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Laboratoire de Biologie & Écologie Végétales



PROJECT
BIOTA W11

West Africa

Restoration of degraded soils in Burkina Faso

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"Biodiversity of Africa - Observation and Sustainable Management for our Future!"
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Outline

Introduction

Methodology

Results & Discussion

Conclusion & Outlook



Introduction

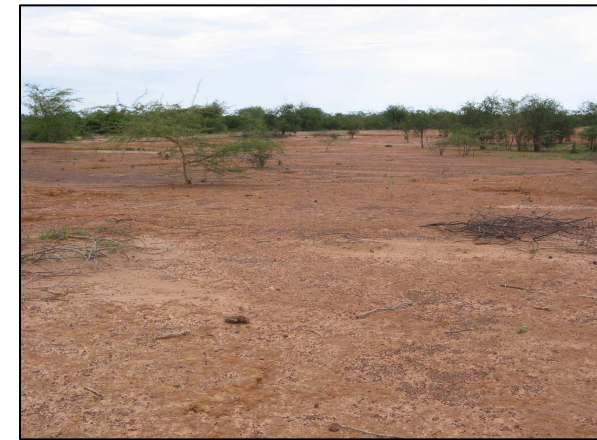
□ Context

- Global change
- Increasing population and poverty
- Continuous weakening of the ecological balance



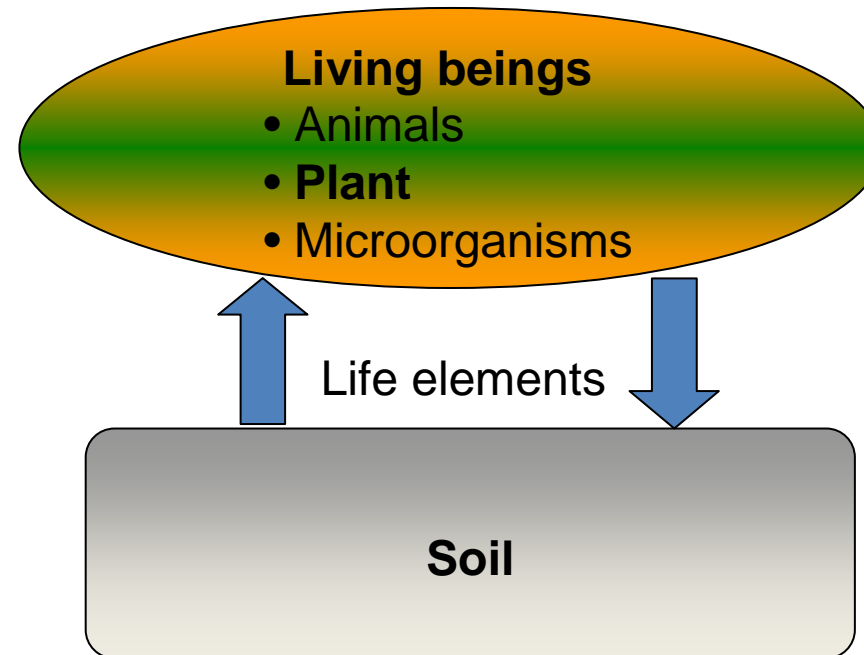
□ Problems

- Degradation of habitats
- Weakness of natural regeneration
- Exposition of lands
- Deterioration and impoverishment of soils
- More than 24% of degraded lands in Burkina Faso



□ Justifications

- Close interdependence Soil/Living being



- Restoration measures by using plants
- Necessity to explore well adapted local plant species

□ Objectives

To propose low-costly technology for restoration of degraded ecosystems

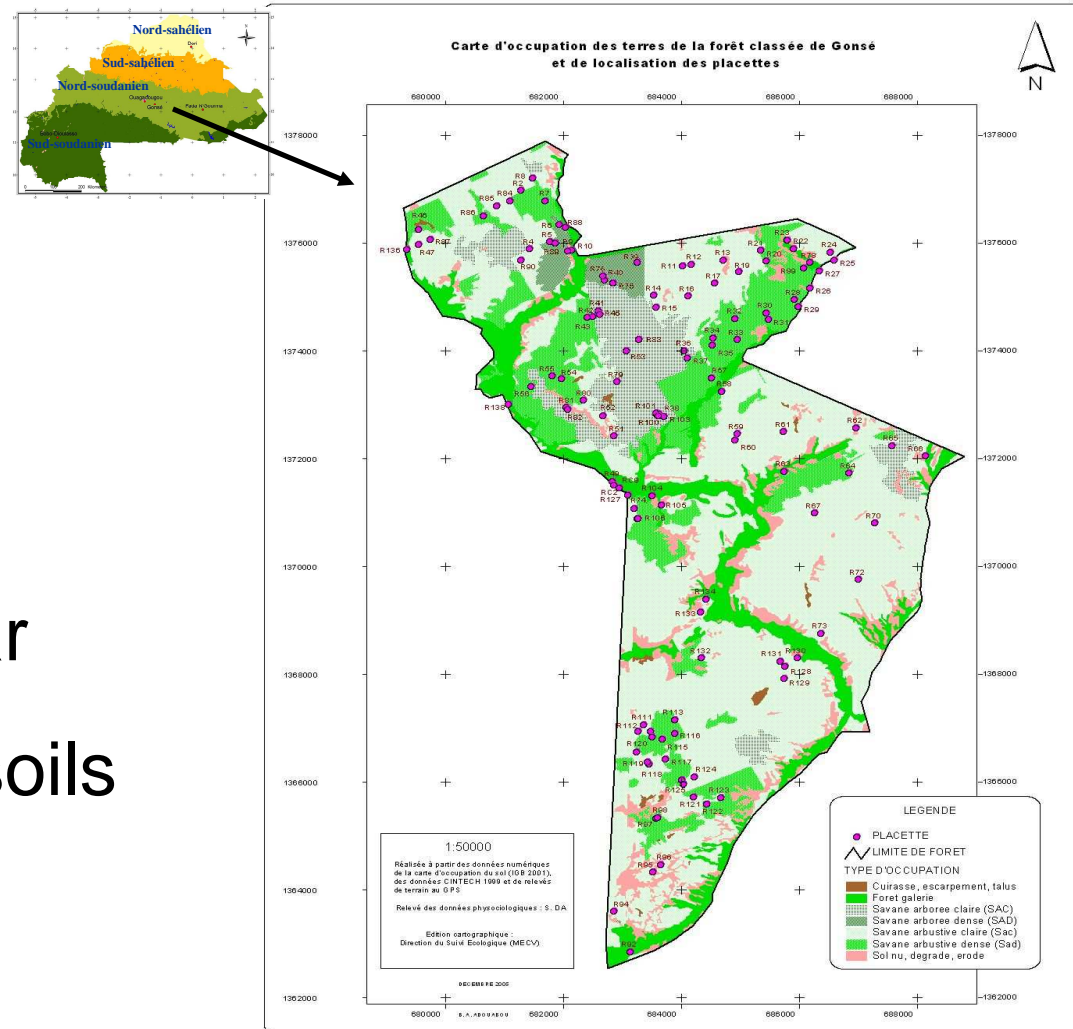
- To test the soil restoration capacities of local species
- To determine the conditions of optimal success



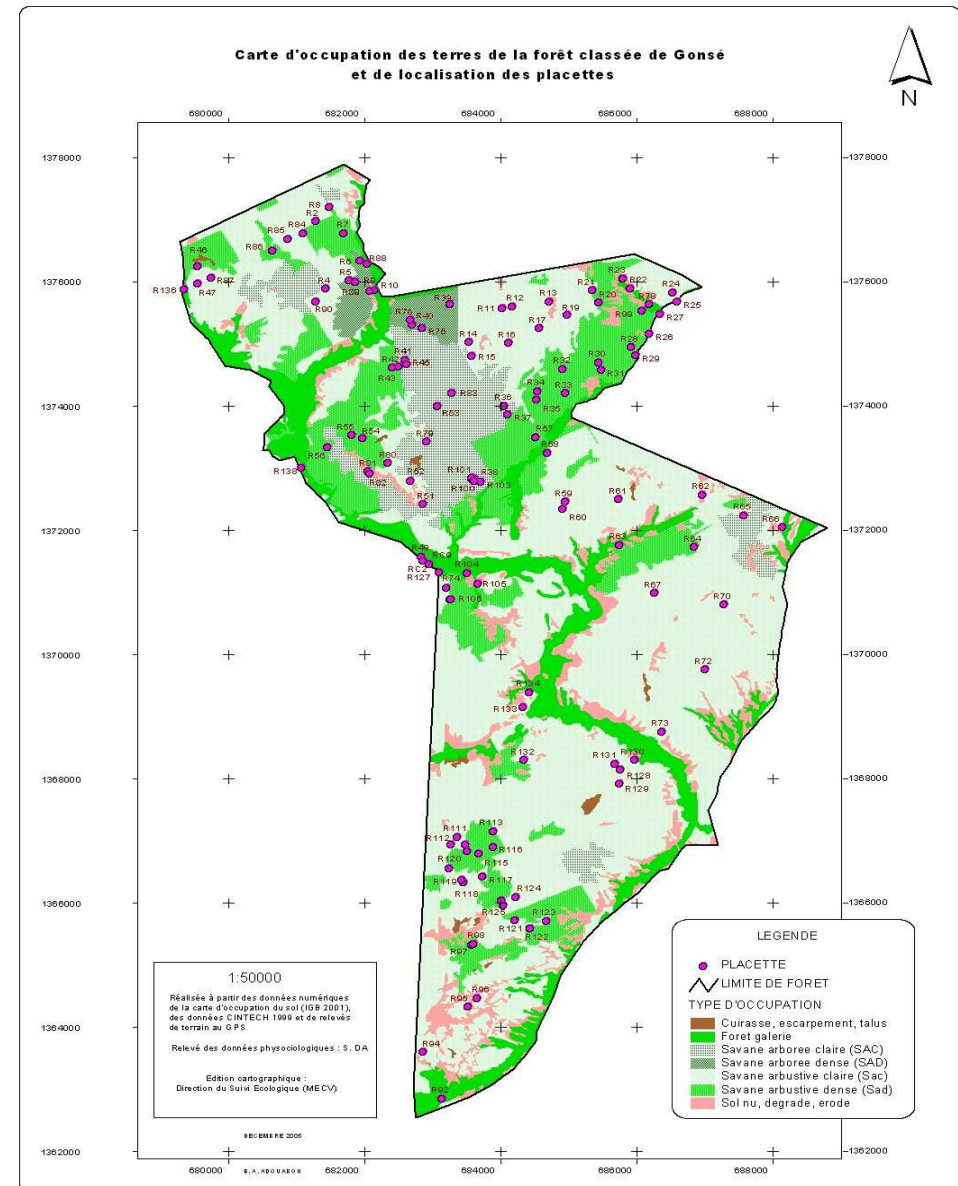
Methodology

□ Study zone

- north-sudanian zone
- 800 mm rainfall / year
- ferruginous tropical soils
- savanna vegetations

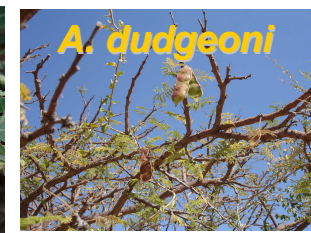


- degraded soils
 - completely bare
 - clayey
 - impermeable
- 4th level degraded soils (UNEP)
- degradation due to leaching



□ Material

- 14 species: 11 Combretaceae and 3 Mimosaceae
- Shrubby species, occurring in populations
- Ecological value species: pioneer
- Cultivation in nursery
- Sturdy and tall individuals selected for plantation



□ Experimental design

- 2 adjoining plots of 1000 m² : 1 fenced and 1 open (control plot)
- Treatments: small basins or furrows, covering with scraps



- 14 blocks per plot
- 1 species per block
- 25 indiv. per species in holes 40 cm deep , equidistants from 3 m
- Plantation at the height of the rainy season



□ Monitoring

▪ Survival

- counting of alive individuals (weekly & monthly)
- appreciating sapling health state

▪ Natural spontaneous regeneration

- annual inventoring of whole species in the plots
- appreciating the vegetation cover

Results & Discussion

□ Sapling survival

- More than the half species show a rate $\geq 50\%$

	Dec. 03		Jul. 04		Jul. 05		Jul. 06		Jul. 07	
	F. plot	C. plot	F. plot	C. plot	F. plot	C. plot	F. plot	C. plot	F. plot	C. plot
<i>A. senegal</i>	100	92	96	56	92	56	92	54	92	54
<i>A. seyal</i>	100	96	96	88	96	88	96	88	92	80
<i>A. dudgeoni</i>	100	72	92	60	88	52	88	52	88	50
<i>C. micranthum</i>	100	92	96	88	92	84	92	84	84	80
<i>C. aculeatum</i>	96	72	92	56	88	48	88	40	80	36
<i>C. molle</i>	96	72	92	60	88	56	88	56	80	48
<i>A. gourmaensis</i>	92	80	80	64	72	44	72	40	72	32
<i>G. senegalensis</i>	76	80	68	44	68	44	68	44	64	44
<i>C. glutinosum</i>	92	88	72	48	68	48	60	44	60	40
<i>C. nigricans</i>	72	56	68	52	60	48	60	44	60	36
<i>C. paniculatum</i>	88	60	76	48	68	44	68	40	60	28
<i>C. collinum</i>	72	68	60	36	48	36	40	28	40	20
<i>C. fragrans</i>	56	62	54	48	54	40	36	32	32	24
<i>T. avicennioides</i>	44	28	36	8	12	0	12	0	8	0

▪ 3 survival classes

- SR \geq 80%
- $60 \leq$ SR < 80%
- SR < 60%

Fenced plot

	Dec. 03	Jul. 04	Jul. 05	Jul. 06	Jul. 07
	F. plot	F. plot	F. plot	F. plot	F. plot
<i>A. senegal</i>	100	96	92	92	92
<i>A. seyal</i>	100	96	96	96	92
<i>A. dudgeoni</i>	100	92	88	88	88
<i>C. micranthum</i>	100	96	92	92	84
<i>C. aculeatum</i>	96	92	88	88	80
<i>C. molle</i>	96	92	88	88	80
<i>A. gourmaensis</i>	92	80	72	72	72
<i>G. senegalensis</i>	76	68	68	68	64
<i>C. glutinosum</i>	92	72	68	60	60
<i>C. nigricans</i>	72	68	60	60	60
<i>C. paniculatum</i>	88	76	68	68	60
<i>C. collinum</i>	72	60	48	40	40
<i>C. fragrans</i>	56	54	54	36	32
<i>T. avicennioides</i>	44	36	12	12	8

Control plot

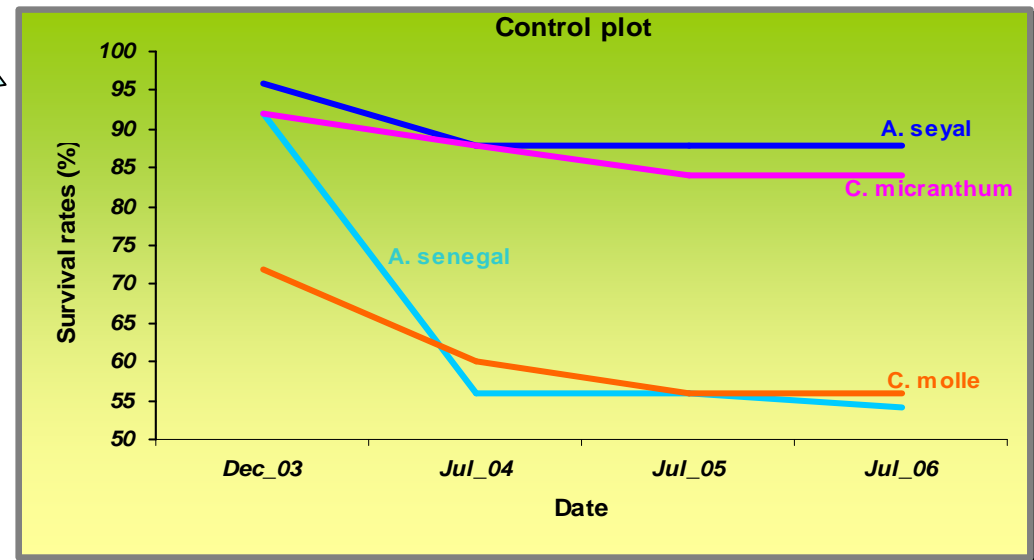
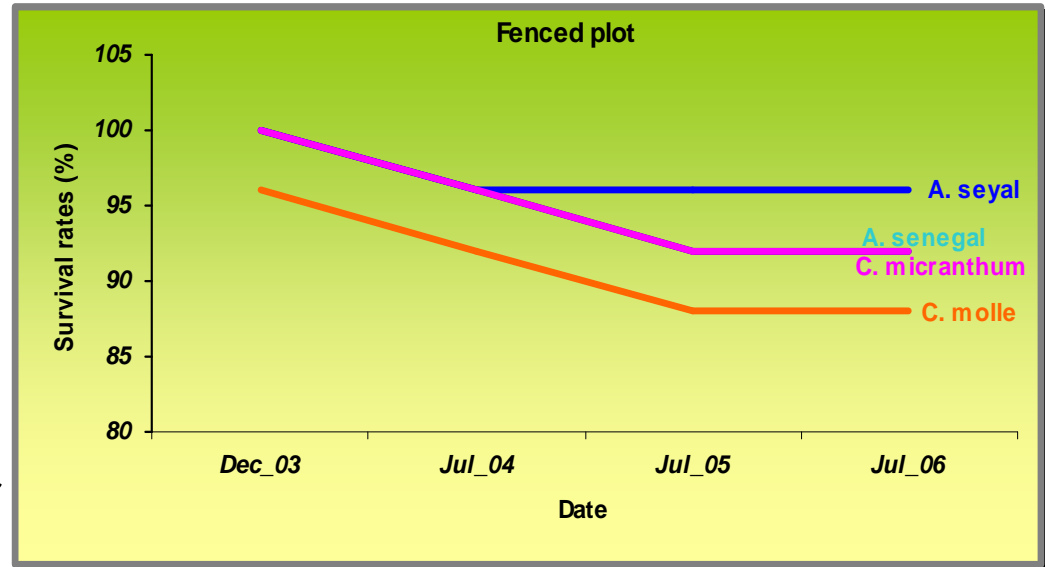
	Dec. 03	Jul. 04	Jul. 05	Jul. 06	Jul. 07
	C. plot	C. plot	C. plot	C. plot	C. plot
<i>A. seyal</i>	96	88	88	88	80
<i>C. micranthum</i>	92	88	84	84	80
<i>A. senegal</i>	92	56	56	54	54
<i>A. dudgeoni</i>	72	60	52	52	48
<i>C. molle</i>	72	60	56	56	48
<i>G. senegalensis</i>	80	44	44	44	44
<i>C. glutinosum</i>	88	48	48	44	40
<i>C. aculeatum</i>	72	56	48	40	36
<i>C. nigricans</i>	56	52	48	44	36
<i>A. gourmaensis</i>	80	64	44	40	32
<i>C. paniculatum</i>	60	48	44	40	28
<i>C. fragrans</i>	62	48	40	32	24
<i>C. collinum</i>	68	36	36	28	20
<i>T. avicennioides</i>	28	8	0	0	0

- Determinant factors

- fencing
- physical treatments

Results & Discussion

■ Stabilization trend



□ Saplings growth

Species	Hight (cm)	
	F. plot	C. plot
<i>A. dudgeoni</i>	36,12 ± 0,91	22,16 ± 2,53
<i>A. gourmaensis</i>	34,22 ± 0,78	29,30 ± 1,11
<i>A. senegal</i>	48,40 ± 2,02	31,35 ± 3,15
<i>A. seyal</i>	109,26 ± 5,33	97 ± 9,92
<i>C. aculeatum</i>	88,90 ± 1,44	(-)12 ± 3,15
<i>C. collinum</i>	26,95 ± 1,92	19,05 ± 2,20
<i>C. fragrans</i>	21,30 ± 2,49	14,10 ± 2,77
<i>C. glutinosum</i>	18,51 ± 1,66	9,28 ± 2,01
<i>C. micranthum</i>	79,42 ± 3,10	45,35 ± 2,88
<i>C. molle</i>	77,33 ± 2,75	52,81 ± 6,33
<i>C. nigricans</i>	36,23 ± 4,25	22,65 ± 6,1
<i>C. paniculatum</i>	53,71 ± 4,12	35,20 ± 7,5
<i>G. senegalensis</i>	38,36 ± 0,99	29,76 ± 4,1
<i>T. avicennioides</i>	7,21 ± 1,55	



□ Spontaneous regeneration of vegetation

■ Flora richness

- fenced plot: 60 new species (12 lign. & 48 herb.)
- control plot: 28 new species (7 lign. & 21 herb.)

→ soils fertilization

■ Spatial dynamic of recruitment

- dispersion from furrows



- Vegetation cover
 - total cover: 5% for c. plot and 20% for f. plot
 - increase cover of initial species: *Cassia tora*
 - new species with high cover percentage: *Spermacoce radiata*, *Setaria pumila* et *Hackelochloa granularis*



- Sign of biodiversity installation

- Activity of termites
- Presence of rodents, reptiles, scorpions and divers insects



- Beneficial factors in fenced plot

- absence of pasture
- permeability and water capturing
- limitation of the insolation and evaporation



Conclusion

- Good response in general and best responses from *Acacia seyal*, *A. senegal*, *A. dudgeoni*, *C. micranthum* and *C. molle*
- Most of these local species have intrinsic capacity to adapt to degraded soils
- Necessity to protect plantation during the 1st years
- Protection increased restoration success, but promising results are also obtained without protection



Outlook

- 🌀 Assess the acceptability and accessibility of the approach by local people
- 🌀 Continue investigations for search of performant species
- 🌀 To look into traditional techniques (Zai, composting) with a view to improving them



low cost

improve



@Explore ***Jatropha curcas*** ecological profitability, regarding the actual general craze for this species!



- accumulation of organic matter in soils trough increasing the rate of carbon and nitrogen (0,91% to 1,4%)
- positive effect of leaves composting on crop growth
- how extend are beneficial effect and what are the eventual negative impact on soils?!

Acknowledgements to



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Thank you for your attention !