



System of  
Environmental  
Economic  
Accounting

# Mainstreaming the SEEA EEA Through Policy Scenario Modelling

International Seminar on Natural Capital Accounting  
12-14 November, Beijing, China



United Nations

# Outline

1. Define policy scenario analysis, in the context of the SEEA-EEA
2. Objectives of policy scenario analysis
3. The contribution of SEEA-EEA to policy scenario analysis
4. Types of models
5. Examples



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# Policy Objectives of NCA&VES Project

## Policy Mainstreaming

- Overall broad objectives of the project to:
  - raise awareness of SEEA-EEA among key stakeholders and users of data
  - integrate use of accounts it into decision-making frameworks, processes etc.

## Policy Scenario Analysis

- Specific deliverables of the project that:
  - influence specific live policy decisions
  - test and advance scenario analysis methodologies
  - contribute to policy mainstreaming

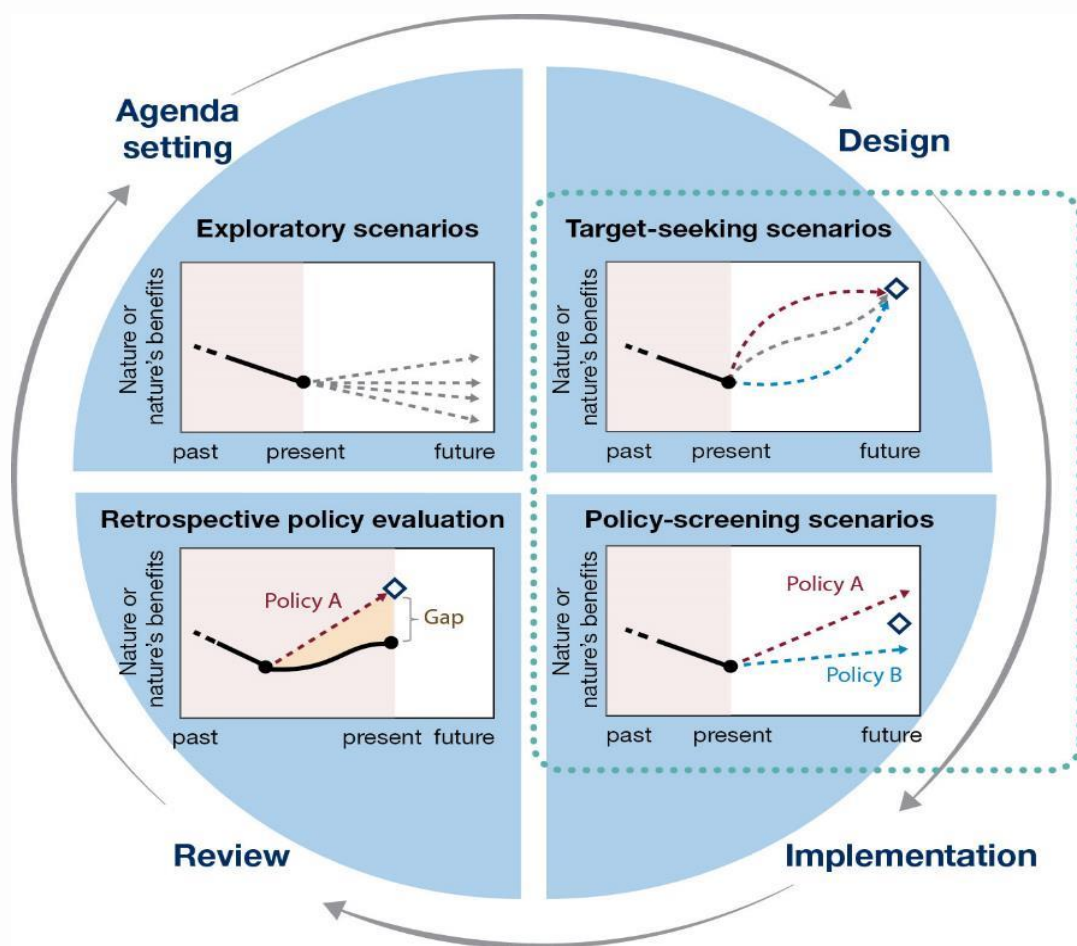
# Definition of scenarios

In general terms, "*scenarios*" can be defined as: "*consistent and coherent descriptions of alternative hypothetical futures that reflect different perspectives on past, present, and future developments, which can serve as a basis for action*" Van Notten (2005)

*Scenario analysis* is:

- An exercise in which several future development alternatives are identified, explained, and analyzed.
- Designed to improve decision making, allowing it to embrace uncertainty and risk.
- Used to explore the impacts of planned interventions and unexpected events, increasing the general readiness to unforeseen external impacts.

# Basic types of scenarios



Different policy & decision contexts often require the application of different types of scenarios, models and decision-support tools

STATIC OR DYNAMIC

Intervention scenarios

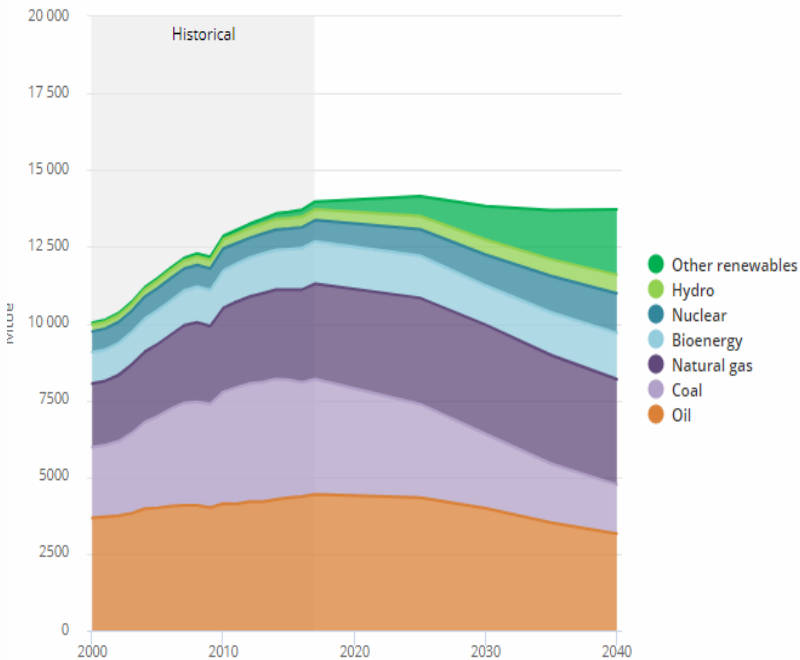
- ◇ Target
- Observed trajectory
- - - - - Expected pathways
- . - . - . Expected pathways

www.ipbes.net

Credit: Conservation International

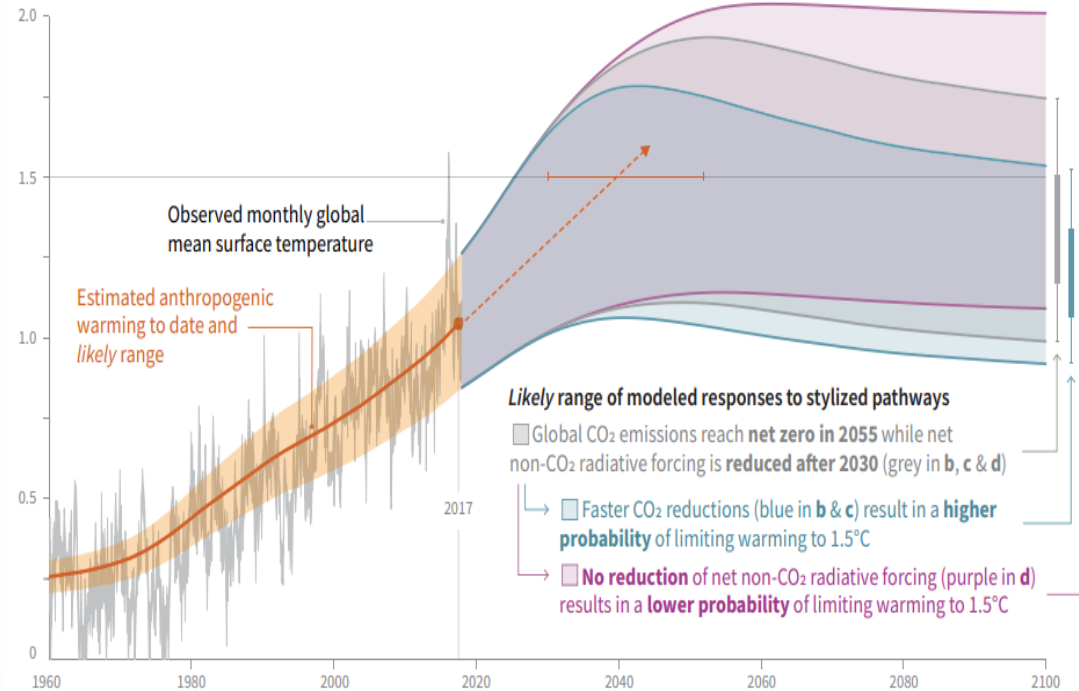
# Scenarios in many contexts

## Projections for Global Energy Demand



Source: World Energy Outlook, 2018

## Global mean surface temperature: Stylized anthropogenic emission and forcing pathways



Source: IPCC, 2018

# Objectives of policy scenario analysis, in the context of the SEEA EEA

- Inform or influence the selection or adaptation of an environmental policy
- Demonstrate the usefulness of the SEEA-EEA accounts
- Demonstrate the applicability of different modelling techniques for policy scenario analysis, drawing on the accounts
- Contribute to the mainstreaming of the use of environmental and ecosystem accounts in local/provincial/national level policy-planning and implementation
- **Improve the effectiveness of decisions for sustainable development through a better understanding of the interconnections between society, economy and environment.**

# Policy scenario analysis informs various stages of decision making...

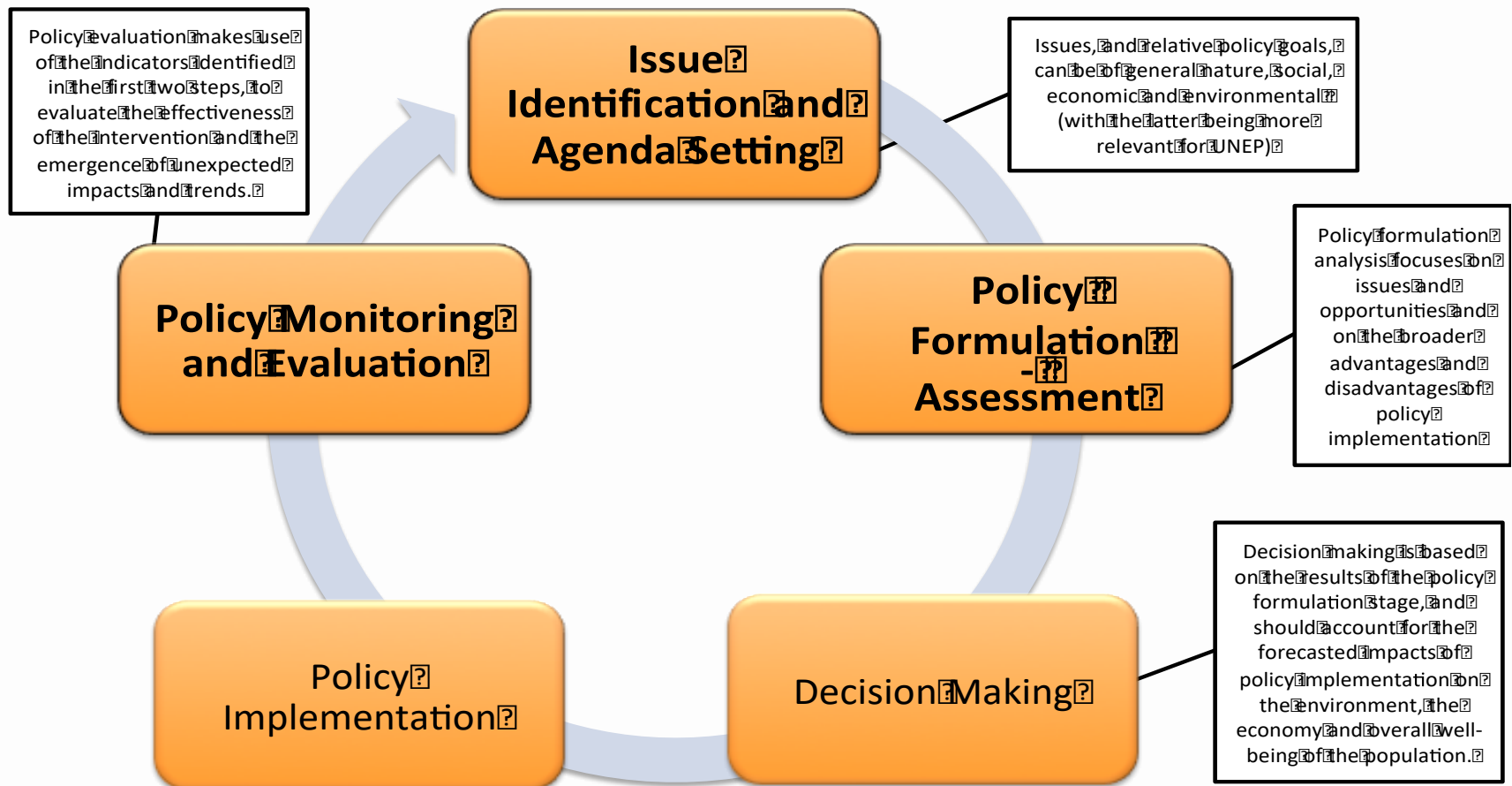


Figure source: A. Bassi.



# Contribution of the SEEA-EEA

- Provide better data with a standardised approach to collection, interpretation and use
- Provide an improved understanding to quantify the interlinkages between society, the economy and the environment that can inform policy formulation
- Develop new indicators to expand the boundaries of analysis
- Allow for better interpretation of results of simulation models currently being used
- Improve and expand existing models with SEEA EEA data to allow stronger forecasting exercises

# Contribution of the SEEA-EEA



NEW AND  
STANDARDIZED  
DATA INPUTS



IMPROVED  
EQUATIONS  
(UNDERSTANDING OF  
DYNAMICS)



NEW  
INDICATORS



SPATIAL  
DISAGGREGATION/  
INTERPRETATION

The SEEA-EEA can contribute to model creation and customization, and to the interpretation of model results, thereby improving information for policy scenario analysis.



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# Types of Models and Approaches

## Scenario creation tools (qualitative)

- Systems maps (causal loops)
- Tree diagrams
- Dynamic pathways

## Scenario forecasting tools (quantitative)

- Computable general/partial equilibrium models of economy or sectors
- Systems engineering models of infrastructure
- Spatially explicit land use models

## Presentation or evaluation of scenario results

- Cost Benefit Analysis
- Multi Criteria Analysis
- Life Cycle Analysis

# SEEA-EEA contribution to types of Models and Approaches

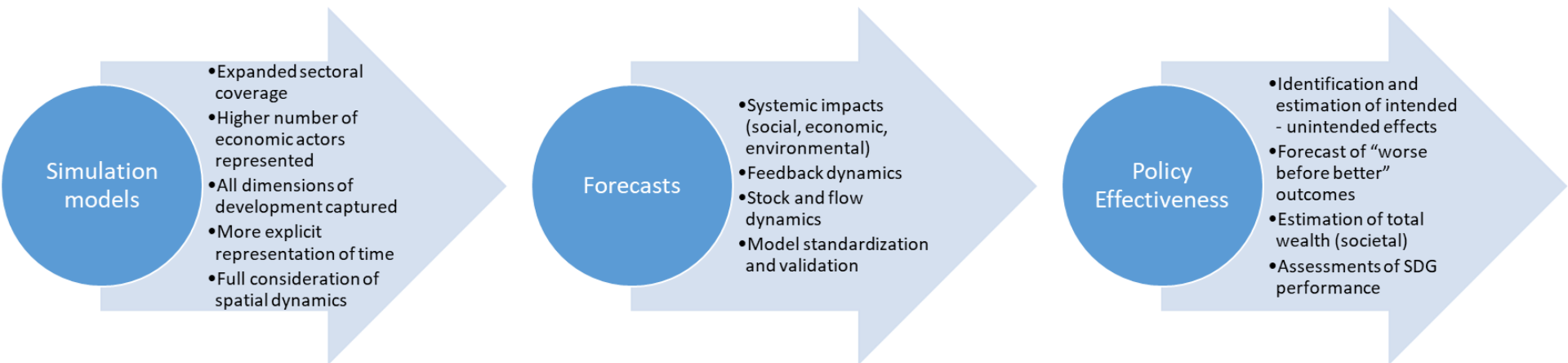


Figure source: A. Bassi.

# Ecosystems service models

- Models, and hence a simplified representations of reality
- Represent the processes in ecosystems that result in services
- These processes can be captured by sets of equations or proxy variables
- In most cases focused on creating spatial outputs to produce maps of ecosystem services.
- Various spatially-defined datasets can be used (e.g. remote sensing images, thematic maps, surveys for specific administrative or ecological units, and point data from specific studies).

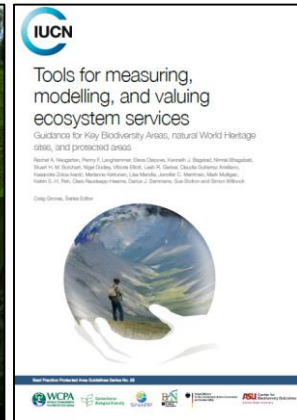
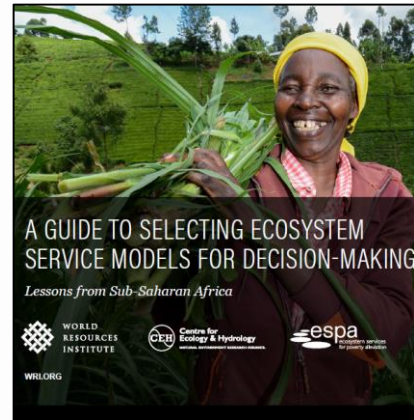
# Ecosystems service models

- Two main approaches:
  - *Simple*: “Look-up Tables” approach or “proxy-based”, based on multipliers and statistical approaches.
  - *Complex* (static or dynamics): process-based models. Represent ecological processes to estimate ecosystem service provision based on a specific land cover / land use map and other data inputs (e.g. topography).
- Forecast values for a specified ecosystem service based on how one or more environmental variables affect the value of that service.
- “Value” can be a measure of a relevant environmental variable (e.g., tons of carbon or liters of water), the monetary or nonmonetary value to humans, or a measure of use of the service by people.

# Examples

## ARIES (aries.integratedmodelling.org)

- An open-source technology that can select and run models to quantify and map ecosystem services, including physical generation, flow, and extraction by beneficiaries.



## Co\$ting Nature (<http://www.policysupport.org/costingnature>)

- A web-based series of interactive maps that defines the contribution of ecosystems to the global reservoir of a particular ecosystem service and its realizable value (based on flows to beneficiaries of that service).

## InVEST ([www.naturalcapitalproject.org/invest/](http://www.naturalcapitalproject.org/invest/))

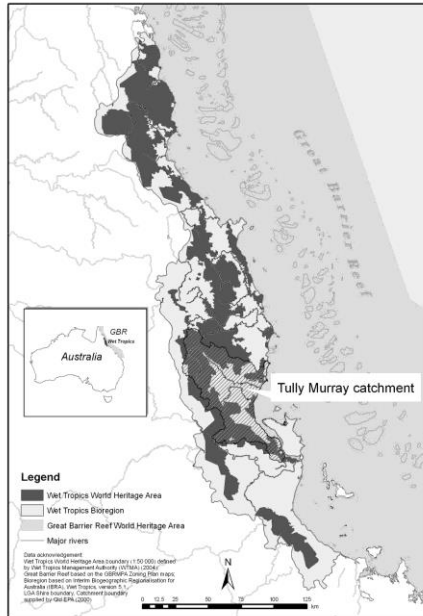
- A suite of free, open-source software models from the Natural Capital Project used to map and value the goods and services from nature. InVEST returns results in either biophysical or economic terms.

Many other models are available, e.g. Multiscale Integrated models for Ecosystem Services (**MIMES**), Social Value for Ecosystem Services (**SoIVES**), Land Utilization and Capability Indicators (**LUCI**).

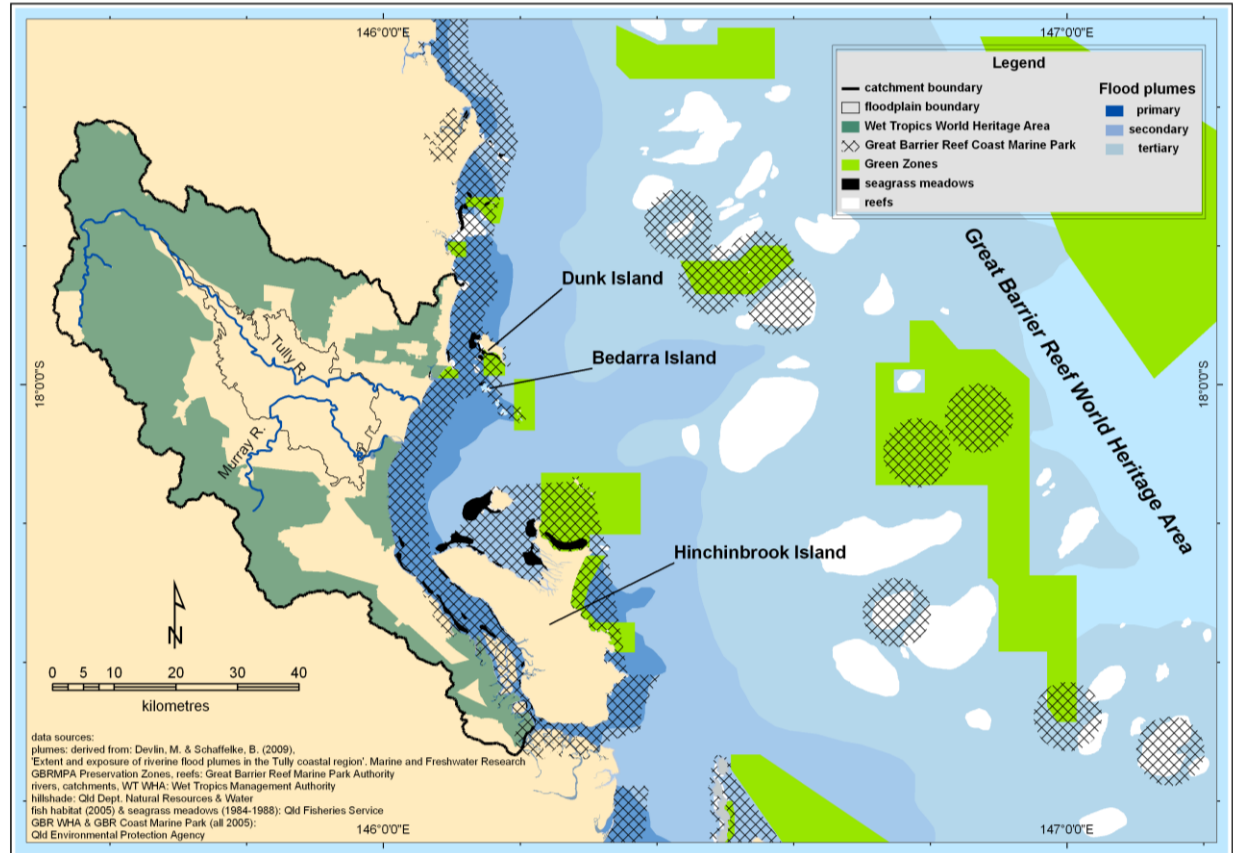
See: [http://aboutvalues.net/method\\_database/](http://aboutvalues.net/method_database/)

Source: A. Bassi.

# SCENARIO EXAMPLE OF FROM AUSTRALIA



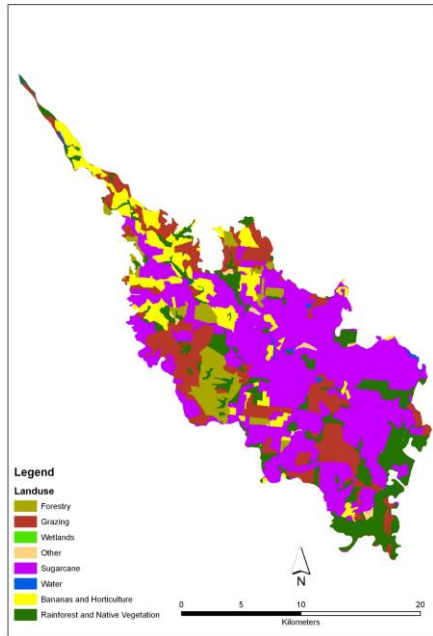
Butler et al. (2013)



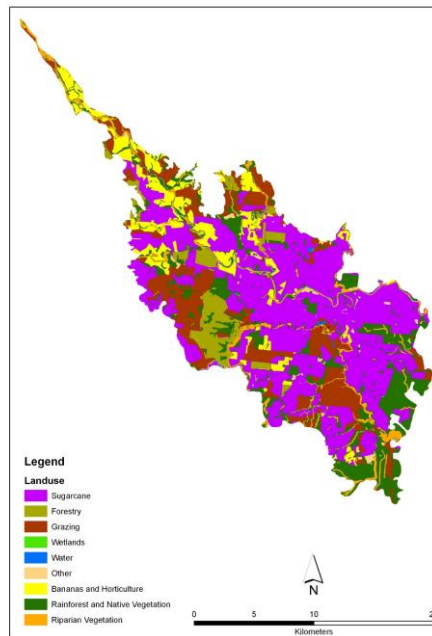


# LAND USE SCENARIOS

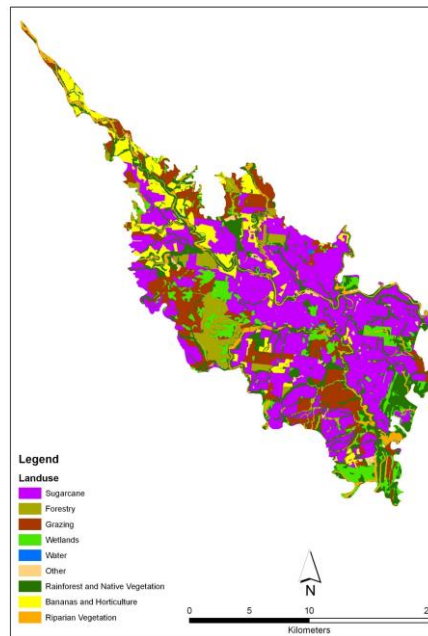
No Vegetation  
Management Act



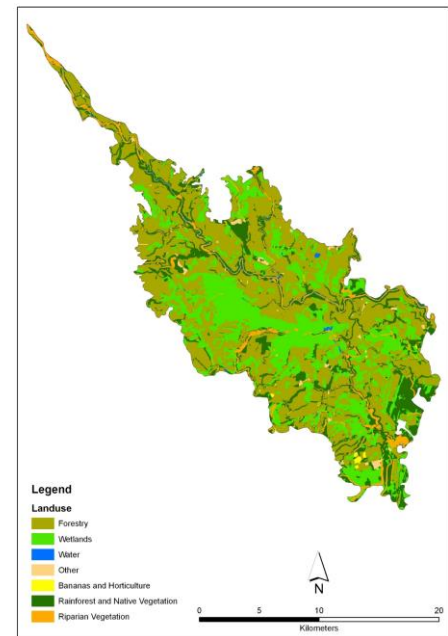
Present Day



De-nitrification and  
sediment priorities



Native forestry



Credit: Conservation International



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# ASSESSING SCENARIO TRADE-OFFS

## Stage 1: Land use scenarios

### Scenario 1: No Vegetation Management Act

- Sugarcane: 37,429 ha
- Bananas and horticulture: 7514 ha
- Forestry: 13,348 ha
- Grazing: 14,385 ha
- Riparian vegetation: 0 ha
- Wetlands: 0 ha

### Scenario 2: Present Day

- Sugarcane: 35,282 ha
- Bananas and horticulture: 7010 ha
- Forestry: 13,053 ha
- Grazing: 13,734 ha
- Riparian vegetation: 2160 ha
- Wetlands: 9 ha

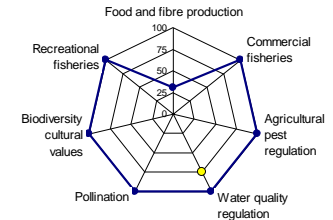
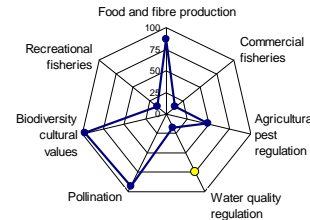
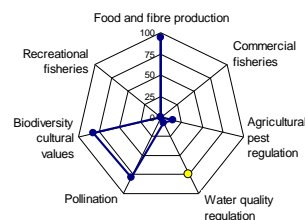
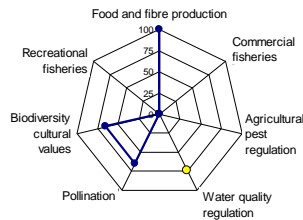
### Scenario 3: De-nitrification and Sediment Priorities

- Sugarcane: 32,085 ha
- Bananas and horticulture: 6239 ha
- Forestry: 12,706 ha
- Grazing: 12,511 ha
- Riparian vegetation: 7180 ha
- Wetlands: 1650 ha

### Scenario 4: Native Forestry

- Sugarcane: 0 ha
- Bananas and horticulture: 0 ha
- Forestry: 45,899 ha
- Grazing: 0 ha
- Riparian vegetation: 14,724 ha
- Wetlands: 11,837 ha

## Stage 2: Change in status of floodplain ecosystem services



## Stage 3: Change in trends of GBR ecosystem services

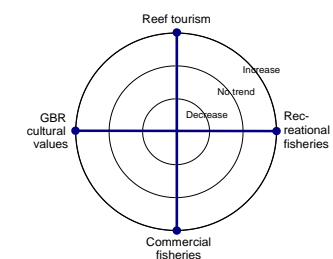
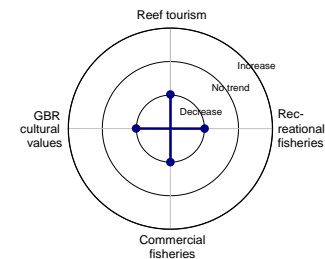
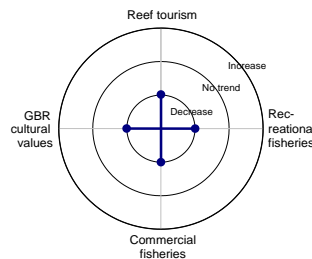
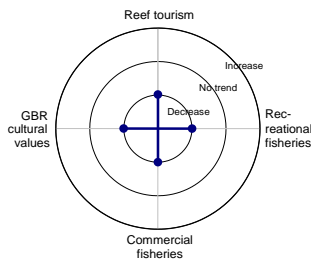
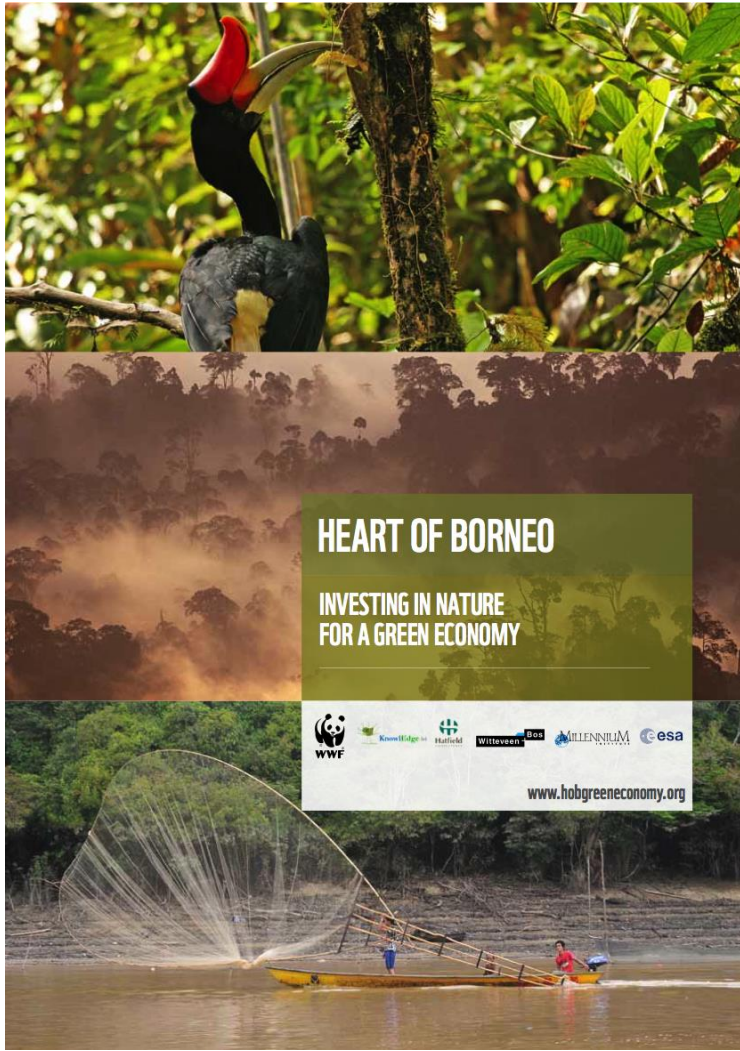
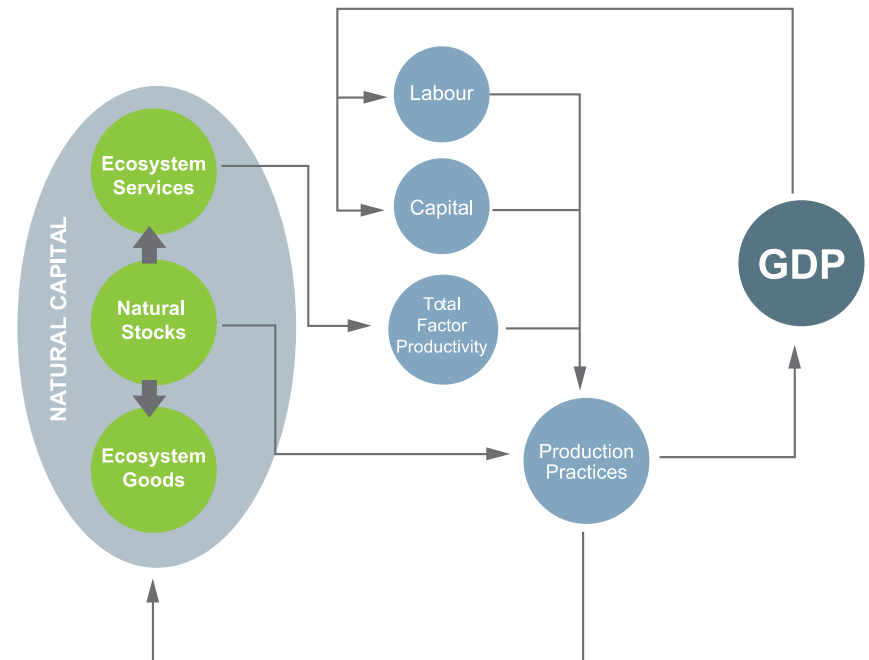


Figure 7. Results of the 3-stage analysis, showing land use scenarios, and resultant changes in floodplain ecosystem service status and linked trends in GBR

# Example: Heart of Borneo



## An integrated economic valuation of environmental stocks and services



Conceptual model of the conventional economy which externalizes natural capital from production

Credit: A. Bassi.

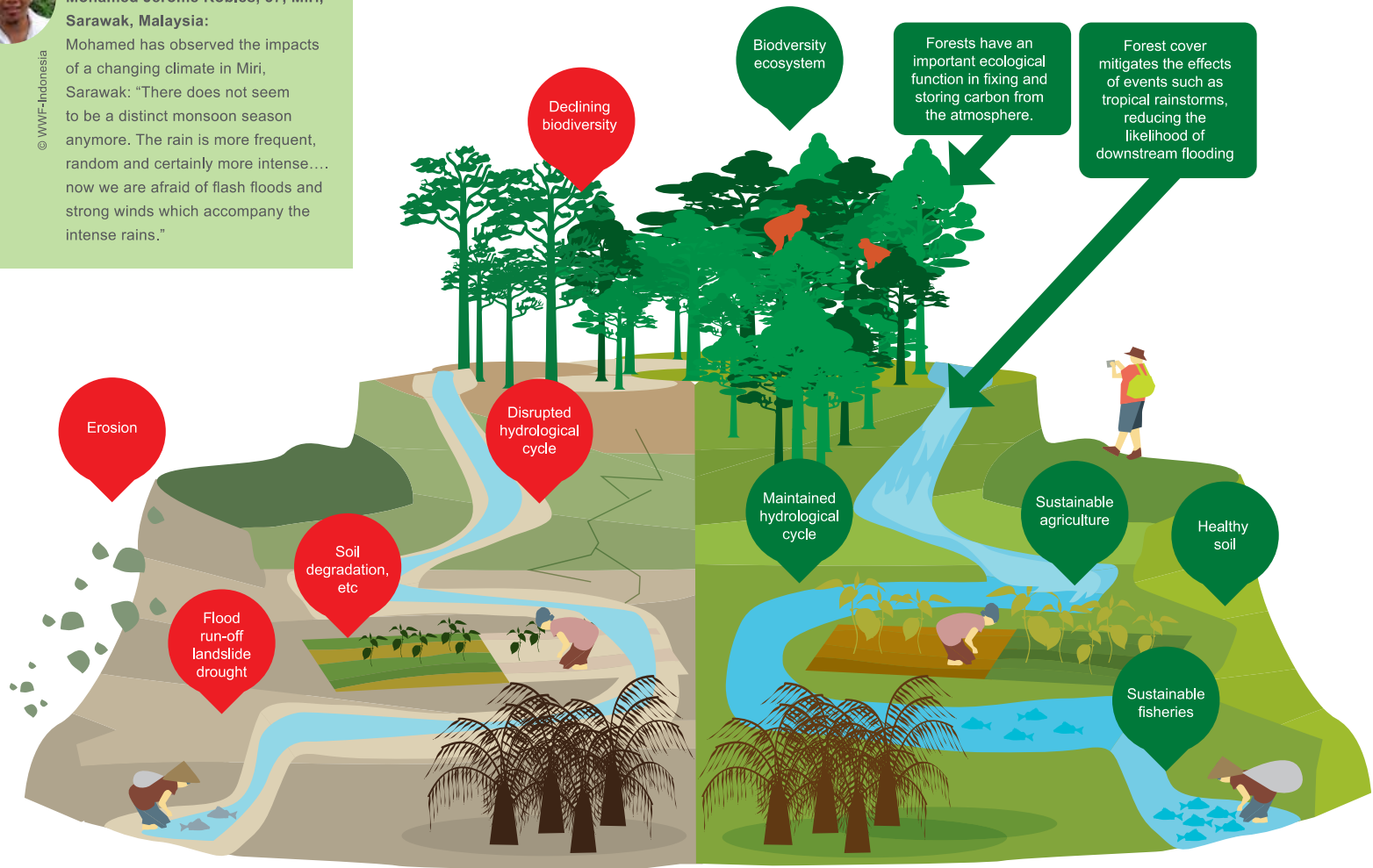
# Example: Heart of Borneo



**Mohamed Jerome Robles, 37, Miri, Sarawak, Malaysia:**

Mohamed has observed the impacts of a changing climate in Miri, Sarawak: "There does not seem to be a distinct monsoon season anymore. The rain is more frequent, random and certainly more intense.... now we are afraid of flash floods and strong winds which accompany the intense rains."

© WWF-Indonesia

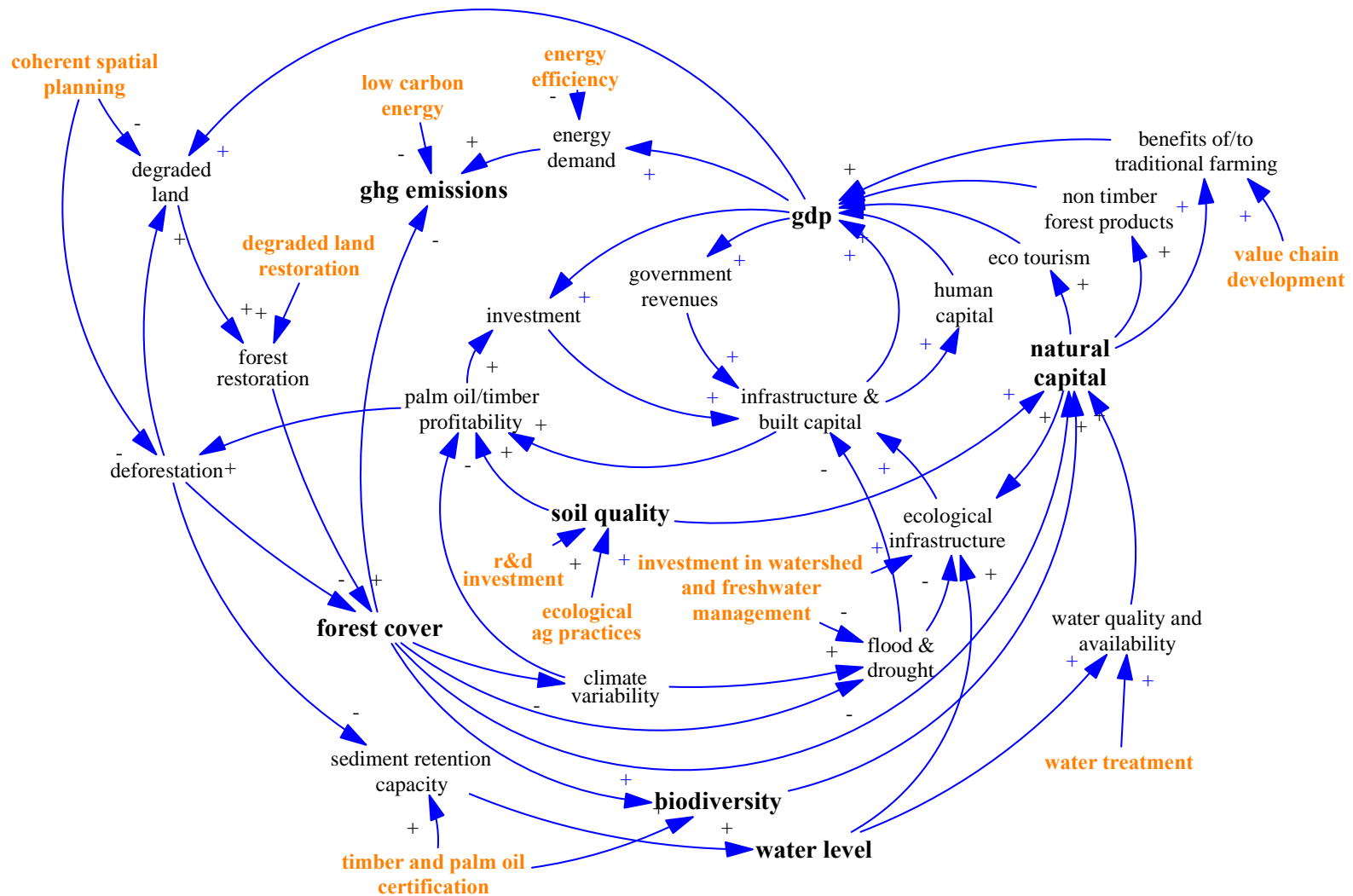


Credit: A. Bassi.

## Example: Heart of Borneo

- Estimation of the **biophysical and economic value** of soil, forest, biodiversity, and carbon storage.
- Estimation of **the economic impact** of **natural resource stock utilization**.
  - For instance, industrial production is influenced by the usability of rivers for transport, which -in our model- is affected by the average level of water, siltation, and extreme events (such as floods and droughts), which are generally driven by precipitation and forest cover.

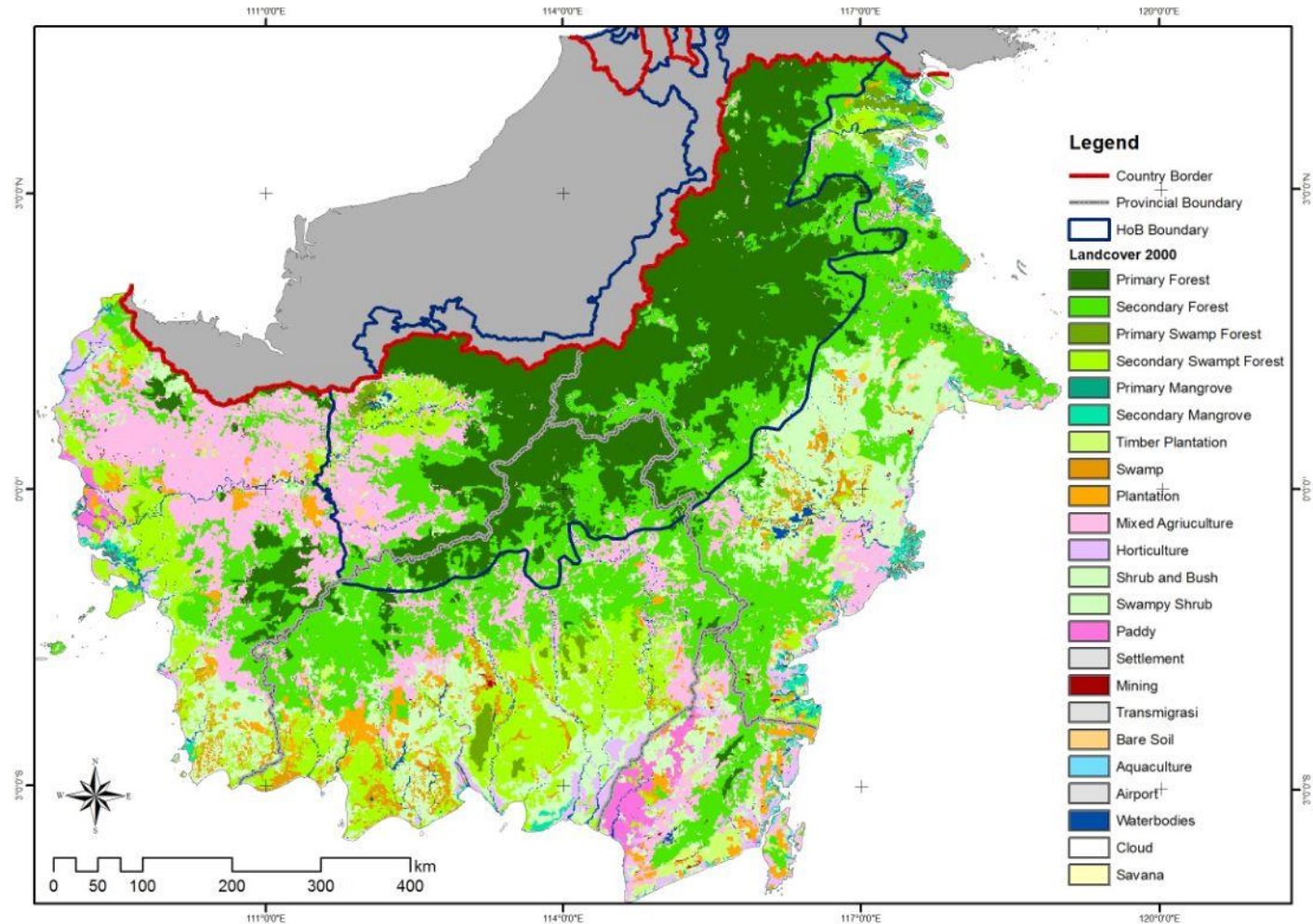
# Example: Heart of Borneo





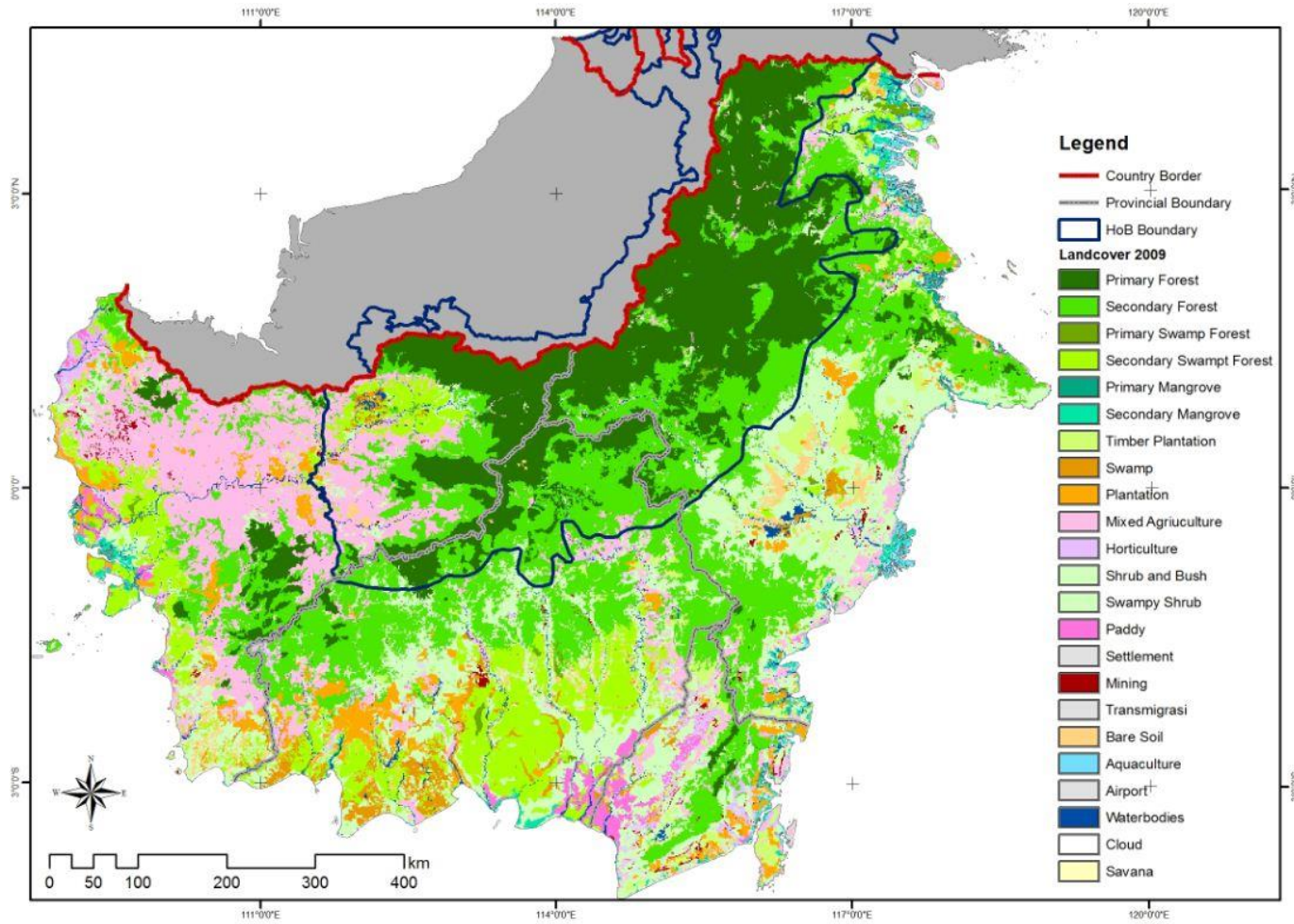
# Example: Heart of Borneo

## Simulation of Spatial Scenarios (2000)



# Example: Heart of Borneo

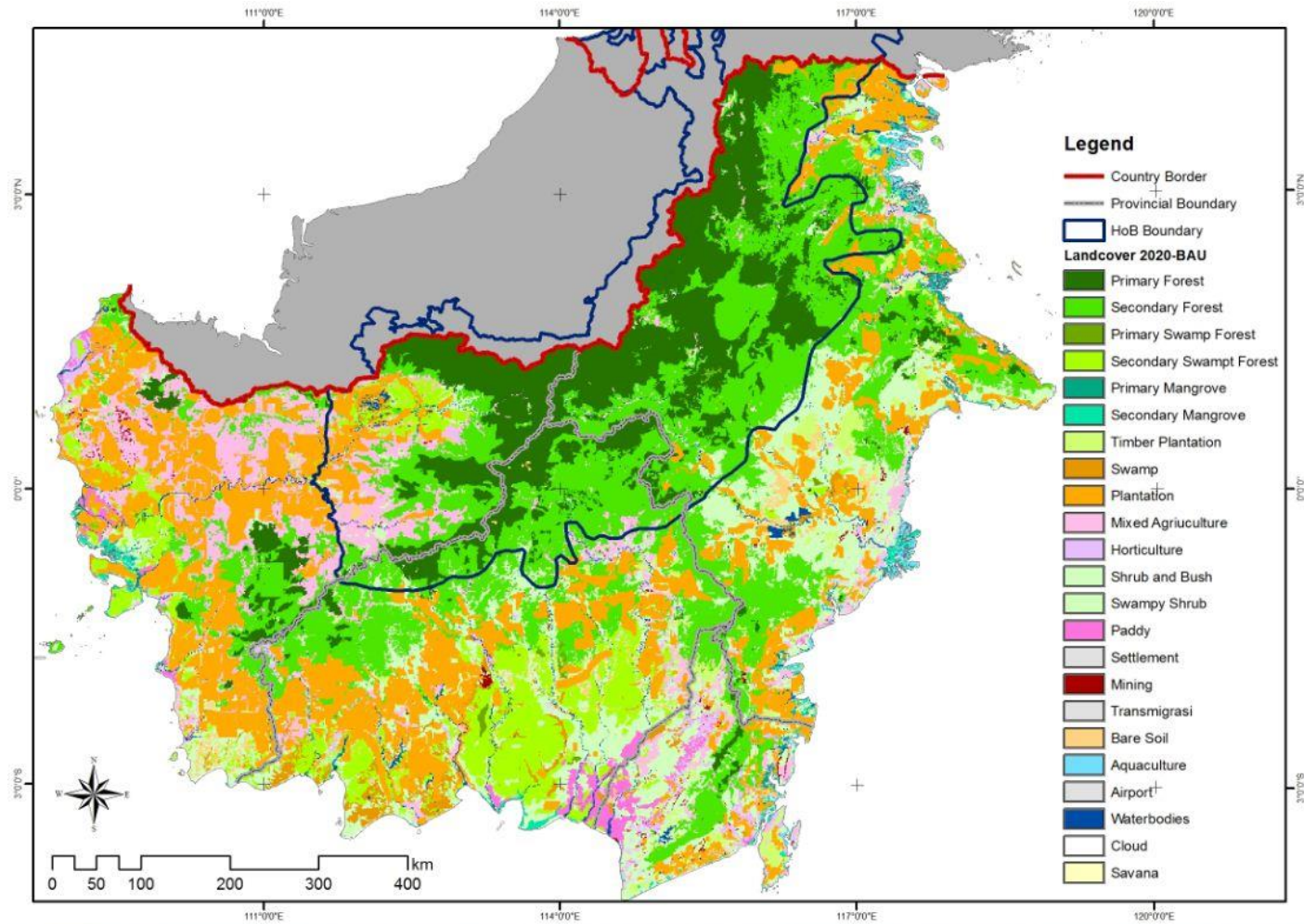
## Simulation of Spatial Scenarios (2009)





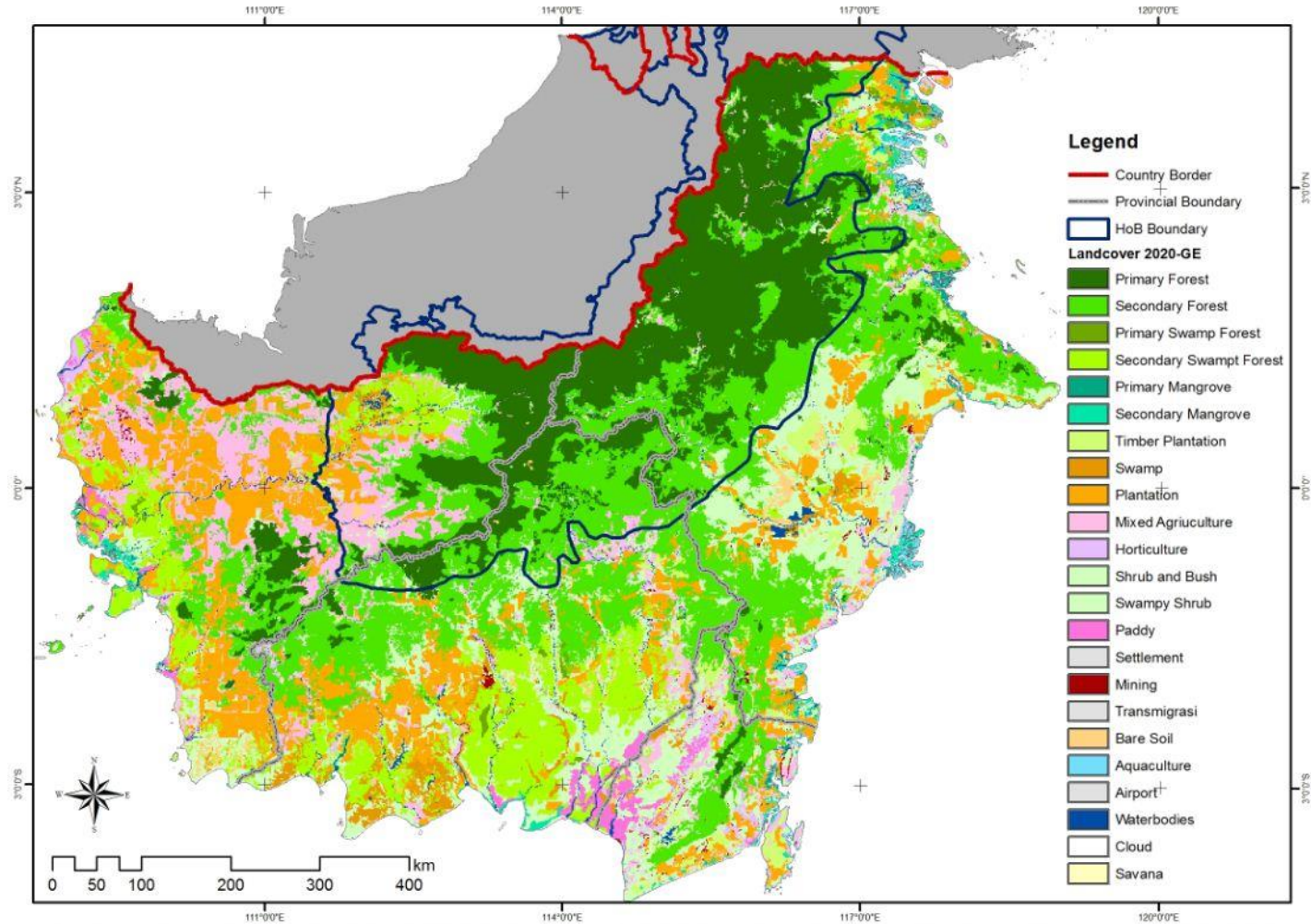
# Example: Heart of Borneo

## Simulation of Spatial Scenarios (2020)



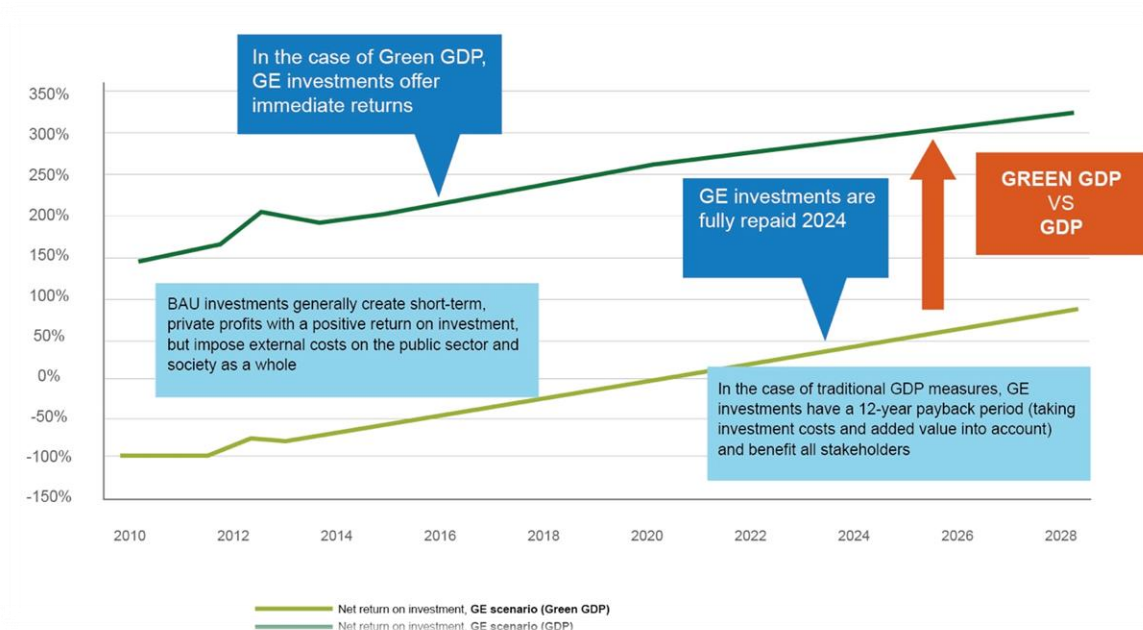
# Example: Heart of Borneo

## Simulation of Spatial Scenarios (GE 2020)



# Example: Heart of Borneo

## Simulation of Spatial Scenarios: Impacts on Growth



GE projections show higher GDP growth than BAU (up to 0.2% of growth per year)

Rural poverty reduces (5% increased rural income)

Higher employment (especially in energy and agriculture),

Reduction in GHG emission intensity of about 30% on average

**Under BAU scenario value of natural capital will decline, turning from a source of revenue to a cost, with estimated turning point shortly after 2020.**



# Example: WWF's 'Road to Dawei' Study

The “Road to Dawei” project involves the construction of a road link from Bangkok (Thailand) to Dawei (Myanmar), across the highly biodiverse Dawna Tenasserim Landscape (DTL), and it was conceived under the framework of the “Dawei deep-sea port” project.



Credit: A. Bassi.

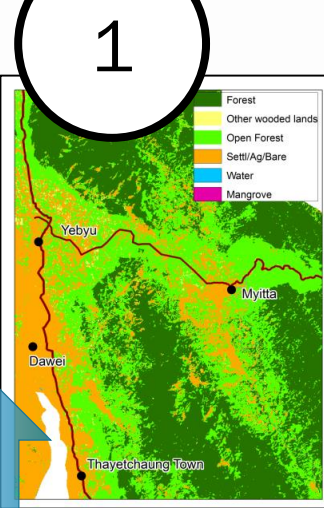
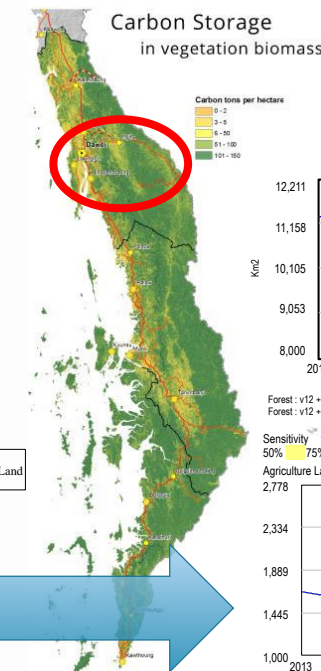
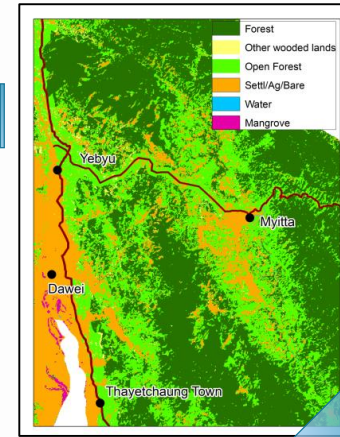
# Relevant Example: WWF's 'Road to Dawei' Study

Three methodologies were used:

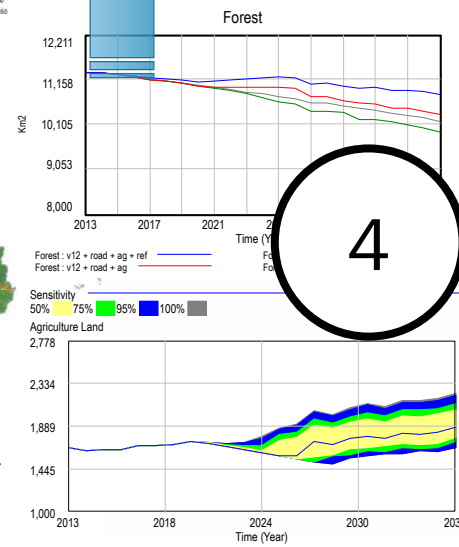
1. The **InVEST** tool to generate spatial information and estimate changes in natural capital stocks
2. **Causal Loop Diagram** to identify the main drivers and impacts of land use change in the DTL region.
3. The **Integrated Planning for Sustainability (IPS)** model was developed using the System Dynamics methodology, and incorporating the key drivers of land use change and impacts.

Credit: A. Bassi.

# Scenario 1



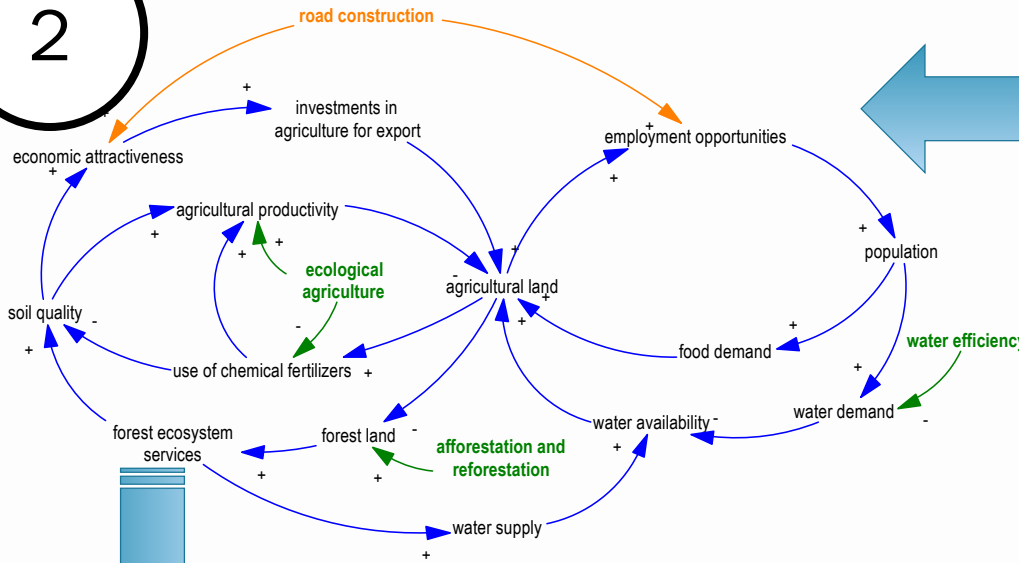
# Scenario 2



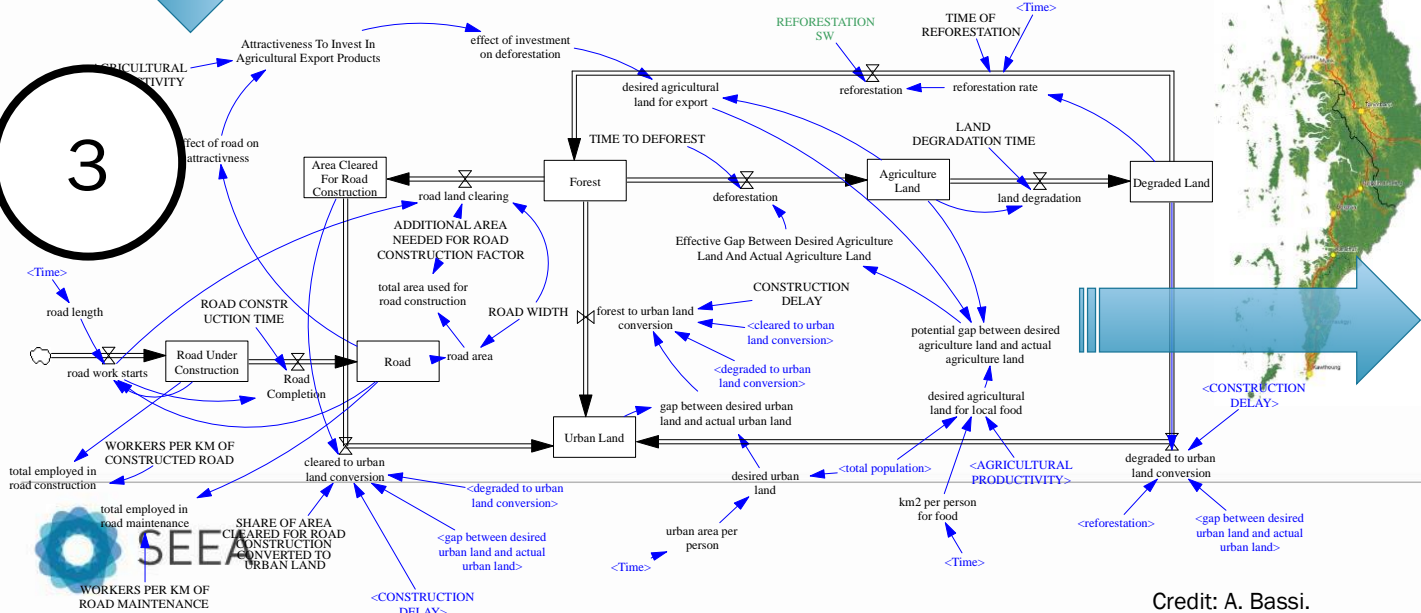
Time (Year)	2035
<b>Cumulative Value Of NTFP (USD)</b>	
v12 + road + ag + ref	482.86 M
v12 + road + ag	473.17 M
v12 + road	464.82 M
v12 BAU	466.61 M

Credit: A. Bassi.

2



3



4



# System mapping for the 'Road to Dawei'

Conserving natural capital in Tanintharyi Region, Myanmar  
*for the benefit of people and wildlife*

## Forest change 2000 - 2012

Percent forest cover loss 2000 - 2012

- 0 - 10
- 11 - 40
- 41 - 60
- 61 - 80
- 81 - 100

Forest change

- Forest gain
- Forest loss
- Forest gain and loss

Tanintharyi (DRC) forest change data was adjusted to match map scale of 1:1,000,000 by reducing the map to show an average value from the assembly of the area. This resulted in an aggregation of 30m resolution to 100m resolution.



Tanintharyi has some of the largest remaining expanses of forest in Myanmar, with a rich array of wildlife including elephants, tigers and other endangered species. These forests are also an important source of **natural capital**, providing vital **benefits to the people of Myanmar** and beyond.

## Reduction of coastal vulnerability

Scale of natural habitat reducing exposure

Low High

Population (no. km)

0-100 101-200 201-300 301-400 401-500



Natural features along the coastline, such as mangrove forests, reduce vulnerability of coastal populations to storm waves, particularly in the densely populated north.

## Carbon Storage in vegetation biomass

Carbon tons per hectare

0-2 3-4 5-6 7-8 9-10 11-12 13-14 15-16 17-18 19-20 21-22 23-24 25-26 27-28 29-30 31-32 33-34 35-36 37-38 39-40 41-42 43-44 45-46 47-48 49-50 51-52 53-54 55-56 57-58 59-60 61-62 63-64 65-66 67-68 69-70 71-72 73-74 75-76 77-78 79-80 81-82 83-84 85-86 87-88 89-90 91-92 93-94 95-96 97-98 99-100 101-102 103-104 105-106 107-108 109-110 111-112 113-114 115-116 117-118 119-120 121-122 123-124 125-126 127-128 129-130 131-132 133-134 135-136 137-138 139-140 141-142 143-144 145-146 147-148 149-150 151-152 153-154 155-156 157-158 159-160 161-162 163-164 165-166 167-168 169-170 171-172 173-174 175-176 177-178 179-180 181-182 183-184 185-186 187-188 189-190 191-192 193-194 195-196 197-198 199-200 201-202 203-204 205-206 207-208 209-210 211-212 213-214 215-216 217-218 219-220 221-222 223-224 225-226 227-228 229-230 231-232 233-234 235-236 237-238 239-240 241-242 243-244 245-246 247-248 249-250 251-252 253-254 255-256 257-258 259-260 261-262 263-264 265-266 267-268 269-270 271-272 273-274 275-276 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777-778 779-780 781-782 783-784 785-786 787-788 789-790 791-792 793-794 795-796 797-798 799-800 801-802 803-804 805-806 807-808 809-810 811-812 813-814 815-816 817-818 819-820 821-822 823-824 825-826 827-828 829-830 831-832 833-834 835-836 837-838 839-840 841-842 843-844 845-846 847-848 849-850 851-852 853-854 855-856 857-858 859-860 861-862 863-864 865-866 867-868 869-870 871-872 873-874 875-876 877-878 879-880 881-882 883-884 885-886 887-888 889-890 891-892 893-894 895-896 897-898 899-900 901-902 903-904 905-906 907-908 909-910 911-912 913-914 915-916 917-918 919-920 921-922 923-924 925-926 927-928 929-930 931-932 933-934 935-936 937-938 939-940 941-942 943-944 945-946 947-948 949-950 951-952 953-954 955-956 957-958 959-960 961-962 963-964 965-966 967-968 969-970 971-972 973-974 975-976 977-978 979-980 981-982 983-984 985-986 987-988 989-990 991-992 993-994 995-996 997-998 999-1000 1001-1002 1003-1004 1005-1006 1007-1008 1009-1010 1011-1012 1013-1014 1015-1016 1017-1018 1019-1020 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2421-2422 2423-2424 2425-2426 2427-2428 2429-2430 2431-2432 2433-2434 2435-2436 2437-2438 2439-2440 2441-2442 2443-2444 2445-2446 2447-2448 2449-2450 2451-2452 2453-2454 2455-2456 2457-2458 2459-2460 2461-2462 2463-2464 2465-2466 2467-2468 2469-2470 2471-2472 2473-2474 2475-2476 2477-2478 2479-2480 2481-2482 2483-2484 2485-2486 2487-2488 2489-2490 2491-2492 2493-2494 2495-2496 2497-2498 2499-2500 2501-2502 2503-2504 2505-2506 2507-2

## A circular logo with a stylized landscape. At the top, a rainbow arches over a bright yellow sun. Below the sun, two white wind turbines stand on a green hill. To the right of the turbines are two green trees. The foreground consists of rolling green hills and a blue body of water at the bottom. The entire scene is enclosed within a circular border.

**Low Carbon Development plan** is a set of inclusive development planning policies and low-carbon investment strategies for the RPJMN 2020-2024 and the Roadmap of SDG 2030 that encourage Indonesia to reduce the intensity of emissions and GHG Emissions





# Indonesia case study

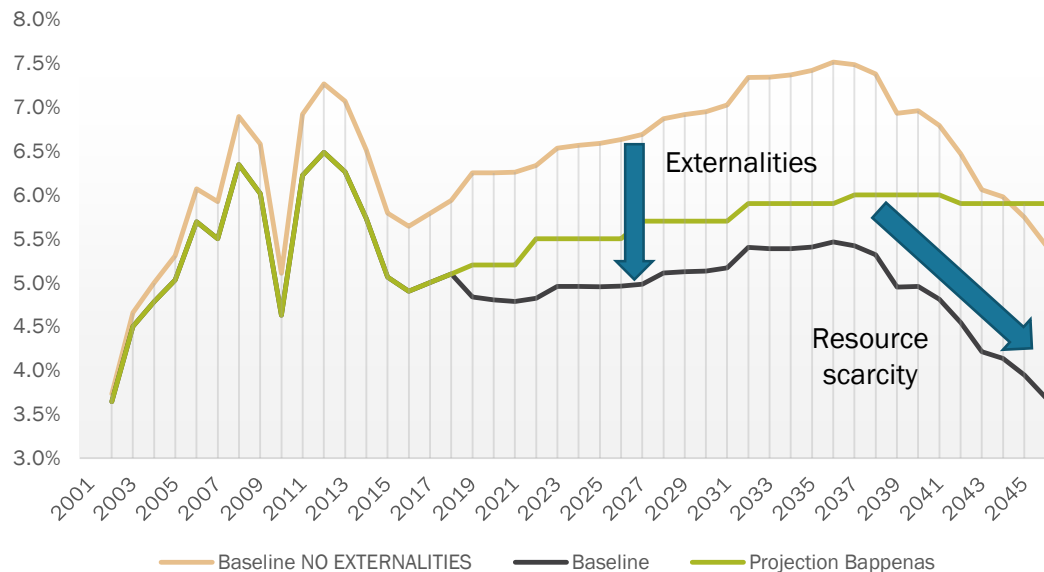
Carrying capacity is embedded in the model using two main dynamics:

- **Ecosystem services:** water and air quality have a negative impact on productivity and therefore on economic performance.
- **Ecological scarcity:** the use of natural resources is essential for production. The decline of the stock of available natural resources leads to price increases (e.g. imports are generally more expensive than domestic production, and fossil fuels become more and more expensive to extract as depletion increases).

Credit: A. Bassi.

# Indonesia case study

GDP growth rate - with resource constraint  
(potential and actual)



The limitations of natural resources (depletion of Water, Energy and Forests) are projected to **hamper economic growth** if there is no intervention in development policies that **pro-carrying capacity**



**Note: Temporary simulation results and validation will be carried out**

Credit: A. Bassi.

# Thank you!

# 谢谢!