Estimating Avoided Deforestation by Protection Type to inform REDD: governance + location = forest + livelihoods?

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Key Issues

Research: deforestation impacts vary by governance?

- improve Amazon baselines, per recent additionality work
- political economy determining location = f(governance)?

Policy: *strategies* & *targeting* really matter for REDD

- compare sustainable use to integral to indigenous impact
- both *type & location (= f(type) !!)* affect PA forest impact

Recent Baseline/Additionality Work

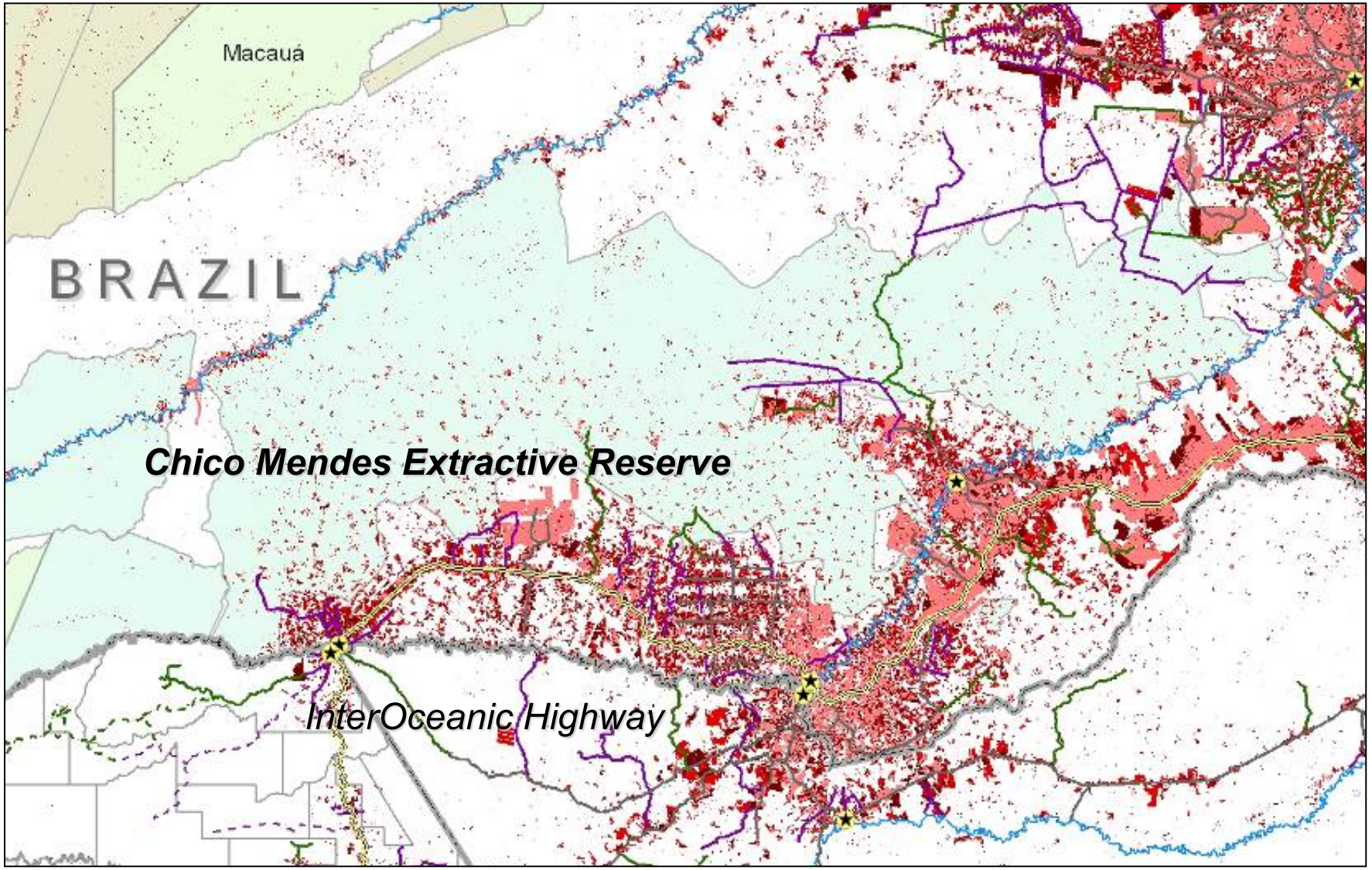
Large Literature w/o Characteristics (Joppa & Pfaff 2010)

- weak baselines = average untreated or same site in past
- average neighbors is a better baseline idea … works? …

Using Measured Characteristics (in particular for matching)

- Costa Rica: average 44%, neighbor 38%, matching 11%
- Costa Rica: impacts vary with road & city distances, slope
- Global: each of >100 countries; median stories are same

Applied to one "in the action" case



Baseline Correction = f(location)

METHOD	1989 – 2000 Deforestation		2000 – 2007 Deforestation	
	Mendes	Other Acre PA	Mendes	Other Acre PA
Average Rates (compare means, treated versus all the untreated)	7%	8%	8%	10%
Regression (controlling for difference in measured characteristics)	7%	1% (insig)	8%	1.5%
Matching (compare means of groups with most "similar" characteristics)	7%	0.2% (insig)	7%	0.2% (insig)

Location Bias: see in baseline correction (e.g. 3rd v. 1st row)

Enforcement: see in matching estimate | location (3rd row)

Acre: creation & location of all the PAs

Significant investments supporting protection:

- developing legal framework & regularizing tenure
- developing and implementing management plans
- investing in monitoring & the capacity to enforce
- supporting sustainable activities (roads, subsidy)

An important feature is fraction of sustainable use:

- public consultations may keep integral 'out of action'
- the processes & locations are different -- consciously
- less capitalized actors may keep 'more action' at bay

Data

Observations about 25k forested (of 800k random)

Deforestation 2000-2004 and 2004-2008 (Prodes)

Protected Areas (all some form of federal)

- Integral (excluding use of the land for production)
- Sust.Use (allows extraction and clearing inside PA)
- Indigenous Land (some extraction, setting differs)

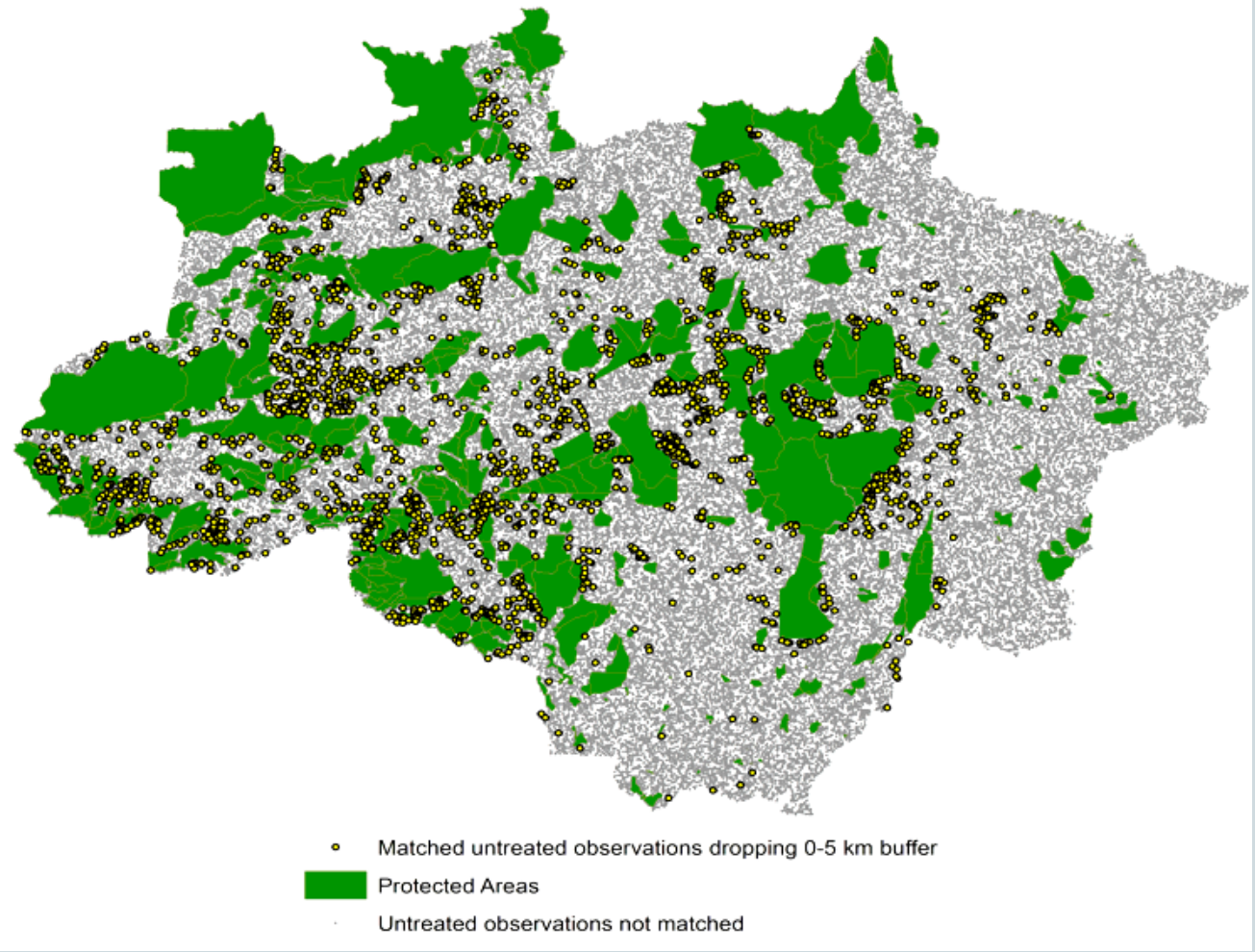
Site Characteristics

- matching is using: states, soil quality, precipitation, slopes, distances to roads (1985) & to cities (1991)

Location Bias (before match to similar)

	2000-04 Deforest	2004-08 Deforest	# Obs.	Distance Road (m)	Distance City (m)	Soil Fertility	Rain (mm)
Unprotected	**2.95%**	**2.15%**	**12,297**	**62,055**	**53,537**	**4.15**	**2,026**
Protected	**0.33%**	**0.33%**	**7,775**	**100,853**	**57,516**	**4.39**	**1,969**
Federal	0.36%	0.43%	5,113	88,289	57,691	4.41	1,988
SustUse	*0.39%*	*0.48%*	*4,369*	*85,901*	*58,546*	*4.44*	*1,953*
Integral	*0.27%*	*0.13%*	*744*	*102,317*	*52,670*	*4.21*	*2,193*
Indigenous	0.29%	0.12%	2,569	128,747	57,239	4.39	1,927

Matching spatially reasonable (per recent PNAS)



Match Equalizes Averages (Tables 2a,b)

Reduction in differences in characteristics after Covariate Matching

Variable	Matched Untreated vs Treated					
	All Parks	Federal Conservation Units	State Conservation Units	Indigenous Lands	Integral Protection parks	Sustainable Management parks
Log Dist Road 85						
Reduction	93.75%	98.77%	91.08%	90.76%	97.49%	90.18%
Initial Difference	0.48	0.25	0.46	0.62	0.46	0.33
Current Difference	0.03	0.00	0.04	0.06	-0.01	0.03
Log Dist City 91						
Reduction	87.18%	98.79%	70.85%	86.92%	96.43%	-298.35%
Initial Difference	0.39	0.13	0.07	0.65	0.32	0.00
Current Difference	0.05	0.00	0.02	0.08*	0.01	0.01
Fertility Index						
Reduction	77.78%	98.30%	92.20%	79.85%	98.53%	91.86%
Initial Difference	-0.18	0.19	-0.32	-0.35	-0.18	0.14
Current Difference	-0.04	0.00	-0.02	-0.07	0.00	-0.01
Rain Index						
Reduction	55.59%	96.33%	89.75%	41.88%	90.43%	83.17%
Initial Difference	42.78	-42.72	182.98	47.02	73.00	65.98
Current Difference	19.00	1.57	18.75	27.33	6.99	11.10
Slope						
Reduction	66.78%	99.24%	100%	64.77%	96.55%	100%
Initial Difference	-0.01	-0.17	0.16	0.02	-0.10	-0.03
Current Difference	0.00	0.00	0.00	-0.01	0.00	0.00
Vegetation Index						
Reduction	100%	100%	100%	100%	100%	100%
Initial Difference	-0.01	-0.05	0.00	0.01	-0.02	-0.05
Current Difference	0.00	0.00	0.00	0.00	0.00	0.00

Impacts By Type, 2000-04 Deforestation

	All PAs	Sust.Use	Integral	Indigenous
Means (full sample)	-2.66%***	-2.55%***	-2.80%***	-2.70%***
OLS (full sample)	-1.08%***	-2.04%***	0.82%	-0.19%
PS Match (bias adjust)	-0.81%***	-2.20%***	-0.66%	-0.35%**
CV Match (bias adjust)	-1.04%***	-2.51%***	-0.24%	-0.04%

Impacts By Type, 2004-08 Deforestation

	All PAs	Sust.Use	Integral	Indigenous
Means (full sample)	-1.85%***	-1.68%***	-2.07%***	-2.04%***
OLS (full sample)	-0.69%***	-0.69%***	-0.01%	-0.69%**
PS Match (bias adjust)	-0.50%***	-0.39%***	-0.23%	-0.23%**
CV Match (bias adjust)	-0.52% ***	-0.68%***	-0.03%	-0.39%

Targeting Matters Within Each *Strategy*

Sustainable Use lack impacts far from pressure too:

- not significant 00-04 if above median distance to a road
- also true for 04-08 & see same story for distance to city

Integral and Indigenous have impact near pressure:

- don't really have Integral closer than median to the roads
- yet Integral are significant when below median to the city
- while Indigenous are significant if below median to a road