









Mapping ecosystem services trade-offs and synergies in a pioneer front context (Brazil)

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Underlines societal dependency towards the **ECOSYSTEM SERVICES** Provisioning FOOD FRESH WATER WOOD AND FIBER FUEL Regulating CLIMATE REGULATION NUTRIENT CYCLING FLOOD REGULATION DISEASE REGULATION WATER PURIFICATION Cultural AESTHETIC SPIRITUAL EDUCATIONAL RECREATIONAL

....

Supporting

Context

SOIL FORMATION PRIMARY PRODUCTION ecosystems (Daily, 1997)

Benefits people obtain from ecosystems (MEA, 2005)

Results

Ecosystem Services (ES) :

Methodology

Discussion



Methodology

Results

Discussion

Ecosystem Services (ES) :

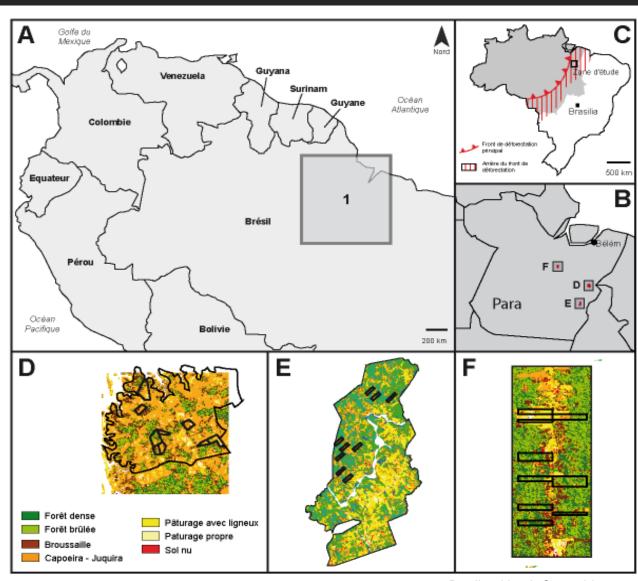
- Considered in an operational way
- Operationalized through the maps
- In interrelations

How to map ecosystem services tradeoffs and synergies and what for ?

Methodology : study sites

Results

Discussion



Realized by J. Oszwald

| | Context | Methodolog | Methodology : field data | | | Results | esults Discussion | | |
|--|---|---|------------------------------------|------------|---------------------------------------|---------------------|-------------------|-------------------------|---------------------|
| | | | | | | | | | |
| | Service écosystémique | ton Régulation | Contrôle | | Maintien | 20 | | 405 | 20% |
| | Régulati Indicateur du cli | ion Régulation Imat du cycle de l'eau | Contrôle de l'érosion du sol | Production | Maintien de la chaîne trophique | Valeur existence | Pollinisation | Cycle des nutriments | Formation du sol |
| AND ADDRESS OF A DESCRIPTION OF A DESCRI | Stocks de carbone) de la végétation | ĸ | | | | | | | |
| and the second second second | Stocks de carbone | ĸ | | х | | | | | |
| | Infiltrabilité du sol | х | × | | | | | | |
| | Eau biodisponible | | | х | | | | | |
| | Qualité chimique du sol | | | x | | | | | |
| | Indice de biodiversité | | | | х | Х | | | |
| | Pollinisateurs | | | | | | х | | |
| | Ingénieurs du sol | | | | | | | Х | Х |



Methodology : generalities

Results

Discussion

How to map ecosystem services tradeoffs and synergies and what for ?

1. Combinaison of single ES maps :

- 1. Map from a **scoring**
- 2. Map from a **PCA**
- 2. Map from landscape units

| | Scoring | PCA | LANDSCAPE UNITS | | |
|---|------------------------------------|-----------------------------|--|--|--|
| Maps for each ES - Le Clec'h et al., 2013 | | | Distance matrix | | |
| | Statistical models linki sensii | Land cover map (6 types) | | | |
| Sc | oring classes | PCA | Landscape units | | |
| | | | Mean value of ES by landscape units | | |
| So | coring map | Trade-offs map | Landscape units map | | |
| S | um of all the scores | On the synthetic variables | Sum by landscape units | | |

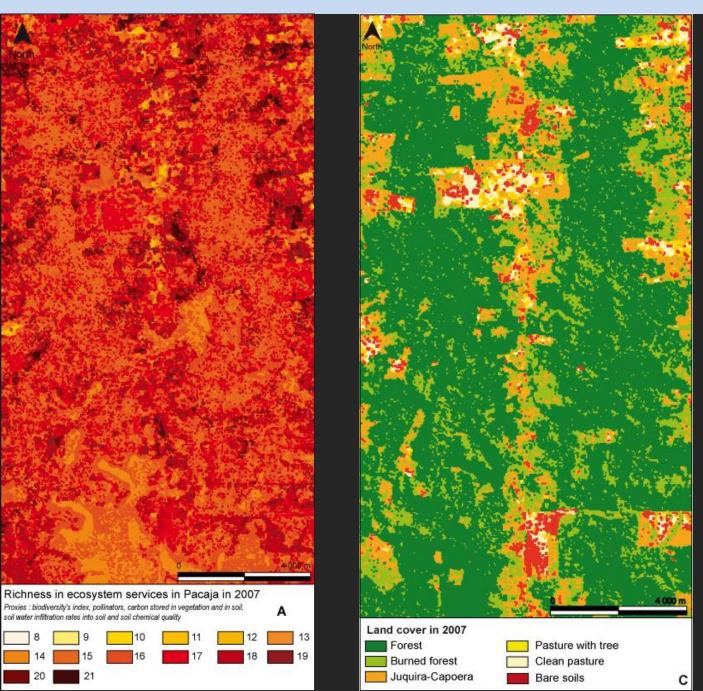
Methodology Results : Maps based on single analysis Discussion

Unequal capacity to modeled ES

| Proxy | R ² (decision tree) |
|-----------------------------|--------------------------------|
| Carbon stocks in vegetation | 0.74 |
| Biodiversity index | 0.65 |
| Available water for plants | 0.39 |

Methodology



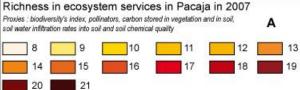




Discussion

Sensitivity to modelized indicators





Proxies : index of biodiversity and carbon stored in vegetation and in soil



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4 000 m Richness in ecosystem services in Pacaja in 2007 Proxies : Soil infiltrability, carbon stored in soil and soil chemical quality 11

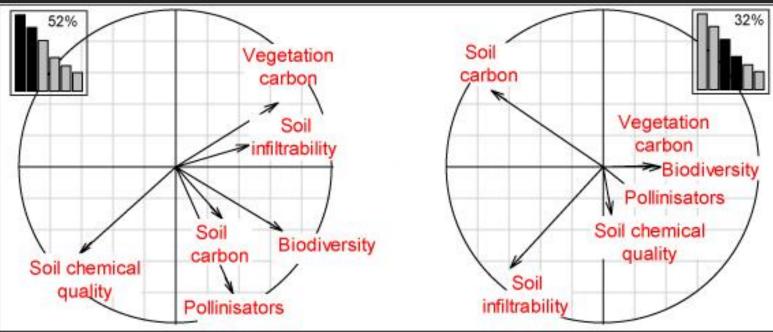
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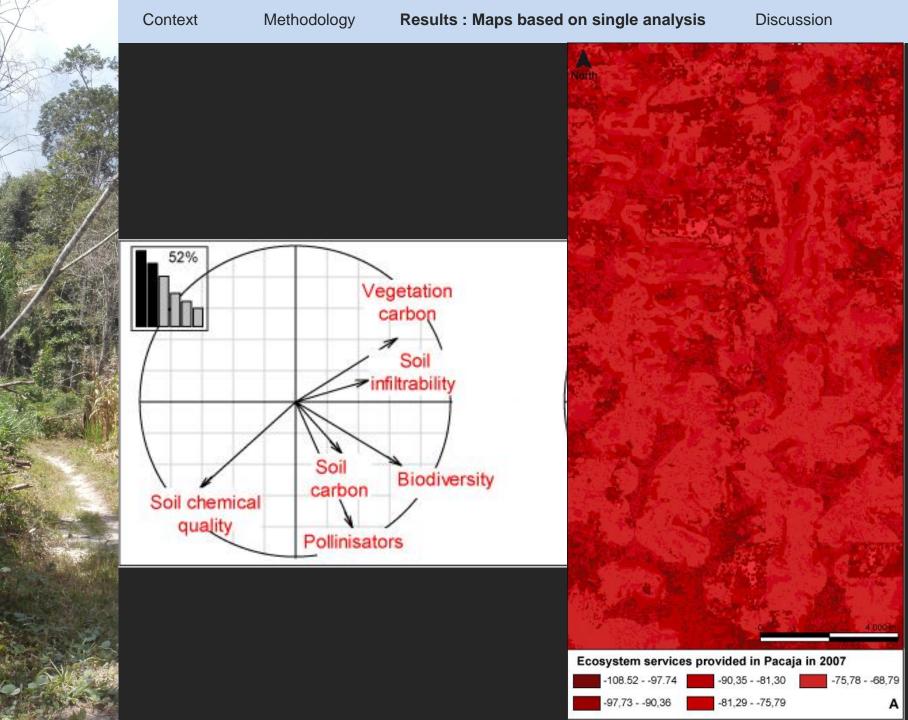


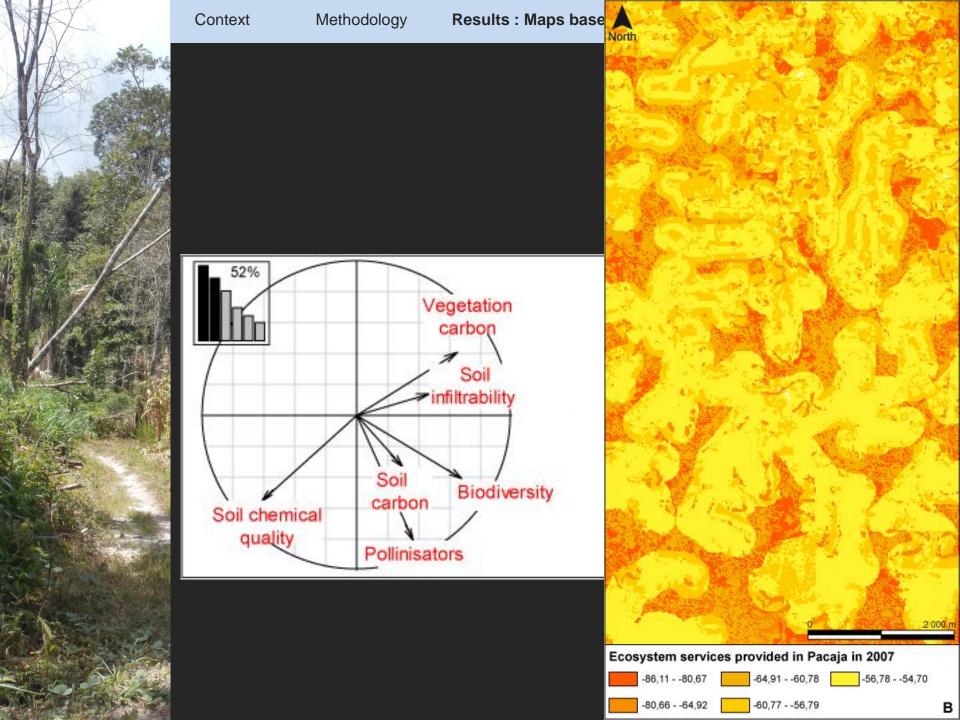
Context Methodology Results : Maps based on single analysis Discussion

PCA

Very synthetic but less explicit





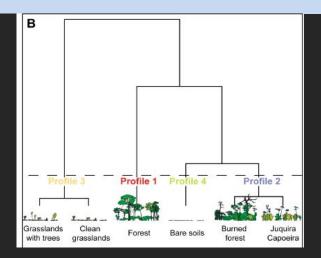


Methodology

Results : Map based on landscape units

Discussion





Methodology

Context

Mapping ES trade-offs rises technical questions

Results

Discussion

There is no one single way to map ES and trade-offs.

Methodological questions : uncertainty, site effect, choice of ES, scale change.

Undeniable questions but questions that exist in all mapping practices.

| Context | Methodology | Results Discussion | | |
|--------------------|---|--|--|--|
| Method | Advantages | Limitations | | |
| PCA | Explanatory tool to understand the correlations between the indicators; Data driven mapping tool. | Difficulties to interpret and explain in terms of the original data (landscape characteristics); Based on monothematic maps (uncertainty); Difficulties to take the interrelationships into account. | | |
| Scoring | Overview of ES hotspots; Opportunity of scoring particular indicators; Easy to implement. | Non data driven; Failure to address the relations between the ES; Limited by the impact of the subjective discretization choice; Based on monothematic maps (uncertainty). | | |
| Landscape units | Very simple method; Very easy map to interpret; Overview of the roles played by the different areas in the ES providing. | Limitation in the remote sensing data use to map (simplification); Limitation of studied indicators; The interrelationships are not taken into account. | | |

Methodology

Results

Mapping ES trade-offs rises questions about the uses

Several uses of the notion of ES. Necessity to adapt the maps and their methods to these uses.

| Pedagogical | Heuristic | Policies / political |
|--|--|--|
| Understanding of social dependance to | Reflexion on the exercice of mapping | <i>Quantitativist approach : tool to evaluate policies</i> |
| EXAMPSE OF COMPARENTS Landscape units method : Easy to explain Landscape easily monitored and affected | Reflexion on the notion itself | Qualitative approach : tool to bring and lead public debate. PCA and scoring methods Flexible concerning the choice of ES |

Dufour *et al.*, 2014. Cartographie, services écosystémiques et gestion environnementale. Entre neutralité technicienne et outil d'empowerment . *In* Arnauld de Sartre X., M. Castro, S. Dufour, J. Oszwald (eds). *Political Ecology des services écosystémiques*, Bruxelles, Peter Lang éditions











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Merci pour votre attention

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