Deforestation Spillovers from

Costa Rican Protected Areas*

Juan Robalino[+] *CATIE and Universidad de Costa Rica*

Alexander Pfaff, Duke University

Laura Villalobos, University of Gothenburg

Abstract

Spillovers can significantly reduce or enhance the effects of land-use policies, yet there exists little rigorous evidence concerning their magnitudes. We examine how national parks within Costa Rica affect the clearing of forest nearby. We confirm that average deforestation spillover impacts are not significant within 0-5km and 5-10km rings around parks. However, we argue that this is the result of the presence of blending heterogeneous impacts with different magnitudes within these rings. Unlike prior analyses, we distinguish impacts in nearby forested locations by their distances to roads and park entrances. We find large and statistically significant leakage effects close to roads in areas without tourism (far from Park entrances). No leakage effects are found far from roads and in areas affected by tourism (close to Park entrances). Low transport costs and low returns to forest generate adequate conditions to the presence of leakage from land conservation policies.

Keywords: Protected Areas, National Parks, deforestation, conservation, spillover effects, impact evaluation, Costa Rica
JEL codes: Q23, Q24, Q28, Q57, O13

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[+]Corresponding author (robalino@catie.ac.cr)

1. Introduction

Covering 12% of the earth's surface (WDPA 2012), protected areas (PAs) are the leading policy to reduce deforestation. Thus, understanding *all* of their impacts upon deforestation is important for future conservation policy (see, e.g., Brunner et al. 2001, Andam et al. 2008, Sims 2008, Pfaff et al. 2009, Joppa and Pfaff 2010a). Yet most analyses to date examine deforestation impact of PAs only within PA borders despite the acknowledged fact that a PA's forest impact also can depend significantly on the impacts outside of its borders.

There are numerous hypotheses about how parks might affect the rates of deforestation in nearby areas. Some argue that land restrictions could displace development to unprotected areas nearby (e.g., Wu 2000, Wu 2005, Armsworth et al. 2006, Robalino 2007, Alix-Garcia et al. 2012). Even expected land-use restrictions in the future could lead landowners nearby to deforest, in order to avoid the restrictions (Newmark 1994, Fiallo and Jacobson 1995). These hypotheses suggest that the presence of PAs could result in an increase in deforestation in nearby areas. If such “leakage” were large, deforestation reductions in PAs might be offset by spillovers.

However, it is also hypothesized that parks could decrease the deforestation in nearby areas. Protection could generate incentives for eco-tourism activities, which support conservation of forest outside of but near PAs (Stern 2003). Some argue that PAs increase environmental awareness (Scheldas 2005). Additionally, private land uses in Costa Rica reinforce each other in terms of deforestation, i.e., private forest conservation shifts the nearby private land-use incentives towards additional forest conservation, on net (Robalino and Pfaff 2012). Should PAs generate the same spillovers, their total impacts are above their internal gains.

Estimates of the impacts of parks in nearby areas may be a blend of multiple interactions, which could include positive and negative effects. Those effects' magnitudes, and thus the magnitude and even the sign of the net effect, may well vary across space. Thus, a PA may increase nearby deforestation on net in one location but lower it on net in another location. A large enough single PA even may generate different net effects in different areas nearby.

We examine deforestation spillovers from Costa Rica's National Parks during 1986-1997, the most recent time period during which deforestation rates in Costa Rica were significant. To go beyond prior empirical work, we use spatially detailed information to distinguish the forest locations near PAs by distances to the nearest road and distances to parks' entrances. We expect both the existence and the intensity of spatial spillovers to vary over space and, specifically, to be affected by transport costs and proximities to factors facilitating tourism.

The spatially detailed data also let us control better for parcel characteristics, as the recent literature on PA impacts has done. Protected parcels differ significantly, on average, from unprotected forests (Joppa and Pfaff 2009 show this globally); thus, the forest parcels near PAs also are likely to differ in relevant characteristics from other unprotected forest parcels to which they are compared to estimate spillovers.[1] We employ matching and regression to lessen the potential biases due to the non-random allocation of the PAs across Costa Rica. In environmental economics, matching strategies have been used for some time to evaluate,

[1] Governments and policy makers are likely to be pursuing specific objectives when choosing PAs' locations. They might minimize conflicts with advocacy groups, target for impact (i.e., additionality) by choosing areas facing higher baseline deforestation threats (as suggested in Pfaff and Sanchez 2004) or, instead, maximize environmental benefits conditional upon impact (Costello and Polasky 2004, e.g., extend a large literature).

e.g., the effects of air quality regulations upon environmental outcomes (Greenstone 2004) and economic activities (List 2003). More recently, it has been applied to land restrictions (Andam et al. 2008, Joppa and Pfaff 2010b, Sims 2010, Arriagada et al. 2011, Ferraro et al. 2011, Aliz-Gracia et al. 2012, Pfaff et al. 2012, Carnavire-Bacarreza and Hanauer 2013, Robalino and Pfaff 2013, Robalino and Villalobos 2015, Robalino et al. 2015).

Following Andam et al. 2008, we confirm that for entire rings of forest immediately around Costa Rica's National Parks, there are no significant deforestation spillovers. However, we argue this result is likely to blend heterogeneous impacts of different magnitudes. The magnitudes of the impacts are influenced by parcels' proximities to roads and to park entrances. Thus for further testing we separate nearby forest land by distances to roads and entrances.

Close to national roads, we do find a significant "leakage" effect of a 10% increase in the deforestation rate within a 0-5km ring of the park but far from its entrance. In the absence of tourism's influence, that inner ring seems to capture all of the pressure for "leakage" pushing out from inside the park. Far from the entrance within the 5-10km ring, we find no impacts on deforestation rates.

When close to the parks' entrances within the 0-5km ring and close to national roads, where tourism should have its greatest influence, we find no spillover effect at all. Yet when moving out to 5-10km while close to the entrance, we find, again, leakage close to roads, of an 8.8% increase in the deforestation rate. Within this second ring, tourism may have less power to promote private forest near parks.

These results show not only the potential importance of spillovers in evaluating PA impact but also the value of delineating specific mechanisms that are likely to underlie spillovers. Looking only inside PAs can be misleading if PAs have positive or negative spillovers to surrounding areas, as in Costa Rica, and where they occur to an extent seems predictable. Both that they exist and where they are most likely inform policies that complement PAs.

In Section 2, we present the background on forest conservation in Costa Rica and spillovers estimation. In Section 3, we present our data and empirical approach. We present our results in Section 4 and, finally, we present our conclusions in Section 5.

2. Background

2.1. Deforestation and Conservation in Costa Rica

While deforestation rates in Costa Rica had decreased significantly by the end of the 1990s, during the early eighties Costa Rica had one of the highest deforestation rates in the world (Sanchez et al. 2001). There are multiple possible reasons for such a change across periods.

One set of factors is economic. For instance, beef prices fell, while ecotourism activity rose. Other traditional products such as coffee and banana are important deforestation drivers and for any period where they generate profit helps to determine where deforestation will occur. A significant factor in profit is transport costs; thus roads should matter and they have been confirmed empirically as important factors in deforestation differences across a landscape.

Simultaneously, however, also conservation policies in Costa Rica greatly increased, so that now they cover 25% of the country; the great majority of that land is within protected areas. There are different types of protection. National Parks is the largest category, covering 10% of the country (Pfaff et al. 2009). One characteristic of National Parks is receiving visitors, which in turn creates related economic activities such as ecotourism. By 1995, tourism was the country's main source of foreign revenue (Inman et al. 1997) and a significant fraction of foreign visitors come for ecotourism that includes visiting parks.

Parks within Costa Rica have been shown to reduce deforestation significantly on average, even if far less than many might assume (Andam et al. 2008). However, their effectiveness depends on location, i.e., characteristics of the land. Protected areas close to roads, close to San Jose and on less steep land avoided significantly more deforestation (Pfaff et al. 2009). One remaining question is whether parks have also affected deforestation in their surrounding areas.

2.2. Empirical Estimation of Deforestation Leakage

Various hypotheses exist for how parks might affect deforestation rates in nearby areas. Some authors argue that parks can increase environmental awareness (Scheldas 2005) and bring tourists, promoting eco-tourism activities that require the protection of forest in private lands (Stern 2003). If this is the case, deforestation will decrease as a consequence of the park.

Others argue that land restrictions displace deforestation toward unprotected nearby areas. Individuals might be displaced (Cernea and Schmidt-Soltau 2006) and land clearing will take place outside protected areas. Landowners could also preemptively deforest to prevent the expansion of land restrictions to their properties (Newmark 1994, Fiallo and Jacobson 1995). This shows that deforestation that would not have occurred if parks have not been implemented, can take place outside protected areas.

Additionally, markets could play an important generating spillover effects (Armsworth et al. 2006 and Robalino 2007). Restricting land use could increase prices of agricultural goods and the returns of land development, which increases the benefits from deforesting in areas where there are no restrictions (Armsworth et al. 2006 and Robalino 2007). Deforestation will take place in areas where increases in the benefits of deforesting will make it profitable. Therefore, forest areas with lower transport costs would be affected the most (Robalino 2007).

Empirical analyses have been conducted. Globally, conservation in one region will increase harvest of timber in other regions (Sohngen et al. 199). There is also evidence of large leakage effects from the Conservation Reserve Program in the United States (Wu 2000). For every 100 hectares retired under the program, 20 hectares were converted to cropland (Wu 2000). Other papers have also shown evidence of leakage in forest carbon sequestration (Murray et al. 2004, Chomitz 2002 and Sohgen and Brown 2004).

In Mexico, there is also evidence of leakage generated by the Mexico's national Payments for Ecosystem Services program (Alix-Garcia et al. 2012). Landowners who enrolled in the program increase deforestation on other property belongings. This effect is stronger in poor municipalities and with less access to commercial banks, where credit constrains is higher (Alix-Gracia et al. 2012).

In Costa Rica, park spillovers have been previously explored (Andam et al. 2008). Net effect of parks in surrounding areas has been found to be negligible (Andam et al. 2008). As we show in this paper, while the net effect might be negligible, leakage effects might be considerable especially in areas where small changes in deforestation could increase deforestation such as in forested lands close to roads and in areas where returns of forest due to tourism is low.

3. Data & Empirical Approach

3.1 Data

Using the spatial detail offered by data in a GIS (Geographic Information System), we drew randomly 50,000 points from across Costa Rica, i.e., one per km^2. These provide our units of analysis.

3.1.1. Forest & Sample

We use forest-cover maps for 1986 and 1997 to determine the deforestation in 1986-1997. The maps were developed by the Tropical Science Center from aerial and satellite pictures and permit us to estimate forest presence or absence in each of our randomly drawn points. To study deforestation, we drop from the sample the points with uncertainty about presence of forest (leaving 47,241 points, see Table 1). We also drop 2864 observations covered by clouds or shadow. We then analyze only observations in forest in 1986 (42% or 21,087). The focus of this analysis is non-protected private forest. Therefore, we also drop the points inside parks and in all public areas within which government chooses land uses, leaving 9480 observations. One important variable we use is distance through roads to park entrances. However, some points are too far away from roads so that our calculations of proximity to park entrances through roads are not adequate. So, we dropped observations that not reachable by roads (466 observations). The total number of forest observations left is 9014.

The dependent variable is deforestation. To calculate deforestation in each point, we examine whether forest points in 1986 were cleared or remain in forest by 1997.

3.1.2. National Parks & Nearby Areas

Maps of all protected areas (PAs) in Costa Rica were digitalized by the GIS Laboratory at the Instituto Tecnológico de Costa Rica. We focus on National Parks because they cover the largest total area of protected areas, are one of the strictest types of protection, and they include tourism. We drop all other types of PAs and to analyze neighboring areas also all points in the Parks. To determine which points are neighbors of the National Parks, i.e., "treated", we compute linear distances from each of the forested points to each of the National Parks.

That leaves three resulting sets of observations (see Table 1). First, we consider the 1253 forested locations within 5km of the nearest border of a National Park (Ring 1). Second, we consider the 1486 forest locations between 5km and 10km from the nearest border of a National Park (Ring 2). Finally, 6275 observations are over 10km from a National Park (Far From Parks).

We define proximity to the entrance of a National Park as road distance of less than 20km from the nearest entrance. Within Rings 1 and 2, we split treated observations into close to entrance (503 in Ring 1 and 408 in Ring 2) versus far (750 in Ring 1 and1078 in Ring 2).

Finally, we distinguish observations closer versus farther than 1km from a national road. We consider the rings separately. Within each, we distinguish: close to entrance and road (125 in Ring 1 and 92 in Ring 2); far from entrance but close to road (84 in Ring 1 and 190 in Ring 2); close to entrance but far from road (378 in Ring 1 and 316 in Ring 2); and far from entrance and road (666 in Ring 1 and 888 in Ring 2). All are compared with untreated. There are 6275 observations 10 km or farther from National Parks. Out of those, 1136 observations are located close to National Roads and 5139 are located far away from national roads[2].

3.1.3. Parcel Characteristics

Spatially specific information within a GIS also was used to obtain parcel characteristics helpful for improving comparisons, i.e., finding untreated points most similar to the treated. We obtained measures of slope, precipitation, elevation, distances to rivers and oceans that we classify as natural characteristics. We also computed distances to San Jose, population centers, sawmill and schools. Finally, we computed the fraction of forest in 1986 at the census track level and assign it as a measure of forest stock in the general 'neighborhood'. We can compare treated and untreated observations on these dimensions, as within Table 2.

3.2. Empirical Approach

To determine the impact of National Parks on deforestation rates in neighboring areas we must answer the question: "what would the neighboring deforestation rate have been had a Park not been established nearby?". The simplest estimation strategy to try to answer this 'baseline' question is to consider the average deforestation rate in untreated forest locations

[2] We also dropped 119 observations because they were within the 20km distance through roads but at more than 10km away from parks linearly.

(i.e. 'naive' estimation in Morgan and Winship 2007). This approach is relatively common (Joppa and Pfaff 2010a list examples) but clearly may be inadequate if the treatment group and the untreated group differ in terms of characteristics that also affect deforestation rates.

We observe some such differences. Compared to the controls, parcels within 0-5km of the nearest National Park have steeper slopes, more precipitation, higher elevation, higher census-tract forest in 1986, and longer distances to roads, rivers, cities, coasts, sawmills and schools (Table 2). In sum, Ring 1 points are more remote and likely face less deforestation pressure than does the average unprotected forest parcel which is not located near to a PA. Ring 2 also differs from unprotected forest far from PAs but it is less remote than is Ring 1.

Table 2 suggests that National Parks blocked deforestation in 0-5km (Ring 1) but may have increased it in 5-10km (Ring 2). However, the observed differences in deforestation rates might be caused by the differences in land characteristics, i.e., not the presence of Parks. To control for land characteristics' influences, we use matching − to compare treated to similar untreated points that do not differ in average land characteristics − as well as regressions.

Matching selects as controls the most similar untreated observations, then uses the control deforestation to estimate what would have happened in areas near Parks without the Parks. Compared to standard regression, which nonetheless can be employed after such matching, this imposes fewer assumptions about the functional forms for controlling for influences of characteristics that affect the outcome (Rubin 2006). Such assumptions affect the estimated treatment effects: if the treated are far from roads, e.g., estimated treatment effect is likely to depend on the functional form assumed for the variable distance to roads (e.g. linear or log-linear). Matching directly reduces the difference in distance to roads between treated and untreated, as shown below, which reduces the effect of functional form assumptions on the estimates.

However, matching relies upon an identification assumption, that there are no unobservable factors – factors not in the data − that affect deforestation and the chance of being treated, i.e., of being near a Park. Given finite data, many possible influences may go unmeasured, though our relatively rich data set should help to reduce the extent to which this is violated.

Matching also requires a definition of 'similar'. One is the distance in the characteristics space between any two points[3] (Abadie and Imbens 2006). This matching strategy is called Covariate Matching. The advantage of using this matching strategy is that standard errors are consistently estimated (Abadie and Imbens 2006). Table 3 examines balance or differences between the treated and matched untreated points. Covariate matching reduced the number of covariates that differ significantly[4].

4. Results

4.1. No Spillovers On Average

We test first whether there exist deforestation spillovers on average nearby to Parks. The naïve estimator shown in the first two columns of Table 4 suggests that Parks are reducing deforestation within 5 km, in particular near to Park entrances and far from roads. On the contrary, for the second ring, we find no difference on average, but higher deforestation for observations far from parks' entrances and close to a roads. However, as we discussed, , land characteristics that can explain deforestation rates vary significantly between the

[3] This distance between points in the land characteristics or covariate spaces specifically is defined as $((x_1-x_2)' V (x_1-x_2))^{1/2}$ where x_1 and x_2 are the vector of land characteristics for any two observations and V is a positive-definite weight matrix.

[4] We also tested PS matching but balances were worst than covariate matching. So, we choose to focus on covariate matching.

treated and the untreated observations. Therefore, we cannot conclude that parks have generated these differences in deforestation rates.

We then include land characteristics using ordinary least squares and covariate matching and find that these control variables explain some of the differences found before. However, OLS results show some leakage in the 5-10 km ring, especially far from parks' entrances and close to roads. When using covariate matching (CVM), we do not find any significant effects in either of the rings, whether or not we distinguish subsets by the distance to entrance. This result confirms the average ring results for Costa Rica found previously in Andam et al. 2008.

However, this might be the result of blending effects of different magnitudes around the parks. Specifically, we believe these results could be a combination of heterogeneous treatment effects. As discussed previously, National Parks might reduce deforestation in nearby areas for some reasons and in some conditions, yet increase deforestation within other nearby areas under other conditions. Thus, the average findings in Table 4, in principle, could result from combining and offsetting heterogeneous effects.

4.2. Distance To Road: looking where we expect spillovers

We might expect more leakage where the differential between agricultural returns and forest returns is higher. One powerful determinant of agricultural returns certainly is the distance to nearest road. One powerful determinant of tourist activities, which we believe can contribute to returns to forest, certainly seems likely to be proximity to the entrance of the park. Table 5 combines these factors.

We should expect an increase in deforestation due to the creation of the park far from the entrances and close to roads. We find large and significant effects in Ring 1 and close to Roads (see Table 5). The impacts vary from XXX to XXX.

Similarly, after reaching the second ring, tourist activities decrease, and close to roads, leakage effects appear again. These impacts vary from XXX to XXX.

4.3 Distance to Park Entrance: a countervailing influence

If tourism activities are in fact reducing leakage effects near parks' entrances, we should expect lower effects than far from parks. This is what we find close to roads (see Table 5). This result is robust to different empirical strategies, OLS, CVM and when we restrict the sample to have enough overlap between treated and control observations. Similarly, far from roads the effects are insignificant. Only when using the restricted sample with CVM, a marginally significant (10%) effect appears far from roads and close to the trance, which are less affected by tourism than close to roads.

5. Discussion

Leakage or spillovers can significantly reduce or multiply the effects of land conservation policies. We empirically examined how parks affect deforestation rates in nearby areas. We used parcels far away from parks to estimate the counterfactual deforestation rates. However, the criteria used by policymakers when choosing park location creates an empirical challenge when trying to determine the correct control group. To address this source of bias, we use covariate matching techniques.

We found in average insignificant net results of the implementation of parks within 5km (Ring 1) and within 5 to 10km (Ring 2) when using matching techniques. However, we find that these might be the results of combining heterogonous effects. Park effects in areas close to park entrances associated with higher tourism activities are insignificant. However, large increases in deforestation (around 9%) are found near roads in areas less affected by tourism. The areas less affected by tourism are located within 5km of the park but far from tourists' entrance and between 5 and 10km of the park but within 20km in roads.

These results can be used to evaluate parks' overall effects on deforestation rates. Within-park effects as a measure of parks efficiency might be misleading if parks have positive or negative effects in surrounding areas. These results are also relevant to identify where deforestation will leak once protection is implemented. They are also important to define relevant areas within park buffers that might require extra attention.

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Table 1

Forest and Sample

	Number of observations	Percentage
Observations (total)	**50000**	**100**
Drop if uncertain about presence of forest	2759	5.52
Drop if there are clouds or shadows	2864	5.73
Drop if there was not forest in 1986	23290	46.58
Drop if it is not private land	11607	23.21
Drop if undefined distance by roads to Parks	466	0.93
Total observations for the analysis	9014	18.03
Ring 1: 0-5Km	**1253**	**100.00**
Close to the entrance	*503*	40.14
Close to National Roads	125	9.98
Far from National Roads	378	30.17
Far from the entrance	*750*	59.86
Close to National Roads	84	6.70
Far from National Roads	666	53.15
Ring 2: 5-10Km	**1486**	**100.00**
Close to the entrance	*408*	27.46
Close to National Roads	92	6.19
Far from National Roads	316	21.27
Far from the entrance	*1078*	72.54
Close to National Roads	190	12.79
Far from National Roads	888	59.76
Beyond 10km	**6275**	**100.00**
Close to National Roads	1093	17.42
Far from National Roads	5063	80.69
Dropped if close to the entrance (20km through roads)	119	1.90

Table 2

Land Characteristics & Group Mean Differences

	Untreated	0-5 km		5-10 km	
		Treated	*t-stat*[1]	*Treated*	*t-stat*[1]
Dependent Variable					
Deforestation rate	13.42	10.61	-2.70	14.87	1.47
Control Variables					
Slope (percentage)	44.85	64.93	7.66	55.01	4.19
Precipitation (mm)	3.30	3.73	15.15	3.67	14.02
Elevation (m)	0.35	0.75	27.08	0.43	6.53
Dist. to local roads (Km)	0.78	1.01	8.34	0.99	8.15
Dist. to national roads (Km)	3.90	4.35	3.96	3.69	-2.11
Dist. to rivers (Km)	1.42	1.61	4.80	1.25	-4.83
Dist. to capital city (Km)	105.70	104.01	-1.14	116.42	7.81
Dist. to pacific coast (Km)	52.30	50.45	-1.44	55.70	2.80
Dist. to atlantic coast (Km)	110.23	104.99	-2.49	96.75	-6.79
Dist. to towns (Km)	2.82	3.36	9.51	3.10	5.49
Dist. to sawmills (Km)	18.34	22.28	11.55	22.06	11.49
Dist. to school (Km)	15.21	14.32	-2.98	13.37	-6.58
Percentage of forest 1986	52.17	58.86	9.08	55.05	4.15

[1] Test of means against untreated.

Table 3

Matching Balances -- Statistically Different Covariates (at 5%)

	Pre-match	**After CVM**
Ring 1	11	2
Close to Entrance	10	0
Close to Roads	6	0
Far from Roads	10	0
Far from Entrance	13	2
Close to Roads	5	0
Far from Roads	12	2
Ring 2	12	0
Close to Entrance	9	0
Close to Roads	5	0
Far from Roads	10	0
Far from Entrance	9	0
Close to Roads	5	0
Far from Roads	12	0
Ring 1 and 2	11	2
Close to Entrance	9	0
Close to Roads	6	0
Far from Roads	10	0
Far from Entrance	11	2
Close to Roads	5	0
Far from Roads	10	2

Table 4

Initial Estimates of National Parks' Impacts on Nearby Deforestation

	Naive		OLS[1]		Covariate Matching[1]	
	0-5 Km.	**5-10 Km.**	**0-5 Km.**	**5-10 Km.**	**0-5 Km.**	**5-10 Km.**
Overall Effect	-0.0280***	0.0145	0.0071	0.0199**	0.0079	0.008
	[0.010]	[0.010]	[0.011]	[0.010]	-0.013	-0.013
Far From Parks' Entrances	-0.0137	0.0255**	0.0186	0.0211*	-0.0001	0.0059
	[0.013]	[0.011]	[0.014]	[0.011]	-0.018	-0.015
Close To A Park Entrance	-0.0515***	-0.0173	-0.0017	0.0065	0.0081	0.0186
	[0.016]	[0.017]	[0.014]	[0.015]	-0.015	-0.019
Far From Roads	-0.0424***	0.0034	0.0038	0.0148	0.0070	0.0064
	[0.011]	[0.011]	[0.012]	[0.011]	[0.014]	[0.014]
Close To A Road	0.0387	0.0579**	0.0280	0.0420*	0.0435	0.0234
	[0.026]	[0.024]	[0.027]	[0.023]	[0.032]	[0.027]

***, ** and * represent significance at 1, 5 and 10% level respectively. [1] The control variables used are shown in Table 1. Distances are in logs.

Table 5

Additional Matching Estimates of National Parks' Impacts on Nearby Deforestation

	Ring 1: 0- 5 Km			Ring 2: 5 - 10 Km		
	OLS	**CVM**	**CVM Trimmed[a]**	**OLS**	**CVM**	CVM **Trimmed[a]**
FAR FROM ENTRANCE						
Close To A Road						
Effect	0.0859**	0.1039**	0.1327**	0.0269	-0.0145	-0.0313
	(0.040)	(0.052)	(0.057)	(0.028)	(0.034)	(0.040)
Far From Roads						
Effect	0.0110	0.0114	-0.0289	0.0192	0.0072	-0.0217
	(0.015)	(0.018)	(0.023)	(0.012)	(0.016)	(0.018)
CLOSE TO ENTRANCE						
Close To A Road						
Effect	-0.0008	0.0161	0.0187	0.0632*	0.0882**	0.1682**
	(0.032)	(0.035)	(0.054)	(0.037)	(0.039)	(0.070)
Far From Roads						
Effect	0.0084	0.0125	0.0310*	0.0060	0.0083	-0.0149
	(0.018)	(0.016)	(0.019)	(0.019)	(0.021)	(0.024)

(a) Using only observations in the interval of 0.1 and 0.9 of the propensity score as suggested by Crump et al. 2009.