

SESSION – SPATIALLY SIMULATING LAND DECISIONS & CONSEQUENCES

**Economic and Econometric
approaches to private & public
Determinants Of Deforestation**

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DAY 1 – LAND-USE DECISIONS: COMPARING ALTERNATIVE MODELS

PREFACE: observations \neq econometrics

- certainly assuming there is value in data/observation
- definitely suggesting that econometrics can be of use
- BUT clearly theory (economic / other) & predictions arise from other forms of checking against the data:
anecdotes; complex multi-equation benchmarks; ...

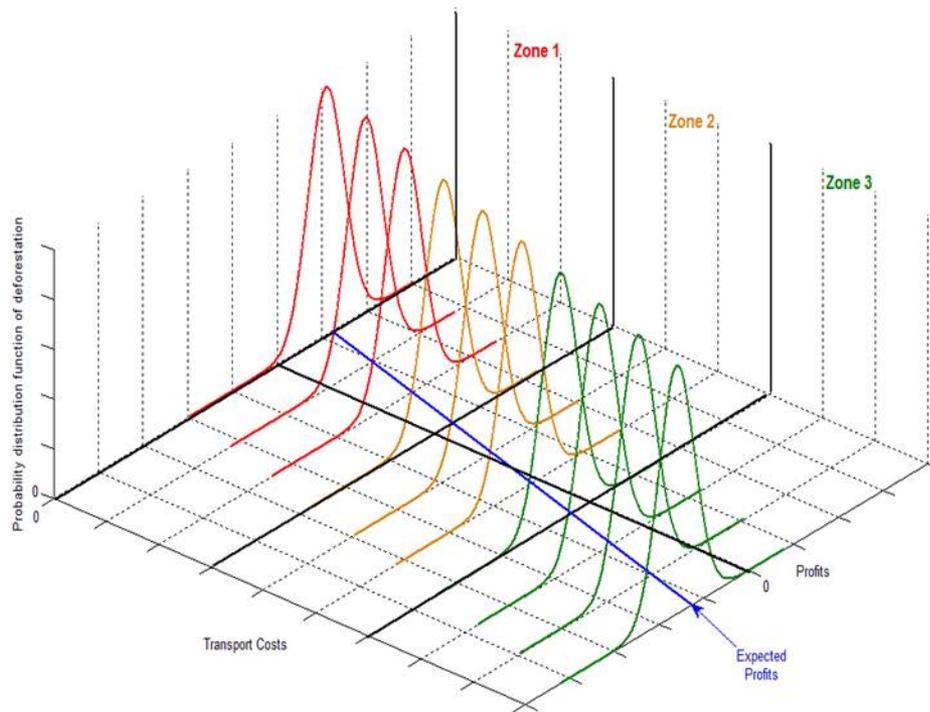
-> interesting to ask when use which approach

I. WHICH DECISIONS? (economic theory)

- Private choice scenarios: **BAU & each Public option**
- **Public choice?** Consider ALL private benefits & costs, e.g. land-use policy's forest gain & development loss.
- **Private behaviors affect Public processes & impacts:**
 - protection avoids development? roads follow migration?
 - investment and migration, in turn, respond to new roads?

-> public affects private but also private shapes public

Profit-Maximizing Farmer, Integrated With Markets



High Threat = Near To Market:
rents and % deforested
already relatively high

Medium Threat = The Frontier:
expected rents close to 0
& much land is on margin

Low Threat = Beyond Frontier:
rent < 0 , clearing is small,
& a large shift is required

(see von Thunen 1826, urban monocentric land model, ...)

-> econometrics on determinants of deforestation

Utility-Maximizing Farmer, Not Market Integrated

Pfaff Amacher Sills 2012, Model #2:

- imperfect labor market -> use one's own scarce time
- imperfect goods markets -> consume own production
- imperfect credit market -> one's cash is a constraint

-> affects land-use choices & land impacts of policies:

- PES' income could lead you / neighbor to clear
- additional road impact if integrates in markets

-> must describe land at microscale ? (many people !)

Public Optimization & Forest Degradation

Pfaff Amacher Sills 2012, Model #3

- most tropical forests officially owned by governments
- corruption: private actors try to influence constraints
- decentralization growth: local = govt? communities?

-> affects land-use choices & land impacts of policies:

- concessions grow with public revenue needs?
- REDD payments just shift equilibrium bribes?

-> what assume about public decisions ? (many ha!!)

Public-Private-Interaction Theory Meets Some Data

Engel Palmer Pfaff 2012: communities in park, in Indonesia

- prior land conflict, as private and public goals differ
- decentralization policy: more use rights, if monitor
- > model land conflict: who wins when? leading to?
 - **theory -> simple econometrics gets it wrong**
 - simple relationships support model relevance
 - higher costs of actually shifting private choice
- > **theory & even simple data help model scenarios ?**

II. ECONOMIC THEORY → ECONOMETRICS ?

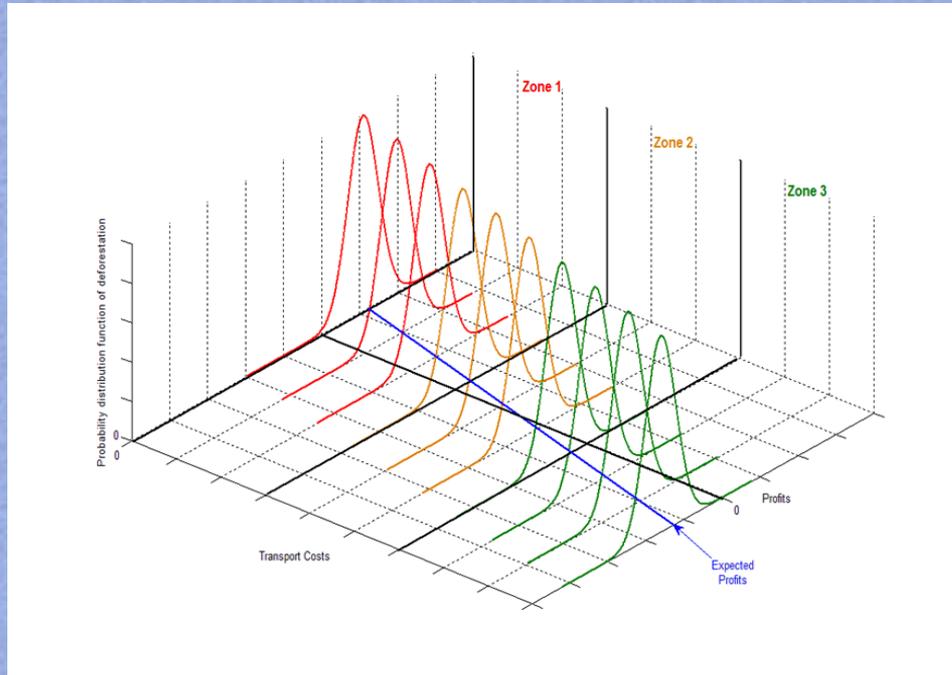
- **theory has not been reflected** in typical evaluations of development (income, road) or conservation (PA, e.g.)
 - in general, might be looking at the wrong set of data or at associations that do not correctly inform policy
 - **if econometrics reflects theory, does further inform:**
 - numerical parameters providing some sense of magnitude
 - what is not explained suggests distribution of other factors
- > if not, do other IA parameterizations solve ??**

Trade -> must consider outcomes elsewhere too !

Pfaff & Walker 2010:

- 'Forest Transition Theory' claims dependable path, as develop, of forests falling and then rising (~EKC)
 - associations of development/income and forest, econometric or other, suggest modeling this link
 - but forgetting trade / theory distorted inference
 - New England (US) imported food, timber
 - Brazilian Amazon if anything now exports
- > Meyroidt, Lambin, Rudel getting #s ...

Transport Costs -> expect heterogeneous impacts !

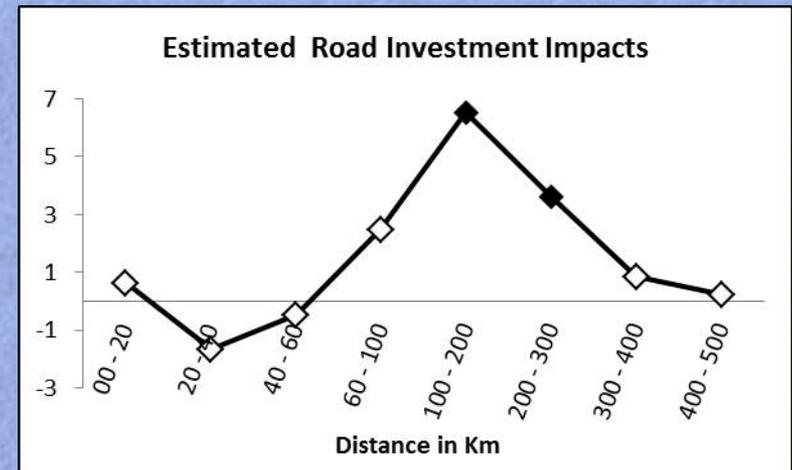


Theory says frontier for road/transport impacts:
(yet not in the roads lit)

- near city, mostly cleared
- at frontier, shifts matter
- far out, still not a profit

PAs contrast: *(again not in lit)*

- PA near city has big impact
- at the frontier, intermediate
- farther out, keeps declining



Land Restrictions -> recall spatially varying baseline !

Recall, landscape theories

-> PA impacts should vary

Reflecting simple theory also

-> cleaner impact estimates!

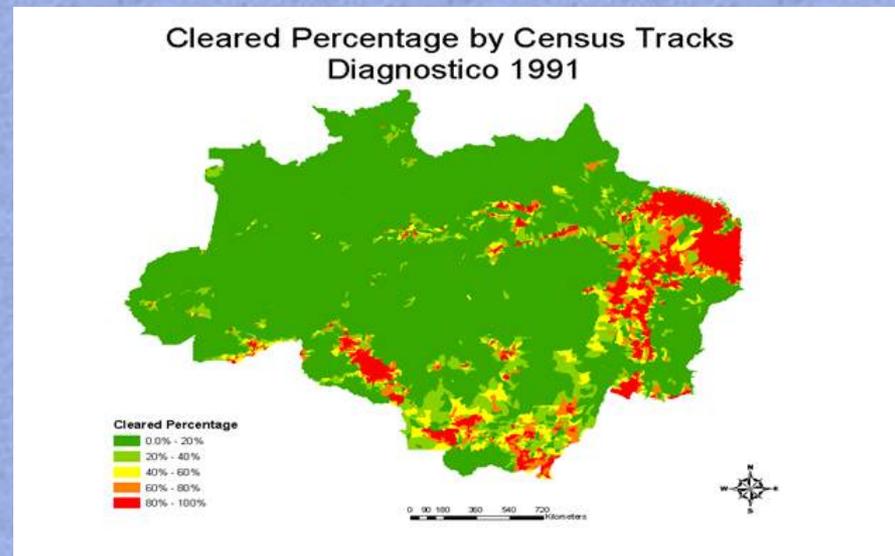
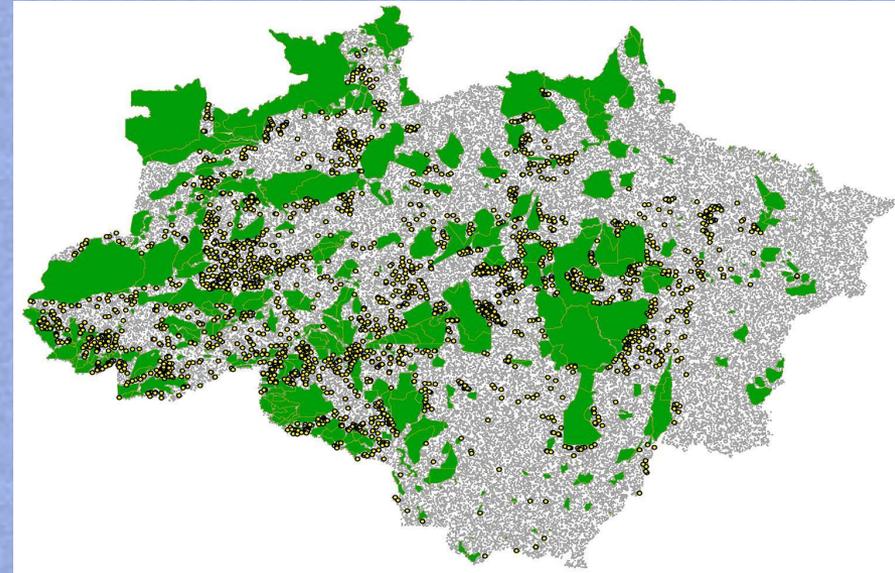
Apples-to-Oranges (use all unprotected)

Apples-to-Apples (matched unprotected)

Baseline = Counterfactual:

what see without a policy?

- should not use all unprotected
- not even neighbor unprotected
- instead, similar characteristics !
- **impacts | costs usually fall !!**



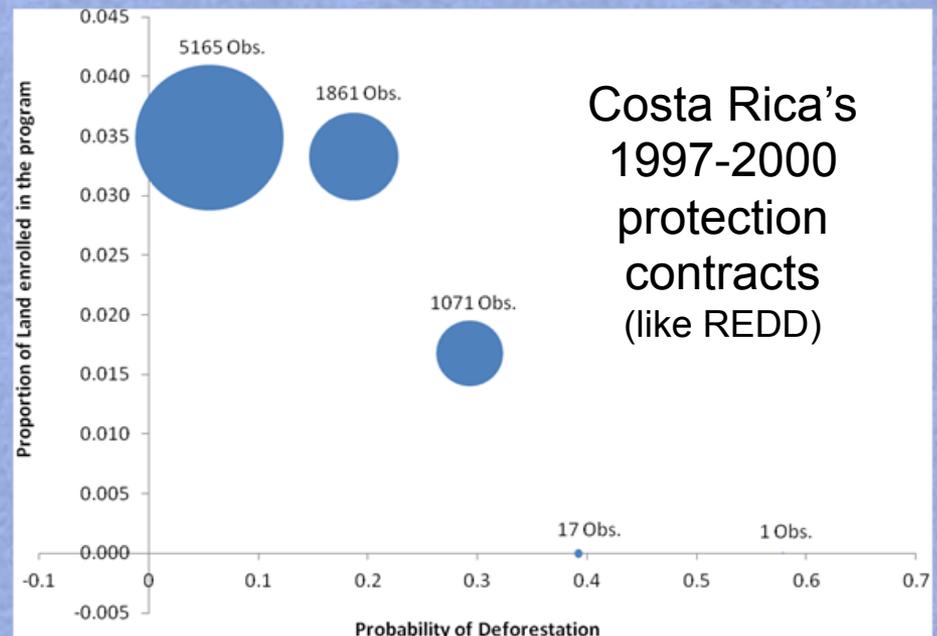
Public Processes -> incorporate private interests !

Protected Area Locations & Impacts (political economy key)

- Acre: sustainable use impact > strictly exclusive impact
- Brazilian Legal Amazon: federal impacts > state impacts

Ecopayment Locations:

- biased against impact
since voluntary? →
- MX add objectives
- NGOs counteract?



III. ECONOMETRICS → ECONOMIC THEORY ?

- Theorizing certainly has some particular advantages... given data needs, one example is interaction/linkages
 - yet Theories may provide an excess of riches (stories) and, further, still may be leaving out some key links !!
 - Econometrics can help sort out and suggest Theories:
 - what is NET effect of multiple stories? VARIES over space?
 - variation in net effects across SETTINGS suggests theories?
- > when *a priori* vs. when helps select model ??**

Spatial-Interactions Theory: deforest -> neighbor ?

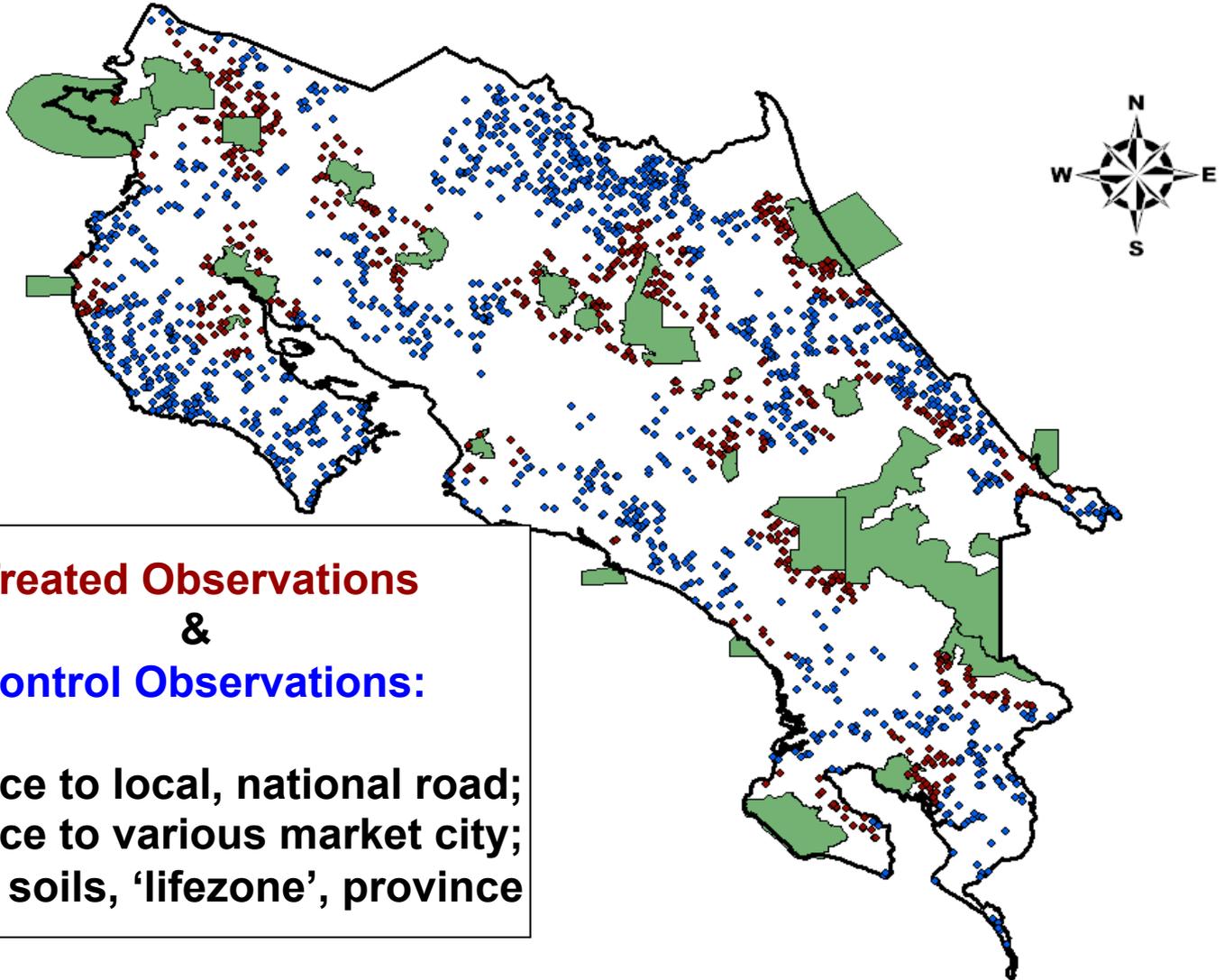
<u>NEIGHBORING DECISION</u> →	<u>MANY DIFFERENT INTERACTIONS COULD ARISE, WITH DIFFERENT SIGNS, AND SIMULTANEOUSLY</u>	
<i>(DEVELOPMENT, E.G. INFRASTRUCTURE, TAKEN AS GIVEN)</i>	Increases Neighbor Deforestation Rate	Decreases Neighbor Deforestation Rate
<u>Through Economic Activities</u>	Increased Returns for others in Agriculture (Zilberman et al 2006, Robalino 2007, leakage)	Increased Returns for others in Ecotourism (Stern 2003, Sims 2010, newspaper/anecdotes)
<u>Through Various Perceptions</u>	Perceived expansion of environmental policy -> clear to prevent takings (Newmark 1994, Fiallo and Jacobson 1995, Ferraro 2006)	Shifted perceptions of environmental policy (e.g. expect buyout) or the Environment (Scheldas 2005)

Econometrics Sorts Theory: C.Rica private spillovers

Robalino & Pfaff 2011 JDE (econometrics = IV, using slope):

- conservation -> same (twist on tourism returns: neighbor farmers band together for tourist forest)
- deforestation -> same (additional private returns, e.g. economies of scale in transport of crop output)
- > net effect varies, larger as further from markets:
 - more tourist-based forest->forest near park
 - less production-based clear->clear near city

Econometrics Sorts Theory: C.Rica parks' spillovers



Treated Observations
&
Control Observations:

distance to local, national road;
distance to various market city;
slope, soils, 'lifezone', province

Number of statistically different covariates pre- & post-matching (5% significance)

Treatment	Pre-matching	Post-matching (PSM)	Post-matching (CM)
All Within 10km	11	5	2
Close to entrance	9	5	0
Close to Roads...	6	0	0
Far from Roads	10	3	0
Far from entrance	11	4	2
Close to Roads	5	0	0
Far from Roads	10	5	2

-> will focus on Covariate Matching (CM) results

Impact of protected areas on deforestation in nearby areas

Distance To A Park	0-10 Km	0-5 Km	5-10 Km
Untreated - Treated	-0.50%	-2.8% ***	1.45% *
		<i>Park distance</i>	<i>clearly can matter.</i>
OLS w/characteristics			
ALL TREATED		<i>Entrance distance</i>	<i>clearly can matter.</i>
Close to entrance	-3.62% ***	-5.15% ***	-1.73%
Far from entrance	0.94%	-1.37%	2.55% **
Covariate Matching	<i>Site characteristics</i>	<i>& blending effects</i>	<i>clearly can matter.</i>
ALL TREATED	0.92%	0.79%	0.80%
Close to entrance	1.60%	0.81%	1.86%
Far from entrance	0.41%	0.00%	0.59%

Impact of protected areas on deforestation in nearby areas
 (allowing for **different impacts** to show, instead of cancelling)

	COVARIATE (FULL SAMPLE)		COVARIATE (RESTRICTED)	
PARK DISTANCE	0-5 KM	5-10 KM	0-5 KM	5-10 KM
Close to entrance				
Close to roads	1.61	8.82**	1.87	16.82***
Far from roads	2.50	0.83	3.10*	-1.49
Far from entrance				
Close to roads	10.39**	-1.45	13.27**	-3.13
Far from roads	1.14	0.72	-2.89	-2.17

Econometrics Suggests Theory: Amazon spillovers

Could PAs Be Shifting Returns In A Much Broader Fashion?

recent evaluations say isolated conservation -> little, w/little counterfactual or 'baseline' clearing to block (for example, far from road maybe little to be done)

perhaps rational long-run development diversion?
(for example, if road not there BECAUSE of a PA!!)

- PA signals less future development in area?

- could shift private migration and investments

- that in turn makes less public action rational..

Brazilian Amazon Conservation Spillover ('blockage'?)

Different Estimates of Park Impacts on Adjacent Deforestation, 2000-2004

Method	Treatment buffer		
	0-10km	0-20km	0-30km
<i>Mean comparison</i>	-0.027 (***)	-0.024 (***)	-0.021 (***)
<i>OLS</i>	-0.009 (***)	-0.008 (***)	-0.007 (***)
<i>PS Matching</i>	-0.008 (***)	-0.006 (***)	-0.006 (***)
<i>PS Matching bias-adjusted</i>	-0.008 (***)	-0.006 (***)	-0.005 (***)

Brazilian Amazon Conservation Spillover ('blockage'?)

Additional Tests: 2000-2004 deforestation impacts BY prior road distance

Distance to 1985 road	Treatment Buffer		
	0-10km	0-20km	0-30km
<i>0 - 20 km</i>	-0.01 (***)	-0.01 (**)	-0.01 (***)
<i>20 - 40 km</i>	-0.02 (***)	-0.02 (***)	-0.02 (***)
<i>40 - 60 km</i>	0.00 (---)	0.00 (---)	0.00 (---)
<i>60 - 100 km</i>	0.00 (---)	0.00 (---)	0.00 (---)
<i>100 - 200 km</i>	0.00 (***)	0.00 (***)	0.00 (***)
<i>200 - 300 km</i>	0.00 (***)	0.00 (***)	0.00 (***)
<i>300-400 km</i>	0.00 (---)	0.00 (---)	0.00 (---)
<i>400 - 500 km</i>	no good matches	no good matches	no good matches
<i>> 500 km</i>	no data	no data	no data

Summary & Extension

Lots of ways for us to learn from land-use observation.
Economic Theory can help to generate key questions
(whether or not Econometrics used to examine data).

Econometrics big challenge is to reflect relevant theory
in order that the numbers produced can inform policy:

- when not, other data approaches solve issues?
- when does, provides #s (parameters, residuals)
- careful inspection also feeds back to modeling

Extension Example: co-benefits (*more integration !!*)

- species habitat: more micro for spatial pattern
- biodiversity: additional level of spatial linkages