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IEEM Integrated Economic-Environmental Modeling

THE IEEM PLATFORM AND NCA-BASED MODELING

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OUTLINE

- We have accounts, now what?
- From accounts to models (integrating NCA into SNA?).

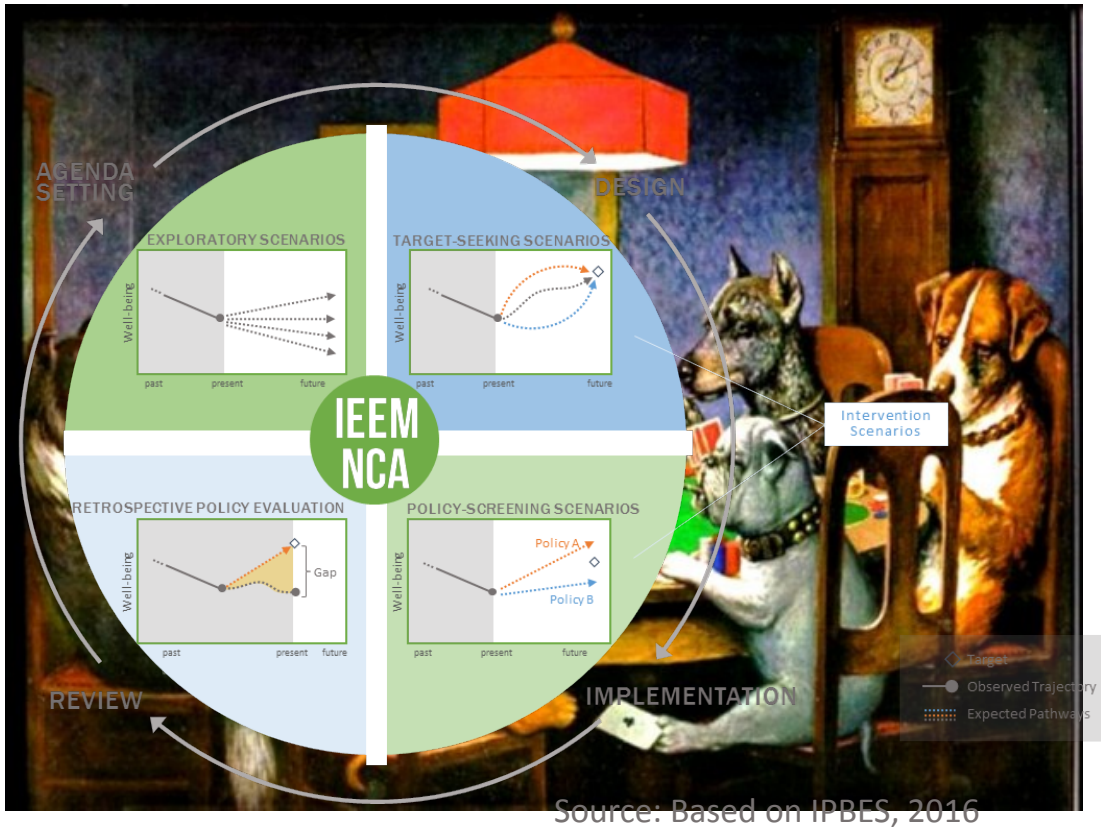
The Integrated Economic-Environmental Modeling Platform and Evidence-Based Policy Modeling.

- Exploratory scenarios- investing in irrigation.
- Target seeking- NDCs.
- Policy screening- SDGs.
- Retrospective evaluation- investing in tourism.
- Getting spatial- IEEM + ESM and Green Growth.

USES OF NCA: INDICATORS

- NCA as information system.
- Indicators for monitoring/issues:
  - Water productivity, energy intensity, pollution per unit output, investment in environment, wealth.
- Guatemala:
  - In 60 years, Guatemala lost 50% forest cover; 95% illegal.
  - Only 54% of HH fuelwood could be supplied legally.
  - Real Policy Impact: strategies for control of illegal logging; fuelwood; forest incentives.

USES OF NCA: EVIDENCE-BASED POLICY



Source: Based on IPBES, 2016

Models: represent the essential features of the object of interest in an idealized or simplified way.

NATURAL CAPITAL BASED MODELING

- Space pen? Models fit for purpose, from simple to complex. Depends on the question/resources ($+t)/ capacity.
- Scenario analysis:
  - Extended input-output model; enviro flows to demand.
  - **IEEM: Integrated Economic-Environmental Modelling Platform.**

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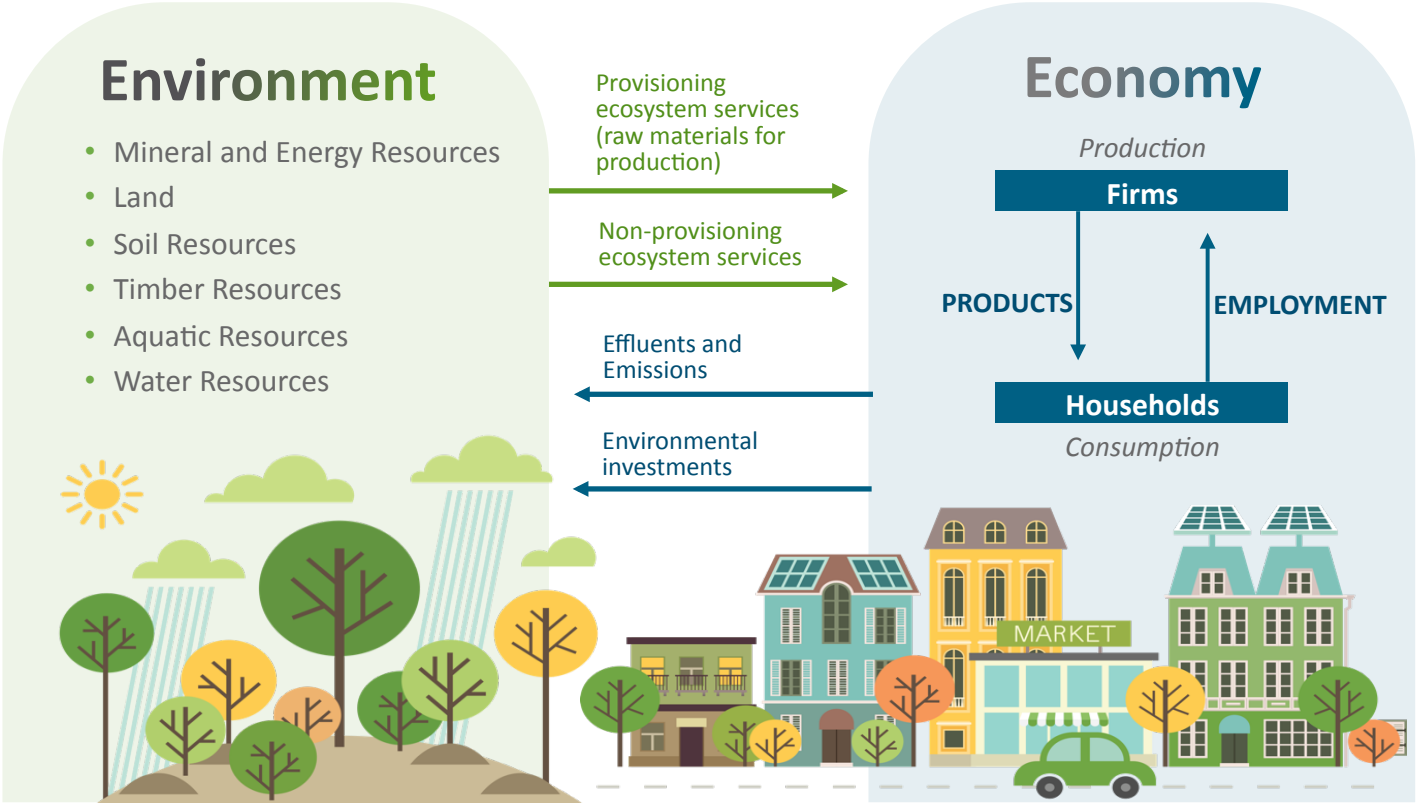
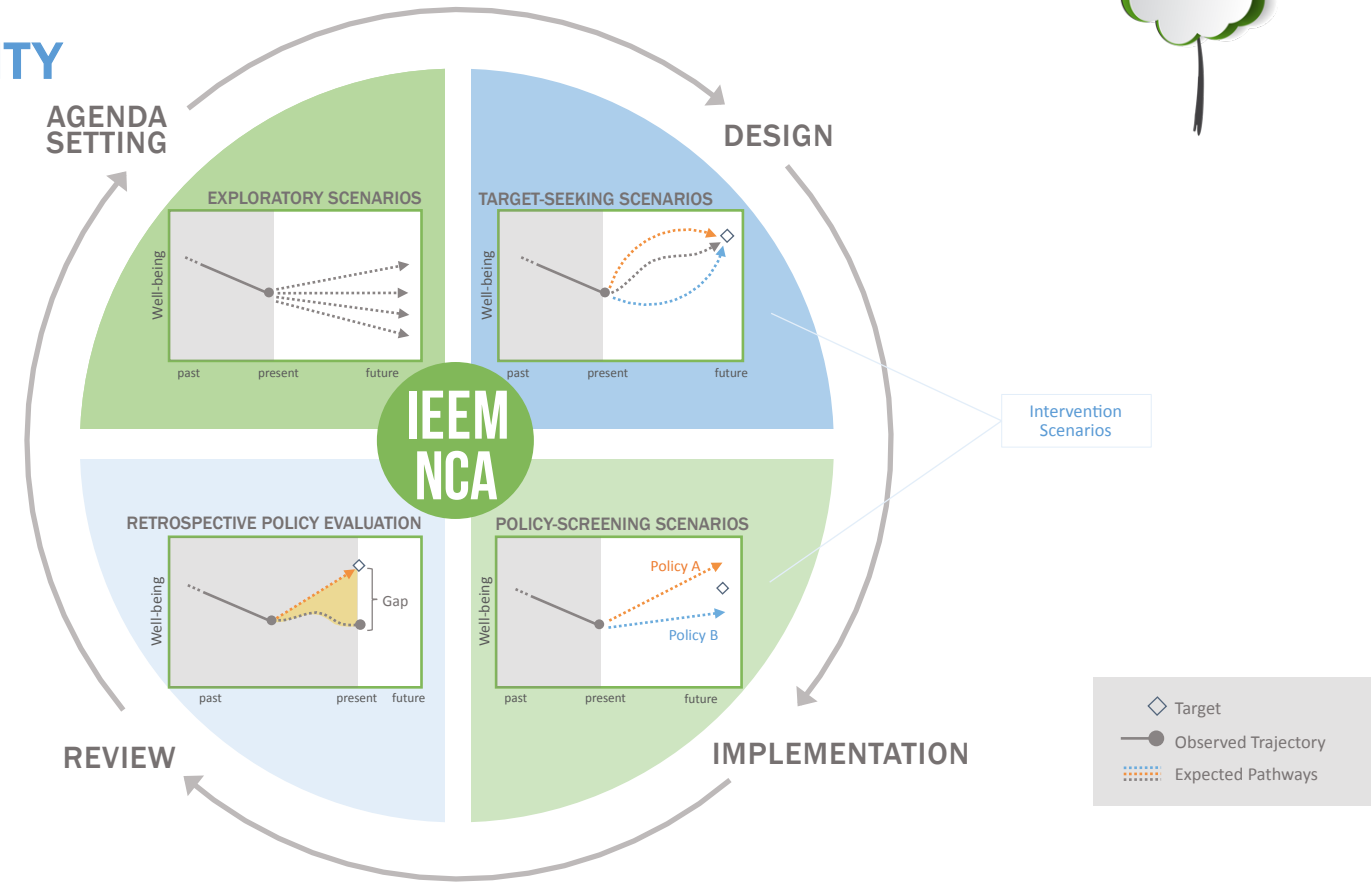
INTEGRATED ECONOMIC-ENVIRONMENTAL MODELING



AGENDA SETTING: EXPLORING VIABILITY WITH IEEM

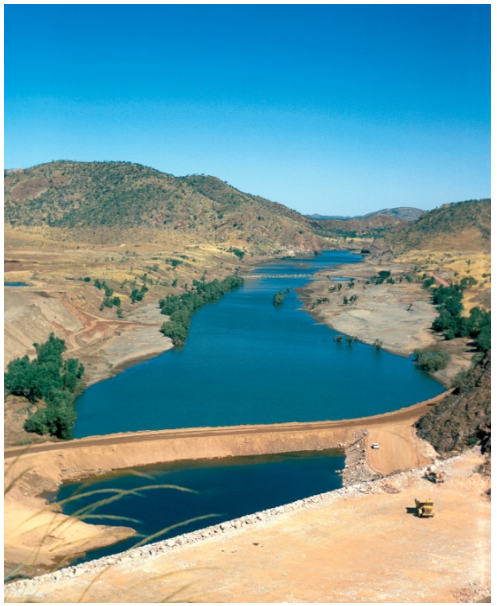


AGENDA SETTING: EXPLORING VIABILITY WITH IEEM

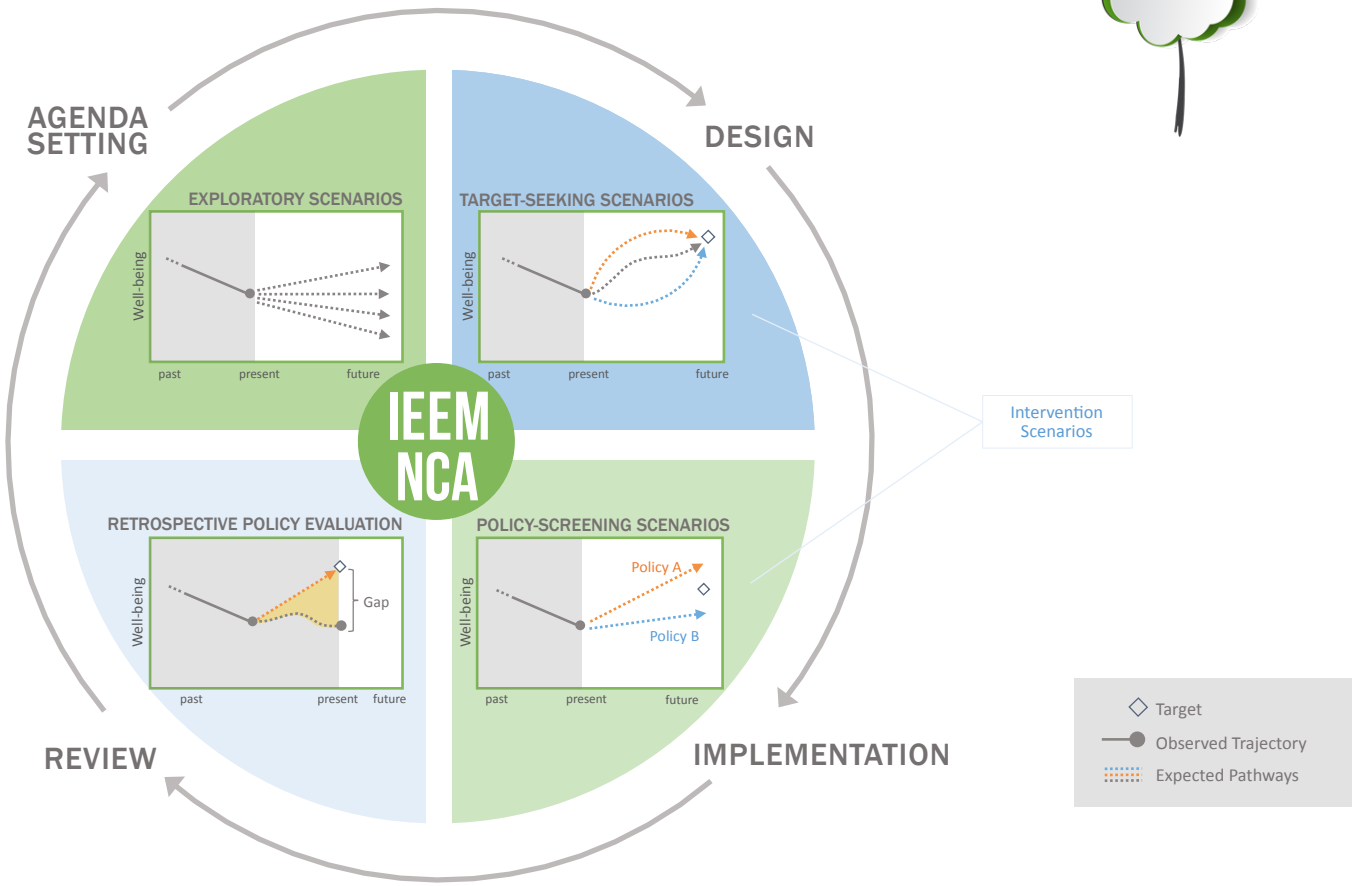
- Policy question from AUS Government: what would be the economic impact of US$3 billion investment in irrigation in Flinders Gilbert, NW Queensland?

RESULTS

- Region: 4% more jobs, 6% higher income.
- Nation: worse off. Net present value: **-US$51 million.**
- Alternative **FACTS**
- Alternative **FUTURES:**
  - Faster export growth, NPV: **US$86 million.**
  - Climate change impact, Murray Darling, NPV: **US$36 million.**



POLICY DESIGN: TARGET-SEEKING SCENARIOS WITH IEEM



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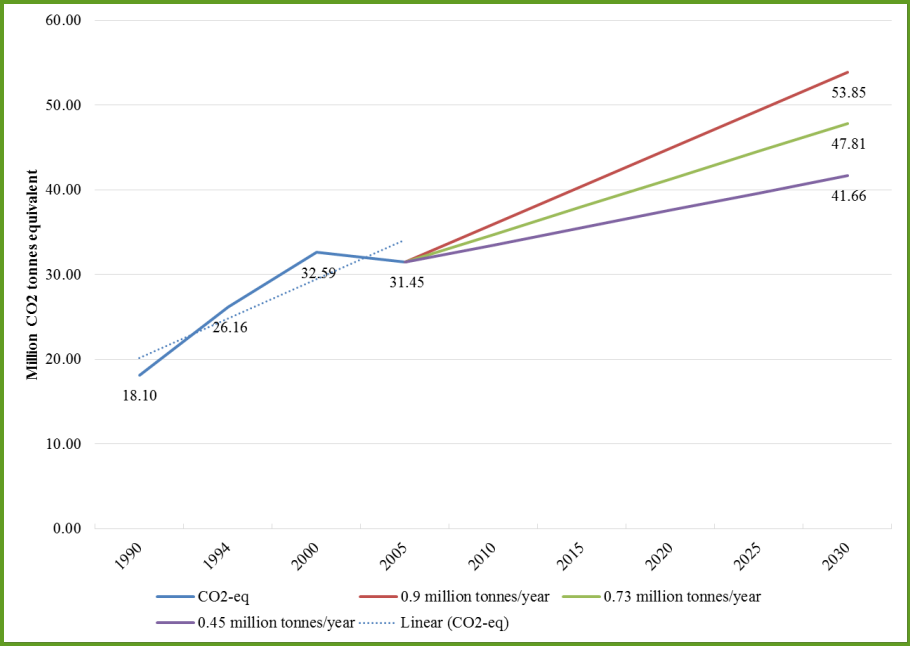
TARGET-SEEKING: GUATAMALA'S NATIONALLY DETERMINED COMMITMENTS



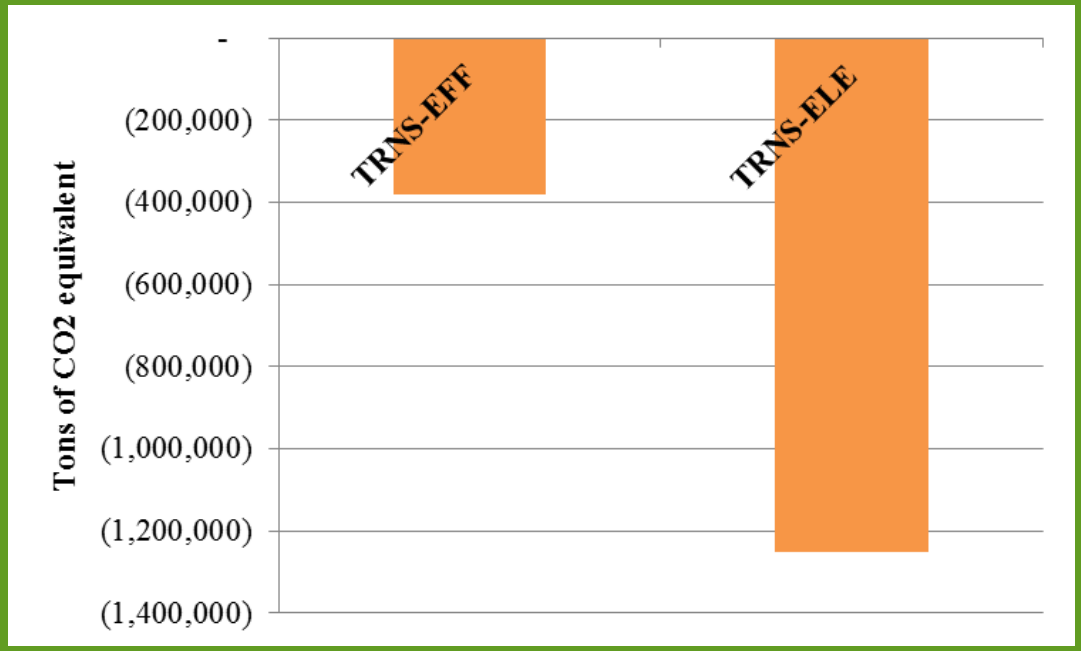
- Guatemala: responsible for <0.1% of global emissions.
- BAU= 53.85 million tons CO2 equivalent in 2030.
- Reduce emissions 11.2%, by 6.04 M tons; or 22.6%, by 12.19 M tons- with financial support.
- Target sectors: forestry, agriculture and transport sectors.

TRANSPORT SECTOR SCENARIOS

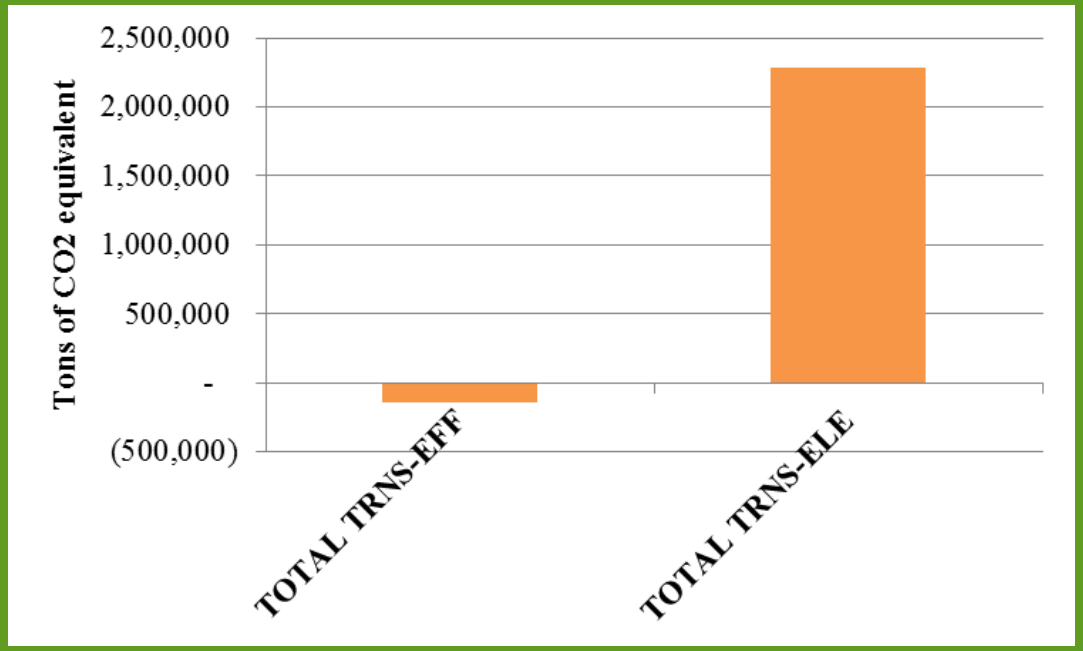
- **TRNS-EFF:** 15% increase efficiency in fossil fuel combustion in transport (freight shipping) sector.

- **TRNS-ELE:** Substitute 15% of fossil-fuel based energy with electricity in transport sector (same number of terajoules generated).

RESULTS: TRANSPORT SECTOR EMISSIONS CHANGE BY 2030



RESULTS: ECONOMY-WIDE EMISSIONS CHANGE BY 2030



TARGET-SEEKING: GUATEMALA FOREST SECTOR AND FUELWOOD SCENARIOS

- Fuelwood supplies 57% of Guatemala's national energy consumption.
- Issues: deforestation; 10 million m^3 deficit; 5,000 premature deaths per year, and; 1% GDP loss.

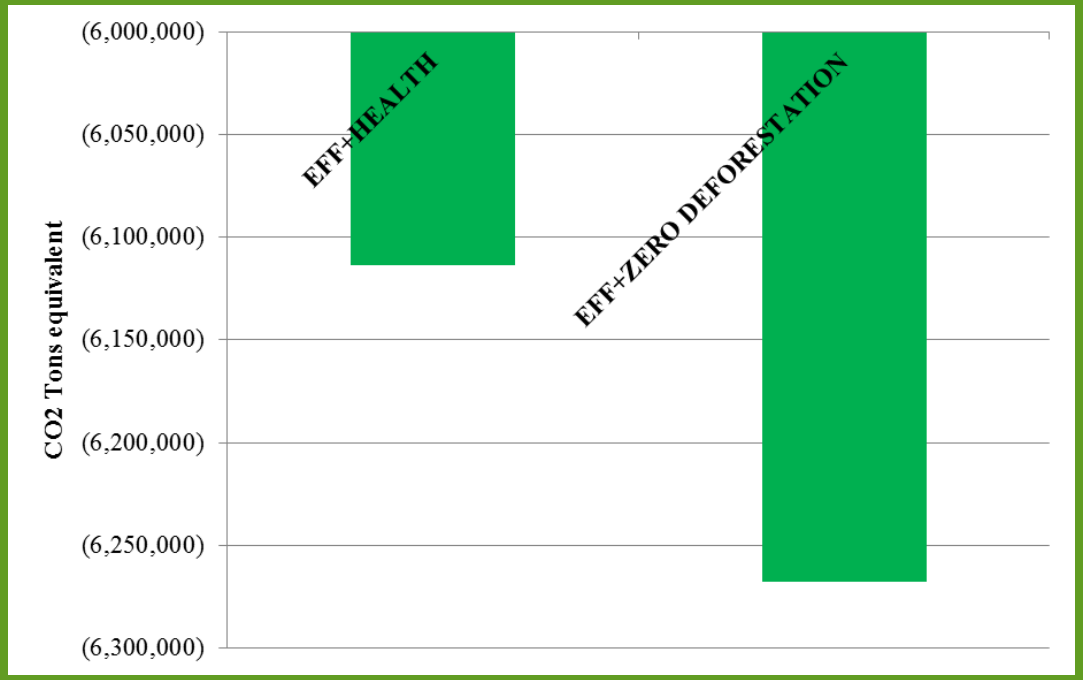
EFFICIENCY + HEALTH:

25% more efficient fuelwood cookstoves; health benefits agricultural labor productivity.

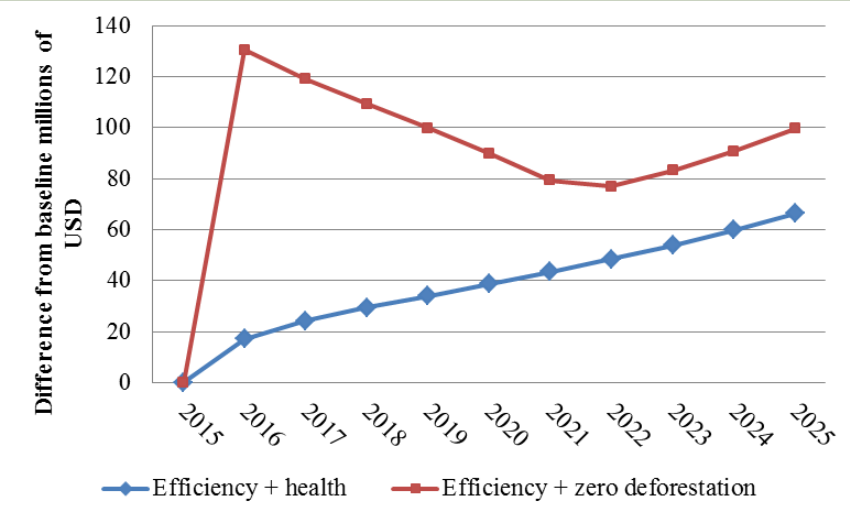
EFFICIENCY + ZERO DEFORESTATION:

efficiency + health, with complementary strategy of zero deforestation.

RESULTS: ECONOMY-WIDE EMISSIONS CHANGE BY 2030



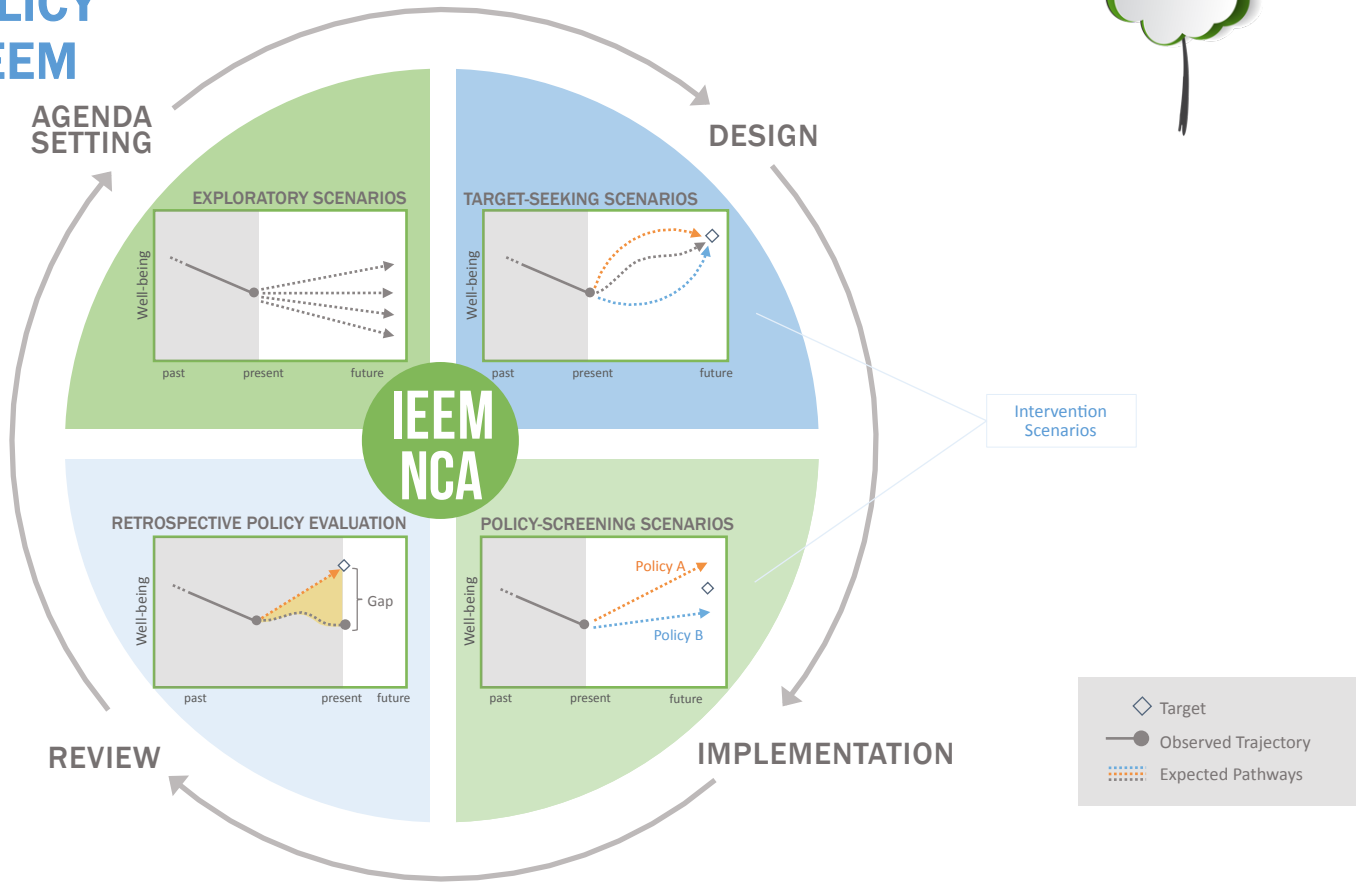
RESULTS: BEYOND GDP; GENUINE SAVINGS



Transmission mechanism:

- Increase in forest stock.
- Lower emissions.
- Less expenditure on fuelwood = more income for consumption and savings.

POLICY DESIGN: POLICY SCREENING WITH IEEM



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POLICY SCREENING: SDG 2 AND IRRIGATED AGRICULTURE

Irrigated Agriculture

SDG 2, Zero Hunger, Target 2.3: double agricultural productivity and rural incomes.

Strategy: increase irrigated agriculture.

Increase of irrigated area:
106,300 ha.

Investment:
US$7.95 million

Time horizon:
5 years

SDG

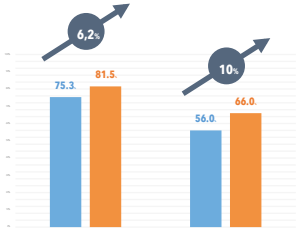
SDG 2, Target 2.3

POLICY SCREENING: SDG 6 AND WATER AND SANITATION

Water and Sanitation

SDG 6, Water and Sanitation, Target 6.1 and 6.2: water and sanitation for all.

Strategy: increase coverage of water and sanitation.



Increase water and sanitation coverage by 6.2% and 10% to **81.5% and 66%, respectively**

Investment:
US$1.67 billion

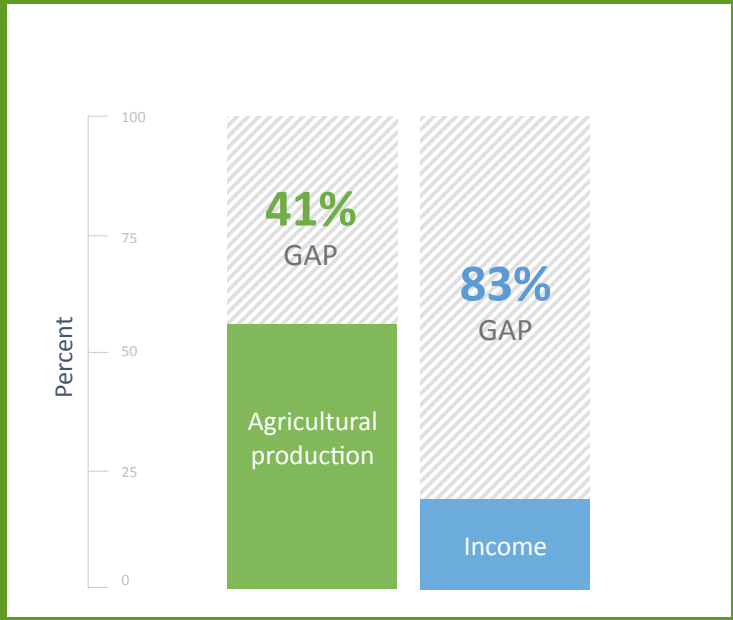
Time horizon:
13 years

SDG

SDG 6, Target 6.1 and 6.2

RESULTS: ECONOMIC AND POVERTY IMPACTS

- 41% and 83% gap remain to double agricultural output and income, respectively.
- Poverty impacts: 2.42 million people are lifted from poverty; 100,000 people attributed to investments.
- Negative NPV for water and sanitation, though is basic human right (UN64/292 de 2010)
- Irrigation investment compensates with combined NPV of USS$1.4 mil million.



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RESULTS: ENVIRONMENT

Total greenhouse gas emissions increased by **642,346 tons of CO_2.**

Water consumption per capita across all uses increased by **1,860 ML/ capita.**

36,528 ha deforested by 2030; additional 9,820 ha deforested with investment. Genuine savings increases by **US$595 million.**

INTEGRATED ANALYSIS REVEALS

Synergies:

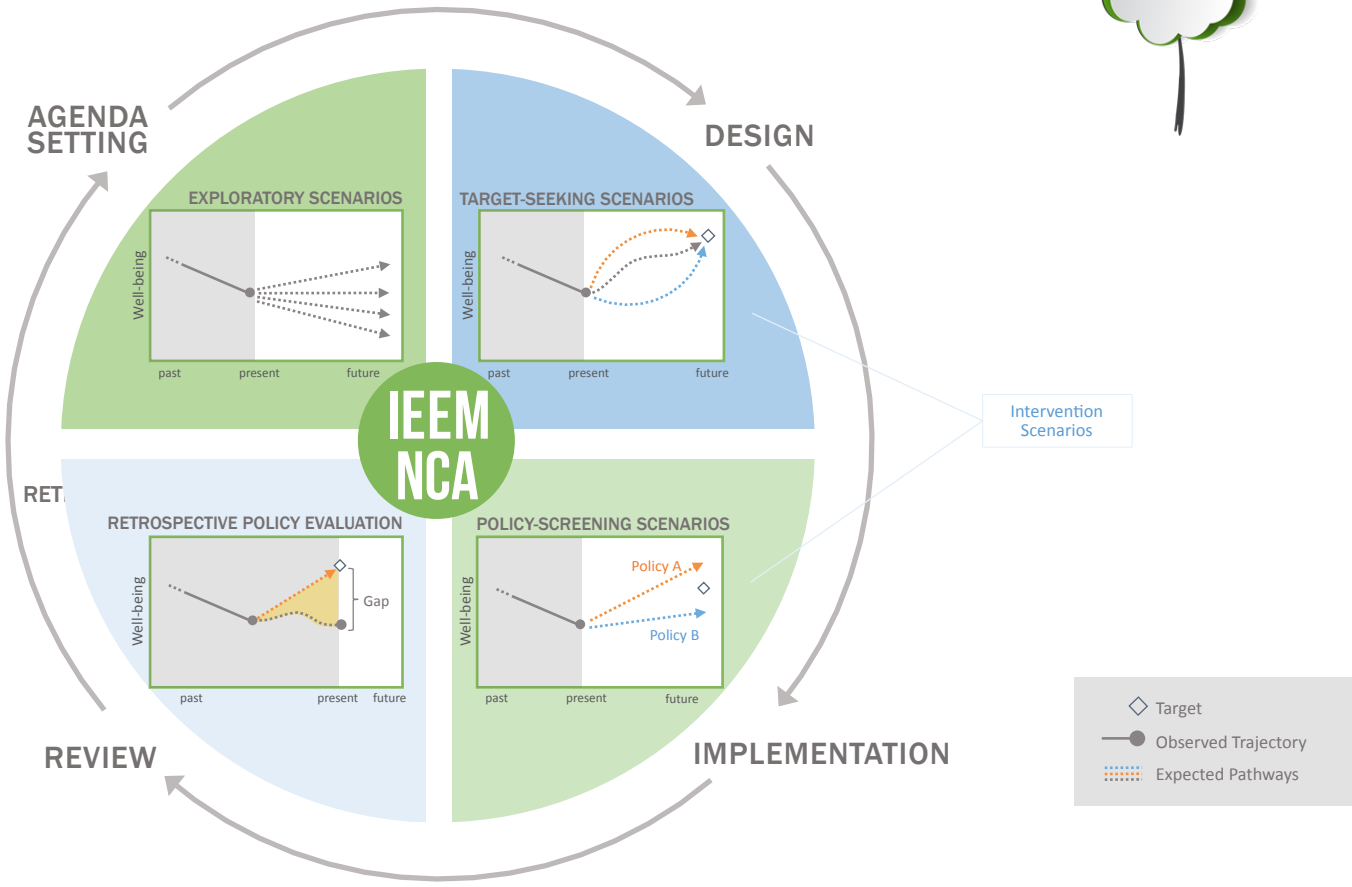
Certain lines of action (2.3- Zero Hunger) can contribute to various SDGs: **SDG 1-** Eliminating Poverty, and; **SDG 8-** Promoting Sustainable Economic Development and Employment (increase GDP by US$1.37 billion).

Perverse impacts:

Trade-offs: advances toward **SDG 2** imply additional deforestation which moves away from achieving **SDG 15-** Promoting Sustainable Use of Forests.

Increased emissions slows progress toward, **SDG 13-** Action on Climate Change.

POLICY REVIEW: RETROSPECTIVE POLICY EVALUATION WITH IEEM



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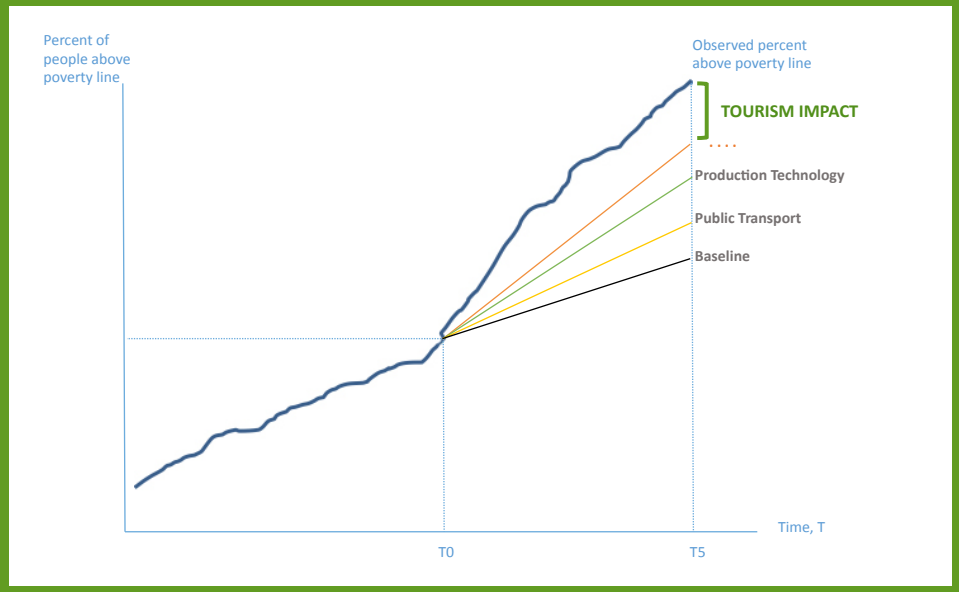
RETROSPECTIVE TOURISM POLICY EVALUATION WITH IEEM



- Investment of US$13 million in municipality in Nicaragua between 2012 and 2016.
- Tourism evaluations complex due to lack of counterfactual.
- Retrospective economic evaluation with IEEM requires construction of baseline and post-investment IEEM.

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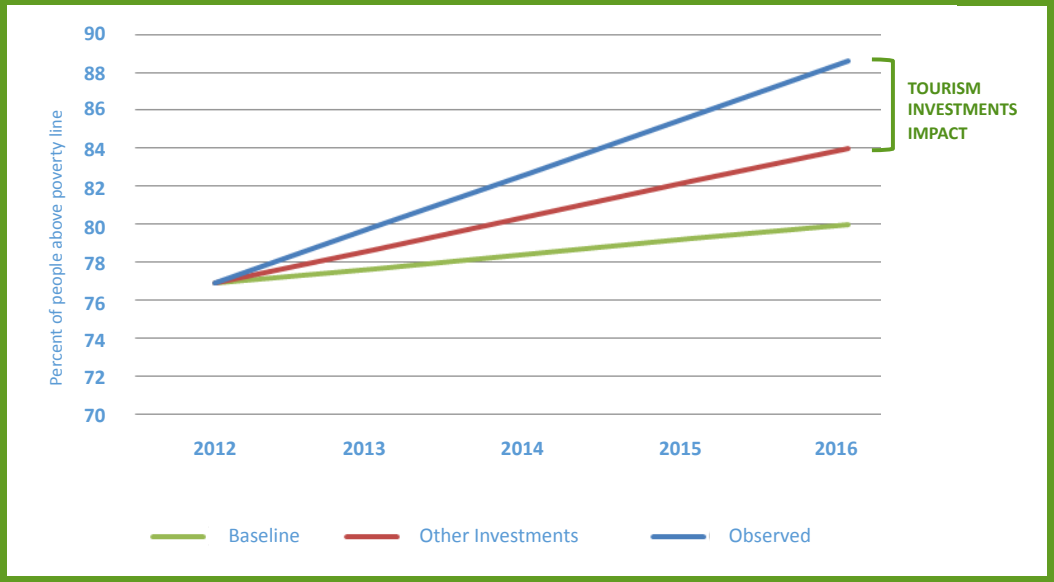
RESULTS: POVERTY IMPACTS



- 80% above poverty line in business as usual.
- Simulated other policy/ investment impacts 84% above poverty line.
- Difference between estimated and observed is tourism investment impact.

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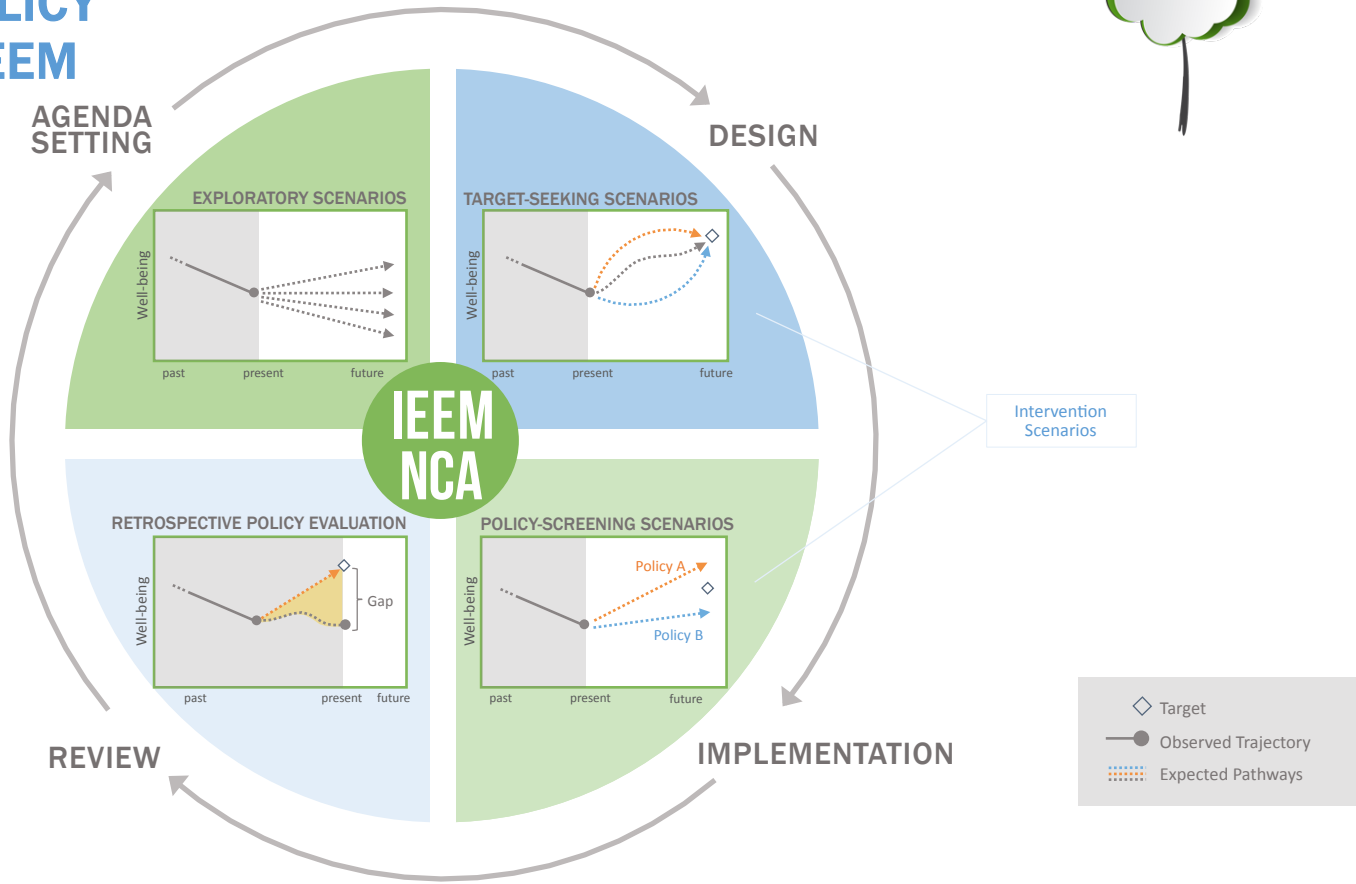
POLICY SCREENING: IEEM + ECOSYSTEM SERVICES MODELLING (ESM)

POLICY DESIGN: POLICY SCREENING WITH IEEM + ESM



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IEEM + ESM

Ecosystems

- Regulating ecosystem services, e.g. climate regulation (carbon) and erosion retention/ sedimentation
- Cultural and aesthetic ecosystem services

Ecosystem service supply feedbacks to economy/IEEM

Non-provisioning ecosystem services

Scenario impacts on ecosystem service supply

Economy

Production

Firms

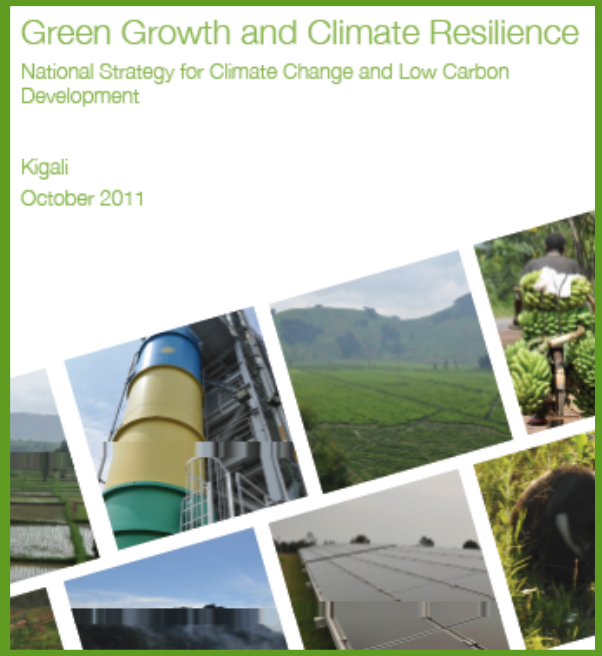
PRODUCTS

EMPLOYMENT

Households

Consumption

IEEM APPLIED TO RWANDA'S GREEN GROWTH STRATEGY



- Achieve middle income country status.
- Transform economy from subsistence-based to knowledge-based.
- Important aspects of Strategy are to increase agricultural productivity and forest cover.

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SCENARIOS

FOR1

Increase forest cover to 30%, planting 103,504 ha.

Cost: **US$285.6 million** over 12 years.

FUEL

Fuelwood provides 86% of energy. More efficient cookstoves/charcoal kilns improve efficiency by 25%.

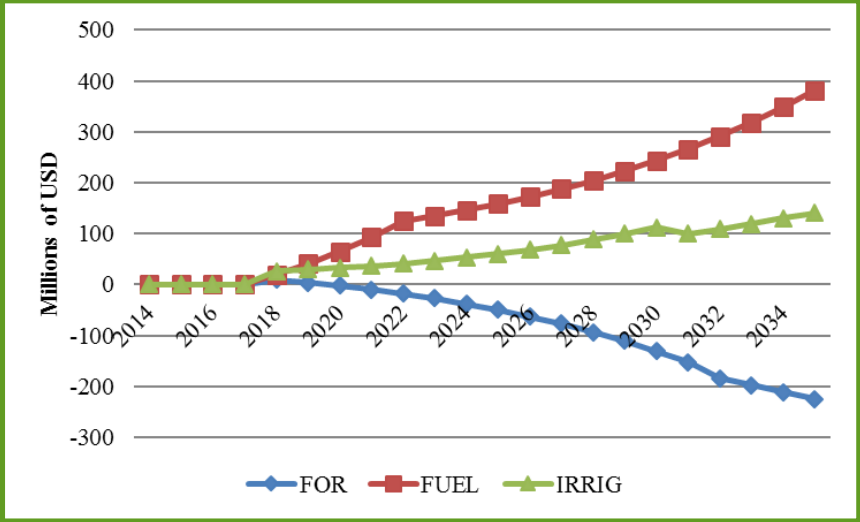
Cost: **US$4.5 million** over 5 years.

IRRIG

Increase irrigated area by 85,473 ha for 25% increase in productivity.

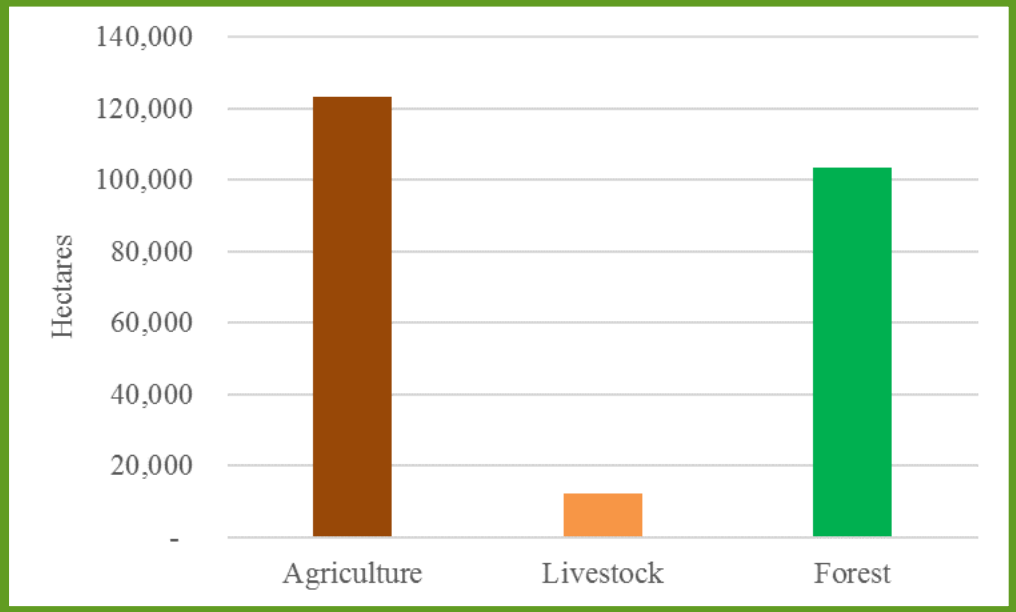
Cost: **US$972.5 million** over 12 years.

FOR1 RESULTS: GDP, DIFFERENCE FROM BAU



- FOR expansion is in competition with agriculture.
- FUEL allows reallocation of factors to other sectors (knowledge/services economy)

FOR2 LAND USE CHANGE BY 2035, NO COMPETITION BETWEEN USE



Increase of 123,292 ha. agriculture; 12,139 ha. livestock; 102,633 ha. forestry.

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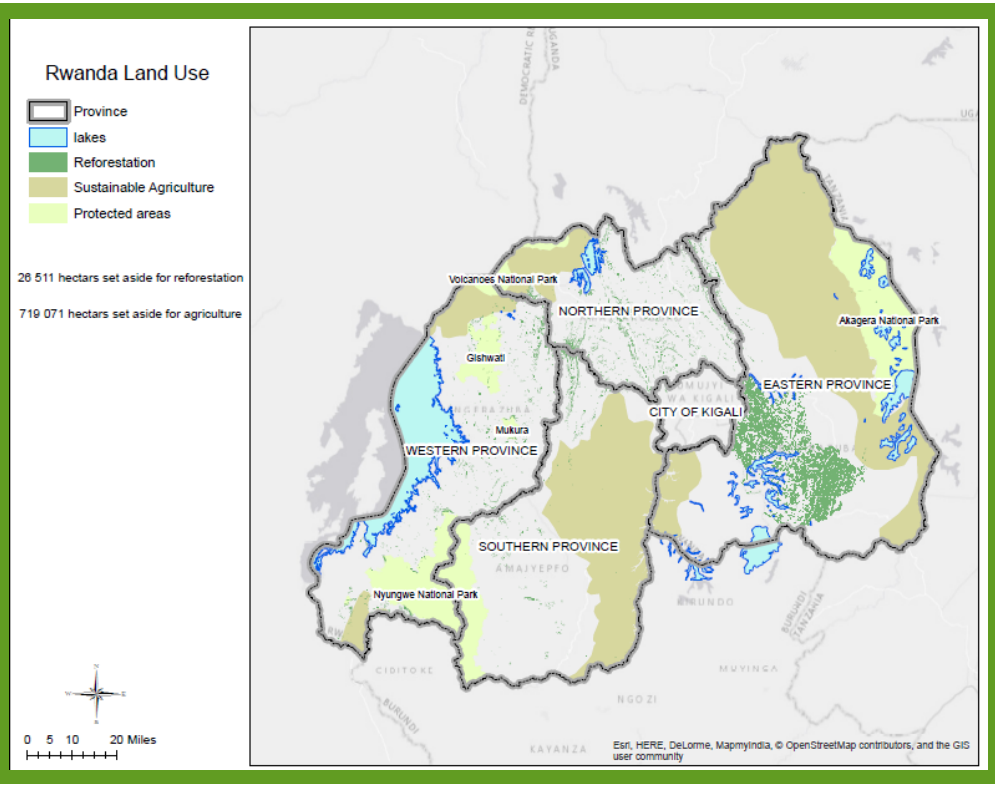
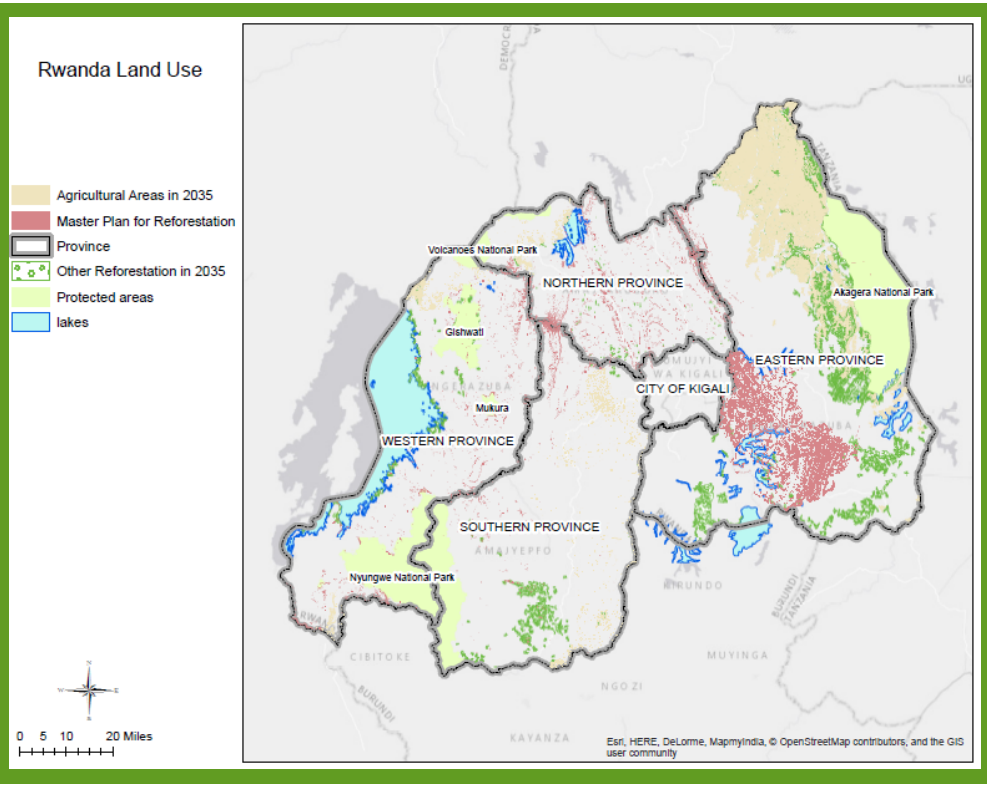
DECISION CRITERIA AND LAND USE CHANGE

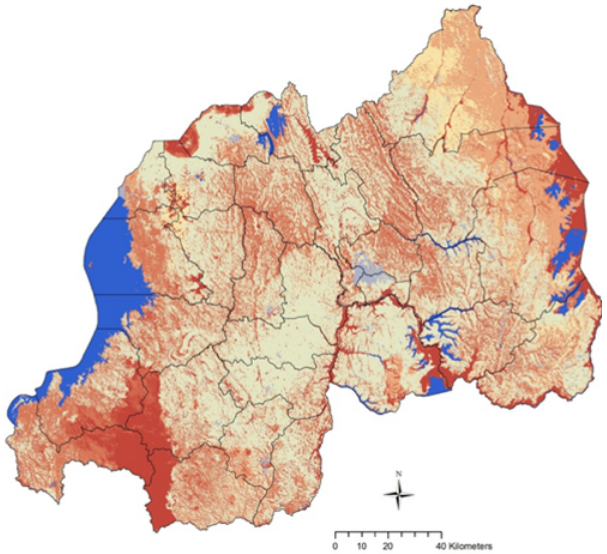


FOR2: LAND USE IN 2035



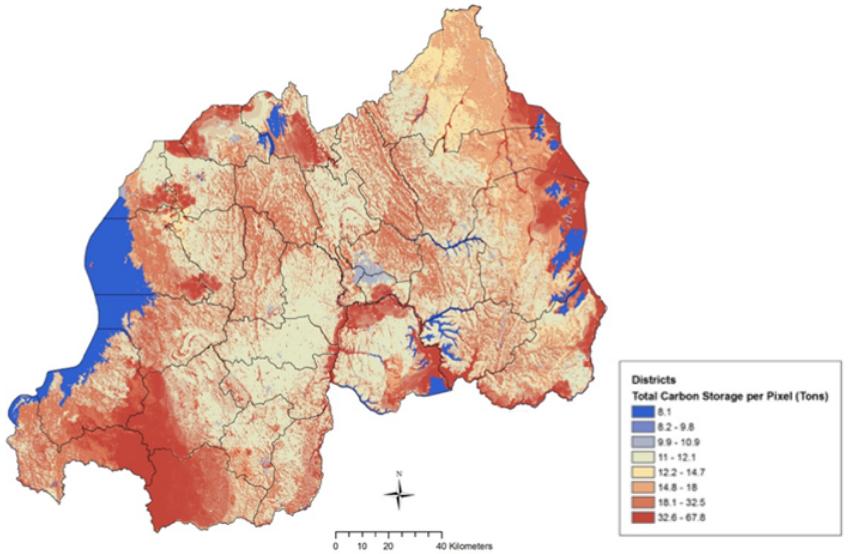
FUTURE ECOSYSTEM SERVICE SUPPLY

Baseline carbon storage
Tons of carbon/pixel



Source: Bagstad et al. In preparation.

FOR2 scenario carbon storage in 2035
Tons of carbon/pixel



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FOR MORE INFORMATION ON NCA-BASED MODELING AND IEEM, CONTACT:

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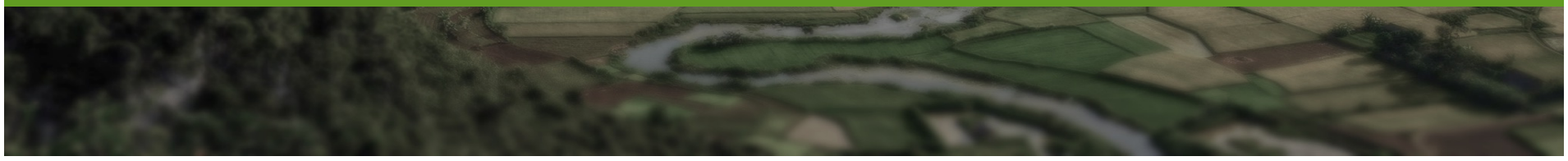

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For further information on IEEM platform, please contact Onil Banerjee at onilb@iadb.org