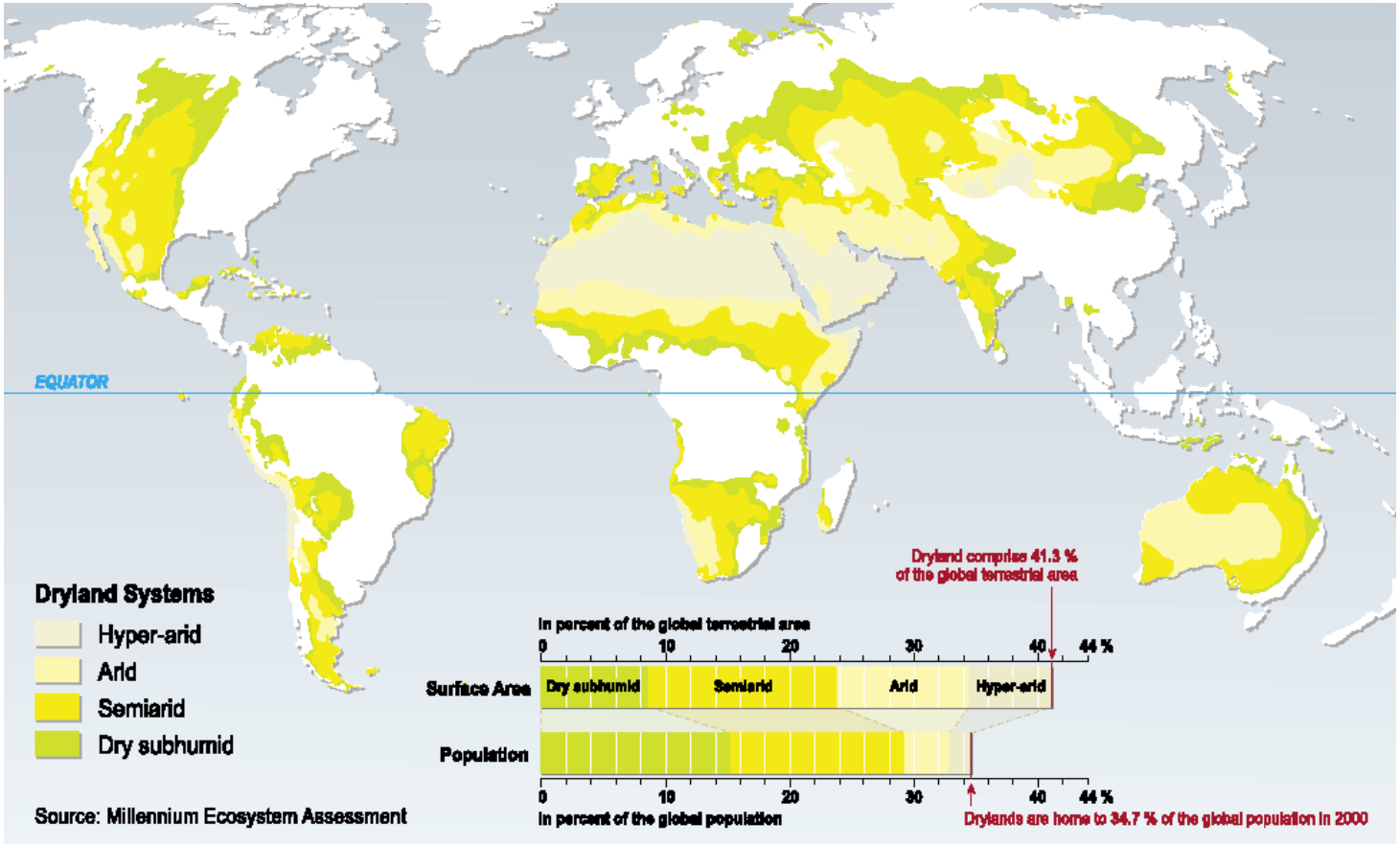
Objective

WP3: Traditional land-use and ecological knowledge

- We focus on the use and tending of *A. tortilis* and its subspecies among five main tribes in the Red Sea Hills

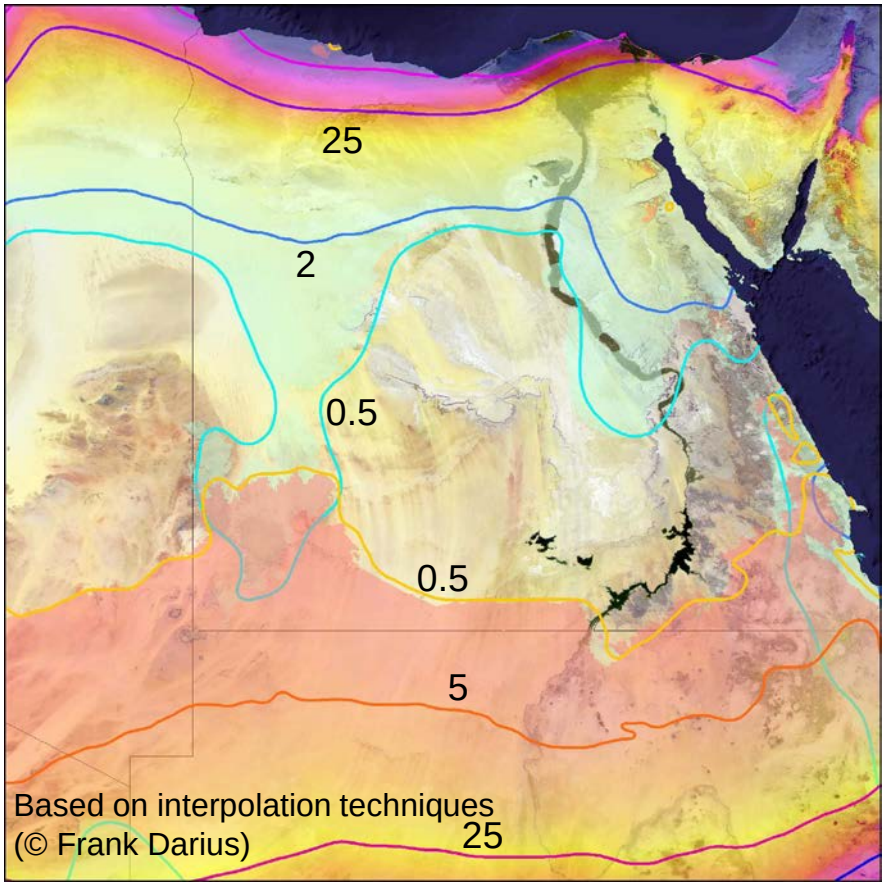
- Our aim is to record tending practices and their underlying traditional ecological knowledge while there are still informants who can tell us in their own terms how they understand and carry out their activities.

Eastern Sahara – hyper-arid climate



Precipitation pattern

- Hyper-arid
- Two regimes
  - Winter rainfall (from north)
  - Summer rainfall (from south/monsoon)
- Possible overlap



The Red Sea Hills

- Mountainous desert
- Aridity gradient (N-S)
  - 10mm prec. / coefficient of variation 200%
  - 100 mm prec / coefficient of variation 68%

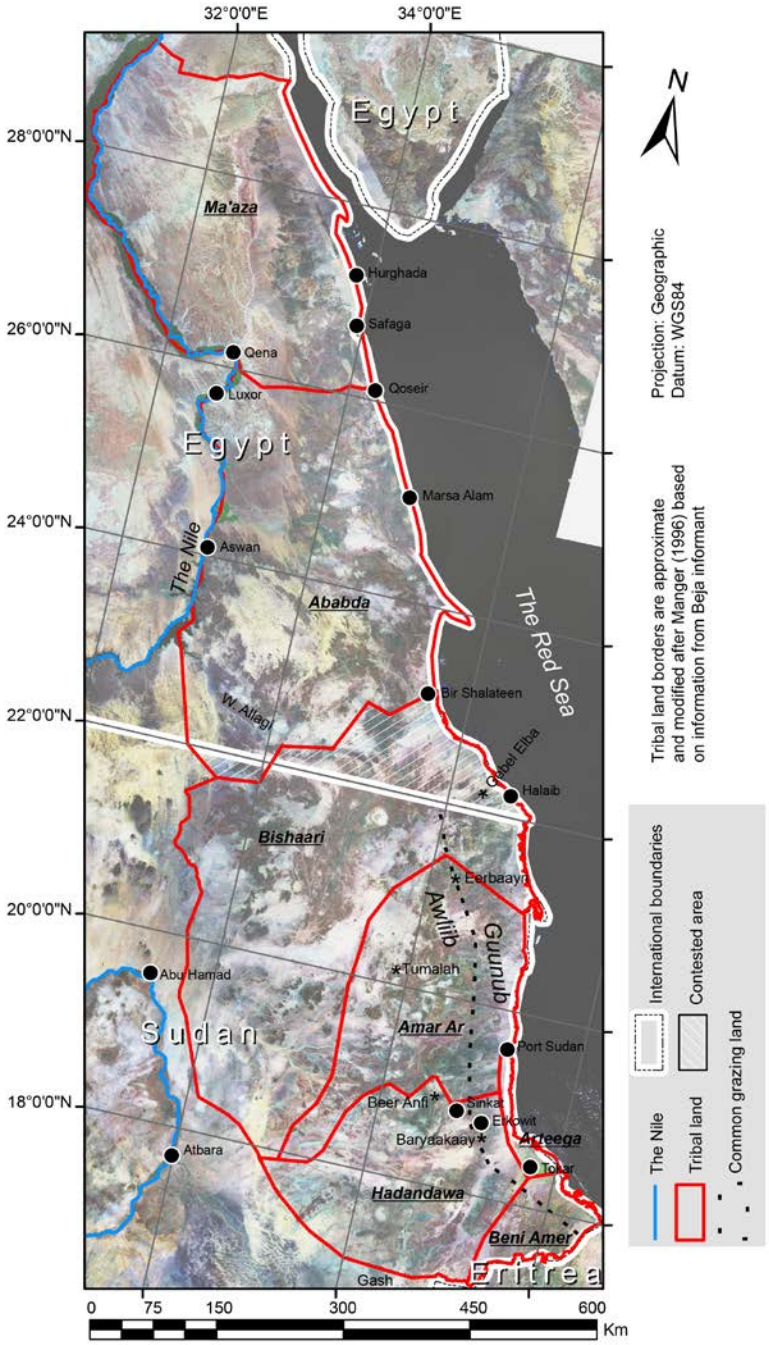
Ma'aza,

Ababda

Bishari

Amara'ar

Hadendowa



Ma’aza, ‘Ababda, Bishari, Amara’ar, Hadendowa





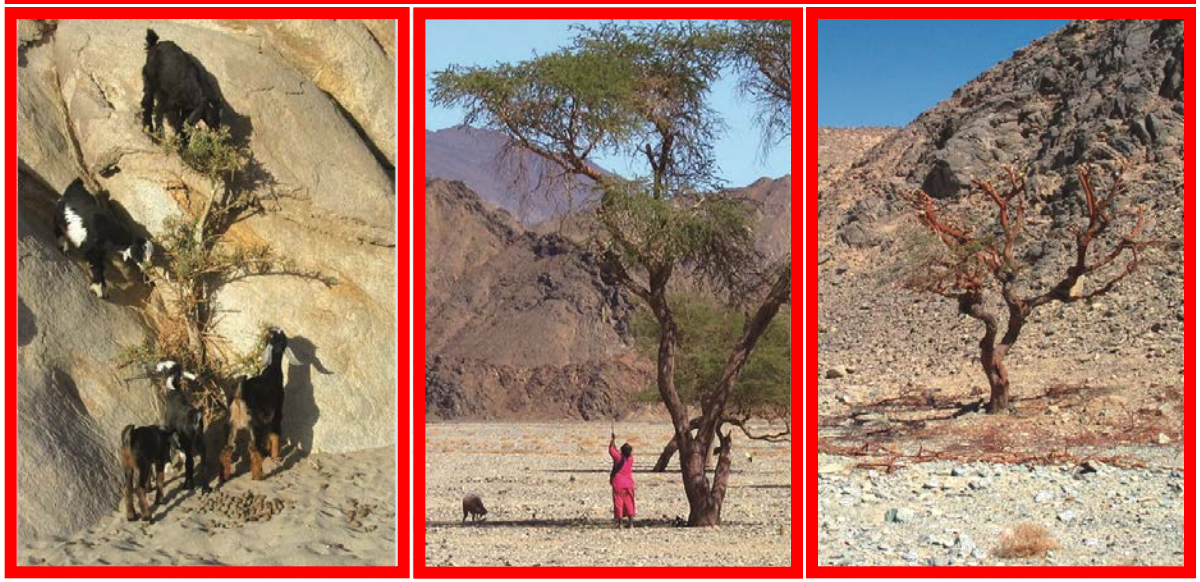

Acacia – an essential resource

- Dominant species
- Found under optimale water conditions, mainly in the wadis

Current management strategies are old!

Egyptian
New Kingdom

Modern inhabitants still use the trees the same way



The traditional nomadic lifestyle has adapted to and shaped the environment over millennia

Direct browse

Shaking branches

Pollarding the trees

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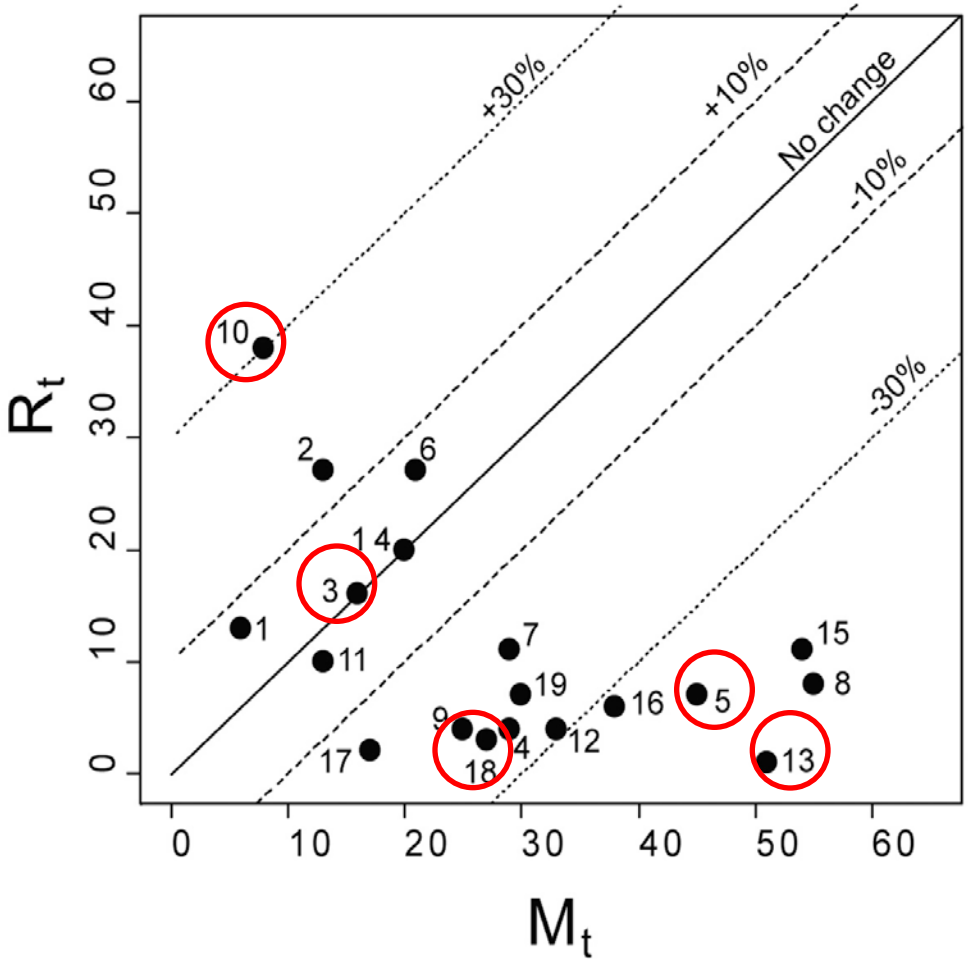
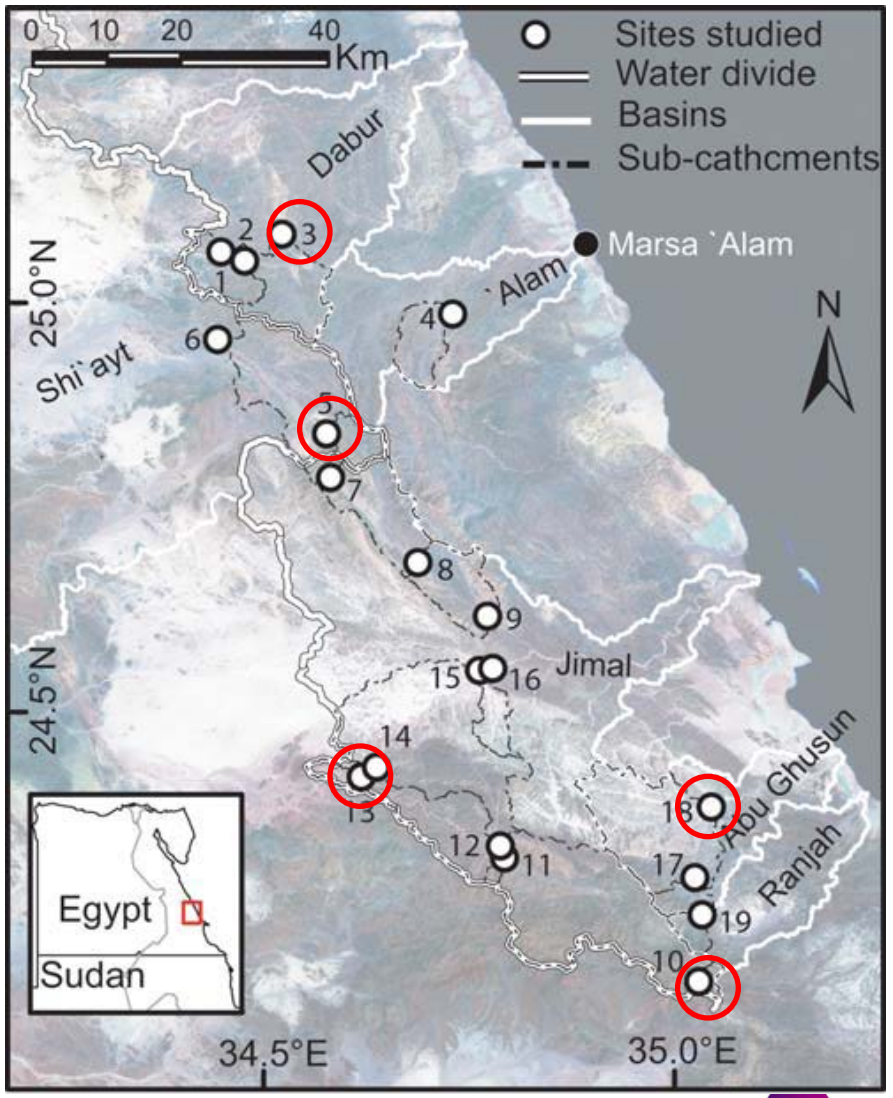
Transformation processes

- Sedentarisation
- Tourism
- Marginalisation
- Globalisation

Changes in arboreal resources

- 1965-2003
- High mortality
- Low recruitment





Methods

- structured and open-ended interviews
- 74 informants across tribes, gender and generation
- complemented by our observations from more than 25 years of studies in this area.

Summary of tribal and gender (age) characteristics of informants

Tribe	#men	#women	#boys	#girls
Maᶜaza	2 (60+)			
Ababda	8 (30-60)	1		1
Bishaari	8 (20-70)	1	2 (16-17)	
Amar Ar	6 (37-70)	6 (40-63)	6 (7-16)	3 (13-16)
Hadandawa	15 (40 – 70+)	11 (25 – 60)	2 (7-11)	2 (10-12)

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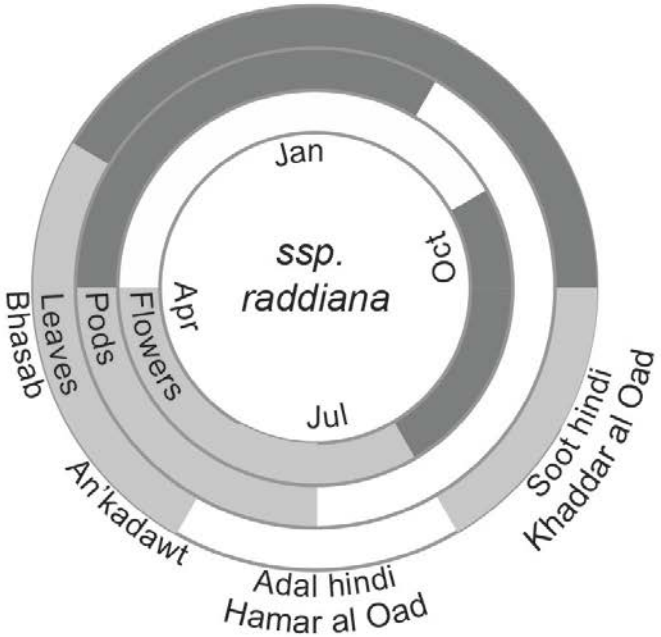
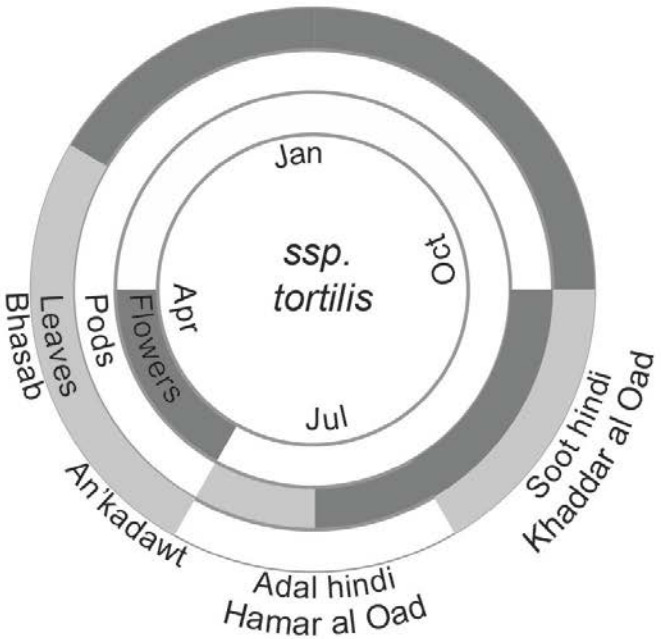
Results

A. tortilis subspecies variation

- Difficult to describe clear differences between sub-species – comparative terms
- Phenology best character
- valuable fodder products throughout the year; *gifts,* durra, fruit





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Tending practices

- Protection of seedlings
  - Not because of overgrazing but to protect against accidental harm (trampling) – traditional herding
- Circumscision
  - Done at the ”shigla”/”dehanoot” stage
  - Strengthens and shape the tree / accessibility to shade, products
  - A disappearing practice
  - Done by men and only “owners”, not “guest”
  - Found no reference to this in any studies!
- Shaking
  - mainly seedpods, but also leaves, buds and flowers,
  - By women and children; done with care! Guest can be given permission

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Pruning and pollarding

- Cutting off a branch, limb or twig,
- Many local terms: Waak, janiyy, taghsiin or tahsiin
- ssp. tortilis is never cut
- Only done on mature trees (also e.g. Balanites aegyptiaca, Zizyphus spina-christi)
  - for renewal (dry, old or weak) – beautification
  - to provide fodder for animals; unreachable branches; when animals need it (dry season)
- Left overs for fuelwood/charcoal
- Gariid (among Ma'aza) – gives browse, material for cordage (bark) and remaining wood crunched for fodder
- Primarily done by men, not allowed by guest!

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Pruning and pollarding

- is good for a tree because it cleans it of dry branches, renews it, and keeps it “lighter” and young
  - Water consumption / longevity
- Have by many outsiders been considered as destructive pruning
- Is in fact subject to a set of rules that demonstrably conforms to good pruning practices as described in current literature.
- Have disappeared among Ma’aza

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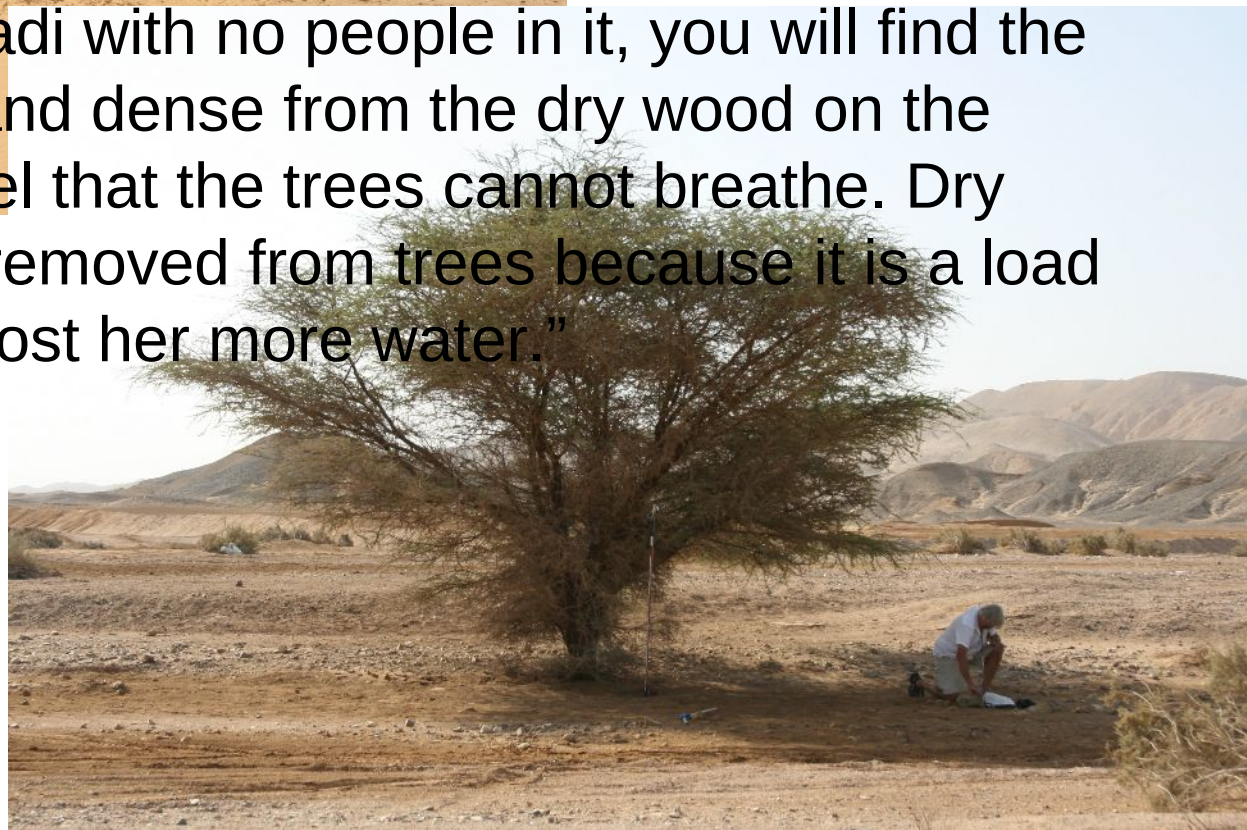
- “if you go to a Wadi with no people in it, you will find the trees looks bad and dense from the dry wood on the trees. You will feel that the trees cannot breathe. Dry wood should be removed from trees because it is a load on the tree and cost her more water.”



Conclusion

- At present, until more research is done, we can only speculate whether these practices actually increase the survival of trees, but the “gardening” of trees that is still traditionally practiced in the RSH, in particular among the Beja, has several effects that undoubtedly protect, strengthen and renew their trees.

Download https://vimeo.com/65253932

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Rights to trees

- Regulated by traditional customary laws
- Owners; can do all types of tending but never cut green trees
- Guest; can graze and browse, but need permission to shake and prune

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Circumscision

- removal of lower branches (below canopy height) from the trunk(s) of smaller *ssp. raddiana*,
- done when the tree is considered strong enough to withstand harmful browsing, in order to strengthen the trunk and to make it grow faster/better.
- Shape the tree; with one or two trunks and a clearly defined canopy that offers good, accessible shade.
- An uncircumcised tree will have dense branches at lower heights that make it difficult to approach and use.
- A disappearing practice
- We have not found reference to this in any studies!

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shaking

- Shaking, using the shepherd’s crook, is a way to access trees’ products, mainly seedpods, but also leaves, buds and flowers, without cutting off branches
- Children and woman; with care
- Minimize shaking to increase pod production
- Some still collect and store pods; weak animals

Growth stages

Table 3: Terms in Bidhaawyeet (B) and Arabic (Ar.) for different growth stages of *A. tortilis*

Term	Growth stage
Eera saganeeb (B)	Sapling of *ssp. raddiana*; used by some Beja, referring to the whiter (*eera*) color of the thorns (than *ssp. tortilis* has)
shigilt (B); shigla(s)/shigil (pl) (Ar.)	Small tree; Among the Beja tribes this stage is defined as the size of a sitting bird (eagle), among Ababda they use this expression until the tree reaches the size of a man.
Dehanoot (B)	Term used by the Beja for a tree grown as big as a sitting man, literally meaning *virgin*, indicating that it has not yet given any flowers or pods
Tawaay (B); Sayyal (Ar.)	Mature individual of *ssp. raddiana*
Saganeeb (B); Samour (Ar.)	Mature individual of *ssp.tortilis*

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Use of the community capitals framework to understand adaptation of silvopastoral systems: bridging the gap between research and development

Gutierrez-Montes, I., Sibelet, N., Villanueva, C., Sanchez, D., Mosquera, D., and Marie, C.

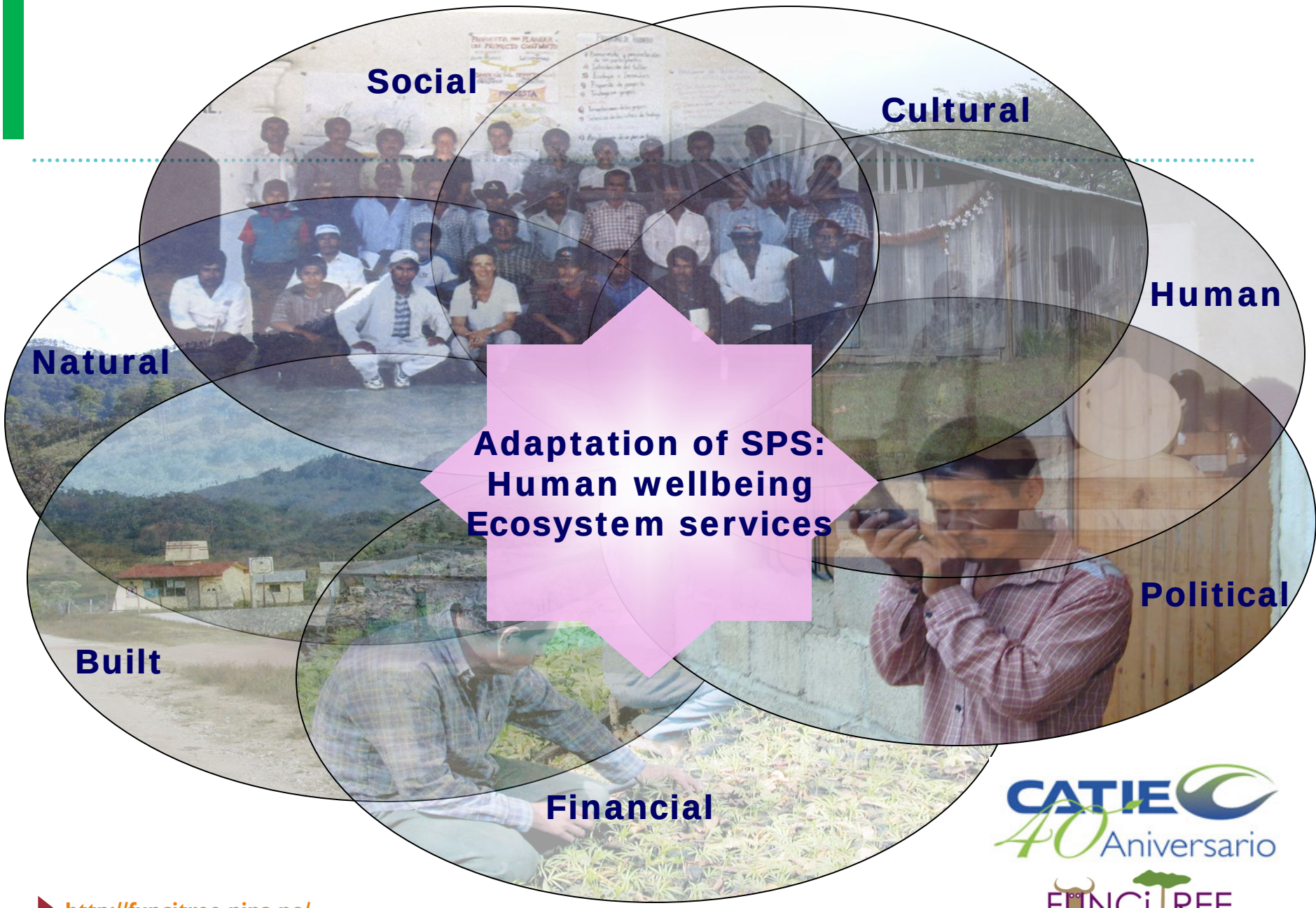
Outline

- Overview of the Community Capitals Framework (CCF)
- Why Focus on the **Capitals** to understand adaptation of silvopastoral systems: examples from FUNCiTREE

Community Capitals Framework

All communities have **resources/assets** that:

- Can be consumed/spent (used up and gone)
- Can be stored/ hidden(nobody can used them)
- Or, they can be invested in ways that generate assets in other **capitals**.



http://funcitree.nina.no/

Why Focus on the **Capitals** to understand adaptation of silvopastoral systems?

… goes beyond financial/ economical considerations to adapt SPS:

- Importance of “place” (relevance of contexts).
- Mapping systemic change:
  - Interdependency and interaction.
  - Balance.
  - Ripple effect.

Capitals and SPS:

- Examples from FUNCiTREE (and MAP)

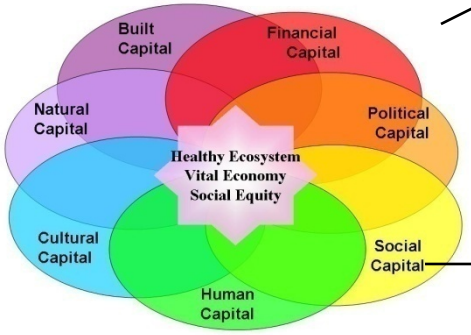
CCF and SPS Research Process

Stories of SPS success

Promote changes

Expectations

mapping of community assets: CCF



Data on:

Assets invested used up

Assets created / destroyed

Analysis of:

- Change in community capital stocks and increase or decrease in capacity
- Community and organizational change processes

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CATIE 40 Aniversario

FUNCiTREE

Natural Capital

- Water
- Soils
- Biodiversity
- Landscape
- Carbon sequestration

Cultural Capital

In terms of SPS, shade trees providing cultural benefits/services and associated with:

- Local Knowledge
- Traditional species
- Natural resource management practices

Human Capital

Participants sharing and applying better:

- Skills
- Training
- Leadership

Social Capital

Process opening and broadening:

- Trust and Reciprocity
- Groups
- Cooperative work

Political Capital

Efforts with SPS provide:

- Connections between grass roots and other organizations at different levels
- Access and good use of power structures

Financial Capital

SPS provide:

- Diversified income sources
- Savings
- Loans and credits
- Investments
- Tax deductions
- Grants

Built Capital

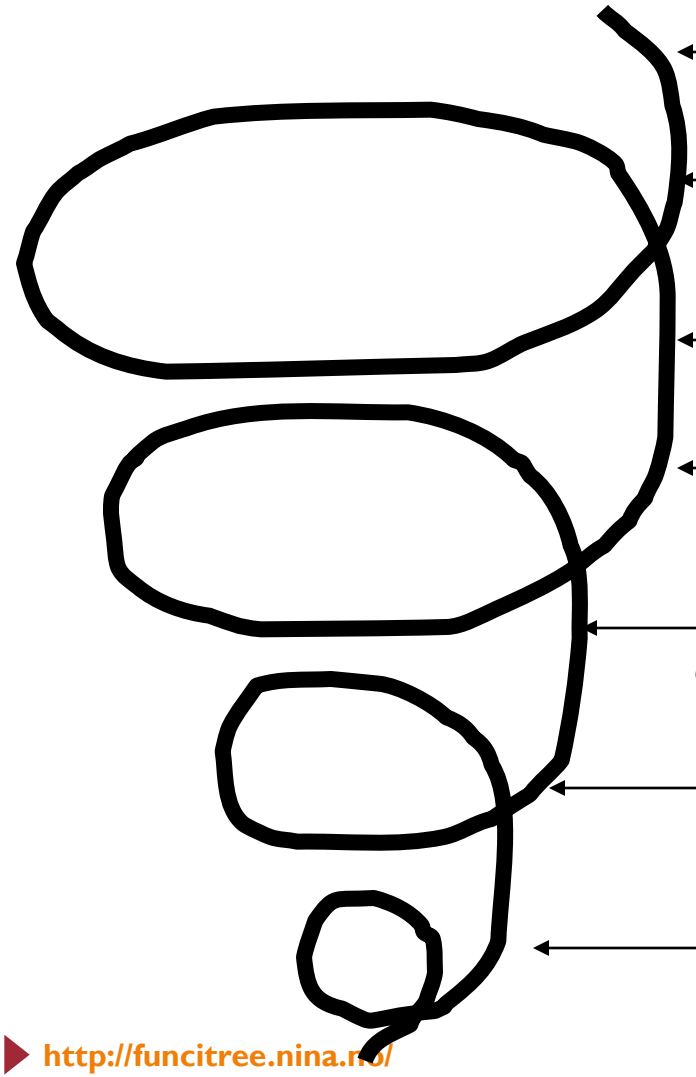
Betterment of:

- Housing
- Roads
- Machinery

What needs to be there to be successful in adaptation of SPS?

- Sustainability involves strengthening local capabilities to adapt/innovate (HC)
- Indigenous/local knowledge and skills (CC) are as important as exogenous technical knowledge/skills
- Participation of local people/institutions (SC)
- Empowerment for sustainable development is a political process involving increasing local consciousness, learning, and control (over **assets** including adaptation of SPS and decision making) (PC).
- Key indicator is locally initiated collective action (SC) toward the development and adaptation of multifunctional SPS (NC)

Spiraling of Capital Assets with MFSPS



Functional diversity and ecosystem services (Natural capital)

Improvement of productivity (Financial capital)

Participation in decision making (Political capital)

Promotion of SPS as a productive innovation (Built capital)

Relationships‘ with technical personnel and other producers (Social C)

Local knowledge on SPS (Cultural capital)

Capacity building: PR/ FFS (Human Capital)

Spiraling up

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FUNCiTREE

CCF allows us to:

1. Make diagnosis and prepare the base line of participant producers present situation
2. Start the development of a long term vision based on SPS
3. Planning models and innovation projects/ initiatives
4. Start M&E strategies

References

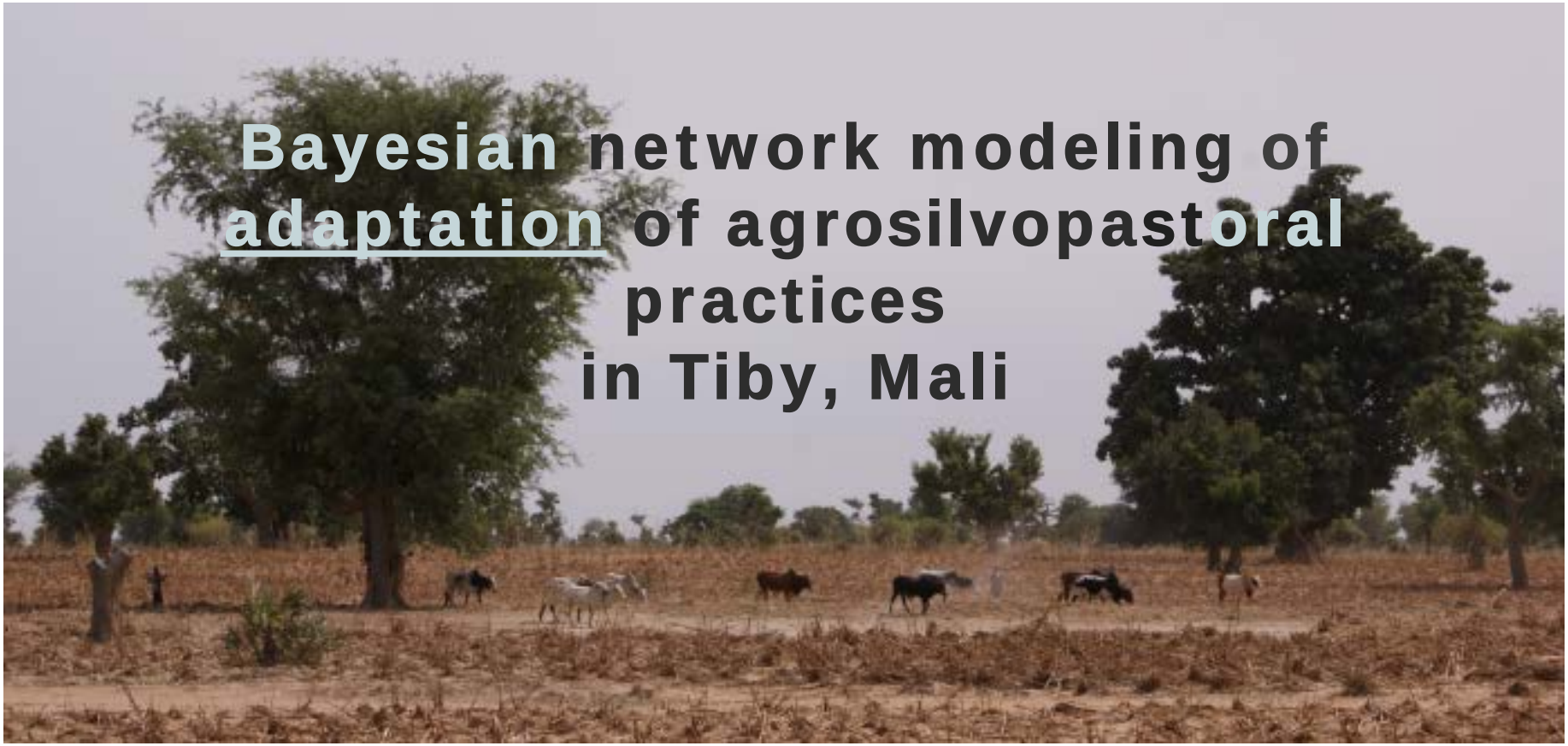
- Emery, M. and C. Flora. 2006. *Spiraling-Up: Mapping Community Transformation with Community Capitals Framework.* Community Development: Journal of the Community Development Society. 37 (1): 19-35.
- Gutierrez-Montes I., M. Emery and E. Fernandez-Baca. 2009. The Sustainable Livelihoods Approach and the Community Capitals Framework: The Importance of System- Level Approaches to Community Change Efforts. Community Development: Journal of the Community Development Society. 40 (2): 106- 113.
- Meinzen-Dick, R., M. Adato, L. Haddad and P. Hazell. 2004. Science and Poverty: An Interdisciplinary Assessment of the Impact of Agricultural Research. Washington D.C. International Food Policy Research Institute
- **Marie, Ch. 2010. De Arboles y Pastos: Manejo de los recursos leñosos y dinámicas sociales en La Chocolata, Rivas, Nicaragua. Thesis MSc. 39p.**
- **Mosquera D. 2010. Conocimiento local sobre bienes y servicios de especies arboreas y arbustivas en sistemas de producción ganadera de Rivas, Nicaragua. Thesis MSc. CATIE. Costa Rica. 128 p.**

Thank You!

David N. BARTON, Youssouf CISSE, Bocary KAYA, Ibrahima N'DIAYE, Harouna YOSSI, Abdoulaye DIARRA, Souleymane KEITA, Amadou DEMBELE, Daouda MAIGA

FunciTree Final Conference Trondheim 23-25 May 2013

Bayesian network modeling of adaptation of agrosilvopastoral practices in Tiby, Mali



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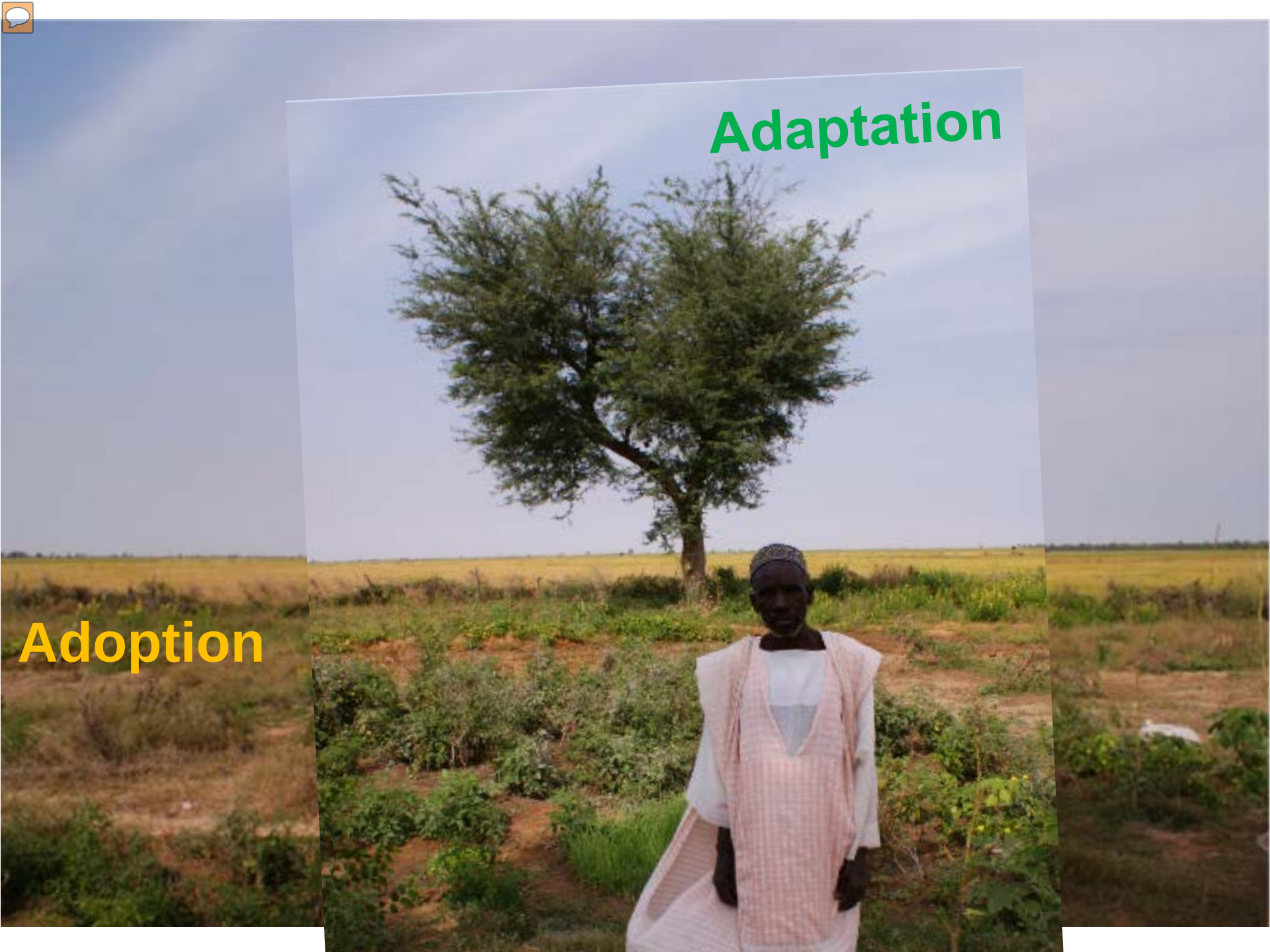
FUNCiTREE

Overview

- **Challenge - Adoption vs. adaptation?**
- **Bayesian network analysis method**
- **Study area and data**
- **Results**
- **Discussion**
  - **Knowledge integration**
  - **“Bayesian updating”= adaptative learning?**
- **Conclusion**
- **Acknowledgement**


Adaptation
Adoption

Bayes (-Price-Laplace) Theorem

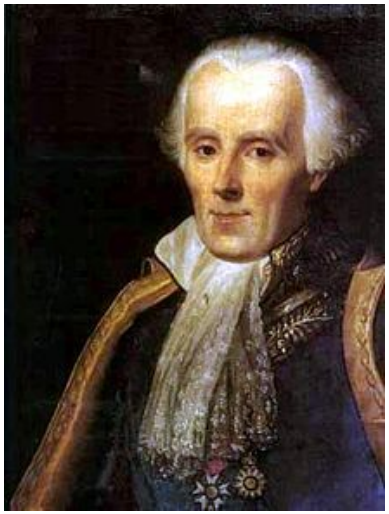
- Bayes'(1702-1761) theorised..

- his friend Price published…

- Laplace's (1749-1827)

did the maths…

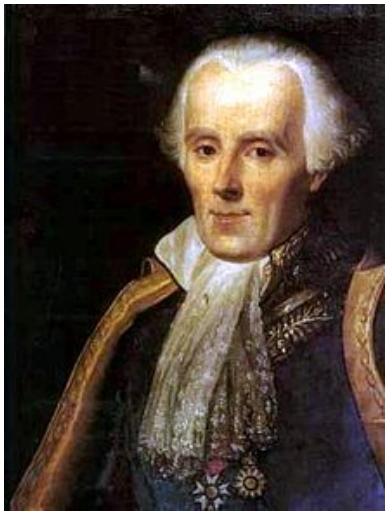
«probability of causes»



Bayes Theorem

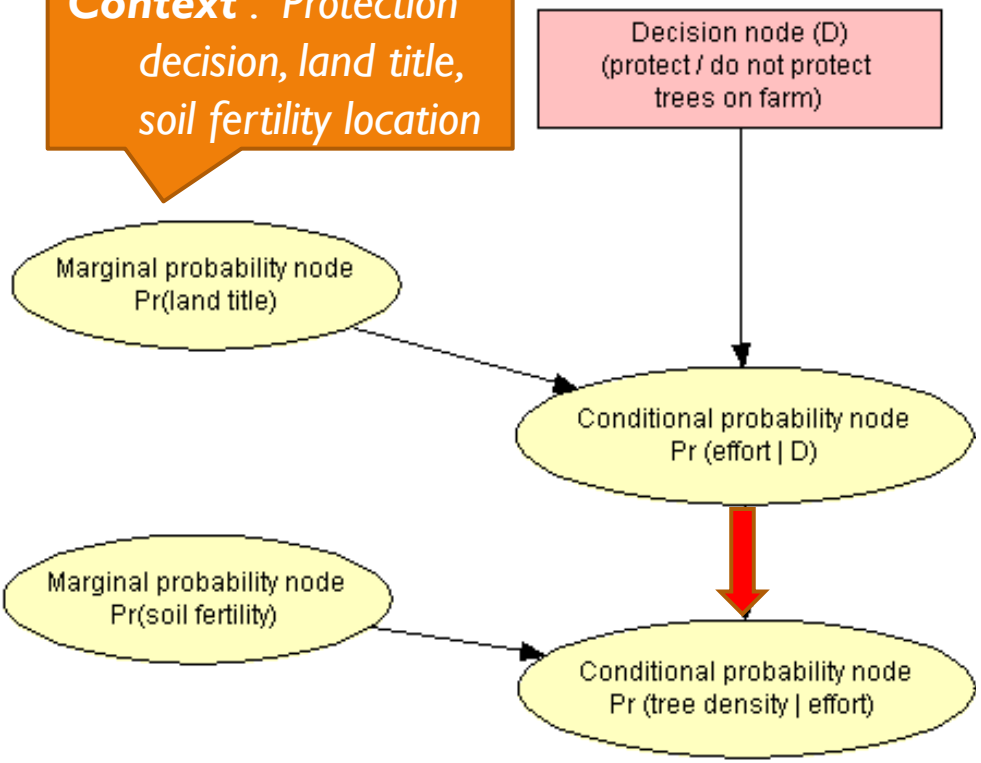
- «By updating our initial belief about something with objective new information, we get a new and improved belief»

(Bertch Mcgrayne 2011)



"Bayes theorem" applied to AFS adaptation

Context : *Protection decision, land title, soil fertility location*



Likelihood :
Probability of effort given observed tree density: Pr (effort | tree density)

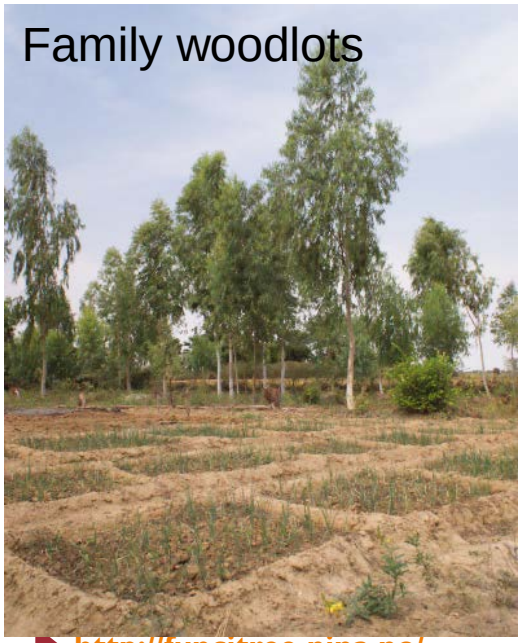
A Priori belief
Probability of tree density : Pr(Density)

$$\Pr(Density \mid Effort, context) = \frac{\Pr(Effort \mid Density, context) \times \Pr(Density \mid context)}{\Pr(Effort \mid context)}$$

A Posteriori belief :
Probability of tree density given effort: Pr(density | effort).

Probability of protection effort: Pr(Effort).
(normalised by probability of causes over all likelihoods):

Adaptation of agroforestry practices



G.Rusch

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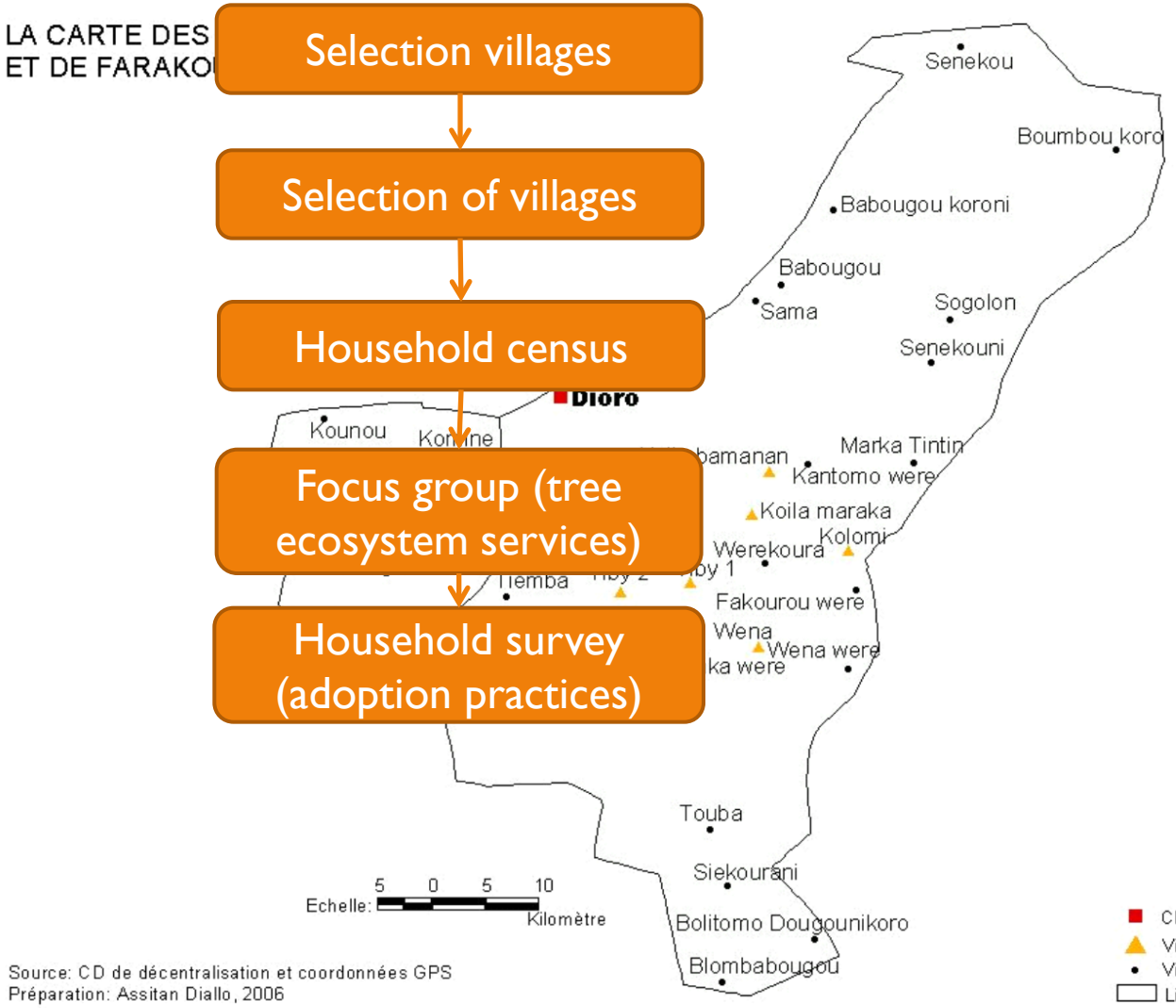
Study area and sample



Frame: 39 Millenium Project Villages

Sample: 15 villages:

8 MVP «research villages «

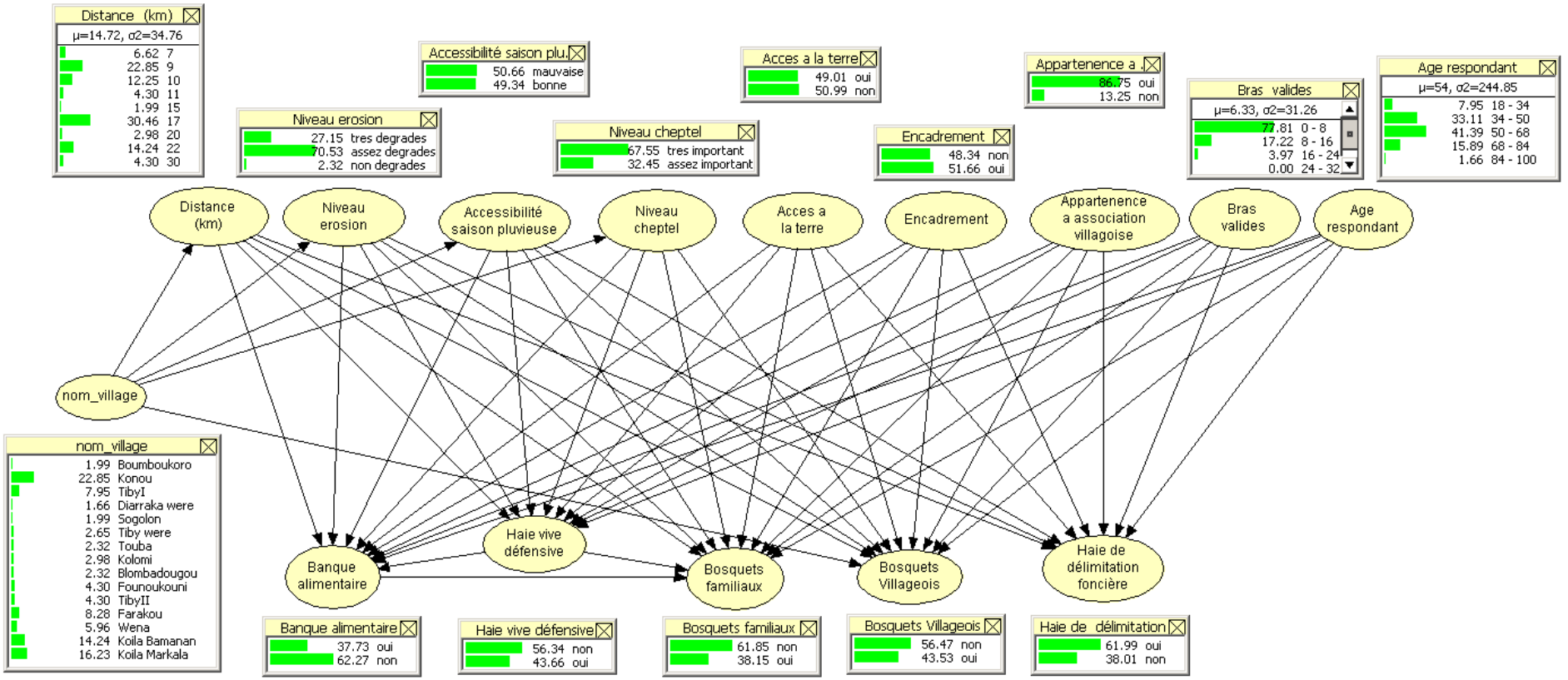
+7 randomly selected

(1735 households)

Purposive sample for survey: N=302

(crop, cattle farmers, women)

Bayesian network of factors affecting agrosilvopastoral practices in villages , Tiby region , Mali



- Try Hugin demo…
  - http://funcitree.nina.no/

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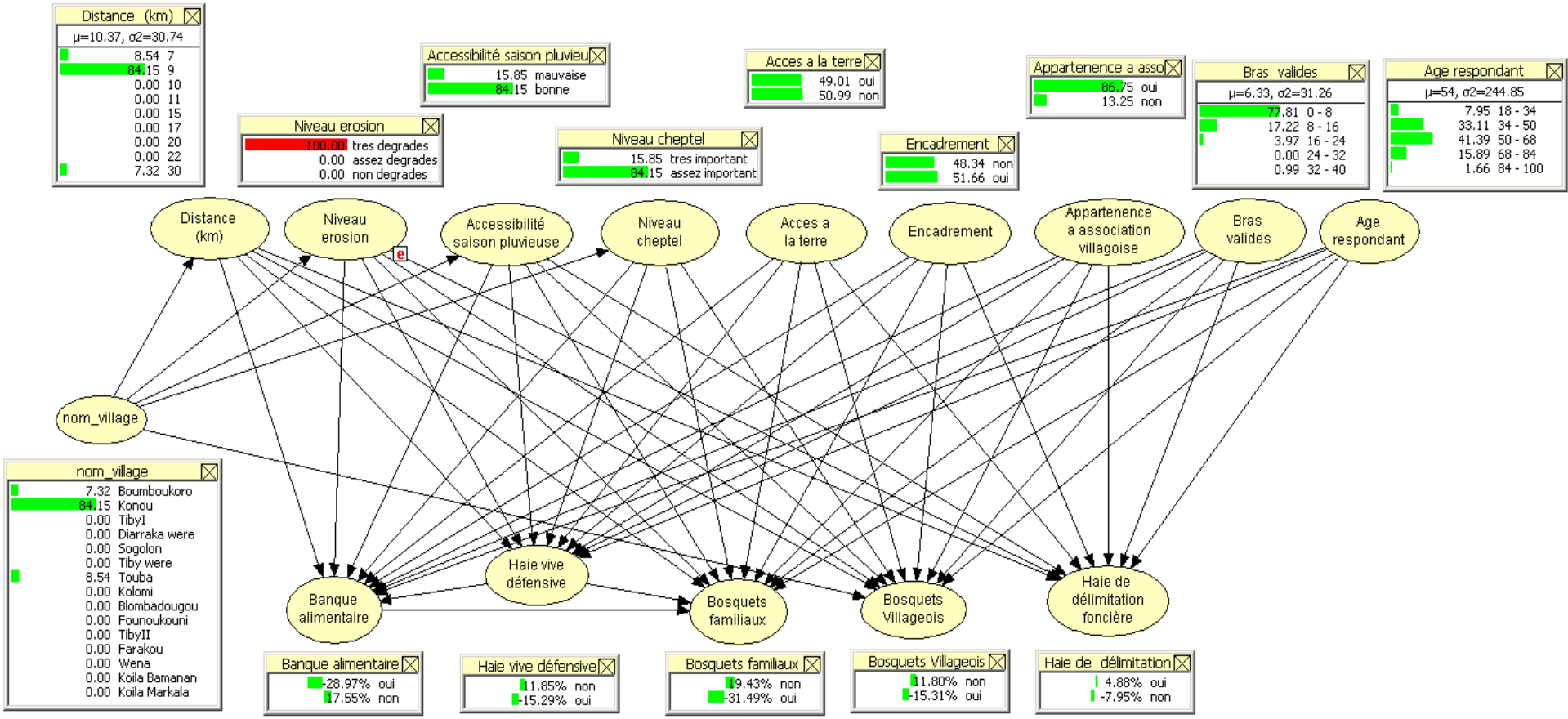
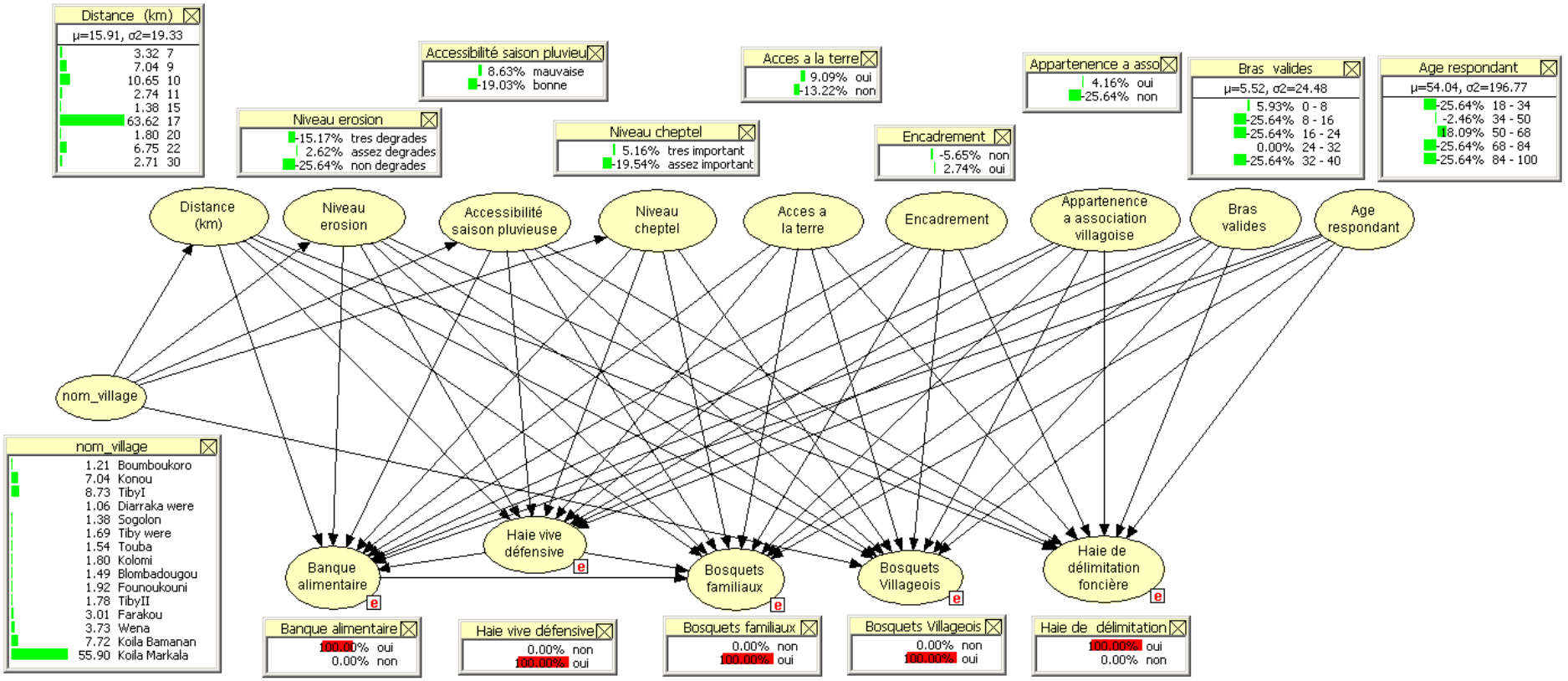
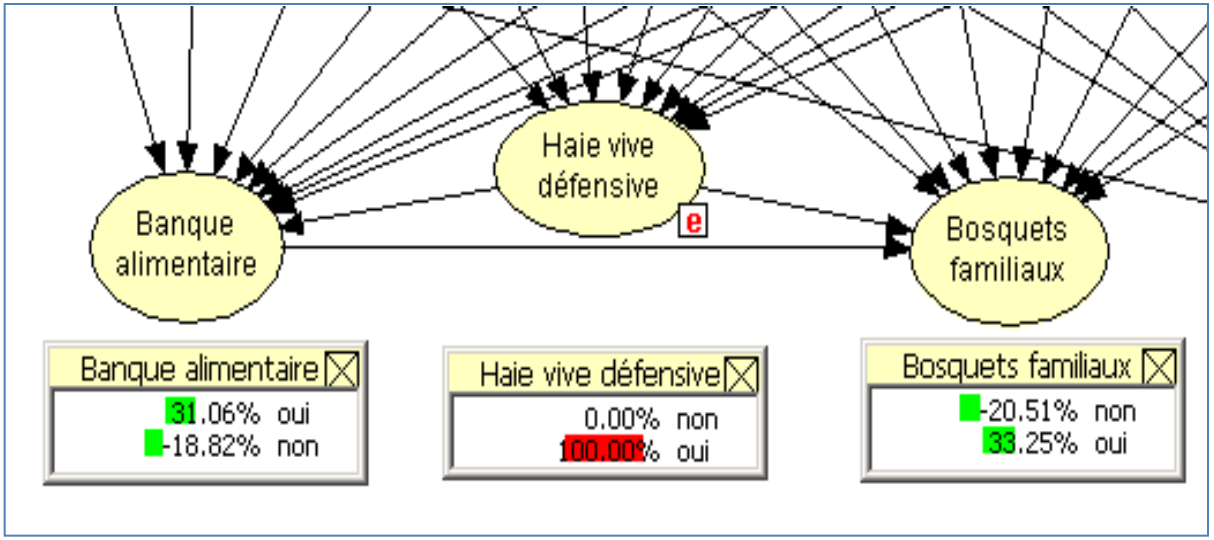
Deductive or scenario analysis
– "probability of effects" given causes (adoption probabilities)



Diagnostic / inductive analysis
– "probability of causes" given evidence of effects (adaptation probabilities?)



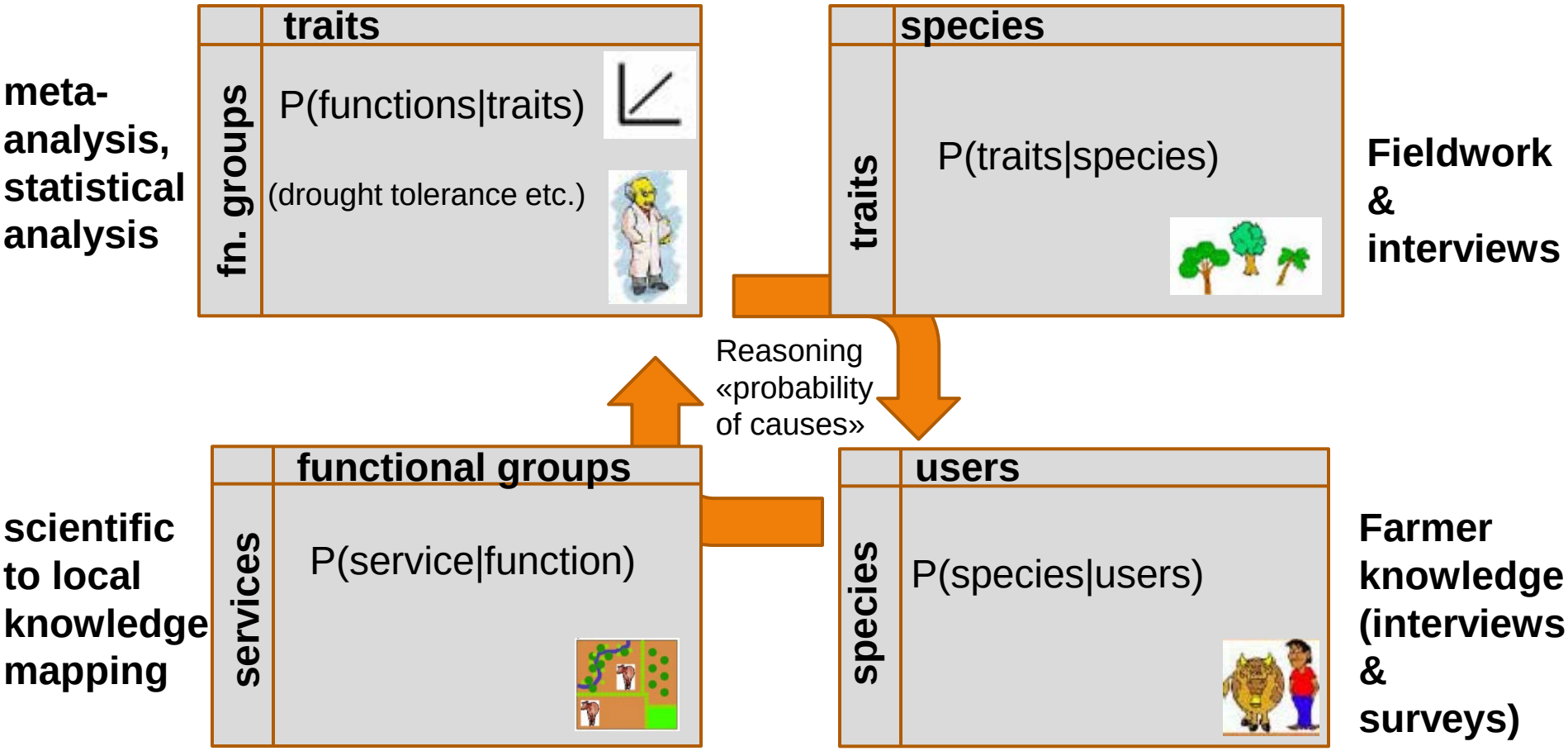
Correlation of between adaptation measures (“effects as causes…”)



Discussion

- Adaptation studies – using Baysian updating of probabilities of practices with monitoring data
- Integration of knowledge

Data integration using Bayesian belief networks



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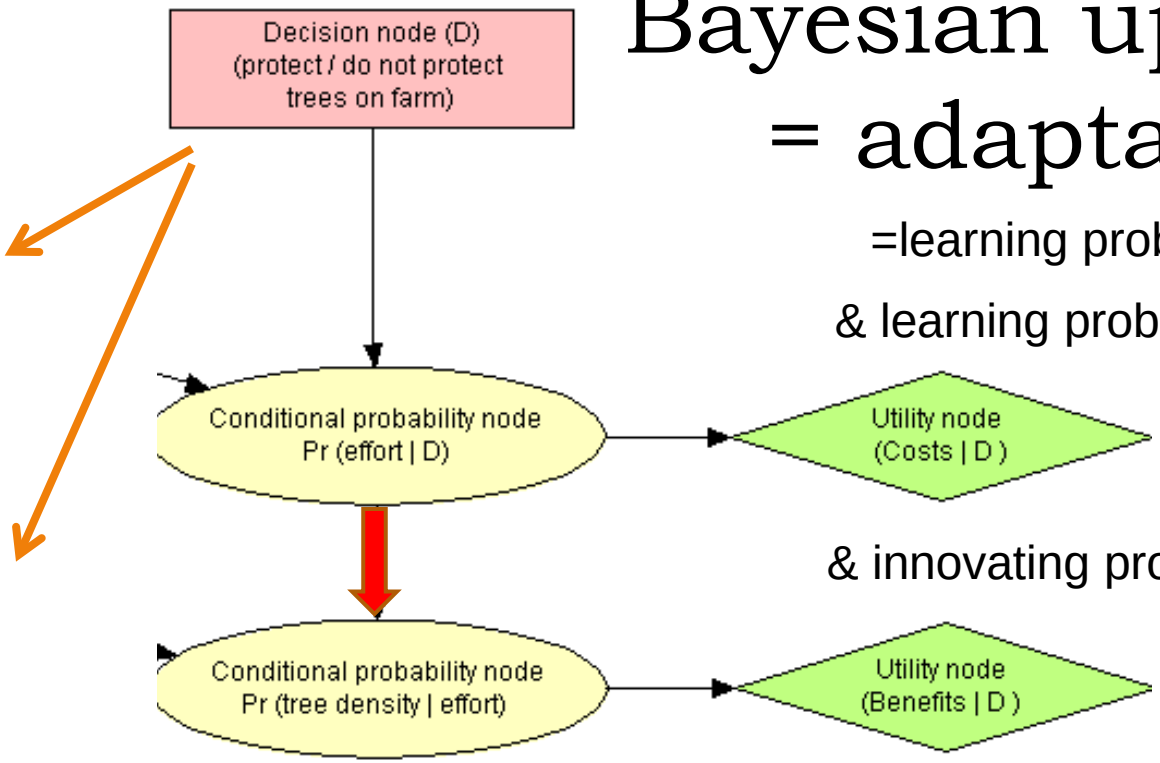
http://demo.hugin.com/Barton/FunciTree/
User: demo
Password: g2kfRe5iAs9hKcn4Fvkd

FUNCiTREE

Bayesian updating = adaptation



=learning probabilities

& learning problem structure

& innovating problem structure

$$\Pr(Density \mid Effort, context) = \frac{\Pr(Effort \mid Density, context) \times \Pr(Density \mid context)}{\Pr(Effort \mid context)}$$

Conclusions

- BBNs complement adoption probability studies using logistical regression (NOT hypothesis tests)
- Deductive reasoning:

  P(adaptation | hh characteristics)
- Inductive reasoning:

  P(hh characteristics | adaptation)

- Potential for
  - dissemination of data
  - knowledge integration
  - AFS interactions

FUNCiTREE

Functional Diversity:
An ecological framework for sustainable and adaptable agro-forestry systems in landscapes of semi-arid ecoregions.

Based on the principles of functional ecology, FUNCiTREE addresses the provision of multiple services of silvopastoral systems (SPS) in semi-arid regions in Africa and Central America. FUNCiTREE aims to provide farmers in the regions with a portfolio of regionally suitable tree species that are capable of providing multiple services. The project integrates theories and concepts from agroforestry and ecological science and will provide a scientifically based model for the design of modernized SPS.

NINA (Norway): The leading research center in Norway on applied ecology, emphasizing the interaction between human society, natural resources and biodiversity

CATIE (Costa Rica): A regional research and education centre about agricultural sustainability, environmental protection and poverty eradication

WUR (The Netherlands): Internationally leading university in agricultural Almeria has a focus on organism responses to drought, ecological interactions, biodiversity conservation, desertification, and soil science

CIRAD (France): Research on agro-ecosystems for international sustainable development, environmental, and climate research

CSIC (Spain): Research at the Arid Zones Research Station,

ISRA (Senegal): Priority areas relate to agronomic, animal and forest production, and rural economy

IER (Mali): The leading research centre in Mali on agriculture and agro-ecosystems.

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