Why and for whom to develop fisheries in Burkina Faso?

Philippe CECCHI
IRD

SUSFISH Workshop – French Institute – Vienna, Austria, June 27 2013

Presentation

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Ouagadougou
Aquatic Ecology

What?

Abiotic controls of Phytoplankton Communities

Where?

Shallow ecosystems: Small Reservoirs and Coastal Lagoons

How?

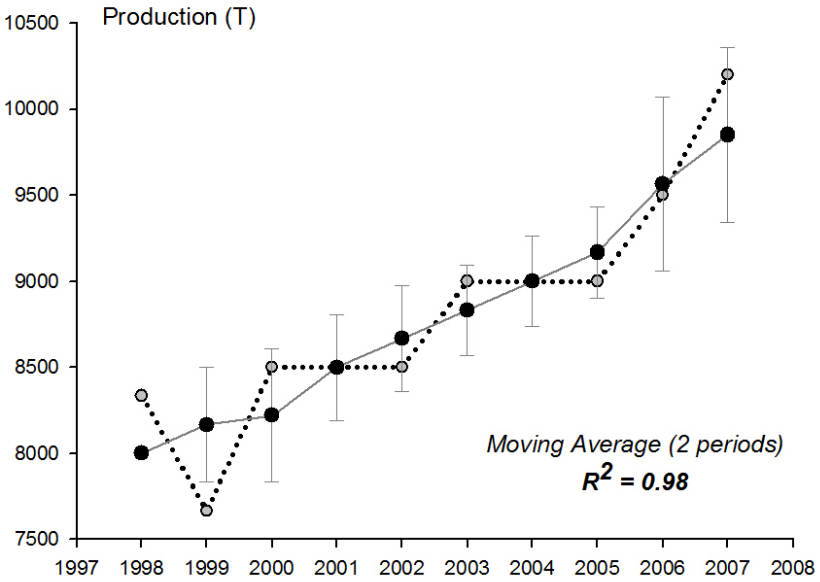
Interdisciplinary approaches (fonctions / uses)

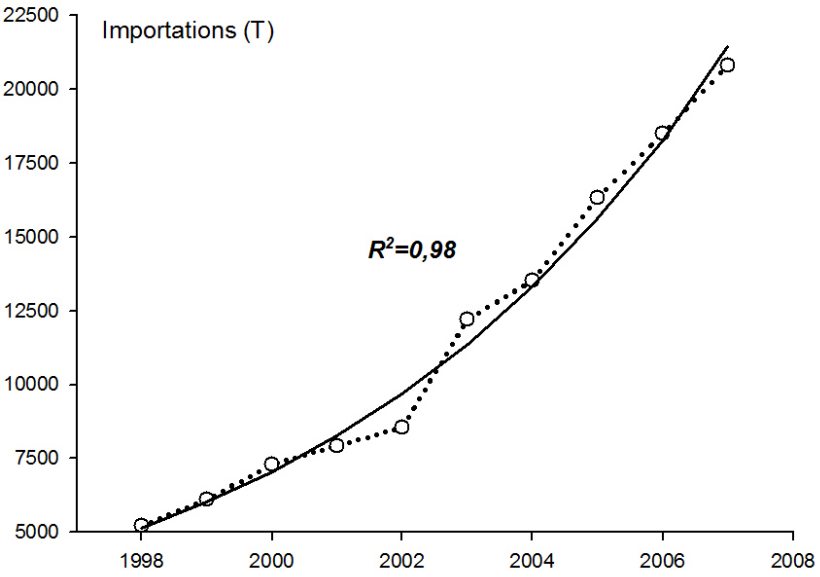
Why?

Health status of ecosystems: nexus 'exploitation' - 'preservation'

1994-2000 : Bouaké, Ivory Coast
2000-2003 : Montpellier, University
2003-2007 : Ouagadougou, Burkina Faso
2007-2010 : Montpellier, University
2011-2012 : Montpellier, G-eau
2013-2014 : VOLTA Basin
(Burkina Faso, Ghana)

In a nutshell…





Fisheries Production:
+ 200 T/year

Fish Products Importation:
+ 2000 T/year

TO COPE WITH DISCREPANCY…

➔Economic necessity
➔Political duty

BUT HOW?

Genesis

1

CIRAD

Programme d'Appui au Développement de l'Agriculture du Burkina Faso,
Phase II
Composante n°2 : Développement Rural Décentralisé

Appui à la définition de stratégies de développement des filières agro-sylvo-pastorales et halieutiques sélectionnées dans les régions d'intervention du PADAB II
« Goulots d'étranglement et actions pilotes »

RAPPORT FINAL FILIERE POISSON
REGIONS EST, CENTRE-EST, SAHEL

JUIN 2009

Nessan Désiré COULIBALY
Marie-Hélène DABAT

2

cirad
LA RECHERCHE AGRONOMIQUE POUR LE DÉVELOPPEMENT

Programme d'Appui au Développement de l'Agriculture du Burkina Faso Phase II (PADAB II)
Composante n°2 : Développement Rural Décentralisé

ACTIONS PILOTES PROPOSEES EN PISCICULTURE DANS LES REGIONS EST/CENTRE EST/SAHEL

Mission du 2 au 13 novembre 2009

Mars 2010

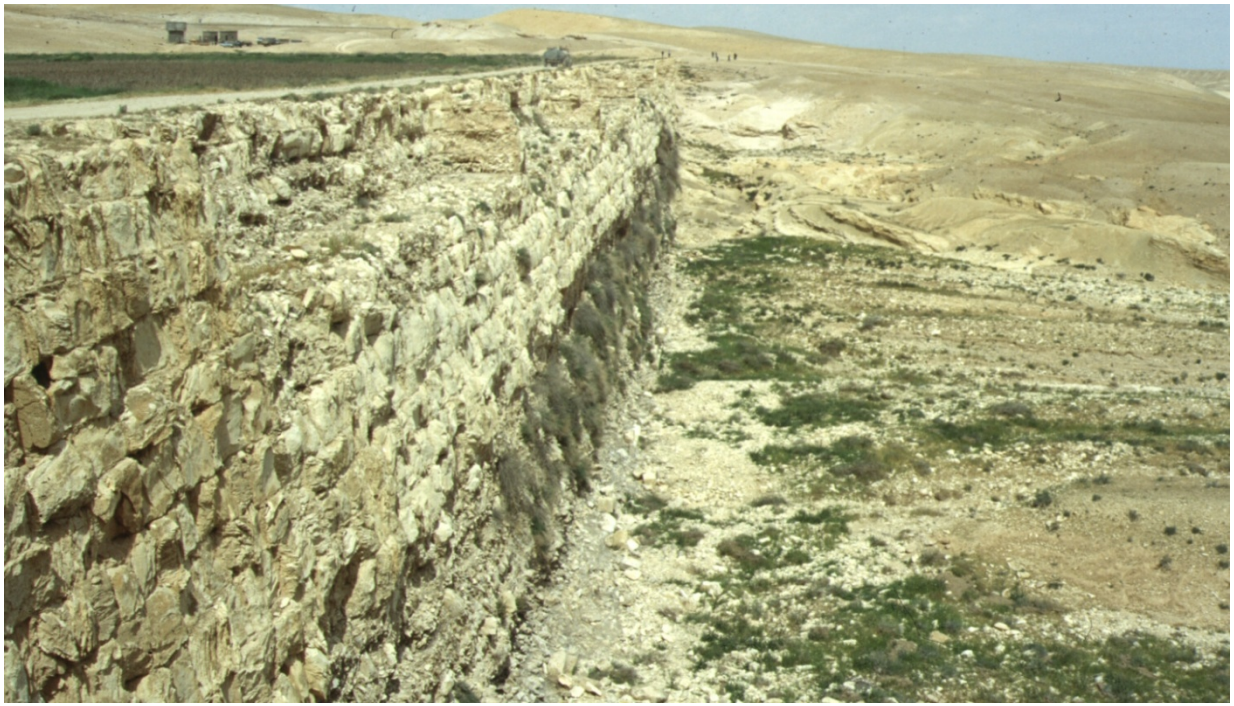
Nessan Désiré Coulibaly
Jérôme Lazard
Philippe Cecchi

Aquaculture: YES……. but…….
What about Fisheries & Reservoirs?

Small Reservoirs?

By default: all what is not a Large Reservoir!
« those greater than 15 meters (m) high or with storage capacity exceeding 3 Mm^3 for heights between 5 and 15 m » (CIGB/ICOLD).

Very old infrastructures (Mediterranean basin, Asia).



Roman Dam of Badieh in Tunisia (J. Albergel)

Small Reservoirs?

In West Africa, SR are structures
- located at the top of hydrological networks
- that store a portion of the flow (rainy season) for future uses (dry season)
- most often rustic with one earth dike and a simple spillway

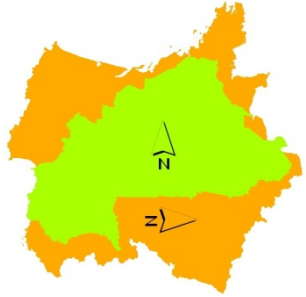
Unit cost is about half a million Euros and often much less.

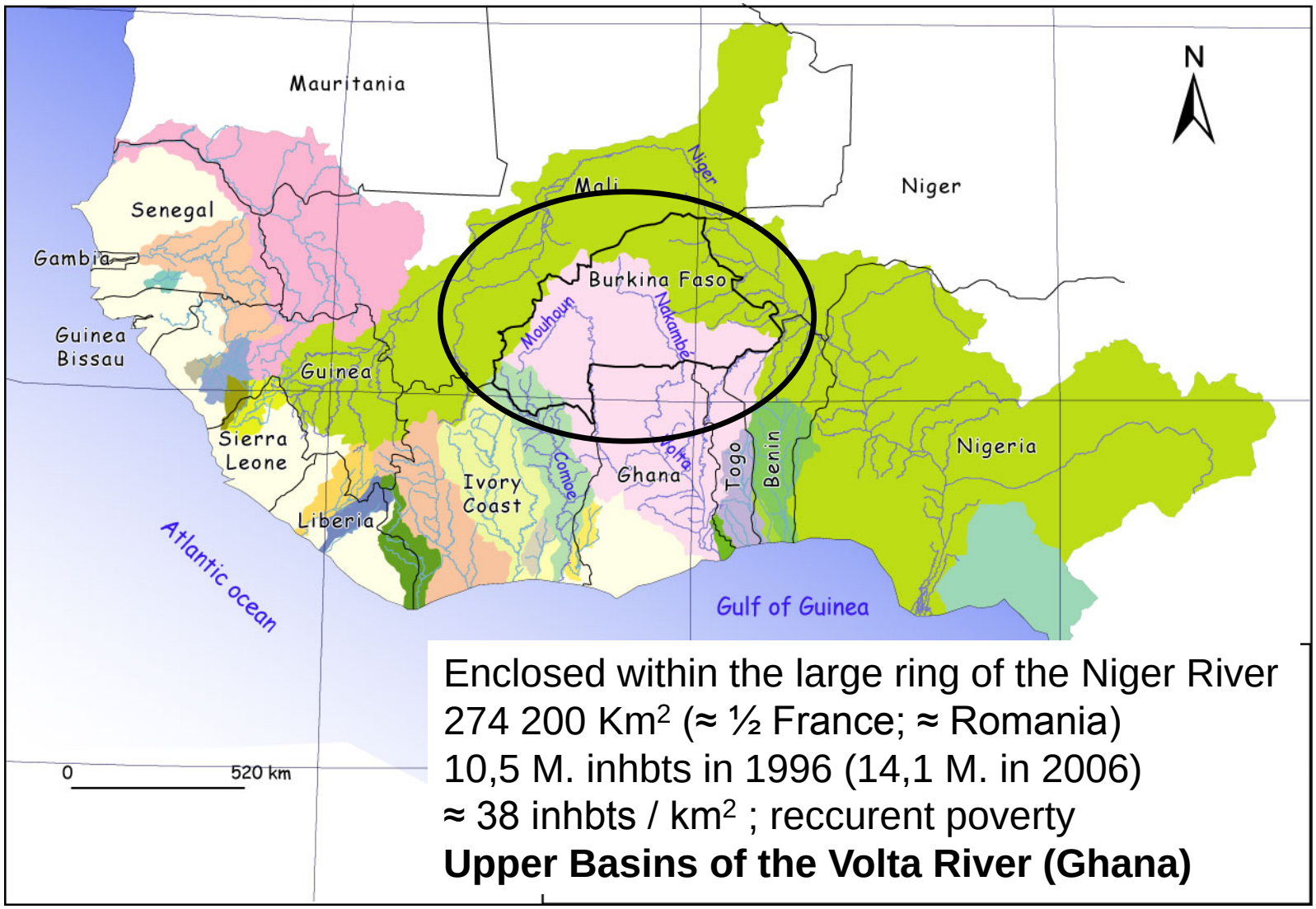
But why to study Small Reservoirs in Burkina Faso?

We first answer this question and describe « contexts », before coming back to the aim of the communication relative to:

The relationship between Fisheries and Small Reservoirs in Burkina Faso.

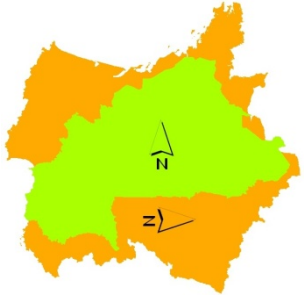
Burkina Faso Localization

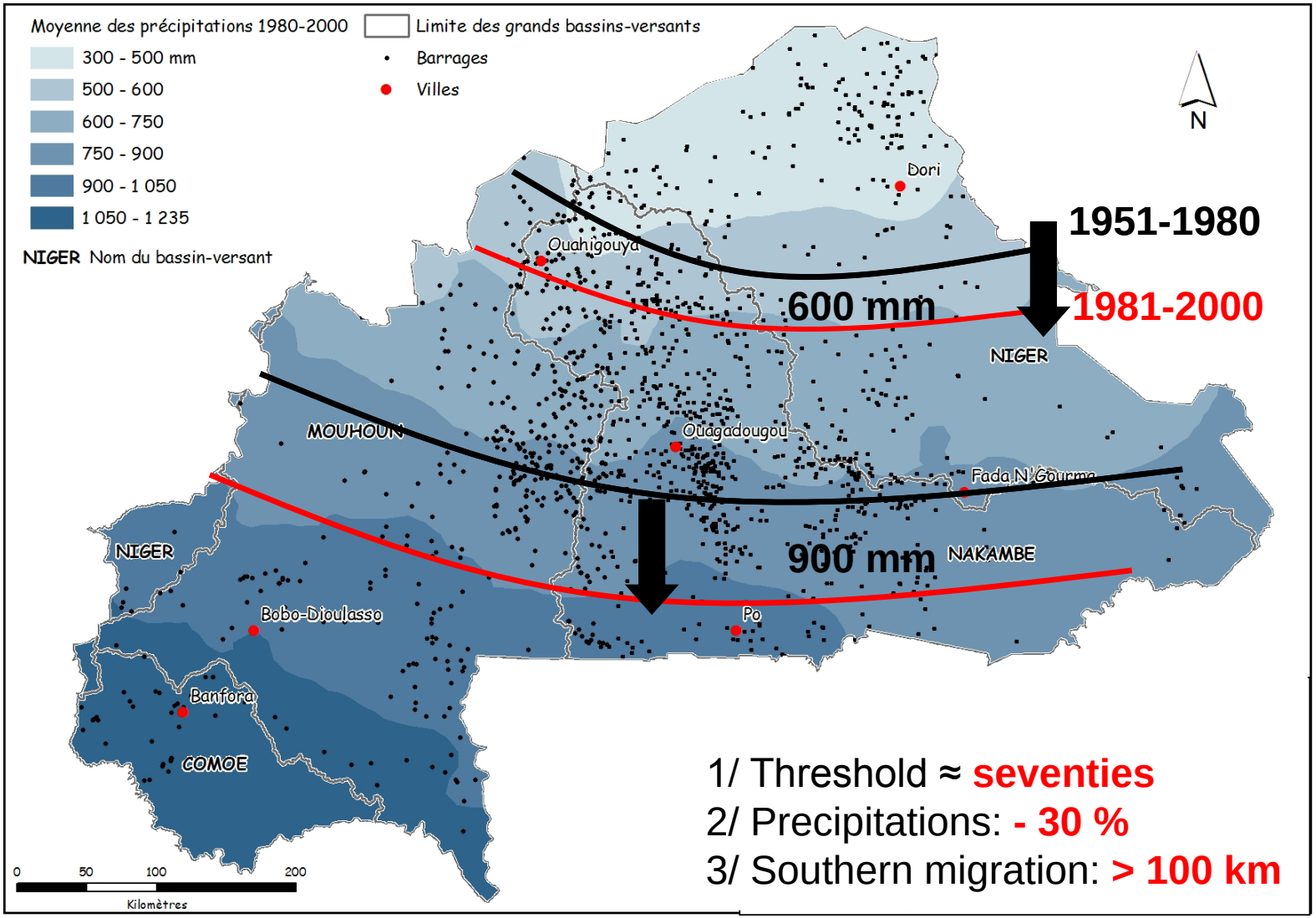




Enclosed within the large ring of the Niger River
274 200 Km^2 (≈ ½ France; ≈ Romania)
10,5 M. inhbts in 1996 (14,1 M. in 2006)
≈ 38 inhbts / km^2 ; reccurent poverty
Upper Basins of the Volta River (Ghana)

Burkina Faso Aridification



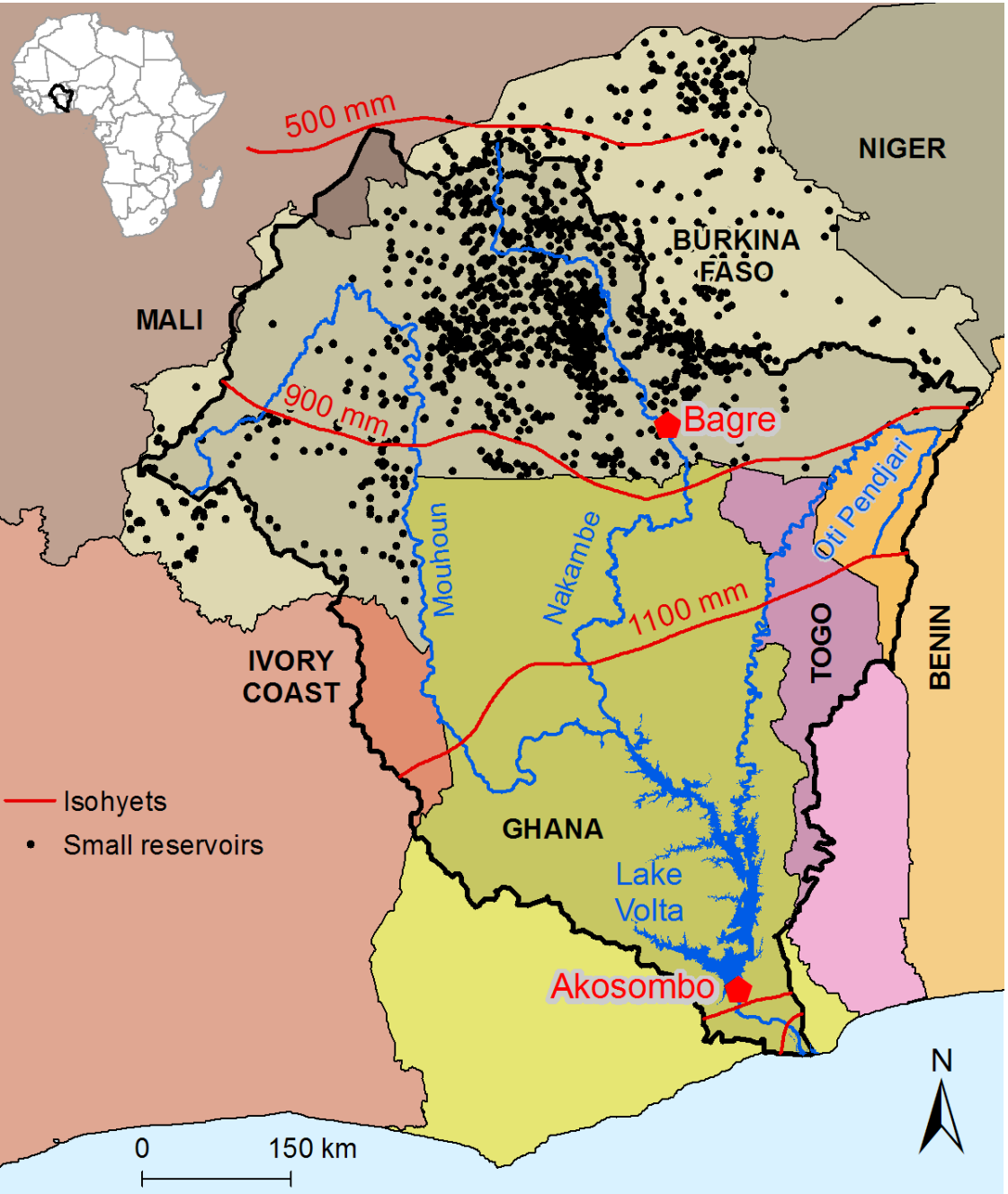


1/ Threshold ≈ **seventies**

2/ Precipitations: **- 30 %**

3/ Southern migration: **> 100 km**

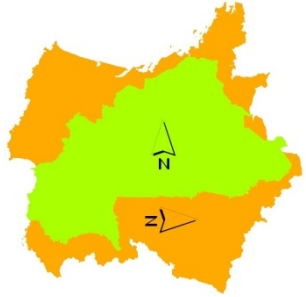
The Volta basin



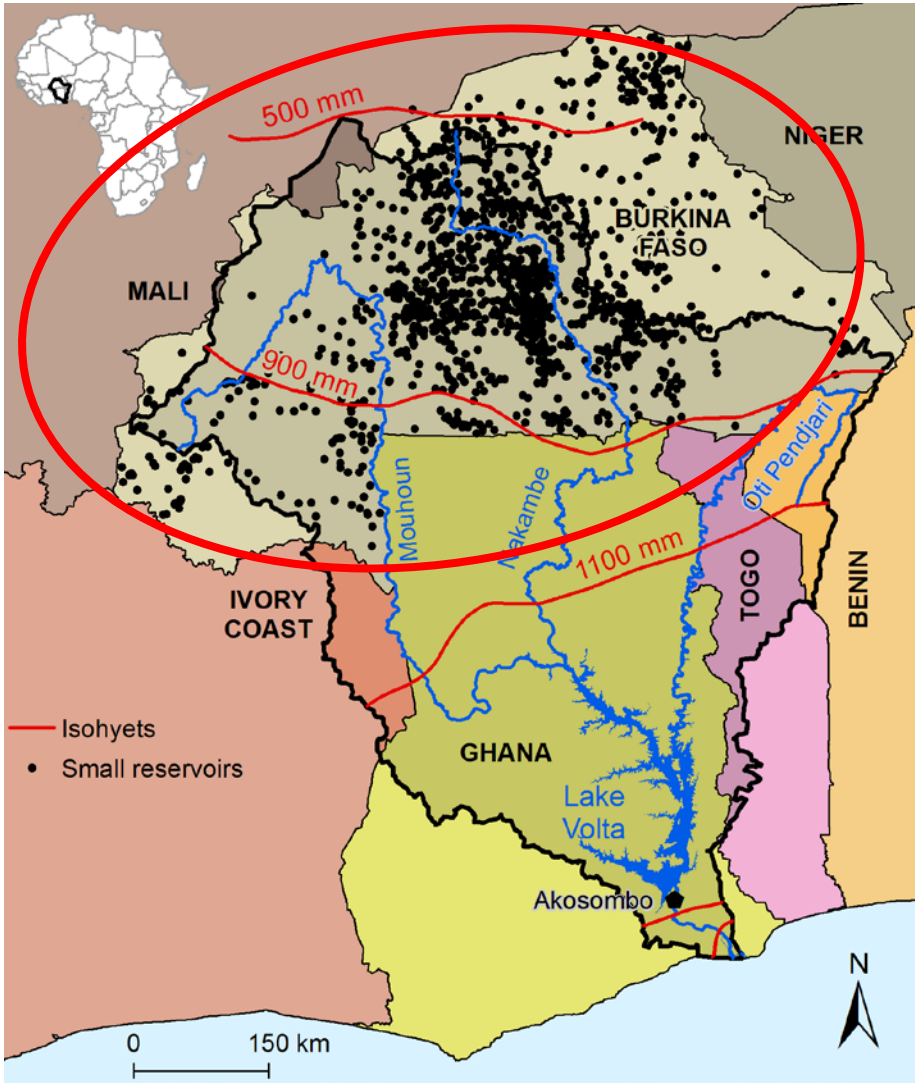
- 400,000 km².
- **Transboundary**: basin shared by 6 countries.
- Rainfall gradient:
  - **upstream drier than downstream**
- **Aridification**
- ⇒ **small reservoirs upstream**.
- ⇒ **Hydropower schemes downstream**

  (Akosombo: 8500 km² 150 km³)
- ⇒ **Water sharing...**

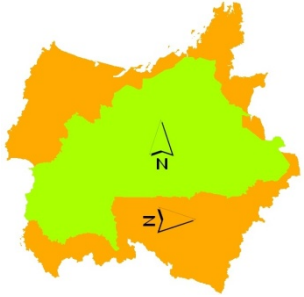
Burkina Faso
Small reservoirs…



- Where are they ***exactly***?
- What's their ***cumulated size***?
- What are their ***impacts***?



Burkina Faso
GIS Implementation



- Official
- ‘Recent’
- Validated
- Databases

BNDT (IGB)
- **Boarders** & **other Administrative Limits**

BNDT + [**RGPH96** + **PEM06**] (DGRE)
- **Populations** & **Villages**

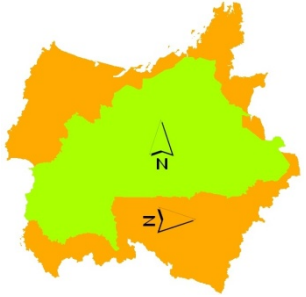
[**BAD01** + **PEM06**] (DGRE)
- **Reservoirs** & **Water Resources**

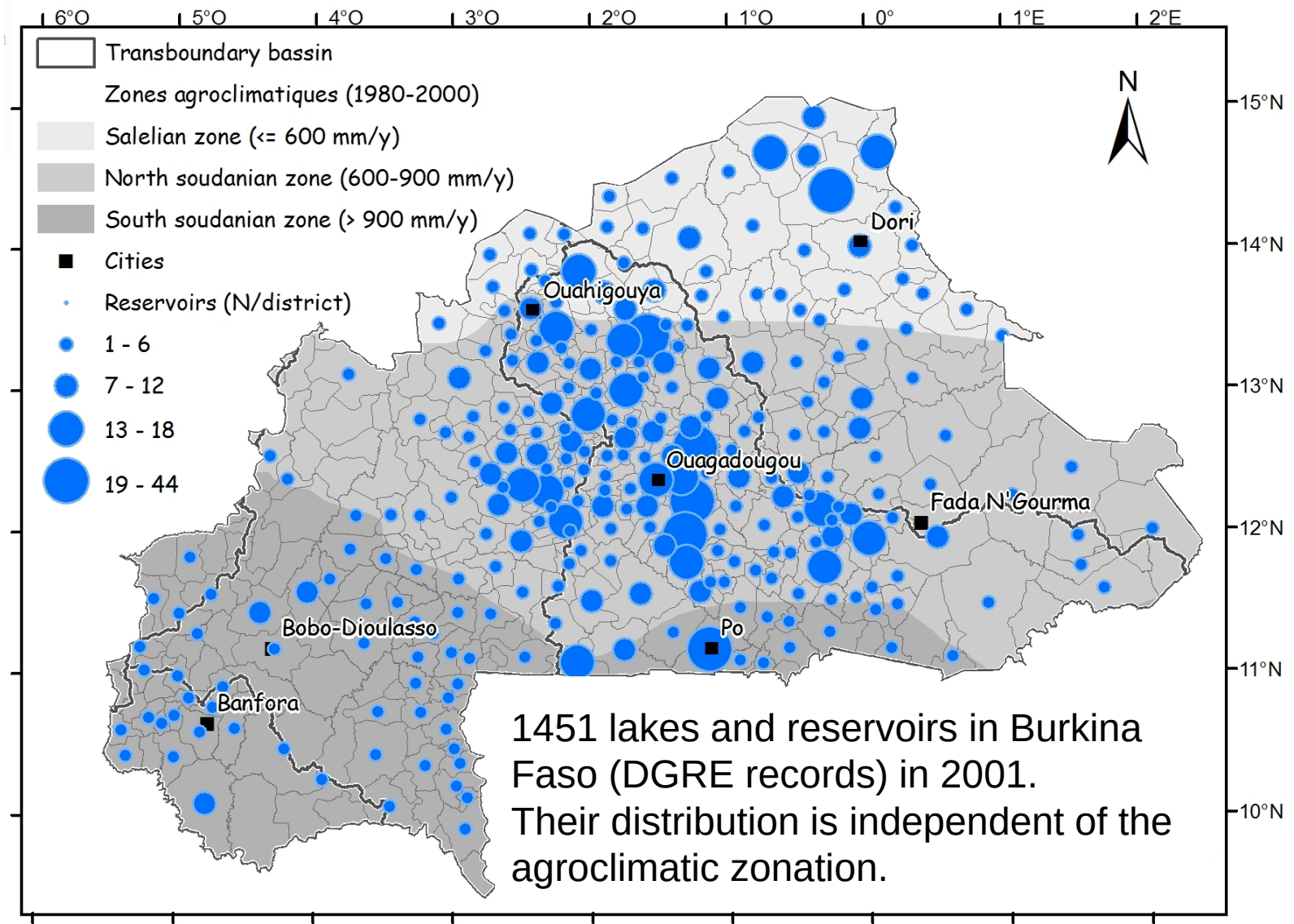
MNT SRTM90 (NASA)
- **Hydrographical network** & **Watersheds**

BDOT 1992-2002 (IGB)
- **Land Use**.

CRU06
- **Meteo**

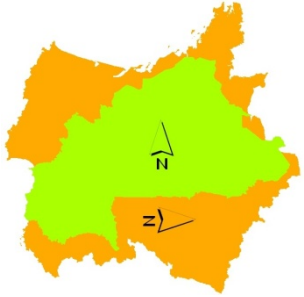
Where are they?

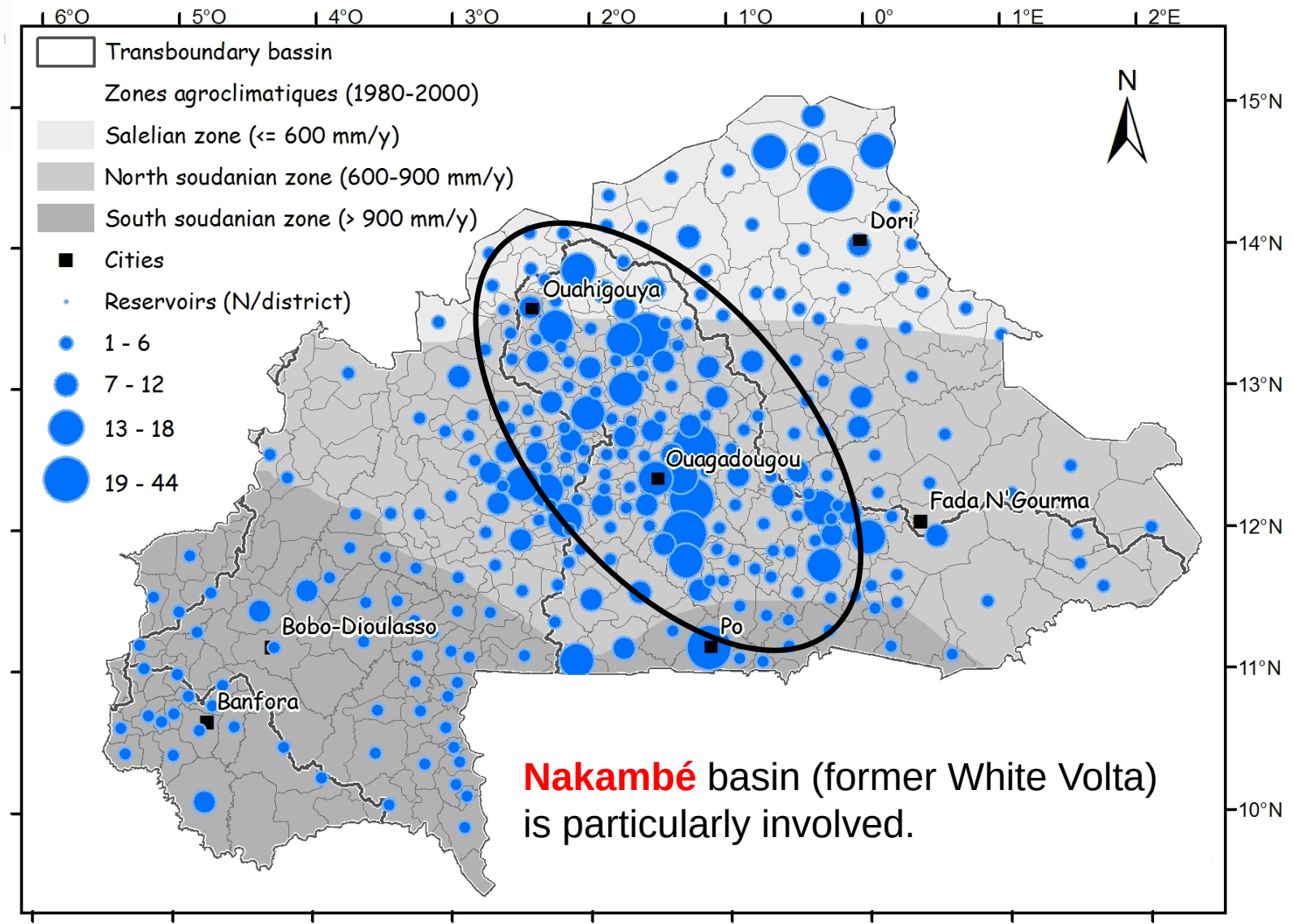




1451 lakes and reservoirs in Burkina Faso (DGRE records) in 2001.
Their distribution is independent of the agroclimatic zonation.

Where are they?





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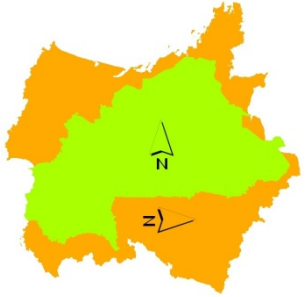
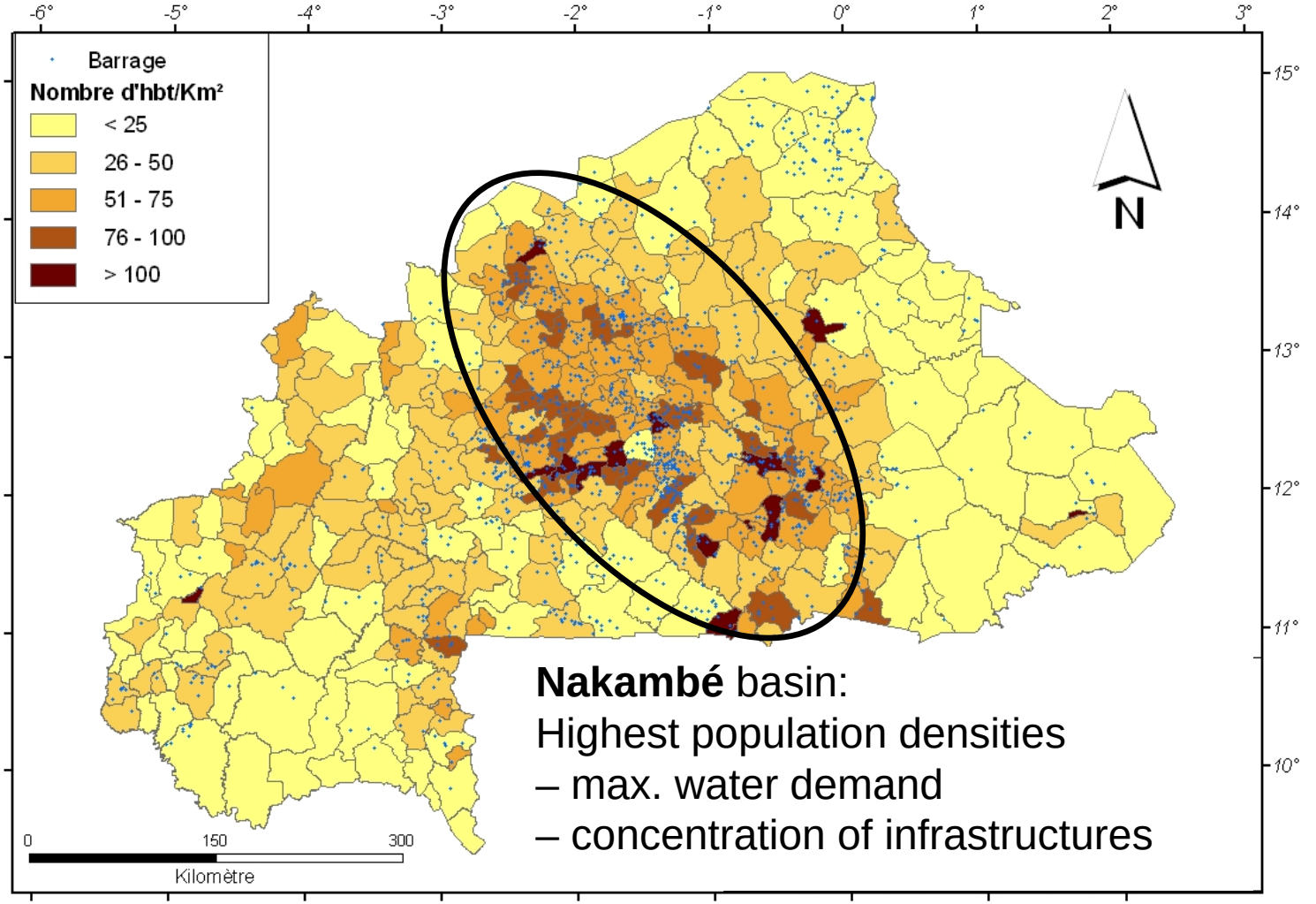
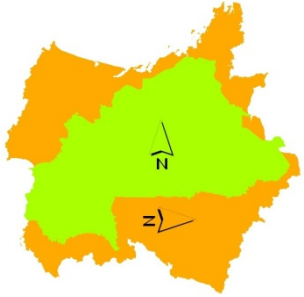


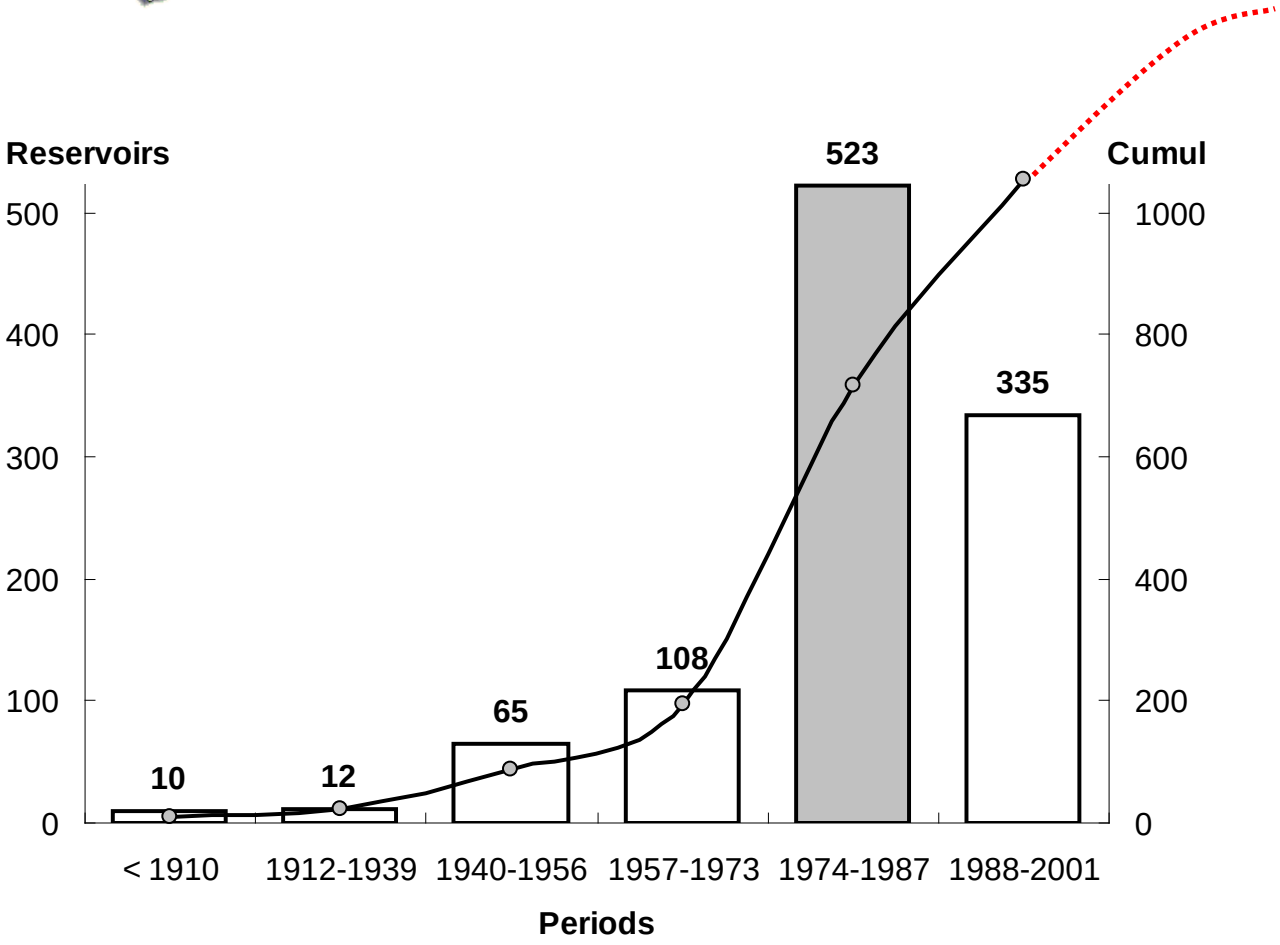


Nakambé basin:
Highest population densities
– max. water demand
– concentration of infrastructures

How much are they?

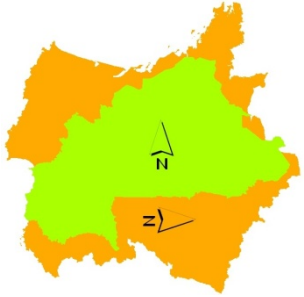


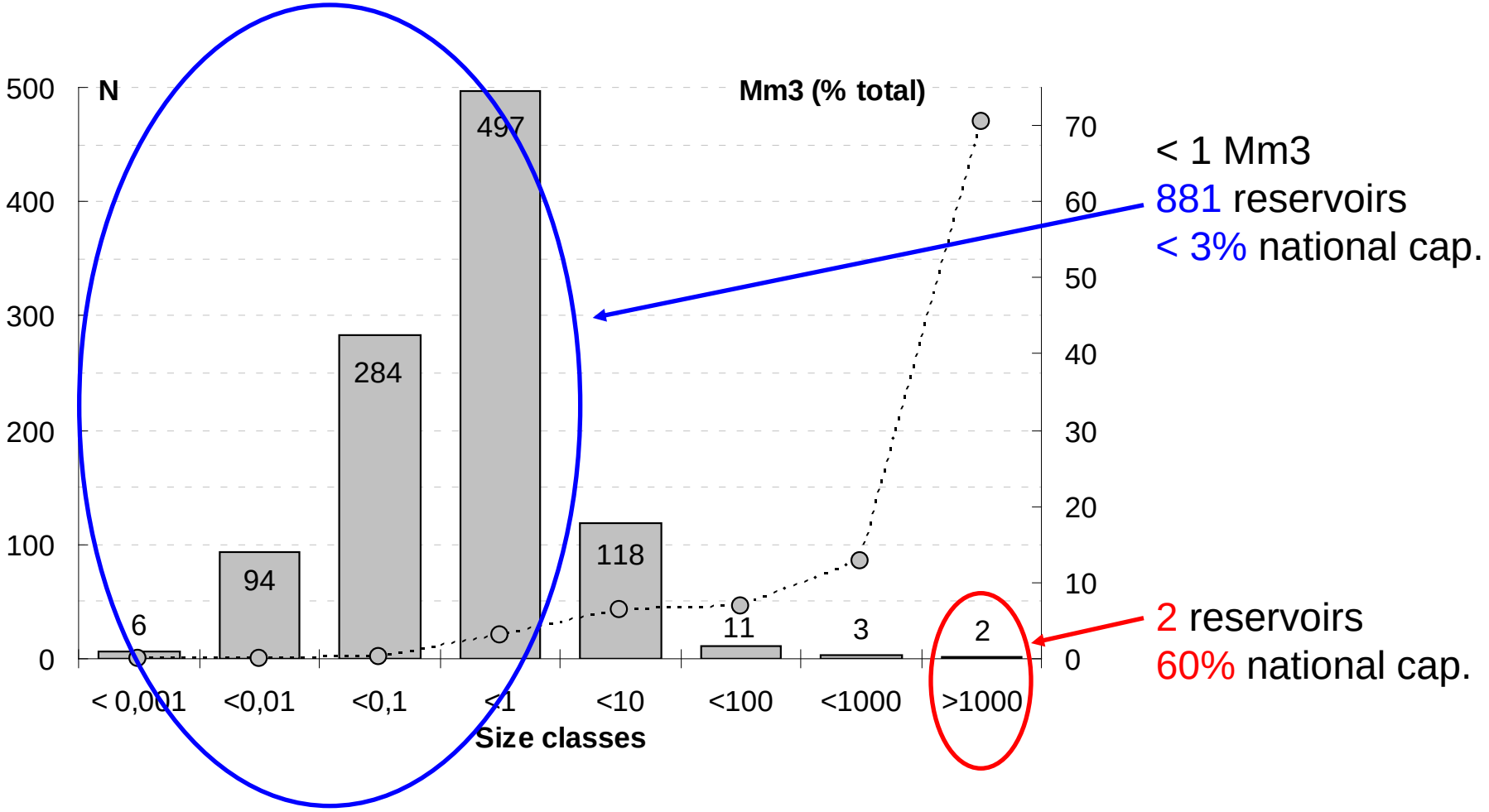
> 1700
(2009)



Age of reservoirs in Burkina Faso (N = 1053 / 1451 DGRE records).
The drought period (1974-1987) is indicated in grey.

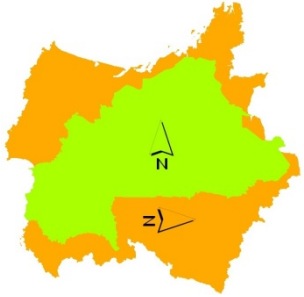
About capacities…

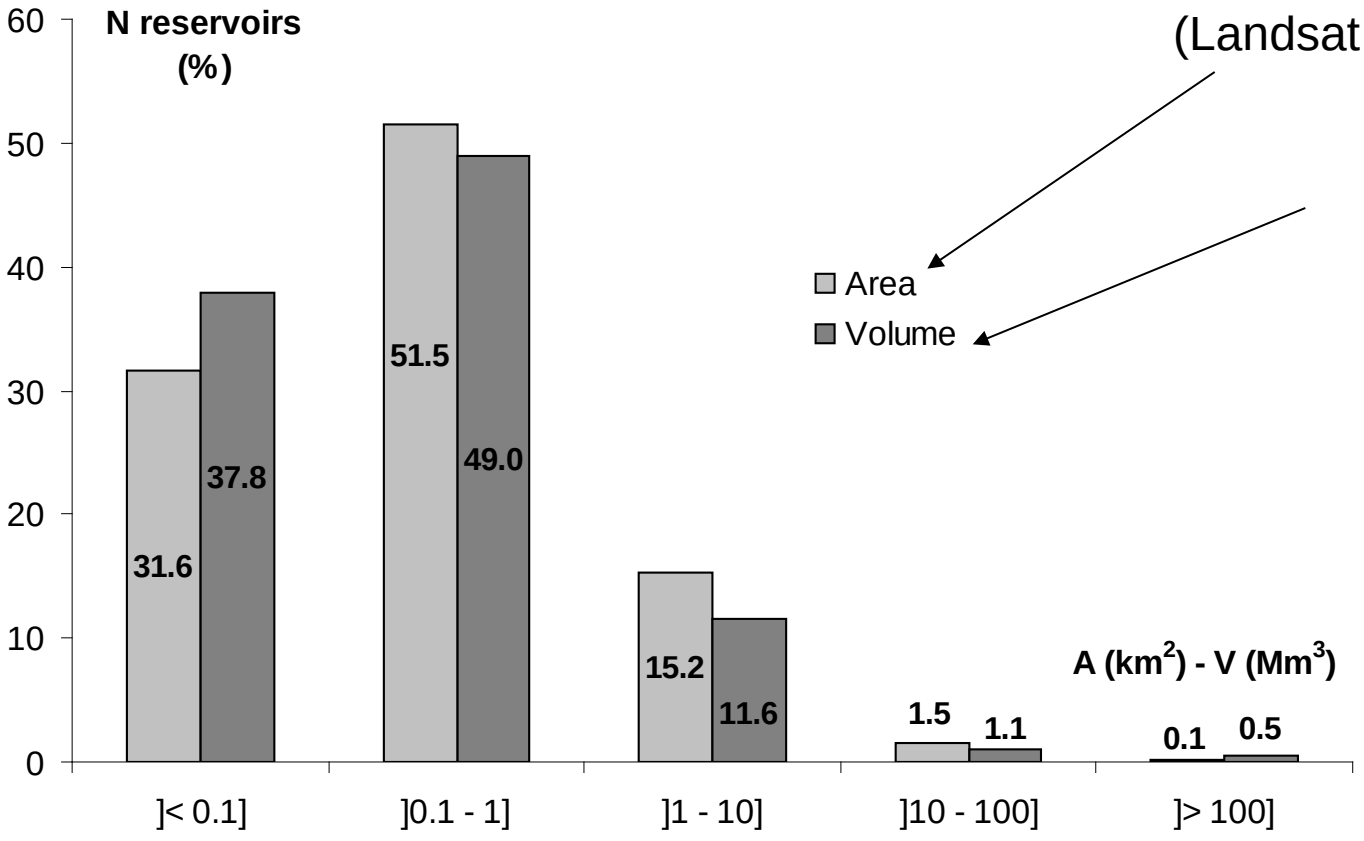




Size distribution (volumes) of reservoirs in Burkina Faso (DGRE database).
Volume is registered for 1015 reservoirs (70 % of the records) in the DGRE census.

Estimating volumes…





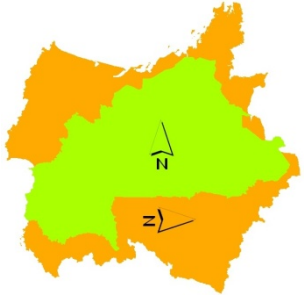
Automatic procedure (Landsat 2002)

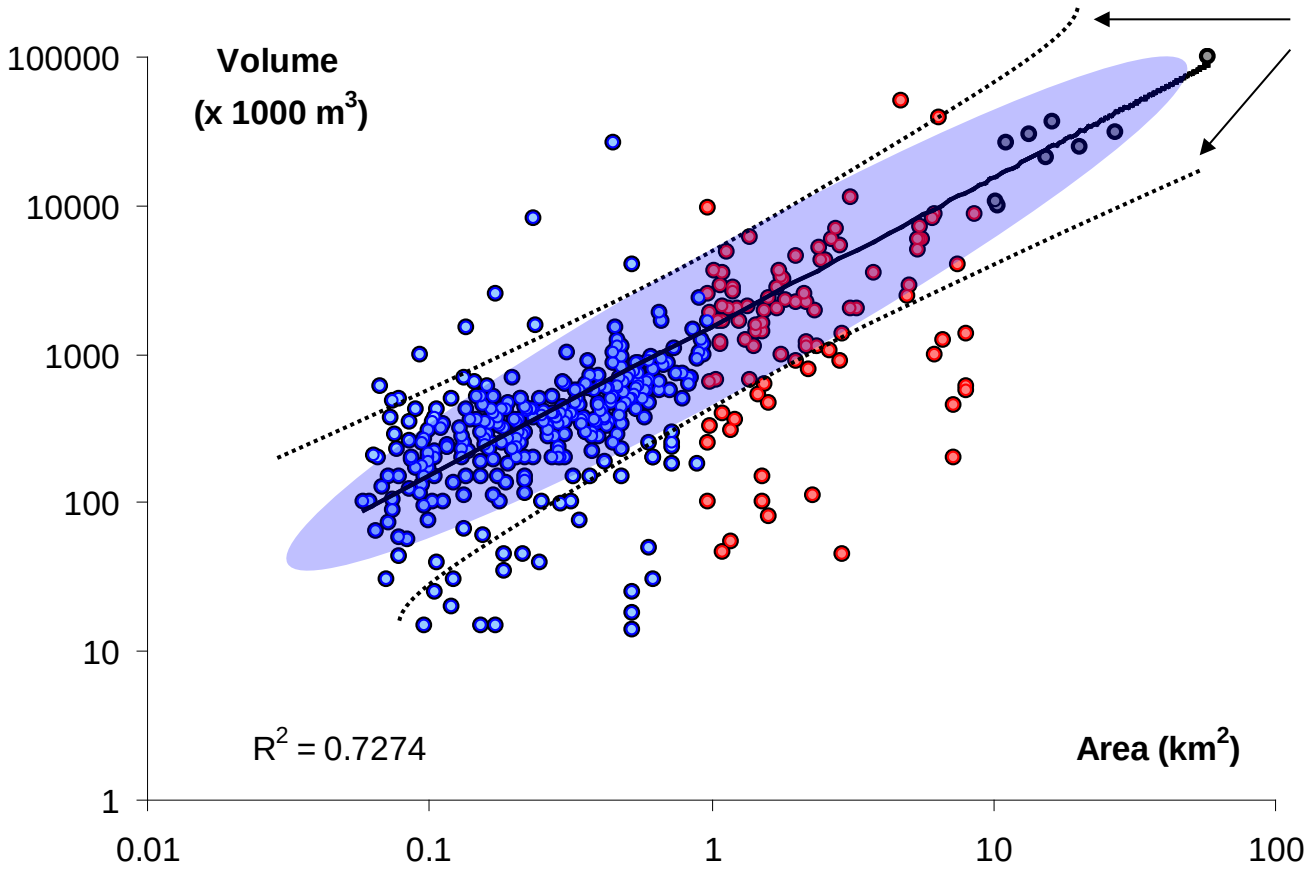
DGRE census (2001)

Redundancy

Size's distribution (% per classes) of lakes and reservoirs.

Estimating volumes…





δ < 75%; N=277

$V = 1{,}612 \times A$

$R^2 = 0.95$

1.56 km³

Small & medium reservoirs

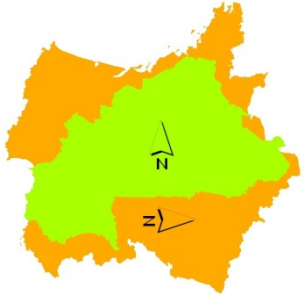
≈ 1%

Akosombo: 150 km³

Allometric relationship linking volume (V) and areas (A)
N= 414 lakes and reservoirs < 100 km2 from Burkina Faso.

Estimating impacts…

(www.smallreservoirs.org/toolkit)



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Shorelines (around **4000 km)** : development of **irrigated cultures**

– exportation

– growing urban requirements

Fisheries (surface water during the dry season ≈ 1000 km^2)

> 6000 tons / year (largely underestimated here)

≈ 2 M€ / year (*no monitoring for small water masses*)

\-

Shorelines: around **4000 km** = contact area (largely underestimated)

≈ 1 M. (rural folk) living less than 3 km

– **water-borne diseases** (schistosomiasis, malaria, diarrhea)

Water providing:

– 1 M. urban people: treated surface waters

– **≈ 1M. (rural folk): untreated surface waters**

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Burkina Faso
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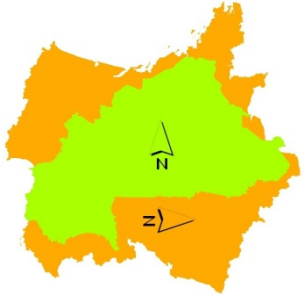

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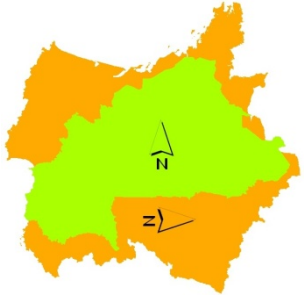
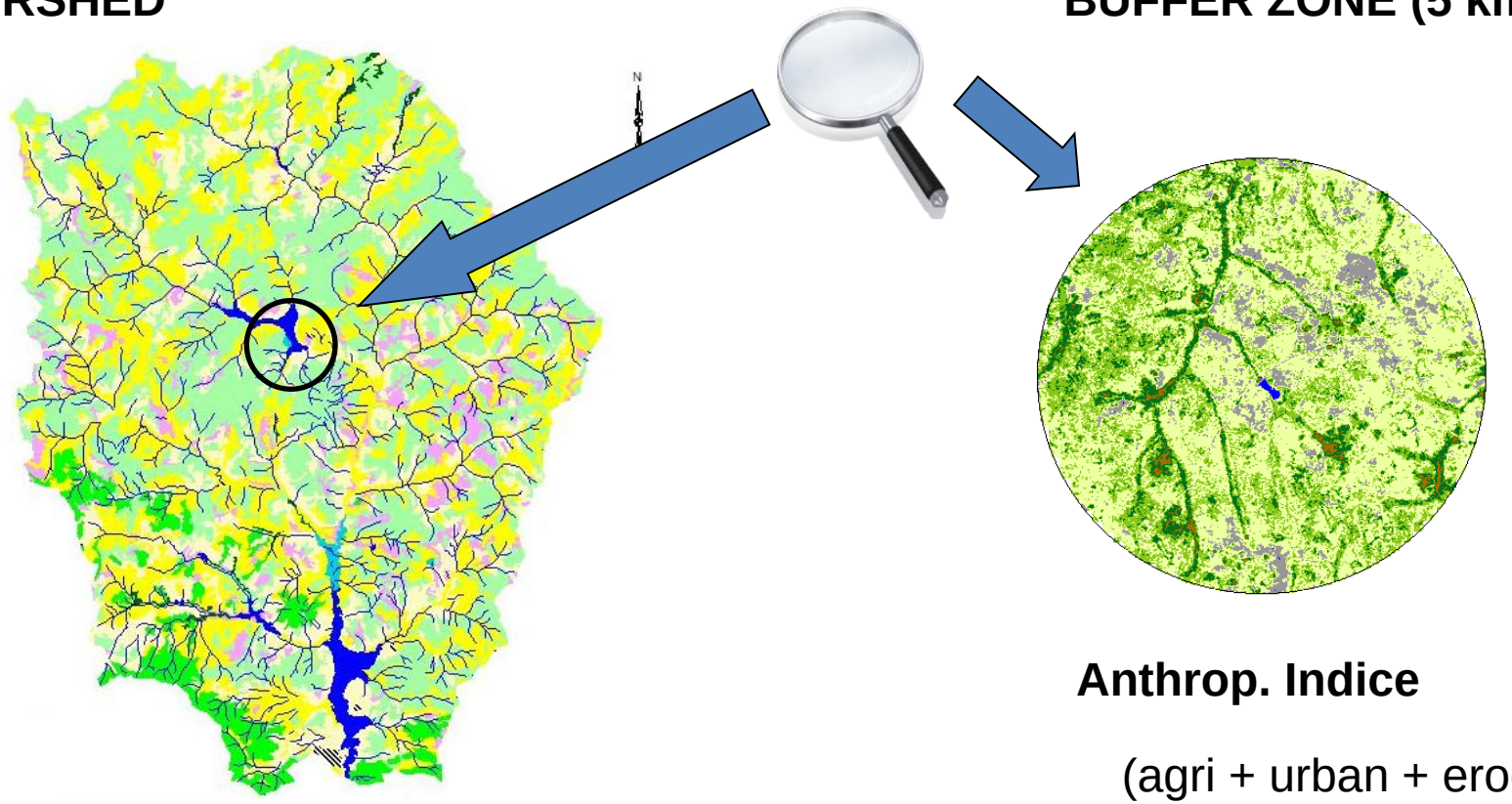
Anthropogenic Pressures ?



WATERSHED

BUFFER ZONE (5 km)

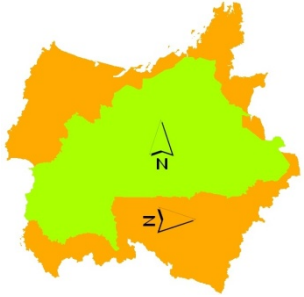


Population density
(inhbts/km^2)

Anthrop. Indice

$$\text{ratio} = \frac{(\text{agri} + \text{urban} + \text{eroded})}{(\text{natural} + \text{pristine})}$$

Burkina Faso
GIS Implementation



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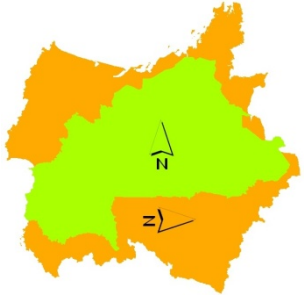
❶ To provide a synoptic view on **Anthropogenic Pressures** in relation with **Cyanobacteria...**

❷ But that sustains also '**other perspectives**':

➔this reflexion on the relationships between ***Fisheries* and *Reservoirs*** is thus *a sort of* '**unexpected by-product**'

➔ That needs ***to be updated***
➔ Even if I do assume that the **main tendencies** described here do remain the same...

Fisheries & Reservoirs



	Nature	Surf. Area (ha)	Importance (%)	
897,9 km²	Reservoirs > 2000 ha	50 310	39.8%	**71.1%**
	Reservoirs [100-2000] ha	22 480	17.8%	
	Reservoirs < 100 ha	17 000	13.5%	
	Rivers	34 580	27.4%	
	Swamps & Lakes	1 970	1.6%	
	total	***126 340***	***100.0%***	

(From Coulibaly & Dabat 2009)

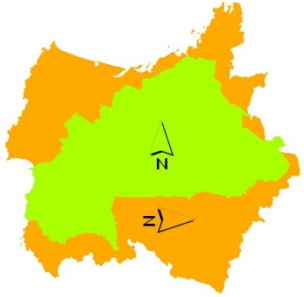
At the end of the dry season: > 900 km²

Large Reservoirs (6): 40% ➔ Urban Markets

Medium Reservoirs: 18% ➔ perenial, important stocks already exploited

Small Reservoirs: 14% ➔ Multi-uses systems; mainly agriculture…

Fisheries & Reservoirs



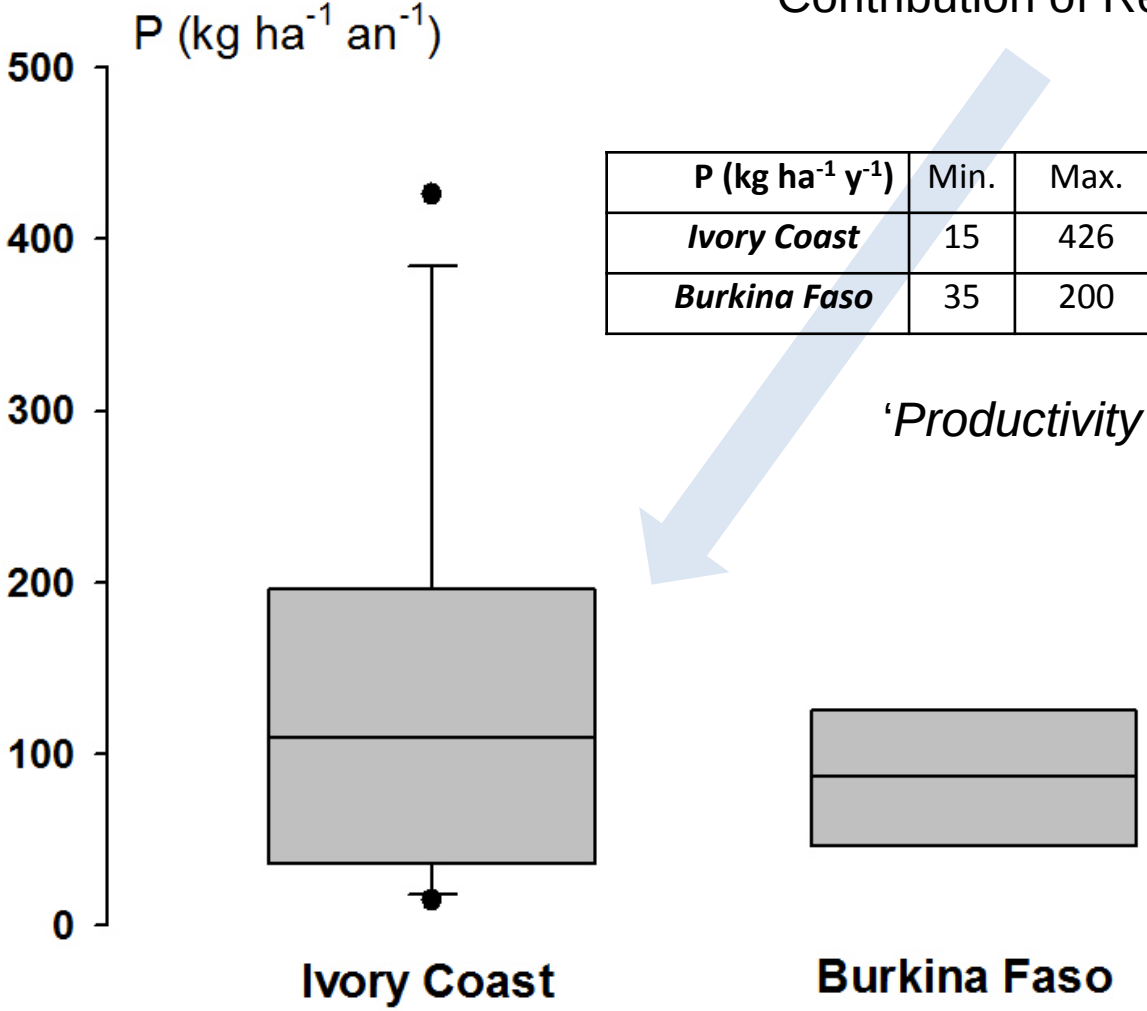
	Nature	Production (T)	Production (%)	Kg/ha/an	
6 000 T	Reservoirs > 2000 ha	3 287	34.2%	65.3	**62.2%**
	Reservoirs [100-2000] ha	1 350	14.0%	60.1	
	Reservoirs < 100 ha	1 350	14.0%	79.4	
	Rivers	3 437	35.7%	99.4	
	Swamps & Lakes	200	2.1%	101.5	
	total	***9 624***	***100.0%***	***76.2***	

(From Coulibaly & Dabat 2009)

76.2 Kg/Ha/Year compared to 60-65 (FAO 2009)
50-100 (Baijot *et a*l 1994)
80 (Villanueva *et al*. 2006)

Fisheries productivity

Contribution of Reservoirs: ≈ 71 % (Hectares)
≈ 62 % (Tonnes)

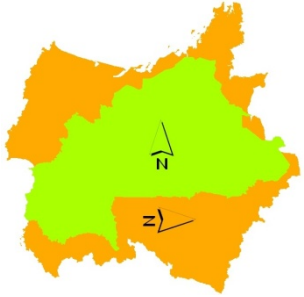


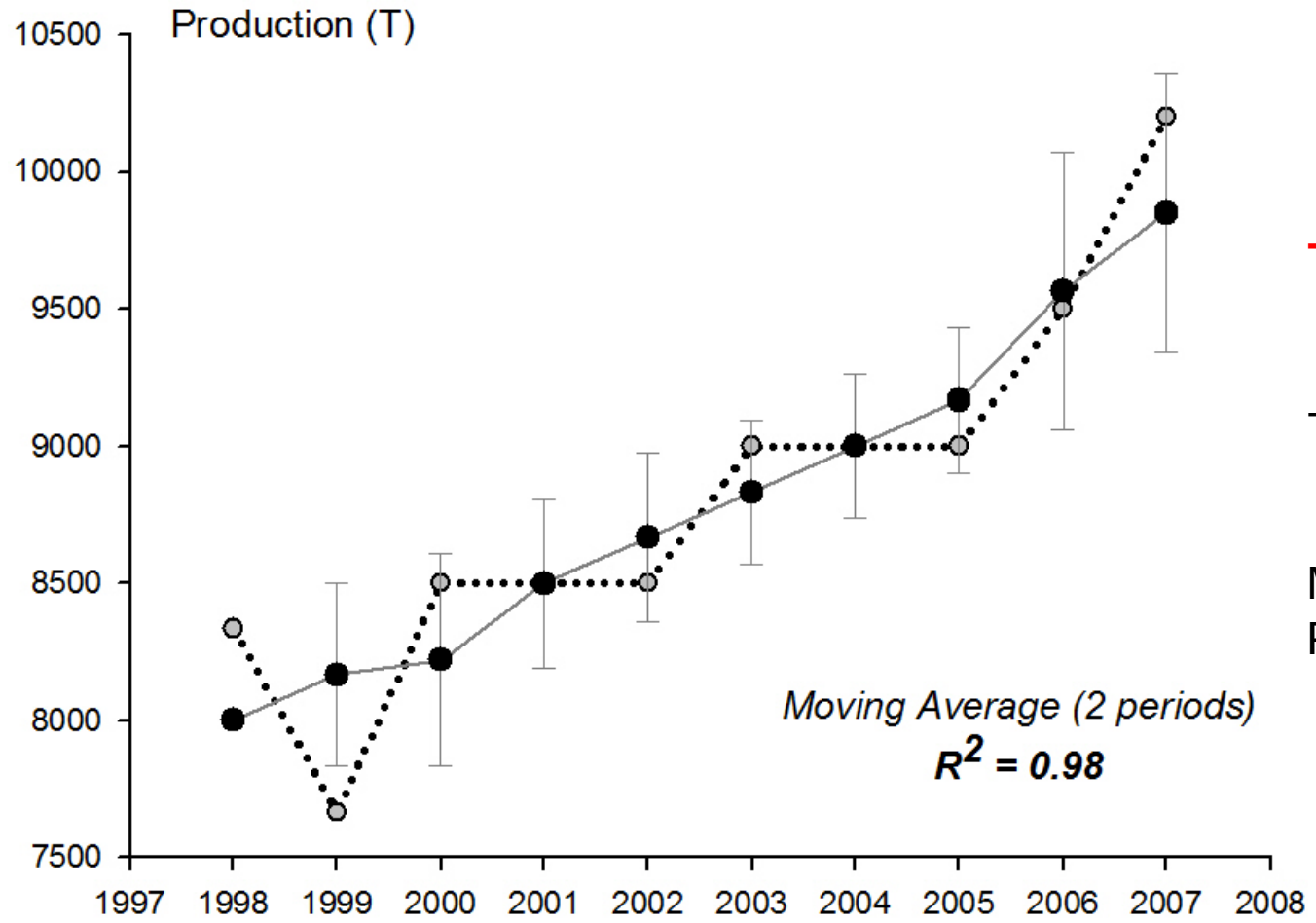
P (kg ha^{-1} y^{-1})	Min.	Max.	Moy.	Med.
Ivory Coast	15	426	137	109
Burkina Faso	35	200	93	87

'*Productivity differential*'

If 100 Kg/ha/y:
⇒12,600 T
⇒ 9,000 T only for reservoirs…

Production





(From Coulibaly & Dabat 2009)

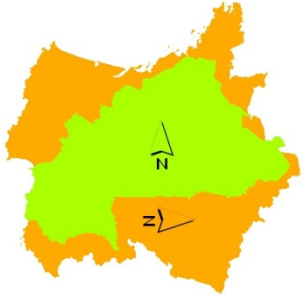
+ 200 Tonnes / year
corresponding to

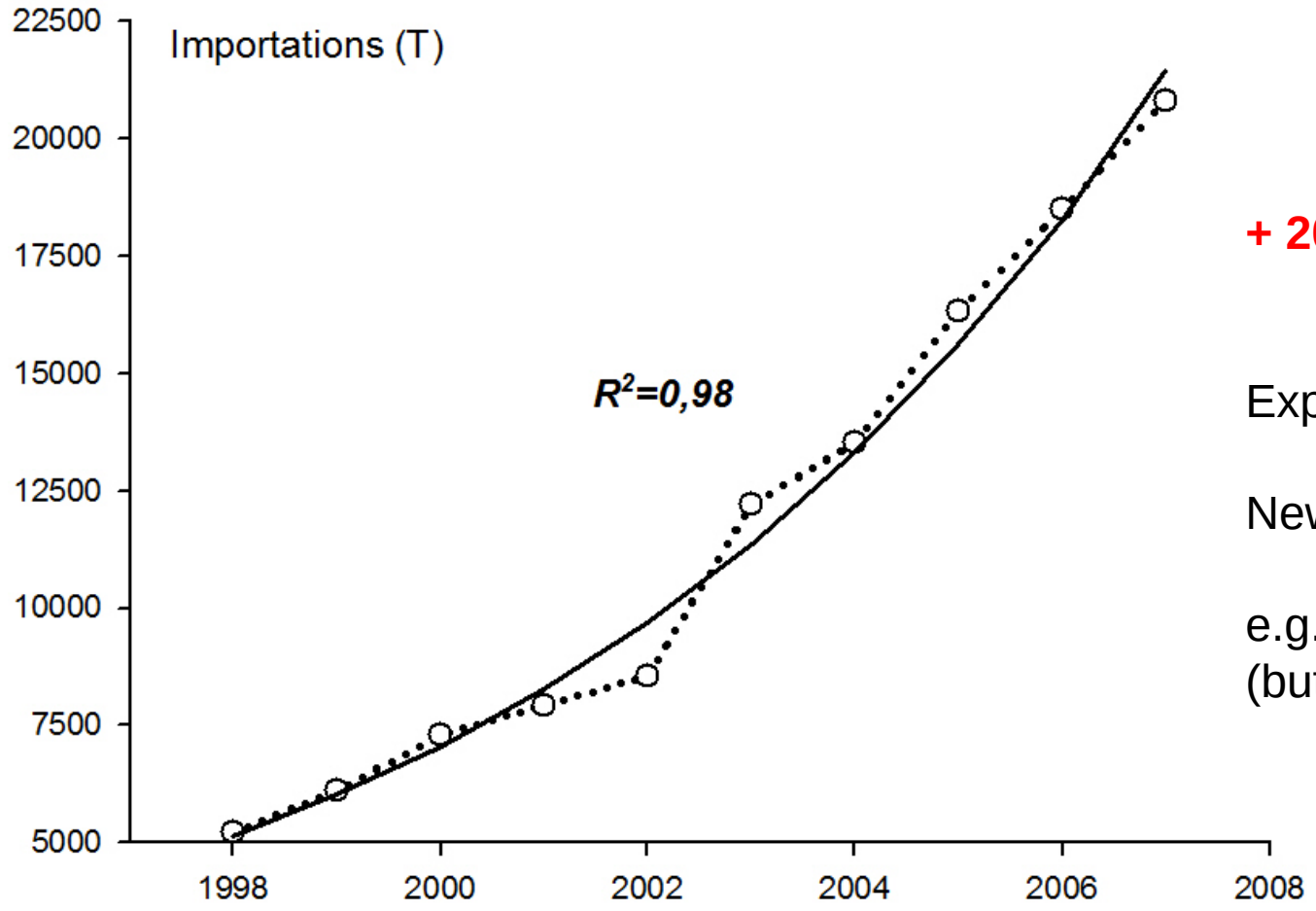
+ 240 new Reservoirs
between 1997 & 2008

Mean size: 110 -125 ha
Productivity: 70 kg ha^{-1} y^{-1}

Tendency perfectly explained by the increasing number of (small) reservoirs

Importations





(From Coulibaly & Dabat 2009)

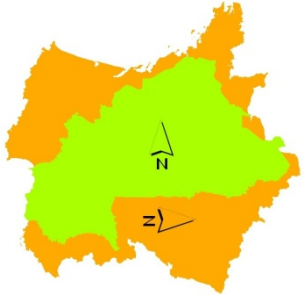
+ 2000 Tonnes / year

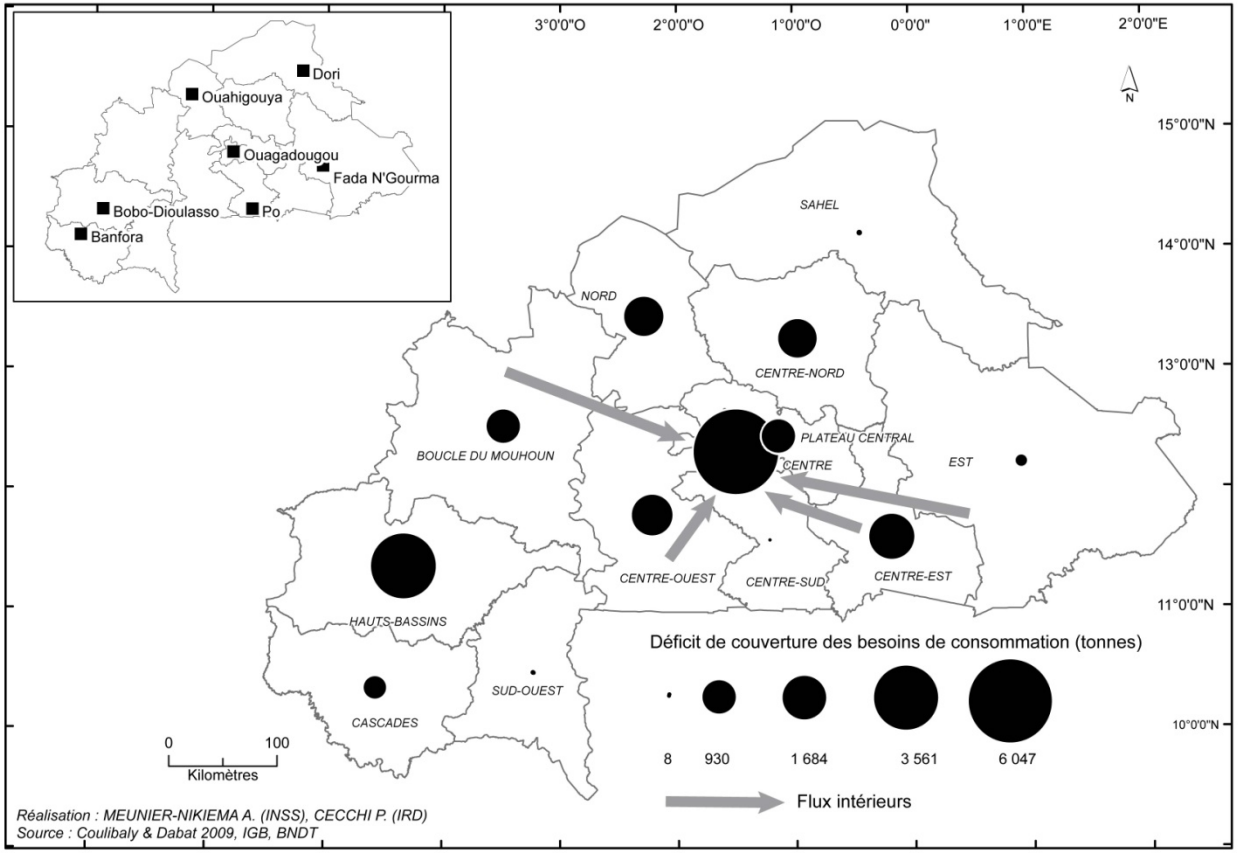
Exponential

New reservoirs: not enough,

e.g. Samendeni: + 1200 T (but once!)

Urban Market





(From Coulibaly & Dabat 2009)

Ouagadougou
(53% nat. urban pop)
Increasing Population
Increasing Demand

How to cope?

Aquaculture (?)
(Private Sector)

New Large System(?)

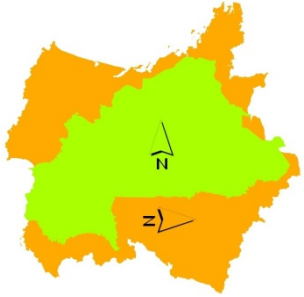
Intensification of the exploitation of existing Large Systems?

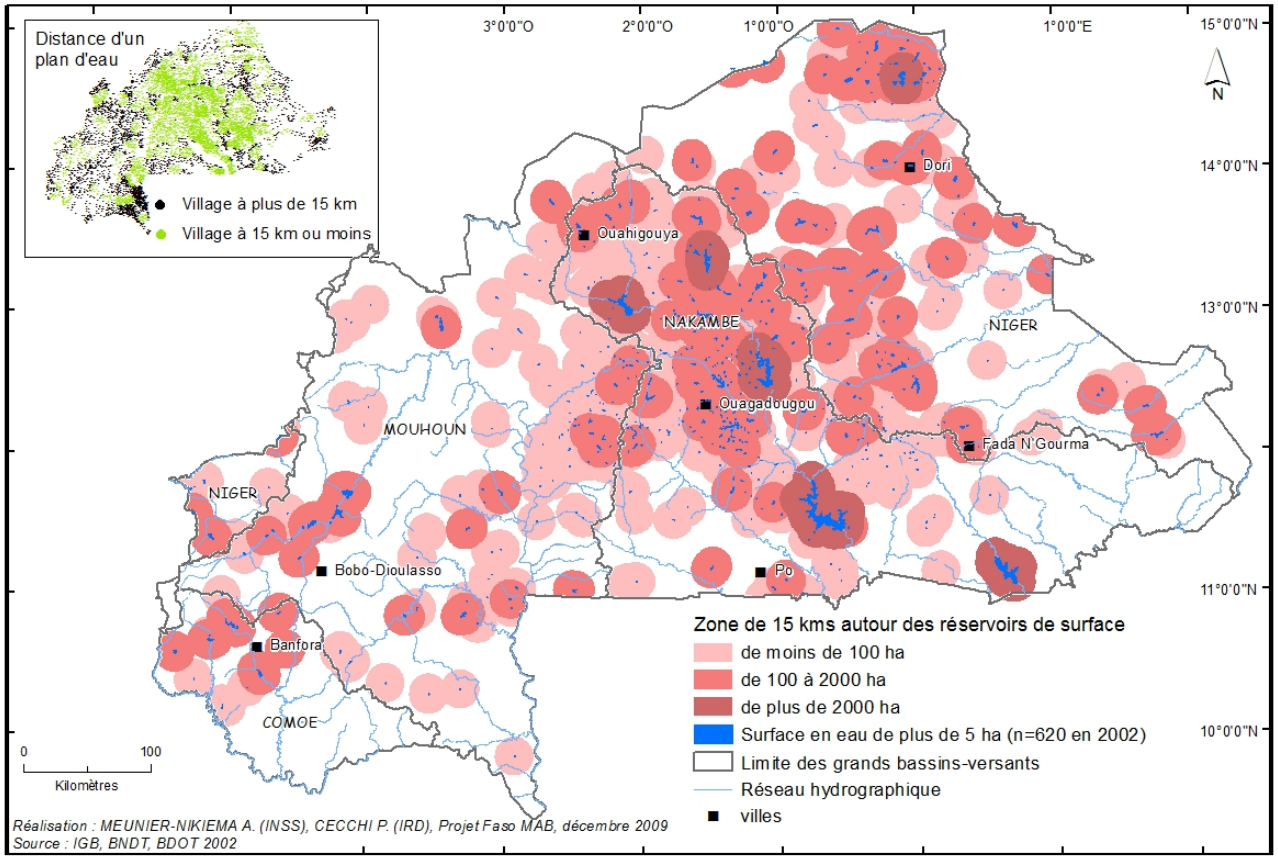
Current Strategy?

To Manage the Exploitation of Large Systems in Protecting stocks

PHIE status (Périmètre Halieutique d'Intérêt Économique)

Fish & Population: A question of vicinity





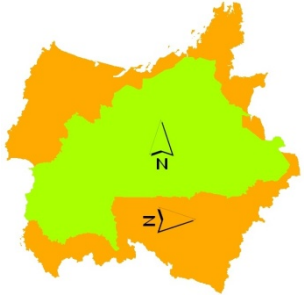
620 Reservoirs (> 5ha)
(BDOT 2002)

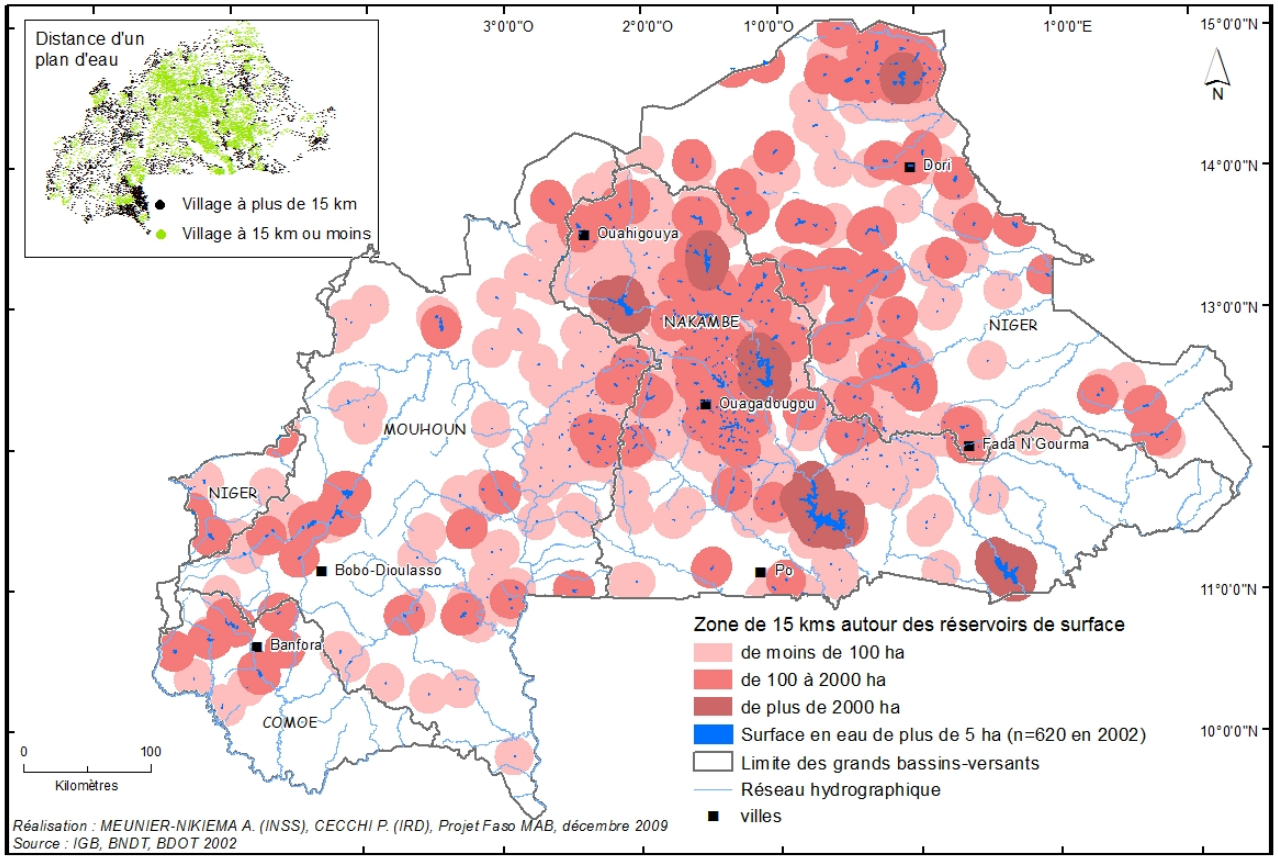
6,158 Villages
7 M inhabitants
(PEM/DGRE 2006)

< 15 km

> 2000 ha ⇔ N=6 (1%) ⇔ 46% (surface) ⇔ 8.5% (population) ⇔ 4.14 kg/Inh/y
< 100 ha ⇔ N=488 (80%) ⇔ 15% (”) ⇔ 88% (”) ⇔ 0.13 ”

Fish & Population: A question of vicinity





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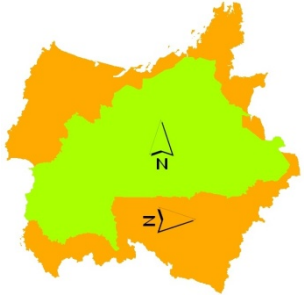
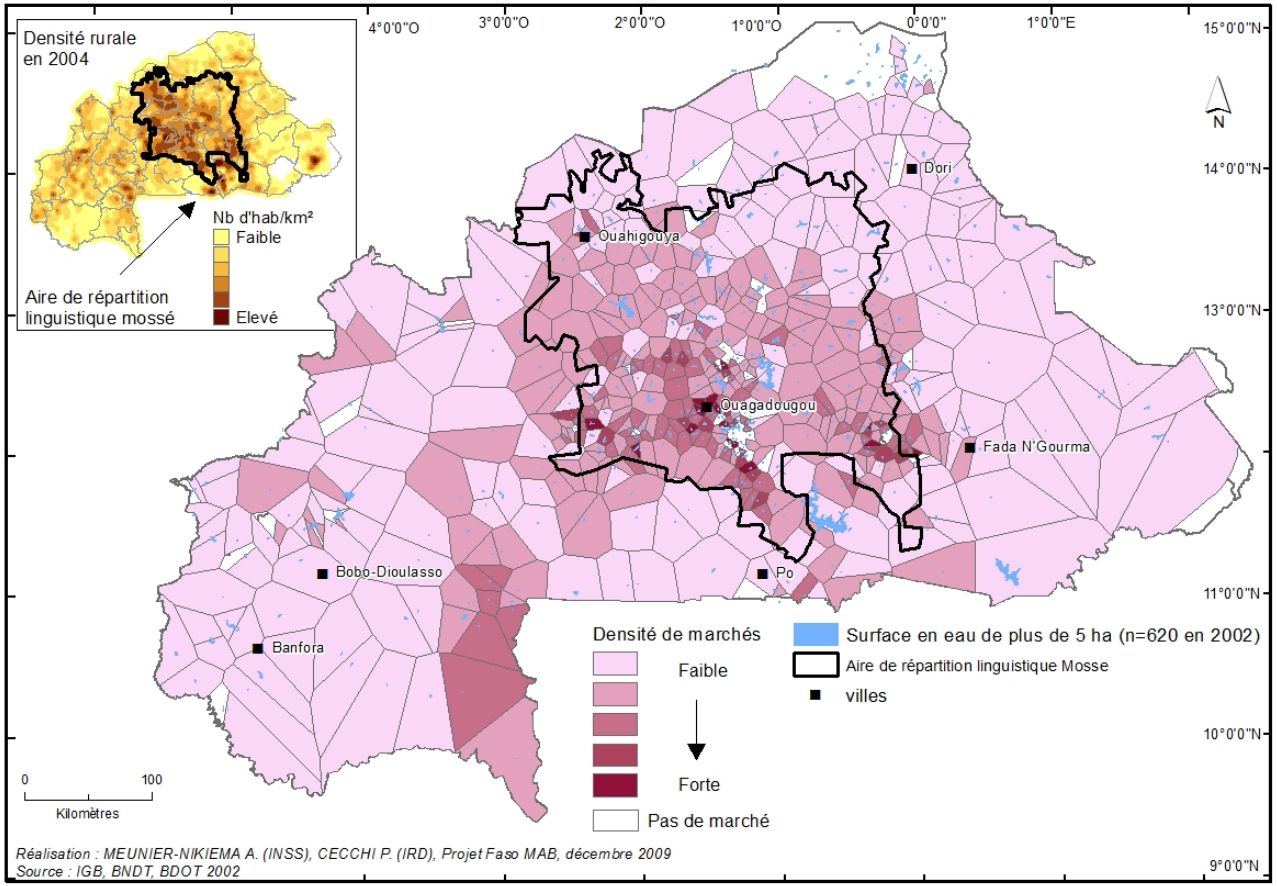
< 15 km

In Burkina Faso, 71.4 % of the total population (2/3) are living less than 15 km of (at least) one perenial water body: unexpected for a SAHELIAN country *(isn'it?)***….**

Fish & Market





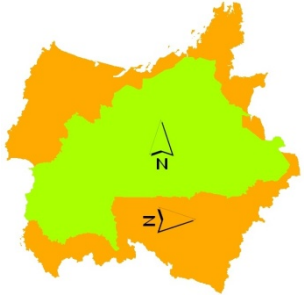
620 Reservoirs (> 5ha)
(BDOT 2002)

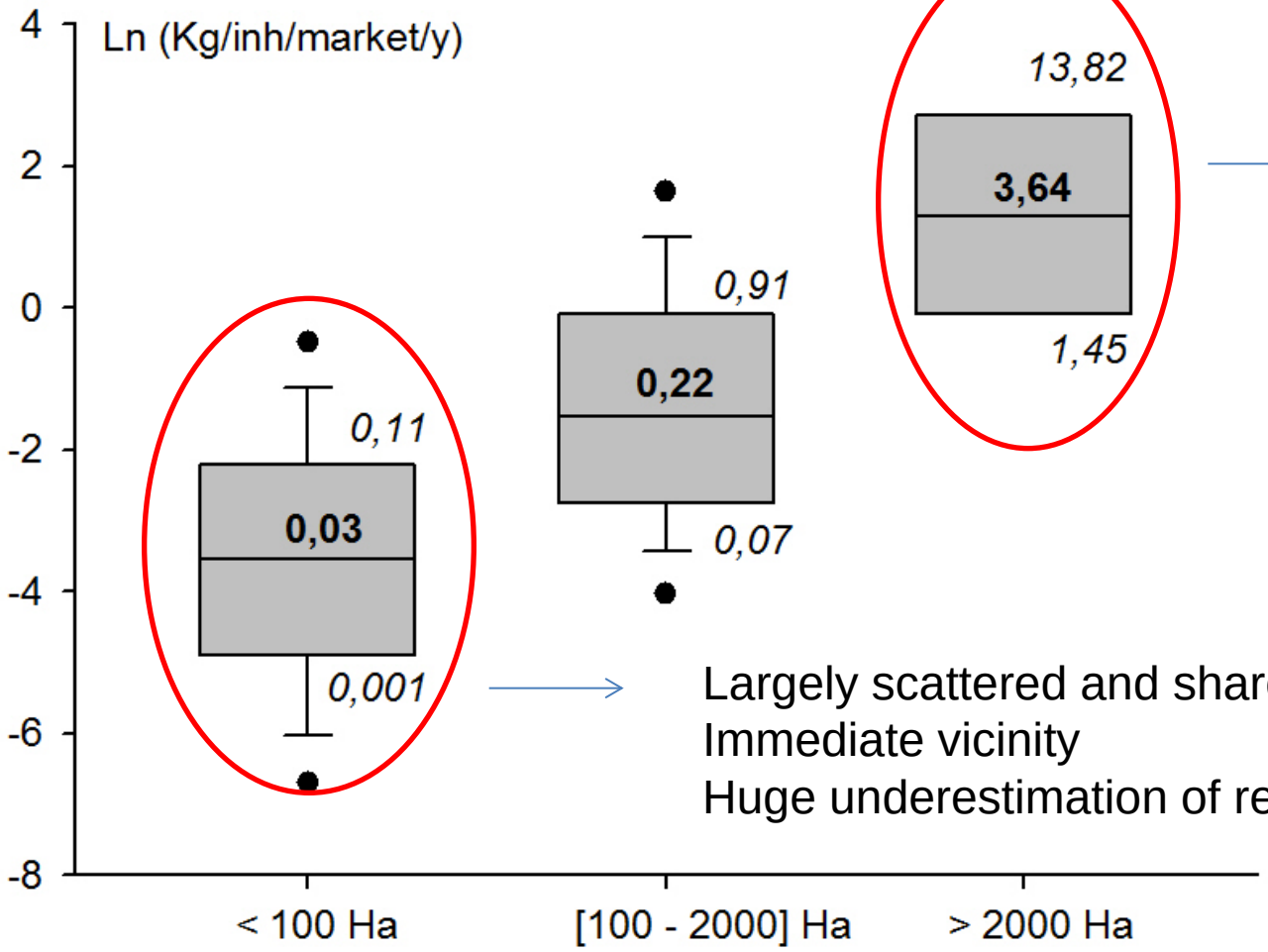
2,982 Markets
(PEM/DGRE 2006)

National Rural Pop (9.8 M)
(PEM/DGRE 2006)

The color gradient corresponds to the density of Markets within the Thyssen Polygons associated to each of the 620 reservoirs… mainly associated to pop. densities.

Fish & Market Size effects!

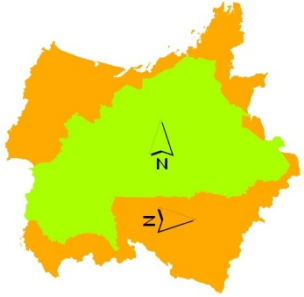




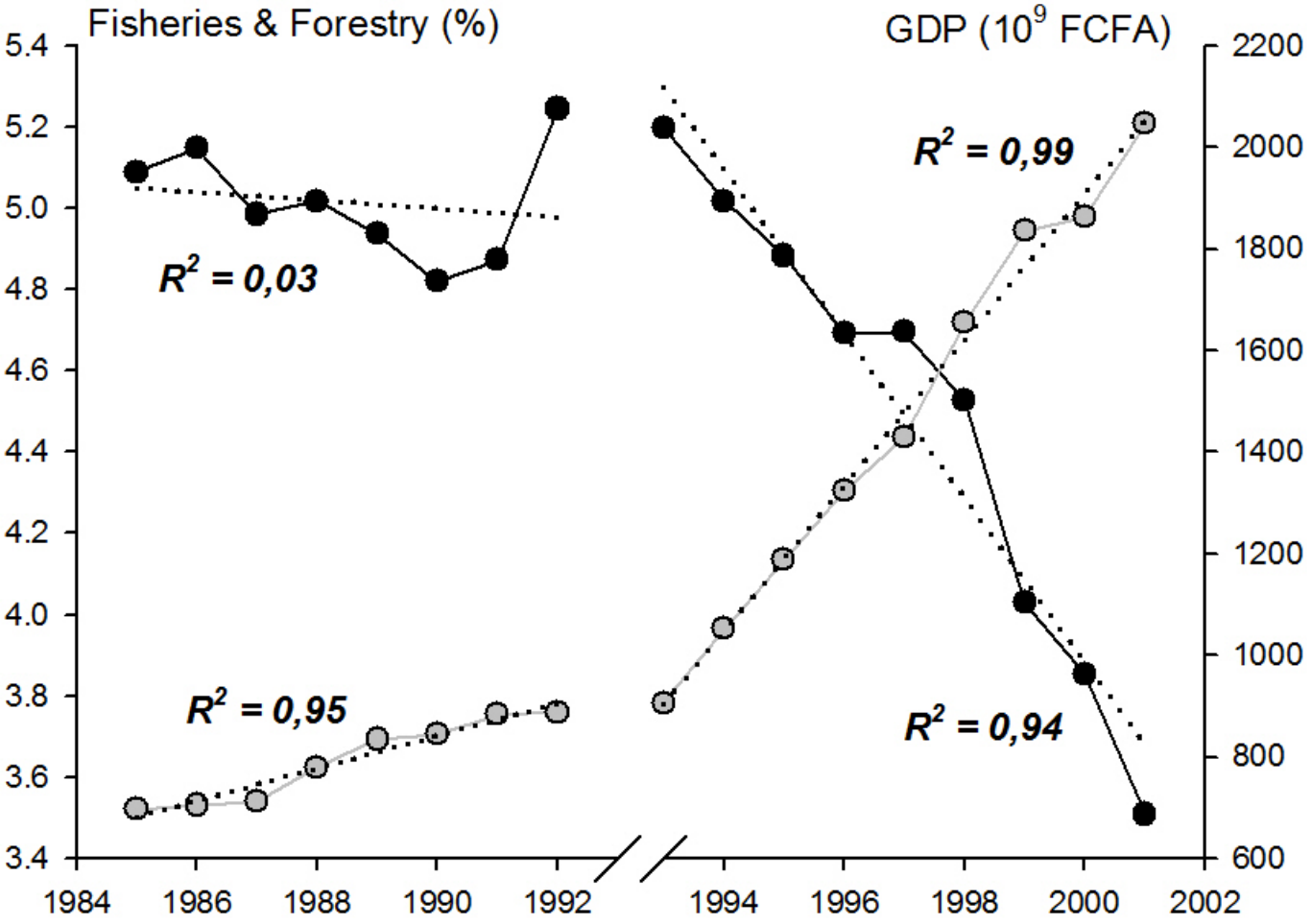
Exportation towards urban markets…

Largely scattered and shared resource
Immediate vicinity
Huge underestimation of real productions

Fisheries economics: sector weight



(From INSD 2009)

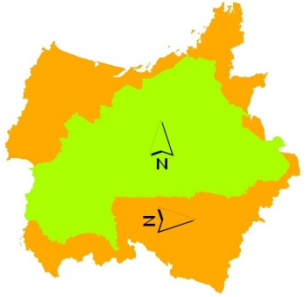


Gross Domestic Product (GDP) is continuously increasing.

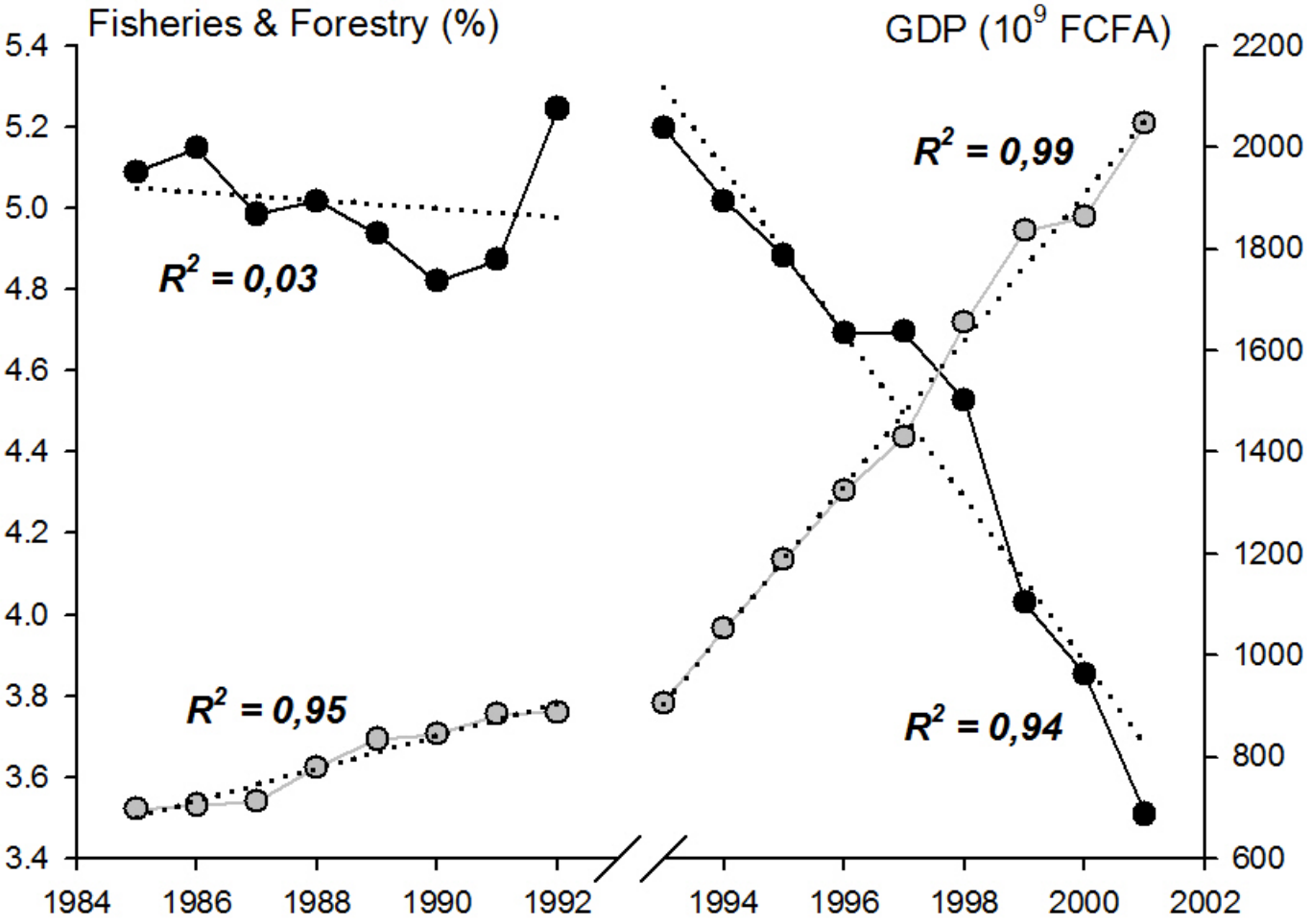
AND / BUT

Contribution of Fisheries is continuously decreasing.

Fisheries economics: sector weight



(From INSD 2009)



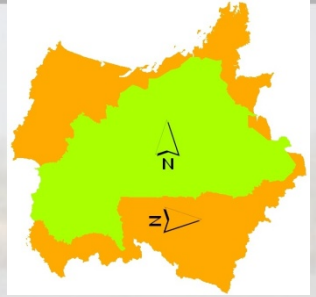
So

***WHY* TO *DEVELOP* FISHERIES?**

***WHY* TO *INVEST* IN THIS SECTOR?**

AND *FOR WHOM*?

Why and for whom?



To slow down the importations' tendency appears unrealistic.
And urban appetite will continue to increase!

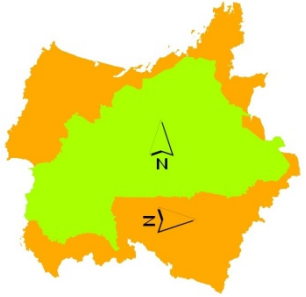
➔There is probably some space for **LOCAL AQUACULTURE** to fill part of this gap.

But the **FISHERIES NATIONAL POTENTIAL** is real.
It concerns mainly Small Reservoirs & their immediate populations.

➔ There is a **real need in terms of knowledge** related to their:

STOCKS (dynamics and productivity)
EXPLOITATION (current levels of fisheries' production)
ENHANCEMENT PATHWAYS (who and how).

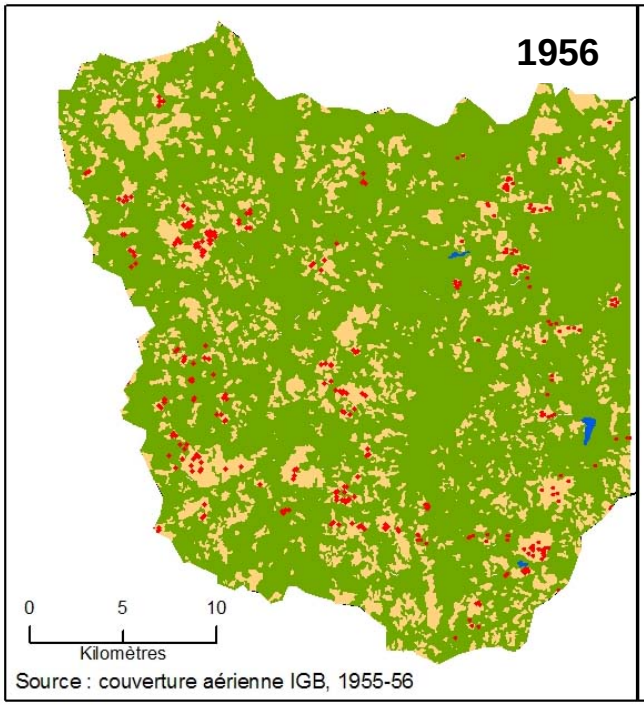
Under Global Change

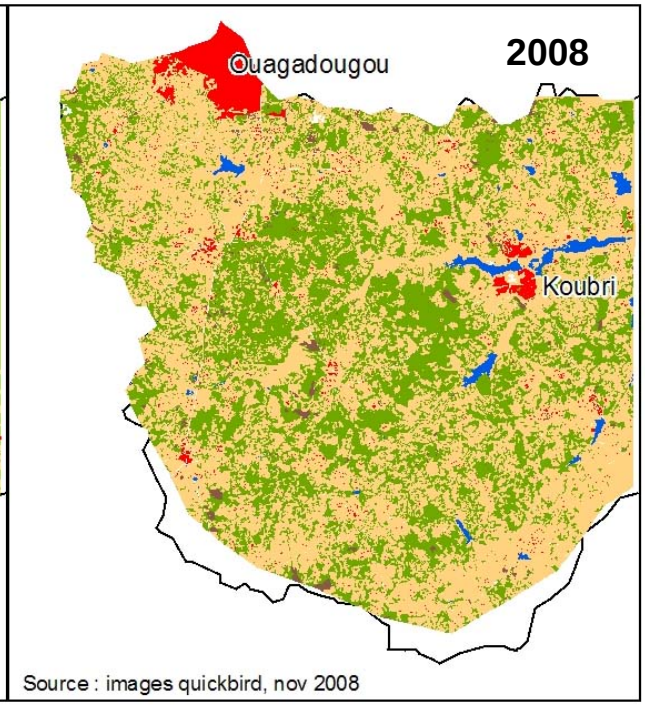


1986

1996

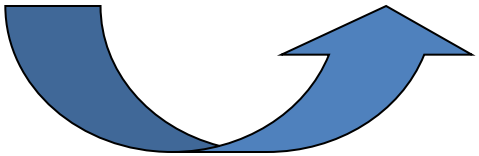
2006





Forest dominated

Agriculture dominated

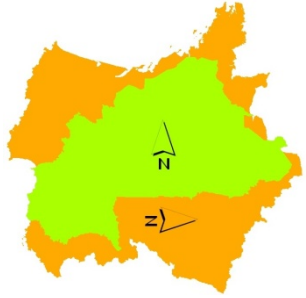


Solid & dissolved Fluxes
Eutrophication
Water Quality
Ecosystem Services

Multiple Uses Context

Because the **involved stakeholders** are fundamentally **MULTIPLE USERS**: Agriculture **+** Fisheries **+** Transformation **+** …

Governance Context



(N > 400 SRs)	Line ministries	Donors	Contractors	Local government	Traditional authorities	WUA's	Community	Farmers	Others
construction	41	6	33	8	2	2	3	2	2
exte								0	8
major maintenance	39	13	6	22	2	7	4	2	3
minor maintenance	4	0	0	5	5	36	42	6	2
setting management								6	2
implementing & monitoring rules	5	0	0	4	13	49	21	5	4
relation wi	11	1	0	9	12	42	18	3	5
co	5	0	0	8	54	20	11	1	2
protection	7	0	0	4	10	45	33	5	2
exploitation & marketing	13	0	0	1	5	14	12	47	6

Administrative devolution: (rural) communes

+

IWRM (Integrated Water Resource Management)

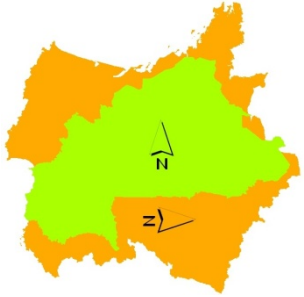
=> **convergence of interests** in terms of Resources' Management

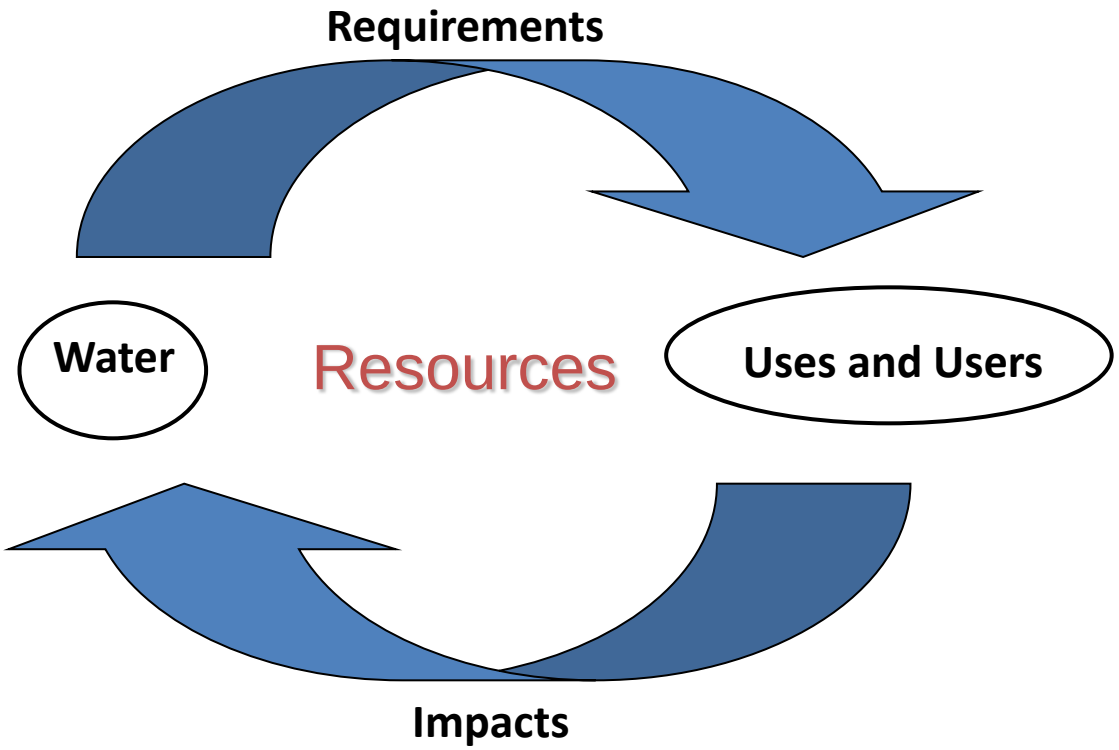
=> **cross-sectorial strategies** (i.e. soil & water conservation)

=> **Participatory processes**

=> (Theoretical) **Involvement of 'End-Users'**, in their diversity…

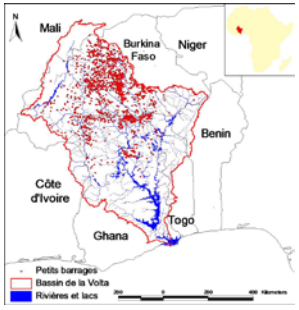
Our job?

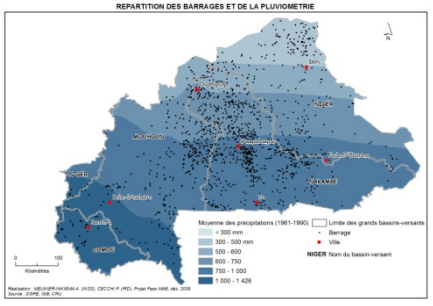




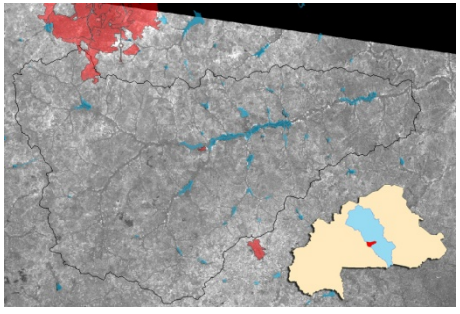
To document To inform To forecast

Our job?



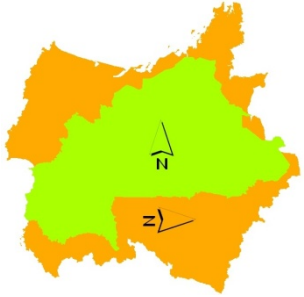


Cross-scaling in terms of resource ***management*** and/but also in terms of ***processes*** involved



True for Fisheries, Agriculture but also for Water Quality as well…
(Ecosystem Services)

Demand is explicit!



"The challenge lies not merely in ***reducing vulnerability*** [*against Climate Change*] but also in ***getting the structures*** in place so governments and investors can ***tackle adaptation*** in the most effective manner possible.

The good news is we can improve lives today while ***building*** the crucial ***infrastructure*** needed for ***tomorrow***."

Source: "*Global Warming and Adaptability*"
Wall Street Journal, 12 Dec. 2011

Thank you for your attention…

Associated Paper in press:
Cecchi P. & Meunier-Nikiema A.
Pourquoi et pour qui développer la pêche au Burkina Faso ?
Les Cahiers d'Outre-Mer, Numéro Spécial Burkina Faso, à paraître.

And many thanks also to Andy M. for his invitation,
and to the French Embassy for its support.