

Sustainable Jobs from BECCS in South America

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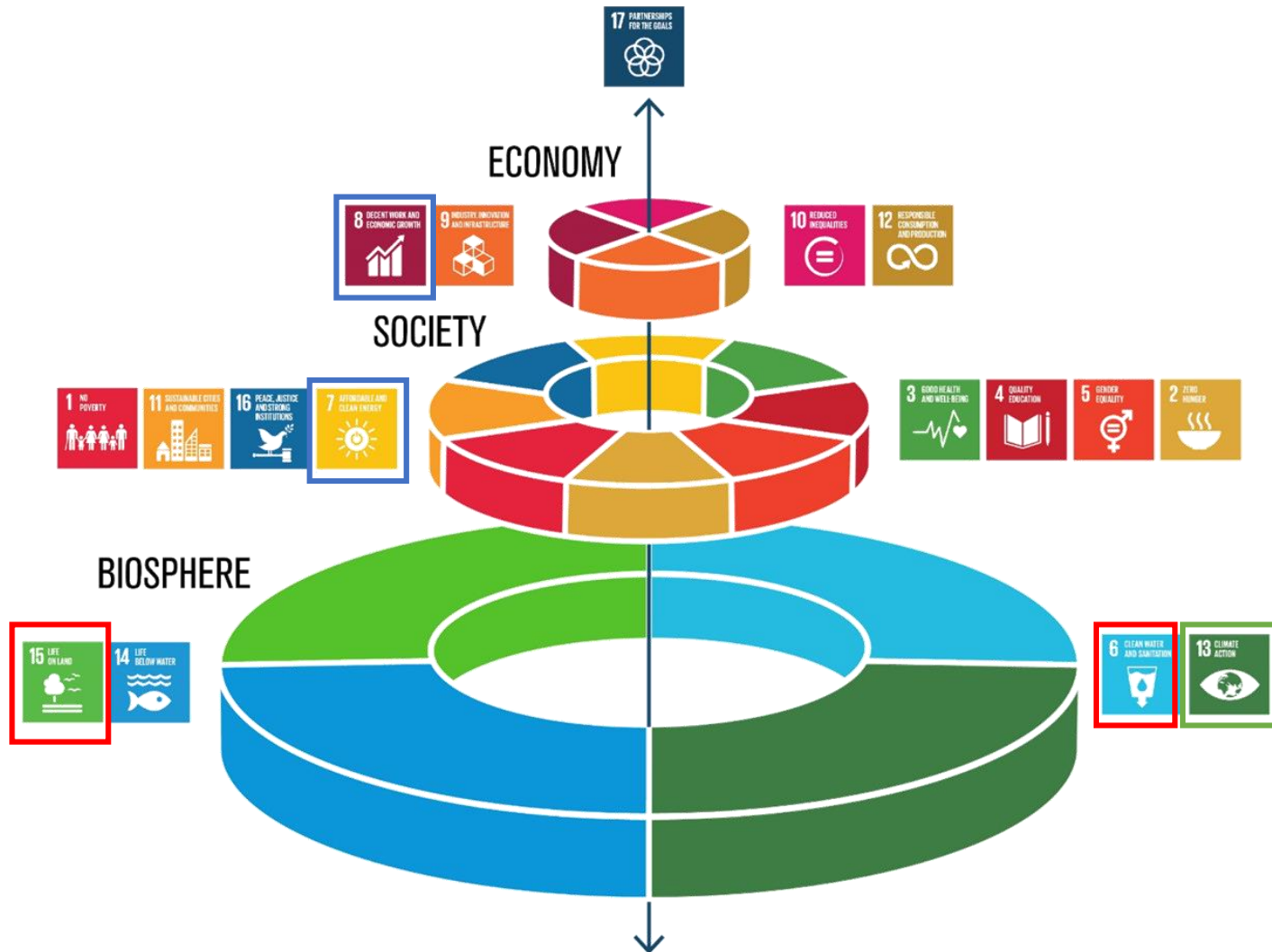
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BECCS and the SDGs: not all about cost



So far the focus has been on...

- **Objective:** climate action
- **Potential unintended consequences** to avoid: life on land, clean water
- **Co-benefits:**
 - affordable clean energy

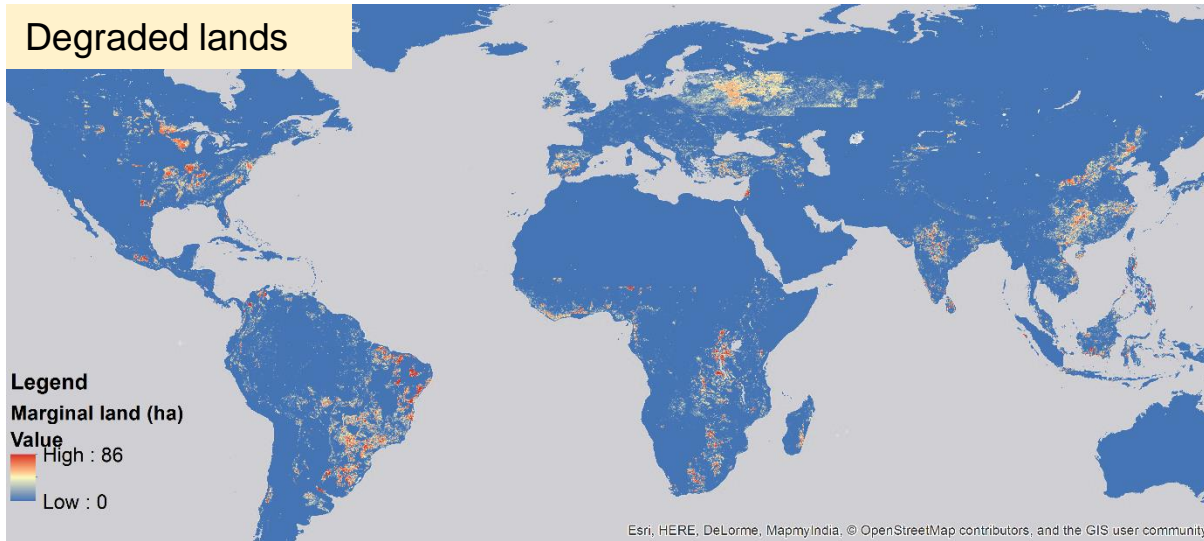
But important added value to consider is also BECCS impact on:

- **decent work and economic growth**

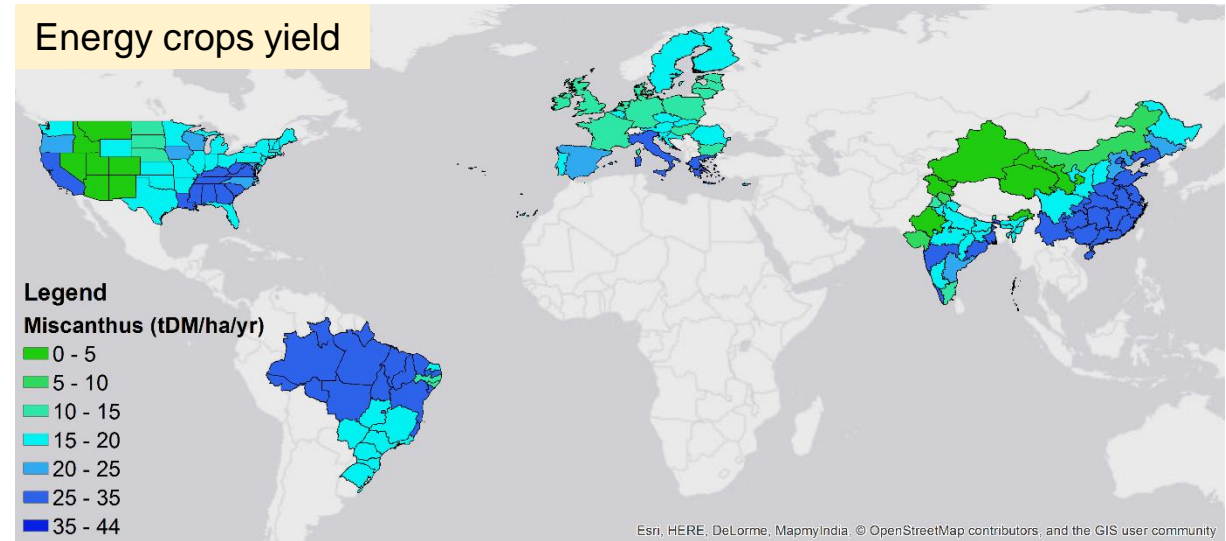
Cost vs. value

Different geophysical constraints...

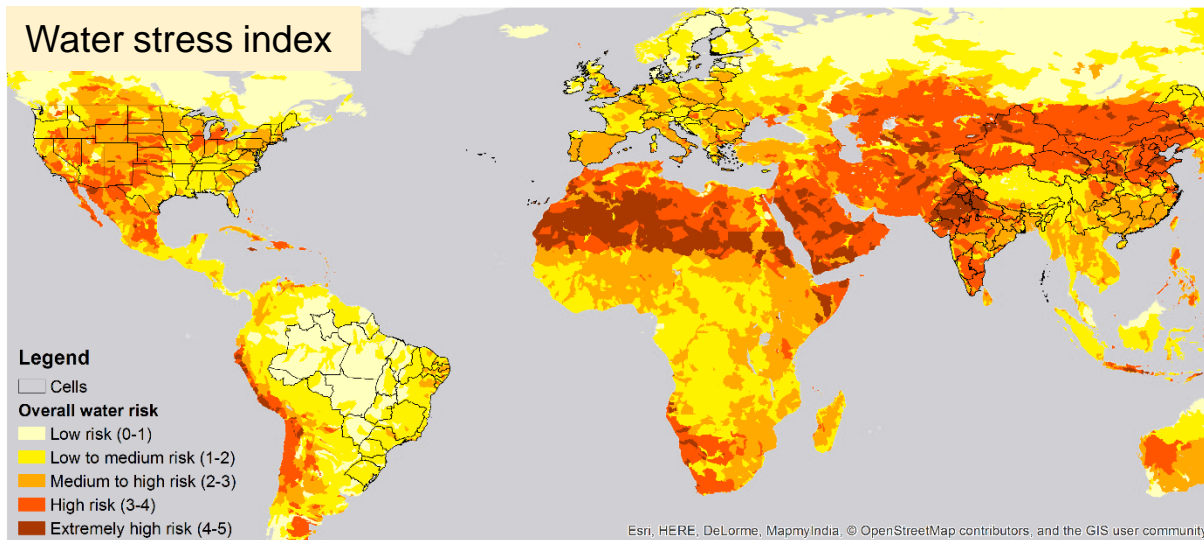
Degraded lands



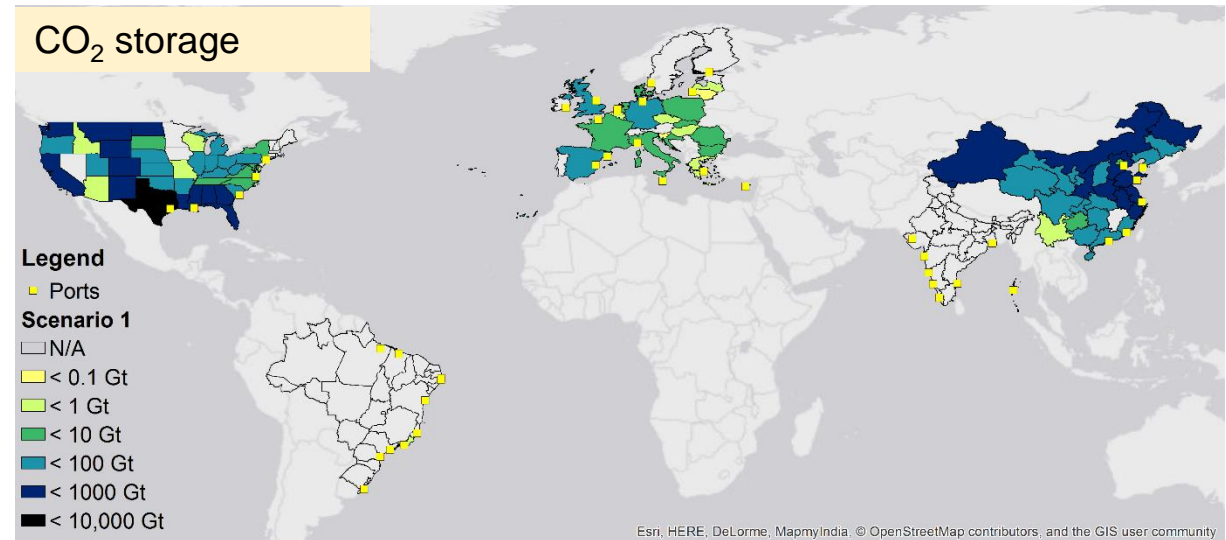
Energy crops yield



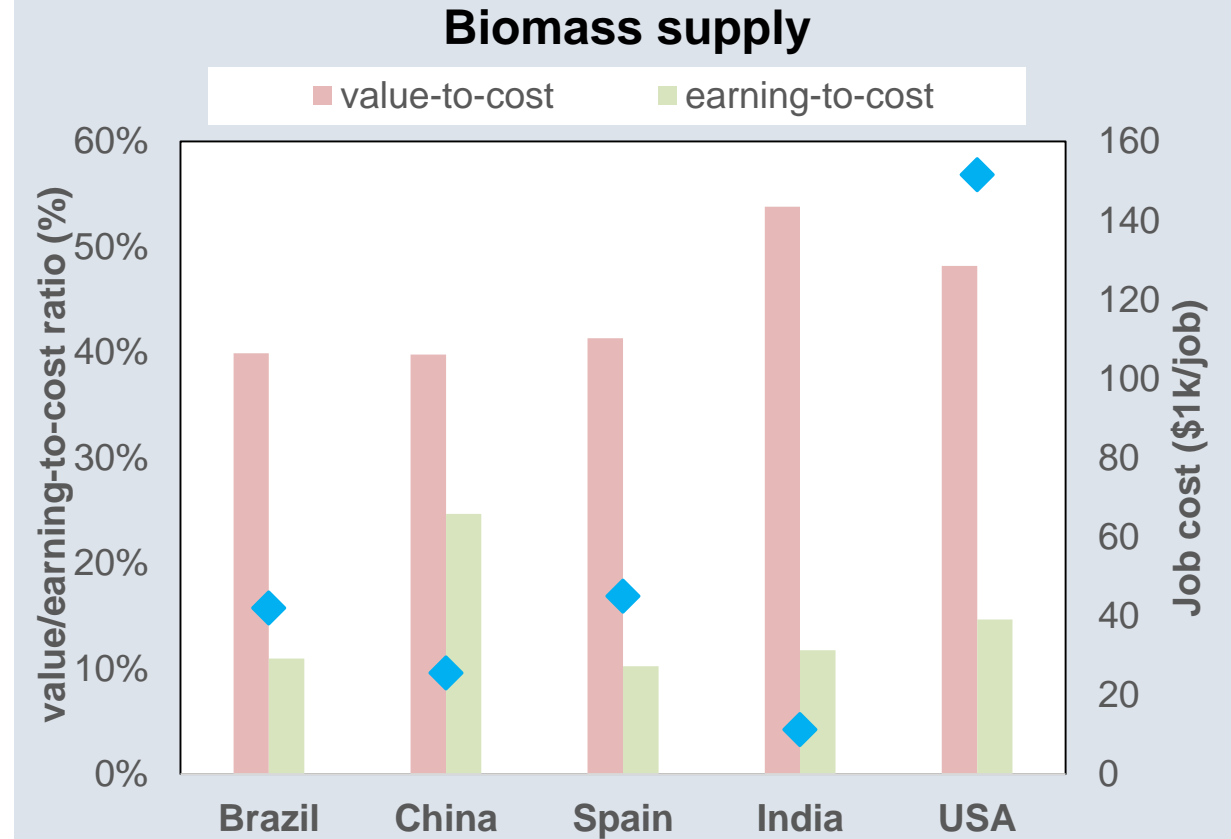
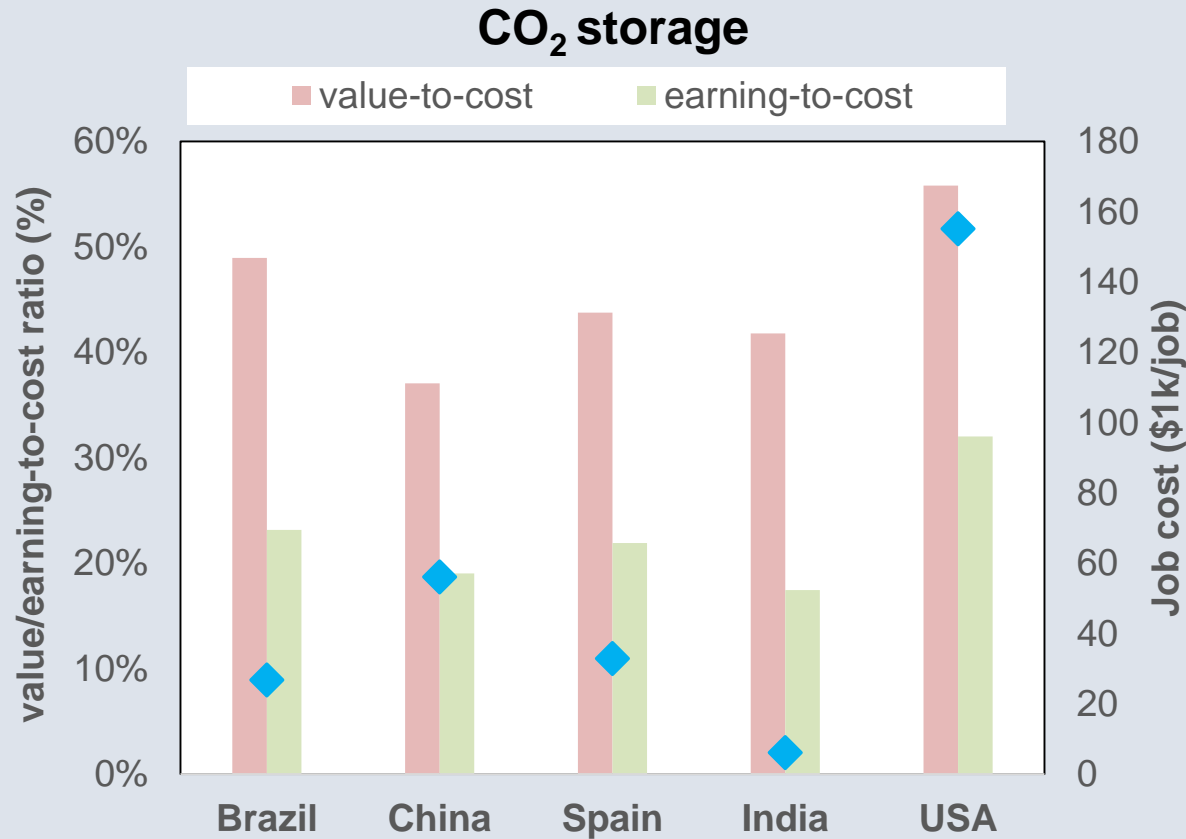
Water stress index



CO₂ storage



...and different economic opportunities



MONET-JEDI Integrated approach

Monet model

Simulation framework:

(Supply chain cost breakdown):

- Biomass supply



- CO₂ storage



Optimization framework:

- 1 GtCO₂ removed for each region
- No CO₂ trading
- Biomass trading between regions
- Target year: 2030
- Objective function:

$$\text{Min } \sum_y tcost_y - tvalue_y$$

$sr \in \{UK, Illinois.. \}$
 $i \in \{land, farming \dots\}$
 $b \in \{Mischantus, willow \dots\}$
 $p \in \{Hull, New York \dots\}$
 $t \in \{truck, Ship \dots\}$

$s \in \{Agriculture, manufacture \dots\}$

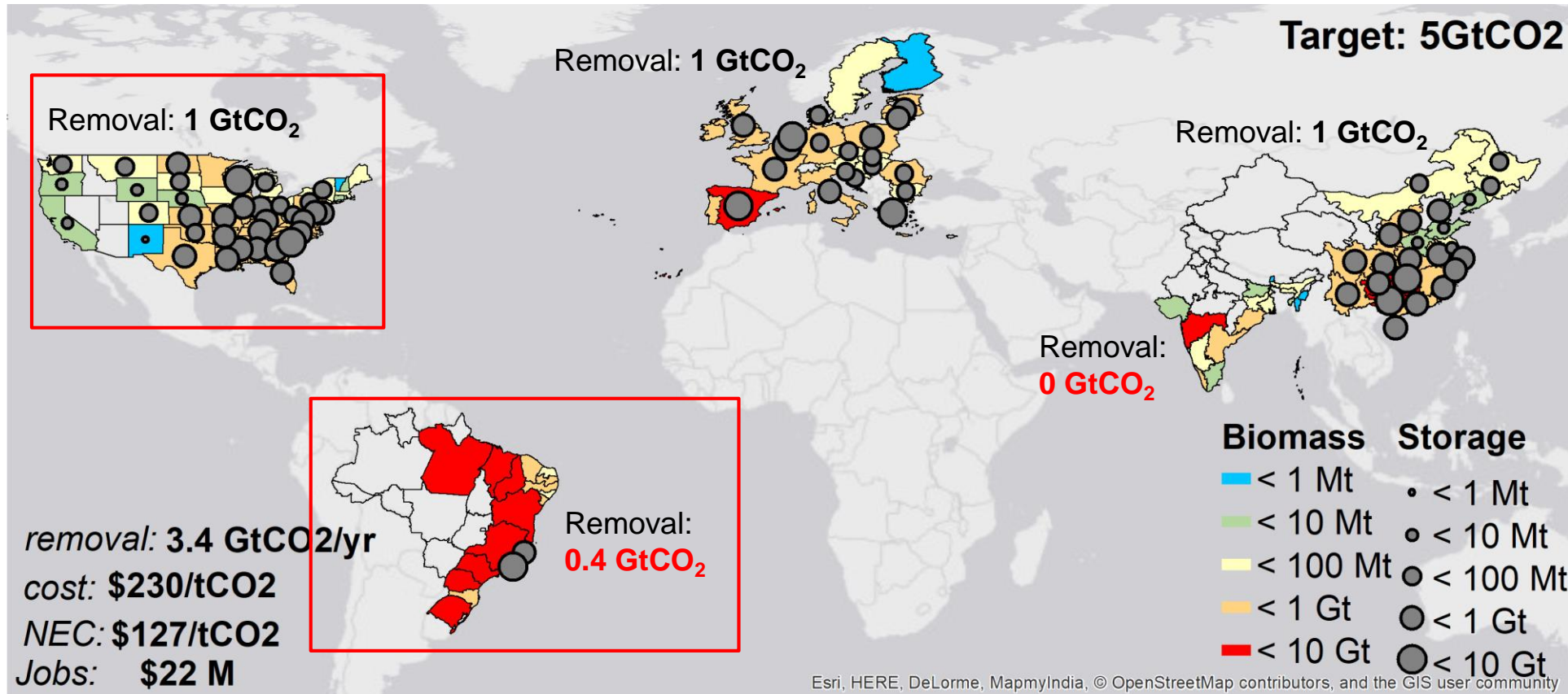
JEDI

- Sector breakdown
- Input / Output tables
- Socio-economic indicators

Metrics:

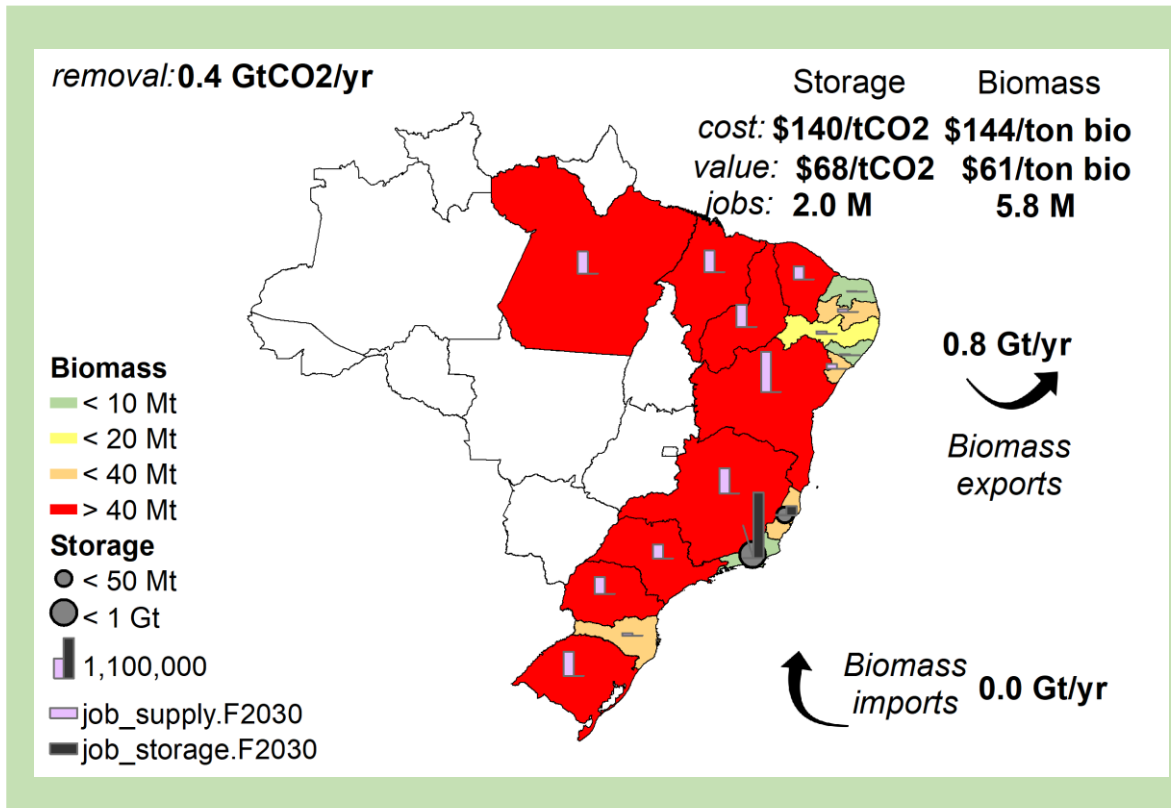
- Gross value added
- Earnings
- Employment

Large scale deployment of BECCS

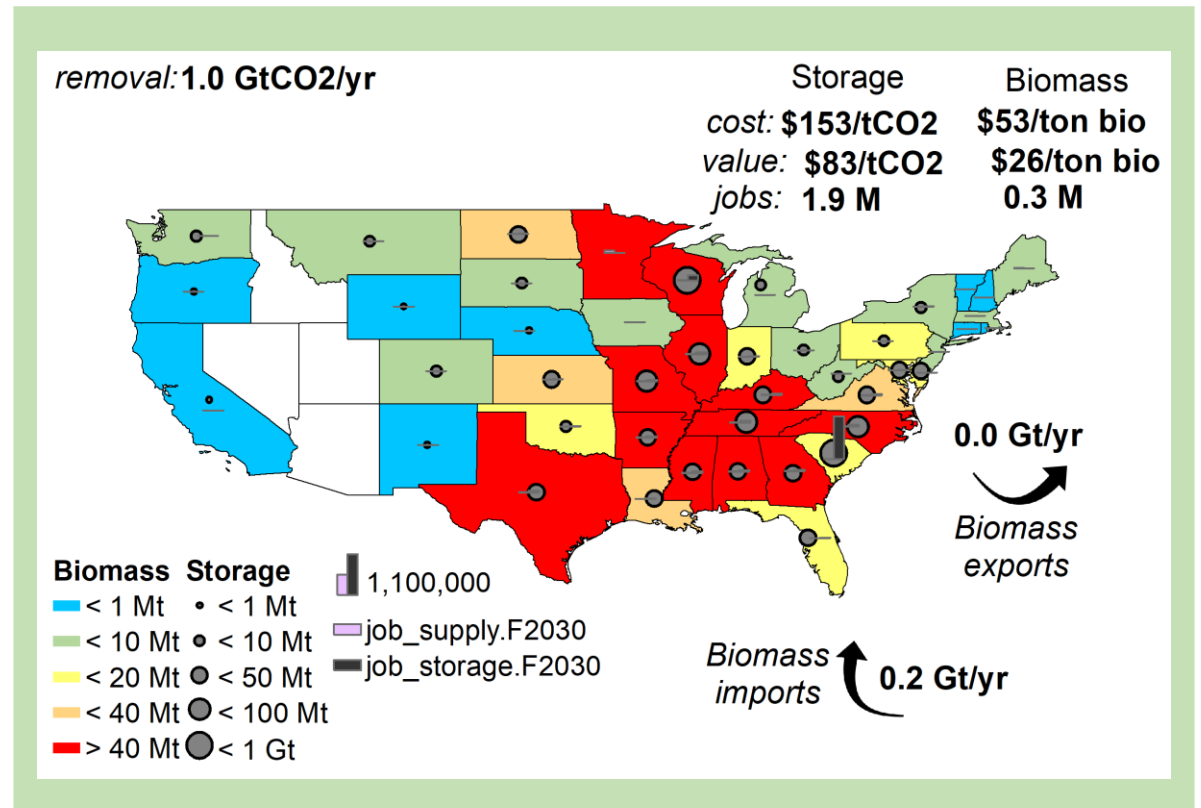


- Cannot meet the 5 GtCO₂ target because of CO₂ storage and biomass availability constraints
- Regions with low storage availability supply biomass to region with high storage availability

Comparing two economies



- Brazil cannot meet a 1GtCO₂/yr target (lack of storage)
- Large job creation from biomass production



- Some biomass imports from Brazil
- Job creation driven by CO₂ storage, very limited contribution from biomass production

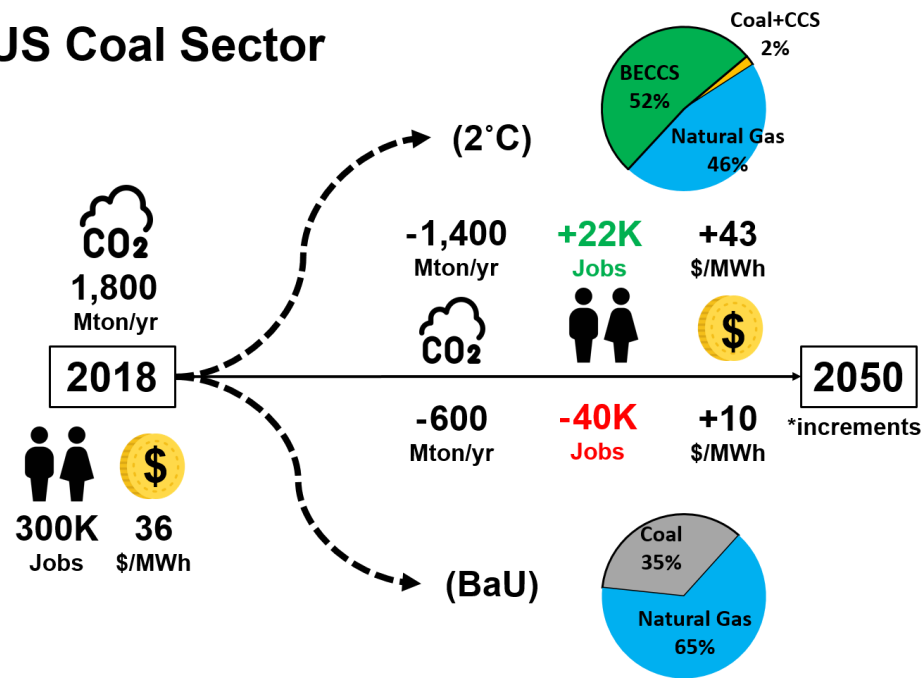
Conclusion

- We proposed a novel optimization approach that account for other, often overlooked, BECCS deployment impacts on sustainable development: employment and economic growth.
- When **social impacts** rather than **costs** alone are targeted, the cooperative BECCS supply chains show the greatest co-benefits
- In this way, each regions focus on its own local expertise (sustainable biomass production in Brazil and CCS deployment in China and US) and maximize job creation while reducing costs

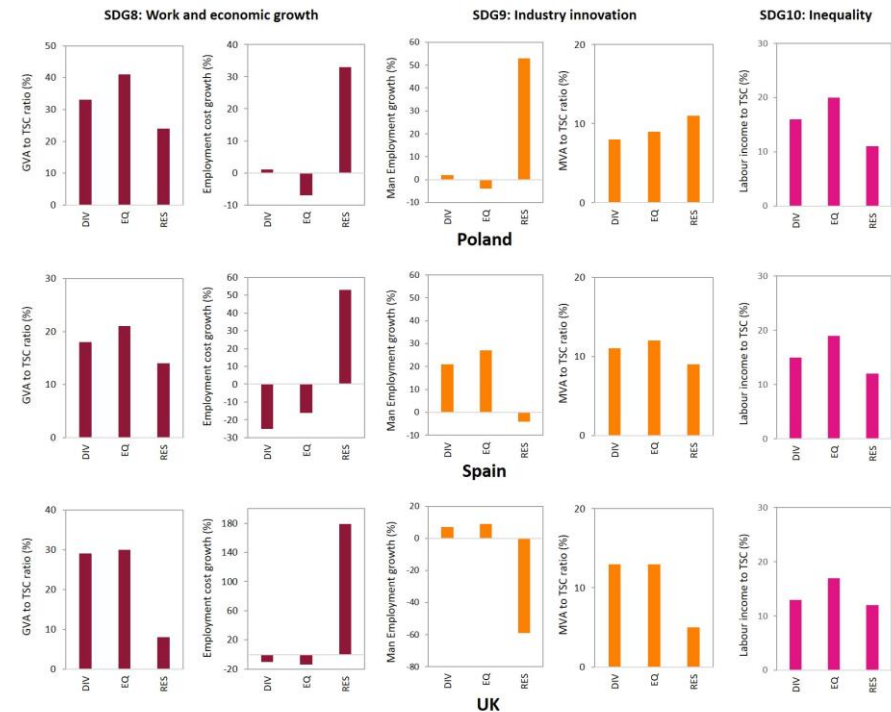
Additional works on Job creation

- 1) BECCS for the US coal sector :
- 2) Just a transition for EU energy systems:

US Coal Sector



Patrizio et al (2019). Reducing US Coal Emissions Can Boost Employment, Joule



Patrizio et al (Forthcoming). Socially equitable energy system, Nature Sustainability

Gaps in the literature

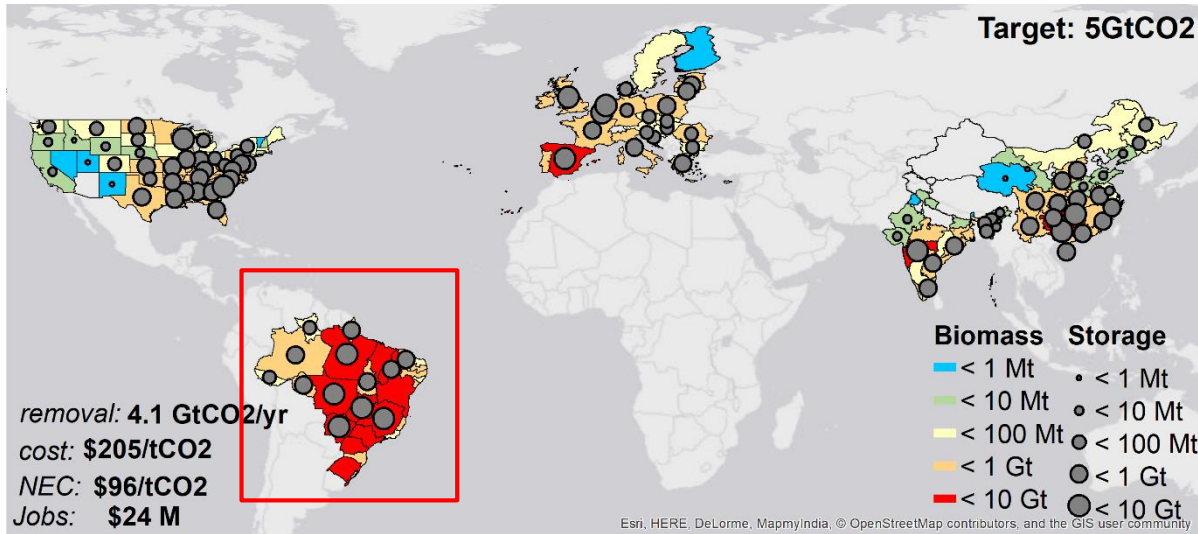
- Job creation resulting from BECCS deployment at the global scale
- Trade-offs between cost and added value

Objectives of this study

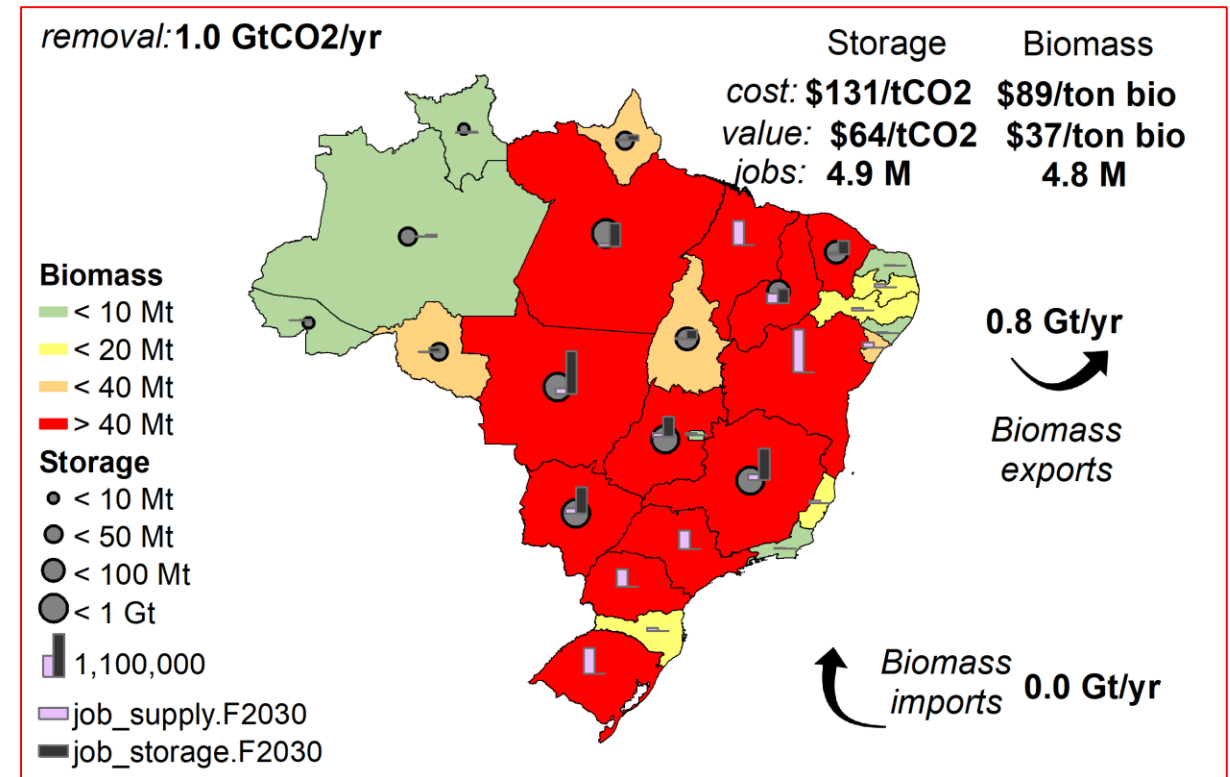
Using the Modelling and Optimisation of Negative Emissions Technologies (MONET) framework, the objective is to explore the optimal deployment pathways of BECCS between five potentially key actors of CDR (China, India, USA, Brazil, EU), to answer to following questions:

- Which pathways lead to maximal value and/or job creation?
- Trade-offs between cost and value/job

What if more storage is available in Brazil?



- Total cost decreases by 11%
- Biomass can be used locally, which reduces overall cost of removal
- Job creation increases in Brazil, with balanced role of CO₂ storage and biomass production



Jobs and Economic Development Impact (JEDI)

Socio-economic
analysis

Investment analysis

Sector disaggregation

Impact
analysis

OECD Database

Socio-economic indicators

- GVA
- Employment rate
- Household income
- Labor share of GVA
- Wages
- I/O tables

Requirements matrix

$$A_{i,j} = \begin{bmatrix} A_{i,i} & A_{i,j} \\ A_{j,i} & A_{j,j} \end{bmatrix}$$

$$L_{i,j} = (I - A_{i,j})^{-1}$$



Sector disaggregation



JEDI model

Direct impact

$$VA_{c,i,t} = Output_{i,t} * \%VA_{c,i}$$

$$Jobs_{c,i} = \sum_t (VA_{c,i,t} * \%Labor_{c,i}) / Wages_{c,i}$$

Indirect impact

$$Ind_VA_{c,i,t} = VA_{c,i,t} * \sum_j L_{i,j}$$

$$Ind_Jobs_{c,i} = Jobs_{c,i} * \sum_j L_{i,j}$$

