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Net Primary Production Carbon Demand and Supply: A Case Study in Morocco

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Net Primary Production Carbon Demand and Supply: A Case Study In Morocco

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Our Common
Future

Hannover · Essen
2 - 6 November 2010



Vulnerability Assessment and Risk Level of Ecosystem Services for Climate Change Impacts and Adaptation in Morocco

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Outline

Introduction

methodology

Results

Conclusion



Introduction:

- The amount of net primary production (NPP) required to support human activities is a powerful measure of the aggregate impact on the biosphere and indicator of societal vulnerability to climate change.
- A unique combination of satellite, socioeconomic data and data collection by questionnaire during field trips, were used to explore the relationship between the NPP (carbon *supply*) and the amount of NPP-required (*Demand*) in Morocco.
- “Global patterns in human consumption of net primary production”,
Marc L. Imhoff, Lahouari Bounoua et al. Published in *Nature* /VOL 429/
24 JUNE 2004



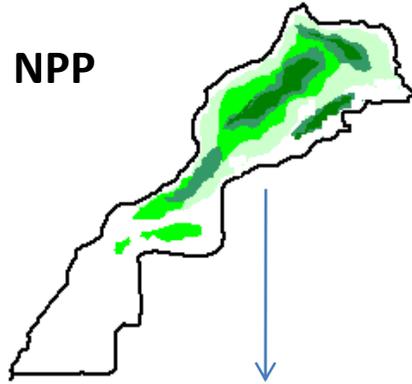
Objective:

To what extent increases in human demand for food and fiber will affect ecosystems sustainability in Morocco within the context of climate change?



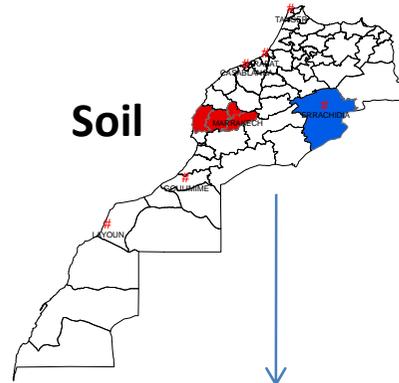
Methodology:

NPP

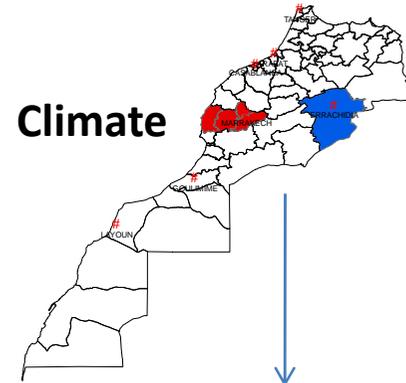


SUPPLY

Soil



Climate



Soil characteristics

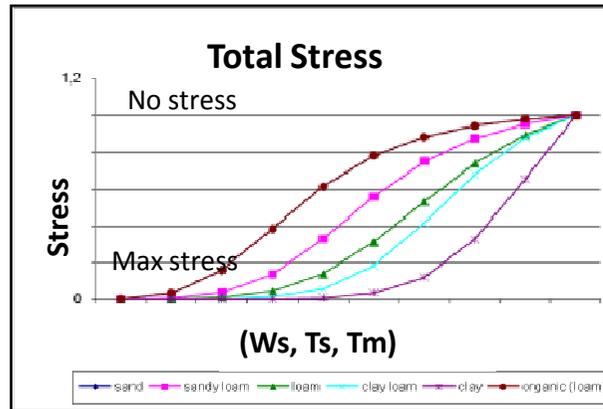
Climate Changes (T,P)

Climate change

$$NPP_{2015} = NPP_{2010} * TT_s(2015)$$

$$NPP_{2020} = NPP_{2015} * TT_s(2020)$$

$$NPP_{2025} = NPP_{2020} * TT_s(2025)$$



Total_stress

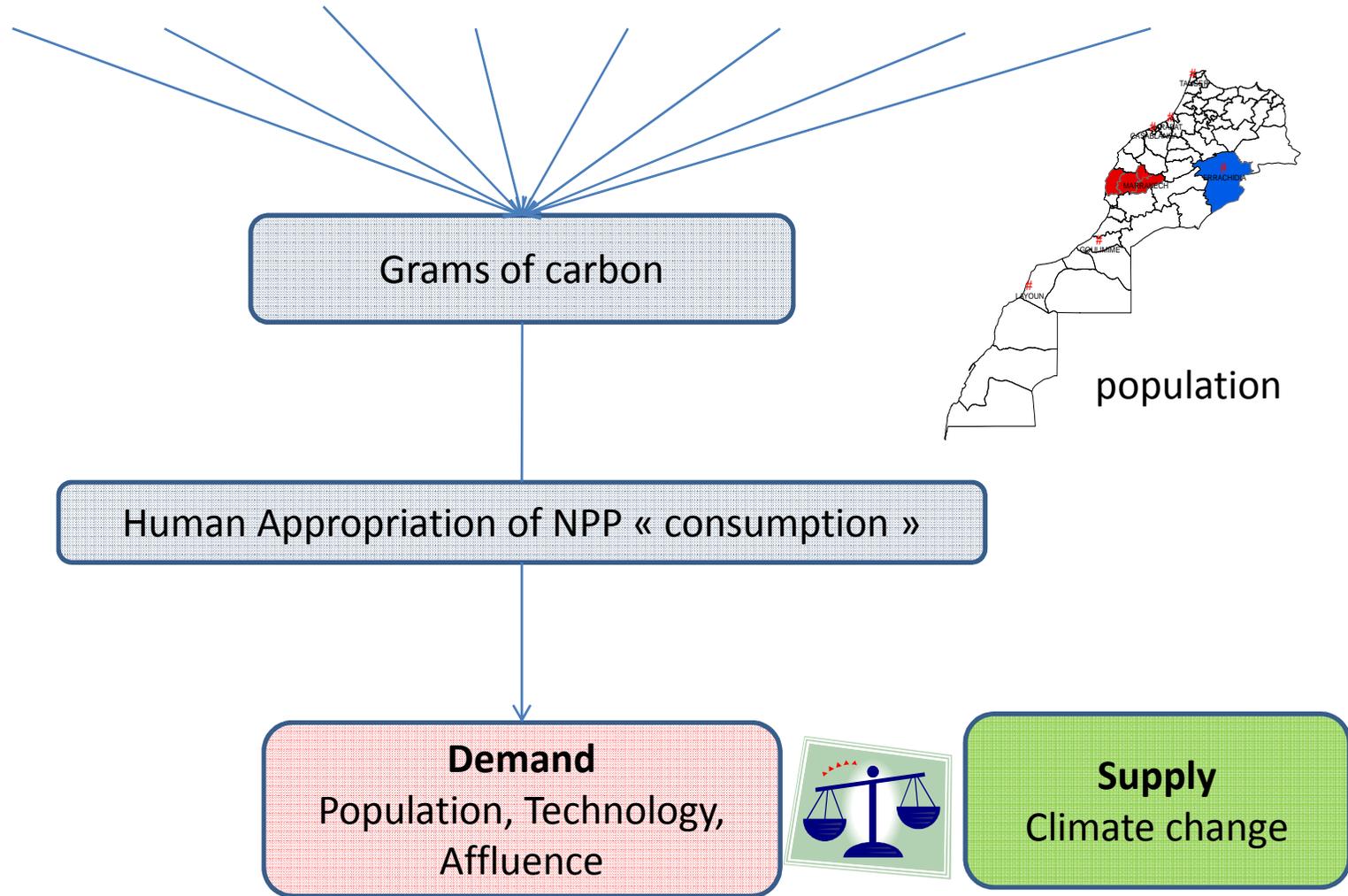
$$\Pi = W_s * T_s * S_s$$



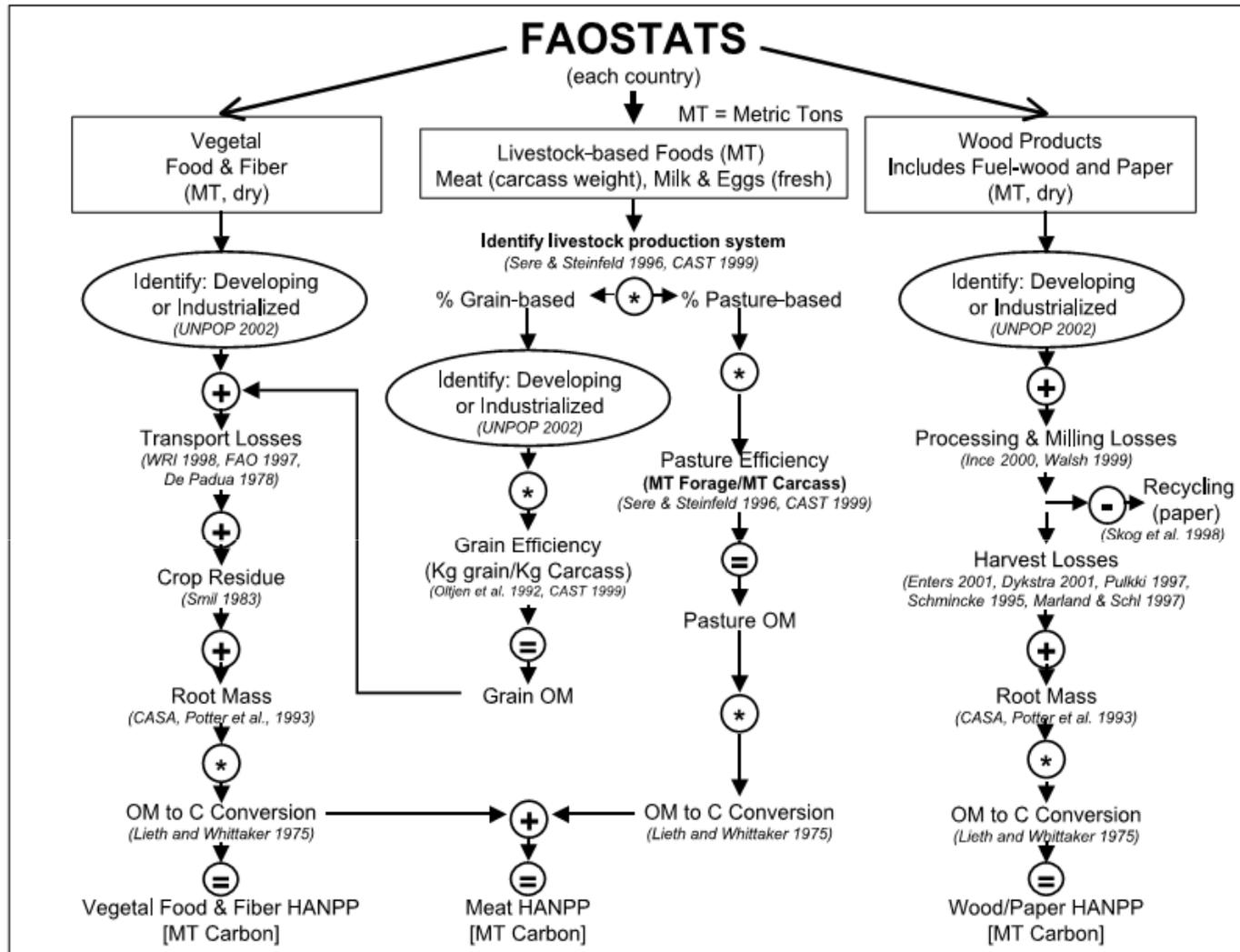
Methodology:

Demand

Vegetal food eggs meat milk paper Fiber crop Fib Furnish wood

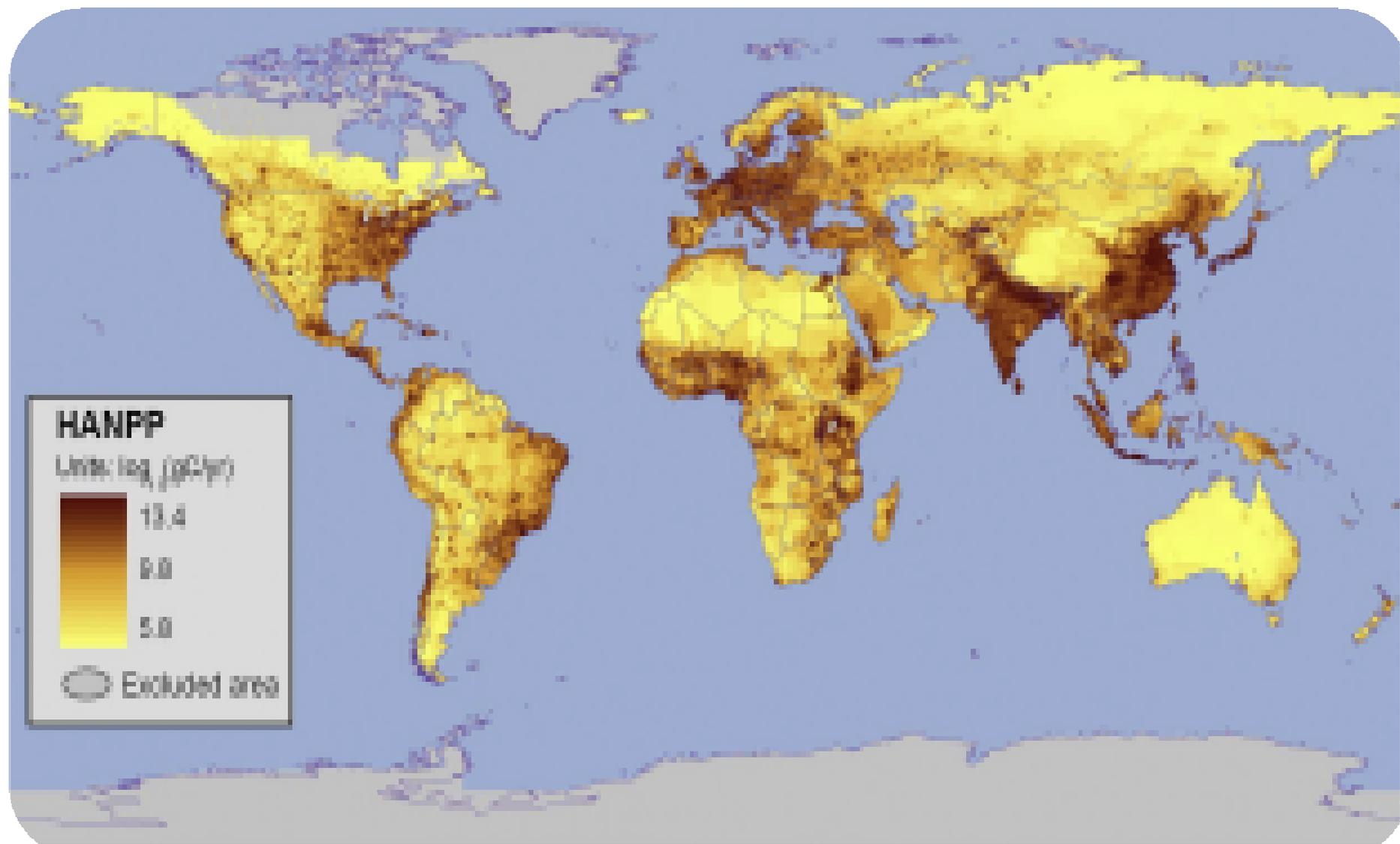


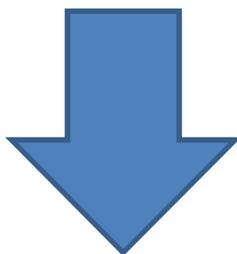
Flow of Computation of the end products at the landscape level



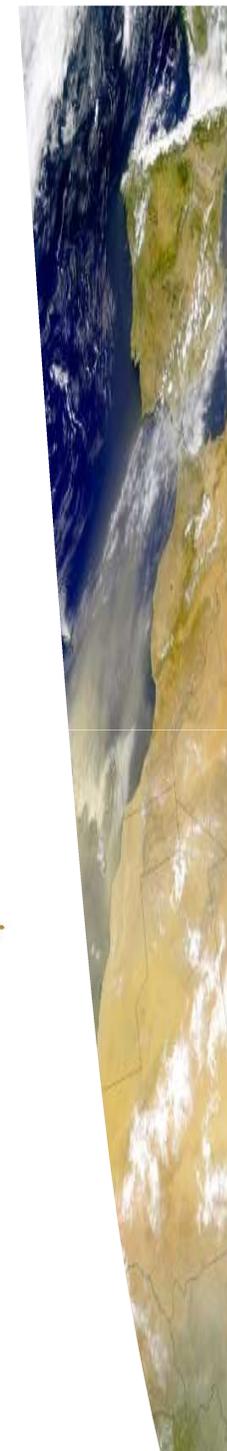
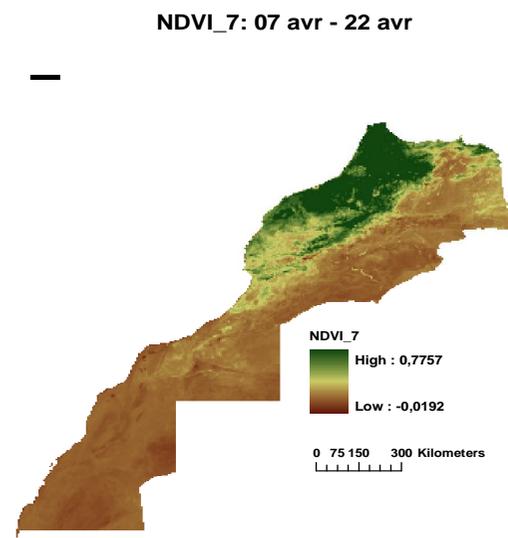
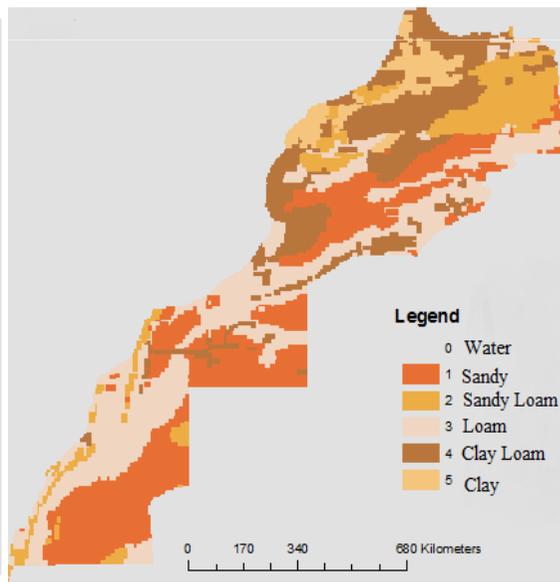
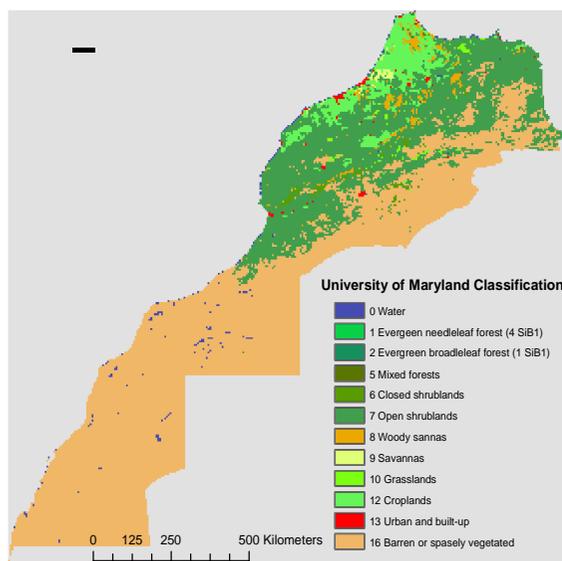
From Imhoff and Bounoua 2006





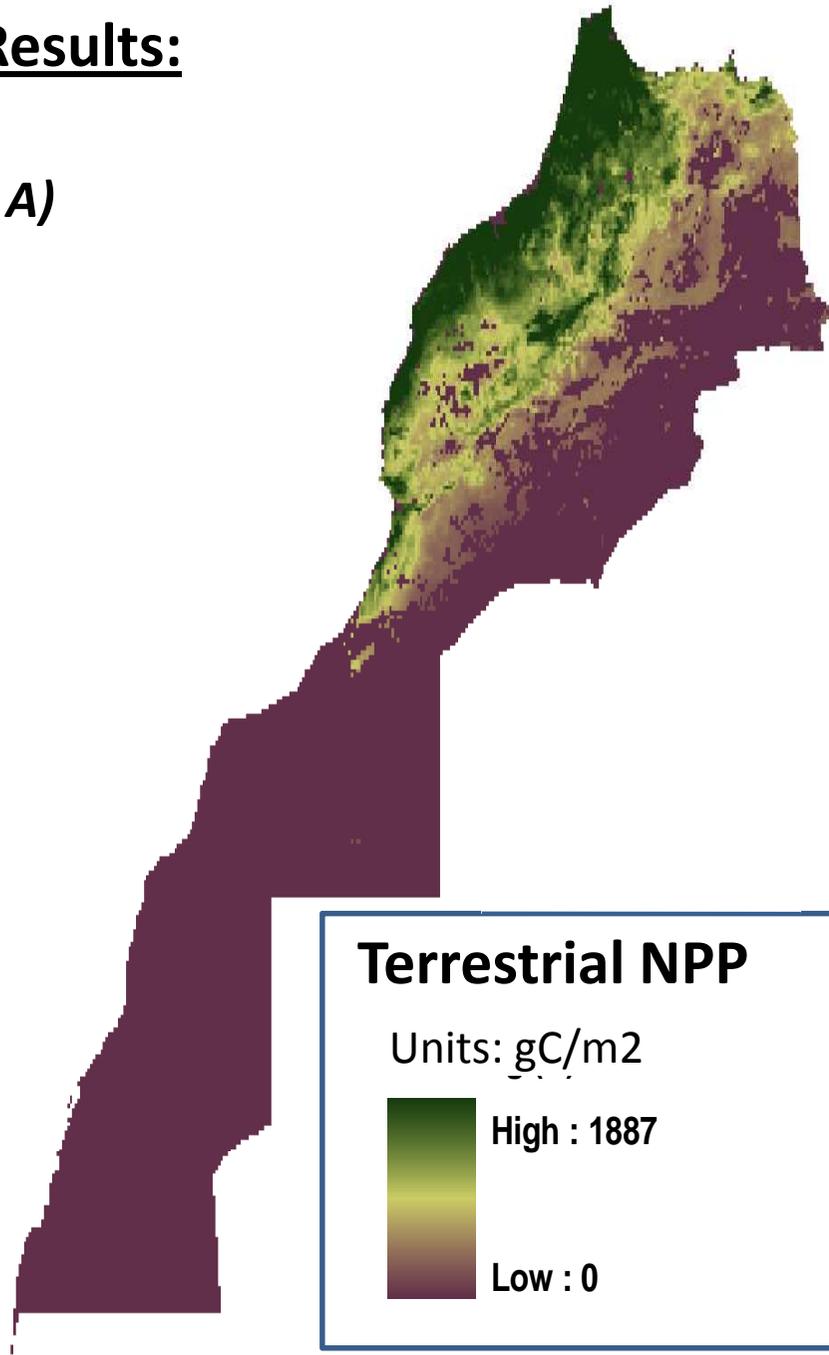


All data were gridded at 0.05 ° latitude/longitude which is equivalent to a spatial resolution of about 5 X 5 km.

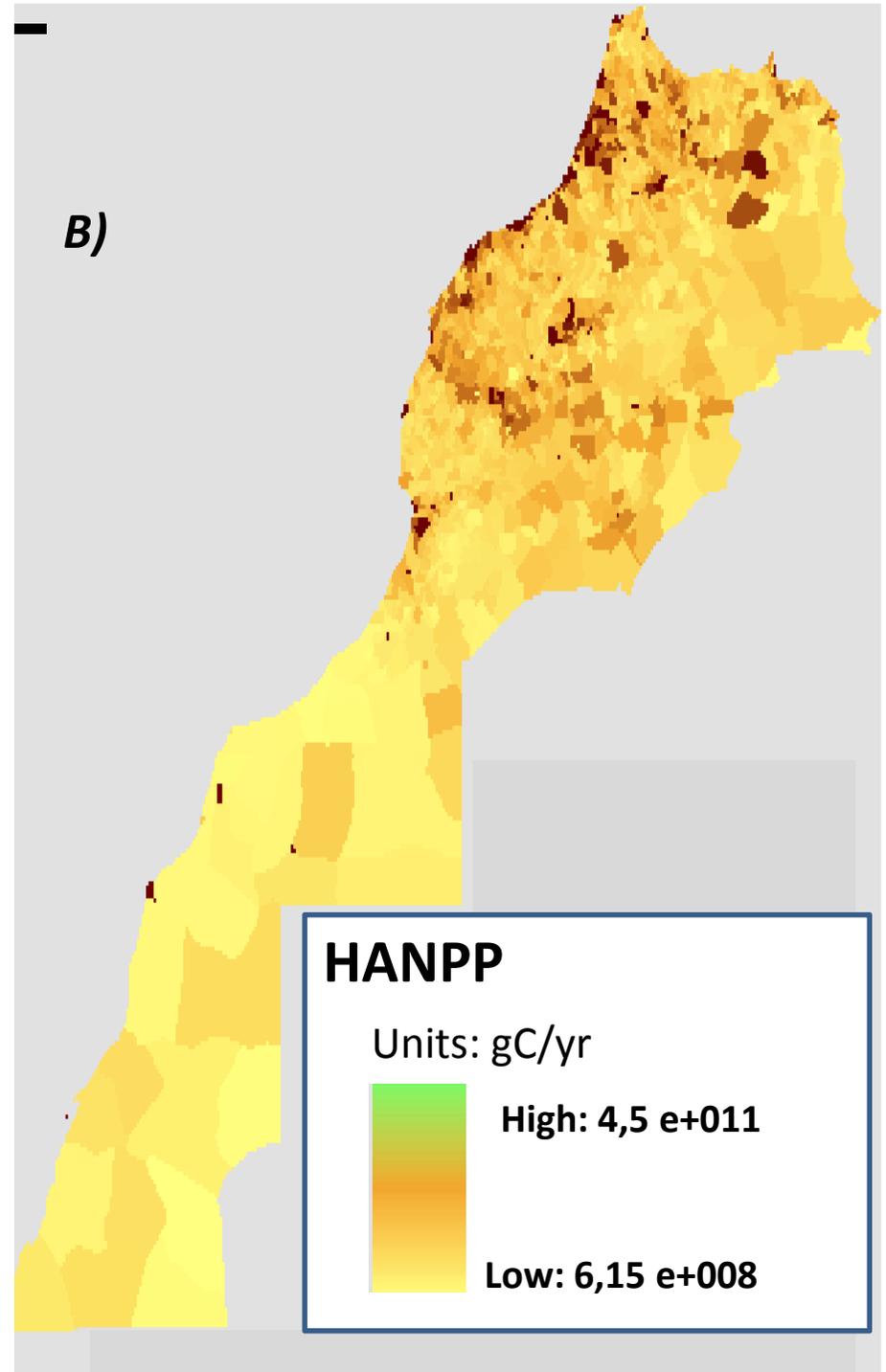


Results:

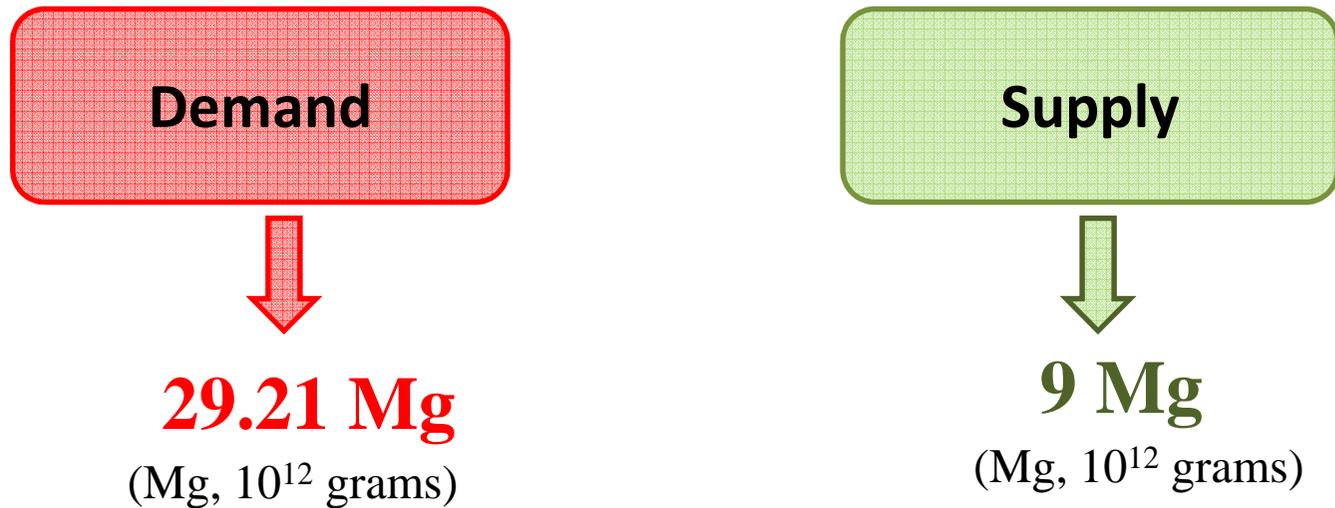
A)



B)

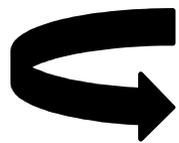


Results:



Comparing the total values for NPP **supply** and **demand**, we find that Moroccans appropriate approximately

324.58% of supply.



Without adding the impacts of climate change to the productivity of the landscape, it would take more than 3 years for Morocco's ecosystems to produce the amount of food and fiber appropriated by local populations in 1 year.

Future Scenarios:

$$I = PAT$$

(Holdren and Ehrlich [1974])

(I): Impact of human activities

(P): Population size

(A): Affluence

(T): Technology

Combination	P	A	T
1	↑	—	—
2	—	↑	—
3	—	↑	↑
4	↑	↑	—
5	↑	↑	↑



Conclusion:

- Changing patterns of HANPP will have important consequences for human welfare and global biodiversity.
- Further growth and development in Morocco is likely to impoverish local ecosystems and diminish the vital services they provide , it will also require increased NPP imports, alterations to flows of NPP-based products and exertions of greater pressure on ecosystems elsewhere.
- Improved technologies, meanwhile, may help to reduce HANPP through better efficiencies and product substitutions.



Thank you

4 6 2006



Guide-Voyage Info

Terrestrial NPP supply (here after designated as NPP) in the form of elemental carbon was estimated by applying the Carnegie-Ames-Stanford Approach (CASA) terrestrial carbon model to global fields of normalized difference vegetation index (NDVI) from the Advanced Very High Resolution Radiometer (AVHRR) and surface climatology data from ISLSCP II (International Satellite Land Surface Climatology Project initiative II) and the Global Inventory Monitoring and Modeling System (GIMMS).



nearly 32 million and an area of 710,850 km²

[4] From a biological perspective, NPP represents the primary energy source for Earth's ecosystems and complex food webs by supplying food energy to the planet's hetero- trophic organisms (organisms that require preformed organic compounds for food, including human beings).

Also included is an exploration of how changing population and socioeconomic conditions are reflected as potential forcings in NPP carbon demand under different consumption scenarios.

scenarios. In order to avoid confusion with the various published definitions of HANPP [Haberl et al., 2002], quantities reported here for Human Appropriated NPP or HANPP represent the amount of total NPP required (as elemental carbon) to produce consumed products including; food, fiber, wood, and wood-based fuels (same as Imhoff et al. [2004]). NPP required, NPP demand, and HANPP are synonymous terms in this paper



Terrestrial NPP supply (here after designated as NPP) in the form of elemental carbon was estimated by applying the Carnegie-Ames-Stanford Approach (CASA) terrestrial carbon model [Potter et al., 1993] to global fields of normalized difference vegetation index (NDVI) from the

Advanced Very High Resolution Radiometer (AVHRR) and surface climatology data from ISLSCP II (International Satellite Land Surface Climatology Project initiative II) [Hall et al., 2005] and the Global Inventory Monitoring and Modeling System (GIMMS).

For calculations of per capita consumption at the national level, the population of these entities was added to that of the administrative country and a national per capita consumption was obtained by dividing the administrative country's consumption by the total population.



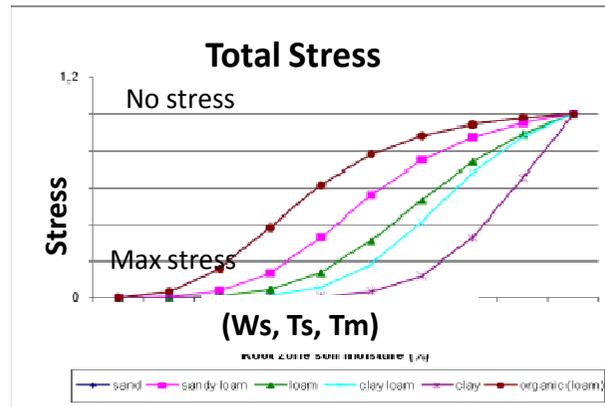
Without major changes to the productivity of the landscape, (comment ça va se développer ds le future) it would take more than 2 years for this region's ecosystems to



Scenarios modeling the impact of per capita consumption, population growth, and technology suggest that NPP demand is likely to increase substantially in the next 40 years despite better harvesting and processing efficiencies.







Methodology:

