

# ENVIRONMENTAL ECONOMICS FOR EVIDENCE BASED POLICY MAKING

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## Promoting Synergies Between Producers and Users of Natural Capital Accounting



IEEM

Integrated Economic-  
Environmental Modeling



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The Integrated Economic-Environmental Modeling (IEEM) Platform integrates natural capital in an analytical framework for the formulation of evidence-based public policies. This enables the consideration of the relationships between public policies and investments and the three pillars of wealth: manufactured capital, human and social capital, and natural capital (figure 1). IEEM permits decision-makers to consider both the economic implications and the environmental consequences before implementing any public policy. In other words, it permits the formulation of “What if...”, questions thus shedding light on the ways in which a policy could influence a country’s development priorities, as well as its goals and global commitments, such as the Sustainable Development Goals or the Paris Agreement<sup>1</sup>.

In this third edition of the “Environmental Economics for Evidence Based Policies” series, we briefly review the advances with respect to the IEEM mission, and its lines of strategic action, which are: (i) the development of new platforms and applications of IEEM

for those countries with Environmental and/or Ecosystem Service Accounts; (ii) integration of regulation and cultural and aesthetic ecosystem services within the IEEM framework; and (iii) collaborations with government institutions in the region, intended to create capacities to implement and apply the IEEM Platform.

With respect to this third point, in this third edition of the series, we are pleased to have the contributions and perspectives of Henry Vargas, Director of the Department of Macroeconomic Statistics and Evelyn Muñoz Salas, Director of the Department of Economic Research, both based at the Central Bank of Costa Rica. Based on a workshop given by the IEEM team at the Central Bank’s facilities during the week of April 17 to 21, 2017, our colleagues shared with us their experiences with Environmental and Ecosystem Service Accounts, the importance of a framework like the IEEM Platform for their institution, and how they are considering the integration of IEEM in the day-to-day work of the Central Bank of Costa Rica.

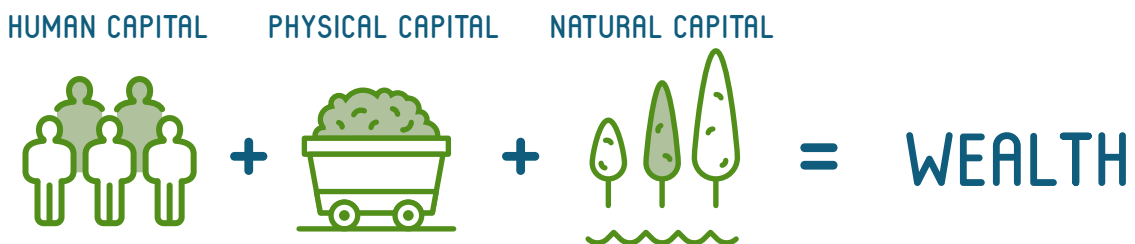


Figure 1. The three forms of capital that constitute wealth.

<sup>1</sup> Banerjee, O., Cicowiez, M., Vargas, R., and Horridge, M. 2017. *Assessing Strategies to Achieving the SDGs: An Integrated Economic-Environmental Modelling Approach*. In: Vardon, M., Bass, S., Ruijs, A. & Ahlroth, S. (eds.). *Better Policy Through Natural Capital Accounting: Stocktake and Ways Forward*. Washington DC: WAVES World Bank.

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## FROM CONCEPTUAL FRAMEWORK TO PUBLIC POLICY TOOL

The conceptualization of IEEM was based on the recognition of the importance of ecosystem services, their contribution to economic development and well-being, and the risk represented by the absence of their integration in conventional analytical decision-making frameworks<sup>2</sup>.

The point of departure for the IEEM Platform was the integration of environmental information organized under the first international standard of economic-environmental statistics published by the United Nations

and other international institutions. This standard is referred to as the System of Environmental-Economic Accounting<sup>3</sup>. The System of Environmental-Economic Accounting, published in 2014, has the same status as the System of National Accounts that is implemented by the majority of countries for transparent monitoring of their economies. In ecosystem service terminology, this integration of environmental information consists of the inclusion and detailed description of the contribution of provisioning ecosystem services to the economy, and the emissions and residuals that production processes return to the environment. Figure 2 shows the two-way relationship between the environment and the economy embodied by the IEEM Platform.

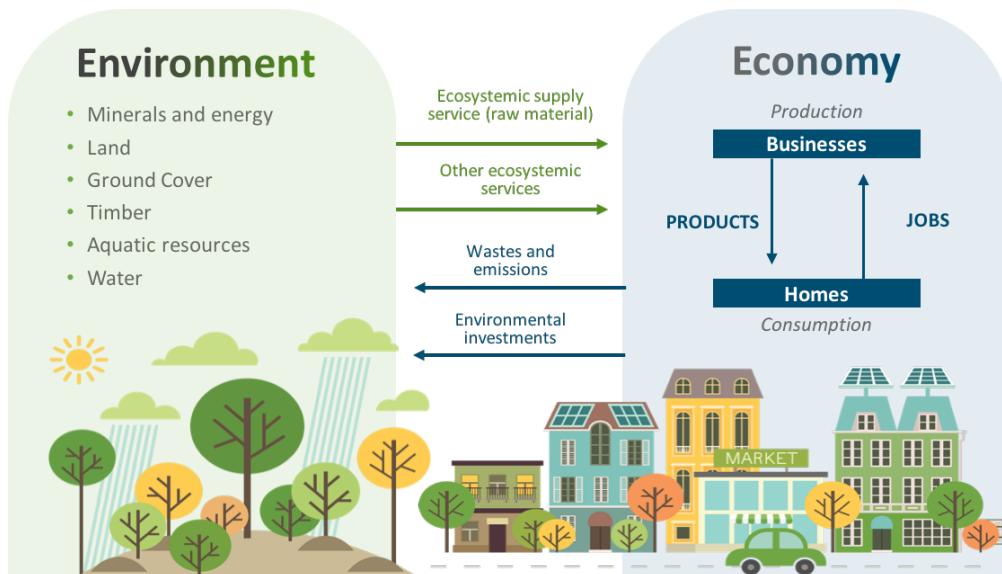


Figure 2. The Economic-Environmental Relationship Captured by the IEEM Platform.

<sup>2</sup> Banerjee, O., Cicowicz, M., Horridge, M. and Vargas, R. 2016. A Conceptual Framework for Integrated Economic-Environmental Modelling. *Journal of Environment and Development*, 25(3), pp.276 - 305.

<sup>3</sup> United Nations, European Commission, Food and Agriculture Organization, International Monetary Fund, Organisation For Economic Cooperation and Development & The World Bank. 2014. *System of Environmental Economic Accounting 2012- Central Framework*. New York: UN.



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The first IEEM Platform was developed for Guatemala (IEEM-GUA); currently both a national and multi-regional platforms have been developed where the multi-regional version represents the country's 22 departments. This is the first multi-regional model developed for Guatemala. IEEM-GUA has been applied to the analysis of various priority areas for the country, such as strategies and lines of action for progressing toward the Sustainable Development Goals, the efficient use of fuelwood, and forestry incentives<sup>4</sup>.

## A GROWING NUMBER OF COUNTRIES HAVE AN IEEM PLATFORM

The second IEEM model, developed for Costa Rica, IEEM-CRI, integrates its new Environmental Accounts developed under the System of Environmental-Economic Accounting framework.

The third IEEM model was developed for Rwanda. In one of the most densely populated countries of the world, IEEM-RWA is being applied to the evaluation of the country's Green Growth Strategy, and to the analysis of the expansion of agriculture and forestry to achieve food and raw material security in the country.

The fourth IEEM model was developed for Colombia and, in collaboration with the National Planning Department of Colombia, IEEM-COL is being applied to the analysis of alternative post-conflict land use trajectories and to the evaluation of Colombia's Green

Growth Strategy.

With a Platform that is robust and has been well-tested in various countries, the future of IEEM will unfold following three strategic lines of action. The first is to continue the development and application of IEEM Platforms for countries that demand them, and to continue raising awareness about the importance of Environmental and Ecosystem Service Accounts and the analytical frameworks that integrate them in economic analysis such as IEEM. The second line of action is the integration into IEEM, ecosystem services that go beyond provisioning ecosystem services and include those services for which markets do not yet exist. Examples of these regulating, and cultural and aesthetic ecosystem services are erosion mitigation services and recreational services, respectively.

To achieve the second objective, beginning with IEEM-GUA, we are developing a low-cost approach for the development of Ecosystem Service Accounts for a country, with the possibility of applying the approach to other countries and contexts. Based on a participative workshop held in Guatemala City in May 2017 with various government entities, including, for example, the National Forestry Institute, National Council of Protected Areas, and academic institutions such as Rafael Landívar University, 4 ecosystem services were prioritized for the development of ecosystem service accounts. Through this exercise, biomass and water provisioning services were prioritized, as were the regulating services of erosion mitigation and climate regulation through carbon capture.

<sup>4</sup> Banerjee, O., Cicowicz, M., Vargas, R. & Horridge, J.M. 2016. *The Integrated Economic-Environmental Modelling Framework: An Illustration with Guatemala's Forest and Fuelwood Sectors*. IDB Working Paper Series No. 757. Washington DC: Inter-American Development Bank.

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Based on these accounts and the calibration of ecosystem services supply models, the IEEM Team has linked the IEEM Platform with the ecosystem service modelling (IEEM + ESM) to estimate future public policy and investment scenario impacts on the economy, natural capital, and provisioning, regulating and cultural and aesthetic ecosystem services. With the IEEM + ESM framework, we are examining the potential impacts of climate change on the intensity and frequency of natural disasters, and evaluating the economic advantages of investing in mitigating and adapting to these events.

The link between these two types of modelling frameworks, IEEM and ESM, is established through the creation of new land use land cover maps for each scenario and each year for the period of analysis. The Team has also advanced the IEEM + ESM approach in Rwanda through a collaboration with the National Centre

for Ecological Analysis and Synthesis, The Nature Conservancy, and Wildlife Conservation Society<sup>5</sup>. Using the new IEEM-RWA Platform, we are evaluating Rwanda's Green Growth Strategy and its potential economic impacts and impacts on priority ecosystem services for the country, namely water provisioning ecosystem services, climate regulation and erosion mitigation (figure 3).

The third strategic line of action is collaboration with government and academic institutions to promote the use of the IEEM Platform for both public policy and investment analysis. By way of example, we are collaborating with the Central Bank of Costa Rica to create capacity to apply IEEM in the institution, with the possibility of expanding its use to other government ministries.

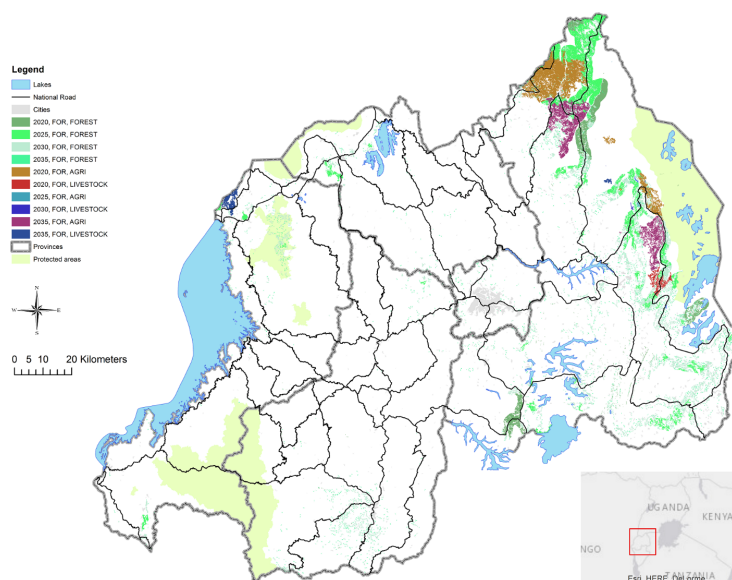


Figure 3. New areas for agriculture and forestry in 2035.

<sup>5</sup> Banerjee, O., Cicowicz, M., Dudek, S., Masozera, M. & Alavalapati, J. R. R. 2017. Economic and Land Use Impacts of Rwanda's Green Growth Strategy: An Application of the Integrated Economic-Environmental Modelling Platform. In: GTAP (ed.) GTAP 20th Annual Conference on Global Economic Analysis. Purdue University, West Lafayette: Purdue University.

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## ***A Strategic Line of Action of the IEEM Mission is to Collaborate with Government Entities to Institutionalize Evidence-Based Policy Design.***

### **THE PERSPECTIVE OF THE CENTRAL BANK OF COSTA RICA:**

The case of the Central Bank of Costa Rica (BCCR) is interesting, given the importance that it has placed on developing its Environmental Accounts and their integration with the country's macroeconomic statistics.

To begin with, the principal objective that the Law confers to the BCCR is to control inflation. Included in the BCCR's strategic plan is to maintain low and stable inflation, on the order of the inflationary rate registered by the primary commercial partners which is around 3%.

Costa Rica is a country that is vulnerable to climate change, and in the past, it has experienced negative effects due to the El Niño phenomenon, which ultimately may generate significant increases in domestic prices, particularly in the area of food commodities.

Thus, the policy actions of the BCCR need to be

forward-thinking, given that there is a lag between the moment that a measure is implemented and when its effects begin to register. For this reason, the BCCR's decisions are not based on what has already happened, but on what it expects could happen in the future.

As an example, it is important for the BCCR to understand the impact of climate change on internal pricing and how this relationship might evolve over time. A tool such as the IEEM Platform enables this type of forward-looking analysis of public policies and investment, allowing an understanding of potential impacts of decisions before these are implemented.

Additionally, the BCCR has the second objective of promoting the nation's steady economic growth, with the goal of optimizing the use of the nation's productive resources.

Costa Rica is a middle-income country, with aspirations to achieve higher levels of development and well-being for its people. It is true that, as a matter of public policy, it is desirable to reach higher levels of growth in production, however, the BCCR is also concerned with ensuring that the pace of economic growth is sustainable in the medium-term.

This interest is directly related to the need to have a system of accountability with respect to natural resources, in order to understand whether production increases and national wealth are reducing the value of natural resources in a way that is not sustainable over time. To incorporate the environmental dimension in the development of public policies, it is essential to have the information (complete, and of quality) to support this analysis and economic research.

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Another area of interest in application of the IEEM Platform is to incorporate risk scenarios that consider the impact of environmental factors and policies in the macroeconomic analysis undertaken by the BCCR. Many other applications are possible which will depend on the information demands of other public entities to which the BCCR responds.

The BCCR team in charge of applying IEEM-CRI seeks to complement the knowledge of National and Environmental Accounts specialists with that of researchers who are experienced in economy-wide and macroeconomic modeling. This strategy aims to strengthen capacity for the use of the new IEEM Platform.

As such, in the case of Costa Rica, our interests are very much aligned in terms of how we value the importance of the systematic production of the Environmental Accounts, the need to generate demand for these accounts, and the importance of having analytic frameworks at hand that permit the integration of environmental and ecosystem service information in the way that the IEEM Platform allows.

## STRENGTHENING AND EXPANDING ENVIRONMENTAL AND ECOSYSTEM SERVICE ACCOUNTS

As part of the process of expanding the reach of Environmental Accounts, the BCCR is currently working on the development of the Materials Account and the

Forest Ecosystem Service Accounts for tourism; Accounts for Agriculture for crops such as pineapple, coffee, sugarcane, and bananas; Carbon Capture; and Water Regulation. This represents a worthwhile opportunity to link these new accounts to the IEEM-CRI Platform, which, for example, allows modeling the benefits of ecosystem services, and the impact that changes in ecosystem service provision can have on production and well-being.

## THE COLLABORATION WITH THE CENTRAL BANK OF COSTA RICA IS AN EXAMPLE OF OUR WAY OF WORKING

From April 17-21, 2017, the IEEM Team held an intensive technical workshop on the IEEM Platform at the BCCR. Workshop content ranged from the fundamental principles of economy-wide analytical frameworks known as computable general equilibrium models, to demonstrating a simplified version of an energy and emissions application with IEEM-CRI. The five-day workshop was certainly challenging in terms of the material covered, but the enthusiasm and dedication of the BCCR team were palpable.

A second workshop with the BCCR was held from July 3-6, 2017, to deepen understanding and knowledge of IEEM-CRI, with a new version of the Platform that features a better household level disaggregation, and the full integration of the country's Environmental Accounts.



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Workshop participants proposed a suite of new applications based on interests of the BCCR, including topics of public policy and investment such as analyzing the impact of factor productivity changes in the agricultural sector; increases in energy efficiency in the transportation sector; fiscal incentives for importing electric vehicles and, as a consequence, a decrease in emissions, and; examining the important impacts the global financial recovery can have on international trade, the demand for Costa Rican exports, and direct foreign investment, among others.

## CONTINUING THE COLLABORATION WITH THE BCCR

One area of particular interest for Costa Rica and the IEEM Team is the relationship between natural capital/ecosystem services and tourism demand. Using IEEM-CRI as a pilot, advances will be made in the

methods used in the analysis of public policy and investment in the tourism sector, linking natural capital stocks, environmental quality and tourism demand. This initiative is made possible through the Environmental Accounts that BCCR has produced and the advances it has made in the development of Ecosystem Service Accounts.

Finally, based on the applications and preliminary results generated, the BCCR and IEEM Teams will choose two applications; working together, they will deepen this analysis with the end goal of contributing to the public policy debate in the country. Documenting the findings of the study, the Teams will write several policy briefs and articles for publication in scientific journals. These products will serve to demonstrate what can be achieved when productive collaborations are established between producers and users of Environmental and Ecosystem Service Accounts, with the IEEM Platform as the bridge between the two.





