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Do Payments for Environmental Services promote Conservation in Costa Rica? A Tale of Two Regions

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Introduction

This research paper will evaluate the environmental policy that was recently implemented by the Costa Rican government: payments for environmental services (PES). This policy has been hailed as innovative because, theoretically, it relies on market mechanisms to achieve environmental goals. Payments for environmental services seek to give a monetary value to previously ignored non-market benefits of forests. By valuing these benefits and compensating landholders for providing them, it is hoped that landholders will be more motivated to keep their parcels as forest cover and be less inclined to change to other land uses. The program is especially concerned with small landholder incomes so that through these payments this group of agents will find it financially attractive to conserve forests. The PES program has been well received by international institutions such as the World Bank. Other developing countries, including Central American countries, are also seeking to imitate this type of policy.

Unfortunately, as this research has found out, the current policy does not provide enough of an incentive to encourage conservation by small landholders in areas of high conservation priority. The two areas that were analyzed were the Huetar-Atlantic and Brunca Regions. Conservation remains an unprofitable activity, and agricultural land use represents a more financially attractive option for small landholders in these areas. The opportunity cost of conservation remains very high.

Conservation is only promoted at the margin, in lands that are very infertile and unsuitable for agriculture. Private reserves that had been previously set aside for conservation seem to be benefiting from the current payments because they provide enough to cover maintenance costs of the reserves. However, the owners of these reserves are not dependent on these properties for income.

The research has also been able to determine that current payments are not even deterring inappropriate deforestation because they are not fully internalizing all of the non-market benefits of the forest. Current deforestation is also occurring on moderately fertile or infertile soils where conservation or sustainable forestry would be preferable. The amounts that are now being disbursed do not correspond with valuations of the non-market benefits of the forest.

An important argument of this paper is that there may be a significant difference between the total economic value of a pristine forest and a managed one. Most authors have assumed that conservation and sustainable forestry are the same, yet this cannot be valid in light of evidence in Costa Rica. Many landholders in Costa Rica have set up private reserves and sacrifice timber harvests in order to fully conserve the forest. This would not make sense from an economic point of view unless intact forests are in some way more valuable than intervened forests. It should be determined then whether pristine forests offer more non-market benefits in terms of environmental services; bequest values or existence values than managed forests.

The results of this research paper have to be interpreted in the context of several issues and limitations. The first important limitation is that there is no data available on regional deforestation rates in Costa Rica. This inhibits the cross-section comparison of deforestation rates between the two regions as well as time-series analysis for both regions. Important sources like the Tropical Science Center and the Centro de Investigaciones en Desarrollo Sostenible have said that deforestation rates in both the Huetar-Atlantic and Brunca regions are high and that current trends in private lands will wipe out remaining natural forest (outside of public reserves) in a few years. However, they do not provide the specific data.

Finally, it has to be understood that the decision to conserve a forest may be influenced by other factors besides rational, economic decision-making. If small landholders feel that forests have a spiritual value to them, as may be the case for some indigenous groups, they may be willing to conserve even if it is not financially viable option for them. Risk can also be an influencing factor in the decision-making process. Agriculture can involve some uncertainty that conservation doesn't, making a smaller but steadier flow of cash preferable to a higher but more uncertain one. Also, farmers may not have perfect information on the potential returns from competing land uses (Howard and Valerio 1996). Clearly, the decision to conserve can be quite complex and economics is only part of the explanation.

This paper has been divided into five chapters. This chapter, Chapter One, contains the introduction and explains the focus of this paper. Chapter Two explains the theoretical framework that will provide the tools to make the analysis. The framework used is the theory of valuation and its relationship with cost-benefit analysis is also explained. This is followed by Chapter Three which gives a brief but important background about deforestation and the Payments for Environmental Services program in Costa Rica. This chapter is necessary to familiarize the reader not only with the PES and its logic, but also with deforestation in the country. A definition for deforestation is clearly established in order to maintain consistency in the analysis. Once the theory and background are established, Chapter Four describes the methodology used to conduct the analysis. The methodology includes a cost-benefit calculation of the different land use options available to small landholders in the areas of study. Chapter Five shows the results and engages in a discussion of these results. The final pages are dedicated to conclusions and some recommendations.

Focus of the study

The following research will evaluate whether an innovative environmental policy by the Costa Rican government called Payments for Environmental Services promotes conservation in two of the most highly deforested areas in Costa Rica, the Huetar-Atlantic Region and the Brunca Region. Currently, these two regions face pressure from financially constrained peasants and indigenous groups who accept offers from loggers to clear-cut their properties and then use the land for agricultural production.

By giving monetary values to environmental benefits from conservation, the government of Costa Rica seeks to modify the land use decision-making process and make small landholders less inclined to changing to agricultural uses. The policy wishes to boost landholder incomes with these payments and in this way promote conservation of forests on these lands.

Since small landholders depend on their properties to obtain revenue, i.e. cultivate and sell the products in the market, the policy would have to make out of conservation a financially viable option in order for small landholders to adopt it. For this reason, this research has used cost-benefit analysis to evaluate which form of land use, agricultural production, conservation, or sustainable forest management is more profitable for small landholders. Forest management is presented as one of the land-use options because it is compensated by the PES program as a separate alternative to conservation. In the economic literature that has been reviewed, sustainable forest management and conservation are lumped into a single category. However, as this study will show, there are reasons to believe that these two are not necessarily perfect substitutes. These two activities may not yield the same amount of non-market benefits. Private landowners are engaging in conservation and renouncing to timber harvest benefits, meaning that the non-market values of intact forests may be higher than those of sustainable forestry.

After the cost-benefit analysis is carried out, the theory of valuation is used to assess the accuracy of these payments and what modifications may be needed for the improvement of the program.

The main hypothesis of this paper is:

- The current system of payments for environmental services does not promote conservation by small landholders in the study areas.

Other hypotheses that will help answer the main hypothesis are:

- Conservation remains an unprofitable activity for small landholders relative to other land use options available in both regions.
- Current payments for environmental services do not curb inappropriate deforestation
- The current difference between payments for conservation and sustainable forest management is unjustified from an economic point of view and should be reversed (conservation should receive higher payments)

The main questions to be answered by this paper have been established. The analysis will now aim to answer these questions, always taking into consideration limitations such as data availability and complexities not present in economic theory. The following chapter will describe the theoretical framework that will provide the conceptual tools to answer these questions.

Chapter Two

Theoretical Framework

Section I: The theory of environmental valuation

A basic principle in the field of economics is that resources are scarce, and that due to this reality, individuals must make choices about the allocation of these resources. If individuals have information on these resources (or production based on these resources) such as prices, characteristics, and qualities then it is possible to make an accurate choice on their allocation. The choice is made by weighing the information on quantity, quality and price on offer, as well as some uncertainty arising from incomplete information (Pearce 1993).

However, when it comes to environmental assets and services, information is limited and there is no price in the market place on which to base decisions. Environmental goods are public; they display characteristics of joint consumption and non-exclusion. This hampers the development of a market for environmental goods and services. Making a choice regarding environmental goods and services becomes more complex than in purely private goods and services. A priced good must be compared to an unpriced good. For example, sometimes a choice must be made between converting land to agriculture with tangible monetary benefits or conserve it in its pristine state. Conservation means that there will be environmental goods and services provided, but since there are no market prices available for them, monetary benefits are not accrued. Agents may not want to adopt this form of land use, even if it does have considerable benefits.

The importance of economic valuation then becomes clear. In the market, individuals compare their willingness to pay with the price of a good. Goods are purchased when the willingness to pay equals or exceeds price, not otherwise. Imputing values on environmental goods and services implies finding a willingness to pay measure in circumstances when markets fail to reveal this information (Pearce 1993).

When the market fails to attach a value to environmental goods and services, as well as to the costs of their degradation, misallocation of resources will occur. Market failure also occurs when wrong values are attached to these goods and services, as when marginal private costs, benefits, or products differ from social ones. The wrong choices will be made because there is no information available on true costs and benefits. These costs and benefits can be borne by a private individual, but they can also be borne by third parties or by society as a whole. Proper valuation of these environmental values will provide more information and might lead to more correct choices when incorporated in decisionmaking. Economic valuation is a method that allows the disclosure of the true costs of consuming environmental resources (Pearce 1993).

Instruments are the mechanism whereby environmental values are incorporated into the decision-making process. If cutting woodlands by private agents leads to social losses in terms of soil erosion, watershed protection, biological diversity, etc, then the value of these losses should be reflected in private decision-making. The incorporation of environmental costs and benefits can be achieved through the implementation of standards, taxes, permits, incentives, etc. Valuation in the context of these instruments is essential because it gives the scale or strength of the instrument that is to be applied. Many instruments are applied without clear or detailed rationale, and this can compromise their effectiveness. Valuation is helpful as a check on criteria being used to design a policy (Pearce 1993).

Section II: Cost-benefit analysis and its relation to environmental valuation

The benefit-cost rule states that in order to choose between two project options, at the private or public level, their net discounted benefit streams must be compared. If benefits minus costs of project A are greater than benefits minus costs of project B, then project A must be undertaken.

A more specific example in the present context is provided by the option of conservation versus agricultural conversion. Landowners will allocate their properties to the use that maximizes their utility. A stand of forest has competing uses, and a landowner will choose the land use path that yields the most net discounted benefits. Net benefits from conversion of forestland are obtained from the production of agricultural goods on newly converted forestland. The net benefits from conservation include environmental services, non-wood forest resources and amenity services (Barbier and Burgess 1997).

Conservation benefits are a mix of cash flows and non-market benefits. Two biases are introduced when decisions are made following the cost-benefit rule. The first bias is that an option with tangible cash flows is made to appear more 'real' than an option without cash flows. Decisions are then made in favor of the conversion option because conservation benefits are not calculable. The second bias, related to the first, is that unless incentives are devised to internalize non-market environmental values in the land-use choice process, conservation benefits are downgraded. Those who benefit from timber extraction or agricultural clearance cannot consume non-marketed benefits. The asymmetry of values leads to biases in the decision-making process (Pearce 1993).

Once again, the process of valuation becomes crucial, because it is the only way by which the asymmetry of values will be corrected. In order to measure the benefits of a conservation option, the total economic value (TEV) of a forest must be derived. Total economic value is the sum of its use-value and non-use value, or TEV = UV + NUV. Use value is then subdivided into direct, indirect, quasi-option and option values value. Non use value is made up of existence and bequest values, although sometimes bequest value is not separated from existence value.

Direct use value of the forest would include sustainable timber yields, non-timber products, recreation, medicines extracted from the forest and plants. It is a straightforward concept but not necessarily easy to measure because the markets for most of these goods are limited. Indirect use value includes nutrient cycling, watershed protection, air pollution reduction and microclimate regulation. Many of these benefits accrue at the social level, i.e. they are not enjoyed by one individual but by society as a whole. Measurement of these indirect values can be a complicated task. Quasi-option value refers to the benefit from delaying current development of a forest as more becomes known about future benefits and costs in the next period (Bulte et al 2001). "As the prospect of receiving better information in the future improves, the incentive to remain flexible and take advantage of this information also increases" (Bulte et al 2001:2). Option value also makes up an important part of total economic value. Option value is the willingness to pay to conserve a forest for future use. No use is made of it now, but in the future. It is a kind of insurance premium "to ensure the supply of something the availability of which would otherwise be uncertain" (Pearce 1993:20). There is no guarantee that this value is positive, but in the case of forests, the supply of their goods and their environmental qualities are threatened by deforestation. Existence value is the value that is given to a good simply because it exists. Empirical measures of existence value have revealed that it can be an important component of TEV, particularly when the asset is unique (Pearce 1993). Bequest value, or the value of leaving something for future generations is sometimes regarded as another component of non-use value, other times it is simply lumped together with existence value. In summary, TEV = DUV + IUV + QOV + OV + EV, where DUV, IUV, QOV, and OV represent use values, and EV (and BV if the case) represents non-use values.

The components of TEV are additive, but one must be careful not to add competing values. Trade-offs exist between different types of use value and between direct and indirect use values. The value of clear timber felling cannot be added to the value of timber forest products or sources of indirect value such as regulatory functions (Pearce 1993).

If the TEV of a forest can be determined or at least closely approximated, then it can become incorporated through instruments in the decision-making process. Tangible cash flows can now be derived for environmental benefits from conservation and they can be compared with cash flows from other land use options. This would in theory correct for biases and lead to an appropriate allocation of resources. "To summarize, it is important in making forest land allocation decisions to include all the benefits and costs, including environmental values, associated with alternatives. The failure to do so will result in a less than optimal allocation of land" (Barbier and Burgess 1997:177).

Before engaging in the literature review, it is important to mention that cost-benefit analysis has its limitations. One of its most important problems is that it is deterministic: cost-benefit analysis assumes that all benefits and costs of forest conservation are known and readily comparable (Bulte et al 2001). Current knowledge about the benefits of forest conservation is limited. Even valuations of direct-use value, such as sustainable extraction of fruits, latexes and hunting, are very site specific and cannot be extrapolated to expanses of rainforest. Other TEV components such as quasi-option value are often overlooked in cost-benefit analyses (Bulte et al 2001). Nevertheless, the studies that have used cost-benefit analysis provide important insights.

Section III: Review of the literature

This section provides a review of some studies that have been conducted which apply the cost-benefit rule for their analysis. Given the importance of valuing environmental costs and benefits, one would assume that studies abound which take these values into account. Unfortunately, as Barbier and Burgess (1997) have found out, "a recent review of case studies on the economic evaluation of forest land use options found only 55 studies that were strictly relevant" (Barbier and Burgess 1997:176). Most of these studies simply present data on net benefits of a single form of land use and do not analyze economic tradeoffs. The ones that will be reviewed here do attempt to compare tradeoffs.

The studies that will be discussed yield some important information for the current research paper. First, they point out the relevance of incomplete information available to landholders in Latin America. The costs and benefits of land use options over extended periods of time may not be available to farmers. They highly value immediate wages and profits even if this means no return to capital. Some land use options, such as sustainable forest management and conservation, are poorly understood or information is not available. This is clearly relevant to Costa Rica because farmers that live in remote areas may not be aware that they have access to the current system of payments. Factors of uncertainty and dependability, as in the Pinedo-Vásquez (1992) study, also clearly influence private decision-making.

Howard and Valerio (1996) used discounted cash flow analysis to estimate potential returns from three land use options available to landowners in Costa Rica: sustainable forestry management, cattle ranching, and crop production. Growth and yield models were used to predict periodic timber yields from a sample of forests in the three most important timber producing regions of the country. Information on costs, product yields and prices for cattle ranching were obtained from several sources including regional offices of the associations of cattle producers and interviews with ranchers. Information on corn and bean production was obtained from regional offices responsible for setting prices, buying from producers and selling to large-scale producers. They used a recursive system, a simultaneous set of regression equations fitted one at a time in a logical sequence, to predict product yields and harvesting costs for both crops. The range of product yields was used as a means of exploring the effect of variations in site quality and soil fertility for which the authors had no information. This kind of regression analysis is a valuable tool to add reality to the cost-benefit analysis. Unfortunately time constraints and difficulties in data gathering did not permit the application of this technique in this research paper. The authors used a planning horizon of 80 years and a real discount rate of 10% to conduct their analysis. Liquidation timber harvest of 60% prior to conversion was used as a baseline for all agricultural options, and it was increased to 80% to account for the possibility of illegal removals. The authors also use a range of price change scenarios for timber, beef, beans and corn.

Howard and Valerio (1996) found that financial returns to sustainable forest management of existing, untreated natural tropical forests are higher than the traditional uses outlined in their paper under some conditions. Stumpage price appreciations made sustainable forest management out-compete agricultural production options over a range of scenarios. Howard and Valerio (1996) conclude that in many cases, landowners were not basing their land use decisions on economic grounds alone. Landowners may be adverse to the periodic nature of cash flows associated with sustainable forestry management. Operating a farm at break even levels may provide an annual wage to landowners which is highly valued, even if there is no return to capital. They also believe that landowners may lack information on returns and technical requirements for the forestry alternative.

Pinedo-Vásquez et al (1992) analyze and compare the economics of timber extraction, swidden (an area cleared for temporary cultivation by cutting and burning the vegetation) agriculture, and harvesting of fruits and latexes from an intact forest within a single village in Iquitos, Peru. The authors obtained a representative sample of the secondary forest community using a doubly random sampling procedure to identify sampling subplots. Production costs and price data for timber resources and agricultural crops were obtained from the Federación Departamental de Campesinos y Nativos de Loreto. Extensive interviews and surveys were conducted. The authors attempted to quantify the net economic costs and benefits that would accrue to rural populations from a one-time removal of commercial timber. They also estimated revenues from swidden agriculture for a range of discount rates (5% to 15%). Pinedo-Vásquez also consider the collection of fruit and latexes from the forest as a separate alternative management scenarios for forestland. The results of their analysis indicate that rural populations in the region will continue to convert forestland to swidden markets for agricultural staples are more dependable than markets for perishable goods with limited markets (such as forest fruits), there is more of an incentive for communities to engage in agriculture. Government credit is available for agricultural production. Also, one-time exploitations of timber resources are compatible with swidden agriculture. This adds more net revenues to the first swidden rotation of crops. The authors consider the current behavior of the ribereño communities to be logical and expected.

Barreto et al (1998) compare the costs and benefits of alternative logging practices in eastern Amazonia. The authors mapped and measured all trees of commercial value with a dbh[1] greater or equal to 25 centimeters. They estimated productivity of tree felling by measuring the volume felled over 3 days in a planned operation and over six days in an unplanned operation. Estimates of total wood volume extracted in each area and total road and log landing area allowed the authors to determine productivity. Wood waste with and without planning was estimated based on the length and diameter of the parts of the trunks that were wasted. They conclude that planned timber extraction operations can be more profitable than unplanned operations. The study however does not consider the long-term ecological and biological impacts of timber extraction. Their study is not an endorsement of Amazonian logging even in the presence of 'best practices' (Barreto et al 1998). They conclude that management techniques have generally not been adopted in eastern Amazonia. Benefits of planned extraction are not understood and unplanned extraction remains profitable.

[1] Diameter at Breast Height

The present study uses an approach similar to these other studies, but also has important differences. Cost-benefit analysis is used as a tool to compare different land use options for small landowners after they are compensated with payments for environmental services. Cash flows from each of the land use options include payments for environmental services to determine whether these payments are enough to motivate landholders to conserve the forest or use it in a sustainable manner. Since Costa Rica is one of the first countries to implement a market-based incentive mechanism for conservation, there are no studies that have yet evaluated the potential success of such policies. Cost-benefit analysis was chosen because it yields specific information on the economic incentives present to adopt a certain form of land use in the chosen areas. The theory of valuation, specifically theory on the total economic value of forests, is used afterwards to assess the accuracy of these payments and to suggest changes that may need to be made in order to improve the program.

Chapter 3

Deforestation and the PES program in Costa Rica

This chapter will provide a brief but necessary background about deforestation in Costa Rica, its current trends and the role of that the PES program plays in curbing it. As the chapter will explain, there is still no good solid data on deforestation in Costa Rica, neither for the country as a whole or at a regional level. The Tropical Science Center/ Centro de Investigaciones para el Desarrollo Sostenible (1998) study is the most recent one but the methodology used only compares changes in forest cover from 1986/1987 to 1996/1997. It also provides more qualitative rather than quantitative information on deforestation, especially at a regional level. The chapter also describes the workings of the Payment for Environmental Services program and its current propects and limitations.

Defining deforestation

Before trends in deforestation in Costa Rica are discussed in detail, deforestation must first be defined since "different perspectives on tropical forests lead to very different definitions of deforestation" (Fairhead 1998:6). Environmentalist definitions by ecologists and conservation agencies such as the World Wildlife Fund, the International Conservation Union and the World Conservation Monitoring Center consider the impact of excessive logging, wood gathering, fire and livestock grazing as deforestation. More 'economistic' definitions of deforestation used by the Food and Agriculture Organization and the World Resources Institute consider the processes mentioned above as degradation but not deforestation unless the result is total conversion of forest to other land uses (Fairhead 1998).

For the purpose of this paper, deforestation will be defined as the conversion of natural, primary forest to agricultural uses. The selection of this definition is justified based on the findings from several sources. As stated by van Kooten and Bulte (2000), deforestation is primarily caused by a desire to convert forests to agriculture, especially in Latin America. In the case of Costa Rica, a survey conducted by the CATIE-World Bank in Costa Rica determined that clear-cutting to change the use of lands under forest cover to the production of subsistence crops and pastures is the main cause of deforestation (Lutz et al 1993). Landowners are the principal actors in the current process of deforestation because they seek revenue from the sale of timber and from using the land for agriculture. De Camino et al (2000) also found that the main change in land use in Costa Rica has been the transformation from forests to **pastures** and **farmland**. Chomitz et al (1998) state that agriculture has been responsible for replacing the forest. This process is also known as the expansion of the agricultural frontier.

Logging will not be considered as deforestation because, theoretically, all wood harvests in Costa Rica at this moment are 'sustainable'. All logging operations need a management plan so it falls under the category of sustainable forest management. This confirms van Kooten and Bulte (2000) who state that contrary to popular belief, commercial logging in the tropics rarely results in direct land conversion. Commercial logging in the tropics almost never involves clear-cutting. Selective

Commercial logging in the tropics almost never involves clear-cutting. Selective cutting is conducive to forest regeneration and regrowth. However, it is important to note that in many cases logging can be a catalyst to agricultural conversion. In order to transport logs from harvest areas to commercial areas, foresters have to construct a road network. "Roads then facilitate access for cultivation and increase the profitability of producing cash crops by reducing transportation costs" (van Kooten and Bulte 2000:443). Actual conversion is easier in selectively logged forests than in pristine forests because big trees have been removed. Agricultural conversion proceeds at a higher pace in over-logged forests as compared to pristine, undisturbed primary forests because commercial logging provides the necessary infrastructure (van Kooten and Bulte 2000).

It is also vital to identify two types of deforestation: appropriate and inappropriate. Appropriate deforestation occurs on good soils, and "results in sustainable, relatively high-value agriculture, and yields a one-time harvest of valuable timber" (Chomitz et al 1998:3). Even if forest benefits are priced and taken into account in the conversion process, some deforestation may still be desirable because the opportunity costs of conservation exceed its benefits (Bulte et al 2001). This cost-benefit calculation is not independent of the discount rate chosen. This is a choice that will inevitably influence the value of agricultural yields, conservation, and sustainable forestry yields. Real discount rates in developing countries are known to be relatively high compared to developed countries, making short-term agricultural production a more attractive investment than sustainable forestry and conservation with their longer returns (Bulte et al).

Inappropriate deforestation occurs on soils that are not appropriate for agriculture and on poor terrain, such as slopes. If yields from agriculture are lower than yields from conservation and forestry on these terrains, then clearly the area should be kept intact and free from conversion. The distinction between appropriate and inappropriate deforestation is crucial when one wishes to determine whether deforestation has made economic sense or been socially excessive. It is also an important distinction when discussing whether payments for environmental services have been accurately determined.

Current trends of deforestation in Costa Rica

Deforestation has become a major concern not only in Costa Rica but also worldwide because private decisions to convert forests to other land uses have not accounted for the value of the goods and services that these forests provide to various levels of society. Since external benefits do not enter a private landholder's cost-benefit calculus, social costs have exceeded private gains and too much forest has been converted from a social standpoint (Chomitz et al 1998). Surprisingly though, there is little empirical evidence to substantiate the claim that deforestation is socially excessive (Bulte et al 2001).

The most recent study of deforestation at the country-level was conducted by the Centro Científico Tropical and the Centro de Investigaciones en Desarrollo

Sostenible(TSC/CIEDES 1998). It is entitled "Survey of Forest Cover in Costa Rica, 1986/1987-1996/1997". This study had 3 main objectives:

- To estimate the extent and distribution of forest cover in Costa Rica in 1996/1997.
- To compare and contrast the changes in forest cover that occurred due to deforestation or forest recovery during the period , 1986/1987-1996/1997.
- To spatially locate the areas that receive incentives for forest protection and recovery.

The study also sought to fill in the gaps that previous studies conducted by the Ministry of Environment and Energy (MINAE) and the National Meteorological Institute (IMN) had left. The study used NASA's Pathfinder methodology for tropical deforestation to propose four different categories of forests: primary forests, intervening forests, secondary forests, and forest plantations whose density and crown cover could be determined by the method (De Camino et al 2000). The process then involves comparing the 1996/1997 classification with that of 1986/1987 to define areas where there was a change in forest cover. Areas with deforestation and with forest recovery can then be detected (TSC/CIEDES 1998). The results from the study are summarized as follows:

- Loss in forest cover from 1987 to 1997 diminished considerably if compared to data for the 1970's. The rate of deforestation between 1987-1997 reached about 16,500 hectares per year. This can be compared to an average deforestation rate of 50,000 hectares per year during the 1970's.
- Conservation policy, especially the creation of National Parks and Reserves, as well as an increase in citizen awareness for environmental issues during the last 10 years seems to have contained the process of deforestation in Costa Rica.

- Regions such as the Atlantic and Brunca regions still present considerable processes of deforestation, leading to ecosystem fragmentation.
- From the point of biological diversity, the loss in the quality of forest continues(TSC/CIEDES 1998).

De Camino et al (2000) summarize the current situation of forests in Costa Rica, based on the TSC/CIEDES 1998 study as well as earlier studies from the MINAE and the IMN. The final numbers obtained reveal that the annual deforestation rate between 1987-1997 was around 16,400 ha/year, and an annual reforestation rate of 22,282 ha/year. This leaves a net positive balance of 5,857 ha/year. Some of this regrowth represents plantations and spontaneous regeneration on abandoned pastures (Chomitz et al 1998). Costa Rica's forested areas are increasing, but the controversy remains that since much of this is due to regeneration of secondary forests in abandoned pastures as well reforestation, the quality of these forests in terms of biodiversity is lacking. "Deforestation continues, and the increased area of plantations and secondary forests has less environmental value than that of natural forests" (de Camino et al 2000).

The protected area system has been successful in curbing primary forest loss but outside of these protected areas forest degradation continues leaving a fragmented forest landscape (Chomitz et al 1998). Deforestation in the Atlantic area of the country as well as in the Brunca region exhibits important rates and considerable fragmentation of ecosystems and deterioration can be observed (TSC/CIEDES 1998). These regions are of high conservation priority due to the uniqueness and complexity of their forest habitats. The Brunca Region in particular has biodiversity as complex and rich as that of the Amazon rainforests or tropical forests of Africa and Asia (WRM 2001).

In conclusion, forest regeneration and reforestation in Costa Rica have increased forest cover, while publicly owned protected areas have also helped in curbing rates of deforestation. However, deforestation continues at considerable rates in private lands. Current deforestation rates are high enough to threaten the remaining natural forest. At the current rate of deforestation, all of the remaining natural forest will be gone in a couple of decades, except for those forests in protected areas. Unfortunately, even forests in protected areas will be harvested too when economic pressure increases (Bulte et al 2000). This is especially true in the Atlantic and Brunca regions, which are experiencing considerable forest loss and forest damage. The need for an appropriate evaluation of deforestation in Costa Rica is growing and "the question of proper valuing of forest functions in a monetary sense can be considered as a highly relevant issue in Costa Rica" (Bulte et al 2000:497).

Payment for environmental services

The concept of valuation that was explained in Chapter 2 serves as a platform to introduce the concept of payments for environmental services. The previous discussion on deforestation helps understand why private landholders are being targeted for the current program of payment for environmental services.

According to what was explained in the Theoretical Framework, values must be imputed for environmental costs and benefits and must be incorporated into decisionmaking if the appropriate allocation of resources is to occur. Otherwise, choices on this allocation will be biased in favor of activities and goods that yield tangible cash flows and ignore those that do not. If the goal is to preserve socially optimum levels of forest cover, then mechanisms must be introduced to compensate private landholders for keeping their forests intact and providing environmental goods and services. Forest preservation benefits both Costa Ricans and people around the world, so both Costa Ricans and international agents must pay for these services. "As long as forest owners are not compensated to take into account these benefits, they will choose to ignore them in making decisions about the use of natural forests (van Kooten and Bulte 2000).

The Costa Rican Forestry Law of 1996, law no. 7575 recognizes that forests provide four environmental services for society:

- Water Conservation
- Preservation of biological diversity
- Natural Beauty
- Carbon sequestration

This law does not only recognize these services, it also allows private forest owners to receive payments to compensate them for their expenditures in ensuring these services. A landowner will be more aware of the fact that his forests not only produce wood, but also other products like water protection, CO_2 sequestration, preservation of biodiversity, and natural beauty for touristical use" (Heindrich 1997:12).

The PES system is also claimed to respond to the Rio Declaration of Environment and Development where the principle of "polluter pays" was established. Payments are made by those who have consumed these services previously free of charge: hydroelectric power plants, the tourist industry, consumers of fossil fuels, and developed nations. The National Fund for Forestry Financing (FONAFIFO) is the administrative unit that manages the flow of funds from consumers of environmental services to producers of these services.

Sources of finance

FONAFIFO is responsible for obtaining the sources of finance necessary to implement the PES program. Until now, three definite sources of finance have been tapped: Joint Implementation, an eco-tax and forest conservation certificates. However, these sources are not without their problems and challenges. Other potential sources have been identified and several agreements have been made to transfer funds from consumers to producers. The following is a brief description of the available and potential sources of finance for implementing the PES program.

Collection of revenues from selling CO2 certificates to international buyers, also known as Joint Implementation (carried out through the Costa Rican Joint Implementation Office or OCIC): Since industrialized countries have made a compromise to curb their greenhouse emissions in compliance with the Framework Convention on Climate Change, they can then finance activities or measures that curb CO_2 in developing nations. The amounts of carbon trapped through the finance of such measures would lead to an achievement of their own national emission reduction targets. The funds go to FONAFIFO which is responsible for disbursing the payments to forest owners "who in turn relinquish their rights to market this CO2 fixation to FONAFIFO" (Heindrich 1997: 15). The funding potential from this source is considerable. However, the measurement of carbon quantities sequestrated as a result of project financing is difficult to measure and can be unreliable. Also, big countries like Brazil that contain more surface area of primary forest could become more important than Costa Rica as a potential partner for industrialized countries (Heindrich 1997).

Eco-tax on petroleum derivatives: The forestry law stipulates that one third of the revenues collected from a tax on fuel and other petroleum products should go to compensatory payments for environmental services. Unfortunately the amounts designated to the PES have not been disbursed by the government. In 1996 and 1997, $14 million were transferred each year with the purpose of financing the PES program. In the year 2000 only $1 million were transferred to the PES (Segura 2000). If the decline in the amount of resources assigned to the program continues, there will only be enough to cover existing contracts, while consumers continue to pay for the tax and producers who wish to participate on the program are kept out.

A forest conservation certificate (CCB): This forestry certificate is a copy of a prior Certificate for Forest conservation and the source of funding continues to be the state. In this case, the state provides a lump sum in the form of a tax exemption for those forest owners who conserve their forests without logging for the provision of environmental services. The CCB does not seem to relate to the new concept of payments for environmental services and there is no written explanation available as to why the government must fund it.

Tourism: Costa Rica's natural beauty is an important asset for one of its major industries and sources of foreign exchange, tourism. Unfortunately, as of yet tourism has not been tapped as a source of funding and no plans have been designed on its potential use. A tax or fee similar to the eco-tax could in principle be utilized (Heindrich 1997).

Biological prospecting: The National Biodiversity Institute (INBIO) has been established with the aim of using the country's rich biodiversity as a potential source of funds. InBio takes inventories and is in charge of biological prospecting to assess the amount of marketable substances that could in principle be used for pharmaceutical applications. If the substances discovered are then artificially synthesized by laboratories, Costa Rica could exploit intellectual property rights legislation to its own advantage and thus guarantee the flow of funds to FONAFIFO and then forest owners.

Power Plants: Costa Rica's main source of electricity comes from hydrological power plants. The logic is that these plants should be charged for the use of the hydrological protection services forests provide. Deforestation is responsible for water shortages and fluctuations in precipitation volumes (Heindrich 1997). The existence of forest cover is crucial for the provision of electricity. If suppliers of electricity are charged, they may be forced to raise prices and hopefully motivate efficient energy use by consumers. Currently, several private and public hydroelectric companies have compromised themselves to make payments for the provision of hydrological services (Segura 2000). This same concept of hydrological protection can be applied to waterworks

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Other sources

Other potential sources of financing for the PES include loans and grants from national and international donors, fund from international debt-for-nature-swaps and funds for the repayment of loans. Recently, the World Bank approved a US$33.9 million loan to support a US$8 million grant from the Global Environmental Facility to Costa Rica's National Forestry Fund (World Bank website 2001). This money is to provide funding for the PES program.

Amounts to be paid for compensation

The amounts that are paid as compensation for the provision of environmental services are as important as the sources of funding. It was mentioned previously in this chapter, the main culprit for deforestation in Costa Rica is the expansion of the agricultural frontier. Farmers can be motivated to conserve if they are compensated for the opportunity cost of sacrificing agricultural production on forest lands. However, conservation in these areas is difficult due to the high opportunity costs of holding on to natural forests. Forest ecosystems can only be protected if conservation and sustainable use are competitive with other forms of land use such as agriculture (van Kooten and Bulte 2001).

The initial amounts to be paid as compensation for the provision of environmental services can be seen in Table 3.1.

Table 3.1: Different promotional sums to be granted per hectare, based on type of forestry measure (in US$)

Measure	Sum (US $ per ha)	Time period	Year 1	Year 2	Year 3	Year 4	Year 5
Afforestation	540	15 yrs	50%	20%	15%	10%	5%
Management	320	15 yrs	20%	20%	20%	20%	20%
Forest conservation	200	15yrs	20%	20%	20%	20%	20%

Source: Chomitz et al 1998

There are several explanations as to how these sums were arrived to, but none of these explanations come from FONAFIFO itself. According to Heinrich (1997:25), "the sums involved are closely modeled after traditional promotional approaches." Compared to the system of promotion before the PES, the amounts for afforestation have remained the same, for forest management it has been reduced and for forest protection it has been raised slightly (Heinrich 1997).

Chomitz (1998) as well as Heinrich (1997) find the afforestation alternative to be extremely generous, "since financial analyses find reforestation to be preferable to alternative land uses such as pasture" (Chomitz et al 1998: 8). However, Chomitz (1998) believes that high discount rates and risk aversion among smallholders may discourage plantation investments and thus require higher promotional amounts.

Heinrich (1997) believes that this sum was derived probably based on the costs of the forestry measures since it incurs more costs than the rest.

As far as sustainable forestry management is concerned, the sum paid is probably a rough approximation of the opportunity costs of sustainable versus 'business-as-usual' logging (Chomitz 1998). If one compares the sums paid to sustainable forest management to that of conservation, the amount does not seem correct because forest management offers greater revenues and less environmental benefits. This is one of the most important points made by those who advocate immediate changes in the current system. Jimenez (2001), a biologist from the National Biodiversity Institute and Figuerola (2001), an ecological forester insist that forest management is already a profitable activity and it is damaging to environmental services provided by the forest. They advocate increasing the sum paid for conservation so that it can compete with management or eliminating the promotion from forest management altogether.

FONAFIFO reported some changes to these amounts in the year 2000, mainly that reforestation would receive \$509.90 per hectare, forest management \$311.20 per hectare and conservation \$198.7 (Sáenz 2000). There is no apparent justification for this change and why these amounts were chosen.

The sums paid out by the PES are intended as a lump-sum compensation for environmental services. The sums are paid over a period of five years but beneficiaries must pledge to maintain the same type of land use for another 15 years, for a total of 20 years. FONAFIFO has not provided any explanation as to why forest owners must maintain the same type of management for those additional years and why the payments only occur during five years. Environmental services are provided indefinitely, so the reason for this implementation procedure does not seem justified.

Monitoring requirements

In order to receive these promotional sums, forest owners must pass an independent inspection to verify the sustainability of their forestry measure. A certified forest management plan designed by a forestry engineer has to be presented for acceptance into the program. A simpler, less expensive plan has to be presented for conservation. After this initial presentation, the property must be visited regularly (about twice a year) by forestry engineers to assure compliance and for the proprietor to receive the funds. Strict monitoring is required to ensure that forests are being protected (conservation) or sustainably harvested (sustainable forestry). The responsibility of monitoring belongs to each participant's supervising forester, who is recognized as having 'public faith' and serves as a third-party certifier (Chomitz et al 1998). Monitoring by these foresters has become an important concern for officials in the Ministry of Environment and Energy, as well environmentalists. Authorities in the Ministry of Environment and Energy constantly complain about lack of resources to monitor foresters who are infamous for their corrupt practices. A formal system that audits foresters' reports is not in place, nor is there an independent certification procedure in Costa Rica to determine that a property is complying with what is required. Another problem lies in the fact that there is still no explicit penalty for noncompliance with the program (Chomitz et al 1998).

One can now make a short summary of the most important aspects of the Payment for Environmental Services Program. It is based on the idea that monetary values must be assigned to environmental goods and services that have until now been unpriced and ignored in the private decision-making process to either conserve a forest, convert it to agriculture or use it sustainably. It is also based on the 'beneficiary pays' principle in which those who consume these benefits must pay for them. The choice of funding sources for the program closely reflect this principle, except for the Forest Conservation Certificates that seem unrelated to the concept of environmental services. FONAFIFO hasn't specified how the amounts of compensation were derived although sources such as Chomitz et al (1998) and Heinrich (1997) provide some alternative explanations. However, no economic studies have been found to back these figures. The problem of monitoring has also risen. There are no clearly established certification procedures, and the integrity of foresters is highly questioned. Now that the background to deforestation in Costa Rica has been established and that the logistics behind the PES have been explained, the quantitative analysis can begin in the Methodological chapter that follows.

Chapter 4

Methodology:
Cost-Benefit analysis of land use options

This research is focused on two areas of high conservation priority in the country and also with high rates of deforestation. The two areas selected were the Huetar-Atlantic region as well as the Brunca region.

Land use options for small producers and peasant farmers were identified with the help of the Ministry of Agriculture and National Production Council (CNP). In order to compare profitability between different land-use options, cash flows were constructed for 3 land used options (agriculture, sustainable forest management, conservation) available in the Huetar-Atlantic and Brunca Regions.

Section I: Constructing cash flows

Main land use options for the Huetar-Atlantic and Brunca regions

The first step of the research was to determine the most important crop production options available to farmers in the Huetar-Atlantic region and in the Brunca Region. Information from the Ministry of Agriculture and the CNP reveals that the cultivation of root vegetables as well as basic staples such as beans and rice are important activities for small and medium size producers in the Brunca region. The National Banana Corporation or CORBANA also cites plantain as an important crop in the

Brunca region, although at 10 % lower yields than in the Huetar-Atlantic region due to different climatic conditions (Laprade 2001). The Huetar-Atlantic region exhibits similar cultivation options: root vegetables, plantains, bananas, chiles and palmito.

Information was available at a disaggregate level for the cultivation of root vegetables in both regions, as well as plantain. The Ministry states that root vegetable and plantain production have experienced important increases in the cultivated areas of these crops.

It has been assumed that production in both regions is carried out on sites proper for each of the options to obtain maximum yields. The Huetar-Atlantic region covers an area of more than 9,000 square kilometers with varied topography, and the Brunca covers a similar area (around 9,500 square kilometers) with varied topography as well. Climatic conditions also vary between regions. Given these facts, it is logical to assume that not all terrains will give maximum yields or be suitable for these crops. Unfortunately data was not available to compare differences in yields in sites less suitable for each of the production options.

Plantain and root vegetable production

Cash flows were constructed using costs and prices in US dollars. Net cash flows were computed as product yields and prices minus costs of production. The cash flows were then discounted at a baseline 10% discount rate to obtain the net present value, although different authors have used other discount rates. For, example Howard and Valerio (1996) use a discount rate of 10% equivalent to a nominal rate of

28% and a historic inflation rate of 18%. Bouman et al (2000) use a 7% discount rate in their application of a 'Sustainable Options For Land Use' model. They state that this discount rate is a reasonable approximation of the opportunity cost of capital under the conditions that existed in Costa Rica in the late 1990's. Kishor and Constantino (1994) experiment with interest rates ranging from 4% to 35% in an examination of private returns to different land uses in Costa Rica.

Before starting cultivation, the land must be cleared from all trees. Howard and Valerio (1996) provide data for the contribution of a one time clearing of forests to engage in agriculture. Landowners receive income from initial harvests of forests that remove all trees with commercial value. Subsequent cuttings provide no income, they are simply necessary for complete conversion of the land. Although volume per unit area removed in initial cuttings is difficult to estimate, owners can legally remove up to 60% of the standing volume trees larger than 60 cm in diameter at breast height (DBH). Adherence to these legal standards can be questioned though due to monitoring problems (Howard and Valerio 1996). This study assumes that legal practices are the norm and thus takes Howard and Valerio (1996) data for a one-time liquidation of 60% of the valuable trees in the property. For both plantain and root vegetable production, the contribution from an initial removal of all commercial tree species in the landholding was included in the cash flows.

Information on costs, product yields and prices for plantain production and root vegetable production were obtained from the following sources[1]:

- The Costa Rican Ministry of Agriculture and Ranching, CNP, regional branches in the Huetar-Atlantic and Brunca regions provided data for root vegetable production in both regions.
- Sergio Laprade, a technician from the Corporación Bananera Nacional (Corbana) provided information for plantain production in both regions.

The data for plantain production can be seen in Annex 1. This data is for a production intensity of 2500 plants per hectare. The price of plantain stands at US$8.70 per box. Laprade (2001) states that although there is some international fluctuation in plantain prices, the amount paid to the producers remains constant.

In plantain production, the period from planting to harvest is called a cycle, and one 'set' of plants will last 3 cycles due to loss of vigor from the parent plants. After this third cycle, a new set of plants must planted, although investment in seeds is not necessary since they will come from the previous parent plants. In theory, plantain production is a perennial crop and can be carried out indefinitely.

For root vegetables, production begins on year one and continues indefinitely without fallow periods. This is because preparation of the land requires machinery that increases costs so additional fertilizer is given to supply the necessary nutrients to the land. The minimum scale for this type of production is 3 hectares. This study has

[1] Considerable difficulties were encountered in gathering this information. Ministry officials are not

focused on the production of tiquisque, a kind of root vegetable available for small producers in both regions and with data available for both regions. The data for tiquisque production can be seen in Annex 2.

Sustainable forestry

"Sustainable forest management is the cultivation and exploitation of timber and non-timber forest resources for economic gain leading to a perpetual periodic yield of marketable products with strict preservation of capital" (Howard and Valerio 1996:36). Capital includes soil resources as well as the appropriate stocking level and species composition of the forest in use to maintain production possibilities. "This definition does not require and 'even-flow' of products" (Howard and Valerio 1996:36). Sustainable forestry, as the name suggests, can be carried out for indefinite periods of time.

The sources used to construct the cash flows for sustainable forestry are:

- Howard and Valerio (1996) who provide timber yields for sustainable forest management for both the southern region and the Atlantic region.
- Stumpage prices from the Costa Rican Forestry Chamber
- Bulte et al (2001) who provide a valuation of the annual benefits from the extraction of non-timber forest products and Kishor and Constantino (1994) who provide a valuation of the annual benefits from ecotourism in Costa Rica. This same valuation had to be used for forests in both regions because specific data is not available for each region.

always available or willing to provide it.

- Chomitz et al (1998) who provide information on the promotional amount paid to sustainable forestry through the payment for environmental services program. This amount is supposed to compensate for regulatory functions of the forest such as carbon uptake and storage and watershed protection, as well as habitat functions such as biodiversity protection and scenic beauty.

The data gathered allows the inclusion in the cash flows not only timber benefits available for sustainable forestry, but also non-timber benefits.

The analysis had to take into consideration price ranges paid for wood, so minimum, average and maximum stumpage prices for the two regions were used to determine different net present values for the different price ranges. Detailed data for the costs of primary forest exploitation was not available. However, the present situation of small and medium size farmers in Costa Rica allows us to work without this data and not introduce a major problem. Small landholders can ask formal logging companies to remove trees at no additional cost to them. All they need to have is a land title, which if not present available can also be paid for by the logger (Jiménez 2001). Detailed data for sustainable forest management can be seen in Annex 3.

Conservation

Absolute conservation of primary forest means that the forest will be kept intact indefinitely[2]. This means that no wood harvesting is allowed and only low impact activities such as non-timber forest products and low impact eco-tourism will be

[2] The PES requires that the forest be kept intact for at least 20 years.

sources of revenue from the activity. Non-market benefits compensated for by the PES are also included. Although most of the literature groups sustainable forest management and outright conservation together as one single form of land use, as mentioned before this should not be the case for Costa Rica. The government is currently paying different sums for each activity, and there are landholders who opt for one land use or the other. For this reason, this analyses seeks to construct a cash flow for conservation based solely on the payments for environmental services, as well as extraction of non-timber products and sustainable eco-tourism.
Information for provision of payments of environmental services from conservation was available from Chomitz et al (1998). These payments were included as contributions for conservation. Valuations for the extraction of non-timber forest products come from Bulte et al (2001) and values for ecotourism come from Kishor and Constantino (1994).

Section II: Calculating Net Present Values

The calculation of net present values was done in the standard fashion. According to the information obtained from all of the sources, all of these land-use options can be done indefinitely, even the agricultural activities. In situations for which the benefit streams extend over an indefinite period of time, one can calculate the net present value of a 'perpetuity' simply by dividing the constant amount by the discount rate. However, in the case of the benefit streams for all the land use options, benefit streams are not constant, they change over the time horizon. In this situation, it is valid to calculate benefit streams for fifty-years or more as a close approximation of the net present value.

Annex 4 shows the calculation procedure for all land use options available in both regions.

Chapter 5

Results and Discussion

This chapter will discuss the results obtained from the cost-benefit analysis. The results indicate that conservation cannot compete with alternative agricultural land uses in the study regions, even when promoted by the Payment for Environmental Services program. Sustainable forest management is not as profitable as agricultural uses, but it is preferable to conservation. It is also being promoted with a greater sum than a less profitable activity, conservation. Further analysis in this chapter also indicates that the promotional sum given by the PES to conservation does not correspond with valuations of the Total Economic Value of the forest, and should therefore by modified. If the sum is adjusted to compensate for non-market benefits, then inappropriate deforestation is more likely to be curbed than under the current system. Section I will discuss the opportunity costs of conservation and sustainable forest management, and Section II will analyze the relationship between the Total Economic Value and the sums that must be paid for non-market benefits.

Section I: The Opportunity Costs of Conservation and SFM

Tables 5.1 through 5.3 provide the net present value of the discounted benefits for the production of Tiquisque and Plantain in both regions. Minimum, average and maximum stumpage prices were used to determine the change in NPV due to these price fluctuations in the price of wood. Since agriculture entails, as mentioned before, a 60% liquidation of all valuable trees on the property, the NPV fluctuated accordingly. The most profitable activity in both regions is tiquisque, with low initial investment requirements and production starting on the first year. It is considerably more profitable in the Huetar-Atlantic region than in the Brunca Region. This is due to better farm prices available for producers in the region.

Better weather conditions for plantain production in the Huetar-Atlantic mean higher yields and utilities than in the Brunca region. However, higher initial investment costs may not make it as attractive as root vegetable production. The need for a minimum acreage of 1500 ha for the production of plantain could also deter potential producers from engaging in this type of production.

As far as fluctuations in NPVs due to changes in stumpage prices go, the NPVs in the Brunca region are more responsive to these fluctuations. The Brunca region has more valuable wood than the Atlantic region, therefore higher stumpage prices, although variations in stumpage prices between regions are also due to differences in transportation costs (Howard and Valerio 1996). Even if the law only permits a 60% liquidation of trees for agriculture, the high value of trees available in the Brunca region could tempt landowners to liquidate more than that percentage. This situation is not uncommon and has been documented by Howard and Valerio (1996). "Commonly, again because of slack enforcement, regulations have not been adhered to, so the cut per hectare has been somewhat higher" (Howard and Valerio 1996:37).

Table 5.1 Net present values per hectare of two types of crop production with prior 60% liquidation of all valuable trees in property (at average stumpage price)

Type of crop	Brunca Region (Osa)	Huetar-Atlantic Region
Tiquisque	$18,716.15	$24,627.85
Plantain	$7,204.37	$10,294.08

Table 5.2 Net present values per hectare of two types of crop production with prior 60% liquidation of all valuable trees in property (at minimum stumpage price)

Type of crop	Brunca Region (Osa)	Huetar-Atlantic Region
Tiquisque	$17,960.22	$24,441.11
Plantain	$6,517.16	$10,124.32

Table 5.3 Net present values per hectare of two types of crop production with prior 60% liquidation of all valuable trees in property (at maximum stumpage price)

Type of crop	Brunca Region (Osa)	Huetar-Atlantic Region
Tiquisque	$19,204.25	$24,776.24
Plantain	$7,648.10	$10,428.98

Given these results, one may question why any small landholder would want to engage in the production plantains given that root vegetables are more profitable. The reason is that not all lands in the regions are suitable for root production. As mentioned before, the two regions are characterized by their own diversity of products. The kind of crop that can be planted depends a lot on the type of soil, the topography and the micro-climatic conditions of the area where the parcel is located. Although tiquisque and plantain are the most widely spread crops in the two regions, not all lands are suitable for these crops, so farmers have to adjust to these conditions.

Complete conservation of forest cover has the least present value of all the options even after being compensated with Payments for Environmental Services. The results for conservation can be seen in Table 5.4.

Table 5.4 Net Present Value per hectare of full conservation of primary rainforest in both regions (with subsidy from PES)

PES Amount	Both Regions
$198.7 per hectare for 5 years	$468.64

Even with the payments for environmental services the opportunity cost of maintaining the land as forest is very high. A net present value of $468.64 per hectare for conservation must compete with net present values ranging from $17,000 to $19,000 per hectare for tiquisque in the Brunca region, to more than $24,000 in the Huetar-Atlantic region. In order for conservation to become profitable, payments need to be increased to meet, at least, the opportunity cost of conservation which can be obtained by looking at the value of production from other uses.

If one does not include PES compensation for conserving forests, the net present value for both regions is of only $318. For the Brunca region, a small farmer must be compensated with AT LEAST $7330.10 per hectare (for plantain production at a maximum stumpage price for trees) in order to deter him from changing forest land to plantain production. This involves a yearly disbursement of $748.98[1] per hectare as compensation. Minimum compensation for land suitable for tiquisque would be of $18,886.25 (at maximum stumpage price), or a yearly compensation of $1,929.77 per hectare.

For the Huetar-Atlantic region, a small landholder would need to receive at least $10110.98 (or $1,033.13 yearly compensation) per hectare (at maximum stumpage price) to not cultivate plantains and $25,094.24 ($2,564.09 yearly) (at maximum stumpage price) to not cultivate tiquisque and conserve the forest. In both regions, an economically constrained peasant farmer or indigenous person would perceive that conservation is a costly activity in terms of benefits forgone from engaging in this form of land use. Given that both areas have important populations of indigenous peoples as well as peasant farmers, such a result can be worrisome in terms of conservation potential.

The initial liquidation of valuable wood is an important source of initial income for the landholder. This corresponds with van Kooten and Bulte (2001) who state that if clear felling occurs to make room for activities such as agriculture, net discounted

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[1] This can be calculated using the capital recovery rate formula: $A = P\frac{i(1+i)^n}{(1+i)^n - 1}$ (Bouman et al

benefits can be high. The same authors estimate that rents from clear-cutting lie in between $1800 and $4,800 per hectare, without the inclusion of returns from subsequent land uses. This is in agreement with the figures obtained from the 60% liquidation of trees on the properties. For the Atlantic region, at average stumpage prices, rents from clear cutting are of $1,332, while the Brunca region yields rents of with an NPV of $3890. Clearly then, the value of the wood located in areas targeted for conservation is a very important determinant of the amount of compensation which is to be paid.

Sustainable forest management is by far a more profitable activity than conservation. Tables 5.5 and 5.6 show the net present values for sustainable forest management in both regions, at different stumpage prices.

Table 5.5 Net present values per hectare for sustainable forestry with stumpage price ranges (Brunca Region) including PES of $311.20 per hectare

Stumpage prices	Standing tree ($ per PMT)	Brunca Region (Osa)
Minimum	0.12	$3,332.15
Average	0.15	$4,001.74
Maximum	0.17	$4,434.09

2000).

Table 5.6. Net present values per hectare for sustainable forestry with stumpage price fluctuations (Huetar-Atlantic Region) including PES of $311.20 per hectare

Stumpage prices	Standing tree ($ per PMT)	Huetar-Atlantic Region
Minimum	0.07	$1,850.59
Average	0.08	$2,029.54
Maximum	0.09	$2,171.74

PMT: Pulgada Metrica Tica (362 PMT equal one cubic meter of wood)

The Osa Peninsula has the most productive forests in all of Costa Rica and also some of the most valuable tree species in the country. Unsurprisingly it yields higher net present values for all stumpage values than the Atlantic forests. Net present values for both regions include payments for environmental services. Higher values for sustainable management in the Brunca Region, specifically in the Osa Peninsula, correspond with claims from several sources about the abundance of management plans in this area (WRM 2001). As stated before, it has been assumed in this research that sustainable forest management follows the criteria stated by Howard and Valerio (1996). However, slack enforcement and monitoring make it doubtful that current sustainable forestry in Costa Rica follows Howard and Valerio's criteria.

Even without PES payments, sustainable forestry is still more profitable than conservation. Table 5.7 shows net present values for sustainable forestry with stumpage price fluctuation in the Brunca Region, without including the PES payment. The same information is available for the Huetar-Atlantic region in Table 5.8.

Table 5.7: Net present values per hectare for sustainable forestry with stumpage price fluctuations (Brunca Region) without PES payment

Stumpage Price	Standing tree ($ per PMT)	Brunca Region
Minimum	0.12	$3,087.87
Average	0.15	$3,757.76
Maximum	0.17	$4,189.82

Table 5.8: Net present values per hectare for sustainable forestry with stumpage price fluctuations (Huetar-Atlantic Region) without PES payment

Stumpage Price	Standing tree ($ per PMT)	Huetar-Atlantic Region
Minimum	0.07	$1,606.31
Average	0.08	$1,785.26
Maximum	0.09	$1,927.46

With this information, one can then see that the Payments for Environmental Services do not compensate for the opportunity cost of conservation and sustainable forestry. As stated in Chapter 1, the government of Costa Rica claims that it wishes to boost landholder incomes and in this way achieve conservation goals. The results in this section clearly indicate that small landholder incomes cannot be boosted if they decide to conserve, because conservation is the least profitable of all land use options in these regions. Conservation is an economically unwise thing to do, unless patches of primary forest are located on lands with infertile soils and very low agricultural yields and where topography makes it impossible to cultivate. These areas would also include lands where production costs are high due to their remoteness from road networks and commercial centers. Some lands with low agricultural productivity but with some infrastructure could be destined to sustainable forest management. The conservation benefits from the current status quo are marginal. Carranza et al (1996) confirm that opportunity cost compensation is necessary because the prohibition to cultivate in lands suitable for agriculture but with forest cover represents a considerable "punishment" for the landowner. The PES does not compensate in totality the potential income that agricultural production represents. If the gap between the opportunity cost of conservation and the amount received for conservation increases, then the greater the tendency for producers to not participate in conservation measures (Carrranza et al 1996).

Besides containing deforestation in lands inappropriate for agriculture and forest management, current payments for conservation are probably also compensating landowners who had already decided to conserve their forests and who in the past had never been rewarded for doing so. This would include owners of private reserves which in the past decade have proliferated in Costa Rica and the rest of the world. Langholz et al (2000) conducted as study in the country to determine the economic considerations of privately owned parks. One of the main findings of this study was that although profit was a powerful motivator behind private reserve operation, many owners did not rely on their reserves for revenue generation. "Results showed overall reliance on reserves for annual income to be weak at best" (Langholz et al 2000:180). This statement corresponds to an interview with an owner of a private reserve called 'Selva Tica', who stated that payments that had been received from the PES are enough to cove the costs of maintenance and preserving the forest. This person admitted that the owners of the reserve were not dependent on the property for income generation (Alianza para Bosques 2001). If PES payments are compensating owners of already existing reserves, then they are not promoting or increasing conservation, they are merely paying for something that was long due. Protection of forests seems to remain a privilege of those who can afford it and not for holders who depend on their land for income.

The amounts paid by the PES also do not correspond with the profitability of the promoted activities. Compensatory payments should be higher for conservation, and lower for sustainable forestry.

Section 2: The Total Economic Value of Costa Rican Forests

The results obtained in the previous section led to the conclusion that current payments are not compensating for the opportunity cost of land in areas of high conservation priority. Conservation is only being promoted marginally. The current system of payments cannot deter deforestation in lands that are suitable for agricultural production, the main reason for deforestation in these regions. The fact that deforestation may still makes economic sense may seem like a dismal finding from an environmental point of view. However, one must now analyze whether these current payments truly internalize non-market benefits of the forest. If they do, then this deforestation is warranted. But if these payments do not accurately value forest non-market benefits, then the cost-benefit procedure of the previous section still contains asymmetry of values. Inappropriate deforestation will still be happening in Costa Rica, because full forest benefits are not being accounted for. Inappropriate deforestation will be contained when the total economic value (market plus nonmarket benefits) of the next hectare left as natural forest is greater than the returns from a competitive use (van Kooten and Bulte 2000). One must now then look at valuations conducted in order to estimate the TEV of the forest.

In order to determine whether current payments are able to deter inappropriate deforestation, they must be compared with valuations that estimate the TEV of the forest, separated into market and non-market benefits. If the sums correspond to with valuations of non-market benefits, then deforestation that is currently taking place is appropriate. If on the other hand, the payments are still unable to internalize non-market benefits, then deforestation in Costa Rica is currently also inappropriate. Important studies that have attempted to value non-market forest benefits in Costa Rica include Carranza et al (1996), Kishor and Constantino (1994).

The Carranza et al study of 1996 is one of the most well-known in Costa Rica, but the problem is that it relies on other studies to make its recommendations. In many senses, the Carranza study makes educated guesses based on what others have said. The authors make a review of the literature (including Kishor and Constantino 1994), then base their suggestions on the prices obtained from these sources and their knowledge of the biological functions of several forms of vegetative cover. The valuations have not followed economic methodologies. Table 5.9 shows the values obtained for the four environmental services which forests provide.

Table 5.9: Recommended promotional amounts per year and ha (US$) from the Centro Científico Tropical

Environmental service/forest type	Primary Forest
CO2 sequestration	38
Water conservation	5
Biodiversity	10
Natural beauty	5
Total	58

Source: Carranza et al (1996)

Carranza et al (1996) give a detailed discussion of how they arrived to these numbers. This procedure can be summarized as follows:

- Carbon fixation: Vegetative cover provides the service of extracting carbon dioxide form the atmosphere through photosynthesis and fixating it as organic biomass. This prevents the accumulation of excessive CO2, a greenhouse gas. The quantity of carbon fixated is equal to half of the biomass, or NNP/2, where NNP is the Net Primary Production in tons of dry biomass per hectare per year. Measurements of fixating capacity in Costa Rican forests have yielded figures of 5.1 tons per hectare per year in premontane humid forests and 16.7 tons per hectare per year in tropical humid forests. For the establishment of Payments for Environmental Services, primary forest is considered to have maximum capacity to give the carbon-fixation environmental service. Carranza et al (1996) considered that the difference between primary forest and intervened forest in terms of carbon-fixation capacity is minimal. It was determined that 7.6 tons of carbon dioxide can be fixated per hectare of primary forests. The price per ton used for this valuation is $5.00, yet the authors do not justify their choice of this price, only that consultants to the Joint Implementation Office recommended this amount. It is estimated then that the value of the carbon fixation function per hectare of primary forest per year is $38.00.

- Hydrological services: Forest intervention, from simple non-commercial product extraction up to complete extraction has different levels of impact on the forest's hydrological cycle. Erosion, sedimentation and nutrient flows have been grouped as impacts on water quality. Changes in water quantity, seasonal flows, and response of maximum flows and subsequent protection against floods, protection of water tables and precipitation are considered as impacts on water quantity. From the point of view of the landholder, these environmental impacts can occur on location or out of location, and they mostly affect activities such as agriculture, forestry, forest production, recreation, navigation, hydroelectric production, flood damages, water supply, labor health and productivity. Several studies have calculated the impact of erosion and sedimentation on hydroelectric projects in Costa Rica. Figures range between 200.000 and 2.196.450 tons of material per year. However, the association between these figures and monetary values has not been done. There are estimations for impacts on agricultural production. Several studies cited in Carranza et al (1996) make estimates on benefits from irrigation projects and losses in agricultural productivity due to erosion. For irrigation, benefits are valued at around $4 to $8 per year. Losses of productivity caused by erosion lie between $24.92 per hectare per year and $13.63 per hectare per year. The only straightforward valuation of the value of hydrological services is Kishor and Constantino (1994) who estimate the value of the service at $4 and $9 per hectare per year. Carranza et al (1996) make recommendations for payments based on the ability of forests to control floods. They suggest that primary forests, both intact and intervened receive $5 per hectare per year, with 50% variability upwards and downwards. The authors warn though that they base this entirely on their knowledge and criteria, and that it is an area of research that should be expanded.

- Biodiversity protection: Biodiversity protection brings benefits to scientists, pharmaceutical companies and individuals of present and future generations due to the provision of drugs, genetic banks and information and existence values. Most studies have focused on the production of drugs and existence value has been less studied. Studies in Costa Rica done by the Harvard Business School (1992) (reference in Carranza et al 1996) and based on an accord between Merck Pharmaceuticals and INBio estimates that the net present value per species is of $253. Aylward (1993) estimates the revenues from bio-prospecting to be between $20 and $2000 per sample. Kishor and Constantino (1994) estimate the values of biodiversity of Costa Rican forests to lie around $12,80 and $32 per hectare per year. Carranza et al (1996) suggest a payment of $10 per hectare per year with the possibility of varying it between $5 and $15 per year. They warn that forests lying in different life zones display varying degrees of biodiversity, so more research must be done to develop biodiversity indices.
- Protection of scenic beauty and ecosystems: Protection of scenic beauty entails not only the conservation of plant and animal species but also the preservation of the physical and biological connections that exist between them and their natural

environment. Different ecosystems are an attraction for both recreational and scientific tourism. Several studies have been conducted in Costa Rica to value the willingness to pay of visitors to attend a national park or reserve. Authors attempt to value eco-touristic and existence values. Echeverría et al (1995) estimated the willingness to pay of visitors to Monteverde National Park to avoid the conversion of the forest into agricultural land. The results obtained were of $122 per visitor per year, leading to a net present value of $400 per hectare per year. Larman and Perdue (1988) estimate annual income received by Costa Rica from activities organized by the Organization for Tropical Studies (dedicated to scientific tourism). The results lie between $1.62 to $5.70 per hectare per year. Kishor and Constantino (1994) estimate the value of this environmental service to be of $12.60 per hectare per year and $25 per hectare per year. Carranza et al (1996) suggest a minimum payment of $5 per hectare per year which corresponds to the necessity of conserving ecosystems for their existence values. They believe that since eco-touristic use of properties has medium to high degrees of exclusion, this component should not be granted to forest owners. The authors assume that both intervened and non-intervened forests provide the same amount of service.

Based on the promotional values suggested by the CCT, both conservation and sustainable forest management should receive a promotional amount of $58 per hectare per year for as long as the land is dedicated to these activities. Following their recommendation, there is no reason to differentiate between conservation and sustainable forest management. If $58 are constantly paid to these activities, then conservation yields a net present value of $897.29 (in both the Huetar-Atlantic and

Brunca Regions). Sustainable forest management would yield a net present value of $4,337.18 in the Brunca Region at average stumpage price, and $2,364.97 for the Huetar-Atlantic Region at average stumpage prices. This valuation however ignores option, quasi-option and existence values.

Carranza et al (1996) have assumed that conservation and sustainable forestry yield the same amount of environmental services, in other words, they are perfect substitutes. So, if one assumes that conservation and sustainable management yield the same amount of services, one would have to ask why the government would want to make distinctions between the two and pay higher amounts for sustainable forestry. Also, if there is no difference in the amount of environmental services provided, then from an economic point of view it does not make any sense to conserve and not harvest timber, and sacrifice potential income from wood sales. This contradicts the reality that in Costa Rica there is an abundance of private reserves (as stated by Langholz et al 2000) and that even with the current payments which do not compensate for non-market benefits, owners choose to conserve and give up timber harvest benefits. One can infer that non-use values of intact forests such as existence and bequest values can be a significant component of their total economic values, and probably much higher than those of intervened forests. If sustainable forest management is destructive of environmental services or if they do not provide the same amount of non-market benefits as pristine forests, then payments should be adjusted to account for these differences. This would also lead to higher compensatory payments for conservation and lower for sustainable forestry, a reversal of the current system.

It is now important to compare the valuation of Carranza et al (1996) with that of Kishor and Constantino (1994). Kishor and Constantino (1994) also do not differ between conservation and sustainable forestry

Table 5.10: Average annual value of environmental benefits provided by Costa Rican forests per hectare per year (US$); estimated by Kishor and Constantino (1994)

Environmental benefit	Annual value/ha of service (US$)
Carbon Sequestration	$60-$120 (at $20/ton)
Ecotourism	$12.56 - $25.12
Hydrological benefits	$16.55- $35.6
Urban water supply	2.3-4.6
Loss of hydroelectric productivity	10.0-20.0
Protection of agricultural lands	0.25-2.0
Flood Control	4.0-9.0
Existence and option values	$12.8-$32.0
Pharmaceuticals from bioprospecting	$0.15
Total	$102.2-$213.7

Source: De Camino et al (2000)

Based on this Kishor and Constantino (1994) study, payments for environmental services to both conservation and sustainable forest management should range between $102 and $212.87. Unlike Carranza et al (1996), they include option and existence values of forests, two important aspects of the total economic value of the forests. These payments should also be granted for as long as the activities are carried out. Compared to the actual sum that is now being paid per hectare for conservation, $198.70, the figure isn't out of the range of this valuation. The problem is that FONAFIFIO pays this sum divided into five years and only paid during these five years and not again. In actuality, all that is being paid is $39.74. The literature covered does not offer any explanations from FONAFIFO about why this payment policy was chosen. Sustainable forestry is being compensated with $322.20, divided over five years is only $64.44. Since these payments for environmental services do not fully account for non-market benefits of the forest, then one can conclude that current deforestation in Costa Rica is also inappropriate. Landowners are not completely internalizing social forest benefits in their decision-making process. Even on lands where conservation and forest management may make sense from an economic perspective, low yielding agriculture will be preferred because all the benefits from the other two activities have not been monetized.

Net present values for conservation in both the Brunca and Huetar-Atlantic Regions, with payments of $102 per hectare per year would be of $1,154.85 per hectare. If payments are increased to the higher end of the range, $212.87 per hectare per year, conservation benefits rise to a net present value of $2,191.53 per hectare. For sustainable forestry in the Brunca region, obtaining these compensations would mean increasing the net present value to a range of $4,652.03 - $5,760.19 (at average stumpage prices). In the Huetar-Atlantic Region, net present value ranges would be $2,679.82 - $3,787.95, also for average stumpage prices. These net present values for sustainable forestry represent the TEV of the forest, because they include both market and non-market benefits. Direct use value from timber has been accounted for, as well as other direct use values such as ecotourism and pharmaceuticals. Indirect values from regulatory functions are also included, as well as option and existence values. Given these results, one can say that some deforestation will still be acceptable in both these areas because agriculture is still more profitable than these two activities.

This result would agree with Bulte et al (2000). Bulte et al (2000) conduct a study in the Atlantic zone that determines an economic benchmark to assess the claim that deforestation rates are excessive in developing countries. The monetary value of various functions of tropical rainforests is estimated and used in an optimal control model to compute the globally optimal natural forest stock in the Atlantic zone of Costa Rica. They arrive to the conclusion that forest stock is sub-optimally large and that further conversion can increase economic welfare. This study however does not take into consideration hydrological and other ecological services, leading to lower optimal forest stocks. They also assume that policy makers in Costa Rica are able to take full benefits of carbon fixation into account. "Currently most governments in developing countries are not fully compensated for the carbon that is fixed, even though the government of Costa Rica receives some compensation [.]" (Bulte et al 2000:509). The inclusion of hydrological services and full internalization of carbon benefits would probably reverse the conclusions obtained in this study.

Bulte, E., van Soest, D., van Kooten, C., and Schipper, R. (2001) conduct a more sophisticated study that concludes that deforestation in the Atlantic Zone of Costa

Rica is excessive. Bulte et al (2001) quantify the impact of uncertainty about environmental services and the tradeoff between forest conservation and agricultural expansion in the Atlantic Zone. Incorporating uncertainty into the model is essential because it adds the component of quasi-option value into the calculation process. They suggest that studies that ignore quasi-option value yield results in which forest stocks are sub-optimally large. The conclusion of this study, based on superior data, model specification, and incorporating this element of uncertainty, is that "uncertainty about future forest benefits has a significant positive impact on optimal forest stocks [.]" (Bulte et al 2001:19). If uncertainty is accounted for, too much primary forest has been converted to agriculture (Bulte et al 2001). Deforestation in the region is also found to be excessive when transboundary spillovers of environmental services to the international community are accounted for. However, if only the domestic benefits of conservation are accounted for, further deforestation in the region is still warranted.

Until now, most negotiations for carbon fixation between Costa Rica and the rest of the world have been based on negotiations and solid economic studies that reveal willingness to pay from the international community are lacking. If willingness to pay is high, then current payments for carbon fixation may be comparatively low and developing countries have to find a way of capturing full compensation for this service. "The opportunity cost of sustainable forest management may be considerable (as is the case of AZ of Costa Rica), and it is an open question whether developing countries are willing to pay for this cost alone" (Bulte et al 2000:509). This reveals the difficulty of attempting to find willingness to pay of all agents in society, at the local, regional, national and international level.

Chapter 6

Conclusions and Recommendations

This final chapter will summarize the most important conclusions of the study. The conclusions are based on the results obtained in Chapter 4 and Chapter 5. The conclusions also take into account problems when conducting the research, as well as complexities that lie beyond economic theory. The final section discusses some important recommendations that would help to improve not only the Payment for Environmental Services program, but also to curb the transformation of forest land to agricultural uses in cases when this is not an economically wise decision.

Section I: Conclusions

The present study has given many valuable insights about the current system of payments for environmental services. First, given the results of the cost-benefit analyses, one can question whether conservation is truly being promoted in the Huetar-Atlantic and Brunca Regions. Conservation of forests in the two highly deforested areas remains an unprofitable activity and due to this, it is unlikely that small private landholders are engaging in this type of land use even with the current compensation. Agricultural production of some of the most important crops of the two regions is the most attractive land use option. Conservation is only being promoted marginally, in very infertile soils or locations with difficult topography. Large private reserves whose owners do not depend on them for income and that had already been destined for conservation, are receiving some benefits from these payments. However, one could say that these were 'accounts past due'.

This study has also revealed that current deforestation in the study areas is inappropriate from an economic point of view, because the payments that are being granted do not internalize the full value of non-market forest benefits. The valuation by Constantino and Kishor (1994) can be cited as the most reliable and methodological of all valuations done for Costa Rican forests. According to this valuation, the current magnitude paid is approximately correct, but it must be paid every single year, and not only for five years. However, important components of the TEV, such as quasi-option value have been ignored in this valuation. Also, many of these valuations only find the willingness to pay up to the national level and ignore the necessity of finding the willingness to pay of the international community.

This research has also found that current valuations assume that sustainable forest management and conservation provide the same amount of non-market benefits. However, the fact that in Costa Rica there are many private reserves where there is absolutely no extraction of timber or other products may mean that intact forests have higher bequest values than managed ones. Some biologists and foresters, such as Figuerola (2001) and Jiménez (2001) claim that managed forestry actually destroys environmental services. Clearly then, valuations may need to begin differentiating between intact forests and managed ones.

Even in light of the cost-benefit figures, it is important to interpret these results with caution. Unfortunately, there isn't regional data that allows us to compare the 'with PES' and 'without PES' scenarios, both between regions and over time. There isn't regional deforestation data or other primary data to provide further insights. The results do however correspond with the assessment of the latest deforestation study conducted in the country, the CCT and CIEDES study. These are the regions that are currently experiencing the highest rates of deforestation in the country even with the PES program. The second issue that must be considered when interpreting the results is that there are many determinants in the decision to conserve a piece of forest. The decision may involve considering the risk involved in cultivation due to weather disasters, price fluctuations, etc. Even in light of this risk though, when there is such a disparity between returns to different forms of land use, risk may not be enough to deter a farmer from cultivation. It would depend on whether farmers are risk averse or they actually have a preference for it. Cultural and personal characteristics may influence landholders to conserve, even if the monetary rewards for doing so are scant. Indigenous landholders may hold certain perceptions of the forest, religious ones for example, which enter their decision-making process. Clearly then the decision to conserve is a complex one, and economics are only part of the explanation.

Section II: Recommendations

There are several recommendations that stem from the results of this research. The most straightforward one is to increase the sums paid to private landholders. The question is whether they should be raised to meet opportunity costs or to cover the non-market benefits of the forest. It would not be reasonable to believe that the Costa Rican government would be willing to pay for the opportunity cost of conservation given its limited budget and given the fact that opportunity cost will vary depending on the type of soil, topography, weather, etc. Opportunity cost may even vary within a parcel of land. The most appropriate procedure would be to conduct reliable, methodological valuations of the different non-market benefits, applicable to the target areas, and determine a good approximation of the value of these benefits. Such valuations could lead to the conclusion that conservation can indeed be a profitable activity, and in many cases, it may even compete with agricultural production. Inappropriate deforestation could be curbed with payments set at the correct levels, and allow for agricultural conversion where it is warranted. According to Bulte et al (2000), possibilities for further deforestation in Costa Rica are limited not only because the remaining forest is located in publicly owned parks, but also because some of the land is of marginal value for agriculture. Veldkamp (1993) (cited in Bulte et al 2000) has established that recent deforestation in the Atlantic zone of Costa Rica takes place on moderately fertile or infertile soils.

The current system of payments is too general and it fails to take into account the different levels of environmental services that are offered by different types of ecosystems. Although it is true that a system of payments cannot be too complex, oversimplification can compromise the achievement of goals. The best way of balancing between complexity and simplicity would be to conduct valuations of different life zones based on the Holdridge classification system. The Holdridge classification system is based on the work of L.R Holdridge (1967) and has been widely utilized in Costa Rica ever since its publication. Valuations of services can be done according to different life zones. Following the Holdridge life-zone classification, Otárola et al (2000) suggest 5 eco-regions for the PES system. These are:

- Tropical Dry Forest
- Tropical Humid Forest
- Tropical Very Humid Forest
- Pre-montane forest
- Montane forest

Following the Hodridge scheme would allow an organized way of differentiating between ecosystems without allowing the payment system to become too complex.

An improvement in the monitoring of the PES program is urgent. As Richards (2000) suggests, institutional strengthening and the development of a regulatory framework for private sector forestry are vital for the effective implementation of these incentive mechanisms. This applies both at the national and international level. Good monitoring can be as important as correctly valued non-market benefits, but it also depends on the willingness of politicians to enforce the laws. "At the national level, the difficulties of effective regulation in the face of negative public sector incentives and attitudes should not be underestimated" (Richards 2000:1014). Costa Rica is no exception to this reality, and the influence of powerful reforestation and logging groups within the government has been of great concern to active conservationists in the country. Many of these powerful lobbies have taken an active part in determining the amounts that are paid in the PES program. "The 'true value' of environmental services [...] ultimately, [is] a political issue" (Heinrich 1997: iv).

These regulatory frameworks also apply at the international level. As mentioned before, many non-market benefits are enjoyed by the international community. Regulations must be applied to create the demand and willingness to pay for non-market benefits that accrue beyond the national level (Richards 2000). At the moment, it is not sure that currently Costa Ricans are being fully compensated by the international community for the carbon fixation services of their forests. Right now it may be little more than a 'cheap bargain'. "[T]he main potential here is for capturing global public good values, and compensating those responsible for forest protection, including the opportunity costs of excluded local people-otherwise conservation may prove socially unsustainable" (Richards 2000:1013). Developing countries like Costa Rica will not be able to bear the full costs of conservation and will be forced to continue cutting forests.

Finally, Costa Rica would also be wise to consider other approaches to achieving conservation or to complement the current system. These different approaches could also prove to be more cost effective in achieving environmental and social goals. Most deforestation is the result of non-forestry policy and econometric evidence has also revealed the importance of extra-sectoral approaches to reducing inappropriate deforestation (Richards 2000). "Indigenous peoples and peasants, owners of forests, are under the constant prowl from loggers and land speculators, specialized in profiting from the generalized lack of ecologically-balanced, culturally-sensitive, rural development options" (Figuerola 2001). Increasing rural wages and employment opportunities will provide more development alternatives to economically constrained populations, and forest destruction may become less attractive. Increasing productivity in labor-intensive agriculture may also prove to be a valuable way of reducing pressure for conversion at the agricultural frontier (Richards 2000). New trends in sustainable and ecological agriculture are interesting alternatives of achieving these goals and should not be ignored. The Costa Rican government should also be aware of the potential effects of road construction on deforestation. As mentioned in Chapter 3, roads can be an indirect cause of deforestation, because they facilitate access to forested areas and raise land values (Richards 2000).

The recommendations that have been suggested for the Payment for Environmental Services program in this research are vital to its success. Currently the program is does not seem to be doing much to promote conservation. Inappropriate deforestation continues and will continue until all landholders, big and small, are able to internalize the intangible benefits (or costs) of their actions. Unfortunately, the prospects of such a change in the system are unlikely, because currently the system does not have the funds to increase payments and to give them for the required periods of time. Moreover, the current system allows the Costa Rican government to raid these funds and use them to pay for other government expenditures. Add to this, pressures from interest groups such as loggers and the reforestation lobby, and conservation prospects look even more dismal. Hopefully the fact that the World Bank has currently provided funds for the program and also the fact that the system is becoming more well-known, will force its designers to take the necessary steps reform it in a way that will promote correct allocation of forest resources in Costa Rica.

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Annex 1: Data for Plantain Production[1]

1.1: Plantain yields per hectare, plantation intensity and prices (yields in Brunca Region are 10% lower than in the Huetar-Atlantic region).

Plants per hectare		2500
Yields	first year	900 boxes ha-1
	Second year	750 boxes ha-1
	third year	600 boxes ha-1
Must plant again in third year		
Price per box	$8.40	

1.2 Initial Investment costs per hectare

Initial Investment(in US $)			
Buildings, infrastructure	199387		
Drainage	437301		
Machinery and equipment	92814		
Additional installation	24923		
Packing equipment	24923		
Planting of seeds	1475460		
Pre-production	2429935		
Administration	132840		
Subtotal Investment	4817583		
Formalization costs	233231		
Total	5050814	Investment per hectare	3367.2113

1.3 Costs of Production per hectare

Costs of production per ha (2500 plants per ha)

Labor and/or materials	Units	# of cycles	# of units	US$ per unit	Total
Manual "chapeo"	contract	1	1	71.79	71.79
Cutting trees	jornal	1	1.9	6.67	12.673
Cleaning of area	jornal	1	5.6	6.67	37.352
Initial herbicide	jornal	1	3.7	6.67	24.679
Glifosato	Liter	1	3.7	17.89	66.193
Plants in bag	Unit	_	2857	0.27	771.39
Distribution of plants	jornal		4.7	6.67	31.349
Digging of holes	jornal	1	14	6.67	93.38

[1] All of the production data is for small producers, source Sergio Laprade, Corporación Bananera Nacional (Corbana).

Planting	jornal	1	5.7	6.67	38.019
Fertilization	jornal	1	1.9	6.67	12.673
Fertilizer	kg	1	286	0.25	71.5
Rodagea (Deshoja)	jornal	5	17.5	6.67	116.725
Herbicide application	jornal	3	5.75	6.67	38.3525
Fluazitop Butil	Liter	NA	NA	NA	
Paraquat	Liter	1	3.75	5.33	19.9875
Glifosato	Liter	2	5.5	17.89	98.395
Pruning	jornal	1	1.4	6.67	9.338
Pruning (deshijar)	jor/cont	2	9.4	6.67	62.698
Fungicide application	jornal	13	4.29	6.67	
Propicanozole	Liter	8	3.2	78.67	251.744
Tridemorf	Liter	5	3	40	120
Agricultural Oil	Liter	13	195	0.57	111.15
Emulsifiant	Liter	13	1.12	6.67	7.4704
Deshoja despunta	jornal	8	24.93	6.67	166.2831
Apuntalar	jornal		7	6.67	46.69
Embolse Encinta	contract		2651	0.05	132.55
Puntal	Unit		1085	0.13	141.05
Bag	Unit		2651	0.08	212.08
Fert.Cultivo	jornal	12	18	6.67	120.06
Ammonium Sulfate	kg	4	571	0.19	108.49
15-3-31	kg	8	1693	0.23	389.39
Recava Zanjos	m	1	244/475	0.47/0.23	224.7
Corta Acarreo	contract		1070	0.27	288.9
Packing	Unit		1070	0.37	395.9
Packing Material	Unit		1070	1.5	1605
Envío Muelle Trámite	Unit		1070	0.96	1027.2

Annex 2: Data for root vegetable production (tiquisque)[2]

2.1 Yields per hectare and prices for tiquisque in Huetar-Atlantic Region

Yields per hectare(kg)	8000
sale price (in US $ per kg)	0.48

2.2 Land preparation costs per hectare

Labor costs	Units	Quantity	Unit cost(US$)	Total costs (US$)
Arada	H.M	1	47.92	47.92
Rastreada	H.M	2	63.90	127.80

[2] H.M. stands for 'horas máquina' or machine hours; H.H. stand for 'horas hombre' or man hours; source Ministry of Agriculture and Ranching, Consejo Nacional de Producción (CNP).

Alomillado	H.M	1	79.87	79.87

2.3 Labor costs per hectare

Preparation	Unit	Quantity	Unit cost (US$)	Total costs (US$)
Seed preparation	H.H	6	7.99	47.92
Planting of seeds	H.H	10	7.99	79.87
Fertilizer application	H.H	2	7.99	15.97
Fertilizer application	H.H	1	7.99	7.99
Fertilizer application	H.H	1	7.99	7.99
Herbicide application	H.H	3	7.99	23.96
Herbicide application	H.H	3	7.99	23.96
Herbicide application	H.H	3	7.99	23.96
Insecticide and Nematicide application	H.H	4	7.99	31.95
Harvest and selection	H;H	20	7.99	159.74
Deshija	H.H	4	7.99	31.95
Others				47.92
Packing and transportation		6	7.99	47.92

2.4 Material and Input costs per hectare

Costs/HA (US$)

Materials and inputs	Unit	Quantity	Unit cost (US$)	Total costs (US$)
Semilla	kg	1500	0.16	239.62
Busamart	Litro	1	28.24	28.24
Vydate	Litro	1	51.12	51.12
15-3-31 (2)	Kilo	300	0.30	89.14
10-30-10	Kilo	200	0.30	59.42
Gesaprin	Litro	2	5.28	10.56
Gramoxone	Litro	4	5.75	23.00
Lazo	Litro	2	6.61	13.21
Nutran	kg	200	0.21	41.53
Python	Litro	1	63.90	63.90
Metamidofos	Litro	1	6.39	6.39
Agrimicin	Kg	1	39.23	39.23

2.5 Yields per hectare and prices for the Brunca Region

Yields	kg/ha	9200
Price	US$/kg	0.29

2.6 Land preparation costs per hectare

Land preparation costs	Units	Quantity	Unit costs(US$)	Total cost per ha per yr (US$)
Chapear	H.H	5	4.79	23.96
Amontonar maleza	H.H	2	4.79	9.58
Arada	H.M	1	95.85	95.85
Encalar	H.H	3	4.79	14.38
Alomillado	contract	1	73.48	73.48
Moving seeds	H.H	1	4.79	4.79

2.7 Labor costs per hectare

Labor Costs per hectare	Units	Quantity	Unit costs	Total cost per ha per yr
Seed preparation	H.H	8	4.79	38.34
Planting of seeds	H.H	20	4.79	95.85
Fertilizer application	H.H	2	4.79	9.58
Fertilizer application	H.H	2	4.79	9.58
Fertilizer application	H.H	2	4.79	9.58
Herbicide application	H.H	7	4.79	33.55
Herbicide application	H.H	4	4.79	19.17
Herbicide application	H.H	17	4.79	81.47
Insecticide and Nematicide application	H.H	2	4.79	9.58
Harvest and selection	H.H	40	4.79	191.69
Harvest transport	sacks	200	0.19	38.34
Seed transport		1	9.58	9.58

2.8 Material and input costs

Materials and inputs				
Semilla	qq	30	4.79	143.77
Calcium Carbonate	qq	20	1.73	34.50
Kilol	L	1	11.39	11.39
Phosphorus	qq	2	8.47	16.93
15-3-31	qq	3	10.70	32.11
KMG	qq	3	12.76	38.29
Fusilade	L	1	26.41	26.41
Paraquat	gallon	1	21.04	21.04
Counter	gallon	5	4.31	21.57

Annex 3: Data for sustainable forestry management[3]

3.1 Timber yields for Atlantic Region (m3 per ha)

Forest number	Cutting number (yr)							
	Conversion phase			Maintenance phase				Liquidation
	1(0)	2(10)	3(20)	4(35)	5(50)	6(65)	7(80)	60%
1	32.3	30.6	24.5	18.5	18.8	18.5	17.9	51.5
8	25.7	24.1	23	18.9	17.7	17.5	17.4	46.7
9	20	20.1	22.2	20.6	20.5	18.4	18.6	31.7
10	30.8	28.1	21.4	21.3	24.4	25.5	24.8	51
14	21.2	20.8	19.7	18.4	18.6	18.6	19.4	33.6
Mean	26	24.7	22.2	19.5	20	19.7	19.6	42.9

3.2 Timber prices for Atlantic Region (US$ per PMT[4], standing tree)[5]

Minimum	Average	Maximum
0.07	0.08	0.09

3.3 Timber yields for the Brunca Region (m3 per ha)[3]

Forest number	Cutting number (yr)							
	Conversion phase			Maintenance phase				
	1(0)	2(10)	3(20)	4(35)	5(50)	6(65)	7(80)	60%
2	41.1	43.7	33.5	26.2	25.8	26.1	26.2	74
4	39.5	40.1	32.3	20.4	20.4	21	20.5	71.1
8	37.7	40.6	33.1	23.7	23.7	24.1	22.6	67.9
9	39.9	41.4	32	23.1	24.8	24.4	22.7	71.8
11	34.8	38	31.1	20.6	20.6	20.5	19.6	62.6
14	34.8	37.6	29.6	20.5	21.2	21.3	20.1	62.6
16	44.8	46.4	37.3	25.3	23.5	22.4	21.9	80.6
17	36.6	40.3	29.1	26.3	25.6	26.5	25.5	65.9
Mean	38.7	41	32.3	23.3	23.2	23.3	22.4	69.6

[3] Source: Howard and Valerio (1996)
[4] PMT: Pulgada Métrica Tica; one cubic meter of wood is equal to 362 PMT
[5] Source: Costa Rican Forestry Chamber

3.4 Timber prices for the Brunca Region (US$ per PMT, standing tree)[5]

Minimum	Average	Maximum
0.12	0.15	0.17

Annex 4: Cost-benefit analysis for all land use options, both regions.

Plantain production											
Atlantic Region											
Years	0	1	2	3	4	5	6	7	8	9	10
Benefits (per hectare)											
Export sales			$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00
60% liquidation of trees in property			$ 1,126.78								
TOTAL BENEFITS		0	$ 8,686.78	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00
Costs (per hectare)											
Initial investment		$ 3,367.21									
Variable costs											
Manual "chapeo"			$ 71.79	$ 71.79	$ 71.79	$ 71.79	$ 71.79	$ 71.79	$ 71.79	$ 71.79	$ 71.79
Cutting trees			$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67
Cleaning of area			$ 37.35	$ 37.35	$ 37.35	$ 37.35	$ 37.35	$ 37.35	$ 37.35	$ 37.35	$ 37.35
Initial herbicide			$ 24.68	$ 24.68	$ 24.68	$ 24.68	$ 24.68	$ 24.68	$ 24.68	$ 24.68	$ 24.68
Glifosato			$ 66.19	$ 66.19	$ 66.19	$ 66.19	$ 66.19	$ 66.19	$ 66.19	$ 66.19	$ 66.19
Plántulas en bolsa			$ 771.39			$ 771.39			$ 771.39		
Distribution of plants			$ 31.35			$ 31.35			$ 31.35		
Digging of holes			$ 93.38	$ 93.38	$ 93.38	$ 93.38	$ 93.38	$ 93.38	$ 93.38	$ 93.38	$ 93.38
Planting			$ 38.02	$ 38.02	$ 38.02	$ 38.02	$ 38.02	$ 38.02	$ 38.02	$ 38.02	$ 38.02
Fertilization			$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67
Fertilizer			$ 71.50	$ 71.50	$ 71.50	$ 71.50	$ 71.50	$ 71.50	$ 71.50	$ 71.50	$ 71.50
Rodagea (Deshoja)							116.67				
Herbicide application					$ 38.35			$ 38.35			$ 38.35
Fluazitop Butil											
Paraquat			$ 19.99			$ 19.99			$ 19.99		
Glifosato				98.395		98.395		98.395		98.395	
Pruning			$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34
Pruning (deshijar)				62.67							
Aplicar funguicida											
Propicanozole										251.73	
Tridemorf							120				
Aceite Agrícola											
Emulsifiant											
Deshoja despunta										166.2	

Apuntalar			$ 46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69
Embolse Encinta			$ 132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55
Puntal			$ 141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05
Bag			$ 212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08
Fert.Cultivo											
Ammonium Sulfate						$ 108.49				$ 108.49	
15-3-31										387.58	
Recava Zanjos			$ 224.70	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7
Corta Acarreo			$ 288.90	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9
Packing			$ 395.90	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9
Packing Material			$ 1,605.00	1605	1605	1605	1605	1605	1605	1605	1605
Envío Muelle Trámite			$ 1,027.20	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2
TOTAL COSTS		$ (3,367.21)	$ (5,334.39)	$ (4,672.73)	$ (4,550.02)	$ (5,541.28)	$ (4,748.34)	$ (4,648.41)	$ (5,334.39)	$ (5,524.06)	$ (4,550.02)
Net Benefits per hectare		$ (3,367.21)	$ 3,352.39	$ 1,627.27	$ 489.98	$ 2,018.72	$ 1,551.66	$ 391.59	$ 2,225.61	$ 775.94	$ 489.98
NPV	$10,124.32										

11	12	13	14	15	16	17	18	19	20	21	22
$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00
$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00
71.79	$ 71.79	$ 71.79	71.79	$ 71.79	$ 71.79	71.79	$ 71.79	$ 71.79	71.79	$ 71.79	$ 71.79
12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67
37.352	$ 37.35	$ 37.35	37.352	$ 37.35	$ 37.35	37.352	$ 37.35	$ 37.35	37.352	$ 37.35	$ 37.35
24.679	$ 24.68	$ 24.68	24.679	$ 24.68	$ 24.68	24.679	$ 24.68	$ 24.68	24.679	$ 24.68	$ 24.68
66.193	$ 66.19	$ 66.19	66.193	$ 66.19	$ 66.19	66.193	$ 66.19	$ 66.19	66.193	$ 66.19	$ 66.19
771.39			771.39			771.39			771.39		
31.349			31.349			31.349			31.349		
93.38	$ 93.38	$ 93.38	93.38	$ 93.38	$ 93.38	93.38	$ 93.38	$ 93.38	93.38	$ 93.38	$ 93.38
38.019	$ 38.02	$ 38.02	38.019	$ 38.02	$ 38.02	38.019	$ 38.02	$ 38.02	38.019	$ 38.02	$ 38.02
12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67
71.5	$ 71.50	$ 71.50	71.5	$ 71.50	$ 71.50	71.5	$ 71.50	$ 71.50	71.5	$ 71.50	$ 71.50
116.67					116.67					116.67	
		$ 38.35			$ 38.35			$ 38.35			$ 38.35
$ 19.99			$ 19.99			$ 19.99			$ 19.99		
98.395		98.395		98.395		98.395		98.395		98.395	
$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34
			28.6								
						251.73					
120					120					120	
			110.5								
			7.47								
						166.2					
46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69
132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55

141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05
212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08
		120									
		$ 108.49				$ 108.49				$ 108.49	
						387.58					
224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7
288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9
395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9
1605	1605	1605	1605	1605	1605	1605	1605	1605	1605	1605	1605
1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2
$ (5,669.46)	$ (4,511.67)	$ (4,876.90)	$ (5,480.96)	$ (4,610.06)	$ (4,786.69)	$ (6,346.79)	$ (4,511.67)	$ (4,648.41)	$ (5,334.39)	$ (4,955.22)	$ (4,550.02)
$ 1,890.54	$ 1,788.33	$ 163.10	$ 2,079.04	$ 1,689.94	$ 253.31	$ 1,213.21	$ 1,788.33	$ 391.59	$ 2,225.61	$ 1,344.78	$ 489.98

23	24	25	26	27	28	29	30	31	32	33	34
$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00
$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00
71.79	$ 71.79	$ 71.79	71.79	$ 71.79	$ 71.79	71.79	$ 71.79	$ 71.79	71.79	$ 71.79	$ 71.79
12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67
37.352	$ 37.35	$ 37.35	37.352	$ 37.35	$ 37.35	37.352	$ 37.35	$ 37.35	37.352	$ 37.35	$ 37.35
24.679	$ 24.68	$ 24.68	24.679	$ 24.68	$ 24.68	24.679	$ 24.68	$ 24.68	24.679	$ 24.68	$ 24.68
66.193	$ 66.19	$ 66.19	66.193	$ 66.19	$ 66.19	66.193	$ 66.19	$ 66.19	66.193	$ 66.19	$ 66.19
771.39			771.39			771.39			771.39		
31.349			31.349			31.349			31.349		
93.38	$ 93.38	$ 93.38	93.38	$ 93.38	$ 93.38	93.38	$ 93.38	$ 93.38	93.38	$ 93.38	$ 93.38
38.019	$ 38.02	$ 38.02	38.019	$ 38.02	$ 38.02	38.019	$ 38.02	$ 38.02	38.019	$ 38.02	$ 38.02
12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67
71.5	$ 71.50	$ 71.50	71.5	$ 71.50	$ 71.50	71.5	$ 71.50	$ 71.50	71.5	$ 71.50	$ 71.50
			116.67					116.67			
		$ 38.35			$ 38.35			$ 38.35			$ 38.35
$ 19.99			$ 19.99			$ 19.99			$ 19.99		
98.395		98.395		98.395		98.395		98.395		98.395	
$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34
				28.6							
		251.73								251.73	
			120					120			
				110.5							
				7.47							
		166.2								166.2	
46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69
132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55

141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05
212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08
		120									
		$ 108.49				$ 108.49				$ 108.49	
		387.58								387.58	
224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7
288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9
395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9
1605	1605	1605	1605	1605	1605	1605	1605	1605	1605	1605	1605
1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2
$ (5,432.79)	$ (4,511.67)	$ (5,682.41)	$ (5,571.06)	$ (4,756.63)	$ (4,550.02)	$ (5,541.28)	$ (4,511.67)	$ (4,885.08)	$ (5,334.39)	$ (5,524.06)	$ (4,550.02)
$ 2,127.21	$ 1,788.33	$ (642.41)	$ 1,988.94	$ 1,543.37	$ 489.98	$ 2,018.72	$ 1,788.33	$ 154.92	$ 2,225.61	$ 775.94	$ 489.98

35	36	37	38	39	40	41	42	43	44	45	46
$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00
$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00
71.79	$ 71.79	$ 71.79	71.79	$ 71.79	$ 71.79	71.79	$ 71.79	$ 71.79	71.79	$ 71.79	$ 71.79
12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67
37.352	$ 37.35	$ 37.35	37.352	$ 37.35	$ 37.35	37.352	$ 37.35	$ 37.35	37.352	$ 37.35	$ 37.35
24.679	$ 24.68	$ 24.68	24.679	$ 24.68	$ 24.68	24.679	$ 24.68	$ 24.68	24.679	$ 24.68	$ 24.68
66.193	$ 66.19	$ 66.19	66.193	$ 66.19	$ 66.19	66.193	$ 66.19	$ 66.19	66.193	$ 66.19	$ 66.19
771.39			771.39			771.39			771.39		
31.349			31.349			31.349			31.349		
93.38	$ 93.38	$ 93.38	93.38	$ 93.38	$ 93.38	93.38	$ 93.38	$ 93.38	93.38	$ 93.38	$ 93.38
38.019	$ 38.02	$ 38.02	38.019	$ 38.02	$ 38.02	38.019	$ 38.02	$ 38.02	38.019	$ 38.02	$ 38.02
12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67
71.5	$ 71.50	$ 71.50	71.5	$ 71.50	$ 71.50	71.5	$ 71.50	$ 71.50	71.5	$ 71.50	$ 71.50
	116.67					116.67					116.67
		$ 38.35			$ 38.35			$ 38.35			$ 38.35
$ 19.99			$ 19.99			$ 19.99			$ 19.99		
98.395		98.395		98.395		98.395		98.395		98.395	
$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34
					28.6						
						251.73					
	120					120					120
					110.5						
					7.47						
						166.2					
46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69
132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55

141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05
212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08
		120									
		$ 108.49				$ 108.49				$ 108.49	
						387.58					
224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7
288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9
395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9
1605	1605	1605	1605	1605	1605	1605	1605	1605	1605	1605	1605
1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2
$ (5,432.79)	$ (4,748.34)	$ (4,876.90)	$ (5,334.39)	$ (4,610.06)	$ (4,696.59)	$ (6,583.46)	$ (4,511.67)	$ (4,648.41)	$ (5,334.39)	$ (4,718.55)	$ (4,786.69)
$ 2,127.21	$ 1,551.66	$ 163.10	$ 2,225.61	$ 1,689.94	$ 343.41	$ 976.54	$ 1,788.33	$ 391.59	$ 2,225.61	$ 1,581.45	$ 253.31

47	48	49	50
$7,560.00	$6,300.00	$5,040.00	$7,560.00
$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00
71.79	$ 71.79	$ 71.79	71.79
12.673	$ 12.67	$ 12.67	12.673
37.352	$ 37.35	$ 37.35	37.352
24.679	$ 24.68	$ 24.68	24.679
66.193	$ 66.19	$ 66.19	66.193
771.39			771.39
31.349			31.349
93.38	$ 93.38	$ 93.38	93.38
38.019	$ 38.02	$ 38.02	38.019
12.673	$ 12.67	$ 12.67	12.673
71.5	$ 71.50	$ 71.50	71.5
		$ 38.35	
$ 19.99			$ 19.99
98.395		98.395	
$ 9.34	$ 9.34	$ 9.34	$ 9.34
		251.73	
		166.2	
46.69	46.69	46.69	46.69
132.55	132.55	132.55	132.55

141.05	141.05	141.05	141.05
212.08	212.08	212.08	212.08
		120	
		$ 108.49	
		387.58	
224.7	224.7	224.7	224.7
288.9	288.9	288.9	288.9
395.9	395.9	395.9	395.9
1605	1605	1605	1605
1027.2	1027.2	1027.2	1027.2
$ (5,432.79)	$ (4,511.67)	$ (5,682.41)	$ (5,334.39)
$ 2,127.21	$ 1,788.33	$ (642.41)	$ 2,225.61

Plantain production											
Atlantic Region											
Years	0	1	2	3	4	5	6	7	8	9	10
Benefits (per hectare)											
Export sales			$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00
60% liquidation of trees in property			$ 1,332.19								
TOTAL BENEFITS		0	$ 8,892.19	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00
Costs (per hectare)											
Initial investment		$ 3,367.21									
Variable costs											
Manual "chapeo"			$ 71.79	$ 71.79	$ 71.79	$ 71.79	$ 71.79	$ 71.79	$ 71.79	$ 71.79	$ 71.79
Cutting trees			$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67
Cleaning of area			$ 37.35	$ 37.35	$ 37.35	$ 37.35	$ 37.35	$ 37.35	$ 37.35	$ 37.35	$ 37.35
Initial herbicide			$ 24.68	$ 24.68	$ 24.68	$ 24.68	$ 24.68	$ 24.68	$ 24.68	$ 24.68	$ 24.68
Glifosato			$ 66.19	$ 66.19	$ 66.19	$ 66.19	$ 66.19	$ 66.19	$ 66.19	$ 66.19	$ 66.19
Plántulas en bolsa			$ 771.39			$ 771.39			$ 771.39		
Distribution of plants			$ 31.35			$ 31.35			$ 31.35		
Digging of holes			$ 93.38	$ 93.38	$ 93.38	$ 93.38	$ 93.38	$ 93.38	$ 93.38	$ 93.38	$ 93.38
Planting			$ 38.02	$ 38.02	$ 38.02	$ 38.02	$ 38.02	$ 38.02	$ 38.02	$ 38.02	$ 38.02
Fertilization			$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67
Fertilizer			$ 71.50	$ 71.50	$ 71.50	$ 71.50	$ 71.50	$ 71.50	$ 71.50	$ 71.50	$ 71.50
Rodagea (Deshoja)							116.67				
Herbicide application					$ 38.35			$ 38.35			$ 38.35
Fluazitop Butil											
Paraquat			$ 19.99			$ 19.99			$ 19.99		
Glifosato				98.395		98.395		98.395		98.395	
Pruning			$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34
Pruning (deshijar)				62.67							
Aplicar funguicida											
Propicanozole										251.73	
Tridemorf							120				
Aceite Agricola											
Emulsifiant											
Deshoja despunta										166.2	

Apuntalar			$ 46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69
Embolse Encinta			$ 132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55
Puntal			$ 141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05
Bag			$ 212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08
Fert.Cultivo											
Ammonium Sulfate						$ 108.49				$ 108.49	
15-3-31										387.58	
Recava Zanjos			$ 224.70	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7
Corta Acarreo			$ 288.90	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9
Packing			$ 395.90	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9
Packing Material			$ 1,605.00	1605	1605	1605	1605	1605	1605	1605	1605
Envío Muelle Trámite			$ 1,027.20	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2
TOTAL COSTS		$ (3,367.21)	$ (5,334.39)	$ (4,672.73)	$ (4,550.02)	$ (5,541.28)	$ (4,748.34)	$ (4,648.41)	$ (5,334.39)	$ (5,524.06)	$ (4,550.02)
Net Benefits per hectare		$ (3,367.21)	$ 3,557.80	$ 1,627.27	$ 489.98	$ 2,018.72	$ 1,551.66	$ 391.59	$ 2,225.61	$ 775.94	$ 489.98
NPV	$10,294.08										

11	12	13	14	15	16	17	18	19	20	21	22
$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00
$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00
71.79	$ 71.79	$ 71.79	71.79	$ 71.79	$ 71.79	71.79	$ 71.79	$ 71.79	71.79	$ 71.79	$ 71.79
12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67
37.352	$ 37.35	$ 37.35	37.352	$ 37.35	$ 37.35	37.352	$ 37.35	$ 37.35	37.352	$ 37.35	$ 37.35
24.679	$ 24.68	$ 24.68	24.679	$ 24.68	$ 24.68	24.679	$ 24.68	$ 24.68	24.679	$ 24.68	$ 24.68
66.193	$ 66.19	$ 66.19	66.193	$ 66.19	$ 66.19	66.193	$ 66.19	$ 66.19	66.193	$ 66.19	$ 66.19
771.39			771.39			771.39			771.39		
31.349			31.349			31.349			31.349		
93.38	$ 93.38	$ 93.38	93.38	$ 93.38	$ 93.38	93.38	$ 93.38	$ 93.38	93.38	$ 93.38	$ 93.38
38.019	$ 38.02	$ 38.02	38.019	$ 38.02	$ 38.02	38.019	$ 38.02	$ 38.02	38.019	$ 38.02	$ 38.02
12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67
71.5	$ 71.50	$ 71.50	71.5	$ 71.50	$ 71.50	71.5	$ 71.50	$ 71.50	71.5	$ 71.50	$ 71.50
116.67					116.67					116.67	
		$ 38.35			$ 38.35			$ 38.35			$ 38.35
$ 19.99			$ 19.99			$ 19.99			$ 19.99		
98.395		98.395		98.395		98.395		98.395		98.395	
$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34
			28.6								
						251.73					
120					120					120	
			110.5								
			7.47								
						166.2					
46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69
132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55

141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05
212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08
		120									
		$ 108.49				$ 108.49				$ 108.49	
						387.58					
224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7
288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9
395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9
1605	1605	1605	1605	1605	1605	1605	1605	1605	1605	1605	1605
1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2
$ (5,669.46)	$ (4,511.67)	$ (4,876.90)	$ (5,480.96)	$ (4,610.06)	$ (4,786.69)	$ (6,346.79)	$ (4,511.67)	$ (4,648.41)	$ (5,334.39)	$ (4,955.22)	$ (4,550.02)
$ 1,890.54	$ 1,788.33	$ 163.10	$ 2,079.04	$ 1,689.94	$ 253.31	$ 1,213.21	$ 1,788.33	$ 391.59	$ 2,225.61	$ 1,344.78	$ 489.98

23	24	25	26	27	28	29	30	31	32	33	34
$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00
$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00
71.79	$ 71.79	$ 71.79	71.79	$ 71.79	$ 71.79	71.79	$ 71.79	$ 71.79	71.79	$ 71.79	$ 71.79
12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67
37.352	$ 37.35	$ 37.35	37.352	$ 37.35	$ 37.35	37.352	$ 37.35	$ 37.35	37.352	$ 37.35	$ 37.35
24.679	$ 24.68	$ 24.68	24.679	$ 24.68	$ 24.68	24.679	$ 24.68	$ 24.68	24.679	$ 24.68	$ 24.68
66.193	$ 66.19	$ 66.19	66.193	$ 66.19	$ 66.19	66.193	$ 66.19	$ 66.19	66.193	$ 66.19	$ 66.19
771.39			771.39			771.39			771.39		
31.349			31.349			31.349			31.349		
93.38	$ 93.38	$ 93.38	93.38	$ 93.38	$ 93.38	93.38	$ 93.38	$ 93.38	93.38	$ 93.38	$ 93.38
38.019	$ 38.02	$ 38.02	38.019	$ 38.02	$ 38.02	38.019	$ 38.02	$ 38.02	38.019	$ 38.02	$ 38.02
12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67
71.5	$ 71.50	$ 71.50	71.5	$ 71.50	$ 71.50	71.5	$ 71.50	$ 71.50	71.5	$ 71.50	$ 71.50
			116.67					116.67			
		$ 38.35			$ 38.35			$ 38.35			$ 38.35
$ 19.99			$ 19.99			$ 19.99			$ 19.99		
98.395		98.395		98.395		98.395		98.395		98.395	
$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34
				28.6							
		251.73								251.73	
			120					120			
				110.5							
				7.47							
		166.2								166.2	
46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69
132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55

141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05
212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08
		120									
		$ 108.49				$ 108.49				$ 108.49	
		387.58								387.58	
224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7
288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9
395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9
1605	1605	1605	1605	1605	1605	1605	1605	1605	1605	1605	1605
1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2
$ (5,432.79)	$ (4,511.67)	$ (5,682.41)	$ (5,571.06)	$ (4,756.63)	$ (4,550.02)	$ (5,541.28)	$ (4,511.67)	$ (4,885.08)	$ (5,334.39)	$ (5,524.06)	$ (4,550.02)
$ 2,127.21	$ 1,788.33	$ (642.41)	$ 1,988.94	$ 1,543.37	$ 489.98	$ 2,018.72	$ 1,788.33	$ 154.92	$ 2,225.61	$ 775.94	$ 489.98

35	36	37	38	39	40	41	42	43	44	45	46
$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00
$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00
71.79	$ 71.79	$ 71.79	71.79	$ 71.79	$ 71.79	71.79	$ 71.79	$ 71.79	71.79	$ 71.79	$ 71.79
12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67
37.352	$ 37.35	$ 37.35	37.352	$ 37.35	$ 37.35	37.352	$ 37.35	$ 37.35	37.352	$ 37.35	$ 37.35
24.679	$ 24.68	$ 24.68	24.679	$ 24.68	$ 24.68	24.679	$ 24.68	$ 24.68	24.679	$ 24.68	$ 24.68
66.193	$ 66.19	$ 66.19	66.193	$ 66.19	$ 66.19	66.193	$ 66.19	$ 66.19	66.193	$ 66.19	$ 66.19
771.39			771.39			771.39			771.39		
31.349			31.349			31.349			31.349		
93.38	$ 93.38	$ 93.38	93.38	$ 93.38	$ 93.38	93.38	$ 93.38	$ 93.38	93.38	$ 93.38	$ 93.38
38.019	$ 38.02	$ 38.02	38.019	$ 38.02	$ 38.02	38.019	$ 38.02	$ 38.02	38.019	$ 38.02	$ 38.02
12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67
71.5	$ 71.50	$ 71.50	71.5	$ 71.50	$ 71.50	71.5	$ 71.50	$ 71.50	71.5	$ 71.50	$ 71.50
	116.67					116.67					116.67
		$ 38.35			$ 38.35			$ 38.35			$ 38.35
$ 19.99			$ 19.99			$ 19.99			$ 19.99		
98.395		98.395		98.395		98.395		98.395		98.395	
$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34
					28.6						
						251.73					
	120					120					120
					110.5						
					7.47						
						166.2					
46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69
132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55

141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05
212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08
		120									
		$ 108.49				$ 108.49				$ 108.49	
						387.58					
224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7
288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9
395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9
1605	1605	1605	1605	1605	1605	1605	1605	1605	1605	1605	1605
1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2
$ (5,432.79)	$ (4,748.34)	$ (4,876.90)	$ (5,334.39)	$ (4,610.06)	$ (4,696.59)	$ (6,583.46)	$ (4,511.67)	$ (4,648.41)	$ (5,334.39)	$ (4,718.55)	$ (4,786.69)
$ 2,127.21	$ 1,551.66	$ 163.10	$ 2,225.61	$ 1,689.94	$ 343.41	$ 976.54	$ 1,788.33	$ 391.59	$ 2,225.61	$ 1,581.45	$ 253.31

47	48	49	50
$7,560.00	$6,300.00	$5,040.00	$7,560.00
$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00
71.79	$ 71.79	$ 71.79	71.79
12.673	$ 12.67	$ 12.67	12.673
37.352	$ 37.35	$ 37.35	37.352
24.679	$ 24.68	$ 24.68	24.679
66.193	$ 66.19	$ 66.19	66.193
771.39			771.39
31.349			31.349
93.38	$ 93.38	$ 93.38	93.38
38.019	$ 38.02	$ 38.02	38.019
12.673	$ 12.67	$ 12.67	12.673
71.5	$ 71.50	$ 71.50	71.5
		$ 38.35	
$ 19.99			$ 19.99
98.395		98.395	
$ 9.34	$ 9.34	$ 9.34	$ 9.34
		251.73	
		166.2	
46.69	46.69	46.69	46.69
132.55	132.55	132.55	132.55

141.05	141.05	141.05	141.05
212.08	212.08	212.08	212.08
		120	
		$ 108.49	
		387.58	
224.7	224.7	224.7	224.7
288.9	288.9	288.9	288.9
395.9	395.9	395.9	395.9
1605	1605	1605	1605
1027.2	1027.2	1027.2	1027.2
$ (5,432.79)	$ (4,511.67)	$ (5,682.41)	$ (5,334.39)
$ 2,127.21	$ 1,788.33	$ (642.41)	$ 2,225.61

Plantain production											
Atlantic Region											
Years	0	1	2	3	4	5	6	7	8	9	10
Benefits (per hectare)											
Export sales			$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00
60% liquidation of trees in property			$ 1,495.43								
TOTAL BENEFITS		0	$ 9,055.43	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00
Costs (per hectare)											
Initial investment		$ 3,367.21									
Variable costs											
Manual "chapeo"			$ 71.79	$ 71.79	$ 71.79	$ 71.79	$ 71.79	$ 71.79	$ 71.79	$ 71.79	$ 71.79
Cutting trees			$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67
Cleaning of area			$ 37.35	$ 37.35	$ 37.35	$ 37.35	$ 37.35	$ 37.35	$ 37.35	$ 37.35	$ 37.35
Initial herbicide			$ 24.68	$ 24.68	$ 24.68	$ 24.68	$ 24.68	$ 24.68	$ 24.68	$ 24.68	$ 24.68
Glifosato			$ 66.19	$ 66.19	$ 66.19	$ 66.19	$ 66.19	$ 66.19	$ 66.19	$ 66.19	$ 66.19
Plántulas en bolsa			$ 771.39			$ 771.39			$ 771.39		
Distribution of plants			$ 31.35			$ 31.35			$ 31.35		
Digging of holes			$ 93.38	$ 93.38	$ 93.38	$ 93.38	$ 93.38	$ 93.38	$ 93.38	$ 93.38	$ 93.38
Planting			$ 38.02	$ 38.02	$ 38.02	$ 38.02	$ 38.02	$ 38.02	$ 38.02	$ 38.02	$ 38.02
Fertilization			$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67	$ 12.67
Fertilizer			$ 71.50	$ 71.50	$ 71.50	$ 71.50	$ 71.50	$ 71.50	$ 71.50	$ 71.50	$ 71.50
Rodagea (Deshoja)							116.67				
Herbicide application					$ 38.35			$ 38.35			$ 38.35
Fluazitop Butil											
Paraquat			$ 19.99			$ 19.99			$ 19.99		
Glifosato				98.395		98.395		98.395		98.395	
Pruning			$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34
Pruning (deshijar)				62.67							
Aplicar funguicida											
Propicanozole										251.73	
Tridemorf							120				
Aceite Agrícola											
Emulsifiant											
Deshoja despunta										166.2	

Apuntalar			$ 46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69
Embolse Encinta			$ 132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55
Puntal			$ 141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05
Bag			$ 212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08
Fert.Cultivo											
Ammonium Sulfate						$ 108.49				$ 108.49	
15-3-31										387.58	
Recava Zanjos			$ 224.70	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7
Corta Acarreo			$ 288.90	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9
Packing			$ 395.90	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9
Packing Material			$ 1,605.00	1605	1605	1605	1605	1605	1605	1605	1605
Envío Muelle Trámite			$ 1,027.20	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2
TOTAL COSTS		$ (3,367.21)	$ (5,334.39)	$ (4,672.73)	$ (4,550.02)	$ (5,541.28)	$ (4,748.34)	$ (4,648.41)	$ (5,334.39)	$ (5,524.06)	$ (4,550.02)
Net Benefits per hectare		$ (3,367.21)	$ 3,721.03	$ 1,627.27	$ 489.98	$ 2,018.72	$ 1,551.66	$ 391.59	$ 2,225.61	$ 775.94	$ 489.98
NPV	$10,428.98										

11	12	13	14	15	16	17	18	19	20	21	22
$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00
$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00
71.79	$ 71.79	$ 71.79	71.79	$ 71.79	$ 71.79	71.79	$ 71.79	$ 71.79	71.79	$ 71.79	$ 71.79
12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67
37.352	$ 37.35	$ 37.35	37.352	$ 37.35	$ 37.35	37.352	$ 37.35	$ 37.35	37.352	$ 37.35	$ 37.35
24.679	$ 24.68	$ 24.68	24.679	$ 24.68	$ 24.68	24.679	$ 24.68	$ 24.68	24.679	$ 24.68	$ 24.68
66.193	$ 66.19	$ 66.19	66.193	$ 66.19	$ 66.19	66.193	$ 66.19	$ 66.19	66.193	$ 66.19	$ 66.19
771.39			771.39			771.39			771.39		
31.349			31.349			31.349			31.349		
93.38	$ 93.38	$ 93.38	93.38	$ 93.38	$ 93.38	93.38	$ 93.38	$ 93.38	93.38	$ 93.38	$ 93.38
38.019	$ 38.02	$ 38.02	38.019	$ 38.02	$ 38.02	38.019	$ 38.02	$ 38.02	38.019	$ 38.02	$ 38.02
12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67
71.5	$ 71.50	$ 71.50	71.5	$ 71.50	$ 71.50	71.5	$ 71.50	$ 71.50	71.5	$ 71.50	$ 71.50
116.67					116.67					116.67	
		$ 38.35			$ 38.35			$ 38.35			$ 38.35
$ 19.99			$ 19.99			$ 19.99			$ 19.99		
98.395		98.395		98.395		98.395		98.395		98.395	
$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34
			28.6								
						251.73					
120					120					120	
			110.5								
			7.47								
						166.2					
46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69
132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55

141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05
212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08
		120									
		$ 108.49				$ 108.49				$ 108.49	
						387.58					
224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7
288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9
395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9
1605	1605	1605	1605	1605	1605	1605	1605	1605	1605	1605	1605
1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2
$ (5,669.46)	$ (4,511.67)	$ (4,876.90)	$ (5,480.96)	$ (4,610.06)	$ (4,786.69)	$ (6,346.79)	$ (4,511.67)	$ (4,648.41)	$ (5,334.39)	$ (4,955.22)	$ (4,550.02)
$ 1,890.54	$ 1,788.33	$ 163.10	$ 2,079.04	$ 1,689.94	$ 253.31	$ 1,213.21	$ 1,788.33	$ 391.59	$ 2,225.61	$ 1,344.78	$ 489.98

23	24	25	26	27	28	29	30	31	32	33	34
$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00
$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00
71.79	$ 71.79	$ 71.79	71.79	$ 71.79	$ 71.79	71.79	$ 71.79	$ 71.79	71.79	$ 71.79	$ 71.79
12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67
37.352	$ 37.35	$ 37.35	37.352	$ 37.35	$ 37.35	37.352	$ 37.35	$ 37.35	37.352	$ 37.35	$ 37.35
24.679	$ 24.68	$ 24.68	24.679	$ 24.68	$ 24.68	24.679	$ 24.68	$ 24.68	24.679	$ 24.68	$ 24.68
66.193	$ 66.19	$ 66.19	66.193	$ 66.19	$ 66.19	66.193	$ 66.19	$ 66.19	66.193	$ 66.19	$ 66.19
771.39			771.39			771.39			771.39		
31.349			31.349			31.349			31.349		
93.38	$ 93.38	$ 93.38	93.38	$ 93.38	$ 93.38	93.38	$ 93.38	$ 93.38	93.38	$ 93.38	$ 93.38
38.019	$ 38.02	$ 38.02	38.019	$ 38.02	$ 38.02	38.019	$ 38.02	$ 38.02	38.019	$ 38.02	$ 38.02
12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67
71.5	$ 71.50	$ 71.50	71.5	$ 71.50	$ 71.50	71.5	$ 71.50	$ 71.50	71.5	$ 71.50	$ 71.50
			116.67					116.67			
		$ 38.35			$ 38.35			$ 38.35			$ 38.35
$ 19.99			$ 19.99			$ 19.99			$ 19.99		
98.395		98.395		98.395		98.395		98.395		98.395	
$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34
				28.6							
		251.73								251.73	
			120					120			
				110.5							
				7.47							
		166.2								166.2	
46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69
132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55

141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05
212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08
		120									
		$ 108.49				$ 108.49				$ 108.49	
		387.58								387.58	
224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7
288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9
395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9
1605	1605	1605	1605	1605	1605	1605	1605	1605	1605	1605	1605
1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2
$ (5,432.79)	$ (4,511.67)	$ (5,682.41)	$ (5,571.06)	$ (4,756.63)	$ (4,550.02)	$ (5,541.28)	$ (4,511.67)	$ (4,885.08)	$ (5,334.39)	$ (5,524.06)	$ (4,550.02)
$ 2,127.21	$ 1,788.33	$ (642.41)	$ 1,988.94	$ 1,543.37	$ 489.98	$ 2,018.72	$ 1,788.33	$ 154.92	$ 2,225.61	$ 775.94	$ 489.98

35	36	37	38	39	40	41	42	43	44	45	46
$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00	$7,560.00	$6,300.00	$5,040.00
$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00	$ 6,300.00	$ 5,040.00
71.79	$ 71.79	$ 71.79	71.79	$ 71.79	$ 71.79	71.79	$ 71.79	$ 71.79	71.79	$ 71.79	$ 71.79
12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67
37.352	$ 37.35	$ 37.35	37.352	$ 37.35	$ 37.35	37.352	$ 37.35	$ 37.35	37.352	$ 37.35	$ 37.35
24.679	$ 24.68	$ 24.68	24.679	$ 24.68	$ 24.68	24.679	$ 24.68	$ 24.68	24.679	$ 24.68	$ 24.68
66.193	$ 66.19	$ 66.19	66.193	$ 66.19	$ 66.19	66.193	$ 66.19	$ 66.19	66.193	$ 66.19	$ 66.19
771.39			771.39			771.39			771.39		
31.349			31.349			31.349			31.349		
93.38	$ 93.38	$ 93.38	93.38	$ 93.38	$ 93.38	93.38	$ 93.38	$ 93.38	93.38	$ 93.38	$ 93.38
38.019	$ 38.02	$ 38.02	38.019	$ 38.02	$ 38.02	38.019	$ 38.02	$ 38.02	38.019	$ 38.02	$ 38.02
12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67	12.673	$ 12.67	$ 12.67
71.5	$ 71.50	$ 71.50	71.5	$ 71.50	$ 71.50	71.5	$ 71.50	$ 71.50	71.5	$ 71.50	$ 71.50
	116.67					116.67					116.67
		$ 38.35			$ 38.35			$ 38.35			$ 38.35
$ 19.99			$ 19.99			$ 19.99			$ 19.99		
98.395		98.395		98.395		98.395		98.395		98.395	
$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34	$ 9.34
					28.6						
						251.73					
	120					120					120
					110.5						
					7.47						
						166.2					
46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69
132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55

141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05
212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08
		120									
		$ 108.49				$ 108.49				$ 108.49	
						387.58					
224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7	224.7
288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9	288.9
395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9	395.9
1605	1605	1605	1605	1605	1605	1605	1605	1605	1605	1605	1605
1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2	1027.2
$ (5,432.79)	$ (4,748.34)	$ (4,876.90)	$ (5,334.39)	$ (4,610.06)	$ (4,696.59)	$ (6,583.46)	$ (4,511.67)	$ (4,648.41)	$ (5,334.39)	$ (4,718.55)	$ (4,786.69)
$ 2,127.21	$ 1,551.66	$ 163.10	$ 2,225.61	$ 1,689.94	$ 343.41	$ 976.54	$ 1,788.33	$ 391.59	$ 2,225.61	$ 1,581.45	$ 253.31

47	48	49	50
$7,560.00	$6,300.00	$5,040.00	$7,560.00
$ 7,560.00	$ 6,300.00	$ 5,040.00	$ 7,560.00
71.79	$ 71.79	$ 71.79	71.79
12.673	$ 12.67	$ 12.67	12.673
37.352	$ 37.35	$ 37.35	37.352
24.679	$ 24.68	$ 24.68	24.679
66.193	$ 66.19	$ 66.19	66.193
771.39			771.39
31.349			31.349
93.38	$ 93.38	$ 93.38	93.38
38.019	$ 38.02	$ 38.02	38.019
12.673	$ 12.67	$ 12.67	12.673
71.5	$ 71.50	$ 71.50	71.5
		$ 38.35	
$ 19.99			$ 19.99
98.395		98.395	
$ 9.34	$ 9.34	$ 9.34	$ 9.34
		251.73	
		166.2	
46.69	46.69	46.69	46.69
132.55	132.55	132.55	132.55

141.05	141.05	141.05	141.05
212.08	212.08	212.08	212.08
		120	
		$ 108.49	
		387.58	
224.7	224.7	224.7	224.7
288.9	288.9	288.9	288.9
395.9	395.9	395.9	395.9
1605	1605	1605	1605
1027.2	1027.2	1027.2	1027.2
$ (5,432.79)	$ (4,511.67)	$ (5,682.41)	$ (5,334.39)
$ 2,127.21	$ 1,788.33	$ (642.41)	$ 2,225.61

Plantain production									
Brunca region									
Years	0	1	2	3	4	5	6	7	8
Benefits (per hectare)									
Export sales			6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73
60% liquidation of trees in property			3058.84						
TOTAL BENEFITS		0.00	9931.57	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73
Costs (per hectare)									
Initial investment		3367.21							
Variable costs									
Manual "chapeo"			71.79	71.79	71.79	71.79	71.79	71.79	71.79
Cutting trees			12.67	12.67	12.67	12.67	12.67	12.67	12.67
Cleaning of area			37.35	37.35	37.35	37.35	37.35	37.35	37.35
Initial herbicide			24.68	24.68	24.68	24.68	24.68	24.68	24.68
Glifosato			66.19	66.19	66.19	66.19	66.19	66.19	66.19
Plántulas en bolsa			771.39			771.39			771.39
Distribution of plants			31.35			31.35			31.35
Digging of holes			93.38	93.38	93.38	93.38	93.38	93.38	93.38
Planting			38.02	38.02	38.02	38.02	38.02	38.02	38.02
Fertilization			12.67	12.67	12.67	12.67	12.67	12.67	12.67
Fertilizer			71.50	71.50	71.50	71.50	71.50	71.50	71.50
Rodagea (Deshoja)							116.67		
Herbicide application					38.35			38.35	
Fluazitop Butil									
Paraquat			19.99	19.99	19.99	19.99	19.99	19.99	19.99
Glifosato				98.40		98.40		98.40	
Pruning			9.34	9.34	9.34	9.34	9.34	9.34	9.34
Pruning (deshijar)				62.67		62.67		62.67	
Aplicar funguicida									
Propicanozole									
Tridemorf							120.00		
Aceite Agrícola									
Emulsifiant									
Deshoja despunta									

Apuntalar			46.69	46.69	46.69	46.69	46.69	46.69	46.69
Embolse Encinta			132.55	132.55	132.55	132.55	132.55	132.55	132.55
Puntal			141.05	141.05	141.05	141.05	141.05	141.05	141.05
Bag			212.08	212.08	212.08	212.08	212.08	212.08	212.08
Fert.Cultivo									
Ammonium Sulfate						108.49			
15-3-31									
Recava Zanjos			224.70	224.70	224.70	224.70	224.70	224.70	224.70
Corta Acarreo			288.90	288.90	288.90	288.90	288.90	288.90	288.90
Packing			395.90	395.90	395.90	395.90	395.90	395.90	395.90
Packing Material			1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00
Envío Muelle Trámite			1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20
TOTAL COSTS		-3367.21	-5334.39	-4692.72	-4570.01	-5603.95	-4768.32	-4731.07	-5334.39
Net Benefits per hectare		-3367.21	4597.18	1034.55	11.81	1268.78	958.95	-149.25	1538.33
NPV	6517.16								

9	10	11	12	13	14	15	16	17	18	19	20	21	22
5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82
5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82
71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79
12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67
37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35
24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68
66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19
		771.39			771.39			771.39			771.39		
		31.35			31.35			31.35			31.35		
93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38
38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02
12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67
71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50
		116.67					116.67					116.67	
	38.35			38.35			38.35			38.35			38.35
19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99
98.40		98.40		98.40		98.40		98.40		98.40		98.40	
9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34
62.67		62.67		62.67		62.67		62.67		62.67		62.67	
					28.60								
251.73								251.73					
		120.00					120.00					120.00	
					110.50								
					7.47								
166.20								166.20					
46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69
132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55

141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05
212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08
				120.00									
108.49				108.49				108.49				108.49	
387.58								387.58					
224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70
288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90
395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90
1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00
1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20
-5606.72	-4570.01	-5732.13	-4531.65	-4959.56	-5480.96	-4692.72	-4806.68	-6409.46	-4531.65	-4731.07	-5334.39	-5037.88	-4570.01
120.55	11.81	1140.60	1195.62	-377.74	1391.76	1034.55	-224.86	463.27	1195.62	-149.25	1538.33	689.39	11.81

23	24	25	26	27	28	29	30	31	32	33	34	35	36
6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27
6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27
71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79
12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67
37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35
24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68
66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19
93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38
38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02
12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67
71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50
			116.67					116.67					116.67
		38.35			38.35			38.35			38.35		
19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99
98.40		98.40		98.40		98.40		98.40		98.40		98.40	
9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34
62.67		62.67		62.67		62.67		62.67		62.67		62.67	
				28.60									
		251.73								251.73			
			120.00					120.00					120.00
				110.50									
				7.47									
		166.20								166.20			
46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69
132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55

141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05
212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08
		108.49				108.49				108.49			
		387.58								387.58			
224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70
288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90
395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90
1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00
1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20
-4692.72	-4531.65	-5645.07	-4768.32	-4839.29	-4570.01	-4801.21	-4531.65	-4967.74	-4531.65	-5606.72	-4570.01	-4692.72	-4768.32
2180.01	1195.62	-1063.25	2104.40	887.98	11.81	2071.52	1195.62	-385.92	2341.07	120.55	11.81	2180.01	958.95

37	38	39	40	41	42	43	44	45	46	47	48	49	50
4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73
4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73
71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79
12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67
37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35
24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68
66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19
93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38
38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02
12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67
71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50
				116.67					116.67				
38.35			38.35			38.35			38.35			38.35	
19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99
98.40		98.40		98.40		98.40		98.40		98.40		98.40	
9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34
62.67		62.67		62.67		62.67		62.67		62.67		62.67	
			28.60										
				251.73								251.73	
				120.00					120.00				
				110.50									
				7.47									
				166.20								166.20	
46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69
132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55

141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05
212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08
108.49				108.49				108.49				108.49	
				387.58								387.58	
224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70
288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90
395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90
1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00
1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20
-4839.56	-4531.65	-4692.72	-4598.61	-5961.36	-4531.65	-4731.07	-4531.65	-4801.21	-4806.68	-4692.72	-4531.65	-5645.07	-4531.65
-257.74	2341.07	1034.55	-16.79	911.37	1195.62	-149.25	2341.07	926.06	-224.86	2180.01	1195.62	-1063.25	2341.07

Plantain production									
Brunca region									
Years	0	1	2	3	4	5	6	7	8
Benefits (per hectare)									
Export sales			6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73
60% liquidation of trees in property			3890.36						
TOTAL BENEFITS		0.00	10763.09	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73
Costs (per hectare)									
Initial investment		3367.21							
Variable costs									
Manual "chapeo"			71.79	71.79	71.79	71.79	71.79	71.79	71.79
Cutting trees			12.67	12.67	12.67	12.67	12.67	12.67	12.67
Cleaning of area			37.35	37.35	37.35	37.35	37.35	37.35	37.35
Initial herbicide			24.68	24.68	24.68	24.68	24.68	24.68	24.68
Glifosato			66.19	66.19	66.19	66.19	66.19	66.19	66.19
Plántulas en bolsa			771.39			771.39			771.39
Distribution of plants			31.35			31.35			31.35
Digging of holes			93.38	93.38	93.38	93.38	93.38	93.38	93.38
Planting			38.02	38.02	38.02	38.02	38.02	38.02	38.02
Fertilization			12.67	12.67	12.67	12.67	12.67	12.67	12.67
Fertilizer			71.50	71.50	71.50	71.50	71.50	71.50	71.50
Rodagea (Deshoja)							116.67		
Herbicide application					38.35			38.35	
Fluazitop Butil									
Paraquat			19.99	19.99	19.99	19.99	19.99	19.99	19.99
Glifosato				98.40		98.40		98.40	
Pruning			9.34	9.34	9.34	9.34	9.34	9.34	9.34
Pruning (deshijar)				62.67		62.67		62.67	
Aplicar funguicida									
Propicanozole									
Tridemorf							120.00		
Aceite Agrícola									
Emulsifiant									
Deshoja despunta									

Apuntalar			46.69	46.69	46.69	46.69	46.69	46.69	46.69
Embolse Encinta			132.55	132.55	132.55	132.55	132.55	132.55	132.55
Puntal			141.05	141.05	141.05	141.05	141.05	141.05	141.05
Bag			212.08	212.08	212.08	212.08	212.08	212.08	212.08
Fert.Cultivo									
Ammonium Sulfate						108.49			
15-3-31									
Recava Zanjos			224.70	224.70	224.70	224.70	224.70	224.70	224.70
Corta Acarreo			288.90	288.90	288.90	288.90	288.90	288.90	288.90
Packing			395.90	395.90	395.90	395.90	395.90	395.90	395.90
Packing Material			1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00
Envío Muelle Trámite			1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20
TOTAL COSTS		-3367.21	-5334.39	-4692.72	-4570.01	-5603.95	-4768.32	-4731.07	-5334.39
Net Benefits per hectare		-3367.21	5428.70	1034.55	11.81	1268.78	958.95	-149.25	1538.33
NPV	7204.37								

9	10
5727.27	4581.82
5727.27	4581.82
71.79	71.79
12.67	12.67
37.35	37.35
24.68	24.68
66.19	66.19
93.38	93.38
38.02	38.02
12.67	12.67
71.50	71.50
	38.35
19.99	19.99
98.40	
9.34	9.34
62.67	
251.73	
166.20	

46.69	46.69
132.55	132.55
141.05	141.05
212.08	212.08
108.49	
387.58	
224.70	224.70
288.90	288.90
395.90	395.90
1605.00	1605.00
1027.20	1027.20
-5606.72	-4570.01
120.55	11.81

11	12	13	14	15	16	17	18	19	20	21	22	23	24
6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27
6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27
71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79
12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67
37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35
24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68
66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19
771.39			771.39			771.39			771.39				
31.35			31.35			31.35			31.35				
93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38
38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02
12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67
71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50
116.67					116.67					116.67			
		38.35			38.35			38.35			38.35		
19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99
98.40		98.40		98.40		98.40		98.40		98.40		98.40	
9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34
62.67		62.67		62.67		62.67		62.67		62.67		62.67	
			28.60										
						251.73							
120.00					120.00					120.00			
			110.50										
			7.47										
						166.20							
46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69
132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55

141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05
212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08
		120.00											
		108.49				108.49				108.49			
						387.58							
224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70
288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90
395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90
1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00
1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20
-5732.13	-4531.65	-4959.56	-5480.96	-4692.72	-4806.68	-6409.46	-4531.65	-4731.07	-5334.39	-5037.88	-4570.01	-4692.72	-4531.65
1140.60	1195.62	-377.74	1391.76	1034.55	-224.86	463.27	1195.62	-149.25	1538.33	689.39	11.81	2180.01	1195.62

25	26	27	28	29	30	31	32	33	34	35	36	37	38
4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73
4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73
71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79
12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67
37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35
24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68
66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19
93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38
38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02
12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67
71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50
	116.67					116.67					116.67		
38.35			38.35			38.35			38.35			38.35	
19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99
98.40		98.40		98.40		98.40		98.40		98.40		98.40	
9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34
62.67		62.67		62.67		62.67		62.67		62.67		62.67	
		28.60											
251.73								251.73					
	120.00					120.00					120.00		
		110.50											
		7.47											
166.20								166.20					
46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69
132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55

141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05
212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08
108.49				108.49				108.49				108.49	
387.58								387.58					
224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70
288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90
395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90
1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00
1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20
-5645.07	-4768.32	-4839.29	-4570.01	-4801.21	-4531.65	-4967.74	-4531.65	-5606.72	-4570.01	-4692.72	-4768.32	-4839.56	-4531.65
-1063.25	2104.40	887.98	11.81	2071.52	1195.62	-385.92	2341.07	120.55	11.81	2180.01	958.95	-257.74	2341.07

39	40	41	42	43	44	45	46	47	48	49	50
5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73
5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73
71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79
12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67
37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35
24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68
66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19
93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38
38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02
12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67
71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50
		116.67					116.67				
	38.35			38.35			38.35			38.35	
19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99
98.40		98.40		98.40		98.40		98.40		98.40	
9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34
62.67		62.67		62.67		62.67		62.67		62.67	
	28.60										
		251.73								251.73	
		120.00					120.00				
		110.50									
		7.47									
		166.20								166.20	
46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69
132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55

141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05
212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08
		108.49				108.49				108.49	
		387.58								387.58	
224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70
288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90
395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90
1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00
1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20
-4692.72	-4598.61	-5961.36	-4531.65	-4731.07	-4531.65	-4801.21	-4806.68	-4692.72	-4531.65	-5645.07	-4531.65
1034.55	-16.79	911.37	1195.62	-149.25	2341.07	926.06	-224.86	2180.01	1195.62	-1063.25	2341.07

Plantain production									
Brunca region									
Years	0	1	2	3	4	5	6	7	8
Benefits (per hectare)									
Export sales			6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73
60% liquidation of trees in property			4427.27						
TOTAL BENEFITS		0.00	11300.00	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73
Costs (per hectare)									
Initial investment		3367.21							
Variable costs									
Manual "chapeo"			71.79	71.79	71.79	71.79	71.79	71.79	71.79
Cutting trees			12.67	12.67	12.67	12.67	12.67	12.67	12.67
Cleaning of area			37.35	37.35	37.35	37.35	37.35	37.35	37.35
Initial herbicide			24.68	24.68	24.68	24.68	24.68	24.68	24.68
Glifosato			66.19	66.19	66.19	66.19	66.19	66.19	66.19
Plántulas en bolsa			771.39			771.39			771.39
Distribution of plants			31.35			31.35			31.35
Digging of holes			93.38	93.38	93.38	93.38	93.38	93.38	93.38
Planting			38.02	38.02	38.02	38.02	38.02	38.02	38.02
Fertilization			12.67	12.67	12.67	12.67	12.67	12.67	12.67
Fertilizer			71.50	71.50	71.50	71.50	71.50	71.50	71.50
Rodagea (Deshoja)							116.67		
Herbicide application					38.35			38.35	
Fluazitop Butil									
Paraquat			19.99	19.99	19.99	19.99	19.99	19.99	19.99
Glifosato				98.40		98.40		98.40	
Pruning			9.34	9.34	9.34	9.34	9.34	9.34	9.34
Pruning (deshijar)				62.67		62.67		62.67	
Aplicar funguicida									
Propicanozole									
Tridemorf							120.00		
Aceite Agrícola									
Emulsifiant									
Deshoja despunta									

Apuntalar			46.69	46.69	46.69	46.69	46.69	46.69	46.69
Embolse Encinta			132.55	132.55	132.55	132.55	132.55	132.55	132.55
Puntal			141.05	141.05	141.05	141.05	141.05	141.05	141.05
Bag			212.08	212.08	212.08	212.08	212.08	212.08	212.08
Fert.Cultivo									
Ammonium Sulfate						108.49			
15-3-31									
Recava Zanjos			224.70	224.70	224.70	224.70	224.70	224.70	224.70
Corta Acarreo			288.90	288.90	288.90	288.90	288.90	288.90	288.90
Packing			395.90	395.90	395.90	395.90	395.90	395.90	395.90
Packing Material			1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00
Envío Muelle Trámite			1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20
TOTAL COSTS		-3367.21	-5334.39	-4692.72	-4570.01	-5603.95	-4768.32	-4731.07	-5334.39
Net Benefits per hectare		-3367.21	5965.61	1034.55	11.81	1268.78	958.95	-149.25	1538.33
NPV	7648.10								

9	10	11	12	13	14	15	16	17	18	19	20	21	22
5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82
5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82
71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79
12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67
37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35
24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68
66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19
		771.39			771.39			771.39			771.39		
		31.35			31.35			31.35			31.35		
93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38
38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02
12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67
71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50
		116.67					116.67					116.67	
	38.35			38.35			38.35			38.35			38.35
19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99
98.40		98.40		98.40		98.40		98.40		98.40		98.40	
9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34
62.67		62.67		62.67		62.67		62.67		62.67		62.67	
					28.60								
251.73								251.73					
		120.00					120.00					120.00	
					110.50								
					7.47								
166.20								166.20					
46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69
132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55

141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05
212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08
				120.00									
108.49				108.49				108.49				108.49	
387.58								387.58					
224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70
288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90
395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90
1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00
1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20
-5606.72	-4570.01	-5732.13	-4531.65	-4959.56	-5480.96	-4692.72	-4806.68	-6409.46	-4531.65	-4731.07	-5334.39	-5037.88	-4570.01
120.55	11.81	1140.60	1195.62	-377.74	1391.76	1034.55	-224.86	463.27	1195.62	-149.25	1538.33	689.39	11.81

23	24	25	26	27	28	29	30	31	32	33	34	35
6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73
6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73
71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79
12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67
37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35
24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68
66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19
93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38
38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02
12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67
71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50
			116.67					116.67				
		38.35			38.35			38.35			38.35	
19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99
98.40		98.40		98.40		98.40		98.40		98.40		98.40
9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34
62.67		62.67		62.67		62.67		62.67		62.67		62.67
				28.60								
		251.73								251.73		
			120.00					120.00				
				110.50								
				7.47								
		166.20								166.20		
46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69
132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55

141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05
212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08
		108.49				108.49				108.49		
		387.58								387.58		
224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70
288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90
395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90
1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00
1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20
-4692.72	-4531.65	-5645.07	-4768.32	-4839.29	-4570.01	-4801.21	-4531.65	-4967.74	-4531.65	-5606.72	-4570.01	-4692.72
2180.01	1195.62	-1063.25	2104.40	887.98	11.81	2071.52	1195.62	-385.92	2341.07	120.55	11.81	2180.01

36	37	38	39	40	41	42	43	44	45	46	47	48	49
5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82
5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82	6872.73	5727.27	4581.82
71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79	71.79
12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67
37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35	37.35
24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68	24.68
66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19	66.19
93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38	93.38
38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02	38.02
12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67	12.67
71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50	71.50
116.67					116.67					116.67			
	38.35			38.35			38.35			38.35			38.35
19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99	19.99
	98.40		98.40		98.40		98.40		98.40		98.40		98.40
9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34
	62.67		62.67		62.67		62.67		62.67		62.67		62.67
				28.60									
					251.73								251.73
120.00					120.00					120.00			
					110.50								
					7.47								
					166.20								166.20
46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69	46.69
132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55	132.55

141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05	141.05
212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08	212.08
	108.49				108.49				108.49				108.49
					387.58								387.58
224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70	224.70
288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90	288.90
395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90	395.90
1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00	1605.00
1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20	1027.20
-4768.32	-4839.56	-4531.65	-4692.72	-4598.61	-5961.36	-4531.65	-4731.07	-4531.65	-4801.21	-4806.68	-4692.72	-4531.65	-5645.07
958.95	-257.74	2341.07	1034.55	-16.79	911.37	1195.62	-149.25	2341.07	926.06	-224.86	2180.01	1195.62	-1063.25

50
6872.73
6872.73
71.79
12.67
37.35
24.68
66.19
93.38
38.02
12.67
71.50
19.99
9.34
46.69
132.55

141.05
212.08
224.70
288.90
395.90
1605.00
1027.20
-4531.65
2341.07

Tiquisque production										
Huetar-Atlantic Region										
Years		0	1	2	3	4	5	6	7	8
Benefits per ha (tiquisque)			5166.05	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87
Net benefits from 60% liquidation of wood on property			1332.19							
Sales Revenues			3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87
Costs per ha (tiquisque)			-1472.07	-1472.07	-1472.07	-1472.07	-1472.07	-1472.07	-1472.07	-1472.07
Labor costs			255.59	255.59	255.59	255.59	255.59	255.59	255.59	255.59
Arada			47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92
Rastreada			127.80	127.80	127.80	127.80	127.80	127.80	127.80	127.80
Alomillado			79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87
Preparation costs			551.12	551.12	551.12	551.12	551.12	551.12	551.12	551.12
Seed preparation			47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92
Planting of seeds			79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87
Fertilizer application			15.97	15.97	15.97	15.97	15.97	15.97	15.97	15.97
Fertilizer application			7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99
Fertilizer application			7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99
Herbicide application			23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96
Herbicide application			23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96
Herbicide application			23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96
Insecticide and Nematicide application			31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95
Harvest and selection			159.74	159.74	159.74	159.74	159.74	159.74	159.74	159.74
Deshija			31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95
Others			47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92
Packing and transportation			47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92
Materials and inputs			665.36	665.36	665.36	665.36	665.36	665.36	665.36	665.36
Semilla			239.62	239.62	239.62	239.62	239.62	239.62	239.62	239.62
Busamart			28.24	28.24	28.24	28.24	28.24	28.24	28.24	28.24
Vydate			51.12	51.12	51.12	51.12	51.12	51.12	51.12	51.12
15-3-31 (2)			89.14	89.14	89.14	89.14	89.14	89.14	89.14	89.14
10-30-10			59.42	59.42	59.42	59.42	59.42	59.42	59.42	59.42
Gesaprin			10.56	10.56	10.56	10.56	10.56	10.56	10.56	10.56
Gramoxone			23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00
Lazo			13.21	13.21	13.21	13.21	13.21	13.21	13.21	13.21

Nutran			41.53	41.53	41.53	41.53	41.53	41.53	41.53	41.53
Python			63.90	63.90	63.90	63.90	63.90	63.90	63.90	63.90
Metamidofos			6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39
Agrimicin			39.23	39.23	39.23	39.23	39.23	39.23	39.23	39.23
NET BENEFITS (tiquisque)			3693.98	2361.80	2361.80	2361.80	2361.80	2361.80	2361.80	2361.80
NPV	$24,627.85									

9	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87
3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87
-1472.07	-1472.07	-1472.07	-1472.07	-1472.07	-1472.07	-1472.07	-1472.07	-1472.07	-1472.07	-1472.07	-1472.07	-1472.07
255.59	255.59	255.59	255.59	255.59	255.59	255.59	255.59	255.59	255.59	255.59	255.59	255.59
47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92
127.80	127.80	127.80	127.80	127.80	127.80	127.80	127.80	127.80	127.80	127.80	127.80	127.80
79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87
551.12	551.12	551.12	551.12	551.12	551.12	551.12	551.12	551.12	551.12	551.12	551.12	551.12
47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92
79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87
15.97	15.97	15.97	15.97	15.97	15.97	15.97	15.97	15.97	15.97	15.97	15.97	15.97
7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99
7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99
23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96
23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96
23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96
31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95
159.74	159.74	159.74	159.74	159.74	159.74	159.74	159.74	159.74	159.74	159.74	159.74	159.74
31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95
47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92
47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92
665.36	665.36	665.36	665.36	665.36	665.36	665.36	665.36	665.36	665.36	665.36	665.36	665.36
239.62	239.62	239.62	239.62	239.62	239.62	239.62	239.62	239.62	239.62	239.62	239.62	239.62
28.24	28.24	28.24	28.24	28.24	28.24	28.24	28.24	28.24	28.24	28.24	28.24	28.24
51.12	51.12	51.12	51.12	51.12	51.12	51.12	51.12	51.12	51.12	51.12	51.12	51.12
89.14	89.14	89.14	89.14	89.14	89.14	89.14	89.14	89.14	89.14	89.14	89.14	89.14
59.42	59.42	59.42	59.42	59.42	59.42	59.42	59.42	59.42	59.42	59.42	59.42	59.42
10.56	10.56	10.56	10.56	10.56	10.56	10.56	10.56	10.56	10.56	10.56	10.56	10.56
23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00
13.21	13.21	13.21	13.21	13.21	13.21	13.21	13.21	13.21	13.21	13.21	13.21	13.21

41.53	41.53	41.53	41.53	41.53	41.53	41.53	41.53	41.53	41.53	41.53	41.53	41.53
63.90	63.90	63.90	63.90	63.90	63.90	63.90	63.90	63.90	63.90	63.90	63.90	63.90
6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39
39.23	39.23	39.23	39.23	39.23	39.23	39.23	39.23	39.23	39.23	39.23	39.23	39.23
2361.80	2361.80	2361.80	2361.80	2361.80	2361.80	2361.80	2361.80	2361.80	2361.80	2361.80	2361.80	2361.80

22	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**
3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87
3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87
-1472.07	-1472.07	-1472.07	-1472.07	-1472.07	-1472.07	-1472.07	-1472.07	-1472.07	-1472.07	-1472.07	-1472.07	-1472.07
255.59	255.59	255.59	255.59	255.59	255.59	255.59	255.59	255.59	255.59	255.59	255.59	255.59
47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92
127.80	127.80	127.80	127.80	127.80	127.80	127.80	127.80	127.80	127.80	127.80	127.80	127.80
79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87
551.12	551.12	551.12	551.12	551.12	551.12	551.12	551.12	551.12	551.12	551.12	551.12	551.12
47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92
79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87
15.97	15.97	15.97	15.97	15.97	15.97	15.97	15.97	15.97	15.97	15.97	15.97	15.97
7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99
7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99
23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96
23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96
23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96
31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95
159.74	159.74	159.74	159.74	159.74	159.74	159.74	159.74	159.74	159.74	159.74	159.74	159.74
31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95
47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92
47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92
665.36	665.36	665.36	665.36	665.36	665.36	665.36	665.36	665.36	665.36	665.36	665.36	665.36
239.62	239.62	239.62	239.62	239.62	239.62	239.62	239.62	239.62	239.62	239.62	239.62	239.62
28.24	28.24	28.24	28.24	28.24	28.24	28.24	28.24	28.24	28.24	28.24	28.24	28.24
51.12	51.12	51.12	51.12	51.12	51.12	51.12	51.12	51.12	51.12	51.12	51.12	51.12
89.14	89.14	89.14	89.14	89.14	89.14	89.14	89.14	89.14	89.14	89.14	89.14	89.14
59.42	59.42	59.42	59.42	59.42	59.42	59.42	59.42	59.42	59.42	59.42	59.42	59.42
10.56	10.56	10.56	10.56	10.56	10.56	10.56	10.56	10.56	10.56	10.56	10.56	10.56
23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00
13.21	13.21	13.21	13.21	13.21	13.21	13.21	13.21	13.21	13.21	13.21	13.21	13.21

41.53	41.53	41.53	41.53	41.53	41.53	41.53	41.53	41.53	41.53	41.53	41.53	41.53
63.90	63.90	63.90	63.90	63.90	63.90	63.90	63.90	63.90	63.90	63.90	63.90	63.90
6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39
39.23	39.23	39.23	39.23	39.23	39.23	39.23	39.23	39.23	39.23	39.23	39.23	39.23
2361.80	2361.80	2361.80	2361.80	2361.80	2361.80	2361.80	2361.80	2361.80	2361.80	2361.80	2361.80	2361.80

35	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**
3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87
3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87	3833.87
-1472.07	-1472.07	-1472.07	-1472.07	-1472.07	-1472.07	-1472.07	-1472.07	-1472.07	-1472.07	-1472.07	-1472.07	-1472.07
255.59	255.59	255.59	255.59	255.59	255.59	255.59	255.59	255.59	255.59	255.59	255.59	255.59
47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92
127.80	127.80	127.80	127.80	127.80	127.80	127.80	127.80	127.80	127.80	127.80	127.80	127.80
79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87
551.12	551.12	551.12	551.12	551.12	551.12	551.12	551.12	551.12	551.12	551.12	551.12	551.12
47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92
79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87	79.87
15.97	15.97	15.97	15.97	15.97	15.97	15.97	15.97	15.97	15.97	15.97	15.97	15.97
7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99
7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99	7.99
23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96
23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96
23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96
31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95
159.74	159.74	159.74	159.74	159.74	159.74	159.74	159.74	159.74	159.74	159.74	159.74	159.74
31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95	31.95
47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92
47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92	47.92
665.36	665.36	665.36	665.36	665.36	665.36	665.36	665.36	665.36	665.36	665.36	665.36	665.36
239.62	239.62	239.62	239.62	239.62	239.62	239.62	239.62	239.62	239.62	239.62	239.62	239.62
28.24	28.24	28.24	28.24	28.24	28.24	28.24	28.24	28.24	28.24	28.24	28.24	28.24
51.12	51.12	51.12	51.12	51.12	51.12	51.12	51.12	51.12	51.12	51.12	51.12	51.12
89.14	89.14	89.14	89.14	89.14	89.14	89.14	89.14	89.14	89.14	89.14	89.14	89.14
59.42	59.42	59.42	59.42	59.42	59.42	59.42	59.42	59.42	59.42	59.42	59.42	59.42
10.56	10.56	10.56	10.56	10.56	10.56	10.56	10.56	10.56	10.56	10.56	10.56	10.56
23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00	23.00
13.21	13.21	13.21	13.21	13.21	13.21	13.21	13.21	13.21	13.21	13.21	13.21	13.21

41.53	41.53	41.53	41.53	41.53	41.53	41.53	41.53	41.53	41.53	41.53	41.53	41.53
63.90	63.90	63.90	63.90	63.90	63.90	63.90	63.90	63.90	63.90	63.90	63.90	63.90
6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39
39.23	39.23	39.23	39.23	39.23	39.23	39.23	39.23	39.23	39.23	39.23	39.23	39.23
2361.80	2361.80	2361.80	2361.80	2361.80	2361.80	2361.80	2361.80	2361.80	2361.80	2361.80	2361.80	2361.80

48	**49**	**50**
3833.87	3833.87	3833.87
3833.87	3833.87	3833.87
-1472.07	-1472.07	-1472.07
255.59	255.59	255.59
47.92	47.92	47.92
127.80	127.80	127.80
79.87	79.87	79.87
551.12	551.12	551.12
47.92	47.92	47.92
79.87	79.87	79.87
15.97	15.97	15.97
7.99	7.99	7.99
7.99	7.99	7.99
23.96	23.96	23.96
23.96	23.96	23.96
23.96	23.96	23.96
31.95	31.95	31.95
159.74	159.74	159.74
31.95	31.95	31.95
47.92	47.92	47.92
47.92	47.92	47.92
665.36	665.36	665.36
239.62	239.62	239.62
28.24	28.24	28.24
51.12	51.12	51.12
89.14	89.14	89.14
59.42	59.42	59.42
10.56	10.56	10.56
23.00	23.00	23.00
13.21	13.21	13.21

41.53	41.53	41.53
63.90	63.90	63.90
6.39	6.39	6.39
39.23	39.23	39.23
2361.80	2361.80	2361.80

Tiquisque production									
Brunca Region									
Year	0	1	2	3	4	5	6	7	8
Benefits		6535.73	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37
Sales		2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37
60% Liquidation of trees on property		3890.36							
Labor costs		222.04	222.04	222.04	222.04	222.04	222.04	222.04	222.04
Chapear		23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96
Amontonar maleza		9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58
Arada		95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85
Encalar		14.38	14.38	14.38	14.38	14.38	14.38	14.38	14.38
Alomillado		73.48	73.48	73.48	73.48	73.48	73.48	73.48	73.48
Moving seeds		4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79
Preparation costs		546.33	546.33	546.33	546.33	546.33	546.33	546.33	546.33
Seed preparation		38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34
Planting of seeds		95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85
Fertilizer application		9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58
Fertilizer application		9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58
Fertilizer application		9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58
Herbicide application		33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55
Herbicide application		19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17
Herbicide application		81.47	81.47	81.47	81.47	81.47	81.47	81.47	81.47
Insecticide and Nematicide application		9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58
Harvest and selection		191.69	191.69	191.69	191.69	191.69	191.69	191.69	191.69
Harvest transport		38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34
Seed transport		9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58
Materials and inputs		346.01	346.01	346.01	346.01	346.01	346.01	346.01	346.01
Semilla		143.77	143.77	143.77	143.77	143.77	143.77	143.77	143.77
Calcium Carbonate		34.50	34.50	34.50	34.50	34.50	34.50	34.50	34.50
Kilol		11.39	11.39	11.39	11.39	11.39	11.39	11.39	11.39
Phosphorus		16.93	16.93	16.93	16.93	16.93	16.93	16.93	16.93
15-3-31		32.11	32.11	32.11	32.11	32.11	32.11	32.11	32.11
KMG		38.29	38.29	38.29	38.29	38.29	38.29	38.29	38.29
Fusilade		26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41

Paraquat		21.04	21.04	21.04	21.04	21.04	21.04	21.04	21.04
Counter		21.57	21.57	21.57	21.57	21.57	21.57	21.57	21.57
Total costs		-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38
Net benefits tiquisque		5421.35	1530.99	1530.99	1530.99	1530.99	1530.99	1530.99	1530.99
NPV	$18,716.15								

9	10	11	12	13	14	15	16	17	18	19	20	21	22
2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37
2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37
222.04	222.04	222.04	222.04	222.04	222.04	222.04	222.04	222.04	222.04	222.04	222.04	222.04	222.04
23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96
9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58
95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85
14.38	14.38	14.38	14.38	14.38	14.38	14.38	14.38	14.38	14.38	14.38	14.38	14.38	14.38
73.48	73.48	73.48	73.48	73.48	73.48	73.48	73.48	73.48	73.48	73.48	73.48	73.48	73.48
4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79
546.33	546.33	546.33	546.33	546.33	546.33	546.33	546.33	546.33	546.33	546.33	546.33	546.33	546.33
38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34
95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85
9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58
9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58
9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58
33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55
19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17
81.47	81.47	81.47	81.47	81.47	81.47	81.47	81.47	81.47	81.47	81.47	81.47	81.47	81.47
9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58
191.69	191.69	191.69	191.69	191.69	191.69	191.69	191.69	191.69	191.69	191.69	191.69	191.69	191.69
38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34
9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58
346.01	346.01	346.01	346.01	346.01	346.01	346.01	346.01	346.01	346.01	346.01	346.01	346.01	346.01
143.77	143.77	143.77	143.77	143.77	143.77	143.77	143.77	143.77	143.77	143.77	143.77	143.77	143.77
34.50	34.50	34.50	34.50	34.50	34.50	34.50	34.50	34.50	34.50	34.50	34.50	34.50	34.50
11.39	11.39	11.39	11.39	11.39	11.39	11.39	11.39	11.39	11.39	11.39	11.39	11.39	11.39
16.93	16.93	16.93	16.93	16.93	16.93	16.93	16.93	16.93	16.93	16.93	16.93	16.93	16.93
32.11	32.11	32.11	32.11	32.11	32.11	32.11	32.11	32.11	32.11	32.11	32.11	32.11	32.11
38.29	38.29	38.29	38.29	38.29	38.29	38.29	38.29	38.29	38.29	38.29	38.29	38.29	38.29
26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41

21.04	21.04	21.04	21.04	21.04	21.04	21.04	21.04	21.04	21.04	21.04	21.04	21.04	21.04
21.57	21.57	21.57	21.57	21.57	21.57	21.57	21.57	21.57	21.57	21.57	21.57	21.57	21.57
-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38
1530.99	1530.99	1530.99	1530.99	1530.99	1530.99	1530.99	1530.99	1530.99	1530.99	1530.99	1530.99	1530.99	1530.99

23	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**
2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37
2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37
222.04	222.04	222.04	222.04	222.04	222.04	222.04	222.04	222.04	222.04	222.04	222.04	222.04	222.04
23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96
9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58
95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85
14.38	14.38	14.38	14.38	14.38	14.38	14.38	14.38	14.38	14.38	14.38	14.38	14.38	14.38
73.48	73.48	73.48	73.48	73.48	73.48	73.48	73.48	73.48	73.48	73.48	73.48	73.48	73.48
4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79
546.33	546.33	546.33	546.33	546.33	546.33	546.33	546.33	546.33	546.33	546.33	546.33	546.33	546.33
38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34
95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85
9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58
9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58
9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58
33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55
19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17
81.47	81.47	81.47	81.47	81.47	81.47	81.47	81.47	81.47	81.47	81.47	81.47	81.47	81.47
9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58
191.69	191.69	191.69	191.69	191.69	191.69	191.69	191.69	191.69	191.69	191.69	191.69	191.69	191.69
38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34
9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58
346.01	346.01	346.01	346.01	346.01	346.01	346.01	346.01	346.01	346.01	346.01	346.01	346.01	346.01
143.77	143.77	143.77	143.77	143.77	143.77	143.77	143.77	143.77	143.77	143.77	143.77	143.77	143.77
34.50	34.50	34.50	34.50	34.50	34.50	34.50	34.50	34.50	34.50	34.50	34.50	34.50	34.50
11.39	11.39	11.39	11.39	11.39	11.39	11.39	11.39	11.39	11.39	11.39	11.39	11.39	11.39
16.93	16.93	16.93	16.93	16.93	16.93	16.93	16.93	16.93	16.93	16.93	16.93	16.93	16.93
32.11	32.11	32.11	32.11	32.11	32.11	32.11	32.11	32.11	32.11	32.11	32.11	32.11	32.11
38.29	38.29	38.29	38.29	38.29	38.29	38.29	38.29	38.29	38.29	38.29	38.29	38.29	38.29
26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41

21.04	21.04	21.04	21.04	21.04	21.04	21.04	21.04	21.04	21.04	21.04	21.04	21.04	21.04
21.57	21.57	21.57	21.57	21.57	21.57	21.57	21.57	21.57	21.57	21.57	21.57	21.57	21.57
-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38
1530.99	1530.99	1530.99	1530.99	1530.99	1530.99	1530.99	1530.99	1530.99	1530.99	1530.99	1530.99	1530.99	1530.99

37	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**
2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37
2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37	2645.37
222.04	222.04	222.04	222.04	222.04	222.04	222.04	222.04	222.04	222.04	222.04	222.04	222.04	222.04
23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96	23.96
9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58
95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85
14.38	14.38	14.38	14.38	14.38	14.38	14.38	14.38	14.38	14.38	14.38	14.38	14.38	14.38
73.48	73.48	73.48	73.48	73.48	73.48	73.48	73.48	73.48	73.48	73.48	73.48	73.48	73.48
4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79	4.79
546.33	546.33	546.33	546.33	546.33	546.33	546.33	546.33	546.33	546.33	546.33	546.33	546.33	546.33
38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34
95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85	95.85
9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58
9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58
9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58
33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55	33.55
19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17	19.17
81.47	81.47	81.47	81.47	81.47	81.47	81.47	81.47	81.47	81.47	81.47	81.47	81.47	81.47
9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58
191.69	191.69	191.69	191.69	191.69	191.69	191.69	191.69	191.69	191.69	191.69	191.69	191.69	191.69
38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34	38.34
9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58	9.58
346.01	346.01	346.01	346.01	346.01	346.01	346.01	346.01	346.01	346.01	346.01	346.01	346.01	346.01
143.77	143.77	143.77	143.77	143.77	143.77	143.77	143.77	143.77	143.77	143.77	143.77	143.77	143.77
34.50	34.50	34.50	34.50	34.50	34.50	34.50	34.50	34.50	34.50	34.50	34.50	34.50	34.50
11.39	11.39	11.39	11.39	11.39	11.39	11.39	11.39	11.39	11.39	11.39	11.39	11.39	11.39
16.93	16.93	16.93	16.93	16.93	16.93	16.93	16.93	16.93	16.93	16.93	16.93	16.93	16.93
32.11	32.11	32.11	32.11	32.11	32.11	32.11	32.11	32.11	32.11	32.11	32.11	32.11	32.11
38.29	38.29	38.29	38.29	38.29	38.29	38.29	38.29	38.29	38.29	38.29	38.29	38.29	38.29
26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41	26.41

21.04	21.04	21.04	21.04	21.04	21.04	21.04	21.04	21.04	21.04	21.04	21.04	21.04	21.04
21.57	21.57	21.57	21.57	21.57	21.57	21.57	21.57	21.57	21.57	21.57	21.57	21.57	21.57
-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38	-1114.38
1530.99	1530.99	1530.99	1530.99	1530.99	1530.99	1530.99	1530.99	1530.99	1530.99	1530.99	1530.99	1530.99	1530.99

Sustainable Forestry										
Years	0	1(1)	2	3	4	5	6	7	8	9
Sustainable Timber Harvest		807.39								
Sustainable Extraction of Non-timber forest products		50	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
Sustainable Ecotourism		12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56
PES		62.24	62.24	62.24	62.24	62.24	0.00	0.00	0.00	0.00
Net benefits per hectare		932.19	124.80	124.80	124.80	124.80	62.56	62.56	62.56	62.56
NPV	**2021.80**									

10(2)	11	12	13	14	15	16	17	18	19	20 (3)	21	22
767.02										689.38		
50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
829.58	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	751.94	62.56	62.56

23	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**
												605.54
50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	668.10

36	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**
50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56

49	**50(5)**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**	**61**	**62**
	621.07												
50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
62.56	683.63	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56

63	**64**	**65(6)**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**	**76**
		611.75											
50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00
12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
62.56	62.56	674.31	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56

77	**78**	**79**	**80(7)**
			608.65
50.00	50.00	50.00	50.00
12.56	12.56	12.56	12.56
0.00	0.00	0.00	0.00
62.56	62.56	62.56	671.21

Sustainable Forestry									
Years	0	1(1)	2	3	4	5	6	7	8
Sustainable Timber Harvest		2163.18	0	0	0	0	0	0	0
Sustainable Extraction of Non-timber forest products		50	50	50	50	50	50	50	50
Sustainable Ecotourism		12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56
PES		62.24	62.24	62.24	62.24	62.24	0	0	0
Net benefits per hectare		2287.98	124.80	124.80	124.80	124.80	62.56	62.56	62.56
NPV	$3,994.00								

9	**10(2)**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20 (3)**	**21**	**22**
0	2291.74	0	0	0	0	0	0	0	0	0	1805.44	0	0
50	50	50	50	50	50	50	50	50	50	50	50	50	50
12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56
0	0	0	0	0	0	0	0	0	0	0	0	0	0
62.56	2354.30	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	1868.00	62.56	62.56

23	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**
0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	50	50	50	50	50	50	50	50	50	50	50	50	50
12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56
0	0	0	0	0	0	0	0	0	0	0	0	0	0
62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56

37	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50(5)**
0	0	0	0	0	0	0	0	0	0	0	0	0	1296.78809
50	50	50	50	50	50	50	50	50	50	50	50	50	50
12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56
0	0	0	0	0	0	0	0	0	0	0	0	0	0
62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	1359.35

51	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**59**	**60**	**61**	**62**	**63**	**64**
0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	50	50	50	50	50	50	50	50	50	50	50	50	50
12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56
0	0	0	0	0	0	0	0	0	0	0	0	0	0
62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56

65(6)	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**	**76**	**77**	**78**
1302.37769	0	0	0	0	0	0	0	0	0	0	0	0	0
50	50	50	50	50	50	50	50	50	50	50	50	50	50
12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1364.94	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56

79	**80(7)**
0	1252.07
50	50
12.56	12.56
0	0
62.56	1314.63

Conservation										
Year		0	1	2	3	4	5	6	7	8
PES			39.74	39.74	39.74	39.74	39.74	0	0	0
Sustainable extraction of non-timber forest products			50	50	50	50	50	50	50	50
Sustainable eco-tourism			12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56
Total benefits			102.3	102.3	102.3	102.3	102.3	25	62.56	62.56
NPV		$749.72								

9	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
0	0	0	0	0	0	0	0	0	0	0	0	0
50	50	50	50	50	50	50	50	50	50	50	50	50
12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56
62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56

22	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**
0	0	0	0	0	0	0	0	0	0	0	0	0
50	50	50	50	50	50	50	50	50	50	50	50	50
12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56
62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56

35	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**
0	0	0	0	0	0	0	0	0	0	0	0	0
50	50	50	50	50	50	50	50	50	50	50	50	50
12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56	12.56
62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56	62.56

48	**49**	**50**
0	0	0
50	50	50
12.56	12.56	12.56
62.56	62.56	62.56