

## Summaries

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### Area fees and logging in tropical timber concessions

MARCO BOSCOLO and JEFFREY R. VINCENT

Timber fees have been at the center of policy discussions about tropical forests since the 1980s. Most of the attention has focused on fees that are levied on the volume or value of timber harvested. These harvest fees, or royalties, have been criticized for inducing loggers to high-grade (to harvest only the most valuable trees). As an alternative, studies supported by the World Bank and United Nations have advocated area fees: fixed annual charges on the total area under contract. Area fees are widely perceived to be less distortionary than harvest fees, because they are lump-sum payments.

In this paper we demonstrate that the perception that area fees do not distort logging decisions is mistaken. We focus on tropical forests, which tend to be government-owned and harvested under fixed-term, weakly enforced concession contracts. We demonstrate that in this institutional setting, area fees create incentives for concessionaires (i) to increase the annual area harvested and thereby accelerate the depletion of timber stocks and (ii) if the annual harvest volume is constrained, to harvest less timber per unit area (i.e., to high-grade). We also find that depletion is accelerated further when area fees coexist with harvest fees, as they always do in practice. We gauge the empirical significance of these theoretical findings by analyzing a representative timber concession in Cameroon. We find that area fees in Cameroon are sufficiently high to cause logging companies to prefer to harvest forests in less than half the standard contract length of 30 years.

The fact that area fees encourage violations of annual logging limits does not mean that countries should not use area fees in public forests. No fiscal instrument is perfect, and area fees do have desirable properties. In particular, the total payment that a concessionaire owes could not be easier to calculate than for an area fee, as it is simply the product of concession area and the fee per hectare. Moreover, tropical countries are not homogeneous. One of our key assumptions, that a concessionaire faces no risk of being held liable for area fees during the remaining years of a concession contract if he depletes the concession earlier, holds less strictly in countries with stronger legal institutions, with ministries of finance that are less driven by short-run revenue imperatives, and with transparent ownership of the companies holding concession contracts.

Governments that wish to discourage concessionaires from violating annual allowable logging areas must couple area fees with measures that counter their depletion-accelerating effects. A variety of such measures

exists, including more vigorous monitoring and enforcement, steeper penalties, performance bonds, and revocation clauses in concession contracts. Claims that area fees are administratively less costly than harvest fees must take into account the costs of these measures and their effectiveness in curtailing excessively rapid harvesting.

## **Land conservation policies and income distribution: who bears the burden of our environmental efforts?**

JUAN A. ROBALINO

The demand for land for conservation policies and for agricultural activities has simultaneously increased all over the world and especially in developing countries. We analyze the impact of the collision of these two opposing forces on economic and environmental outcomes.

We find that conservation policies can have important distributional effects through changes in rents and wages. We show how aggregate rents rise when protected areas increase despite the reduction of land availability. Simultaneously, real wages decrease as a consequence of higher agricultural prices. Results suggest that Pareto improving compensation should also be aimed at landless workers. The mobility of labor allows agricultural workers to pass on the negative effects to urban workers.

The increase in rents from the implementation of conservation policies could cause further deforestation. Locations where agricultural activities were not optimal can become profitable as rents increase. The equilibrium quantity of forest does not increase as much as protected areas increase. When designing policies for forest protection it is necessary to consider how the incentives of landowners and workers change.

Our findings can be used not only to forecast what will happen when land conservation policies are expanded over deforested land in developing nations, as proposed by the Kyoto Protocol, but also to project what would have been the alternative scenario under the absence of land conservation policies when national parks or other forest conservation efforts stop agricultural development.

## **Cost-effective species conservation: an application to Huemul (*Hippocamelus bisulcus*) in Chile**

CARLOS ADRIÁN SALDARRIAGA ISAZA, WALTER GÓMEZ BOFILL, and HUGO SALGADO CABRERA

Economic development and biodiversity conservation have often been perceived as conflicting activities. The impact of economic activities, such

as timber production, on sensitive habitats of endangered species makes the two seem incompatible. Is it possible to find a balance that combines sustained economic development with the preservation of the minimum level of biodiversity required from an ecological, biological, and social point of view?

Several disciplines have sought to address this question. Recent economic studies have shown how alternative management plans that do not adopt the idea of 'preserve or degrade' can reach sustainable economic and ecological objectives. The present work applies these concepts to the economic and ecological analysis of the conservation of the Huemul (*Hippocamelus bisulcus*) in the Cordilleran Protection Area (CPA), Region VIII, Chile. This is a conservation area for the last surviving Huemul population in central Chile and for other threatened species. In the area there is also a set of productive activities that have different impacts on the Huemul population.

The objective of this paper is to analyze cost-effectiveness in the management of the mentioned area. The results can be used as a reference point for those institutions responsible for formulating administration policies. Efficiency is intended in this biological conservation context for the maximization of economic benefits, while maintaining a minimum level of species population in the long run.

The confirmed hypothesis of this research is twofold. First, it is seen that current management of the CPA is not cost-effective. This happens mainly because the close relationship of the species with its habitat has been neglected. Second, it can be proved that an alternative administration could produce greater economic benefits while maintaining the Huemul population at the current level.

## Social diversity and ecological complexity: how an invasive tree could affect diverse agents in the land of the tiger

VIKRAM DAYAL

This paper studies the effect of *Prosopis juliflora*, an exotic tree, on diverse agents in Ranthambhore National Park, situated in Rajasthan, India.

Policy that has overlooked the complexity of ecology may prove to be self-defeating. The park management in Ranthambhore planted *Prosopis juliflora* to provide fuelwood to villagers because they were perceived to be harming the park by extracting fuelwood. *Prosopis juliflora* is now spreading through the park, and currently occupies about 5 per cent of the area of the park, to the alarm of the park managers. It reduces feed for wild herbivores, and thereby affects tiger prey abundance.

A bioeconomic model is used to examine the effect of *Prosopis juliflora* on Ranthambhore National Park. The area of the Park is divided into *Prosopis juliflora* and 'other area'. *Prosopis juliflora* also produces pods, which are eaten only by goats. Wild herbivore browsers and goats compete for leaf biomass produced by 'other area'. Wild herbivore grazers and cattle compete for grass produced by 'other area'. There are four agents in the model: wood gatherer, goat owner, park manager, and cattle owner.

There is an inherent trade-off between tiger numbers and village livestock grazing. If *Prosopis juliflora* is not removed, the number of tigers will be lower than if it is removed, *ceteris paribus*. If in addition to it not being removed, village livestock grazing is not restricted, the number of tigers could fall to perilously low levels.

There is uncertainty about the severity of invasion by *Prosopis juliflora* (about its spread and about ecological succession). Also, the ease with which tigers can prey on livestock in comparison with wild herbivores is not known. Adaptive management of the park with experimentation, monitoring, and learning with respect to *Prosopis juliflora* is suggested.

## Sharing the load? floods, droughts, and managing international rivers

JOHANNUS JANMAAT and ARJAN RUIJS

Structures used to manage river flows, in particular dams and storage reservoirs, provide multiple benefits. When water flows are high, storage can be used to minimize flooding damage. In contrast, when water flows are low, water in storage can be released to meet consumptive needs. To maximize the overall benefits generated from the river, management must be coordinated between the different users along the river. When the users are different nations, the means for enforcing such coordination may not exist. In these situations, managing the river to maximizing upstream nations' well-being often causes a reduction in downstream welfare. Aware of this impact, downstream nations are unlikely to assist in the construction of upstream storage as the use of these structures may adversely affect them. The full gains from coordinated management of the river are therefore unlikely to be realized.

In this paper we explore the relationship between two riparian neighbors using a two stage game. During the first stage, each nation chooses how much water storage to build. During the second stage, each nation chooses how to manage that infrastructure. Storage conveys two benefits, making water available for later consumption and preventing flood damage. The construction of storage capacity is costly, while its use may generate a net cost or a net benefit. The balance of these costs and benefits combines with

the likelihood of low or high water conditions to determine whether the downstream nation on balance benefits or loses with an increase in upstream storage capacity. We consider two cases representing an arid region and a humid region, exploring how different combinations of model parameters affect the benefit to the downstream nation of an increase in upstream capacity. We find that when the upstream nation ignores its impacts on the downstream nation, the likelihood that the downstream nation will gain from a further increase in upstream storage capacity is lower in arid regions than in humid regions, even though the potential gains are larger in the arid regions. This result is roughly consistent with observed international relations surrounding rivers.

Our results are driven largely by the lack of repetition in this game. This structure reflects the fact that the operational life of dams and reservoirs is determined more by the essentially irreversible infill of the reservoir than by the need for replacement of the dam. As a result, if the only basis for interaction between neighboring nations surrounds a shared river, then it is unlikely that the gains available from coordinated construction and management of water storage will be fully realized. To enhance the likelihood that these gains can be captured, the riparian game needs to be embedded in a larger interaction between the riparian neighbors. Those seeking to facilitate greater cooperation on international rivers should look beyond agreements that focus exclusively on water management to identify complementary exchanges. If such exchanges do not exist, it may be better to pursue other areas of economic integration before seeking to develop riparian management agreements.

## **Are the poor benefiting from China's land conservation program?**

EMI UCHIDA, JINTAO XU, ZHIGANG XU, and SCOTT ROZELLE

In recent years there has been an increasing interest in using incentive mechanisms, known as Payments for Environmental Services (PES), to finance conservation by landowners in developing countries. One of the most critical questions about the use of PES programs in developing countries is the impact that the programs have on the poor. Proponents argue that, while the PES approach was conceptualized as a mechanism primarily to improve natural resource management, it could also serve as a tool for poverty alleviation. A PES program can offer a means to increase the income of the rural poor, mainly through its monetary payments. In contrast, others have suggested that PES programs have negligible or even adverse effects on poverty. Poor farmers participating in a PES program may end up worse off if they are not compensated for their lost income either

due to a flawed incentive mechanism design, poor program targeting, or poor implementation.

To address this question, we use data from a survey that we designed and implemented to evaluate a large-scale PES program in China. Pushed into action by a series of devastating floods in 1998, China's government started a conservation set-aside program in 1999, frequently known as Grain for Green. Known as one of the largest conservation set-aside programs in the world, its main objective is to increase forest cover on sloped cropland in the upper reaches of the Yangtze and Yellow River Basins to prevent soil erosion. When available in their community, households can set aside all or parts of certain types of land and plant seedlings to grow trees. In return the government compensates the participants with in-kind grain, cash payments, and free seedlings. To date, and internationally, the impact that Grain for Green has had on the poor is still being debated.

To meet the overall goal of evaluating the impact of China's PES program on the poor, this paper has two specific objectives. First, we seek to assess who is participating in the Grain for Green program, and attempt to understand whether China's program officials are disproportionately targeting the poor or not. Second, we seek to understand the impact of the program on income, assets, and the labor allocation decisions of participating households utilizing recent program evaluation methods. We also examine whether or not the program impacts, if any, are different for the poorer participants.

Using alternative approaches, the study finds that the program is implemented in areas in which most people are poor and that due to the program, income from livestock activities and some types of asset holdings of participants have increased significantly more than those of non-participants. Somewhat surprisingly, the results do not generate strong evidence for the expected finding that participating households have changed labor allocation into off-farm work. While it may be too early in the life of the program to have seen substantial changes, it is also possible that training and other programs to increase human capital are needed to help the households move their activities off the farm.