ENVIRONMENTAL ECONOMICS FOR EVIDENCE BASED POLICY MAKING

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Strategies for applying the Integrated Economic-Environmental Modelling (IEEM) Platform to public policy in post-conflict Colombia

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Integrated Economic-Environmental Modeling

IDB

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ENVIRONMENTAL ACCOUNTS AND PUBLIC POLICY

Since 2014, Colombia has developed its natural capital accounts in a collaborative effort between the National Administrative Department of Statistics (DANE), the Institute of Hydrology, Meteorology and Environmental Studies (IDEAM) and the National Planning Department (DNP). The efforts of these public institutions have culminated in the development of Colombia's System of Environmental-Economic Accounting[1] (SEEA) which is comprised of accounts for water, forests, land, mineral and energy resources, waste, emissions and environmental transactions (figure 1). These accounts enable the measurement of the stocks and flows of environmental resources, how they contribute to economic development, and the return flows of waste and emissions to the environment.

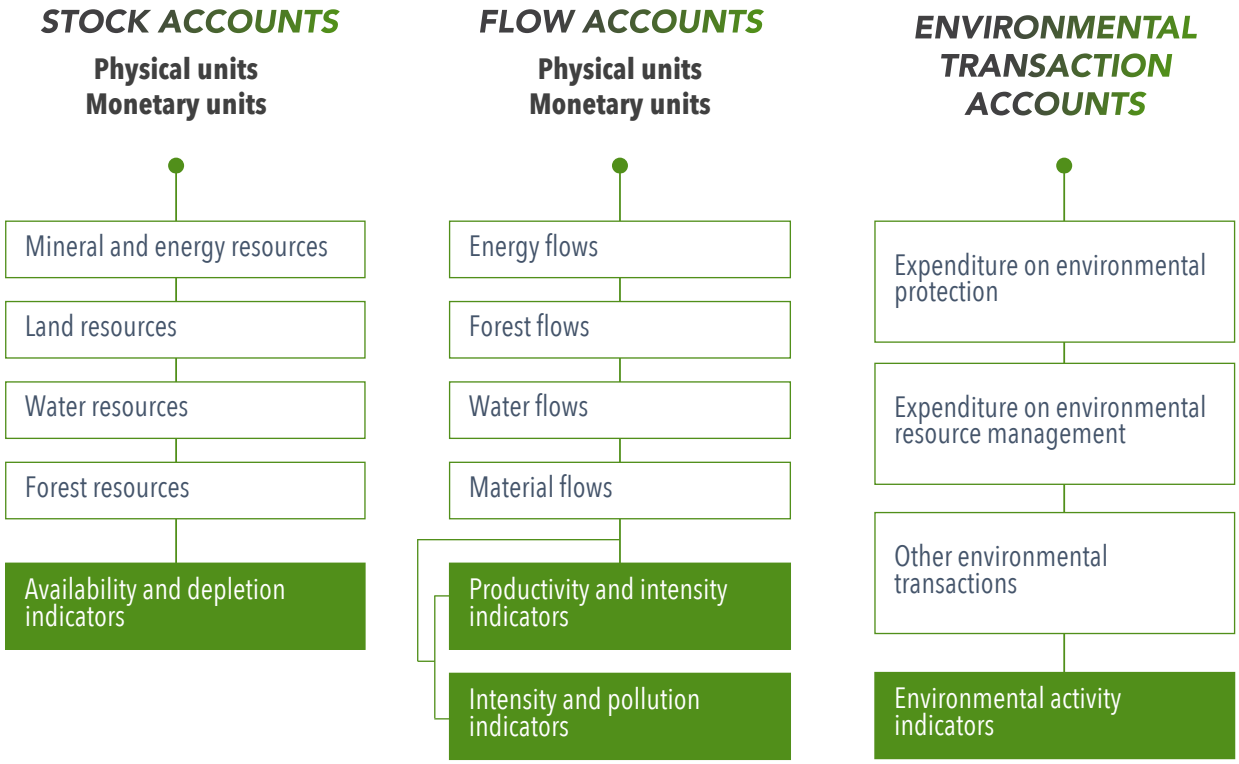

Figure 1. Structure of Colombia's environmental accounts.

Source: DANE, 2017.

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To explore new uses of Colombia's environmental accounts and analytical frameworks that respond to questions related to economic and environmental policy and decision making, on May 8, 2017 members of different institutions[2] met in Bogotá for the event "Uses of Environmental Accounts and the Integrated Economic-Environmental Modelling Platform (IEEM)". At the event, DANE presented Colombia's environmental accounts, DNP presented their new social accounting matrix which integrated water[3] (MCS-Agua), and the IEEM Team led by the Inter-American Development Bank (IDB) presented the IEEM Platform[4], which uses the environmental accounts as an input for integrated economic-environmental analysis.

During the event, Dr. Onil Banerjee, IEEM Team leader from the IDB presented applications with an emphasis on issues of interest to Colombia such as the Sustainable Development Goals[5], Green Growth Strategies[6], and ecosystem service modelling. Next, Dr. Martin Cicowiez, IEEM Team member, presented the environmental modules of the Platform, which capture the dynamic interactions between each environmental resource and the economy.

Three applications of the IEEM Platform to the public policy cycle were highlighted. First, IEEM can inform the agenda setting phase of the policy cycle, serving as an experimental framework for exploring alternative public policies and investments. The second application is in the design and implementation of public policies, as IEEM can be used to help ensure that established targets are reached, for example, doubling rural incomes (Target 2.3 of the Sustainable Development Goals). Third, IEEM can be used for retrospective analysis of the effectiveness of a policy in meeting an objective.

Important outcomes of the May 8 event consisted of the identification of: current uses of the environmental accounts; environmental and ecosystem accounts that could complement Colombia's existing environmental accounts, and; possible uses of IEEM as an analytical tool in public policy design and evaluation. Both policy makers and participants that had some exposure to economic modeling expressed that the accounts had mainly been used to monitor energy flows and emissions, and water flows. Participants indicated that they had interest in the environmental accounts, especially for information related to water flows, as well as the information that the experimental ecosystem accounts could provide.

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Participants also mentioned that the environmental accounts could be more useful if they provided additional information on: coastal and marine resources; monetary values for ecosystem services; biodiversity metrics, and; themes related to environmental degradation and climate change. One view that all participants shared was that regionalized environmental accounting information was required to enable policy alternatives to be considered at a scale more appropriate for some environmental issues.

Finally, participants acknowledged the importance of developing a tool like IEEM for Colombia. They highlighted IEEM's ability to integrate environmental and economic information and to deliver to the challenges of complex public policy issues where difficult trade-offs are often necessary. Participants expressed that with this model, one could evaluate in a forward-looking way, future ecosystem service supply; produce alternative scenarios for the agriculture and livestock sector; identify optimal environmental resource allocation strategies, and; evaluate the impact of environmental or economic policy on the environment, among others.

COLLABORATION WITH THE NATIONAL PLANNING DEPARTMENT OF COLOMBIA

In the three days following the May 8 workshop, the IEEM Team held a workshop with the DNP on the modeling techniques applied in the construction of an IEEM Platform. The DNP also shared its deep knowledge of the Colombian economic, social and environmental context, which would help inform the development of an IEEM Platform for Colombia.

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The institutionalization of IEEM in the DNP is possible due to the DNP's expertise in economic modeling and commitment to evidence-based policy. In particular, the DNP has a long history of applied policy analysis, responding to different information and analytical needs of various government institutions, including the Ministry of Finance, the Ministry of Commerce, Industry and Tourism and the Ministry of Agriculture and Rural Development, among others. The DNP has used economic models to generate information to support the design of national development plans, fiscal policy[7], and trade policy. Recent analysis and policy advice has focused on the economic impacts of climate change[8] which integrates Colombia's emissions[9] and water accounts in the analysis.

Given the interest of national institutions, the IEEM Team and DNP strengthened their commitment to collaboration and to promote the use of the IEEM Platform to inform evidence-based public policy and decision making in Colombia. Moving this collaboration forward, the IEEM Team and the DNP decided to develop specific applications of the new IEEM Platform for Colombia, IEEM-COL, setting a target of presenting this work at the Symposium on Green Growth and Political Economy, organized by the DNP and the University of the Andes, which took place on July 18 and 19, 2017 in Bogotá[10].

POST-CONFLICT LAND USE TRAJECTORIES IN COLOMBIA

The IEEM Team and the DNP chose the theme of "Post-Conflict Land Use Trajectories in Colombia" to explore. Previous analysis by the DNP found that deforestation and land use are closely related and should be considered in post-conflict scenarios for the country[11]. Summed up in the World Bank's Systematic Country Diagnostic of Colombia, this new era of peace represents the greatest opportunity and also the greatest risk to Colombia's natural capital[12], while the country faces major challenges in rebuilding rural economies to sustain the livelihoods of thousands of displaced people. The success of this new phase in Colombia's development will depend largely on peacebuilding becoming an opportunity to implement sustainable models of economic development in which natural capital provides a pillar for peace and prosperity.

At the same time, these challenges are immersed in a new paradigm defined by development agendas such as the current Green Growth Strategy, and fulfilling the goals of the Paris Agreement and the Sustainable Development Goals, all developed to ensure the economic and social prosperity of present and future generations.

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In that sense, there are three significant opportunities for Colombia to follow a growth path that can be considered green[14]. They are: (i) the efficient use of water, soil, energy, and material resources, while minimizing negative environmental residuals; (ii) exploring new economic opportunities through forest-based economies grounded in a transition toward energy efficiency and the strengthening of the bio-economy, and; (iii) increasing competitiveness with improvements in labor productivity, the integration of new technologies, and the formalization of businesses and workers.

In evaluating Colombia's Green Growth potential, it was found that, taking into account the future growth of global demand for food and agricultural exports, demand for agricultural products will grow on average 2.5% annually over the next 15 years, which would generate greater demand for land[15]. To meet this demand, the area dedicated to agriculture would need to increase by 43.8% compared to 2015 in the absence of productivity gains.

Given projections of global demand for agricultural products, meeting Colombia's share of this increase in demand would imply an increase of 117.2% in water use in Colombia compared to 2015. Technological change or improvements in access to water to optimize productivity would reduce this increased pressure on water resources.

APPLYING IEEM-COL

The IEEM Team and the DNP have conducted a preliminary analysis of trajectories of land use in the post-conflict period with the new IEEM Platform for Colombia, IEEM-COL, evaluating three scenarios. The first scenario (DEFOR-INC) evaluates the impact of a 16% increase in the deforestation rate for the period 2018 to 2030. This figure is an estimate of the possible increase in deforestation that can accompany a process of demilitarization. The second scenario (DEFOR-DEC) imposes a 75% reduction in the deforestation rate, achieved through better regulation and monitoring in rural areas. The third scenario (DEFOR-DEC-TFP) assesses a 5% increase in agricultural sector total factor productivity accompanied by the reduction in the rate of deforestation in the previous scenario (DEFOR-DEC).

Forest area in the base year of 2014 is equal to 58.5 million hectares. In the baseline, by 2030, the forested area falls to 49.8 million hectares. In DEFOR-INC, deforestation is 1 million hectares greater by 2030 when standing forests occupy 48.8 million hectares. In DEFOR-DEC, deforestation is slowed and forest cover is equal to 54.6 million hectares by 2030. DEFOR-DEC-TFP mitigates deforestation further where standing forest stock is equal to 56.2 million hectares by 2030.

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One of the most important advantages of an analytical framework such as IEEM is the range of indicators it can generate. A comparison of figures 2 and 3 highlights the importance of considering the contribution of natural capital to well-being. In figure 2, the increase in deforestation (DEFOR-INC) pushes Gross Domestic Product (GDP) upwards by 348 billion Colombian pesos (COP) compared with the baseline in the year 2030. When the rate of deforestation declines in the second scenario (DEFOR-DEC), GDP falls by 2,006 billion COP. Where there is an increase in agricultural productivity and a decline in the rate of deforestation, GDP increases by 1,853 billion COP by 2030. These results indicate that, in terms of GDP-- an economic flow– more deforestation drives up GDP, all other things being equal. When agricultural sector productivity increases, however, the productivity gain more than offsets the negative impact a slower rate of deforestation has on GDP.

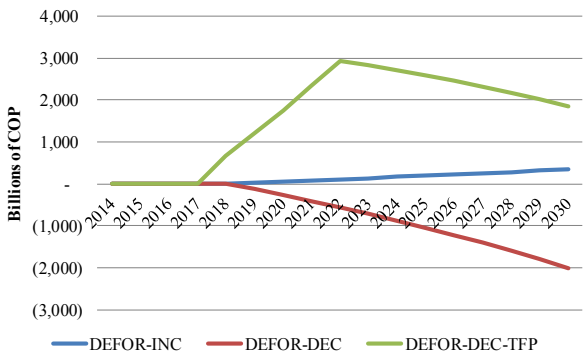

Figure 2. The difference between the base line and post-conflict deforestation scenarios. GDP in billions of Colombian pesos (COP). Source: IEEM-COL results.

The importance of the economic indicator used and presented to policy and decision makers matters and is exemplified by Figure 3. Here the indicator of genuine savings is used which is a welfare indicator that takes into account economic flows, stocks of natural capital and environmental quality. In DEFOR-INC, genuine savings falls 247 billion COP by 2030 where there is an increase in the rate of deforestation. Where the deforestation rate is reduced (DEFOR-DEC), welfare increases and reaches 1,290 billion COP. A reduced rate of deforestation accompanied by agricultural-sector productivity enhancements results in an improvement in welfare on the order of 1,917 billion COP by 2030. Of course, the cumulative welfare gain is much higher. These results demonstrate that the policy implications of the results of these experiments are contingent on the indicator we use, whether our view is short-run as in the case of GDP or a vision of long-run sustainability and concern for current and future wealth as reflected by genuine savings.

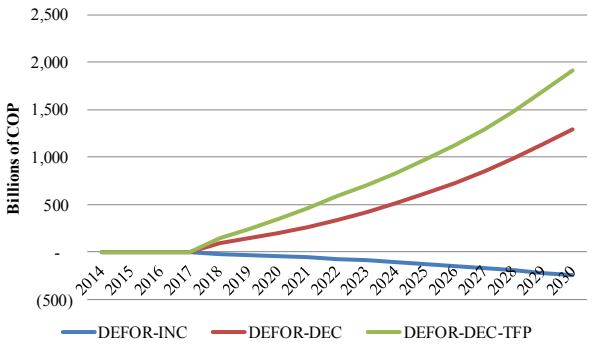

Figure 3. The difference between the base line and post-conflict deforestation scenarios. Genuine savings in billions of Colombian pesos (COP). Source: IEEM-COL results.

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The IEEM Team and DNP are currently deepening this analysis with a series of scenarios, including the endogenous estimation of the increase in total factor productivity that would be required for the agricultural sector to continue growing at its current rate without increasing the rate of deforestation; strategies to increase the export orientation of Colombia's agriculture and forestry sectors, and; assessments of the impacts of a new forestry incentives proposal on rural economies and the forestry sector.

LESSONS LEARNED FROM OTHER POST-CONFLICT COUNTRIES

Lessons learned from other post-conflict countries indicate the need for regulation and monitoring to prevent that irrational land use becomes the source of funding for the reconstruction of rural economies and stability. These views were shared by experts attending the "Symposium on Green Growth and Political Economy" held in Bogotá, where cutting-edge approaches to Green Growth were discussed, with an emphasis on four areas: behavioral economics, the circular economy, economic modeling, and economic instruments for Green Growth.

Professor Reyer Gerlagh, Director of the Department of Economics at the University of Tilburg in the Netherlands, emphasized that: "The cost of policies for environmental sustainability in Colombia is insignificant with respect to the economic growth that it can generate".

During the meeting, participants expressed the need to focus efforts on maintaining peace and rebuilding rural economies, preventing unorganized resettlement that can cause deforestation and conflicts over land ownership, and manage and enhance natural capital for sustainable development.

Participants discussed numerous opportunities for Green Growth in the post-conflict period, including: improving the efficiency of resource use; developing new forest-based economies; promoting ecotourism to take advantage of high biodiversity and conserved spaces; increasing productivity-- especially in agriculture, where there is a gap of 59% with respect to the production frontier, and; enhancing the competitiveness of Colombia's exports to penetrate regional and international markets where there are significant gains to be made.

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The DNP's Green Growth Mission seeks to define inputs and public policy guidelines to orient the country's economic development and "realize the environmental dividends of the peace," said Simón Gaviria Muñoz, the organization's Director.

To conclude, the IEEM Platform-- based on Colombia's environmental and economic accounts-- will enable the country to define public policies and investments that permit the optimal and sustainable use of environmental resources in the critical post-conflict period through integrated economic and environmental considerations. The indicators IEEM generates capture impacts on wealth and well-being in the short and long term, and quantitatively consider environmental resources and their use in productive processes, as well as return flows to the environment. Results generated with IEEM provide a robust evidence base for assessing public policy alternatives to ensure that the peace is indeed the greatest opportunity for ensuring that natural capital is foundational to Colombia's future prosperity.

ACKNOWLEDGEMENTS

Original photos and artwork by Camila Pizano.

NOTES

[1] For more information on Colombia's environmental accounts, see: http://www.dane.gov.co/index.php/estadisticas-por-tema/ambientales

[2] National Planning Department (DNP), Universidad de Los Andes, Universidad del Rosario, Bank of the Republic, National Administrative Department of Statistics (DANE), Institute of Hydrology, Meteorology and Environmental Studies (IDEAM), Ministry of Environment and Sustainable Development, FEDESARROLLO Corporation Colombian Agricultural Research (Corpoica), WAVES, Agricultural Rural Planning Unit (UPRA), Institute for Environmental Studies and Environmental Licensing Authority (ANLA).

[3] Alvarez, AC, GD Romero, LC Riveros, S. Melo, and D. Ordoñez. " Construcción De La Matriz De Contabilidad Social De Agua Como Insumo Económico." In Archivos de Economía, editado por Departamento Nacional de Planeación. Bogotá: Departamento Nacional de Planeación, 2016.

[4] Banerjee, O., Cicowiez, M., Horridge, M. Vargas, R. "A Conceptual Framework for Integrated Economic-Environmental Modeling." The Journal of Environment & Development 25, no. 3- (1 September 2016): 276-305.

[5] Banerjee, O., M. Cicowiez, R. Vargas, and JM Horridge. "Assessing Strategies to Achieving the SDGs: An Integrated Economic-Environmental Modeling Approach." In Better Accounting Policy through Natural Capital: Stocktake and Ways Forward, edited by M. Vardon, S. Bass, S. A. Ruijs and Ahlroth. Washington DC: World Bank WAVES, 2017.

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[8] BID-CEPAL-DNP. "Impactos Económicos Del Cambio Climático En Colombia: Síntesis". En BID Monografía/Naciones Unidas LC/L3851, editado por S. Calderon, G. Romero, A. Ordoñez, A. Álvarez, C. Ludeña, L. Sánchez, C. De Miguel, K. Martínez y M. Pereira. Washington DC: Banco Interamericano de Desarrollo, 2014.

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[10] Search for "Academic Symposium - Green Growth and Political Economy" at the following link: https://www.dnp.gov.co/Crecimiento-Verde/Paginas/Eventos.aspx

[11] Calderon, S.L., C.Z Prada, J.B. López, G.D. Romero, J.E.R. Cala, R.C.O Vengoechea, y L.M. Ibata. "Dividendos Ambientales De La Paz: Retos Y Oportunidades Para Construir Una Paz Sostenible." En Archivos de Economía Documento 451, editado por DNP. Bogotá: Departamento Nacional de Planeación, Dirección de Estudios Económicos, 2016.

[12] World Bank. (2015). Colombia: Systematic Country Diagnostic. Washington DC: World Bank.

[13] Among the challenges of sustainable growth are providing services to displaced people and assisting with their resettlement; monitoring land tenure through zoning and land use planning; improving agricultural productivity through intensive cropping; ensuring the availability of credit; and increasing exports, which now account for only 15% of GDP, while in other neighboring countries such as Ecuador and Peru they constitute 23% and 28%, respectively.

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[15] Ibid.

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