Economic Impacts of Land Use Changes and Best Management Practices in the Floridan Aquifer

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Land Use Change Modeling

Introduction

Economic decision-making is arguably the primary consideration behind environmental and land use changes. However, enacting environmental regulations requires careful consideration and a holistic picture of the multiple ecological and economic tradeoffs involved. Our study aims to reveal the effects of altered land use management practices on water quality and water flow; and in the process, highlight potential environmental threats to the local population (e.g., elevated nitrate levels in groundwater). We plan to estimate how policies which mandate a reduction in surface contaminant levels impact implementation of various best management practices (BMPs) at the farm level. Forecasting the monetary impact (i.e., profit) of alternative policies on agricultural output and input uses along with associated environmental impacts allows for systematic modeling of the interaction between economic and ecological systems. By quantifying the value of water provisioning services for each land use type on a per acre basis, the consequences of management actions on these services may be assessed; and furthermore, permit policymakers to weigh short-term costs of location specific BMP adoption vs lasting benefits offered by improved water services.

Land allocation Model

$$\max \pi = R - C_{land} \quad \text{where } C_{land} = \sum_{i \in I} P_i \cdot L_i$$

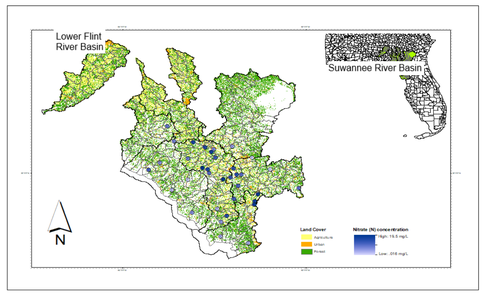
$$\text{s.t.}: L_{corn} + L_{cotton} + L_{peanut} + L_{forest} + L_{carrots} + L_{hay} + L_{pasture} \leq Y_{total}$$

$$H - \varphi \leq L_{corn} + L_{cotton} + L_{peanut} + L_{forest} + L_{carrots} + L_{hay} + L_{pasture} \leq H + \varphi$$

Objectives

1. Determine optimal allocation of land parcels based on economic drivers (i.e., profit max.).
2. Combine preceding land allocations to analyze subsequent nitrate levels.
3. Examine the impact of hypothetical government policies mandating stringent water quality on land use and adoption of different BMPs at the watershed level.

Study Area



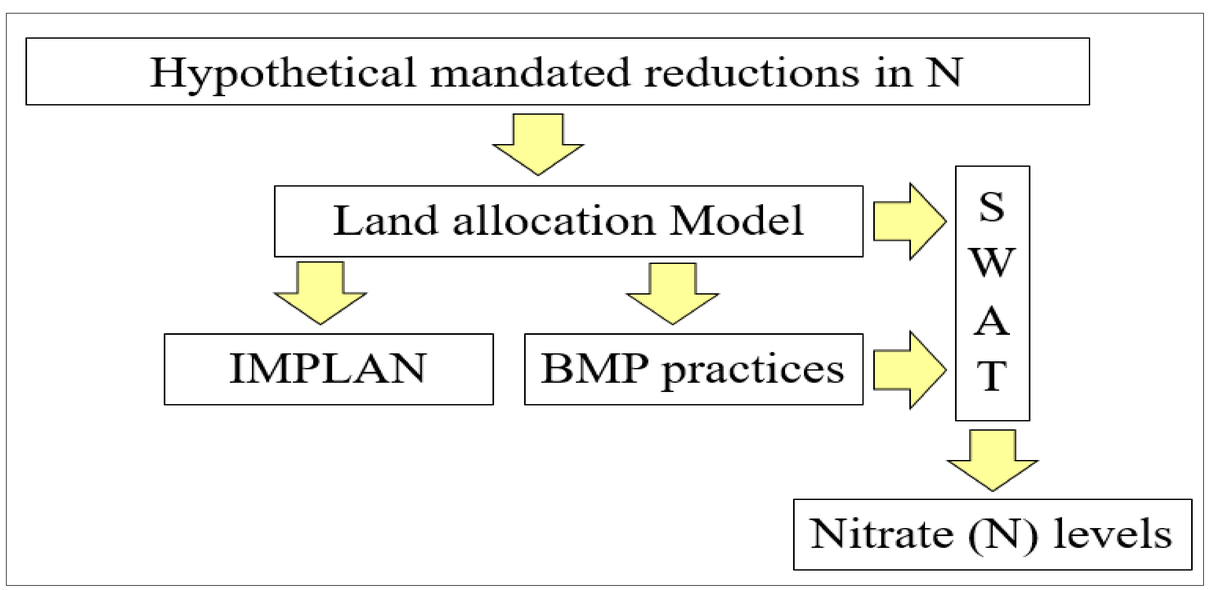


Fig 1: Flowchart describing linkages between land use modeling, IMPLAN modeling, and watershed modeling using integrated SWAT-MODLFOW.

Regional-level Economic Modeling

Introduction

Building on the enterprise-level analysis and land use modeling, regional-level economic modelling will explore impacts of potential BMP adoption on economic activity of the Lower Suwannee and Lower Flint region. Regional-level economic modelling will be done by constructing regional economic models of the study areas using the IMPLAN Input-Output/Social Accounting Matrix (I-O) software and county datasets. Based on North American Industrial Classification System (NAICS), the IMPLAN model uses a 536-sector I-O transactions table to track the impact of expenditures in one sector spreading through other sectors of the economy[1]. IMPLAN reports its results of economic impact analysis in terms of employment, labor income, total industry output total value added and total federal as well as state taxes.

Input-Output Model

Table 1: Example transaction table for an I-O Model of a regional economy showing interactions/exchanges between various sectors within the economy[2]

		Purchasing Industries					**Final Demand**			
Selling Industries		Agriculture	Mining	Processing	Trade	Service	Households	Government	Exports	**Total**
	Agriculture	12	2	10	6	0	1	1	7	**39**
	Mining	5	2	20	0	0	0	2	11	**40**
	Processing	5	3	6	20	5	9	10	40	**98**
	Trade	2	3	2	1	5	25	10	5	**53**
	Service	7	10	30	2	10	18	10	0	**87**
	Indirect Business									
Value Added	Household earnings	5	14	20	12					**51**
	Business Profits	2	4	7	8					**21**
	Imports	1	2	3	4					**10**
	Total Value	**39**	**40**	**98**	**53**	**20**	**53**	**33**	**63**	**399**

IMPLAN

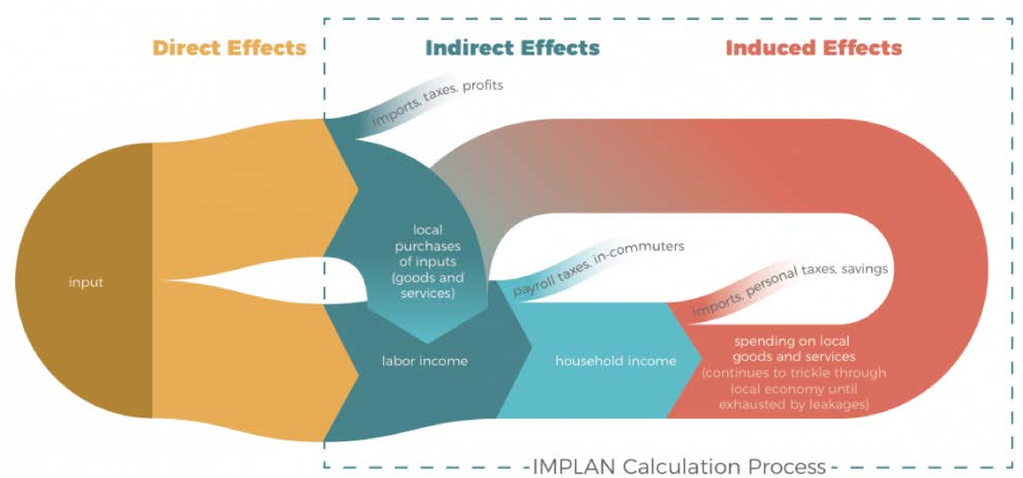


Figure 1: Flowchart showing direct, indirect and induced impacts estimated by IMPLAN within a regional economy[3]

References

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[2]Mulkey, D., & Hodges, A. W. 2000. Using IMPLAN to assess local economic impacts. *A Publication of the Food and Resource Economics Department, Institute of Food and Agricultural Resources. University of Florida. FE*, *168*.

[3]IMPLAN,. nd. The economic impact of an assisted living facility in one Virginia county. Available at: http://implan.com/case-studies/assisted-economy/