Modeling agronomic and economic flux in a small watershed in Niger river basin : case of Kourani-Baria

UNU-INRA Visiting Scholars Programme 2011

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# Outline of the presentation

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- ❑ Problem statement
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- ❑ Objectives of the study
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- ❑ Work plan

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Introduction

- Problem of externalities in irrigated area (flooding, siltation)

- Irrigation schemes are deteriorating because of these externalities

- Technical solutions for these externalities are experimented but they are not done spontaneously

- Issue must be addressed at the scale of watershed

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Study area
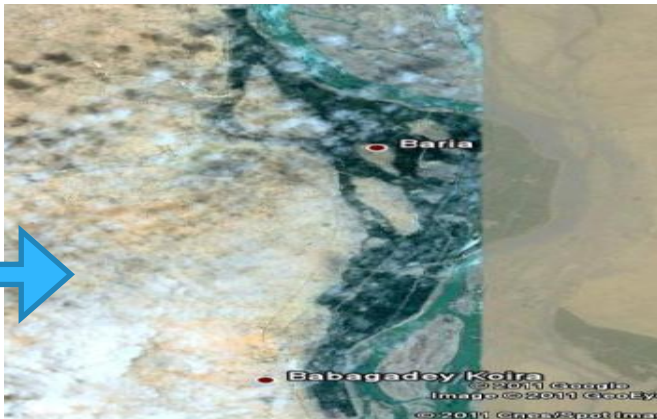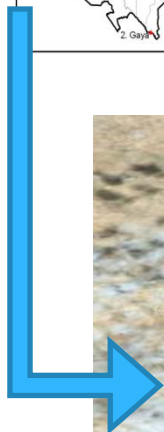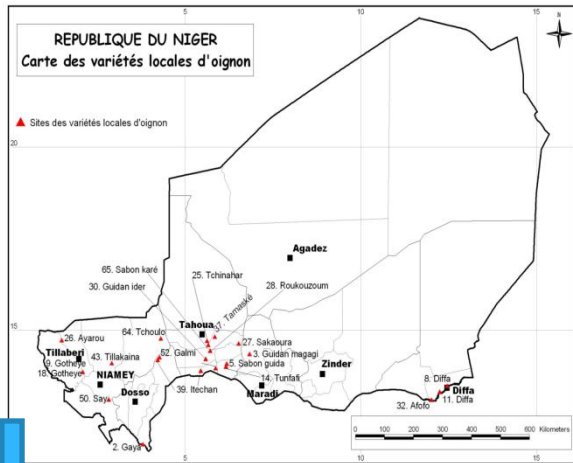
Kourani Baria Watershed
- W Niger, 90 KM NW Niamey
- located at the right side of Niger river
- 15000 habitants
- 21 Villages
- 17000 ha
- Severe upstream erosion

Irrigated area of watershed
- Total irrigated area are 750 ha and 69 3 ha are harnessing
- 1774 rice poducers
- 2 Cooperatives KB1 ET KB2
- Downstream deteriorat by externalities (flooding and salting)

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Problematic : Upstream (1/2)

❑ Agro-pastoralists, with maximum numbers of animals, trying to provide food for them and there animals,

❖ Degrade the environment
- Because of inadapted agricultural practices
- Because of the tragedies of the commons
- This situation require rules to limit numbers of animals and extension of slash and burn practices

❖ create negative externalities
- Erosion, silting, flooding and reduction cultivated area
- to these externalities we can't apply Pigouvian tax

❖ But agropastoralist agree to reduce these externality
- if a salary is given at rates revealed by experience
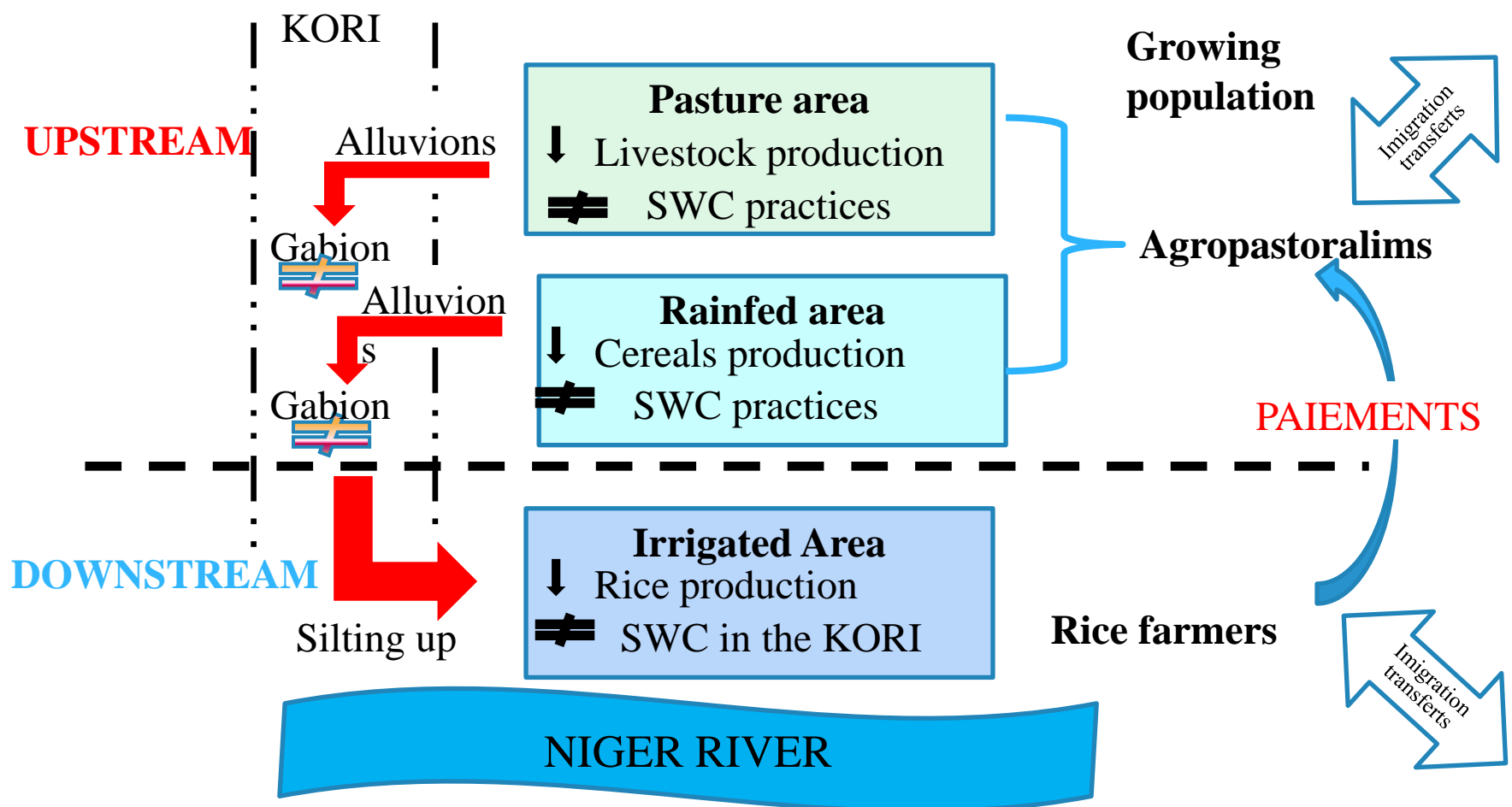- if they are paid at rates revealed by experience

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Problematic: Downstream (2/2)

❑ Rice producer create a tradable rice surplus

  ❖ but they are faced with agronomic and economic loses

    • The yield decrease

    • Rice production cost also increase

    • The irrigate area decrease

    • The irrigation schemes will be completely degrade

  ❖ They are suffering for externalities coming from elsewhere

    • Again, these externalities, it s also impossible to use the pigouvian tax based on the poluter pays principle

    • But it possible to apply an indirect tax based on the beneficiaries pays principle

❖They want to reduce upstream negatives externalities

❖They are ready to pays upstream farmer to preserve their environment

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State of art

- PES tools began around 1980 (Perrings and Arriagada 2009),
  - mainly applied in developed countries (Porras, Grieg-Gran and Neves (2008), Perrings and Arriagada, 2009; FAO, 2007)
  - begin to take hold in developing countries (Grain to green in China, Costarica, etc.)
  - are unexperimented in Africa
- most of the PES concern
  - water services at small scale of watershed (Vittel, Evian, California, etc.)
  - carbon sequestration services at a large scales
  - and biodiversity protection services at a large scales
- We didn't found an example for PES in agriculture where farmers pays other farmers to provide them an ES

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Watershed scheme

KORI

UPSTREAM

Alluvions

Gabion

Alluvions

Gabion

DOWNSTREAM

Silting up

Pasture area
↓ Livestock production
⇄ SWC practices

Rainfed area
↓ Cereals production
⇄ SWC practices

Irrigated Area
↓ Rice production
⇄ SWC in the KORI

NIGER RIVER

Growing population

Imigration transferts

Agropastoralims

PAIEMENTS

Rice farmers
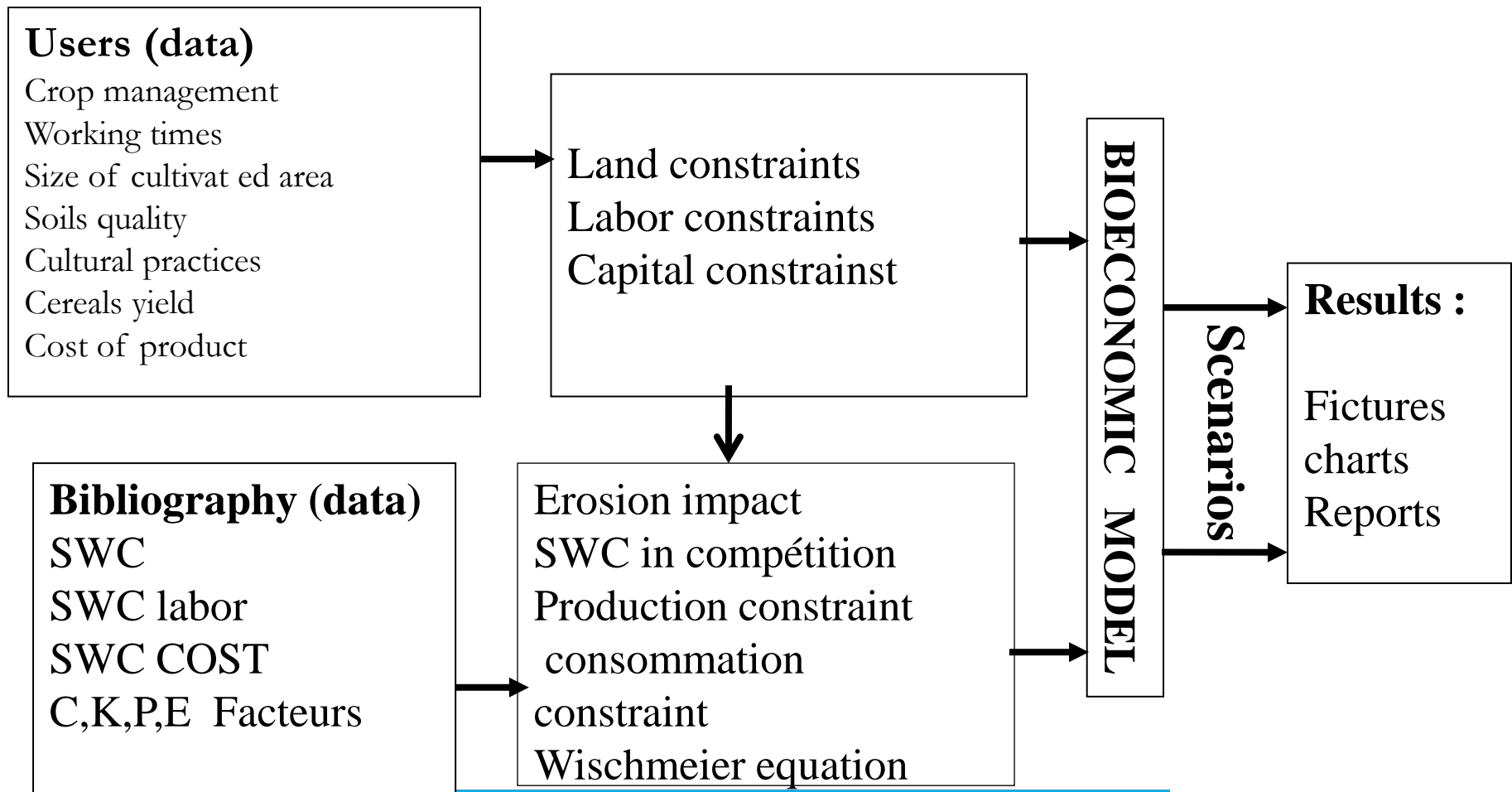
Imigration transferts

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Objectives of the study

- To assess PES tools at local scale
  - Identify the responsibility of those who are generating externalities
  - to assess the impact of those externalities on upstream and downstream activities
- *To achieve these objectives, I am developing a bioeconomic model to simulate different scenarios*

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Methodology: Model (1/2)

- Mathematical progamming
- upstream and dowstream are in interaction
- distinguish three groups of users, both upstream and downstream
- include the flow of agronomic interest
- Is include equation of erosion, sedimentation
- is under constraints of production and consumption
- Production and consumption are non separable
- SWC are in competition
- Dynamic and recursive
- Maximization of monetary income

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Methodology: Steps to build model (2/2)

Users (data)
Crop management
Working times
Size of cultivat ed area
Soils quality
Cultural practices
Cereals yield
Cost of product

Bibliography (data)
SWC
SWC labor
SWC COST
C,K,P,E Facteurs

Land constraints
Labor constraints
Capital constrainst

Erosion impact
SWC in compétition
Production constraint
 consommation
constraint
Wischmeier equation

BIOECONOMIC MODEL

Scenarios

Results :

Fictures
charts
Reports

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Expected results and outcome

- Describe the process of degradation and find responsibility of those degradations
- Predict the possibility of implementation of PES in a small scale
- Predict the evolution of harnessing resource use in the watershed
- Predicting alternative sustainable management of resource
- Offer good agricultural practices and tools for effective sampling of resource
- Predict the development
- Policy brief
- Working paper

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Progress

- State of the art is well advanced

- Questionnaires administed

- Other data has been collected

- Data input and analysis have began

- Bioeconomic model was created to be informed by real data

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Work plan

State of art will be ameliored	06 - 07 september 2011
Study area will be synthetise	07 - 08 september 2011
Model will be informed	09 - 12 september 2011
Model will be implement, calibrated & validated	1 3 - 20 september (progress report)
Scenarios will be simulated	21 - 30 september 2011 (progress report)
Results will interpreted	01 - 20 October 2011
Last seminar will be prepared	01 - 20 October 2011
Discussion and conclusion will be done	21 - 23 October 2011
Policy brief	24 October- 7 November 2011

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Pictures of the study area

Pictures of the study area

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Pictures of the study area

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Announcement:

Next Seminar : <u>Friday September 9, 2011</u>

Topic: Community Based Forest Management:
How to Mitigate Farmer's Infiltration in
Protected Forest in Côte d'Ivoire?

Speaker: Dr. Wadjamsse DJEZOU

Time: 10 am prompt

Venue: UNU-INRA Conference room

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