

Introduction to the Symposium on Trade, Renewable Resources and Biodiversity

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Abstract

The five papers comprising the symposium on trade, renewable resources and biodiversity are good illustrations of a growing literature in this area that show how the design of appropriate policies must take into account complex interactions between ecological, economic and institutional factors. Only through such careful analysis can the impacts of trade on resource management and economic welfare be identified, and only then can possible policy remedies be recommended. Future areas of research include consideration of rent seeking, lobbying and corruption; endogenous institutions and market development; and economic geography.

Keywords: biodiversity, renewable resources, trade.

1. Introduction

On September 5-6, 2002 a workshop on “Trade, Renewable Resources and Biodiversity” was held at Tilburg University, The Netherlands, sponsored by the European Union-funded BIOECON Project. The five papers comprising this symposium in this issue of the *Journal of Environmental Economics and Management* represent some of the invited papers emerging from that workshop.

We believe that both the workshop and the resulting symposium of papers fill an important gap in the economics literature. Although economists are increasingly examining trade-pollution linkages, there are relatively few contributions on trade and renewable resource management.¹ While some of the issues are similar (*e.g.*, spillover benefits and costs associated with conservation, stringency of regulation and competitiveness on international markets, optimal trade interventions), it is clear that trade, renewable resource and biodiversity linkages also entail some distinct elements that present important policy challenges for both host countries and the international community.

In particular, the emerging debate over the effect of trade and trade liberalization on resource conservation and welfare in resource-dependent economies has attracted considerable attention in international policymaking bodies, the popular media and among the interested general public. This debate also poses an important challenge for economists. For instance, the “anti-free trade” view on trade and renewable resource linkages argues in favor of regulated trade, whereas the conventional economic approach to such linkages suggests that pre-existing distortions that prevent optimal resource management should be tackled instead.² Such opposing views are often reflected in international policymaking circles. For example, there are repeated calls for incorporating trade rules focusing on resource management into the World Trade organization (WTO). However, the lack of consensus on the relationship between international trade and renewable resource management hampers the prospects for amending existing WTO rules, or the design of new trade treaties. And while multilateral conventions like the Convention on International Trade in Endangered Species of wild fauna and flora (CITES) and the Convention on Biological Diversity (CBD) have recently embraced

the use of economic incentives to promote sustainable and efficient use of resources and wildlife, there is a lack of insight into how to make progress on this front.

There is a burgeoning economics literature on trade, renewable resources and biodiversity issues. A key feature highlighted by this literature is the role of institutions in resource management [5]. The implications of trade openness for welfare and resource conservation are greatly affected by this change in the institutional context, from optimal management to open access to endogenous property rights. Moreover, the nature of these effects depends on the type of renewable resource and biodiversity conservation policies considered.

The purpose of the rest of this introduction to the symposium papers on trade, renewable resources and biodiversity is to indicate their potential contribution to the emerging literature. In the next section, we briefly summarize the main trends in the trade and renewable resource literature. In the following section we summarize the five symposium papers and identify their key contributions. We conclude briefly with some final remarks on future research in the economics of trade, renewable resources and biodiversity.

2. Key developments in the literature³

Compared to the literature on trade and agriculture, environment or exhaustible resources, the economics literature on trade and renewable resources stands apart for three reasons: i) the key role played by the institutional context as reflected in the resource management regime (i.e., optimal management *vs* open access); ii) the inherently dynamic nature of resource management, with stock size adjusting over time to the opposing forces of replenishment and harvesting; and finally, iii) the associated complex environmental issues beyond concern with just resource extraction (e.g., habitat conversion, non-use values, bio-invasions³, biodiversity, *etc.*). Many resource stocks are not simply a production factor for the traded commodity; they may also contribute to the stability and productivity

of ecological systems that provide invaluable services to mankind, and affect the welfare of individuals directly.

In the 1970s and 1980s, following the rapid spread of optimal control methods throughout the resource economics field, most of the work on trade and resource management assumed the perspective of a benevolent planner or sole owner with secure property rights. Assuming that there are no other distortions in the economy, then trade liberalization can only enhance welfare [15]. This comes at no surprise: removing a binding constraint to a maximization problem implies that outcomes can only improve. In contrast, trade liberalization may be harmful for conserving renewable resource stocks locally. For example, a common finding in the early fisheries literature is that optimal stocks are inversely related to the price of the resource good [7]. From this perspective, opening up for trade is bad for (local) conservation when world prices are higher than domestic ones (and good when the reverse is true). From this perspective, restricting trade in endangered species is a good strategy for conservationists.

However, later contributions to the literature demonstrate that there are clear dangers in translating these rather specific fisheries insights to a more general level. The fisheries literature is based on the assumption that the only alternative to harvesting a fish is not harvesting it. The case for terrestrial renewable resources is more complex. Conservation of most terrestrial species implies setting aside tracts of land as habitat. When alternative uses of the land exist, such as agriculture, the planner must consider the opportunity cost of conservation, and the incentive to incur this cost diminishes as the price of the resource good falls [1,19]. The impact of trade liberalization on conservation of terrestrial resources is therefore ambiguous, and depends on the strength of two opposing forces – the incentive to increase harvesting and the incentive to expand the allocation of land to support the stock.

When the trade and renewable resources literature shifted its focus in the 1990s to the problem of open access management, the unambiguous conclusion that trade liberalization is always beneficial

for welfare also changed. Chichilnisky [6] drew attention to the fact that the assumption of secure property rights is unrealistic for many resource-exporting developing countries. Chichilnisky shows that, despite the fact that neither the North nor the South has a real comparative advantage in producing the resource-intensive good, the lack of property rights for a common-property resource in the South leads it to produce and export resource-intensive goods in the steady state. In other words, the country with weak property rights gains an apparent comparative advantage, but this advantage does not necessarily lead to greater welfare gains, and certainly not resource conservation, from trade.

Brander and Taylor [2,3] demonstrate the potential adverse welfare effects of trade liberalization with open access resources in both a partial and general equilibrium setting. Under autarky too much harvesting takes place. Opening up for trade makes matters worse for those countries that are resource abundant and experience a rise in the terms of trade. In the long run, under certain conditions, a country that exports resources initially may experience declines in welfare compared to autarky.⁴ Karp et al. [13,14] emphasize that multiple equilibria may occur in trade-resource models without property rights.⁵ Changes in prices may induce not only shifts of equilibria, but also “jumps” from one equilibrium to another. As a result, the array of potential welfare effects of trade liberalization is quite rich, and one outcome might be “common ground” between the policy outcomes proposed by “environmentalists” as opposed to “free traders” [13].

Current contributions in the literature are focusing on an endogenous institutional context. The key assumption is that access to the renewable resource is conditional on behavior of the owner, who weighs benefits and costs of protecting his or her property. For instance, Hotte et al. [12] develop a trade-renewable resource model with endogenous institutions, where a private resource owner must decide how much illegal extraction to tolerate. Trade liberalization (higher resource prices) may induce the owner to (i) augment enforcement effort thus raising the costs of illegal harvesting, and (ii) hire legal labor to lower the benefits from illegal harvesting at the margin and thereby crowd it out. However, the re-allocation of labor to manufacturing that follows after restricting access to the

resource may adversely affect labor income elsewhere. Hence, it is possible that trade liberalization is good for conservation (because of stricter enforcement) but bad for welfare (because of adverse impacts on manufacturing labor income) – reversing some of the results from the early literature on trade and optimal renewable resource management discussed above.

To summarize, the current literature on trade, renewable resources and biodiversity suggests that, while the polar extreme cases of perfect management and open access may lead to unambiguous welfare and resource conservation impacts from trade, more realistic assessments generally imply ambiguous outcomes. The interplay of economic, ecological and institutional factors therefore determines whether trade is overall “good” or “bad” for welfare, or whether it will lead to conservation of stocks and biodiversity. The implication is that neither the strictly anti nor pro-free trade view of the world is a good starting point for recommending trade policies and reforms for most of the pressing biodiversity and renewable resource management problems facing the world today. Instead, each specific management problem, whether it be control of ivory poaching, tropical forest conservation, fisheries management, limiting bioinvasions, designing certification schemes, protection of endangered species or preservation of biodiversity “hot spots”, must be analyzed on a case by case basis in order to determine the linkages between the key economic, ecological and institutional factors that are driving the problem. Only through such careful analysis can the impacts of trade on resource management and economic welfare be identified, and only then can possible policy remedies be recommended.

3. The symposium papers

The five papers comprising this symposium illustrate the latter points clearly. Each paper examines trade, renewable resource management and biodiversity conservation for a certain type of management problem or resource context, such as the implications for trade-induced habitat conversion [17,18]; legal and illegal markets for endangered species [9]; trade-related policies for

controlling bioinvasions [16]; and trade regulation schemes to support resource conservation and protection [11].

Smulders et al. [18] extend the general equilibrium model of Brander and Taylor [3] to include the impacts of trade on a habitat-dependent natural resource. To do this, the authors add a third sector, agriculture, which is responsible for habitat destruction through increased demand for land. Trade-induced habitat destruction therefore has two potential impacts. Because the carrying capacity of the species is related directly to habitat size, for a given population a decrease in habitat reduces resource growth. In addition, a smaller habitat makes the wild population easier to catch. Both countries (Home and Foreign) engage in agriculture and exploit resource stocks under open access conditions, Foreign is relatively well endowed with land. When free trade occurs, both countries engage in manufacturing and agriculture, but resource harvesting may occur only in Foreign. However, whereas Brander and Taylor [3] find that trade liberalization reduces welfare in the relatively resource-rich country (Foreign), Smulders et al. [18] show that this outcome depends critically on the role of habitat. For example, if Foreign becomes an agricultural exporter, then this sector will expand and reduce habitat, but this may induce short-run welfare gains if the result that wild populations are easier to harvest. Similarly, both resource stocks and welfare in the long run may be higher for Foreign if it reduces agricultural activity but expands manufacturing rather than resource harvesting, so that habitat increases substantially relative to harvesting effort. Given these complex interactions, it follows that the consequences of Home introducing a tariff on resource imports from Foreign may be counter-productive in some cases, leading to declines in the total habitat of both countries. Thus the authors conclude that such trade interventions may unintentionally worsen conservation in countries with substantial habitat, that are richly endowed with biodiversity and where agriculture is an important source of income.

Polasky et al. [17] employ a 2x2 specific factors trade model, in which the two production sectors (timber and grain) are supported by a fixed endowment and grassland. In addition, once each

type of land is converted to productive use it results in irreversible loss of biodiversity through a species-area relationship. Consumers consume both the produced goods and also care about species conservation. Whereas opening up to trade unambiguously increases welfare from consuming the private goods, if the two countries have symmetric species area relationships, trade unambiguously reduces local biodiversity. On the other hand, if the species area relationships across countries are sufficiently asymmetric, trade may increase local biodiversity. The effect of trade on global biodiversity depends on the degree to which species in each country are endemic. Finally, the overall effects of trade on welfare under free trade depend on the weights consumers attach to the private goods (timber and grain) relative to species conservation, and whether local versus global biodiversity is valued higher.

Using elephant ivory as an illustration, Fischer [9] distinguishes two markets for trade in endangered species: a market of certified products for law-abiding consumers and a market for uncertified (i.e. illegal) products for noncompliant consumers. She assumes that law-abiding consumers abhor the “stigma” associated with buying a product obtained through illegal or inhumane means, and thus the increased legal trade reduces stigma. Fischer shows that critical interactions between the two market, in particular the degree of “laundering” (fraudulent sale of illegal products in the legal market) and stigma, are important determinants as to the effects of a ban on trade in endangered species. For example, if demand from law-abiding consumers is large, stigma effects are weak, and laundering occurs, then an enforceable trade ban would minimize poaching. However, if laundering can be eliminated, the bulk of demand comes from noncompliant consumers and stigma effects are strong, then allowing sales of certified products would tend to lower prices and the return from poaching. The latter effect may be reduced, if certified sales make poaching easier or enforcement more difficult. Nonetheless, limited auctions could be combined with a tax on certified sales to eliminate the producer price discrepancy and thus the laundering incentive between legal and illegal supplies.

Noting that biological invasions may cost the United States anywhere from \$5 billion to \$137 billion annually, McAusland and Costello [16] model the relationship between international trade and the damage from introduction of exotic species. Trade between the importing country (Home) and an exporting country (Foreign) leads to contamination of some known proportion of traded goods with a damaging exotic invader. Home can control this damage either through imperfect port inspections, where higher inspections are costly but facilitate a higher detection rate of contaminated goods, and a tariff on goods imported from Foreign. A principal result of the analysis is that the optimal tariff is always positive and set at the Pigouvian level, equal to the sum of expected damages from contaminated units not detected during inspections plus the costs of inspections in the first place. The optimal tariff should increase with the rate of infection of goods with pests. Home's only incentive to undertake port inspections is to minimize the costs associated with trade in infected goods, by balancing the cost additional inspections and more rejections of incoming goods with the benefits of fewer infected units making it past inspectors. Although at low infection rates the optimal inspection intensity increases with the rate of goods infection by pests, at intermediate levels of infection rates this relationship is reversed, and after some threshold inspections should cease altogether. The authors also find that, whereas inspection intensity increases unambiguously with a higher per-infection damage rate, the optimal tariff rate may fall rather than rise.

Heyes and Maxwell [11] investigate the case for a supernational "World Environmental Organization" (WEO) to set and police mandatory international environmental standards for global public goods, such as biodiversity, as opposed to relying on non-governmental organizations (NGOs) to provide voluntary labeling schemes for environmentally friendly goods. The two schemes may interact in a global market where consumers signal a willingness to pay a premium for "green" goods. However, the environmental attributes of a good are not directly observed by the consumers, and so the green premium will be paid only if trade in the undesirable good is banned or the "green" good carries a reputable label. The WEO is responsible for determining the ban, whereas labeling is used by the

NGO. Heyes and Maxwell [11] find that resistance by producers to any mandatory scheme proposed by the WEO is greater when there exists an NGO offering an alternative voluntary scheme, as the latter is always more attractive to the industry. While the anticipation of industry resistance will cause the WEO to reduce the stringency of its proposed policy, the existence of the alternative NGO scheme may also encourage the WEO to be bolder in its policy proposal. When both WEO and NGO schemes coexist rather than compete, the existence of the NGO always increases social welfare, whether the WEO's proposal is implemented or not and through increasing the probability of implementation by potentially increasing producers' surplus.

4. Final remarks

Along with other contributions in this field, the five papers of this symposium on trade, renewable resources and biodiversity show that the interplay of economic, ecological and institutional factors determines whether trade is overall “good” or “bad” for welfare, or whether it will lead to conservation of stocks and biodiversity. It follows that policy options and recommendations also change considerably with the complexity of trade and environmental issues. Moreover, strict adherence to an “anti” or “pro” free trade stance seems less defensible when fuller consideration is given to the wider ecological and economic linkages underpinning trade, renewable resource management and biodiversity impacts.

Future research in this field is likely to lead to further developments in a number of areas. First, all the papers of this symposium are concerned with optimal market regulation and trade policy. However, markets in many resource-rich countries that are also relatively poor may be incomplete, and regulation of any markets provides opportunities for lobbying, rent seeking and corruption. Exploring these factors may be important for understanding how trade influences the incentives for resource management and biodiversity conservation. Second, the five papers examine a broad range of institutional contexts and market interactions beyond a simple consideration of optimal management

and open access. Equally, we have seen how the current trade and renewable resource literature is increasingly concerned with endogenous institutions, notably the decision to control poaching activities. Further work is likely to explore how a broad range of market and institutional arrangements may develop along with expanding trade and markets in renewable resource products. Finally, renewable resources and biodiversity are not uniformly distributed, yet existing models do not address this implication other than in the aggregate designation of resource or biodiversity “rich” countries and environments. Recent theoretical advances indicate how economic geography affects trade and development patterns generally, and we should also expect that such consideration should influence the relationship between trade, renewable resource management and biodiversity.

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Notes

¹ For example, two recent surveys on renewable resource management do not mention linkages with trade [4,21].

² An economic interpretation of the “anti-free trade” view is espoused by Daly and Goodland [8], who suggest that this view centers around concerns about economic scale relative to ecological limits, distribution, the balance of power between multinational enterprises and national governments, and the implied effects of globalization on incentives for domestic governments to regulate resource use. The conventional economic view on trade-environment linkages is summarized by Ulph [20].

³ In the limited space of this introduction, we are able only to provide a brief overview of developments in this literature through a few examples. For a more detailed overview of the literature on trade, renewable resources and biodiversity, see Bulte and Barbier [5].

⁴ In an extension to Brander and Taylor [2], Hannesson [10] demonstrates that, with diminishing returns to manufacturing, moving from an open access regime to optimal management may or may not lead to an improvement in welfare. Such an “immiserizing effect” of a transition from open access to optimal management will occur if the demand for the resource good is inelastic so that the value of harvested output is less with optimal management than under open access and more labor is withdrawn from the resource sector. The imperfection that drives this result is that insiders in the manufacturing sector cannot prevent outsiders (formerly harvesting the resource) from spilling into “their sector”, adversely affecting the return to their labor. The latter effect is also important to the results obtained by Hotte et al. [12], discussed below.

⁵ While Chichilnisky [6] considers property rights to be absent in the South but fully enforced in the North, Karp et al. [13,14] assume imperfect property rights in both regions, but with the degree of imperfection conditional on population densities and thus assumed higher in the South.