



Natural capital and development in Madagascar: A focus on soil resources

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Few definitions before we start

- **Capital (physical)**

can be defined as a physical stock supplying a flow of monetary services in time

- **Extension to other types of resources**

- human capital: education, health...

- social capital: institutions (formal/informal), trust...

- natural capital: « *stocks of resources generated by natural bio-physical processes that yields flows of useful services and amenities into the future* »

- **Sustainable development**

↔ total capital stock ($K_h + K_n + K_s + K_p$) not declining

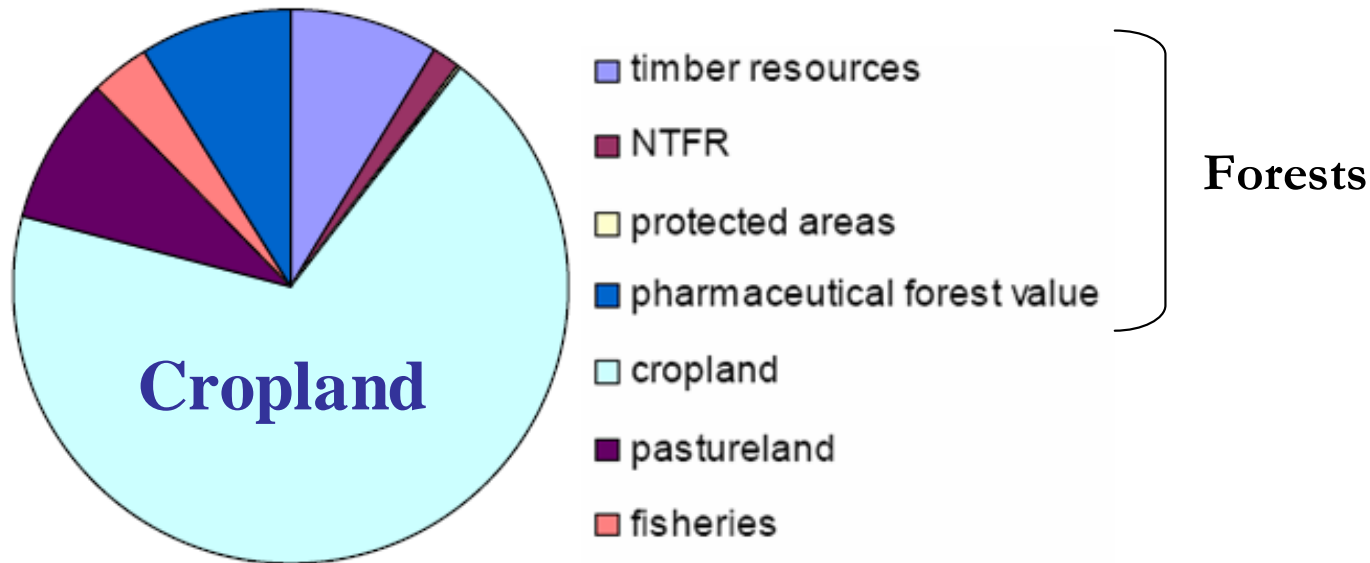
Natural capital particularities

- Multifunctional
- Rarely monetized, free
- Complex dynamic, not linear, thresholds

Few words about « valuing nature »

- Broad sense of value, not only direct use value
- Environment often neglected if we do not understand its importance for human activities
- Tool for conservation justification and decision making
=> but political decision, **normative**, in the end

Madagascar natural capital

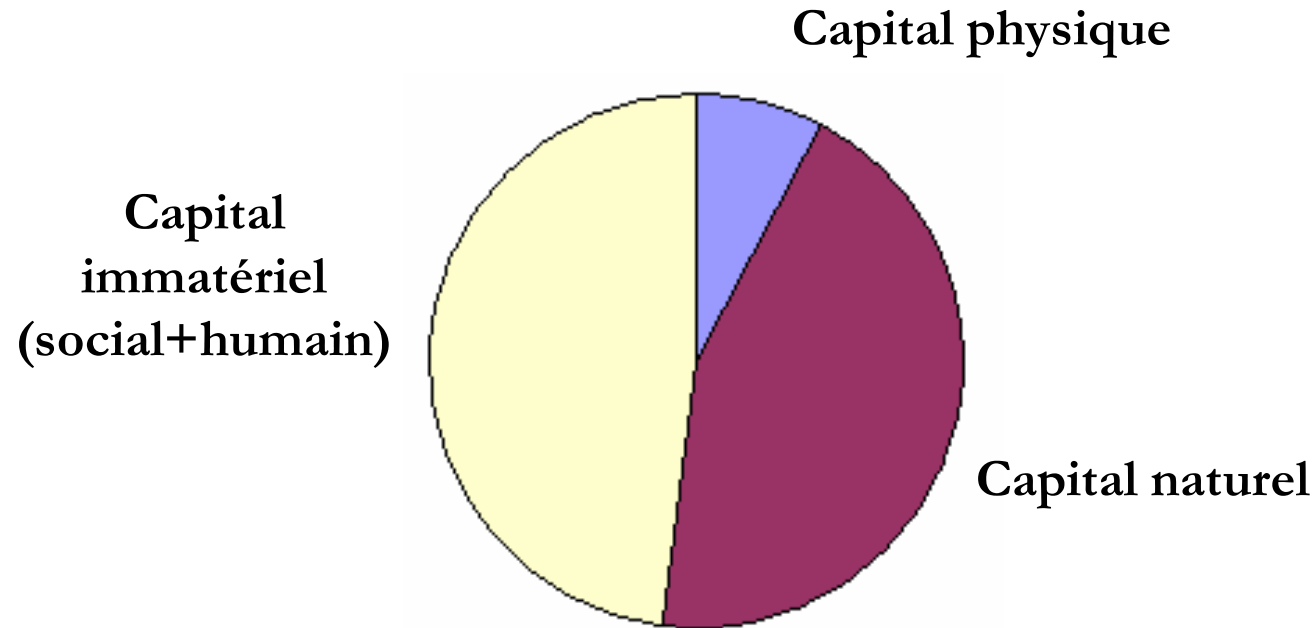


Main message: importance of cropland

⇒ Important to have a better understanding of its dynamics

⇒ Work in progress, many values not included

Natural capital importance compared to other types of capital



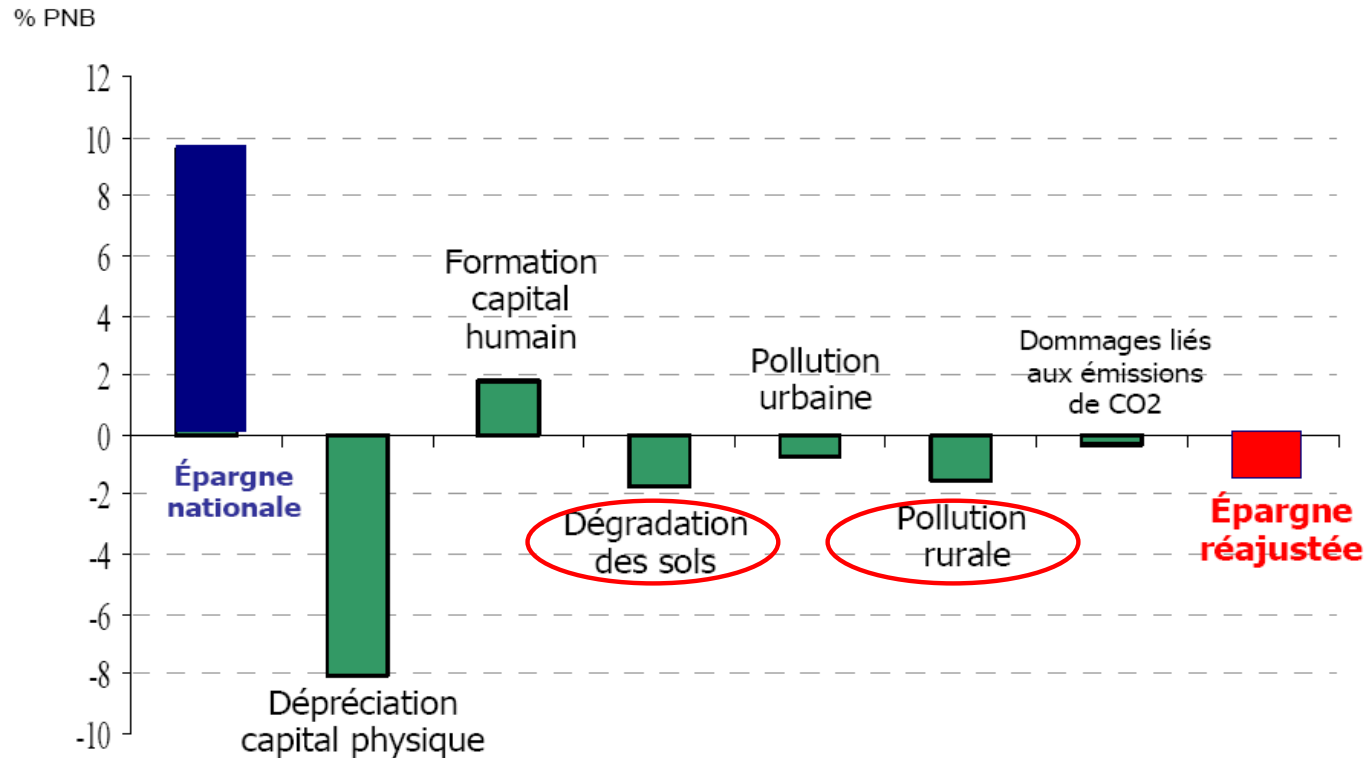
Main messages

- small share of physical capital
- Intangible assets are central in a nation's wealth
- Natural capital share very important in Madagascar (compared to other countries)

A macroeconomic sustainability indicator: the « genuine saving rate »

- Traditional macroeconomic indicator (like GDP) are flawed because do not integrate environmental degradation
- « genuine saving » principle = to correct national saving for natural capital depreciation
 - ⇔ variation of the different capital stocks
 - ⇔ indicator of the growth sustainability
- Integration of: deforestation, rural (indoor) pollution, urban pollution, soil degradation and human capital investment (education only)

Is Madagascar growth trajectory sustainable?



Main output:

- growth may not be sustainable
- importance of soil degradation and rural pollution

=> Many degradations not included

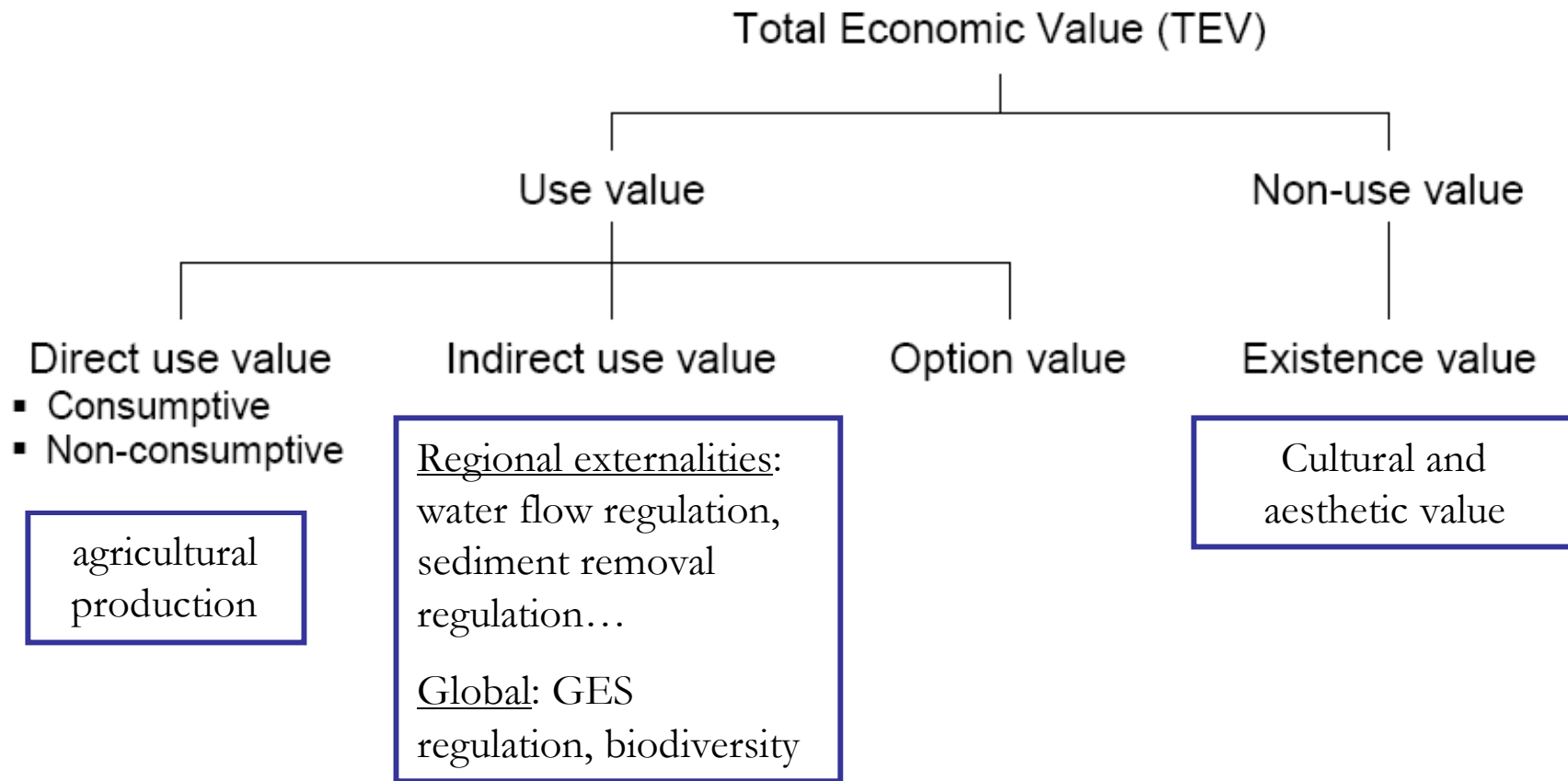
Focus on cropland

- Largest part of Madagascar natural capital
- Poor people are very dependent on this asset
- Frequent correlation between poverty and soil degradation => causality?
- Lots of works are reporting important soil degradation problems in SSA

⇒ Presentation of some theoretical elements on soil resources and economy

⇒ An example of soil capital investment: DMC techniques

The value of croplands



Soil capital value: « from flow to stock dimension »

= discounted value of the stream of net benefits

Organic matter: an interesting proxy of the stock of soil capital

SOM functions (nutrients furniture, water holding capacity, soil structure...) contributes to most of soil services (agricultural production, erosion control, water flow regulation...)

=> Valuable multifunctional natural resource

Main valuation techniques

1. Productivity change approach

« OM value » = Economic impact of a marginal OM increase on the different soil services (crop production, carbon sequestration, erosion mitigation...)

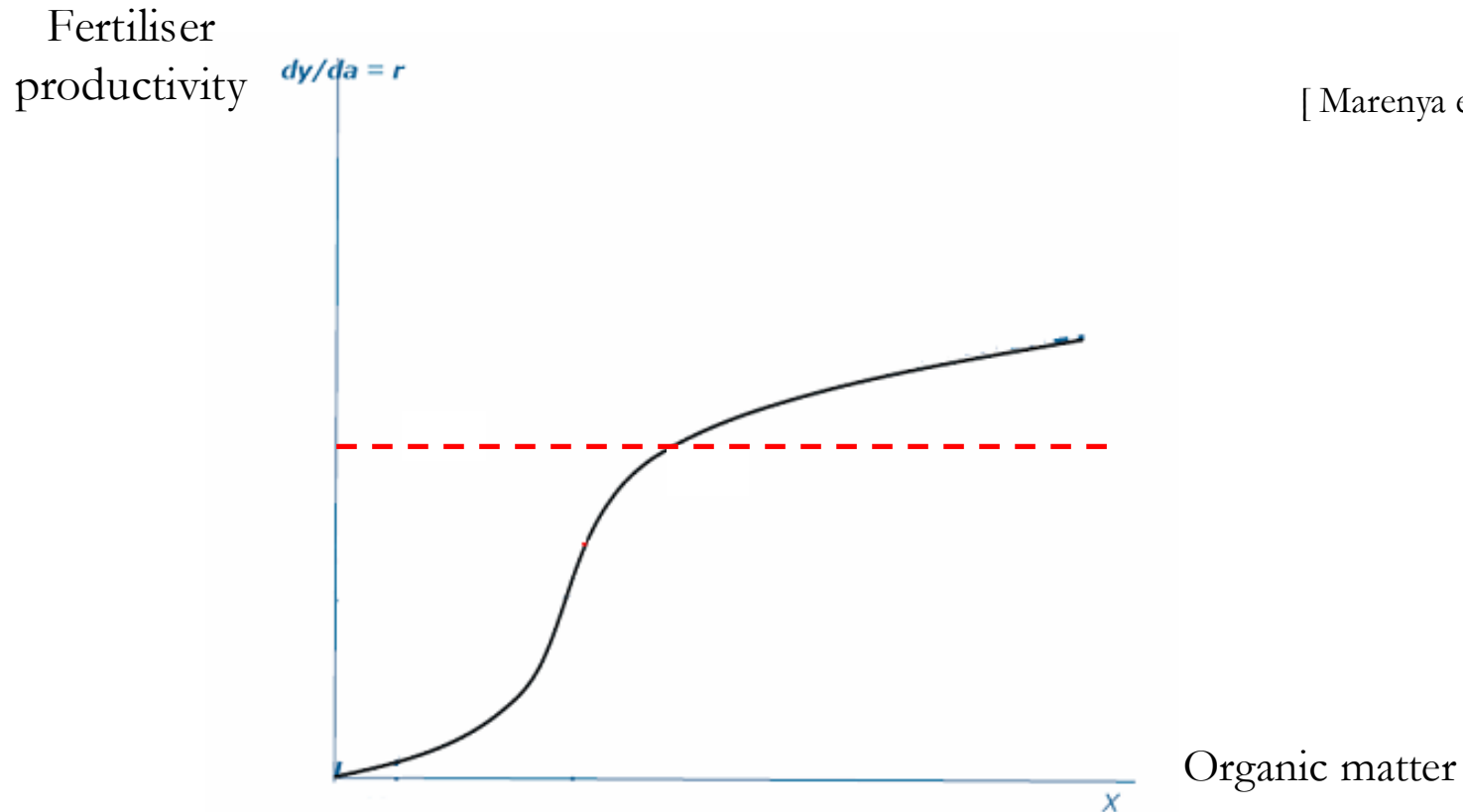
2. Replacement cost approach

Every function get replaced with a close substitute and valued through its cost

Some particularities of soils complex to integrate

- Spatial externalities: watershed protection, carbon sequestration, water regulation, impact on aquifers...
- Threshold effects / not linear / irreversibility
- Ecosystem resilience: to different types of chocs (climatic for example) => valuation of one aspect of 'soil biodiversity'

Poverty traps and soil capital: threshold effects



- ⇒ Economic argument to invest in organic matter replenishment
- ⇒ Complementarity between strategies focused on fertilizers and soil conservation strategies

Some methodological elements on a soil capital investment example: DMC

A soil capital increase through investments in:

- Physical capital: inputs
- Human capital: training, knowledge, research and development
- Social capital: strenghtening property rights, credit access, farmer organisations, inputs access...

⇒ How to measure in a comprehensive way the social rate of return of this kind of investment?

⇒ What are the benefits and the costs at the different scales?

A first level of analysis: the farmer scale

Direct benefits for farmers

- yield increase, for a longer time
- decrease of some production costs
- modification of the growth trajectory of the producer
- increased agrosystem resilience

Costs

- « transition costs»: involvement in new associations/formation, unsuccessful tries at the beginning, adjustment to its own constraints
- eventually: some negative externalities

DMC impact for farmer = net benefits compared to traditional producers

=> Farmers conditions data indicate a very interesting economic impact

A second level analysis: the regional scale

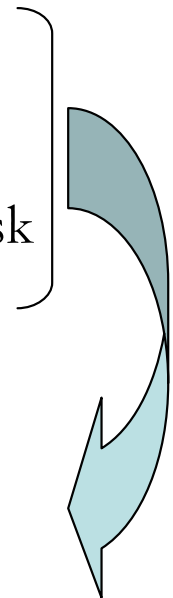
Other benefits

- indirect benefits: erosion limitation, increased biomass production at the village level ... carbon sequestration (global benefit), biodiversity conservation
- spontaneous diffusion / innovation (the whole DMC techniques or only a part)

Costs

- training/vulgarisation
- Costs to adapt the technology to the socio-economic environment
- Costs to adapt the environment to the technology: institutions to decrease market imperfections (credit, property rights, inputs...) and risk

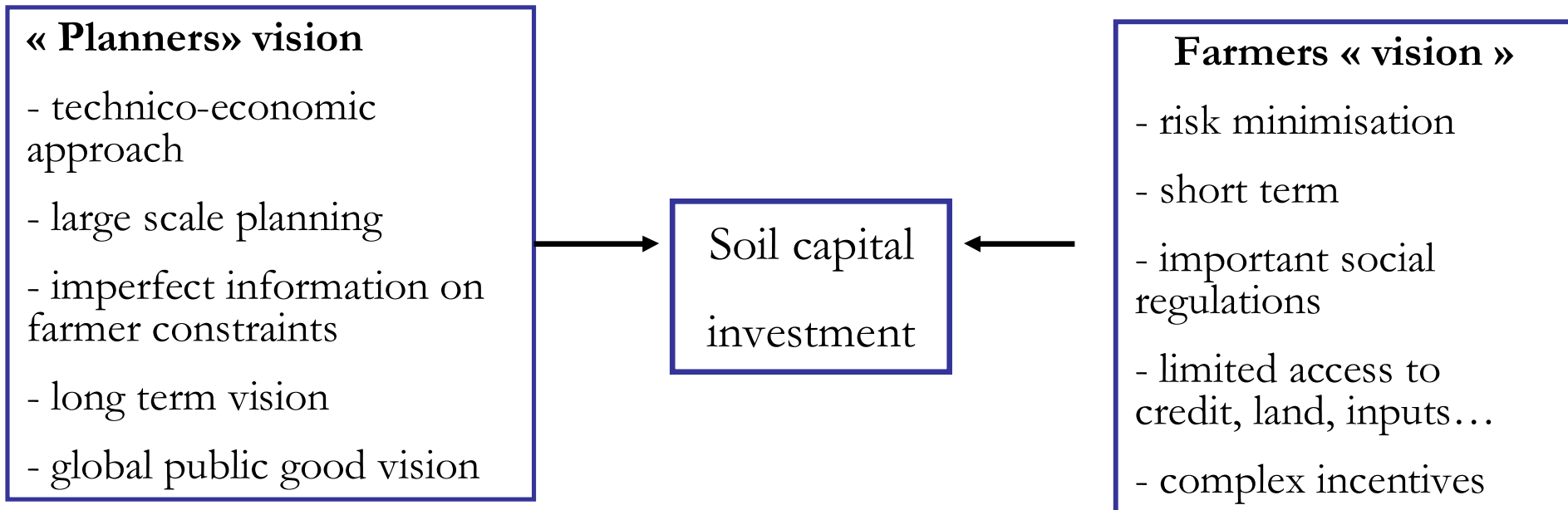
- Depending on farmers constraints and strategies
- Important to understand determinants of adoption to minimize these costs



Many data required

- How does DMC modify the farm growth strategies?
- understanding of the innovation process
- Environmental externalities (erosion, flood regulation...) are difficult to extrapolate from plot level to watershed level
- Negative externalities?
- Soil degradation economic impact and farmers adaptation difficult to assess (Malthus vs Boserup)

To conclude!



=> How to conciliate those different perceptions?

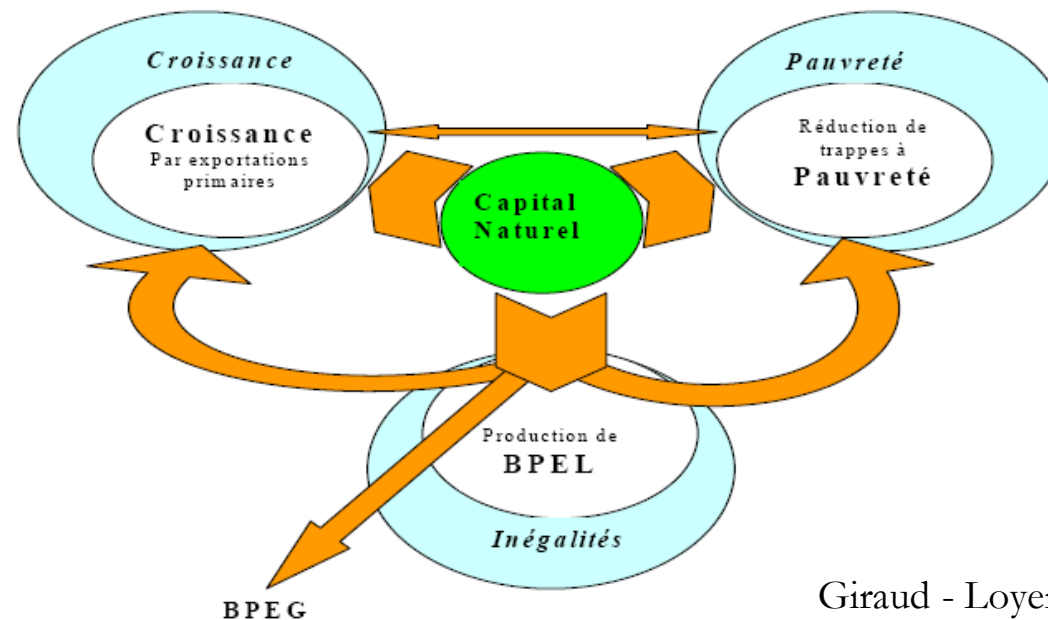
Few subjects for the round-table: focus on DMC

- List of the different constraints to DMC adoption: which are the strongest constraints to DMC adoption? which one can be dealt during the project? How? Which one cannot? How to adapt the approach?
- Threshold effects?
- Qualitative impact of negative externalities ?
- Risk bearing, central question => SCV as a climate buffer versus new risk and dependence introduced (credit, new inputs...)
- Flexibility of the different systems? Of the project? How to conceive a project in which we don't know everything about farmers strategies?
- DMC impact on the different soil functions
- SCV and global public goods:
 - Carbon sequestration and Kyoto protocol
 - SCV and biodiversity



Why to invest in natural capital ?

- Neglected for a long time in development strategies compared to produced and human capital
- A central role in the actual development paradigm: « pro-poor growth »
 - promoting growth: natural capital investment often have high rate of return
 - reducing inequalities: poors very dependant on this asset / poverty traps



Giraud - Loyer (2006)

Interest for this kind of approach ?

- At the farmer level: economic profitability is one of the major determinants of adoption (among others)
- At the regional/project scale: Is such an analysis interesting ?
 - NO: economic tools are not adapted for long term processes / evolving in time
 - YES: the cost of this « change of paradigm » has to be balanced
 - ⇒ opportunity cost of the project compared to other alternatives