

Summaries

Climate change and agriculture in Sri Lanka: a Ricardian valuation

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Both theory and empirical research suggest that the impacts of climate change are not likely to be uniform across the landscape. Climate change itself varies across locations. Further, some countries, such as low-latitude developing countries, may be more vulnerable to climate change because local farmers have less adaptive/protective capacities and are already adversely affected by natural variability of temperature and monsoon rainfall. This paper studies the impact of climate change on Sri Lankan agriculture. Sri Lanka is likely to be severely affected by climate change because it is in the tropics, less developed, small-sized, and an island nation.

We model Sri Lankan agriculture using the Ricardian approach. The model examines the net revenue per hectare of the four most important crops in the country. The limited range of temperature variation allows only a simple test of temperature impacts, but the greater range of precipitation across the country distinguishes more complex precipitation effects. We then examine the impacts of the climate predictions of five AOGCM models and two simple uniform change scenarios for Sri Lanka. The impacts of rainfall increases are predicted to be beneficial to the country as a whole in all five AOGCM scenarios, but temperature increases are predicted to be harmful. Nationally, the impacts vary from – 11 billion rupees (– 20%) to + 39 billion rupees (+ 72%) depending on the climate scenarios. With warming, the already dry and less fertile regions (the Northern and Eastern provinces) are expected to lose large portions of their current agriculture, but the cooler and more productive regions (the central highlands), are predicted to remain the same or increase their yields. The paper reconfirms that climate change damages could be large, especially in more vulnerable areas of tropical developing countries, but highly dependent on the actual climate scenario.

Transaction and abatement costs of carbon-sink projects in developing countries

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Emerging markets for carbon-sequestration services for mitigation of global warming provide opportunities to help some developing countries achieve their sustainable-development goals. This paper focuses on the potential of agroforestry and tree plantations to contribute in this effort. Carbon sequestration is a 'product' that offers smallholders advantages compared with other products, because carbon does not need to be transported and is not subject to the same quality differences as other commodities traded in international markets. However, there are a number of challenges to operationalizing carbon-sink projects with participation by smallholders. We discuss these challenges in the paper.

The need to consider both abatement and transaction costs when assessing the viability of landholders undertaking agroforestry projects in order to supply carbon-sequestration services is emphasized. Transaction costs are discussed and a typology of such costs in the context of landholders supplying to the carbon market is outlined. Seven types of transaction costs are identified: search costs, negotiation costs, approval costs, administration costs, monitoring costs, enforcement costs and insurance costs. Such a typology will assist in identifying the institutional arrangements most likely to promote the competitiveness of projects in specific circumstances.

Four case studies of agroforestry systems in Sumatra, Indonesia, are presented to illustrate how the abatement costs of such projects might be estimated. The estimated abatement costs of the four systems range from a high of US\$28.48 to a low of US\$6.22 per tonne of carbon under base-case assumptions. The influence of discount rates and land productivity on these results is analysed and interesting interactions are identified regarding the ranking of different agroforestry systems in terms of abatement costs.

The influence of transaction costs on the competitiveness of landholders in developing countries supplying to the carbon market is then explored. Although no data are available to estimate the transaction costs of existing projects in detail, we present a general analysis of five projects under the Activities Implemented Jointly of the United Nations Framework Convention on Climate Change (UNFCCC). The paper concludes with a number of suggestions for making projects involving smallholders more competitive relative to large commercial plantations. Some of these suggestions can be acted upon by development assistance projects.

Emission abatement versus development as strategies to reduce vulnerability to climate change an application of FUND

RICHARD S. J. TOL

Poorer countries are generally believed to be more vulnerable to climate change than are richer countries because poorer countries are more exposed to the climate and have less capacity to adapt to change. This suggests that, in principle, there are two ways of reducing vulnerability to and impacts of climate change: economic growth and greenhouse gas emission reduction. Using a complex climate change impact model, in which development is an important determinant of vulnerability, the hypothesis is tested as to whether development aid is more effective in reducing impacts than is emission abatement. This is done by comparing the marginal effects on the impacts of climate change of emission reduction on the one hand and development aid on the other hand. The hypothesis is barely rejected for Asia but strongly accepted for Latin America and, particularly, Africa. The explanation for the difference is that development (aid) reduces vulnerabilities in some sectors (infectious diseases, water resources, agriculture) but increases vulnerabilities in others (cardiovascular diseases, energy consumption). In very poor countries, the former effect dominates the latter effect. In middle-income countries, the latter dominates the former. However, climate change impacts are much higher in Latin America and Africa than in Asia, so that money spent on emission reduction for the sake of avoiding impacts in developing countries would be better spent on vulnerability reduction in those countries.

Evaluating projects that are potentially eligible for Clean Development Mechanism (CDM) funding in the South African context: a case study to establish weighting values for sustainable development criteria

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Development projects within industry sectors are increasingly evaluated in terms of positive and negative contributions to sustainable development.

Although generic approaches have been proposed, sustainable development criteria are typically focused on the societal priorities of the specific country where a development takes place. Within the South African context, a framework of sustainable development criteria is introduced to assess projects that may be eligible for Clean Development Mechanism (CDM) funding under the Kyoto Protocol. The CDM initiative of the Kyoto Protocol aims to promote sustainable development in developing countries, whilst reducing greenhouse gas emissions in these countries. Thereby, developed countries are provided with the means of purchasing greenhouse gas emission reduction credits to partially subsidize a technology that is transferred to a developing country, and which reduces the overall greenhouse gas emissions in the country compared with a baseline situation. The funding is equal to the international market value of the amount of CDM credits. The CDM credits are subsequently subtracted from the reduction requirements (for the developed country) as stipulated by the Kyoto Protocol. The CDM evaluation process requires the host country (of the development project) to grant the final approval of projects based on such a proposed framework of sustainable development criteria, i.e. the project would contribute positively to sustainable development in the host country. Weighting values are established for these criteria from the perspective of the manufacturing industry sector of South Africa. The weighting values are obtained from a survey, which is based on the Analytical Hierarchy Process (AHP), a known Multi Criteria Decision Analysis (MCDA) procedure. Representatives from the automotive supply chain and process manufacturing industries at the decision-making level participated in the survey. The responses from the two industry sectors are normally distributed and aggregate values are subsequently calculated (as a first approximate). With respect to the environmental sub-criteria, the priorities of the South African national government's expenditure trends are compared with the industry judgements. The results indicate a difference in the weights placed on the sub-criteria. Furthermore, national expenditure on the environmental issues alone shows that the three main sustainable development criteria, i.e. social, environmental, and economic, are not of equal importance. Further research work is required in order to establish weighting values that reflect the priorities of all parts of the South African society. This is the responsibility of the Designated National Authority (DNA).

Cost-effective conservation when eco-entrepreneurs have market power

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International investments in ecosystem conservation are often made in the form of subsidies to purportedly eco-friendly enterprises. Examples of such

eco-friendly enterprises include ecotourism, biodiversity prospecting, non-timber forest product extraction, and selective logging. These ventures typically employ relatively undisturbed ecosystems as inputs. The ecosystems are combined with purchased inputs, such as capital and labor, to produce a valuable output, such as tourist excursions, novel chemical compounds, fruits, or timber. Conservation funds are directed toward increasing the eco-output price or facilitating the acquisition of complementary inputs, such as tourism infrastructure, product marketing, and processing facilities. The assumption underlying such interventions is simple: 'eco-entrepreneurs' faced with cheaper inputs or higher output prices for an eco-friendly activity will demand a greater area of intact ecosystem, thereby *indirectly* protecting ecosystems and their constituent services.

An alternative approach to encouraging the conservation of endangered natural ecosystems is to pay for conservation performance *directly*. It has been demonstrated that, if eco-entrepreneurs engaged in eco-friendly activities act as price-takers, making payments conditional on the area of ecosystem protected is a more cost-effective means of motivating an eco-entrepreneur to conserve habitat than the more popular indirect subsidy approach. A donor could always achieve a given conservation objective at a lower cost by providing a direct incentive.

The essence of many arguments for undertaking eco-friendly enterprises is that eco-entrepreneurs can earn rents from exploiting unusual assets. They have market power. In this paper, we assume that an eco-entrepreneur may have market power. Market power is shown to compound the advantage of direct payments. Through a simple numerical example, we show that subsidies intended to achieve habitat conservation by encouraging the acquisition of complementary inputs can be spectacularly inefficient. In fact, subsidizing eco-friendly activities may be more costly than simply buying land outright and not conducting *any* activity on it. Moreover, one can easily construct examples in which indirect subsidies cannot motivate even relatively modest increases in habitat conservation and thus are completely ineffective.

Farmers' perceptions of participation and institutional effectiveness in the management of mid-hill watersheds in Nepal

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Institutions are organized groups of actors in the process of development in general, and in particular, in the process of improving the environment

and socioeconomic conditions of rural life. The involvement of institutions in natural resource management and agricultural development in the mountain watersheds of developing countries are indispensable, especially when considering their contribution to the enhancement of natural integrity, the improvement in farm production and productivity, and the enhancement of rural economy. Several institutions including government organizations (GOs), non-government organizations (NGOs), and community based organizations (CBOs) have been functioning to serve the above purposes. However, household participation in these organizational activities and the effectiveness of the programs are found to be highly influenced by individual household characteristics such as demography, resource ownership patterns, and levels of involvement in the market economy.

Results from our analysis of socioeconomic variables, matched with farmers' responses regarding their participation and the institutional effectiveness of managing a watershed, indicated significant linear relationships between social variables, such as years of education, family size, and training attended by family members with household participation and institutional effectiveness. Likewise, gross farm income, farm size, and livestock holding were also linearly related to household participation and institutional effectiveness. Social and economic variables are categorized into three factors, including labor quality and resources, income sources, and awareness and modern skills. These factors explain the household participation and institutional effectiveness of the mountain watershed management and farming system development process.

Tropical forest harvesting and taxation: a dynamic model of harvesting behavior under selective extraction systems

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In this paper three interactions between economics and biology are incorporated into a rational choice model of selective cutting in a multiple species forest. First, different species have different contemporaneous and intertemporal outputs. Also, the species' specific growth rates can be affected by the inter- and intra-species stocks. The presence of these types of externalities within and between species may affect harvesting strategies as well as the size and distribution of species remaining at the end of the

planning period. Finally, costs may be affected through time by the presence of different stocks.

The model has characteristics similar to models of natural resource extraction where miners must determine the quality–quantity profile of output. Concessionaires are assumed to dynamically allocate the harvest from a fixed initial stock consistent with present value maximization. The major issue addressed is the determination of the dynamic quality–quantity harvest profile; that is, how the concessionaire determines which species and qualities within a species to harvest, when to harvest a particular species, and what volume to harvest both within and between time periods.

A number of properties about harvesting profiles are developed. It is shown how inter-species growth rates, own growth rates and other economic factors interact to determine optimal selective cutting strategies. In addition, the model is used to examine the incentives created by particular taxes. Output or yield taxes (both per unit and ad valorem) are examined. It is shown that the incentives created (both total and marginal) of any tax depend on stock effects, the nature of joint costs and inter-species growth rates.