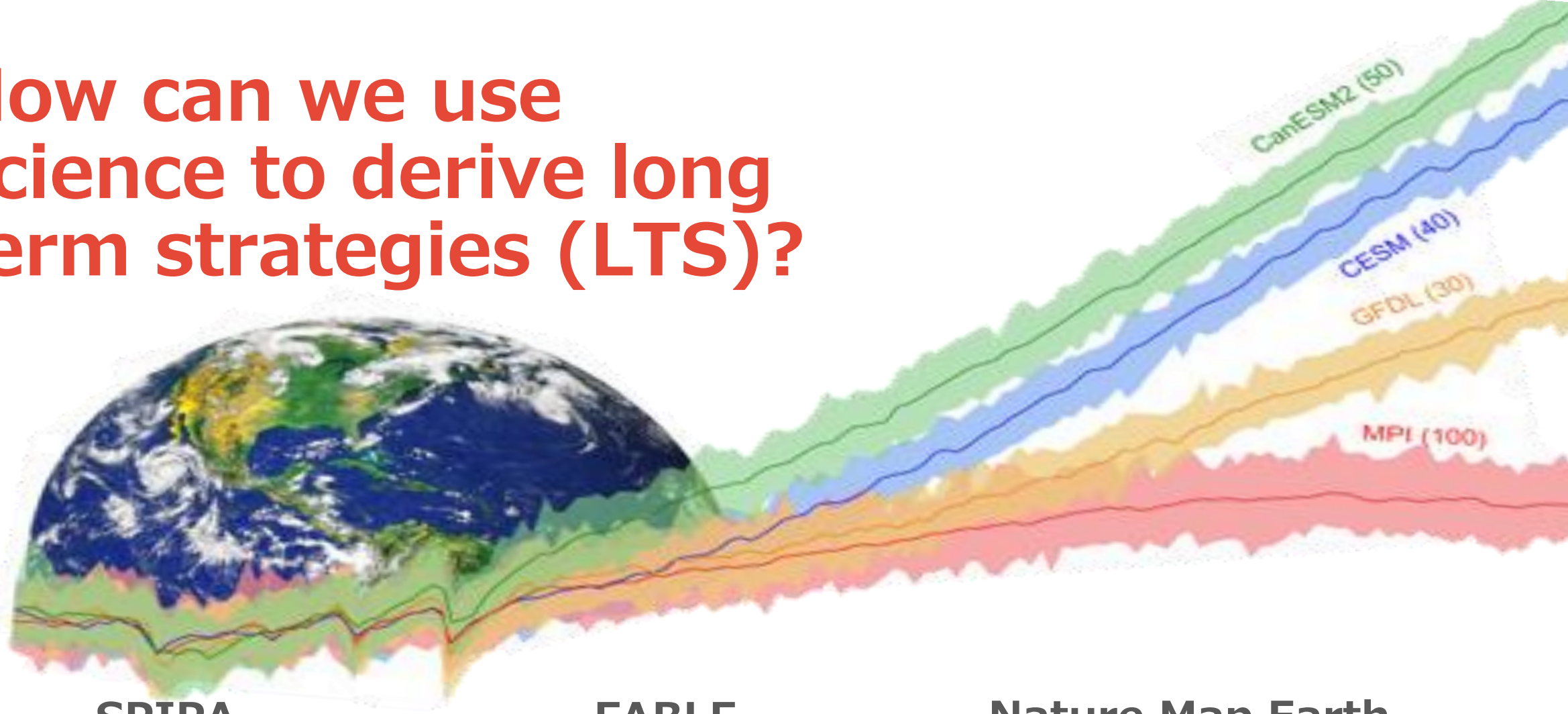
# ‘Spatially explicit approaches at the food–biodiversity–climate nexus’ Lessons from Argentina

**Federico C. Frank**

Ju;ly 10th

# How can we use science to derive long term strategies (LTS)?



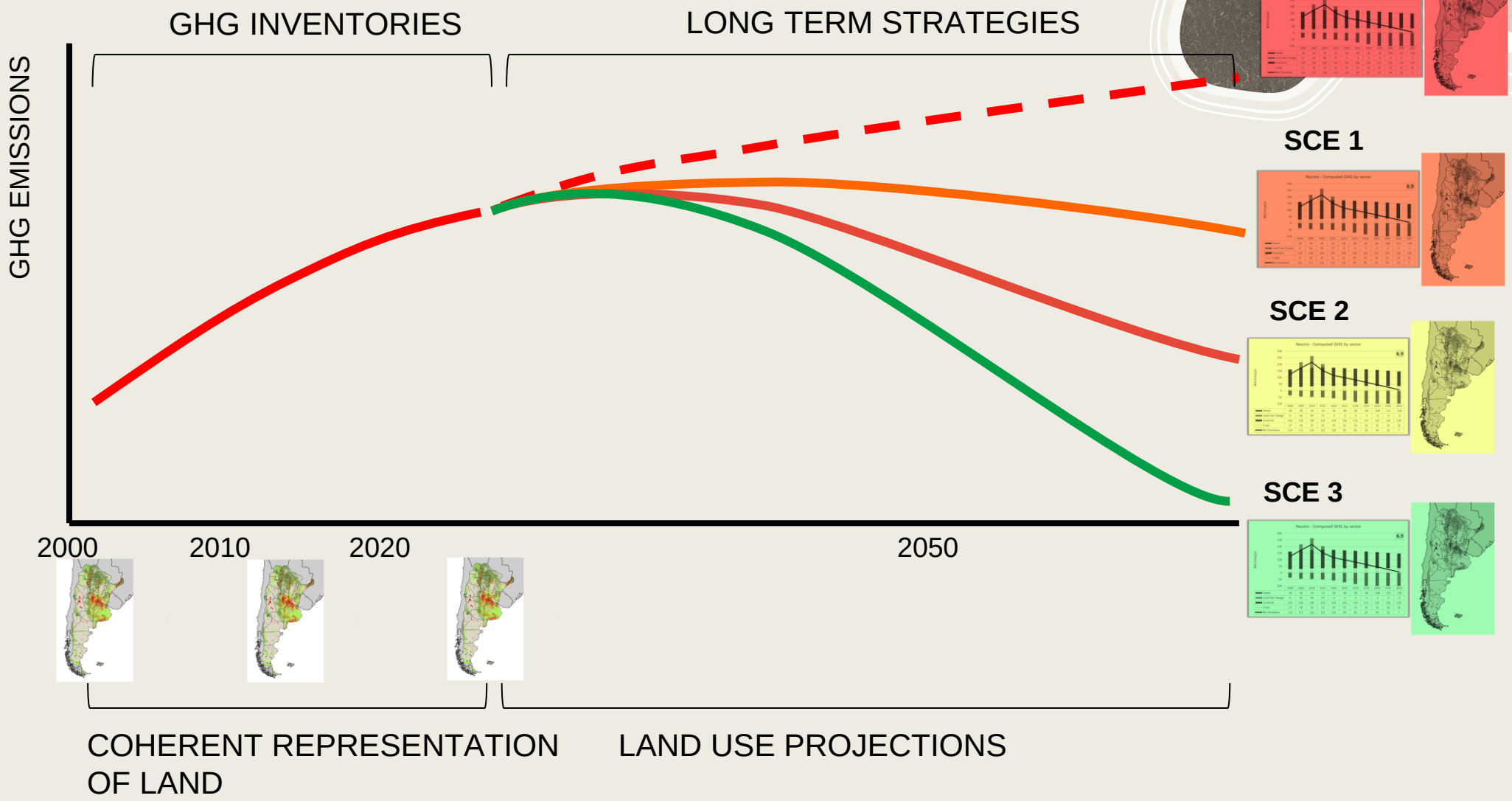

**SPIPA**
giz.de/en/worldwide/87271

**FABLE**
https://fableconsortium.org/

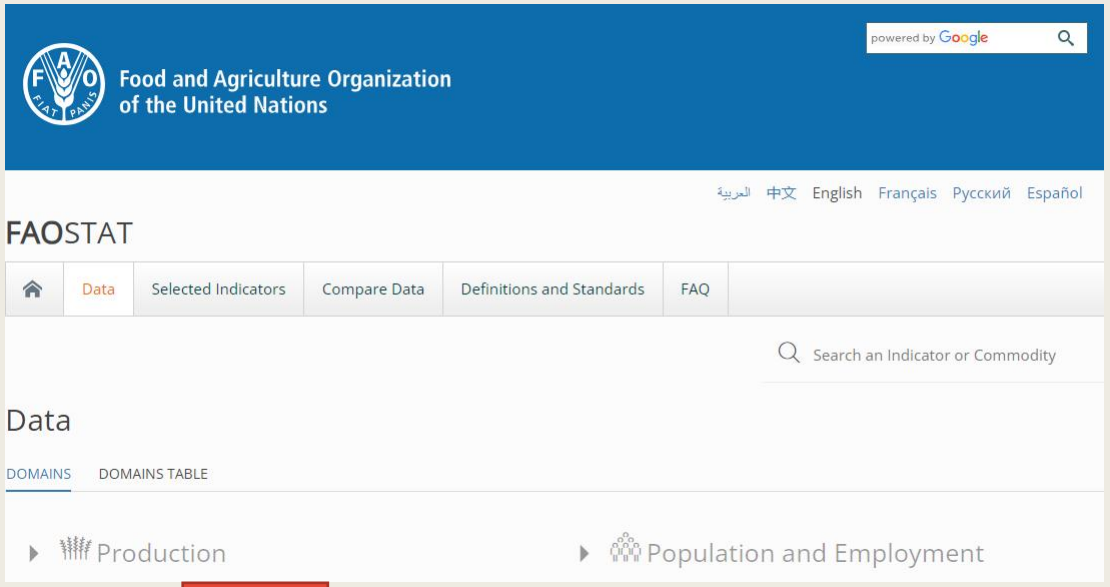
**Nature Map Earth**
https://naturemap.earth/

Objetive: to provide the Ministry of Environment and Sustainable Development and the Ministry of Agriculture with scientific evidence to support the elaboration of LT-LEDS while considering other likewise relevant issues (food provision, biodiversity conservation, etc.)

# POSSIBLE GHG EMISSIONS SCENARIOS FOR A COUNTRY



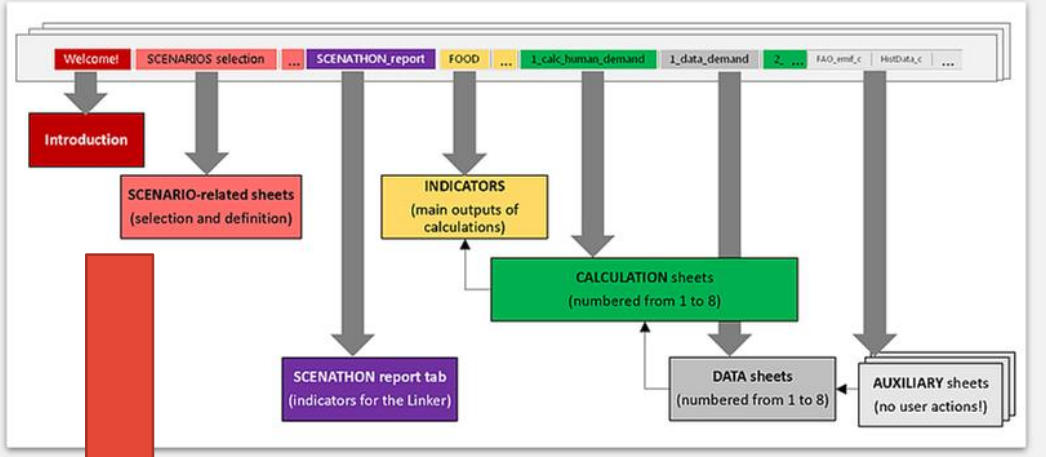
# WORKSHOPS WITH SCENARISTS

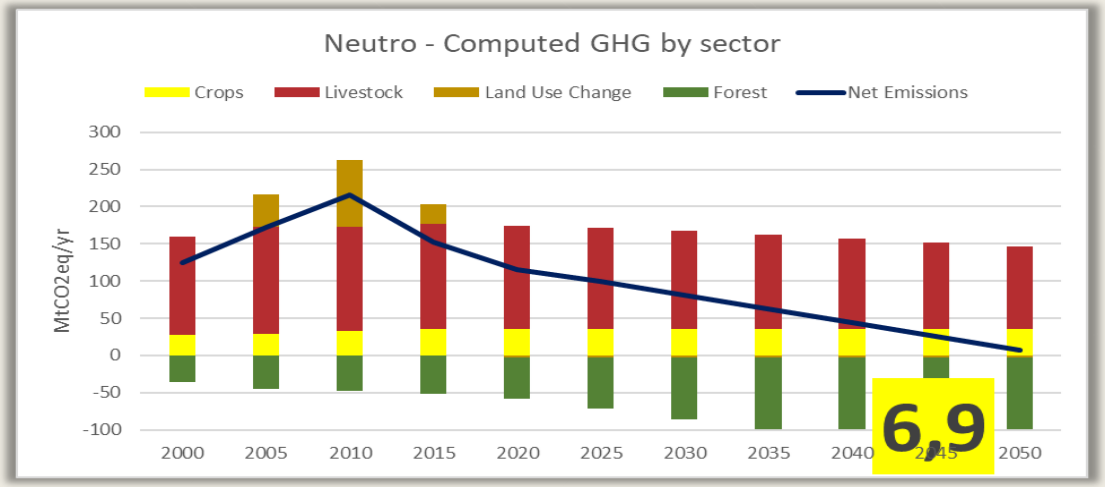



**INPUTS FOR THE MODELING WORK**

**STAKEHOLDERS FROM THE AFOLU SECTOR**

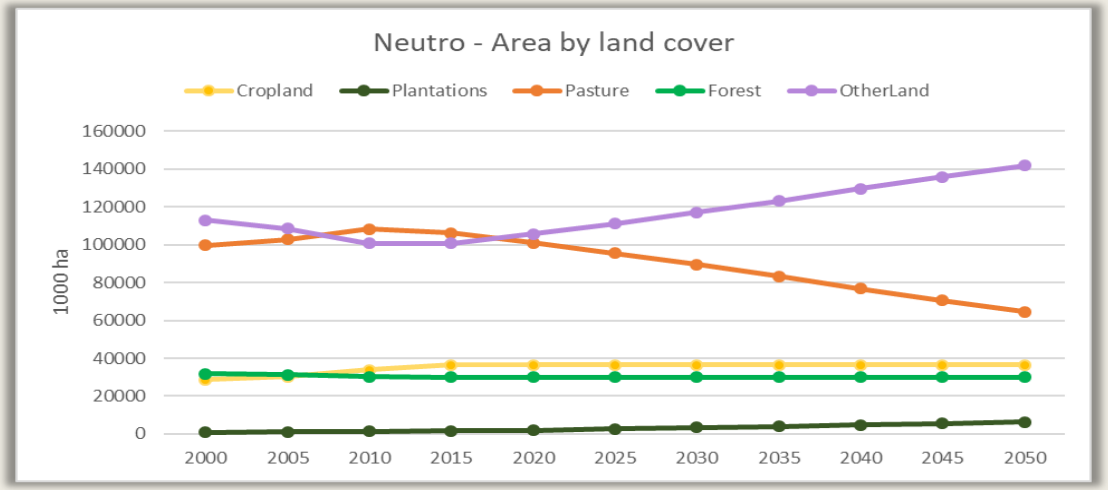
# MODEL 1: FABLE CALCULATOR

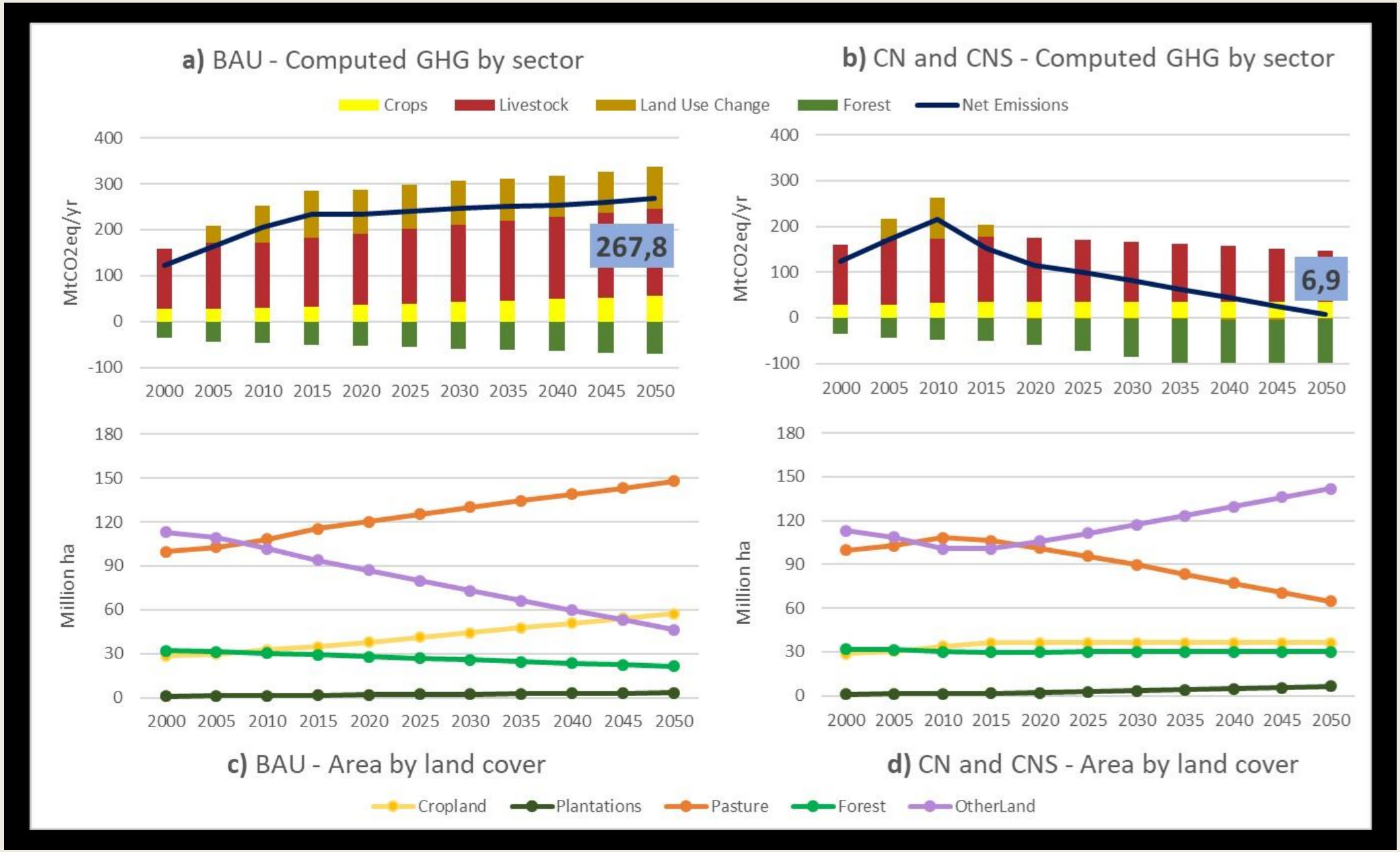



## The calculation STEPS

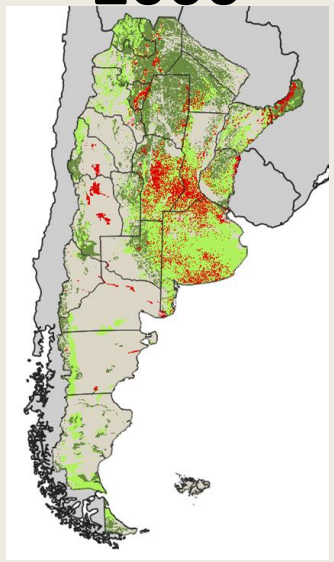
| CONTENT | Calculation SHEETS | Short DESCRIPTION |
|---|---|---|
| Step 1 | 1_calc_human_demand | TARGET human consumption (per crop and animal products). |
| Step 2 | 2_calc_livestock | TARGET herd size, animal feed, pasture area, exports (per animal product and animal type). |
| Step 3 | 3_calc_crops | TARGET crop production, harvested areas and exports (per crop). |
| Step 4 | 4_calc_land | FEASIBLE pasture land and cropland; adjustment factors. |
| Step 5 | 5_feas_livestock | FEASIBLE livestock values: pasture area, herd size, animal feed, exports of animal products. |
| Step 6 | 6_feas_crops | FEASIBLE crop production, harvested areas and exports (per crop and final crop product). |
| Step 7 | 7_feas_consohum | FEASIBLE human consumption and nutrition per capita (per crop and animal product). |
| Step 8 | 8_calc_emissions | Emissions for the FEASIBLE values (per ruminant, monogastric animal, crop production and land use change). |



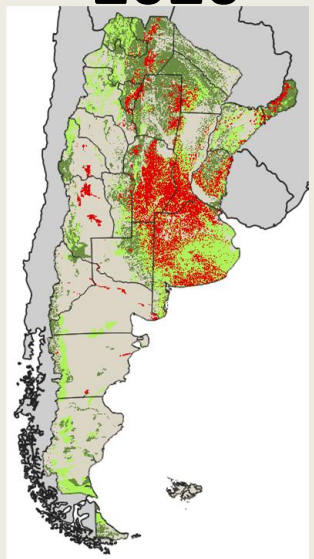

a) BAU - Computed GHG by sector
Crops
Livestock
Land Use Change
Forest
Net Emissions
MtCO2eq/yr
400
300
200
100
0
-100
267,8
2000 2005 2010 2015 2020 2025 2030 2035 2040 2045 2050
b) CN and CNS - Computed GHG by sector
MtCO2eq/yr
6,9
2000 2005 2010 2015 2020 2025 2030 2035 2040 2045 2050
Million ha
180
150
120
90
60
30
0
2000 2005 2010 2015 2020 2025 2030 2035 2040 2045 2050
c) BAU - Area by land cover
d) CN and CNS - Area by land cover
Cropland
Plantations
Pasture
Forest
OtherLand

# MODEL 2: DINAMICA EGO

**2000**



**2020**

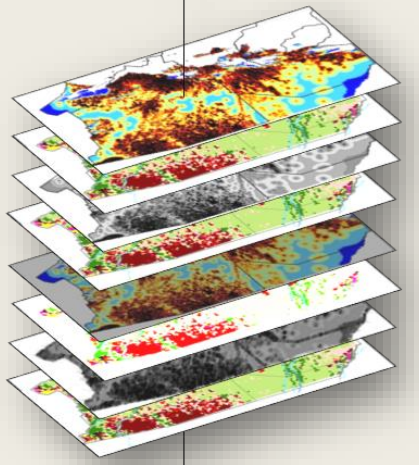


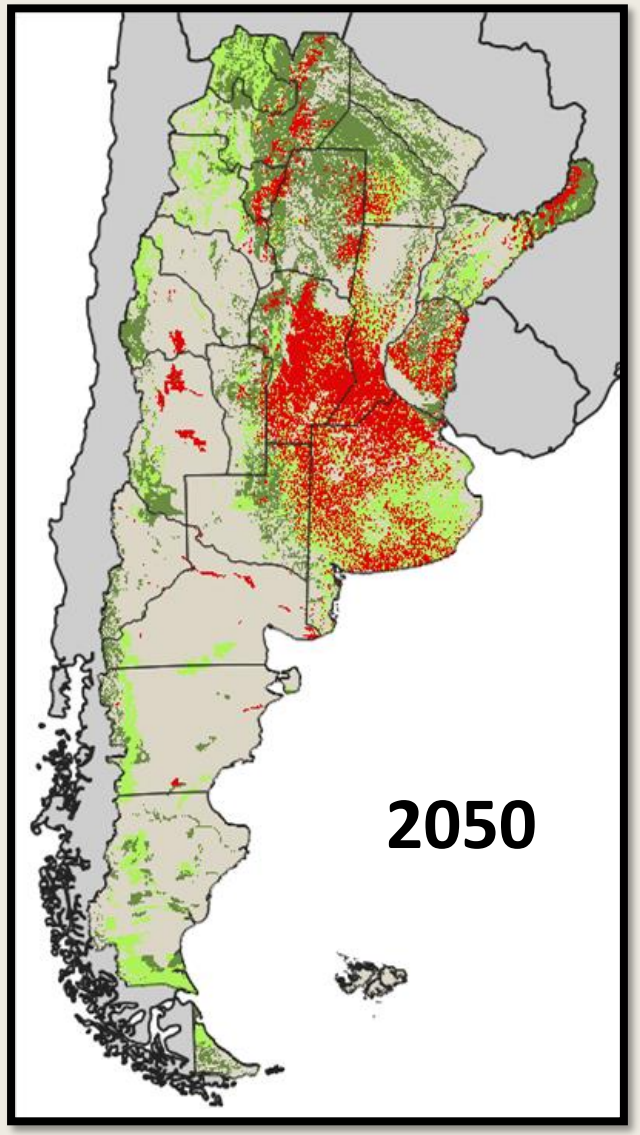
TRANSITION MATRIX

| | | | |
|---|---|---|---|
| 11 | 12 | 13 | 14 |
| 21 | 22 | 23 | 24 |
| 31 | 32 | 33 | 34 |
| 41 | 42 | 43 | 44 |

| | | | |
|---|---|---|---|
| 11 | 12 | 13 | 14 |
| 21 | 22 | 23 | 24 |
| 31 | 32 | 33 | 34 |
| 41 | 42 | 43 | 44 |

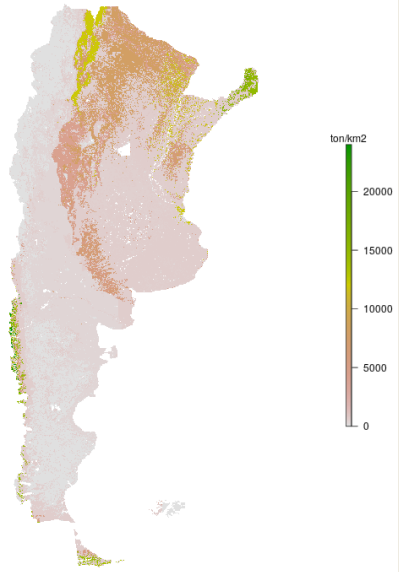
EXPLANATORY VARIABLES





# MODEL 3: NATURE MAP

**Biodiversity**

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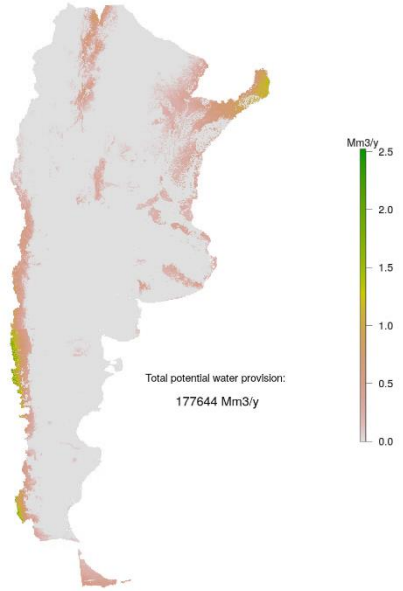
**Water provision**

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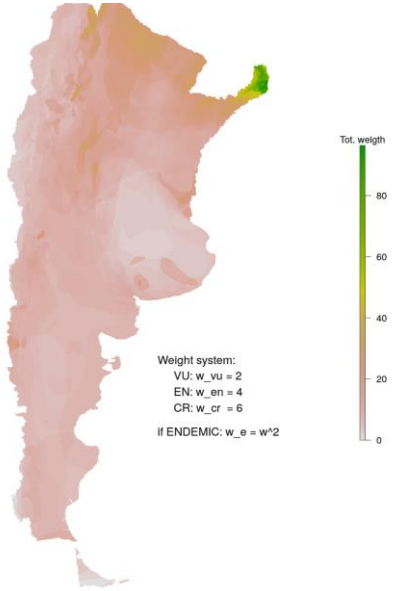
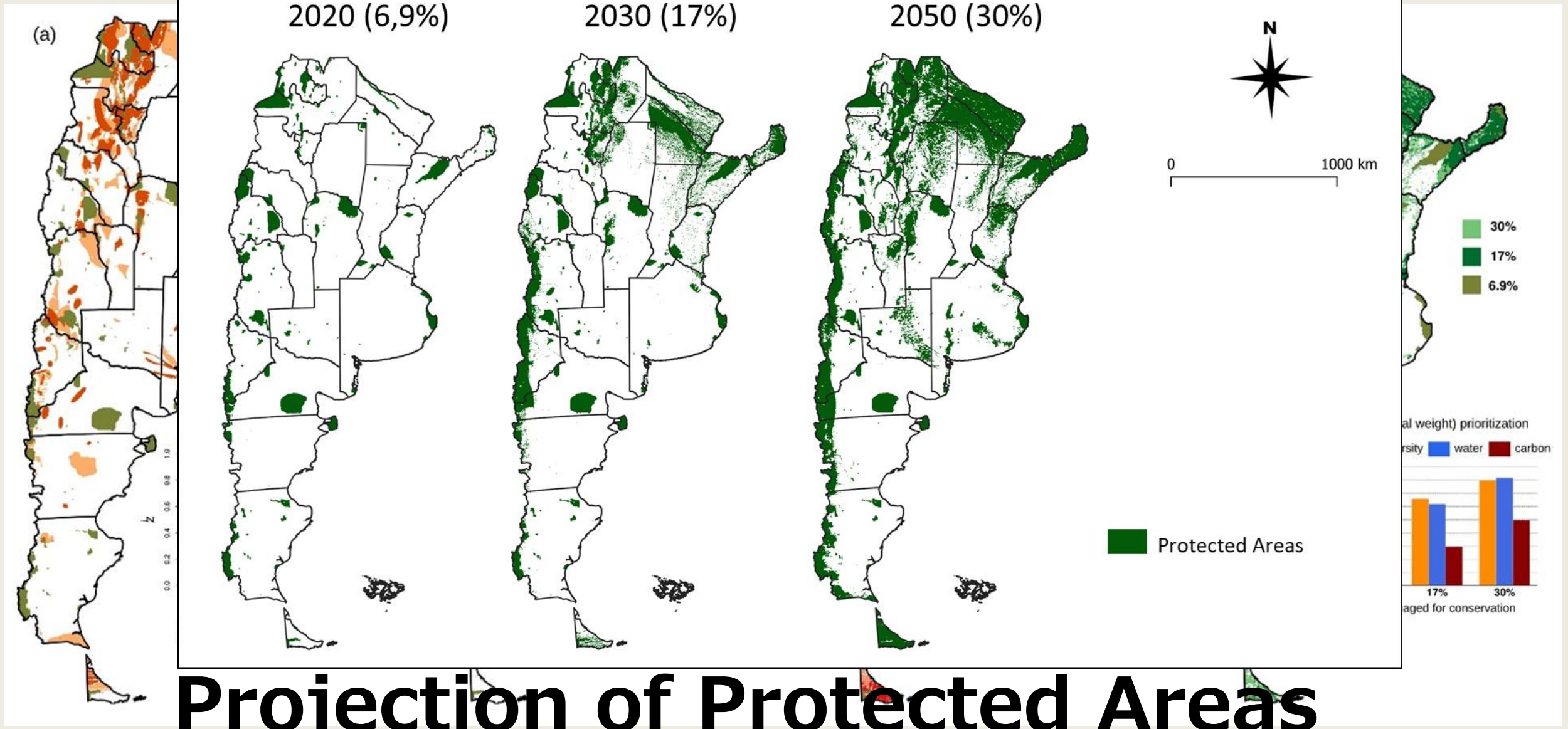
**Carbon Stock**




How can we protect all resources at the same time?

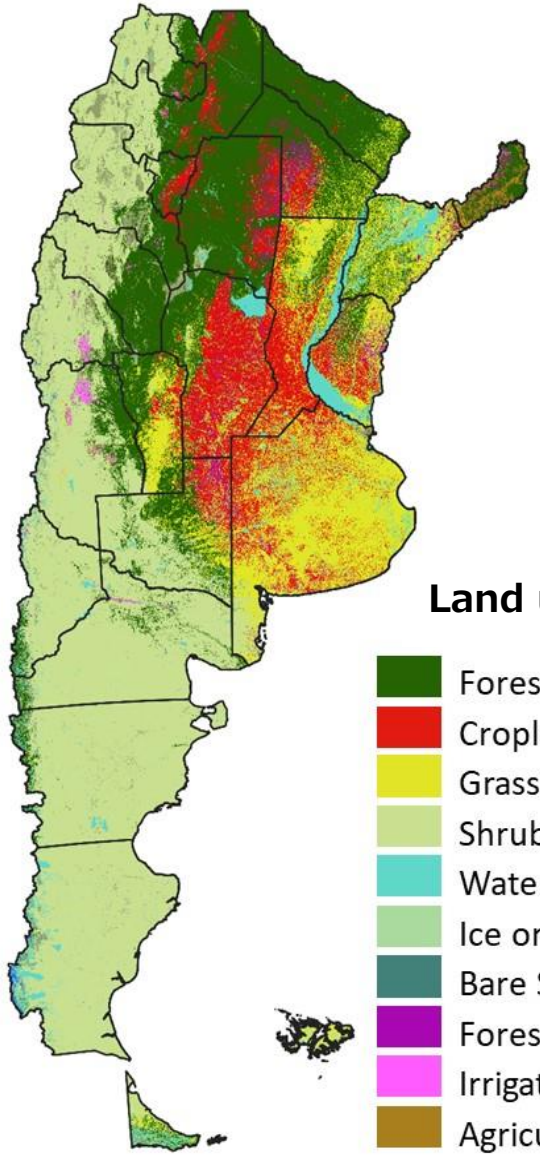
Biodiversity Water provision Carbon Stock Joint Priorization




# Projection of Protected Areas

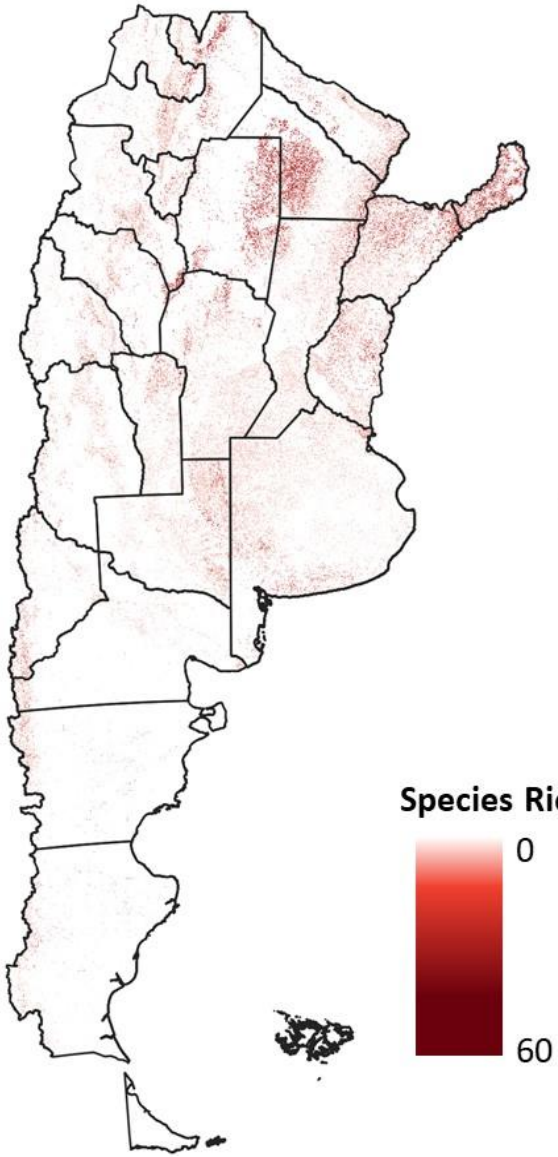
BAU

# Sustainable Carbon Neutral Scenario



**Land use/cover**

- Forest Lands
- Croplands
- Grasslands and Pastures
- Shrubland Steppe
- Water Bodies
- Ice or Snow
- Bare Soil and Infrastructure
- Forest Plantations
- Irrigated Lands
- Agricultural Mosaic



N

**Species Richness Losses**

0

60

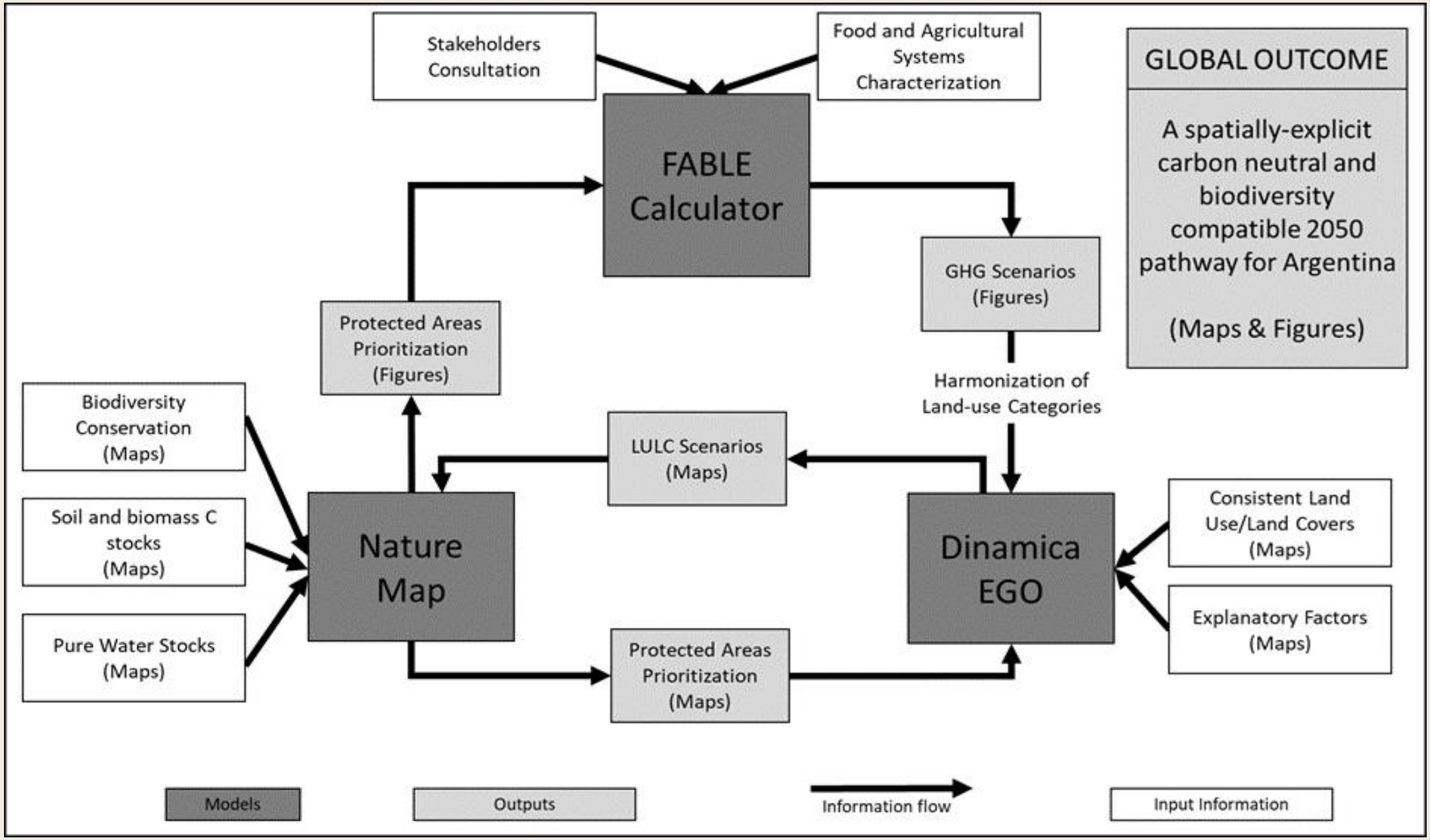
N

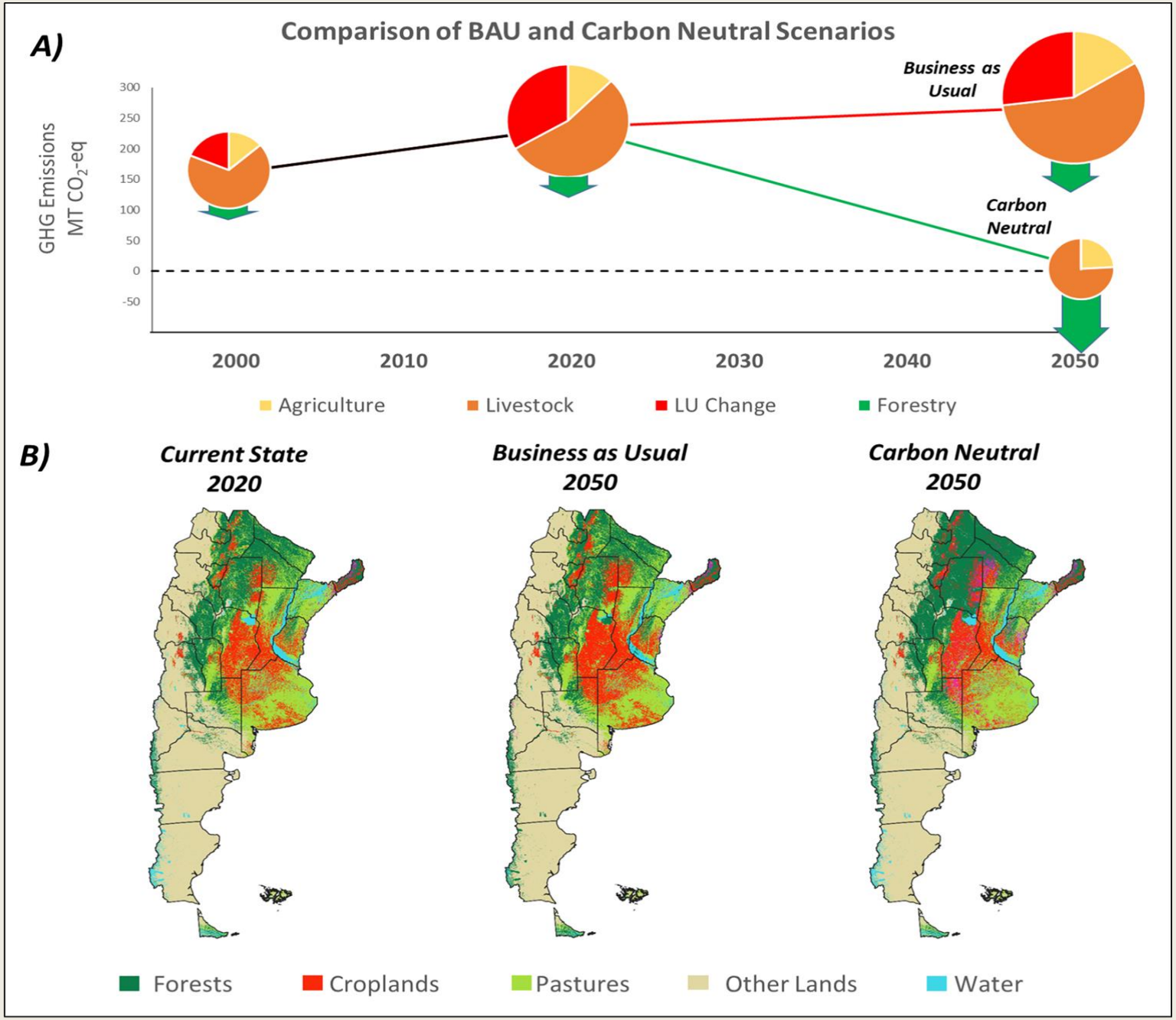
0 1000 km

ecies Richness Loss

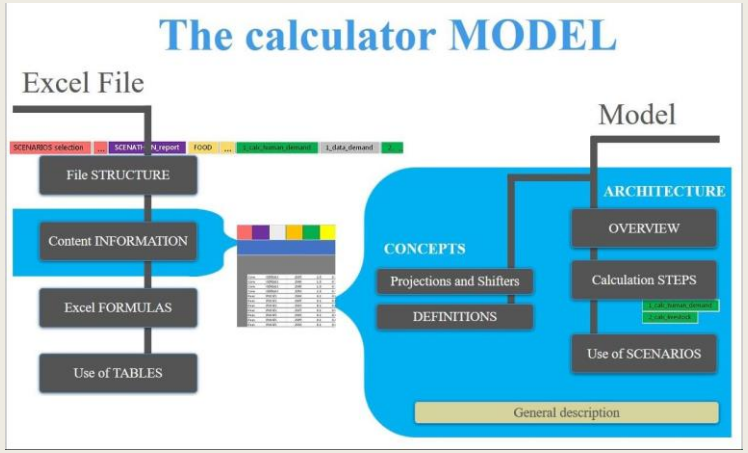
0

60


Stakeholders Consultation
Food and Agricultural Systems Characterization
FABLE Calculator
GLOBAL OUTCOME
A spatially-explicit carbon neutral and biodiversity compatible 2050 pathway for Argentina
(Maps & Figures)
GHG Scenarios (Figures)
Protected Areas Prioritization (Figures)
Harmonization of Land-use Categories
Biodiversity Conservation (Maps)
LULC Scenarios (Maps)
Soil and biomass C stocks (Maps)
Nature Map
Dinamica EGO
Consistent Land Use/Land Covers (Maps)
Pure Water Stocks (Maps)
Protected Areas Prioritization (Maps)
Explanatory Factors (Maps)
Models
Outputs
Information flow
Input Information

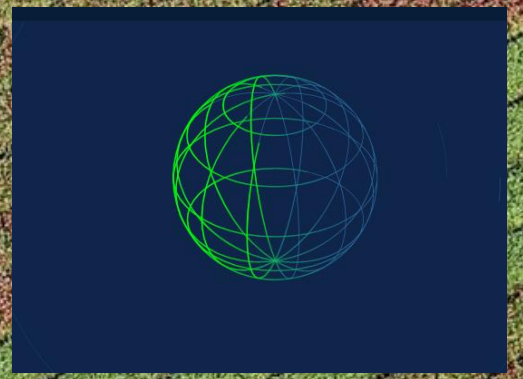

A)
Comparison of BAU and Carbon Neutral Scenarios
GHG Emissions MT $CO_2$-eq
300
250
200
150
100
50
0
-50
Business as Usual
Carbon Neutral
2000
2010
2020
2030
2040
2050
Agriculture
Livestock
LU Change
Forestry
B)
Current State 2020
Business as Usual 2050
Carbon Neutral 2050
Forests
Croplands
Pastures
Other Lands
Water

# FOOD DEMAND
# LAND DEMAND

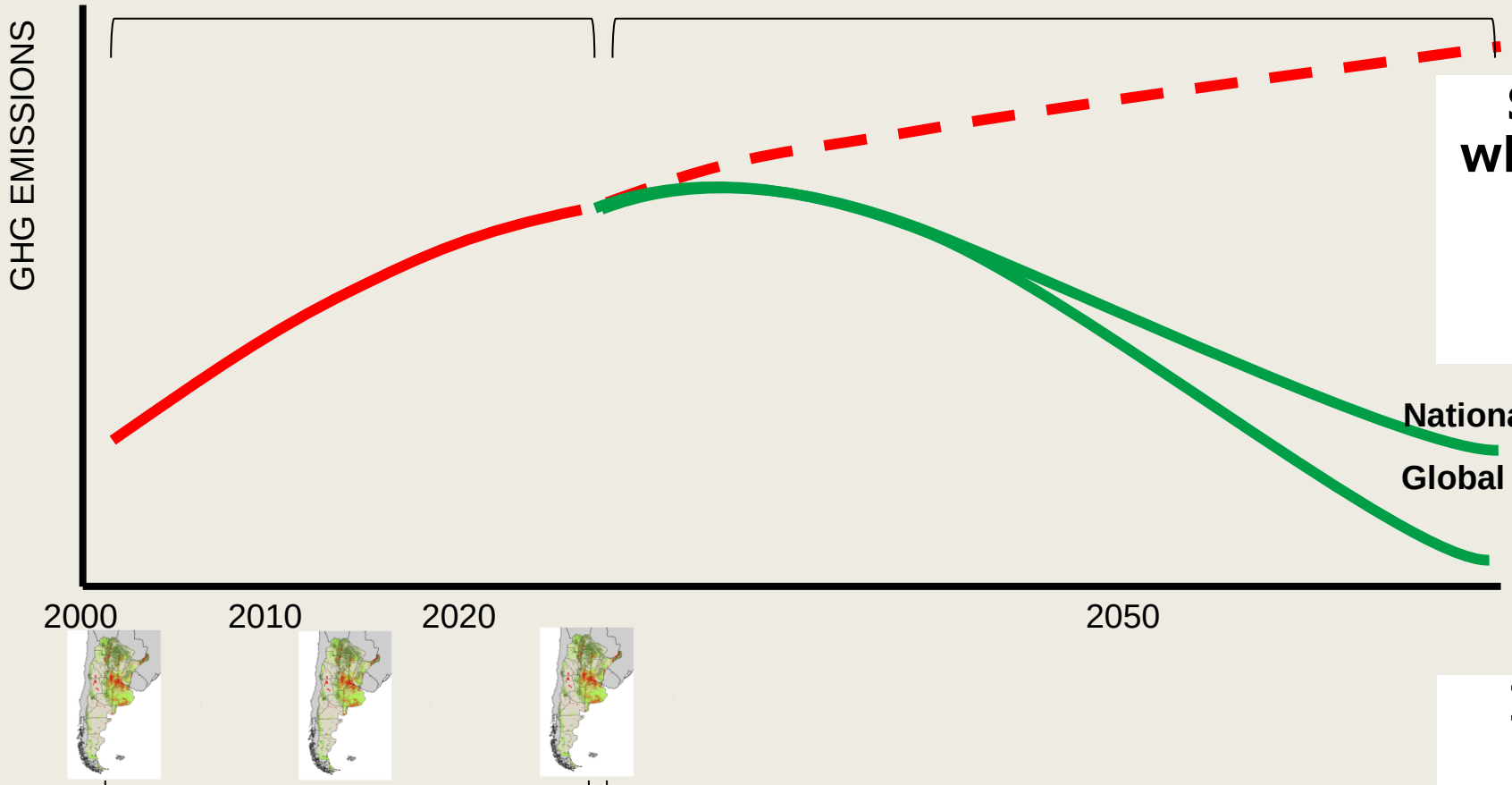



# LAND USE CHANGE
# 2000-2050

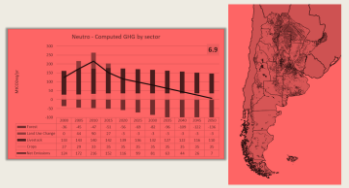
# PRIORITY
# FOR CONSERVATION



# THIS WAS OUR STARTING POINT



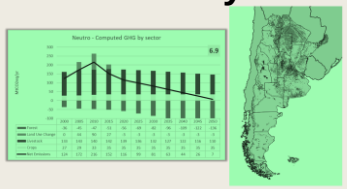

**Current Trends**



**Scenario determined by what is most likely going to happen, coherent with current policies and economically viable**

**National Commitments**

**Global Sustainability**



**Ideal scenarios that are biophysically posible, climatically and ecologically sustainable, but have little consensus among stakeholders and actors**