

# ECONOMIC THEORIES RELATED TO FOREST CONSERVATION UNDER INTERNATIONAL AGREEMENTS AND ITS IMPLICATION TO VIETNAM

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The environmental natural resources are not governed by market principles. Therefore, they are being depleted along with the development of global economy. One of the most important environmental natural resources is natural forest. Natural tropical forests are rapidly being depleted and Vietnam is not an exception. This paper examines the economic mechanisms surrounding the forest conservation and economic theories that are generally acknowledged as basic tools for economic analysis on environmental conservation.

## 1. General Literature Review

### 1.1. *Environmental Economics* (B.C. Field, 1993)

In this world-wide acclaimed book, Field illustrates basic economic theories related to environmental economics. Field not only provides economic theories but also covers every aspect of environmental economic issues. Particularly, the explanation on economic externalities of environmental goods and MAC (marginal abatement cost)-MD (marginal damage) analysis is a useful guidance in examining the impact of environmental problems. Some of the ideas introduced in this paper are generally supported by the logic of this book.

### 1.2. *Governing the Commons* (Elinor Ostrom, 1990)

This article by Ostrom provides an important key to a break-through in the collective action problems. Traditional game theories indicate that the rational behavior by individuals tend to result in the most undesirable outcome. This is considered also true in international relations, especially when it comes to the allocation of contribution of international organizations. Ostrom suggested in this Article that the desirable result can be achieved if proper enforcement of communication is established prior to the games. This factor is represented as “e” in her article and the game is called a cooperative game. This finding is particularly useful in verifying the impact of negotiation under international organizations. The game suggested in this paper is based on the assumption that this factor “e” always exist among member countries of international organizations. Thus, this article of Ostrom is the most important source for this paper.

### 1.3. *The Logic of Collective Action* (Olson, 1965)

Olson first introduced the concept of "collective action problem" in this 1965

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article. The inconsistency between individual and collective interests is explored in detail in this article. Since the tropical timbers are considered as "global commons," this article provides theoretical background why the tropical forests face collective action problem and are doomed to be over-exploited. Combined with other economic theories of public good and common pool resources (CPRs), this article by Olson constitutes one of the backbones of the theoretical approach in environmental economics. Also, this article is the basis for Ostrom to develop her idea related to the cooperative games. Therefore, this article is considered to be a backbone of this paper as well.

## 2. Economic Theories related to environmental conservation

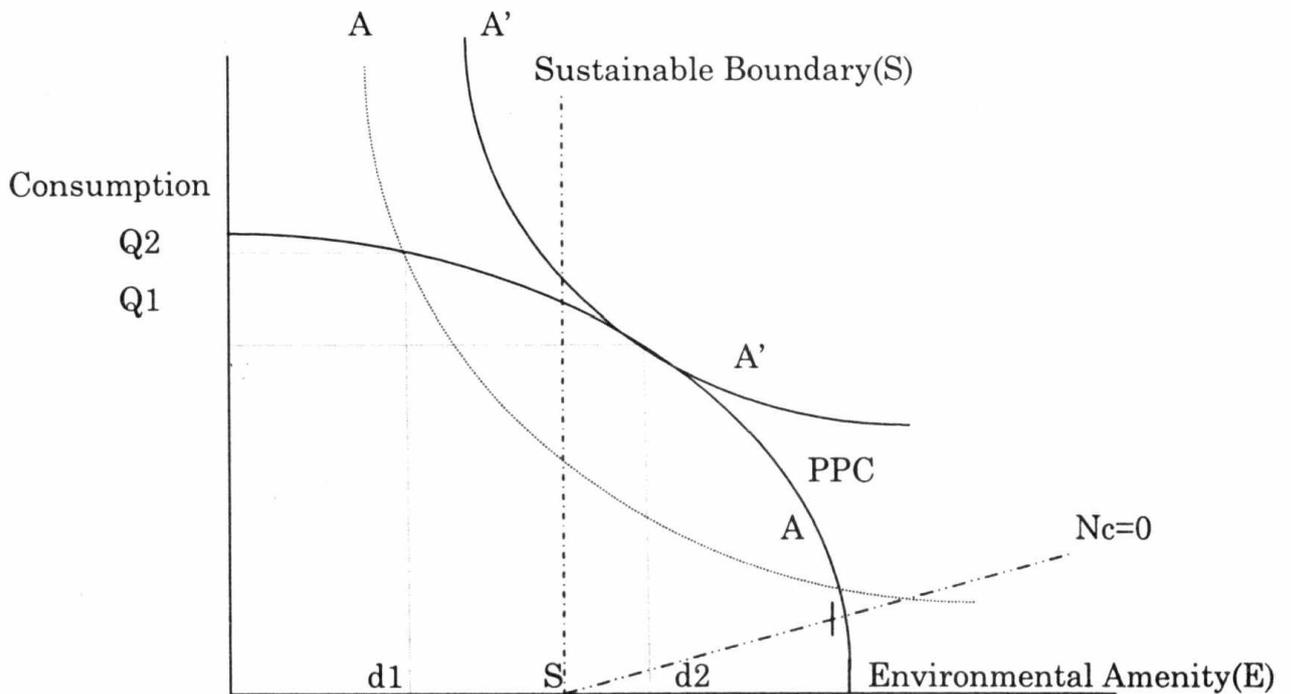
### 2.1. Theories of common pool resources

The implication of tendencies of over-exploitation of public goods (CPRs) for the sustainable management of the resources can be illustrated as shown in Figure 1. In this Figure, the vertical line  $S$  represents where the resource can be managed to maintain the sustainable growth level. If consumption level leaves the environmental amenity level to the right of  $S$ , the resource can be sustainably managed, and if consumption brings the amenity level down to the left of  $S$ , the resource size is not capable to support sustainable management the resources. It should be noted that the word "sustainable" has not been clearly defined in the cases

some of the CPRs such as clean air. Here, in order to understand easier the environmental concerns relating to such CPRs,  $S$  is considered to be the level where the resources can satisfy all environmental economic values. Therefore, below this point the CPRs capacity to maintain global environmental values is not sufficient.

Now, let us introduce a new line in Figure 1. to identify the desired level of consumption. Here, it is named as the Net Consumption ( $N_c$ ) line.  $N_c=0$  line is the boundary within which the net consumption of CPRs is negative. In other words, the consu is being offset by its natural reproduction below this line. The resources will keep decreasing in amount above this level, leading to the continuous shrink of the Production Possibility Curve (PPC). Thus,  $N_c=0$  line is a useful new tool to illustrate the level of "desirable consumption point." This curve provides new concept with regard to the sustainable management. In an absolute sense, the  $N_c=0$  is the true sustainable curve but that is not necessarily the case under consensus. Sustainability is often set at the point where human being can survive sustainably, which allows certain abundant natural resources to reduce its total amount. Therefore, the introduction of the concept of  $N_c=0$  is truly innovative because it illustrates the point of environmental sustainability and resource sustainability at the same time in a figure.

**Figure 1: Natural Resource Budget Line and Sustainable Level**



Further, there is a more important implication in this Figure related to  $N_c$ . Under the definition stated above, the slope of the  $N_c$  curve is found to be equivalent to the velocity of resource reproduction. Hence, the following equations are defined as a condition for sustainable management of renewable resources.<sup>(1)</sup>

$$C \leq \Delta N_c * E + S \text{ therefore, } E \geq (C - S) / \Delta N_c$$

<sup>(1)</sup> A is the original indifference curve when environmental amenity is considered as externality to its economy. A' is the optimal indifference curve that takes into account the value of environmental amenity. If the indifference curve touches the PPC (Production Possibility Curve) to the left of S line, the resources can be managed sustainably. This is endorsed by the relation  $d1 < S < d2$ . It is clear that the resource sustainable point requires much less amount of resource consumption compared with the case where sustainable management in a general sense is attained.

This new equation eloquently tells us that the relations among the reproduction velocity, sustainable level and consumption. Sustainable management thus must satisfy this equation.

## 2.2. Game Theory and International Agreements

It is generally understood that the negotiations at international organizations are explained by the economic theories of collective actions. [Field, p448-470] According to game theories, when there are gains to be made by defecting, rationale behavior by participants will result in the most undesirable outcome for all the participants. This indeed seems to be true in the negotiation process of distribution of contribution among international organization related to

natural resources. Each member country always tries its best to make its own contribution as low as possible at the expense of other members' contributions. If so, no arrangements taken by international organizations can succeed.

In addition to the problem of public goods as stated above, it is necessary to understand the collective action problem in order to fully realize the economic problems that tropical environmental natural resources are facing. The collective action problem was first addressed by Olson (1965) in relation with the provision of public goods by organizations. The essence of collective action problem lies in the inconsistency between individual and collective interests. It is usually explained by using game theory models as shown in Figure 2 as an example. This Figure is designed based on a research which measured the cost for forest conservation as 1500 million dollars per year,<sup>(2)</sup> which should be supplied through the contribution paid to international organizations [Barbier et al, p.140-142].

It has been explained in the previous section, public goods are free to be exploited by anyone once they are provided. Therefore, it would be beneficial, or economically profitable, not to contribute to the provision of these public goods but to free-ride on other countries. In the Figure 2, upper columns indicate economic values for

consuming countries when they contribute and lower columns indicate the value when consuming countries free-ride. Similarly, the left columns indicate the value for producing countries when they contribute and the right columns indicate the values when producing countries free-ride. In this game, the worst outcome is unavoidable if both groups of countries adopt individually the best option that is to defect (free - ride).

Hence, collective action theory tells us that the desirable result will not be reached when individual participants try to its own economic benefit. This is considered particularly true for international community because there is no authority in the international community that can force its individual members to choose an option that can maximize the benefit for the overall community.

It should be noted that Figure 2 presents only a very basic case which could be considered under this game format. The outcome would differ from game to game in accordance with the conditions to be applied to each game. For example, the value which both countries *perceive* in the global conservation is considered the same for both producing and consuming countries in Figure 2, but in reality the value would not be the same. Therefore, the game result would be different by setting different values perceived by each groups.

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<sup>(2)</sup> The research was conducted in 1992 by World Foundation for Environment and Development – WFED, according to Tropical Timber Trade by Barbier et. al. published in 1994.

**Figure 2: Contribution to the Fund and Game Theory**

		Producing Countries			
		Contribute		Not contribute	
Consuming Countries	Contribute	I (Gv:1500) Cv(750) Pv(750)	II (Gv:1500) Cv(0) Pv(1500)		
	Not Contribute	III (Gv:1500) Cv(1500) Pv(0)	IV (Gv:0) Cv(0) Pv(0)		

First, it is assumed that the values for the following factors are known to an international organization responsible for forest conservation.<sup>(3)</sup>

Gv = Global Value Gained from Conservation

Cv = Total Value for Consumers

Pv = Total Value for Producers

Based on these values, producing countries and consuming countries individually decide the amount of contributions as abbreviated as below.

Cp = Contribution by Consumers

Pp = Contribution by Producers

Then, based on the above-mentioned assumption that 1,500 million US dollars would be needed to conserve forest resources to a sustainable level, the following set of equations is established.

$$Gv = 2(Cp + Pp) - 1500^{(4)}$$

<sup>(3)</sup> As implied in the Figure 1,  $Gv = E \geq (C - S)/\Delta Nc$  always needs satisfied. This will be the same for the all of the subsequent games which would be considered under this game format.

<sup>(4)</sup> The coefficient is herewith just assumed to be 2. When there is no spill-over effect, it should be just 1. However, the fund is fully supplied and received with full cooperation, it is generally assumed that the effect of

$$Cv = Gv - Cp$$

$$Pv = Gv - Pp$$

As an important background, the following two factors are assumed to exist

e = Cost of enforcement by penalty (e is applied for non-contributors)

a = Cost of enforcement by self arranged arbitrator

It is generally assumed that  $a > 0$ ,  $e = 0$  (e may turn  $> 0$  when game fails)

$$\text{Namely, } \Delta(Cp + Pp) = F(e, a)^{(5)}$$

It is assumed that either Consumers or Producers provide entire contribution when either Cp or Pp is zero.

### 3. Application of theories to Forest Conservation

#### 3.1. The Present Plight of Tropical Forests

Application of the above theories to international organization's efforts to conserve natural forests would be an interesting and useful attempt.

the fund is more than the actual amount extended from members.

<sup>(5)</sup> The amount of the coefficient is also subject to the effect of "e" and "a."

Generally, producing countries of timbers tend to assert that a large amount of compensation is needed from consuming countries if the latter request the former to forgo a part of economic values being accrued from exploiting the natural forests, while consuming countries tend to request that producing countries also take responsibility to protect global forest environment.

This paper does not actually apply data into models as exemplified in Figure 2, but it would be interesting to know some figures related to tropical forests depletion which may be used as background figures for the models. Figure 3 states that overall tropical forests annual depletion rate is currently 0.8%, while its increase rate by plantation is approximately 0.2%. Therefore, annual net depletion rate is considered to be approximately 0.6% [ITTO, 2003]. Figure 3 illustrates current and future maximum production curves (budget lines) between tropical timber net consumption, i.e., forest exploitation, and the environmental value of forests. Naturally, as long as net depletion rate is a positive figure, this budget line will eventually shrink to the left of the sustainable boundary of S. If the plight of global tropical forests becomes this stage, they can no longer provide sufficient environmental services, such as sink capacity of CO<sub>2</sub>, to the global community even though the rate of net depletion then becomes zero.

ITTO has established a fund to achieve the sustainable management of

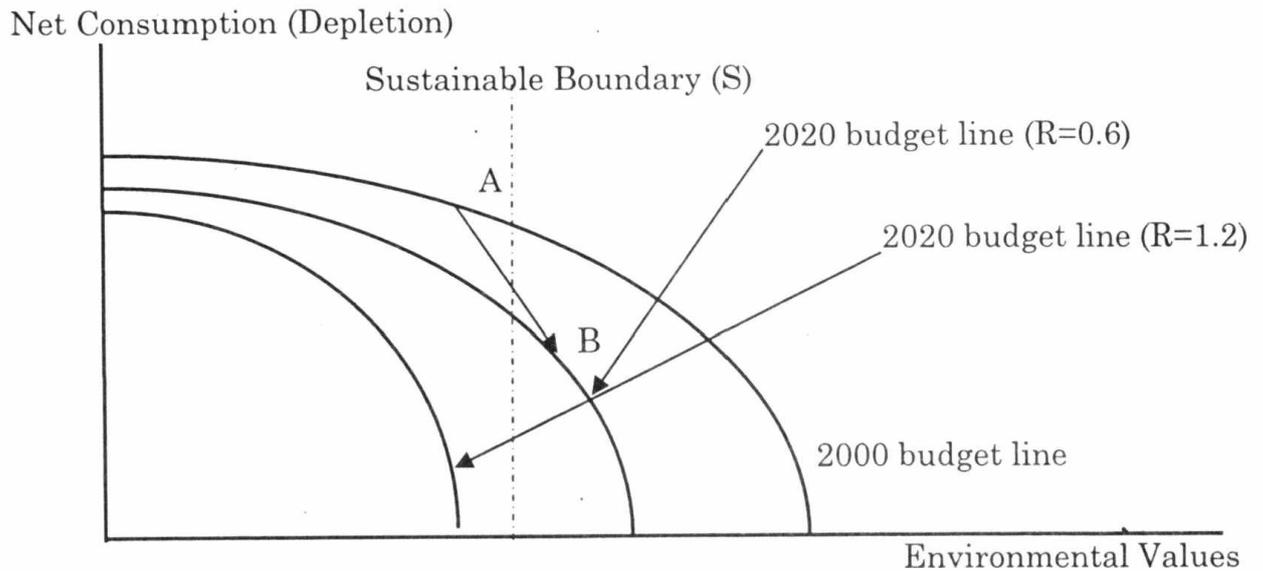
tropical forests and tropical timber trade by the year 2010. The fund is called the Bali-Partnership Fund. The above-mentioned budget line, therefore, has to be become sustainable by 2010 in order to achieve the commitment of the global community.<sup>(6)</sup>

The three budget lines presented in Figure 3. are also illustrated in Figure 4 from a different angle. As long as the annual net depletion rate is positive, tropical forests are doomed to be wiped out completely soon or later, most likely within a hundred years. As Figure 4 shows, net depletion rate has to become zero at a point in the near future if the tropical forests are to be sustainably managed. What is generally envisaged to realize this target is represented by the Gradual Reduction curve in Figure 4. It is a simple fact that either or both reduction in depletion rate and improvement in plantation rate need to be achieved for realization of this goal.

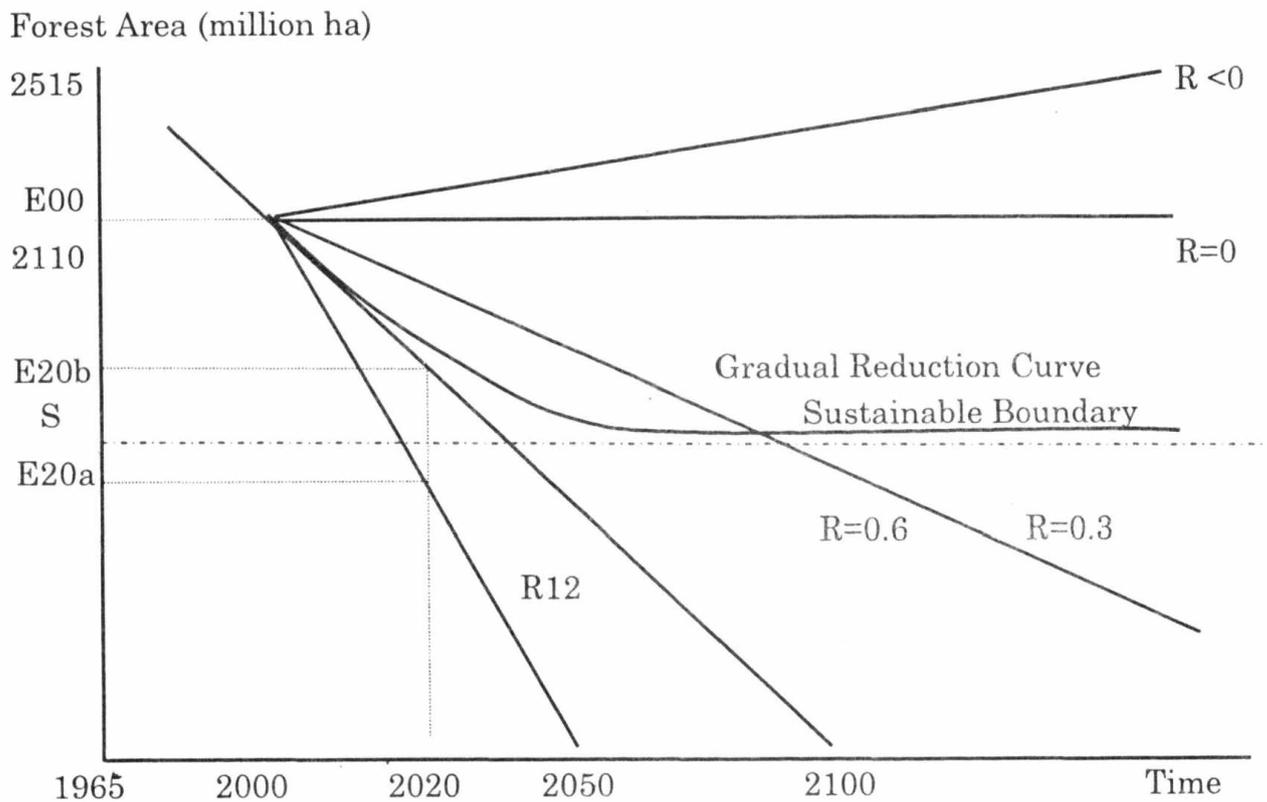
The level of efforts needed by international community depends heavily on where the sustainable boundary level is. If the level S is much lower than the one in Figure 4, the global community can spend much longer years to realize this goal. It may not have to be the year 2010. If the level is already higher than current stock level, it is imminent for the global community to avert the current direction of depletion and then to increase the total amount of tropical forests.

<sup>(6)</sup> As of August 2005, the Bali Partnership Fund has not attracted enough funds to achieve its goal. More efforts are needed by the members of the ITTO.

**Figure 3: Current and Possible Future Budget Lines<sup>(7)</sup>**



**Figure 4: Long-term Tropical Forests Depletion Perspectives<sup>(8)</sup>**



<sup>(7)</sup> Even though the production curve shrinks, sustainable management is still possible if the acknowledged value of environment increases and accordingly the level of consumption decreases which is indicated by the movement from A to B in the figure. The fund which would be used in the Figure 2 needs to be set to achieve such a level.

<sup>(8)</sup> This diagram simply illustrates that sustainable management of forests will not be realized in the year 2020 if the rate of depletion accelerates, while it is still possible under the current depletion rate. However, in order to maintain the forest management truly sustainable, the rate has to be reduced to a substantially low level.

### **3.2. Forests in Vietnam**

In Vietnam, 19 million ha of land, corresponding to 58% of the total land, is classified as forest area. However, much of the area is not covered by trees. The actual area covered by woods is 11.3 million ha, which is divided into 9.7 million ha of natural forest and 1.6 million ha of plantation forest. The forest area decreased from 1943 till 1993 with the annual average depletion rate of 100,000 ha per year. Particularly, forests were severely destroyed during the period of Vietnam-American War 70s by chemical weapons. However, the area of forest has steadily been increasing since it hit the lowest level of 9.3 million ha in 1993. However, there is a strong concern on the quality of forests in Vietnam. The forests with closed canopy consist only 13% of the total forests, and the poorly planted forests consists as much as 55%.

The forest of Vietnam is known as one of the richest in terms of biodiversity. The Vietnamese forests contain as much as 10% of fauna and flora species although the area is only 1 % of the global forest area. The global community is therefore very much concerned about protecting natural forest of Vietnam.

Timber trade has not created serious pressure against forest protection. The amount of timber products exported from Vietnam to other countries is not significant yet in the global timber trade market. Also, only 10% of the exported timber products from Vietnam is

originated in Vietnam [ITTO 2003, p13-50]. Vietnam generally import logs from neighbor countries and process them and export. However, it should be noted that the export of wood products from Vietnam is rapidly increasing during the past few years due to the inception of the Bilateral Trade Agreement with the United States (BTA) in 2001 and other trade promotion mechanisms including AFTA and WTO accession negotiations. Since the export of wood products has proven to be very lucrative, Vietnam industries may turn to exploit local forest for timber and wooden furniture productions.

### **3.3. Game theory scenarios and possible contribution arrangements of international agreements**

In supplementing the game introduced in Figure 2, two basic scenarios may possibly be introduced. The first scenario is assumed for the case where an international organization conducts its conservation activities utilizing the fund provided from both consumers and producers of the natural resource. For each such a game scenario, the second scenario is introduced to examine the effect of fund transfer from consumers to producers as a means of compensation. Case 1 is the game under which producers and consumers are assumed to share the same environmental value in the resources. In case 2, producers are assumed to identify no value in the environmental assets. Producers are assumed to identify the half as much environmental

value as consumers do in case 3. These three cases would probably best illustrate the actual situation surrounding international organizations in their efforts to raise contributions.

Vietnam is a net producer of tropical timbers and a home to tropical forests and their related economic and environmental values. Vietnam, therefore, needs to be considered for all these three cases and see the impacts to its economy and environment. By such a way, Vietnam will be able to find the best strategy to negotiate with other members of international organizations.

#### 4. Conclusion

Based on the summary of the game theory stated above, it may be possible to state that the best recommendation for the sake of conservation of environmental resources is that consumers bear all the contribution to the fund and that the fund be transferred to producing countries as the compensation for forgoing economic benefits to be obtained from the exploitation of the natural resources. However, this solution is not realistic because it would not be accepted by the consumers easily. If the fund is to be used as the compensation of the exploitation, the amount to be claimed by the producing countries would be unattractively high for the consumers. Further, there is a general understanding that the responsibilities need to be shared by both sides. Thus, the compensation measure is not necessarily a stable solution though it is a sure solution for the sake of the

conservation of the environmental resources.

Likewise, the solution under which producers bare all responsibilities is not realistic, because the producers are not willing in the first place to forgo their rights, and also, most obviously, they do not have enough funds to conduct the conservation measures by themselves. They do need proper assistance from consuming member countries.

Another possible recommendation is that consumers provide the entire fund but the fund be used directly to the conservation measures for the environmental resources. In this case, however, the fund may not succeed if producing member countries do not recognize any values in the environmental assets.

If producers recognize at least half as much environmental value as consuming countries do, the fund may become successful because producers even at the worst case may see no difference between contributing and non-contributing tactics. If the producers share the same value as the consumers, the Fund should be considered to succeed.

As for Vietnam, it is important to identify how much environmental value that Vietnam should attach to its own domestic environmental resources and to know how much it is different from values recognized by other countries. Based on the profound understanding on these values, negotiation should be conducted.

Another important factor for the fund to succeed is the introduction of penalty articles in its implementation rules and regulations. By the successful introduction of penalty clauses, the fund would succeed regardless the degree of producers' recognition in the environmental values. However, it may not be easy to reach consensus between both sides in creating effective penalty clauses in the first place.

For this reason, and also for the sake of equalizing the values for both sides, frequent and patient consultations and information exchanges are recommended. If and when both sides share the same information and appreciate each other's positions, they would be able to recognize the same environmental values. Then the fund can succeed even without the penalty clauses.

It should also be mentioned that producers can make their portion of

contribution to the fund as non-cash contribution such as introduction of internal laws and the tighter control measures for export and consumption of their domestic resources. These non-cash contributions will decrease their economic benefits that could have been accrued from the utilization of the resources; therefore, these measures can be considered as equivalent to cash-contribution to the fund.

Hence, by summarizing the above, the most important recommendation is that both sides recognize the same values and that the international organizations should be equipped with proper arbitration or penalty measures. It is recommended that international organizations should hold proper consultations between the producing and consuming member countries so that both groups identify the same environmental value. This should be the same for the case of Vietnam.

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TẠP CHÍ KHOA HỌC ĐHQGHN, KINH TẾ – LUẬT, T.XXII, Số 1, 2005

## **CÁC THUYẾT KINH TẾ LIÊN QUAN ĐẾN BẢO VỆ RỪNG THEO CÁC THỎA THUẬN (HIỆP ĐỊNH) QUỐC TẾ VÀ ĐỐI SÁCH (HÀM Ý) CHO VIỆT NAM**

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Bài báo này trình bày và thảo luận một số lý thuyết liên quan đến vấn đề bảo vệ môi trường và đưa ra những hàm ý chính sách cho Việt Nam khi gia nhập vào các tổ chức quốc tế bao gồm WTO. Lý thuyết nguồn lực chung và lý thuyết trò chơi được giới thiệu như một công cụ chính cho việc phân tích những vấn đề môi trường thực tế. Phân tích cho thấy những tổ chức quốc tế nên đóng vai trò chính trong việc bảo tồn các nguồn lực tự nhiên. Tuy nhiên những đóng góp vào quỹ tổ chức quốc tế không đạt kết quả tối ưu vì những ngoại ứng kinh tế. Bài báo gợi ý rằng những tổ chức quốc tế nên được trang bị hoàn thiện với những cơ chế giải quyết bất đồng và hệ thống cố vấn và Việt Nam nên sử dụng có hiệu quả những hệ thống này để thu được lợi ích tối đa trong vấn đề bảo tồn môi trường tự nhiên của nó.