

Analyzing Life-cycle Environmental Impacts of Local Development Initiatives Using Regional Economic and Environmental Input-Output Models

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Communities and planners need quantitative estimates of both economic and environmental impacts of development projects to make informed decisions about the tradeoffs and synergies between development and environmental protection. Regional input output models have been extensively used to analyze local economic impacts of development initiatives. Regional input-output models augmented with social accounting matrices (SAM) enable estimation of direct, indirect and induced impacts of development projects on local income, output, employment, and tax revenues. However, few practical tools exist for estimating the life cycle (i.e direct and indirect) increases in local resource use, pollutant emissions, waste generation, and local environmental degradation from these initiatives.

The potential usefulness of integrated economic and environmental input-output models has been recognized for decades, but few empirical models have been built due to lack of data. Integrated economic and environmental modeling requires linking changes in the level of economic activity in different economic sectors such as manufacturing, agriculture, and tourism with changes in environmental pressures such as pollutant emissions, waste discharges and resource use.

In this research, we build a conventional 498 sector regional input-output model for the Muskegon River Watershed in Michigan. We then augment it with a comprehensive environmental impact coefficient matrix covering, conventional air pollutant emissions, green house gas emissions, toxic chemical releases, hazardous waste generation, water effluent discharges, municipal solid waste generation, energy use, non-renewable mineral use, fertilizer use etc. We draw on a number of data sources such as the USEPA's Toxic Release Inventory, RCRA hazardous waste database, Aerometric Information Retrieval System (AIRS), NPDES permits database, DOE's energy consumption surveys, and input-output workfiles developed by the Bureau of Economic Analysis (BEA) and estimate sector level environmental burden and resource use coefficients. We estimate environmental burdens from both production and consumption activities. We generate summary indices using appropriate aggregation factors such as global warming potential, acidification potential, ozone depletion potential, eutrophication potential, and toxicity.

The regional input-output model and the environmental burden matrix are designed as a user friendly software. As a result, it provides a practical tool that can quantify both economic and environmental impacts of any developmental initiative within the watershed. The tool can also be easily adapted for use in other regions/watersheds. Obviously, the tool shares the well-recognized strengths and weaknesses of input-output analysis.

The paper also analyzes a proposed dam removal project aimed at restoring a local trout stream as a case study illustrating the application of the methodology and the tool.