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# Bequest Motive for Conservation in Forest Production Communities

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## Abstract

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*The study confirms the existence of a bequest motive, or intergenerational value, closely related to the conservation of forests in poor rural communities with communal forests under logging. A survey with contingent valuation type of questions was applied to the households of two populations living in two contrasting forest communities. Results show that 83% and 71% of head of households declared a willingness to make an altruistic sacrifice for the subsequent enjoyment of their children from this forest resource, measured in different ways. Variables such as age, gender, income, education and forest type are closely related to the bequest motive, as other literature has found to be the case regarding private forest owners. Differences among communities show that the larger the benefits they obtain from the forest resources they own, the larger the bequest motive.*

*Keywords: bequest motive, poor communities, forest conservation .*

## Resumen

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*El estudio confirma la existencia de un motivo de legado o valor intergeneracional estrechamente relacionado con la conservación de bosques en comunidades rurales pobres que tienen extracción maderable. Se aplicó una encuesta con preguntas del tipo disponibilidad a pagar entre hogares de poblaciones viviendo en dos comunidades forestales contrastantes. Los resultados muestran que del 83% al 71% de los jefes de familia declararon una disponibilidad de hacer algún sacrificio altruista medido en diferentes formas, para que las futuras generaciones pudiesen gozar de los recursos forestales ahora disponibles. Las variables edad, género, ingreso, educación y tipo de bosque estuvieron estrechamente relacionadas al motivo de legado, tal y como se ha encontrado en la literatura relacionada con motivo de legado en otros tipos de propiedad. Las diferencias entre comunidades muestran que a medida en que la comunidad obtiene mayores beneficios de los recursos forestales, en esa medida muestran un motivo de legado mayor.*

## *Introduction*

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Bequest refers to the altruistic value that a human generation assigns so that future generations may enjoy an acceptable quantity and quality of the natural resources which now exist (van Kooten and Bulte, 2000; Amacher *et al.*, 2002). The concept was conceived by Krutilla (1967) as part of a collection of values, which include existence and option, which together comprise what is known as non-use values of natural resources (Pearce, 1993).

The literature suggests that the higher the value assigned to this intergenerational transference, the greater the effort to conserve a natural resource (Conway *et al.*, 2003). Such conservation has its costs, often associated with a reduction of the profits derived from the exploitation of the resource and therefore, a lower present consumption. The study of these costs has been related to the analysis of public policies for the provision of public goods among generations, and in particular, to the conservation of natural resources. The results of these studies show that when the welfare of future generations is an important element in the definition of public policies optimal policies should support programs ensuring environmental conservation, ascribing costs to present generations (Riddel and Shaw, 2003). Thus, much of the decision of whether or not to bequeath the environmental resource depends on the characteristics of the resource and the welfare level of the present generation. The characteristics of the goods will determine the preferences for use of resources in the present generation, while its welfare level will determine the necessities of use of the goods and the possibility of conserving the environmental resource.

Decisions regarding costs of willingness to accept, or sacrifice profits in order to bequeath public property, have been strongly challenged. Some authors have even stated that there is no basis for this type of altruism in the provision of public goods (Deacon and Shapiro, 1975). To the contrary, there are various studies that support the existence, theoretically and empirically, of a bequest motive and a value (a relatively high value on occasion) associated with it. What is interesting about these experiences is that the bequest value associated with natural areas has been found in populations equivalent to a state, groups of states (Greenley *et al.*, 1981; Walsh *et al.*, 1984; Lockwood *et al.*, 1993; Popp, 2001), in localities or regions (White and Lovett, 1999; Mallawaarachchi *et al.*, 2001), or even at the level of an individual owner of natural resources (Hulkrantz, 1992; Tahvonon, 1998; Conway *et al.*, 2003). In the case of large populations, it has been difficult to separate the bequest value from that assigned to the existence of option values, which has caused enormous controversies. Nevertheless, at this level of analysis the existence of a bequest motive is undeniable (Cummings and Harrison, 1995; More *et al.*, 1996). In the case of private forestry producers,

the bequest motive has been well identified. It has even been associated with characteristics of the resource, market conditions, and the intrinsic characteristics of the producer, among other relevant variables. When bequest has been studied at locality or regional levels a bequest motive for environmental protection, or conservation of forest areas, has been found. However, in all of the reported studies, the locality or community neither owns nor depends economically on the natural resource. This means that the bequest motive is not well valued in order of magnitude and it is not comparable with use values.

However, communities that have ownership rights over natural resources and occupy the territory of the natural area, in particular forest communities, are cases different from the three previously mentioned levels of analysis. These communities have some degree of economic dependence on the natural resources which they possess and must make decisions concerning the management and use of these resources in a collective way. It has recently been argued that communities managing common property forests through community forest enterprises require an extension of theories of the firm (Antinori and Bray, 2005). The case is attractive due to the fact that the estimation of a bequest value is isolated from an option or existence value, which the community is perfectly familiar with because it depends on the forest and lives within its borders. The study of the bequest value of these communities becomes more attractive in the case of México, where 80% of forests are located in communal lands (Larson and Sarukhán, 2003), and where decisions of use are collective and the communities consist of high levels of poverty. It has been argued that bequest, or intergenerational values, is one of the factors that causes these communities to value their forests differently than from industrial foresters on concessioned public lands (Bray, 2004), for example.

The present document explores various alternatives for empirically proving that despite experiencing high levels of poverty, the rural communities are willing to sacrifice part of the present consumption of a resource of common ownership, in order to bequeath an acceptable amount of natural capital to the following generations. The work was carried out by a survey for all the heads of household, or their spouses, during the spring of 2002. The survey was applied in two forest communities in México, *Laguna Kaná*, an indigenous Mayan community located in a tropical zone of the State of Quintana Roo, and *El Balcón*, located in a temperate area of the Sierra Madre Occidental in the State of Guerrero (Torres Rojo *et al.*, 2005; Bray and Merino, 2004). The results show evidence of the existence of “bequest motive,” which varies according to the socioeconomic characteristics of the population, aligned to the results obtained with other communities (White and Lovett, 1999; Mallawaarachchi *et al.*, 2001) or at property level (Hulkrantz, 1992; Tahvonen, 1998; Conway *et al.*, 2003).

The paper is divided as follows. The first section consists of a general revision of the bequest value and its relation to sustainability; the second section describes the characteristics of the data and the base model, while the third section shows the results of the behavior of these communities, with respect to bequest value. Finally, the fourth section presents the conclusions of the study.

### ***1.- Theoretical Considerations and Context***

The concept of bequest has played a central role in the economic models of generational exchange. Some authors argue that bequest has a fundamental role in the formation of savings (Kotlikoff and Summers, 1981), and as a mechanism for the economic interaction between generations (Cox, 1987; Bernheim *et al.*, 1985). However, other authors minimize the economic role of this concept (Yaari, 1965). In the first context, the literature regularly explores the strategies of the parents in the distribution of private goods among the children (Becker and Tomes, 1976; Bernheim *et al.*, 1985; Behrman and Rosenzweig, 2002) as well as the compensatory mechanisms among generations (Wilhelm, 1996). In these models, the transfers are always of private goods, with a defined market and different assumptions of the altruistic characteristics of parents (Flores, 2002). However, these models do not incorporate the effect of the intergenerational transfer of public goods and services, which are highly relevant in the case of the externalities related to the use of natural resources.

The first reference to these types of environmental goods and services transfers was made by Krutilla (1967). He considered the existence of tastes, preferences, and motives that can lead a non-user of natural resources to be willing to sacrifice his income, maintain an irreplaceable asset, or to bequeath it to future generations. Greenely *et al.* (1981) provided the first empirical evidence of the bequest value, which has been followed by various works of the same nature (Walsh *et al.*, 1984; Lockwood *et al.*, 1993; Mallawaarachchi *et al.*, 2001; Popp, 2001; Conway *et al.*, 2003; Riddle and Shaw, 2003). In spite of these experiences, the concept of bequest value has been a controversial one, both for its significance and for the methodologies employed in estimating it. With reference to its significance, some authors have pointed out that there is no basis for the concept, given that it is associated with altruism in the provision of public goods (Deacon and Shapiro, 1975). In addition, the methodologies employed for its evaluation have been questioned on the level of precision with which it can be measured (i.e. the intrinsic weaknesses of the evaluation mechanisms employed in the appraisal of non-use values), and for its level of comparison with other measures of value (Stevens *et al.*, 1994).

Despite this debate, it is undeniable that a person can have a “motive related reason” for sacrificing part of their wealth in environmental conservation (Cummings and Harrison, 1995; More *et al.*, 1996). This motive has frequently been confused with a value, which has caused problems of interpretation, especially when it has involved a comparison with the use value of this environment, or reflected some market value. The bequest motive or value has been analyzed depending on the form in which they are used (More *et al.*, 1996). For example, it is considered perfectly valid and legitimate that an individual value nature and be willing to pay to preserve it for future generations. However, it is not considered valid to speak on behalf of future generations for the purpose of conservation, given that it puts personal value aside and gives priority to the supposed value that the future generations may place on the environment. Thus, the existence of the bequest motive is not in doubt, but the assigned value is, given that it can be confused with an existence, or option value, of natural goods. Therefore, the present document refers to the bequest motive without attempting to make a precise evaluation of it.

The principles of altruism and intergenerational equity establish that a person will be willing to reduce his present consumption so that his heirs may also satisfy at least a certain level of consumption in the future. This implies that the present generation considers part of the interests of the future generations as its own, which can be interpreted in two ways: 1) the present generation knows the tastes and preferences of the future generations and can estimate a value for them, which as we have seen, can be questioned, and 2) there is a frame of reference for which the present generation considers the permanence of a minimum quantity and quality of environmental goods and services for the future generations to be important, regardless of their technological level, institutional framework and level of welfare. This latter interpretation implies that an individual that has some willingness to pay for conserving the environment for future generations will not be able to decide whether or not these generations can use the environment, which constitutes a form of altruism known as non-paternalistic (Flores, 2002), and is the closest to the concept of bequest motive defined by Krutilla (1967).

For a bequest motive to exist within this context, three premises must be fulfilled. The first and most obvious consists of the adoption of sustainability as a commitment of equity with generations to come. The second has to do with the need to take into account that the costs and benefits resulting from present decisions will be faced by various generations; and finally, that there is a need for an institutional base that recognizes and ensures the rights of future generations with respect to the capacity to enjoy the ecological and economic resources (Padilla, 2002). The first and third premises have to do with the reference framework of the “intergenerational transfer,” whereas



the second is directly linked to the benefits and costs of this transfer. The costs have frequently been referred to as the “bequest value.” However, as has been pointed out, it is extremely difficult to differentiate whether this bequest implies a simple wish for the environment to remain as it is (something like the existence value), in absence of any human function, or whether it is related to the fact that future generations will be able to enjoy it, whether they use it or not. Hence, such a value will be referred to in the rest of the paper as a bequest motive.

## *2.- Collection of Data*

The data were obtained from a survey carried out for all households of the two forest communities previously mentioned Laguna Kaná, and El Balcón. Each survey interview was applied to the head of the family,<sup>1</sup> or his/her spouse during the summer of 2002 in the locality with the largest population of each forest community. An average of 11% of the homes was unoccupied in each locality, because the occupants were traveling or performing agricultural activities.

In order to present a frame of reference for the questionnaire and to know the typical conservation and management activities in each community, preliminary research was conducted by gathering documentation and carrying out interviews with different focal groups in the community. In addition to control questions at the household level, the questionnaire considered various questions to capture the existence of a value associated with a well defined bequest motive; that is, that the next generation should enjoy the same quantity and quality of forest resources, so that these resources might be used and enjoyed in the same way as by the present generation. For this purpose, a frame of reference was presented to each person surveyed in which the direct benefits (income derived from timber harvest, public services, extraction of non-timber forest products [NTFP], and hunting among others) were pointed out, and indirect benefits (protection, recreation and landscape), which they obtained from the forest that they own, were pointed out as well. Once this frame of reference had been defined, questions were asked related to the intensity of use of the natural area in a non-monetary scale. For example, questions were asked about the frequency of use, participation in NTFP activity, the frequency of hunting activities, the proportion of these products in the daily diet, frequency of recreational activities, and use or protection of some sections of the forest. This series of questions had two objectives; the first was to clearly establish a frame of reference for the individual surveyed so that he or she could estimate the

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<sup>1</sup> The interview was applied to the heads of household, regardless of whether they had property ownership rights of the community forest.

amount of benefit obtained from their forest; the second was to help the individual to identify an anchor value, or reference value (Kahneman *et al.*, 1999), for the open question of willingness to pay or to accept.

The analysis of the information consisted in defining basic statistics and relating response variables (integrated by the different alternatives of evaluation of the bequest motive) to socioeconomic variables by means of econometric models. The reduced forms of the tested models were based on the general model of behavior of a forest landowner (Conway *et al.*, 2003), which in turn is based on classical decision models (Johannson and Lofgren, 1986). The model has the following general form:

$$B = B(\beta, \alpha, p, \rho, m, s, \Omega) \quad (1)$$

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Where the bequest motive ( $B$ ) is explained by variables such as site parameters ( $\beta$ ), elements of preference per bequest ( $\alpha$ ), price of the timber product ( $p$ ), rate of time preferences ( $\rho$ ), income ( $m$ ), savings ( $s$ ), other elements important for utility ( $\Omega$ ), and the signs correspond to the expected tendencies of comparative statistics (Conway *et al.*, 2003). For our model the site parameters ( $\beta$ ) were substituted by controlling both communities with a dummy variable; the bequest preferences ( $\alpha$ ) by their participation in the use of forests and their level of poverty, with the latter measured according to the classification of the Mexican government human capital investment program *Oportunidades*<sup>2</sup>. The price of the product ( $p$ ) was substituted by the value of the timber harvest, given the enormous differences of quality and quantity of timber between the two communities studied. The discount rate was not used, although it was assumed to be closely related to the poverty level. Savings were considered to be all of these assets and livestock, and finally, the ( $\Omega$ ) group integrated demographic characteristics (gender and age), condition of the member of the community (whether he/she has property rights on the land or not), environmental preferences, and perception of risk.

### 2.1.- Characteristics of the forest communities under study

In this section we will briefly describe the two populations studied. *El Balcón* is a community located in the Sierra Madre Occidental of the State of Guerrero. The community received its land ownership rights in 1972 after a history of inter and intra-community land conflicts, finally achieving its current size of 25,565 hectares (Torres Rojo *et al.*, 2005). The forest surface

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<sup>2</sup> *Oportunidades*, formerly known as PROGRESA, is a subsidy program aimed at households whose living conditions are considered to be of extreme poverty.

is 15,190 ha, of which 72% is used for timber production and the remaining surface for conservation and restoration. *El Balcón* has successfully established what is known as Community Forest Enterprise (CFE), which is based on the exploitation of the commonly owned forest by industrializing the raw material that it extracts. The current success of this forest community lies not only in the fact that it has become an exporting lumber company, thanks to its commercial partnership with the American company Westwood Forest Products, but also in its ability to organize its community to preserve its forests, generate income, strengthen its social capital, and reduce violence. It's estimated that the CFE invests about 90% of the profits of the community through the provision of public goods, which includes the rehabilitation of roads, provision of drinking water, energy, education, health services and housing (Torres Rojo *et al.*, 2005).

*El Balcón* is composed of three population centers: Pocitos, La Lajita and Mesa Verde, with Pocitas being the largest. Together the three settlements have a population of about 600 members (approximately 92 families), 136 of which have land ownership rights. The illiteracy rate is 15% within the population over 15 years old, and 35% have a schooling level of less than 6 years of primary education. Some important demographic characteristics for both communities are shown in Table 1.

*Laguna Kaná* is a Mayan community located in the State of Quintana Roo, south of the tourist corridor known as the "Riviera Maya" (Bray and Merino, 2004). Although this community was founded in 1942, for many years it was legally considered to be an annex of a forest community known as Chunhuas. In 1999 it was legally recognized as an independent community. The community has 18,495 hectares of territory. The forests of *Laguna Kaná* form part of an important block of semi-humid tropical forests in the central part of the state of Quintana Roo. It is estimated that there exist about 102 species of trees in the zone with an average of up to 30 species per hectare, among which the chicozapote (*Manilkara zapota*), and mahogany (*Swietenia macrophylla*) are outstanding. Logging is carried out communally in spite of the fact that the community does not have permanent working capital or its own equipment. There is no processing of the logwood and community labor works with outside logging contractors in the labor and supervision of the harvest activities. In addition to logging, there exist other activities within the forest such as the exploitation of chicle, hunting, agroforestry, sustainable agriculture and the production of *palizada* (wood used for tourism activity) (Bray, 2004).

In contrast to *El Balcón*, this CFE generates few jobs for the members of the community because the authorized volume for logging in the management plan is much lower. It is estimated that tree felling provides jobs for only about half the members of the community with land ownership rights in a year and for short periods of time, between 3 and 4 months. The benefits obtained

from this activity are mainly from profit-sharing from timber sales distributed in cash to members with ownership rights, and only a small percentage is destined for reinvestment in forest areas, or for the provision of public goods. There is a small Communal Fund to which contributions are occasionally made; however, it is apparently no longer a significant amount. In 1985 the community decided to reserve 10,000 hectares of permanent forest areas for logging under management plans, where no land use change would be allowed.<sup>3</sup> However, contrary to the community of *El Balcón*, little is reinvested; in fact, the only reinvestment which is made in the forest is in the form of annual reforestation which is required by Mexican environmental law.

The population is approximately 1,200 inhabitants; of which 190 have land ownership rights. It is estimated that there are about 189 homes in the community, with an illiteracy rate of 8% within the population of over 15 years of age, and with a high school level equivalent of education considering that it is an indigenous population (See Table 1).

The surveys applied reflect that forest activity is more important in *El Balcón* than in *Laguna Kaná*. To give an example, the principal activities of the head of the household in *El Balcón* are agricultural and forest related, 58% and 33%, respectively, whereas in *Laguna Kaná*, 85% of the population is mainly dedicated to agricultural activities. Though Table 1 demonstrates that there isn't a great difference in the average age of the individuals surveyed in both communities, it is apparent that the schooling level in *El Balcón* is considerably lower than from that of *Laguna Kaná*, where the average reflects a nearly completed primary level education.

Household assets were defined by the amount of livestock and landholdings outside the community borders. The range for livestock holdings in *El Balcón* was between 7 and 12, while in *Laguna Kaná* livestock was insignificant as an asset. With respect to the additional hectares of land outside of the community owned by the household, *El Balcón* reported an average of 9 ha, contrasted with *Laguna Kaná*, where the average was around 2 has.

### 3.- Results

The parameters of a general model were estimated considering the exogenous variables suggested in the theoretical and the empirical models, as well as the

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<sup>3</sup> Evidence has been presented that these permanent forest areas, as a part of community forest regimes, have led central Quintana Roo, the State in which *Laguna Kaná* is located, to have the lowest rate of deforestation recorded in southeastern tropical México (Bray *et al*, 2004). See also Durán *et al* 2005 for evidence on low rates of deforestation in communities including *Laguna Kaná*, as well as the region of *El Balcón* in the State of Guerrero. This is important because it speaks to the sustainability of community logging, an issue not directly addressed in this paper.

different payment vehicles of the altruistic willingness to conserve forest areas for future generations.

### *3.1.- Bequest motive and long term investment*

The first variant for estimating the disposition of paying for the bequest value was formulated through the following question: How many work days without payment would you be willing to give for reforestation?

This question has to do with the perception of cost implied by sustainability (measured through the reinvestment of the natural reserve) by means of the labor effort, particularly in the context of logging (in both communities) dependent on natural regeneration. The evaluation of the bequest motive through investment in reforestation is important for two reasons. The first is that the poor, with monetary limitations by definition, in most cases are owners by virtue of their labor being one of their few productive assets, thus, it is the most direct form of evaluating their bequest motive. The second is that investment in reforestation is a long term investment, given that the maturation of the planted species may take longer than the life span of one generation. Therefore, if there is not a land market<sup>4</sup> that can compensate for long term investment, there must be non-economic motives that justify such an investment. In this respect, Hulkrantz (1992) pointed out that in lieu of a perfect land market altruism for future generations is the fundamental motive of reforestation. This result is maintained even in the presence of forest land markets given that the empirical evidence shows that owners consider the value of a piece of land does not increase with reforestation (Rom *et al.*, 1985; Carlen, 1990).

Results in both communities show that the willingness to sacrifice free work is positive, averaging 10.2 and 3.8 days of work for *El Balcón* and *Laguna Kaná*, respectively. From the total of individuals interviewed, only 16.6% proved unwilling to collaborate with free days of work for the tasks of reforestation, however, they showed a willingness to pay for conservation through other means of payment.

Utilizing a linear model with the response variable defined as the number of days of work per year sacrificed to provide work for reforestation, the general model (1) was tested along with combinations of transformations of the important exogenous variables. Ordinary least squares were used to fit the model and the estimates and goodness of fit statistics are presented in Table 2. This model shows that the higher the age of the head of the household, the fewer the number of days he is willing to work without pay for reforestation. In fact, a person of advanced age would not have so much

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<sup>4</sup> These forest communities are obliged by law to conserve their forest lands in communal property without a selling option.

willingness to reinvest knowing that his life horizon is reduced with the passing of years (Riddel and Shaw, 2003). In other words, he would prefer present consumption to reinvesting in a project that will probably not produce benefits other than the satisfaction of his altruistic interests. This evidence of the reduction of the bequest motive with age has been reported by Popp (2001) and Riddel and Shaw (2003), however, a contrary behavior has been reported by Conway *et al.* (2003). In the latter case there is no control by income of the owners, which evidently does not make the results comparable.

An interesting result of this adjustment is that there is a difference in altruism according to gender. Women are on average are willing to work 0.42 more workdays than men without receiving payment, so that reinvestment through reforestation can be made to insure the maintenance of the resource and continued utilization of the forest. This result probably reflects the women's greater altruistic motivation towards the children, with respect to that of the men.

The effect of the poverty indicator (dichotomous variable that takes the value of 1 if the household participated in the program *Oportunidades*<sup>5</sup>) reflects the aforementioned idea that a poor household will tend to reinvest less in assets that generate yields in a relatively distant time horizon, as is the case with forests, due to its high discount rate, which manifests the urgency to satisfy their present necessities. It should be pointed out that the classification of poverty is not collinear with income, due to the fact that the classification of poverty considers dimensions additional to current income.

The number of household members shows an interesting behavior in the fit, given that it suggests that as the number of household members increases, the amount of days of work without pay will decrease to a minimum point (9 members per household, which is a figure higher than the figure of average members in the homes of both communities) in which the tendency is reverted. This tendency suggests, *Cafeterias paribus*, that as the number of members increases, they will opt for present consumption to satisfy the growing needs within the household, reaching the critical point at which a sufficiently large number of members would contribute to the generation of income for the household.

Finally, the dichotomous variable community tries to capture those characteristics that are not specified in the model but that distinguish one population from another. In this case, although not radically, it is observed that there exists a lower willingness to invest in the community of *Laguna Kaná* with respect to *El Balcón*, probably reflecting factors other than those that were considered. A probable reason for this difference is that logging is much more important as a source of income for the population of *El Balcón*, reflecting the importance that this population gives to its care. Another likely

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<sup>5</sup> This government program classifies families as above or below the poverty level for assigning resources (PROGRESA) through a program of conditional aid.

reason is that *El Balcón* has superior social capital to that of *Laguna Kaná*, since in *El Balcón* the community decides to invest logging profits in public goods. These two elements could influence the fact that the members of *El Balcón* have a more positive attitude towards investment in public goods. It should also be pointed out that the result is consistent with the results showing that tropical forest communities have a higher discount rate than the temperate forest communities; therefore, there is more conservation in the latter (Velázquez *et al.*, 2002).

### *3.2.- Bequest Motive and Value of Future Use*

The second question which is analyzed is much more explicit in terms of linking the present sacrifice of earnings (or consumption) to bequeathing a reserve of natural capital to future generations that will allow them to continue with a productive activity. Two models were constructed for this purpose; the first was to identify the existence of a bequest motive associated with the use of the forest by future generations, that is, a paternalistic altruism. The second model, although similar to the first, sought to measure the “intensity” of this paternalistic altruism.

The first model was constructed with the following question: Do you believe the volume of the present harvest should be reduced to insure that your children will be able to continue to carry out forest extraction in the future?

The response to this question is dichotomous (Yes/No), which was analyzed by using a Probit model using as exogenous variables those defined in (1), while the endogenous variable was the occurrence of the event “reduction of present harvest”. The results of the model of best adjustment are shown in Table 3.

It should be mentioned that prior to asking this question, and regardless of whether the individual knew the present volume of harvest, each one was presented with the information of the volume of harvest and the distribution of benefits to be obtained from it in terms of direct income and public goods, if they existed.

The results show that the inclination to reduce the volume of the present harvest is the majority. Only 28.5% of those interviewed declared unwillingness to do so. Different variables such as age, sex, principal activity of the head of the household, livestock, number of individuals in the household, among others, were incorporated into the analysis, although only the variables of income and ownership of agricultural land had a significant effect on the intentions of bequeathing the forests of one generation to another to continue the timber yielding activity.

As can be observed, the results show that a household owning agricultural land will have about 22% more likelihood of reducing its current harvest to

favor the interests of the following generations, with respect to a household which does not own land. The explanation is evident; the capacity to generate income by means other than that of forest exploitation permits such a sacrifice.

On the other hand, with movements of income, the effect can be ambiguous due to its quadratic effect in the model. As estimators indicate, at relatively small income levels, the likelihood of giving up an income derived from timber yielding activity will grow to decreasing rates, until reaching a maximum (in this case this point was estimated at around \$4,500 pesos a month, which is an extremely high income) from which this probability begins to decline. This tendency has to do with two differentiated phenomena. The first explains the growing segment of the function and how that responds to the conjecture under which, at higher income levels, people can be more willing to sacrifice some of the present profits in favor of the future generations. The decreasing segment has to do with the economic structure of the populations under study. As was observed, the saddle point corresponds to a very high income and is limited to the best paid jobs of *El Balcón* in the forest enterprise. Thus, those households that depend on this activity for a living are less willing to make decisions that will reduce the profits of this sector. The effect in this segment is comparable to that found in “non-industrial private forest” owners with forests in good condition and with high yield (Conway *et al.*, 2003).

An interesting result of this case is that there are no differences between communities, or among members of the community, with or without land ownership rights. This result shows that the bequest motive is not necessarily related to the direct participation in the profits associated with timber exploitation, but rather there must be other perceptions regarding forest goods and services. The above is derived from the fact that not all of those individuals interviewed receive benefits from the timber exploitation activity, either directly, nor in the form of public services.

In an attempt to evaluate disposition to reduce the present level of timber harvest, a referendum type question was asked, but was unanchored. The objective was to take advantage of the fact that the decision to determine the volume of harvest (at the lowest) lies in the hands of a community assembly in which the members of the community with ownership rights have a voice and vote, whereas the members without ownership rights only have a voice. According to Hanemann (1994), the mechanism produces a compatibility of incentives and does not have the problem of a bias due to anchorage (Green *et al.*, 1998). Given that the timber volumes and characteristics of these volumes are different in both communities, it was decided to present this question in terms of a percentage of reduction of timber harvest. In this way, the measure of this disposition was approximated by means of the percentage of volume of harvest of the community that the



head of the household surveyed would ask the general assembly to reduce. Evidently, this approximation does not allow a comparison of the monetary value between the two communities; however, it does permit a comparison of their perception in terms of the benefits they obtain. In other words, we consider that this willingness to pay is more an expression of attitude towards bequest (Kahneman *et al.*, 1999), than an indication of economic preference in the strictest sense (Mitchell and Carson, 1989). In this sense, the analysis did not try to estimate the parameters of the distribution of the willingness to pay function, but only to define the determinants of this bequest attitude. The question used in the analysis was the following: By what percentage do you think that the assembly should be asked to reduce the volume of harvest to insure that your children will continue to work in forest activity?

The average value of percentage of harvest that the community members are willing to reduce was 30.36% (Min = 0, Max = 60%), with a standard deviation of 14.27; seventy-one percent of the total sample of the heads of household showed willingness to reduce the current harvest flow on behalf of the future generations.

After testing various models those of best adjustment are very similar to the previous model, although it allows a better identification of the donor. Clearly for this analysis the variable "income" turns out to be endogenous, since for many members of the community the larger the reduction in harvest flow the lower the income received from forestry activities. For this reason, the models tested with the variable income used instruments for this variable in a first stage equation. The best approximation for such an equation is shown in Table 4.

The percentage in which a community member is willing to reduce the current timber harvest flow is shown and was modeled as a Probit model with a set of instruments for the variable income. Results for the best fit are shown in Table 5.

Relating the previous econometric exercise to the present one, it is again observed that age is inversely related to the willingness to sacrifice current consumption in favor to future generations. The model also suggests that the level of education is a determinant in defining a wish to bequeath to future generations; the larger the numbers of years in school, the larger the percentage of current harvest to sacrifice in order to favor future generations. This effect has been documented by Lockwood *et al.* (1993) and Riddel and Shaw (2003), and explained as the better knowledge regarding environmental benefits from educated people.

For this fit, the differences of both communities was also evident, and once again the community with lower social capital, with less investment in public goods and services, and with lower quality and quantity of resources, is less willing to accept a cost in order to ensure a forest area for future generations.

Monthly income is a variable that does not look to follow the expected trend. However, in this last analysis it is related to the reduction in harvest flow, which has some endogeneity embedded. Observe, that monthly income has a relatively low marginal effect, and with a negative sign. It implies that the larger the income the lower the willingness to accept a reduction in the timber harvest flow. This behavior is expected for households receiving wages from the CFE, or those with property rights and participating in the distribution of profits, since those profit shares or wages directly depend on the harvest flow. However, remaining the community members should have an expected trend, namely, the higher the income the higher the willingness to pay, unless up to a certain limit, as was the case in the previous analysis. It turns out that all community members depend on logging, either directly or indirectly, through job related activities, or for the provision of public goods and services from the CFE. This is what is driving an undefined trend at low and medium incomes, which ultimately is leveraged by large incomes that clearly are not willing to reduce harvest levels.

This behavior is interesting in that it demonstrates that poor forest communities are willing to contribute some additional labor to ensure the permanence of the forest, or to accept a reduction in their income from harvest activities to accomplish the same goal. However, when confronted with a real reduction on their “secure” income or benefits they still show a willingness to accept a cost, but they estimate the trade-off between inheriting an asset and reducing their income.

## *Conclusions*

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In this study, the existence of a bequest motive, or intergenerational value, closely related to the conservation of forests is confirmed for controlled logging under management plans by forest communities, has been confirmed. This attitude of bequest undoubtedly makes it possible to mitigate the loss of forests in the hands of the rural communities that manage forest resources and that find themselves in a marginal situation. Depending on the modality of effort, an elevated figure that ranges from 83% and 71% of household heads declared willingness to make an altruistic sacrifice for the subsequent enjoyment of this resource for their children. It was detected that there is a greater propensity toward carrying this out in terms of work effort, which would allow future yields of natural capital (reforestation tasks), rather than sacrificing present profits (reduction of the volume of extracted harvest). In the study arguments are confirmed that indicate extreme poverty causes this altruistic disposition to be reduced, although without ceasing to be positive. However, when constructing a finer analysis and taking into account income as a continuous variable, it is observed that the bequest disposition is not related in a linear form to income. In our particular case, this surprising fact is due to those homes with higher incomes diminishing this sacrifice to some degree, to the extent that logging activity is their principal source of income. In this sense, the study shows that land reserves allow the diversification of sources of income and demonstrate that the bequest value may be increased with the greater the amount and variety of productive resources. The political implications are relatively clear. An effort aimed at diversifying a population's source of income and reducing their poverty can have a significant effect on conservation, through the effect of the value that people place on the possibility that their children will be able to enjoy these resources in the future.

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TABLE 1. SOME DESCRIPTIVE STATISTICS OF STUDIED COMMUNITIES

<i>Variable</i>	<i>El Balcón</i>	<i>Laguna Kaná</i>
	<i>n= 66</i>	<i>n= 162</i>
Age of the household head (years)	38.8	43.6
Education (years)	3.6	5.5
Household members	6.3	5.5
Area of agricultural parcel (ha)	4.9	1.6
Monthly income (pesos)	2,836.8	807.2
Timber harvest volume (m <sup>3</sup> /a) in the community	20,000	750*
	<i>Percentages (%)</i>	
Owens agricultural plot	87.9	82.4
Beneficiary of PROGRESA**	81.8	64.9

Source: Personal elaboration, based on the surveys made in homes in 2002.

\* / Mahogany and red cedar

\*\* / The Programa de Educación, Salud y Alimentación (PROGRESA) consists of a system of subsidies aimed at households whose living conditions are considered to be of extreme poverty.



TABLE 2: WILLINGNESS TO ACCEPT DAYS OF WORK TO REFOREST WITHOUT PAY

**Dependent Variable: Number of days of work to reforest without pay (per year)**

Variable	Estimate	t Statistic	Prob > t
** Age (years)	-0.020	-5.278	0.000
** [Monthly income] <sup>2</sup> (pesos)	8.46e-09	2.276	0.024
** Gender (1 = female)	0.427	3.335	0.001
** Poverty status (1 = beneficiary of PROGRESA)	-0.187	-4.363	0.000
** Number of household members	-0.145	-2.264	0.025
** [Number of household members] <sup>2</sup>	0.008	1.983	0.049
** Community (1 = <i>Laguna Kaná</i> )	-0.443	-3.133	0.002
** Intercept	2.924	8.425	0.000

$R^2 = 33.78\%$  ,  $n = 175$

\* Significance level  $\alpha \leq 10\%$

\*\* Significance level  $\alpha \leq 5\%$

TABLE 3. LIKELIHOOD TO REDUCE CURRENT HARVEST FLOW

**Dependent Variable: Willingness to reduce current harvest flow in favor of the future generation (Yes = 1, No = 0)**

Variable	Estimate	t Statistic	Prob > t	Marginal change
** Monthly income (pesos)	4.11e-04	2.468	0.013	0.012%
** [Monthly income] <sup>2</sup>	-4.51e-08	-2.305	0.021	-1.00 e-06%
** Agricultural plot (1= owns)	0.737	2.726	0.006	22.015%
Intercept	-0.272	-0.920	0.357	-

Concordant predicted probabilities = 72.41% ,  $n = 175$  ;  $-2 \text{ Log L} = 1719.877$

\* Significance level  $\alpha \leq 10\%$

\*\* Significance level  $\alpha \leq 5\%$

**Dependent Variable: Monthly Income**

Variable	Estimate	t Statistic	Prob > t
* Age (years)	-11.378	-1.98	0.0500
** Agricultural Land (hectares)	122.044	2.61	0.0098
** Remittances (1=receive))	233.239	2.52	0.0127
** Livestock (number)	56.168	6.47	0.0001
** Forest Activities (1=employed by the CFE)	1390.021	3.54	0.0005
** Community (1 = Laguna Kaná)	-1684.44	-6.65	0.0001
** Intercept	3203.578	8.06	0.0001

$R^2 = 58.09\%$  ,  $n = 201$ ,  $F=24.09$

\* Significance level  $\alpha \leq 10\%$

\*\* Significance level  $\alpha \leq 5\%$

table 4. estimate of income

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**Dependent Variable: Percentage of reduction of current timber harvest flow.**

<b>Variable</b>	<b>Estimate</b>	<b>t Statistic</b>	<b>Prob &gt; t</b>	<b>Marginal change</b>
** Monthly income (pesos)	-0.000270	6.8269	0.009	-0.01%
* Age (years)	-0.008740	3.7235	0.0537	-0.22%
** Education (years)	0.036500	4.034	0.0446	0.91%
** Community (1=Laguna Kaná)	-1.2344	27.7097	0.0001	-30.86%
Intercept	0.2952	0.4998		

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Concordant predicted probabilities = 59.7% ,  $n = 175$  ;  $-2 \text{ Log } L = 1688.9546$

\* Significance level  $\alpha \leq 10\%$

\*\* Significance level  $\alpha \leq 5\%$

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table 5. percentage in which a community member is willing to reduce the current timber harvest flow

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