MEXICO'S NATURAL PROTECTED AREAS: ENHANCING EFFECTIVENESS AND EQUITY

Final Narrative Report to the Tinker Foundation

by

Allen Blackman
(Project Director and Principal Investigator)
Resources for the Future
1616 P Street
Washington, DC 20009
v: (202) 328-5073
f: (202) 939-3460
blackman@rff.org

Alexander Pfaff
(Principal Investigator)
Terry Sanford Institute of Public Policy
Duke University
Durham, NC

Juan Robalino
(Principal Investigator)
Environment for Development Center for Central America
Centro Agronómico Tropical de
Investigación y Enseñanza (CATIE)
Turrialba, Costa Rica

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1. BACKGROUND, OBJECTIVES, AND METHODS

1.1. Background

Rural Mexico is plagued by both rampant deforestation and entrenched poverty. Between 1990 and 2000, the country lost 540,000 hectares of forest, about 8% of its 1990 total. (FAO 2011). To date, Mexico has lost 95% of its humid tropical forests and half of its temperate forests, mostly to farming and ranching. This deforestation has bred a host of environmental problems, including soil erosion, aquifer depletion, and diminished biodiversity (Cervigni and Brizzi 2001). The economic situation in Mexico's remaining forests is no less serious. The 10 million people (11% of the country's population) living in these forests are among the country's poorest citizens (Segura 2000). Hence, forest conservation policy in Mexico must strike a balance between environmental protection and economic development. It must attempt to stem deforestation without exacerbating poverty.

One of the principal strategies Mexican policymakers have used to stem deforestation is prohibiting or restricting land use and land cover change in protected areas—the most common approach to forest conservation worldwide. Today, Mexico has 174 natural protected areas (NPAs) covering over 25 million hectares. The NPA system is growing quickly and is likely to continue to expand during the next decade: in 2000, CONABIO proposed establishing 151 new NPAs covering an additional 51 million hectares.

Despite the critical role NPAs play in Mexican forest conservation policy, little is known about whether they actually stem deforestation or have significant impacts on local communities. As for NPA's deforestation impacts, to our knowledge, a rigorous national evaluation of has yet to appear. Past studies have focused on either on a single NPA, or a small number of NPAs, an approach that rules out learning from comparing a large number of NPAs with different characteristics. In addition, as discussed below, past studies of have often been compromised by methodological problems that have biased their results, generally casting NPAs in a more favorable light than may be warranted and generating misleading policy prescriptions.

As for NPAs' impact on local communities, very little is known. Clearly, NPAs have been established in relatively poor areas. Intuitively, there are compelling reasons to expect that NPAs make local communities worse off, and equally compelling reasons to expect the opposite. On one hand, poor rural communities rely on local forests for hunting, collecting biomass for fuel and fodder, logging, and engaging in agroforestry and shifting agriculture. By their nature, NPAs restrict such activities. But on the other hand, NPAs can generate significant local economic benefits by boosting ecotourism and attracting outside investment in roads and other infrastructure. For example, according to the Mexican Ministry of the Environment, NPAs are visited by six million people every year, generating $300 million in economic benefits, 90% of which accrue to local

communities (Elvira-Quesada 2007). NPAs also may benefit local communities by protecting economically important natural resources that otherwise might be degraded.

1.2. Objectives

The broad objective of our project was to provide policy makers with the information they need to design NPA policies that will stem deforestation without exacerbating rural poverty. More specifically, our study sought to answer the following six questions (note these are the same six questions in our 2008 proposal, but have been reordered here for the sake of clear exposition):

i.   How effectively have NPAs stemmed deforestation within their boundaries?
ii.   Why have some NPAs been more successful at stemming deforestation than others?
iii.   To what extent have NPAs displaced deforestation to surrounding areas?
iv.   What positive and negative impacts have NPAs had on local economies?
v.   How does the Mexican with protected areas experience compare with that of Costa Rica?
vi.   What are the implications of our findings for forest conservation policy?

1.3. Methods

As noted above, past studies of NPAs' deforestation impacts have often been undermined by methodological problems. They often measure these impacts by simply comparing rates of deforestation on all land inside NPAs and all land outside of them (SEMARNAT 2003). But this approach ignores the fact that for a variety of reasons, most Mexican NPAs—like most protected areas worldwide—have been sited in remote sparsely populated areas where deforestation pressures are limited. As a result, this method conflates the effect on deforestation of NPAs' siting in certain types of areas with that of legal protection (which is what needs to be measured), thereby generating overly optimistic estimates of NPAs' deforestation impacts.

To address this problem, some studies have estimated NPAs' impacts on deforestation by comparing rates of deforestation inside NPAs and in adjacent areas (Mas 2005; Figueroa and Sanchez-Cordero 2008). However, this method ignores the possibility that NPAs spur deforestation in adjacent areas. If such "leakage" is significant, this approach also will generate estimates of the impacts that are biased upwards.

Quantitative studies of Mexican NPAs' socioeconomic impacts on local communities are even more rare than studies of deforestation impacts. However, any such study confronts the same methodological challenge: the need to control for the fact that NPAs are typically sited in remote areas. Given this tendency, communities in and around NPAs will disproportionately have socioeconomic characteristics associated with remote areas—namely poverty and marginalization. Studies that fail to control for this fact will conflate the effect of NPAs' siting with their effect on local communities leading to overly pessimistic estimates of NPAs' socioeconomic impacts.

To generate unbiased estimates of NPAs' effects on deforestation and rural livelihoods, we used a statistical technique called propensity score matching (Rosenbaum and Rubin 1983). The intuition is straightforward. To control for the tendency of NPAs to be sited in areas with certain characteristics, and for the possibility that they may cause leakage in adjacent areas, we estimated NPAs' impacts by comparing the average "outcome" of interest—either a change over time in land cover or in a socioeconomic indicator—for

- "treatment" areas inside or near NPAs; and
- "control" areas that far away from NPAs but that have very similar characteristics that might affect this outcome, e.g., distance from cities, land tenure, etc.

We matched treatment and control areas using a weighted index of observable characteristics of these areas such as distance from cities, soil quality and land tenure (called a propensity score, this weighted index collapses the difficult problem of finding a close match for each treatment area across a large number of observable characteristics to the much simpler problem of finding a close match for a single weighted index). If we have done a good job of matching treatment areas with control areas, then the only relevant difference between these two types of areas will be that the former were inside or near an NPA and the latter were not, and we can reliably attribute any difference in the average outcome for the two groups to being inside or near an NPA.

2. ACTIVITIES THAT TOOK PLACE AS A RESULT OF THE GRANT

2.1. Analysis of deforestation impacts (study questions i-iii)

2.1.1. Constructed database

To address our first three research questions on NPAs' deforestation impacts, we constructed a detailed geographic information system (GIS) comprising data on land cover change (our dependent variable) and on land characteristics (precipitation, slope, elevation, travel times to urban areas, soil types, tenure, indigenous population and NPA administrative region). The land cover change data are derived from LANDSAT satellite images for 1993 and 2000 and therefore indicate change between these two years.

As discussed in our proposal, most of these data were assembled into a GIS by the National Ecology Institute (*Instituto Nacional de Ecologia*, INE), the research branch of Mexico's Ministry of Environment and Natural Resources. Our additional contribution to this effort was to add several new variables (soil types, NPAs, and NPA administrative region), reconstruct missing metadata (on the scale, units, and source of each variables), and modify the sample to suit our purposes.

Our unit of analysis was a 30-meter square plot, which corresponds to the resolution of the land cover map. The national territory of Mexico includes millions of these plots and using all of them in our statistical analysis would have been impractical. Therefore, we

selected a random sample of 137,632 plots that were forested in 1993. The sample comprised plots two kilometers apart vertically and horizontally.

Because our land cover data only span the years 1993-2000, we were only able to include in our analysis 57 NPAs created prior to 1993. This ensured that all of the plots included in our analysis were either inside a NPA for the entire study period or none of it.

2.1.2. Conducted econometric analysis

Question 1: How effectively have NPAs stemmed deforestation within their boundaries?

To assess NPAs' effect on deforestation within their boundaries, we compared the average rate of deforestation on sample plots inside NPAs and on a *matched* sample of plots outside NPAs—that is a sample of plots that were very similar in terms of the characteristics listed above (precipitation, slope, elevation, etc.). In addition, for the sake of comparison we calculated "naïve" estimates of NPAs' impacts based on (i) simple comparisons of the average rate of deforestation on sample plots inside NPAs and all plots outside NPAs; and (ii) simple comparisons of the average rate of deforestation on sample plots inside NPAs and plots adjacent to these NPAs. We examined NPAs' effect on deforestation at the national level and also at the level of the nine administrative regions of the National Natural Protected Area Commission (*Comisión Nacional de Áreas Naturales Protegidas*, CONANP), the semiautonomous branch of Mexico's environment Ministry that administers NPAs.

Question 2: Why have some NPAs been more successful at stemming deforestation than others?

To identify the characteristics of particularly effective NPAs, we tested whether NPAs with certain characteristics had different impacts on deforestation within NPA boundaries than those without those characteristics. More specifically, in a national sample, we tested for differential impacts in NPAs with sample plots that—compared to all sample plots in NPAs—have above-average (or median)

- altitude;
- travel time to nearest large population center;
- common property tenure; and
- indigenous population > 75%

We also tested whether NPAs that have sample plots with below-average (or median) characteristics have differential impacts. For each subsample of NPAs with above- and below-average characteristics, we test effectiveness by comparing average rates of deforestation on plots in these NPAs and a matched sample of plots outside them.

Question 3: To what extent have NPAs displaced deforestation to surrounding areas?

To determine whether NPAs spur deforestation in adjacent areas, we compared the

average rate of deforestation on sample plots within various distance bands around NPAs and on a *matched* sample of plots farther away from NPAs.

2.2. Analysis of socioeconomic impacts (study question iv)

2.1.1. Constructed database

To analyze NPAs' socioeconomic impacts on local communities, we constructed a second GIS from two broad categories of data. The first was socioeconomic data purchased from the *Instituto Nacional de Estatistica y Geografia* (INEGI), Mexico's national statistics and geography institute. Specifically, we purchased data from a 2000 national Census and from 1995 and 2005 national Conteos (more limited surveys administered in years ending in 5). We merged these data with those on land characteristics, including on both geophysical characteristics—distance to city, coast, roads and rivers, elevation, slope, precipitation, temperature, land tenure, land use, soil quality—and socioeconomic characteristics—population density, immigration, unemployment, indigenous population, education, and literacy.

2.1.2. Conducted econometric analysis

To address our fourth research question—what impacts do NPAs have on socioeconomic characteristics of local communities—we used an empirical approach that differs from that discussed in Section 2.1 in four ways. First, the dependent variables are indicators of socioeconomic characteristics of the local community, not deforestation. Specifically, we examined effects of NPAs on

- population growth;
- income inequality as measured by Gini coefficient, and
- marginality, an index of the overall quality of life generated by the National Population Council (*Consejo Nacional de Población*, CONAPO)—specifically, we used an indicator of whether a municipio is classified as having a "very high" level of marginality.

These three measures are derived from Mexican census data. Second, the unit of analysis was a municipio, roughly the equivalent of a county in the US, not a 30-meter square plot. Hence, we examined the effect of NPAs on socioeconomic characteristics of the municipios in which they are located. Third, we used data from several years, not just one. The years we examined—1995, 2000, and 2005—corresponded to the three most recent years in which Mexican census data were collected. And finally, we used a more complicated statistical test than the simple difference-in-means tests used in the deforestation analysis (for details, see Robalino et al 2011). Essentially, this "difference-in-differences" test amounts to comparing changes in average socioeconomic indicators between 2000 and 2005

- in municipios where NPAs were established sometime between 1995 and 2005; and

- in a *matched* sample of very similar municipios without any NPAs.

The (propensity score) matching controls for the fact that NPAs tend to be sited in municipios with certain characteristics.

We estimated two types of effects of NPAs on socioeconomic indicators. The first, which we called a "short run effect", measured the impact on changes in socioeconomic indicators between 2000 and 2005 of the establishment of a new NPA in a municipio during that same five-year period. The second effect, which we called a "long run effect", measured the impact on changes in socioeconomic indicators between 2000 and 2005 of the establishment of an NPA in a municipio between 1995 and 2000. So essentially, our short run effect measured the contemporaneous effect of establishing an NPA in a municipio, and our long run effect measured the effect over a subsequent five-year period.

2.3. Comparison with results from Costa Rica (study question v)

To determine whether and how our results differ for those from Costa Rica, we compared our final results for Mexico with those for Costa Rica reported in a series of papers by Alex Pfaff, Juan Robalino and their coauthors (Pfaff et al. 2009; Andam et al. 2008; Robalino and Villalobos 2010).

2.4. Implications for forest conservation policy? (study question vi)

To identify the implications of our findings for forest conservation policy, we drew upon our experience evaluating forest conservation policy in developing countries, and on a discussion of our results with policy makers in Mexico (See section 6)

2.5. Dissemination activities

See Section 6 below.

3. SUMMARY OF RESULTS

Question i: How effectively have NPAs stemmed deforestation within their boundaries?

We found that, *on average*, at the national level, the 57 NPAs created before 1993 were not effective in stemming deforestation. They did not have a statistically signficant effect on deforestation within their boundaries. However, not all NPAs were ineffective. Those in three of nine NPA administrative regions (CONANP regions 4, 6, and 9 in the northeast and sourthern parts of Mexico, see map in attached papers) succeed in stemming deforestation.

Question ii: Why have some NPAs been more successful at stemming deforestation than others?

We found that pre-1993 NPAs were more effective in stemming deforestation when they were sited in low altitude areas, comprised of private and state (versus common) property, located far from cities, and had plentiful indigenous inhabitants.

Question iii: To what extent have NPAs displaced deforestation to surrounding areas?

We found that pre-1993 NPAs did not spur leakage deforestation in adjacent areas.

Question iv: What positive and negative impacts have NPAs had on local economies?

We found that at the national level, establishing an NPA between 1995 and 2005: increased marginality both in the short run and in the long run; increased income inequality in the short run, but reduced it in the long run (probably because all residents become poorer in the long run); and had no effect on population in the short run, but reduced it in the long run.

Question v: How does the Mexican experience compare with that of Costa Rica?

We found that in both Costa Rica and Mexico, at the national level, on average, protected areas had a limited effect on deforestation and generated little or no leakage. In Costa Rica, however, the effect on deforestation (10%) was significantly greater than in Mexico (essentially 0%), a discrepancy that is likely due to more stringent monitoring and enforcement of protections in Costa Rica. Further, we found that in Costa Rica, protected areas far from population centers tended to be more effective while the opposite was true in Mexico. This discrepancy is likely due to differing drivers of deforestation in the two countries. Finally, we found that in Costa Rica, protected areas had some positive socioeconomic impacts, depending on the location and economic sector of the affected households, while in Mexico we found overall negative impacts. This difference is likely due to a higher level of aggregation in the empirical analysis for Mexico.

Question vi: What are the implications of our findings for forest conservation policy?

The results from our deforestation analysis have at least two policy implications. First, they provide information policy makers can use to target scarce financial and human resources to *existing* NPAs. For example, if a goal is to improve NPAs' impact on deforestation, our analysis indicates the NPAs that are relatively ineffective in achieving this goal—those in CONANP regions 2, 3, 7, and 8 in the northeastern and southeastern parts of Mexico. Second, our results provide information policy makers need to site *new* NPAs to stem deforestation. They suggest that NPAs will be most effective if sited in areas characterized by low altitude, relatively limited communal tenure, etc. The results from our socioeconomic analysis suggest that policy makers should consider proactive policies to reduce NPAs' negative socioeconomic impacts on local communities.

4. FACTORS AFFECTING PROJECT'S SUCCESS

The main factor contributing to the project's success was the experience of the project team members. The three principal investigators—Allen Blackman, Alex Pfaff and Juan Robalino—all have considerable experience evaluating forest conservation and other environmental policies using econometric matching techniques. In addition, Blackman and Yatziri Zepeda-Medina (who worked on the project in its first year) both have good contacts in the Mexican environmental community, particularly at the National Ecology Institute (*Instituto Nacional de Ecología,* INE), the research branch of the Ministry of Environment and Natural Resources (*Secretaría de Medio Ambiente y Recursos Naturales*, SEMARNAT). Blackman's contacts proved helpful in obtaining data and liaising with policymakers, particularly during the dissemination phase of the project, and Zepeda's contacts were helpful in acquiring data and collecting background information.

We faced two unexpected challenges during the course of the project. First, two Research Assistants left the project team and a third had to take a long leave of absence in the project's final stages for medical reasons. Yatziri Zepeda-Medina was originally the sole Research Assistant on the project. In the Fall of 2008, she left RFF to return to Mexico where she continued to work on a part-time basis through the Spring of 2009 when she took a full time position and resigned from the project team. To replace Yatziri, we split her responsibilities between two new Research Assistants: Nisha Krishnan, a Research Assistant at RFF who worked under Allen Blackman's supervision, and Laura Villalobos, a Research Assistant in the Environment for Development Center for Central America at CATIE who worked under Juan Robalino's supervision. Nisha worked on the deforestation impacts component of the project from July through October of 2010 but then left to take a job at a consulting firm. Allen Blackman ultimately assumed her responsibilities. Laura Villalobos worked on the socioeconomic impacts analysis, but dropped out of the project for several months in the Fall and Winter of 2010 due to an auto accident. (Thankfully, she has since fully recovered!)

Second, we were not able to collect as much land cover data as we had hoped. As discussed in Section 2.1, we acquired compatible 1993 and 2000 national land cover data. In addition, we were hoping to obtain post-2000 national land cover data so that we could evaluate the deforestation impacts of Mexican NPAs established after 1993. We have learned that a 2002 national land cover map compatible with our 1993 and 2000 maps has been constructed. However, it is very tightly held. We have requested it multiple times from multiple sources—including several we know quite well—without success.

5. UNANTICIPATED RESULTS

Three of our principal results were particularly unexpected. First, we found that NPAs in CONANP Region 3 exacerbated deforestation. To our knowledge, ours is the first rigorous study of protected areas—i.e., a statistical analysis using remotely sensed land cover change data along with counterfactual analysis—to find that protected areas speed deforestation. Second, we found that NPAs sited far from population centers were more effective in stemming deforestation. The usual result is the opposite. Finally, we found

that the creation of NPAs unequivocally exacerbated marginality both in the short- and long-run. As discussed above, other studies have found that at least in some cases, protected areas have positive socioeconomic effects on local communities. We continue to explore all three of these surprising findings.

6. TARGET AUDIENCES

The three target audiences for this project were (i) stakeholders concerned with forest conservation policy in Mexico, (ii) stakeholders concerned with forest conservation in other developing countries, and (iii) professional academic researchers. To ensure that our results reached these audiences we undertook the following activities.

i. Policy report in English

We wrote a 13-page non-technical policy report in English (attached). This report aims at our second target audience—stakeholders concerned with forest conservation in other developing countries.

- Blackman, A., J. Robalino, L. Villalobos, and A. Pfaff. 2011. "Deforestation and Socioeconomic Impacts of Natural Protected Areas in Mexico: Summary of Key Research Findings" Resources for the Future: Washington, D.C.

ii. Policy report in Spanish

Translated the policy report into Spanish (attached). This report aims at our second target audience—stakeholders concerned with forest conservation policy in Mexico.

- Blackman, A., J. Robalino, L. Villalobos, and A. Pfaff. 2011. "Deforestación e Impacto Socioeconómico de las Áreas Naturales Protegidas en México: Resumen de los Principales Resultados." Resources for the Future: Washington, D.C.

iii. Dissemination seminar

Allen Blackman, Juan Robalino, and Laura Villalobos presented the policy report in Spanish at a March 9, 2011 full-day dissemination seminar hosted by the Ministry of Environment and Natural Resource (*Secretaría de Medio Ambiente y Recursos Naturales*, SEMARNAT) in Mexico City (see attached agenda and PowerPoint presentations). The seminar was organized by our contacts at the National Ecology Institute (*Instituto Nacional de Ecología*, INE), SEMARNAT's semi-autonomous research branch. At the seminar, we distributed a summary of our results in Spanish (see executive summary in attached policy report). The seminar was inaugurated by

- Luis Fueyo, president of the National Commission on Natural Protected Areas (*Comisión Nacional de Áreas Naturales Protegidas, CONANP)*;
- Francisco Barnés, President of INE; and
- Carlos Muñoz, Director of Economics and Policy Branch of INE.

Roundtable commentators included

- Alexandra Sáenz, of Costa Rica's Environmental Ministry;
- José Manuel Bulás, representing the Mexican office of the president; and
- Carlos Muñoz, of INE

The seminar was very well attended. We invited 140 people including representatives of the Mexican congress, government agencies, non-governmental organizations, multilaterals, and academia (see attached list of invitees). 104 people attended (see attached list of attendees). They included representatives of the following organizations

Government

- Environmental Attorney General (PROFEPA)
- Forestry Research Institute (INIFAP)
- Ministry of Agriculture (SAGARPA)
- Ministry of Development
- Ministry of the Environment (SEMARNAT)
- National Agrarian Registry (RAN)
- National Biodiversity Commission (CONABIO)
- National Ecology Institute (INE)
- National Forestry Commission (CONANP)
- National Protected Areas Commission (CONAFOR)
- State Department (SRE)

Non-government organizations

- Environmental Defense Fund (EDF)
- Fondo Méxicano para la Conservación Naturaleza (FMCN)
- Gente Como Nosotros
- Instituto Interamericano de Cooperación para la Agricultura
- International Human Rights Foundation
- Natura Méxicana
- Pagnia REDD plus
- The Nature Conservancy (TNC)
- Rainforest Alliance (RA) Mexico
- Reforestamos Mexico

Multilaterals

- Food and Agriculture Organization (FAO)
- French International Agricultural Cooperation Agency (CIRAD)
- InterAmerican Development Bank (IDB)
- World Bank

Academia
- Colegio de México (COLMEX)
- Universidad Iberoamericana
- Instituto Politécnico Nacional (IPN)
- Instituto Technológico de Estudios Superiores de Monterry (ITESM)
- Instituto Technológico Autónomo de México (ITAM)
- Universidad Nacional Autónoma de México (UNAM)

iv. One-on-one meetings

In addition to our dissemination seminar we held on-one-one meetings about or results with representatives of

- National Forestry Commission (CONANP)
- National Ecology Institute (INE)

These meetings took place in Mexico City in May 2008 and March 2011.

v. Technical papers

We wrote two technical papers reporting our results (attached).

- Blackman, J. Robalino, and A. Pfaff. 2011. "Paper Park Performance: Natural Protected Areas in Mexico." Working Paper. Resources for the Future: Washington, D.C.
- Robalino, J., L. Villalobos, A. Blackman and A. Pfaff. 2011. "Impacts of Protected Areas on Population Growth, Inequality, and Marginalization in Mexico." Working Paper. Environment for Development Center for Central America: Turrialba, Costa Rica.

vi. Academic seminars

Finally, Allen Blackman presented Blackman et al. (2011) (see above) at George Mason University, Department of Environmental Science and Policy, on February 14, 2011.

7. SHORT-TERM IMPACTS

Having only recently completed and begun to disseminate reports and papers reporting our findings, it is still too early to gauge their impacts. That said our project has the potential to influence policy making in Mexico and academic research worldwide. As for the policy community, indications that our work will have an impact include

- a March 2011 proposal by a CONANP manager (César Sánchez Ibarra, Director of the Creation of New NPAs), to develop long-term collaboration between CONANP, RFF and CATIE to evaluate Mexican NPA policy;

- a March 2011 proposal by an INE director (Marisol Rivera, Director Statistics and Econometrics Unit) to collaborate on an evaluation of the deforestation impacts of post-1993 NPAs;
- attendance by over 100 representatives of government, NGOs, and academia at the March 8, 2011 policy seminar (see above); and
- widespread coverage of this seminar in the Mexican government and media. Links to report of the seminar include

  - Instituto Interamericano de Cooperación para la Agricultura http://www.iica.int/esp/conocimiento/infoRecurso/Paginas/FichaNoticia.aspx?id=58&url=Esp/regiones/norte/mexico/Lists/Noticias%20IICA%20Mexico
  - SEMARNAT Press http://saladeprensa.semarnat.gob.mx/index.php?option=com_content&view=article&id=3095:las-anp-y-el-pago-por-servicios-ambientales-frenan-deforestacion-en-mexico&catid=50:comunicados
  - President´s Calderon's office http://www.presidencia.gob.mx/prensa/semarnat/?contenido=63799
  - Mexican official REDD site http://reddmexico.ning.com/forum/topics/seminario-midiendola?page=1&commentId=4444440%3AComment%3A9519&x=1#4444440Comment9519
  - Other environmental media

    – http://www.teorema.com.mx/biodiversidad/ecosistemas/areas-naturales-protegidas-evitan-deforestacion-ine/
    – http://www.handsearth.com/noticias/anp090311.html
    – http://www.pnuma.org/informacion/noticias/2011-03-18/index.htm

As for academic research, indications that our work will have an impact include

- acceptance of Robalino et al. (2011) at the 2011 "Mind the Gap" Impact Evaluation Conference in Cuernavaca, Mexico June 15-17, 2011 (sponsored by the International Initiative for Impact Evaluation and the IADB among others) and award of a grant to cover travel room, and board; and
- an invitation from *International Forestry Review* to submit a article exploring the implications of our work for REDD.

8. LONG-TERM IMPACTS

In the long term, we are hopeful that our project will help to

- develop stronger links between policymakers and economists conducting rigorous evaluations of conservation policies ;

- provide compelling evidence of the importance of rigorous counterfactual evaluation of the deforestation and socioeconomic impacts of conservation policies;
- contribute to the development of the still relatively small but fast growing and influential academic literature on such evaluation; and
- motivate others to conduct such analyses in other countries.

9. PRODUCTS

The project has generated the following written outputs (all attached).

Policy reports (including executive summary)

- Blackman, A., J. Robalino, L. Villalobos, and A. Pfaff. 2011. "Deforestation and Socioeconomic Impacts of Natural Protected Areas in Mexico: Summary of Key Research Findings" Resources for the Future: Washington, D.C.
- Blackman, A., J. Robalino, L. Villalobos, and A. Pfaff. 2011. Deforestación e Impacto Socioeconómico de las Áreas Naturales Protegidas en México: Resumen de los Principales Resultados. Resources for the Future: Washington, D.C.

Technical articles to be submitted for publication

- Blackman, J. Robalino, and A. Pfaff. 2011. "Paper Park Performance: Natural Protected Areas in Mexico." Working Paper. Resources for the Future: Washington, D.C.
- Robalino, J., L. Villalobos, A. Blackman and A. Pfaff. 2011. "Impacts of Protected Areas on Population Growth, Inequality, and Marginalization in Mexico." Working Paper. Environment for Development Center for Central America: Turrialba, Costa Rica.

PowerPoint presentations (used in march 8 dissemination seminar)

- "Impacto Ambiental y Socioeconómico de las Áreas Protegidas en México"
- "Impactos de las Áreas Naturales Protegidas en la Marginalidad, la Desigualdad y el Drecimiento de la Población en Mexico"

10. VALUE AS A MODEL FOR FUTURE WORK

As discussed above, our project uses state-of-the science statistical tools to control for nonrandom siting of forest conservation policy. It is one of only a handful of ongoing or recently completed studies using such techniques. As such, we believe that it will serve as a model for future studies of conservation policies by both academics and policy makers. As for academics, we are hopeful that our work will help to further advance the small but quickly growing literature in this area. As for policymaking, as noted above, we already have had two inquiries from policy makers for follow-on projects using similar techniques to evaluate conservation initiatives in Mexico: CONANP has proposed a long-

term program of collaborative study of Mexican NPAs, and INE has proposed a collaborative study of post-1993 NPAs. More generally, we are hopeful that our work will help to develop a "best practice" evaluation method among conservation policymakers.

11. PROJECT PERSONNEL

Allen Blackman, Senior Fellow, RFF. As Project Director and Co-principal Investigator, Allen helped design the project, served as its overall manager, carried out the econometric analysis of NPAs' deforestation impacts, provided input into the analysis of socioeconomic impacts supervised by Juan Robalino, and liaised with Mexican stakeholders to solicit input in early stages of the project, collect data, and disseminate project results.

Nisha Krishnan. Former Research Assistant, RFF. Nisha worked on the analysis of NPAs' deforestation impacts during the summer and fall of the projects' final year. She mainly worked on cleaning and reformatting our GIS data base. As discussed in Section 4, Nisha resigned from the project team in the Fall of 2010 to take a full time position in Mexico.

Alex Pfaff, Associate Professor, Terry Stanford Institute of Public Policy, Duke University. As Co-principal investigator, Alex helped design the project, provided overall guidance and input into the econometric research on NPAs' deforestation and economic impacts.

Juan Robalino, Associate Professor, CATIE and Research Fellow, Environment for Development Center for Central America. As Co-Principal Investigator, Juan supervised the econometric analysis of NPAs' socioeconomic impacts, provided guidance on the econometric analysis of NPAs' deforestation impacts, and presented the results of the latter analysis in our March 9, 2011 dissemination seminar.

Laura Villalobos, Research Assistant, Environment for Development Center for Central America. Under Juan Robalino's supervision, Laura conducted the econometric analysis of NPAs socioeconomic impacts, and presented results from this analysis in our March 9, 2011 dissemination seminar.

Yatziri Zepeda-Medina, Former Research Assistant, RFF. Under Allen Blackman's supervision, Yatziri worked on the econometric analysis of NPAs' deforestation impacts during the project's first year. She also gathered much of the data used in the project and liaised with Mexican stakeholders. As discussed in Section 4, Yatziri resigned from the project team in the Spring of 2009 to take a full time position in Mexico.

Please see Section 4 above for a discussion of the effects of personnel changes on the project.

12. BUDGET

The original project budget did prove feasible. There were only a few changes to project allocations. In the first year of the project, we spent only $38,681 of the $68,000 budgeted, leaving $28,319 that was carried over to the second year. The main reason for the carryover was Yatziri Zepeda-Medina's relocation and subsequent resignation from the research team (see Section 4 above). Most of the unspent funds had been budgeted to support Yatziri and to support Allen Blackman to supervise her. It took some time to re-organize the staffing of the project to do the work originally assigned to Yatziri. (This issue was discussed in our First Year Narrative and Financial Reports)

Also, in the first year of the project, we reallocated $953 from the "Travel" budget category to the "Other" category. These funds were used to purchase the socioeconomic data discussed in Section 2.2 from INEGI, the Mexican statistical agency. The funds were spent in two parts. We purchased a first set of INEGI data in September for $500 and a second set in February for $453. (We requested the Tinker Foundation's permission for the first $500 reallocation and received permission in an email from Margaret Cushing dated September 19, 2008.)

Finally, in the second year of the project, we reallocated $7,060 in funds originally budgeted for "Travel" and "Meetings" to "Salaries and Benefits." We budgeted $10,000 to travel over the entire term of the project but only used $4,940, leaving a surplus of $5,060. We budgeted $2,000 for our dissemination seminar but did not have to spend anything on it because the Mexican Environment Ministry, which hosted the seminar, did not charge us for the room or refreshments. (We requested the Tinker Foundation's permission for this reallocation and received permission in an email from Margaret Cushing dated March 28, 2011.)

13. IMPACT ON RFF

The project has already had at least two positive impacts on RFF. First, it has helped to build a new RFF research initiative on reduced emissions from deforestation and degradation (REDD). Our study has clear policy implications for the design and implementation of a mechanism to allow developing countries to generate REDD carbon credits. Conventional wisdom holds that developing countries will be able to generate REDD credits quite cheaply, creating a new supply of low-priced carbon credits. However, our research on Mexico suggests that this may not be the case. Specifically, it suggests that one of the frontline conservation policies developing countries would use to generate REDD credits—protected areas—is less effective than widely believed and, as a result, the cost to developing countries of generating REDD credits is likely be higher than expected. To further explore these hypotheses, RFF is proposing to undertake analogous studies of conservation policies in several other Latin American countries (see Section 14). All of this research effort forms one pillar of RFF's new Forest Carbon Initiative (see http://www.rff.org/fci).

Second, the project has helped to strengthen RFF's institutional ties with INE and SEMARNAT. These ties have spawned a number of new initiatives. RFF researchers are now collaborating with INE researchers on a study of Mexico City's Day Without Driving (*Hoy No Circula*) program. And in April 2011, Juan Rafael Elvira, Mexico's Minister of the Environment, will visit RFF to discuss possible collaboration on INE's new Center for Climate Economics on the country's developing Green Growth strategy.

14. FUTURE ACTIVITIES

In addition to the dissemination activities listed in Section 6, several more are planned for the coming months. These include

- presenting Robalino et al. (2011) at the 2011 "Mind the Gap" Impact Evaluation Conference in Cuernavaca, Mexico June 15-17, 2011 (sponsored by the International Initiative for Impact Evaluation and the IADB among others) (paper accepted and travel grant awarded);
- presenting the policy report, Blackman et al (2011), and Robalino et al (2011) at a seminar hosted by the InterAmerican Development Bank in the summer of 2011; and
- publishing both Blackman et al. (2011), Robalino et al. (2011) as RFF discussion papers and as EfD Discussion Papers, posting them on the websites of RFF, CATIE, and possibly INE, and submitting them for publication at international journals.

RFF is also implementing, planning, or considering a number of projects that build directly or indirectly on the work summarized in these papers. With funding from the InterAmerican Development Bank, RFF is currently working on a project that uses the same types of GIS data and econometric techniques to evaluate the deforestation impacts of forest conservation policies in two Latin American countries. Specifically, these projects include

- forest concessions in the Petén region of Guatemala; and
- tenure reform in the Peruvian Amazon.

Projects in the planning stage include

- a study that uses our existing Mexico GIS data and econometric analysis, along with new spatially explicit data on Mexican forest carbon, species richness and the NPA implementation costs, to directly estimate the cost per ton of REDD from Mexican protected areas, the spillover benefits to biodiversity conservation, and the implications for the targeting of new protected areas.

Finally, as discussed above, project proposals under consideration include

- a March 2011 proposal by a CONANP manager (César Sánchez Ibarra, Director of the Creation of New NPAs), to develop long-term collaboration between CONANP, RFF and CATIE to evaluate Mexican NPA policy; and
- a March 2011 proposal by an INE director (Marisol Rivera, Director Statistics and Econometrics Unit) to collaborate on an evaluation of the deforestation impacts of post-1993 NPAs using 2000-2002 land cover data (versus the 1993-2000 data we have now).

References

Andam, K., P. Ferraro, A. Pfaff, J. Robalino and A. Sanchez. 2008. Measuring the Effectiveness of Protected-area Networks in Reducing Deforestation. *Proceedings of the National Academy of Sciences* 105(42): 16089-16094.

Blackman, A., J. Robalino, and A. Pfaff. 2011. Paper Park Performance: Natural Protected Areas in Mexico. Working Paper. Resources for the Future: Washington, DC.

Cervigni, R., and A. Brizzi. 2001. Biodiversity. Chapter 27 in M. Guigale, O. Lafourcade, and V. Nguyen (eds.), *Mexico: A Comprehensive Development Agenda for the New Era.* Washington, DC: World Bank.

Elvira-Quesada, J. R. 2007. El Ecoturismo, Vía para Combatir la Pobreza y Valorar los Recursos Naturales. Comunicado de Prensa 063/07. SEMARNAT.

Food and Agriculture Organization (FAO). 2011. State of the World's Forests 2011. FAO: Rome.

Figueroa, F. and V. Sánchez-Cordero. 2008. Effectiveness of Natural Protected Areas to Prevent Land Use and Land Cover Change in Mexico. *Biodiversity Conservation* 17: 3223-3240.

Mas, J.F. 2005. Assessing Protected Areas Effectiveness Using Surrounding (Buffer) Areas Environmentally Similar to the Target Area. *Environmental Monitoring and Assessment* 105: 69–80

Pfaff, A. , J.A. Robalino, G.A. Sanchez-Azofeifa, K. Andam and P. Ferraro (2009). Park Location Affects Forest Protection: Land Characteristics Cause Differences in Park Impacts across Costa Rica. *The Berkeley Electronic Journal of Economic Analysis and Policy* 9(2): (Contributions), Article 5.

Robalino, J., L. Villalobos, A. Blackman and A. Pfaff. 2011. Impacts of Protected Areas on Population Growth, Inequality, and Marginalization in Mexico. Working Paper. Environment for Development Center for Central America: Turrialba, Costa Rica.

Robalino, J. and L. Villalobos. 2010. Conservation Policies and Labor Markets: Unraveling the Effects of National Parks on Local Wages in Costa Rica. Environment for Development Discussion Paper 10-02.

Rosenbaum, P., and D. Rubin. 1983. The Central Role of the Propensity Score in Observational Studies for Causal Effects. *Biometrika* 70: 41–55.

Segura, G. 2000. Mexico's Forests Sector and Policies: A General Perspective. Paper presented at Constituting the Commons: Crafting Sustainable Commons in the New Millennium, Eighth Conference of the International Association for the Study of Common Property, Bloomington, IA, May 31–June 4.

Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT). 2003. *La Deforestación en 24 Regiones Proders*. Mexico, D.F.