Business plan

Silvopastoral reforestation and restoration of degraded natural forests in Golondrina, Paraguay

Technical, financial and management information

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Content

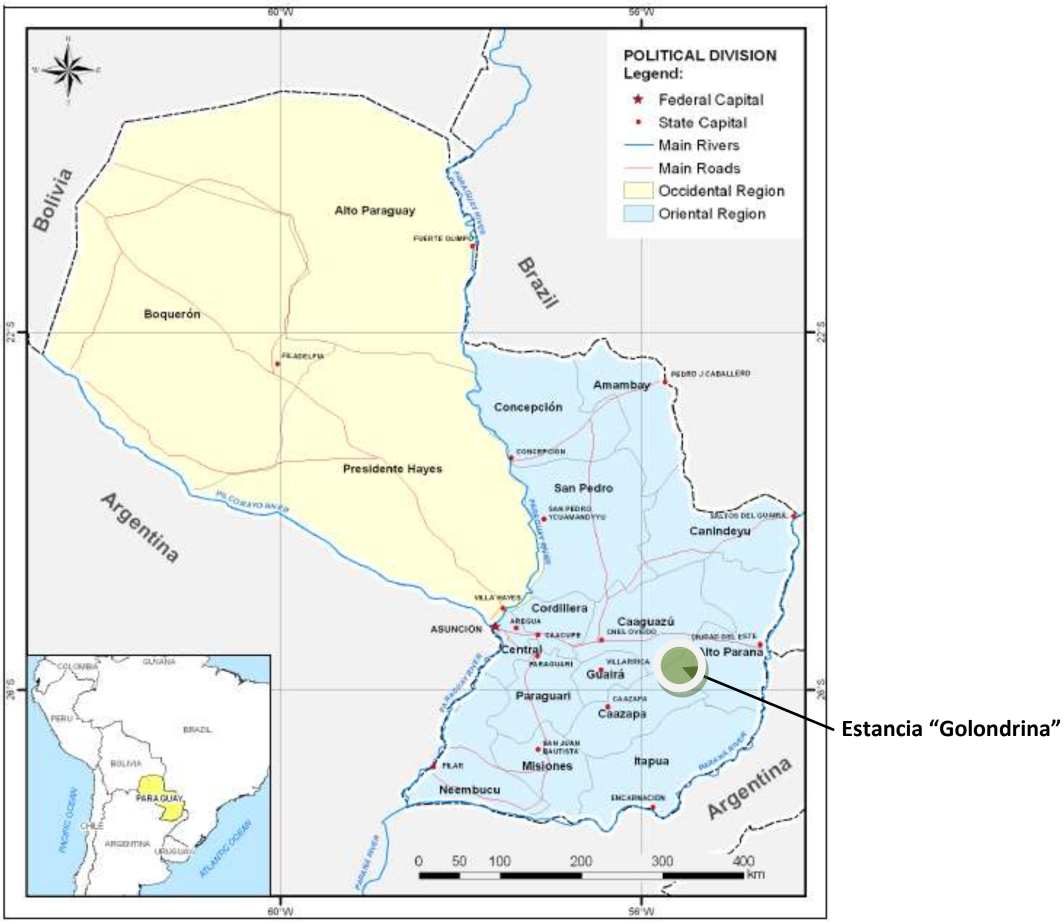
1 Introduction

1.1 Production site

The proposed project is envisioned to be implemented on Estancia Golondrina. Golondrina is a private property located in the Department of Caazapá in eastern Paraguay and owned by SAGSA (Sociedad Agrícola Golondrina S.A.), a subsidiary company of PAYCO (Paraguay Agriculture Corporation).

Annual rainfall in Golondrina oscillates between 1,800 to 2,000 mm. There is no pronounced dry season. Mean temperature is 21.5°C. The natural vegetation in Golondrina belongs to the biodiversity hot spot Mata Atlántica. Golondrina disposes of one of the largest continuous Mata Atlántica forests in eastern Paraguay.

Figure 1: Location of Estancia Golondrina in Paraguay



The property covers 24,000 ha. About 50 % of the area is used for intensive agricultural production and livestock breeding. An area of 11,500 ha corresponds to natural forest including 5,650 ha managed under FSC certification (first Paraguayan company with FSC certificate) by FORCERPA, a consortium between SAGSA and UNIQUE. In addition, 2,000 ha are utilized by an indigenous community living within the property. The remaining forest area is currently not managed and under different stages of degradation.

1.2 Project size and production objectives

The business plan is prepared for a REDD+ compatible forestry production project that envisions undertaking the following activities:

- **431 ha of value timber production under silvopastoral systems** with Eucalyptus species on good site conditions. The rotation (time from planting to final cut) is 12 years. Planting density and thinning regime will allow cattle breeding within the plantation areas.
- **42 ha of biomass production under silvopastoral systems** with Eucalyptus species on marginal site conditions. The rotation is 6 years. Planting density will allow cattle breeding within the plantation areas.
- **400 ha of high value timber production in degraded natural forest**. The natural forests will be enriched on 30 % of the area with two fast growing high value species belonging to the mahogany family (Paraiso and Toona). The non-native species will be introduced only temporarily. When harvesting them after 10 (Paraiso) and 20 years (Toona) respectively, the recovered natural forest will be managed using the remaining native tree species.
- **107 ha of high value timber production in a highly degraded natural forest** area. In 1996 the natural forest was thinned strongly to establish silvopastoral production with native tree species. Due to grazing activities and to fire events, the remaining natural forests in this area have been highly degraded. However, the site conditions are very favorable for forestry production. Therefore, a restoration concept will be developed. In our financial analysis, this activity has not been considered; hence the final clarification of FSC compatibility (conversion after 1994) is still missing.

The management of the plantation will combine state of the art forestry knowledge and technology with the ambitious internationally recognized standard of the Forest Stewardship Council (FSC).

In addition to the reforestation activities the project can be certified according to a carbon standard such as the Verified Carbon Standard (VCS) or Gold Standard (GS) to generate carbon credits as an early add-on revenue stream to reduce investment costs and increase the overall profitability and improve the risk-return profile of the project.

1.3 Scope and structure of this document

This document describes the technical details, financial performance and the management structure of the planned forestry production project on Estancia Golondrina. The business plan is structured as follows:

- Chapter 2 presents the **involved companies**.
- Chapter 3 describes the underlying **general concept** of the project activity.
- Chapter 4 provides information on **specific production schemes**: project area, tree species to be planted, silvicultural concepts including growth and yield performance.
- Chapter 5 introduces to the **timber market** and to commercialization strategies.
- Chapter 6 focuses on the **project management** structure.
- Chapter 7 describes the **financial performance** of the project.
- Chapter 8 provides information on integration of **carbon business**.
- Chapter 9 presents the **risk assessment** and risk mitigation measures.

2 Profiles of involved companies

Since many years the two involved companies SAGSA/PAYCO and UNIQUE work together on development and implementation of forestry production projects. So far two large-scale projects are under implementation:

- Management of 5,650 ha of natural forests, started in 2002.
- Management of 1,000 ha of forest plantations in silvopastoral production schemes, started in 2011. Until end of 2016, the area will be extended up to 9,000 ha.

The companies are briefly presented below.

PAYCO – Paraguay Agricultural Corporation

PAYCO operates 135,000 ha in Paraguay with agriculture, cattle and forestry production through three companies:

- **SAGSA**: Seed and grains production
- **CORINA**: Beef cattle production
- **FORCERPA**: FSC certified wood production (consortium with UNIQUE)

The main activities are:

- **Agriculture production**: Soybean grain and seeds, corn, cotton fiber and seeds, and wheat grain and seeds production
- **Beef cattle production**: Registered Braford bull rearing and beef cattle breeding, rearing and fattening
- **Forestry production**: High value timber production in natural forests, biomass and value timber production in forest plantations

Since 2013 DEG (Deutsche Investitions- und Entwicklungsgesellschaft), a financial institution owned by the German government, is invested in PAYCO.

UNIQUE forestry and land use

UNIQUE is a leading consultancy and project developer and manager in the forestry and land use sector. Headquarters are located in Freiburg, Germany. The company has subsidiaries and branch offices in Asunción, Paraguay (UNIQUE Wood Paraguay S.A.), Kampala, Uganda (UNIQUE East Africa Ltd) and Boppard, Germany and representatives / project offices in Argentina, China and India.

With 40 permanently employed forestry and land use experts the company provides a unique pool of expertise and competence to rapidly, efficiently and professionally respond to clients' demands.

Besides of conducting consultancies UNIQUE works as forestry project implementer and manager in Paraguay (natural forests and forest plantations) and Uganda (forest plantations).

For more details please contact: www.unique-landuse.de and www.unique-wood-paraguay.com.

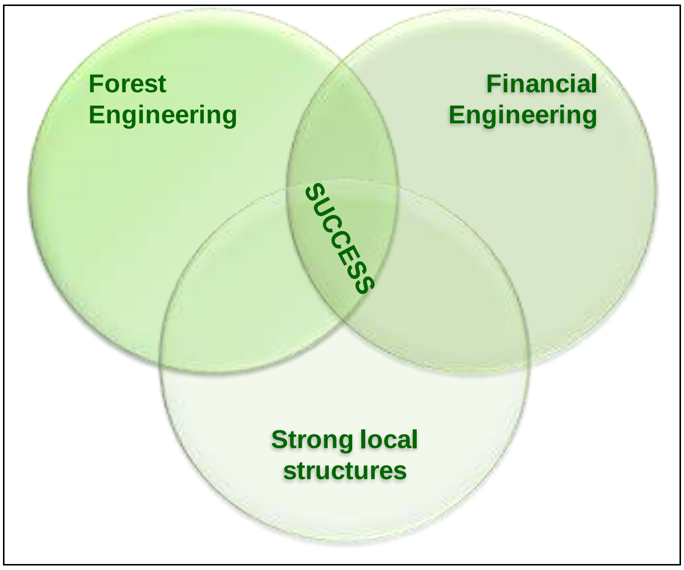
3 General concept

3.1 Our understanding of forest investments

Investment principles

We are convinced that based on the following three principles timberland investments are successful:

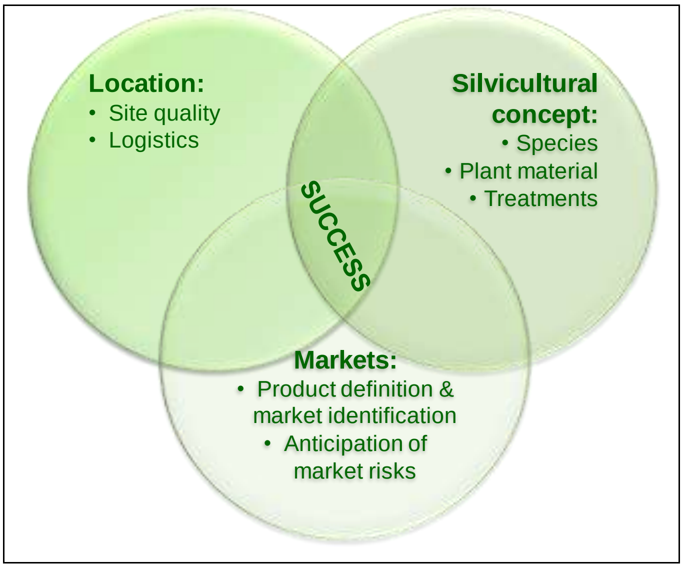
- **Professional forestry engineering** is the basis for optimal and cost efficient sustainable timber production. The correct selection of species and silvicultural regimes (see also below) predetermines economic success of forestry operations.
- **Financial engineering** takes into account the typical forest production cycle: Relatively high initial costs, long production cycles and positive cash flows not before 6 to 8 years of production.
- **Strong local organizational structures** are a crucial asset for an efficient implementation and management of forestry projects.



"Site - species - market" approach

We give due consideration to the three main requirements of an economically successful forest production:

- **Markets:** Products and key markets have to be defined before selecting tree species. Possible commercialization risks have to be anticipated.
- **Project location:** Site quality predetermines the degrees of freedom regarding species selection. Selected tree species must perform on selected sites. Besides site quality, access to markets (logistics) is crucial for the selection of suited locations for forestry projects.



- **Silvicultural concept**: The most suited tree species are selected as a function of production goals, target markets and site quality. Crucial for an optimal production is the quality of planting material and a sound maintenance and tending regime (weeding, disease control, fire prevention, pruning and thinning) of the newly established forests.

3.2 Compatibility with international standards

Forest management standards

The forest production will be undertaken compliant with FSC[1] principles in line with our commitment to sustainable production and the already FSC certified natural forest management and related product value chain.

Compatibility with carbon market standards

The project is designed in a manner to comply with the regulations of the most credible carbon market standards for compliance and voluntary carbon markets that may provide additional financial revenue streams to the investor. UNIQUE already successfully developed forest projects that have been registered under the Clean Development Mechanism (CDM) of the Kyoto Protocol and is supporting projects to obtain the Verified Carbon Standard (VCS), the Climate, Community & Biodiversity Alliance (CCBA) and Gold Standard Land Use & Forestry.

3.3 Risk mitigation by multiple species approach

Following best plantation forestry practices, not more than 20 to 30 % of the total area should be planted with one clone / species. In the proposed project we use the following different clones / species:

- Silvopastoral value timber production: *Eucalyptus grandis* represented by two different clones (still to be defined) and up to 30 % coming from generative propagation (seedlings).
- Silvopastoral biomass production: Hybrid *Eucalyptus grandis x camaldulensis* using clones 113 and 144.
- Enrichment of degraded forests with high value timber: First rotation: *Paraiso (Melia azederach)* and *Toona (Toona ciliata)*. After one rotation, the production will be based on native tree species coming from natural regeneration of the restored natural forest.

In plantation forestry we do not recommend to work with more than four to five tree species in order to

- opt for best-performing planting material, and
- manage the inherent trade-offs of diversification, i.e. increasing complexity along the production chain from tree nursery to product value adding and economy of scale related product marketing.

[1] **Forest Stewardship Council** (**FSC**) is a organization to promote environmentally appropriate, socially beneficial and economically viable management of the world's forests. It carries out this role by certifying sustainable managed forestry operations, and tracking their timber through the supply chain to the end product, which can then carry the FSC evolvable, giving consumers the chance to choose to buy sustainable timber products over unsustainably harvested alternatives.

4 Production schemes

4.1 Production sites

The project will be situated in the eastern region of Paraguay in the department of Caazapá on Estancia Golondrina. The identified project areas within Golondrina are presented in the maps below (see Figure 2 and Figure 3).

Figure 2: Selected project sites – Estancia Golondrina Northern Part

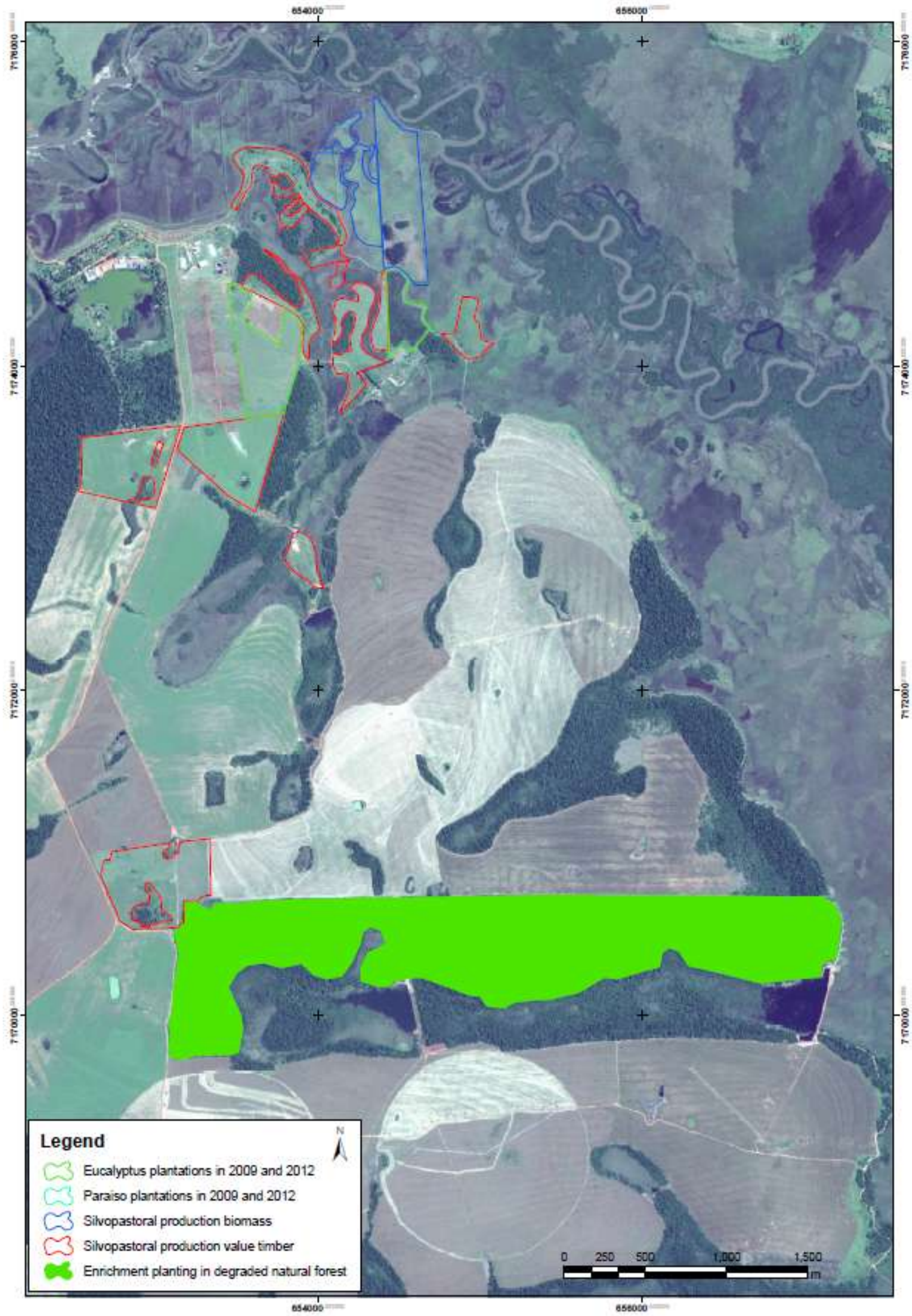
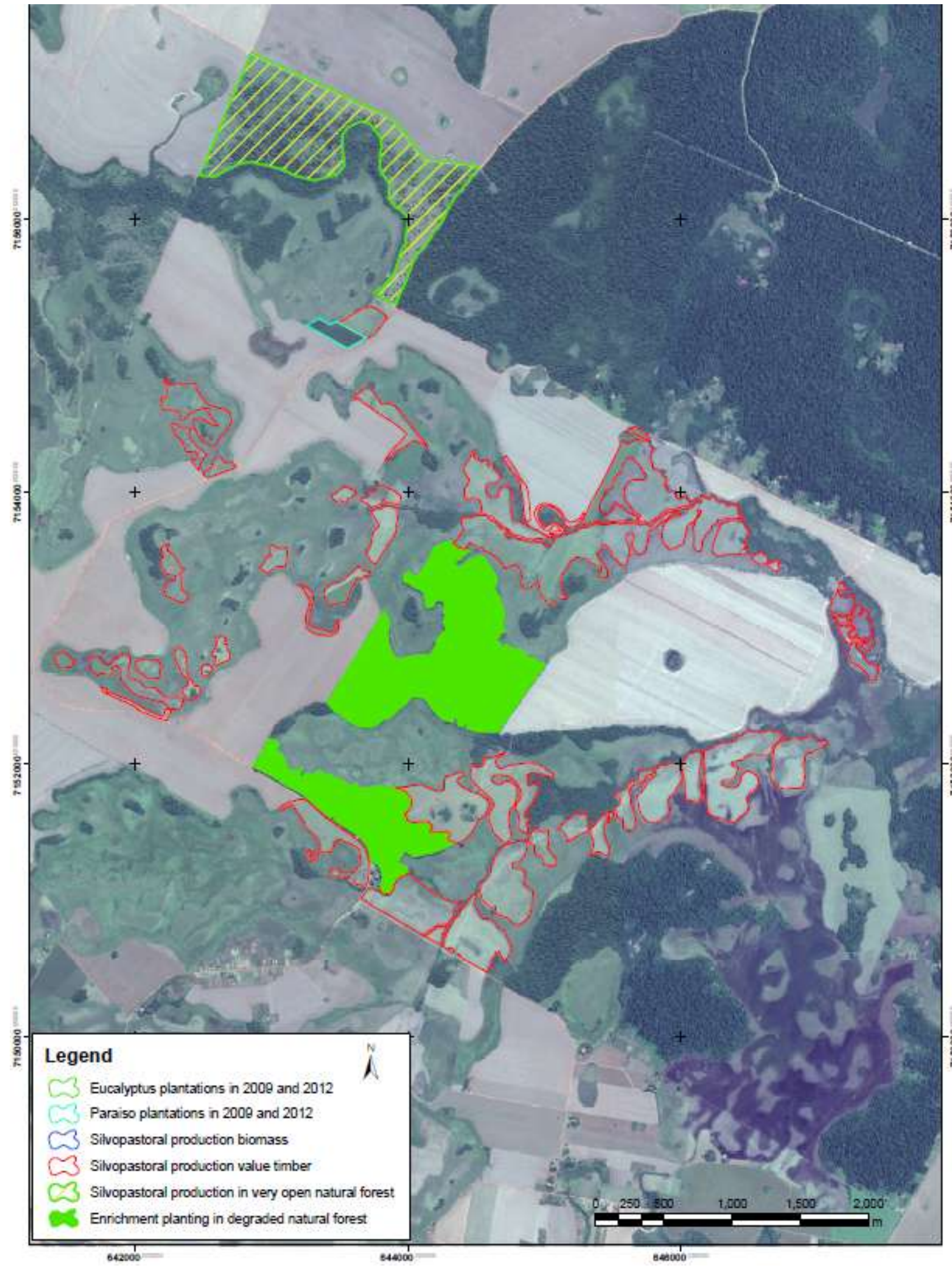


Figure 3: Selected project sites – Estancia Golondrina Southern Part



4.2 Project size and share of tree species

The total size of the project area is envisaged to take place on an area of **980 ha** of which **700 ha** will be planted (see Table 1). Due to different site conditions and diversification of forest production, different species will be planted. The main species are:

- **Eucalyptus grandis**: Planted on well drained sites for value timber production. Within the Eucalyptus family, E. grandis is one of the most frequently planted species due to its growth performance and timber properties. E. grandis has a broad spectrum of utilization: energy, pulp, columns, sawn timber, (rotary cut) veneer for plywood production.
- **Eucalyptus hybrid grandis x camaldulensis**: Planted on sites with excess of humidity. This species will be cultivated in short rotation plantations for energy purposes.
- **Paraiso** (*Melia azederach*) and **Toona** (*Toona ciliata*, Red or Australian Cedar): Both belong to the *Meliacea* familiy. The timber is highly appreciated and similar to Cedro (*Cedrela spp.*, Spanish Cedar), Khaja (Khaja spp., African Mahogany) and Caoba (*Swietenia macrophylla*, American or True Mahogany). It is utilized mainly for furniture and doors and window frames.

Table 1: Share of planted tree species

Site type	Planted tree species	Size
Silvopastoral value timber and biomass production		
Well drained sites; Soil type: Ultisol	Eucalyptus grandis (different clones and seedlings)	Total area: 431 ha Planted area: 431 ha
Excess of humidity: Soil type: Hydromorphic Alfisol	Eucalyptus hybrid grandis x camaldulensis	Total area: 42 ha Planted area: 42 ha
Enrichment planting for restoration of degraded forests		
Well drained sites; Soil type: Ultisol	Paraiso (67 %) and Toona (33 %)	Total area: 400 ha Planted area: 120 ha (Paraíso: 80 ha, Toona: 40 ha)
Well drained sites; Soil type: Ultisol	Paraiso and Toona	Total area: 107 ha Planted area: 107 ha
Total		**Total area: 980 ha** **Planted area: 700 ha**

4.3 Production systems

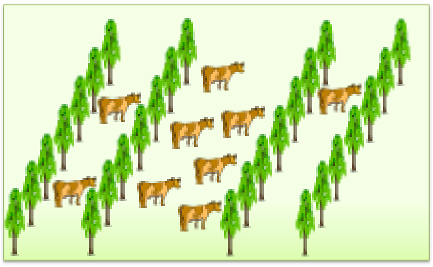
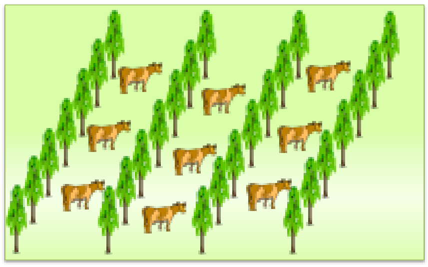
4.3.1 Silvopastoral production

The establishment of silvopastoral systems will allow the combination of livestock and timber production in the same area. Trees will be planted with less density compared to pure forest production stands. To assure sufficient illumination for pasture growth the following spacing for plantation establishment will be applied (see also Table 2):

- Silvopastoral value timber production: Spacing 5x5x9x2 meters, which corresponds to a planting density of 714 trees per hectare.
- Silvopastoral biomass production: Spacing 6x2 meters, which corresponds to a planting density of 833 trees per hectare.

The production goal in planted areas is determined by site quality. The main production goal is quality timber on well drained sites in a production cycle of 12 years. In those areas where site conditions are not suited for value timber due to hydromorphic soil characteristics, biomass will be produced in a production cycles of 6 years. The following table gives an overview on the silvicultural regime of the two different silvopastoral production schemes.

Table 2: Silvicultural regimes silvopastoral production

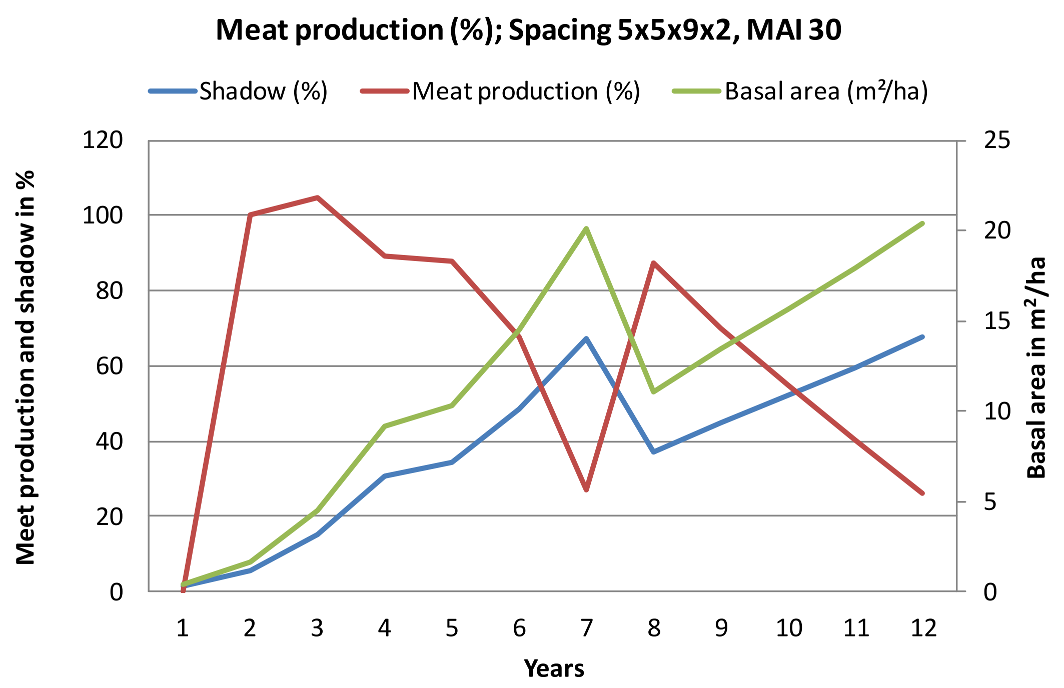
Production goal	**Value timber**	**Biomass**
Species	Different clones and seedlings from Eucalyptus grandis	Different clones from hybrid Eucalyptus grandis x camaldulensis
Spacing	5x5x9x2 m (714 trees / ha) 	6x2 m (833 trees / ha) 
Maintenance	Fertilization, weed control, and control; Replanting where necessary	
Pruning	• 2 years after planting up to 3-4 m • 4 years after planting up to 7-8 m • 6 years after planting up to 11-12 m	None
Thinning	• 4 years after planting reduction to 450 trees / ha • 7 years after planting reduction to 200 trees / ha	None
Final cut	12 years after planting	6 years after planting

Animals will be excluded from plantation sites during the first year, in order to ensure high survival rates and optimal growth performance of the planted trees. From the second year on grazing activities will be taken up between tree rows.

With the planting of trees trade-offs with livestock production will occur. The pasture production depends on the light reaching the ground, thus the crown cover of reforested areas will determine the livestock production potential. With the growth of trees and canopy closure livestock production will decline, while thinning operation will open up the canopy, facilitating grass production and increasing the livestock production levels. Figure 4 shows the correlation between basal area[2] of the stand, shadow on the ground and livestock production.

[2] The basal area is an indicator for canopy closure. For our calculations we assumed that a basal area of 30 m^2/ha corresponds to full canopy closure and 100 % of shadow on the ground respectively.

Figure 4: Livestock production over one rotation period



4.3.2 Restoration of degraded natural forests by enrichment planting

This management system aims at recovering the production potential and value of degraded forests. The recovery of the degraded forest is fostered by two silvicultural measures:

- **Enrichment planting**: This measure allows timber production during the recovery period. The degraded forest will be enriched in 30 % of the total degraded forest area by clearing 15 to 20 meters wide strips. In the strips Paraiso(*Melia azedarach)* and Toona (*Toona ciliate)* will be planted at a density of 4x2 m per hectare. The enrichment strips will be managed as high value timber forest plantations (see Table 2). After one rotation the introduced high value timber species will be eliminated completely. Paraiso and Toona will be shared 2 to 1 (two strips Paraiso, 1 strip Toona).
- **Promotion of valuable native species**: At the same time, the remaining forests between the strips will be restored by promoting potential crop trees (PCTs) at all diameter classes. The promotion consists in competition regulation among young trees, cutting liana and liberation thinnings among semi-mature trees. It is expected that after the final cut of the introduced high value timber species the natural forest will have restored its production potential. After this the natural forests will be managed in a polycyclic manner with intervention intervals of 10 years. The polycyclic interventions consist in harvesting of mature trees and promoting of PCTs to concentrate the site-given growth potential on the best individuals. We have been successfully applying this type of polycyclic management for more than 10 years in an area of 5,650 ha in Golondrina.

Table 3: Silvicultural regimes enrichment planting		
Species	**Paraiso (*Melia azedarach*)**	**Toona (*Toona ciliata*)**
Production goal	High value timber	
Spacing	4x2 m (1,250 trees / ha) 	
Maintenance	Fertilization, weed control, (ant control); Replanting where necessary	
Pruning	• 1 years after planting up to 2 m (several pruning intervention might be necessary) • 2 years after planting up to 3-4 m • 4 years after planting up to 5-6 m	• 2 years after planting up to 2-3 m • 4 years after planting up to 4-5 m • 6-8 years after planting up to 7-8 m
Thinning	• 3 years after planting reduction to 450 trees / ha • 6 years after planting reduction to 150 trees / ha	• 4 years after planting reduction to 600 trees / ha • 8 years after planting reduction to 300 trees / ha • 12 years after planting reduction to 150 trees / ha
Final cut	10 years after planting	20 years after planting

4.4 Growth and yield characteristics of the production schemes

A good growth performance in terms of volume and quality is essential for the economic success of a forestry project. For the economic valuation of the presented project, growth and yield tables for the different productions schemes have been developed. The underlying increments and production cycles of the forest species to be planted have been derived from different sources:

- Own observations and measurements.
- Data provided by well known forest companies and projects (Pomera, Volendam, Plantec, PMRN).
- Local studies on growth and yield.

Table 4 presents growth and yield assumptions for the silvopastoral production schemes.

Table 4: Growth and yield performance silvopastoral production

Value timber *Eucalyptus grandis*	
Mean annual increment	
MAI commercial	30 m³/ha/yr
MAI biological	36 m³/ha/yr
Production cycle	12 years
Target diameter	36 cm
Share fuel wood	14 % of total harvested volume
Products	(see below)

Products		1st thinning	2nd thinning	Final cut	Total
		year 4	year 7	year 12	
Fuelwood	m³	14,7	24,1	12,5	51,3
Logs cat IV/V	m³		14,5	49,8	64,3
Logs cat III	m³		19,3	24,9	44,2
Logs cat II	m³		28,9	37,4	66,3
Logs cat I	m³		9,6	124,6	134,2
Total	m³	**14,7**	**96,5**	**249,2**	**360,4**

Biomass *Eucalyptus grandis x camaldulensis*	
Mean annual increment	
MAI commercial	22 m³/ha/yr
MAI biological	26.5 m³/ha/yr
Production cycle	6 years
Target diameter	-
Share fuel wood	100 % of total harvested volume
Products	(see below)

Products		Final cut	Total
		year 12	
Fuelwood	m³	132,0	132,0
Logs cat IV/V	m³	0,0	0,0
Logs cat III	m³	0,0	0,0
Logs cat II	m³	0,0	0,0
Logs cat I	m³	0,0	0,0
Total	m³	**132,0**	**132,0**

For cattle breeding without tree component we calculate with net revenues of **USD 160 per ha per year** based on a production of **200 kg meat** per ha per year and a net price of **USD 0.80 per kg** of meat. For the economic modeling of silvopastoral production scheme we reduced this 100 % livestock production level as follows:

- In the first year no revenue from livestock production was considered.
- From the second year until end of rotation we adjusted the 100 % production level with the reduction values showed in Figure 4.

In Table 5 growth and yield assumptions for the management of degraded forests by enrichment planting are presented.

Table 5: Growth and yield performance enrichment planting

Enrichment planting Paraiso	
Mean annual increment	
MAI commercial	16 m³/ha/yr
MAI biological	18 m³/ha/yr

Table 5: Growth and yield performance enrichment planting

Production cycle	10 years
Target diameter	36 cm
Share fuel wood	43 % of total harvested volume
Products	

Products		1st thinning year 4	2nd thinning year 7	Final cut year 12	Total
Fuelwood	m³	14,5	27,0	28,1	69,6
Logs cat IV/V	m³		0,0	0,0	0,0
Logs cat III	m³		27,0	0,0	27,0
Logs cat II	m³		0,0	28,1	28,1
Logs cat I	m³		0,0	37,4	37,4
Total	m³	**14,5**	**54,0**	**93,6**	**162,1**

Enrichment planting Toona

Mean annual increment	
MAI commercial	10 m³/ha/yr
MAI biological	11 m³/ha/yr
Production cycle	20 years
Target diameter	38 cm
Share fuel wood	37 % of total harvested volume
Products	

Products		1st thinning year 4	2nd thinning year 8	3nd thinning year 12	Final cut year 20	Total
Fuelwood	m³	6,4	23,8	21,5	24,5	76,2
Logs cat IV/V	m³		0,0	0,0	0,0	0,0
Logs cat III	m³		10,2	21,5	0,0	31,7
Logs cat II	m³		0,0	0,0	49,0	49,0
Logs cat I	m³		0,0	0,0	49,0	49,0
Total	m³	**6,4**	**34,0**	**43,0**	**122,5**	**205,9**

Management of native forests

Mean annual increment	
MAI commercial	4 m³/ha/yr
MAI biological	8 m³/ha/yr Only 50 % of the trees in the forests are merchantable
Production cycle	Starts in year 11; polycyclic management with interventions each 10 years
Target diameter	40 to 50 cm
Share fuel wood	100 % when opening strips 50 % when entering in regular interventions
Products	

Products		Clearing strips year 1	First intervention year 11	Second intervention year 21	and so on ...
Fuelwood	m³	70,0	20,0	20,0	20,0
Logs cat IV/V	m³		0,0	0	0,0
Logs cat III	m³		0,0	0	0,0
Logs cat II	m³		12,0	12	12,0
Logs cat I	m³		8,0	8	8,0
Total	m³	**70,0**	**40,0**	**40,0**	**40,0**

The assumed growth and yield is a realistic estimate. Volendam cooperative, located in San Pedro, owns around 100 ha of Paraiso plantations and calculates with production cycles of 8 to 10 years. Pomera, Paraguay's largest E. grandis producer with more than 10,000 ha, calculates with current MAI up to 46 m³/ha/yr.

5 Timber markets

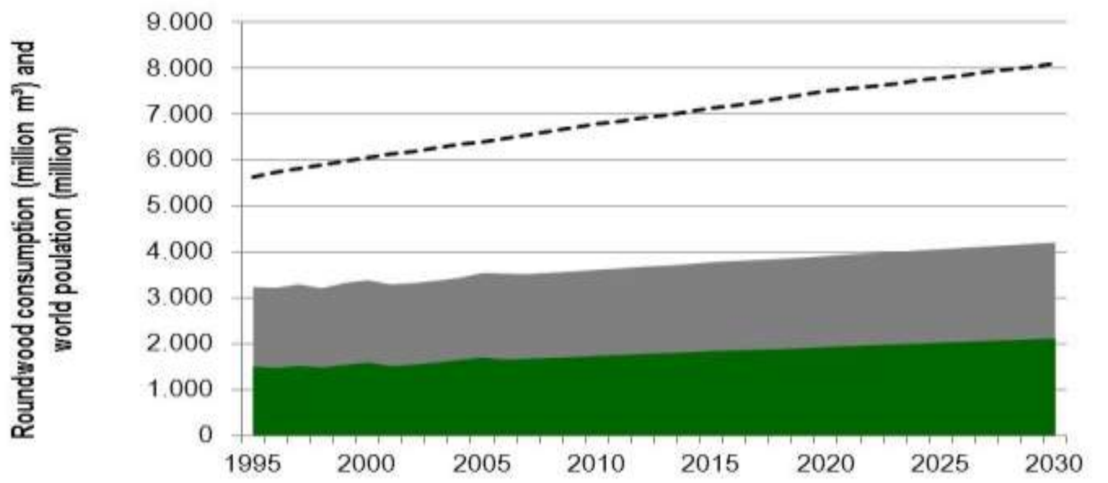
5.1 Global forest product market

There is a strong correlation between population growth and increasing demand for forest products. Considering only this correlation, more than 5 million ha of forest plantations have to be planted each year to satisfy the growing demand. In reality, less than 3 million ha per year are planted and in many countries deforestation is an ongoing process.

Additionally, the consumption of paper in emerging economies like China, Brazil, India, etc. is dynamically growing. Moreover, bioenergy becomes more and more important. In Europe, there are already several huge biomass plants experiencing severe problems to secure sufficient feedstock (in general chips, in the future pellets or torrefacted fuel power).

Taking all this into account, timber is increasingly becoming a scarce good.

Figure 5: Increasing roundwood demand



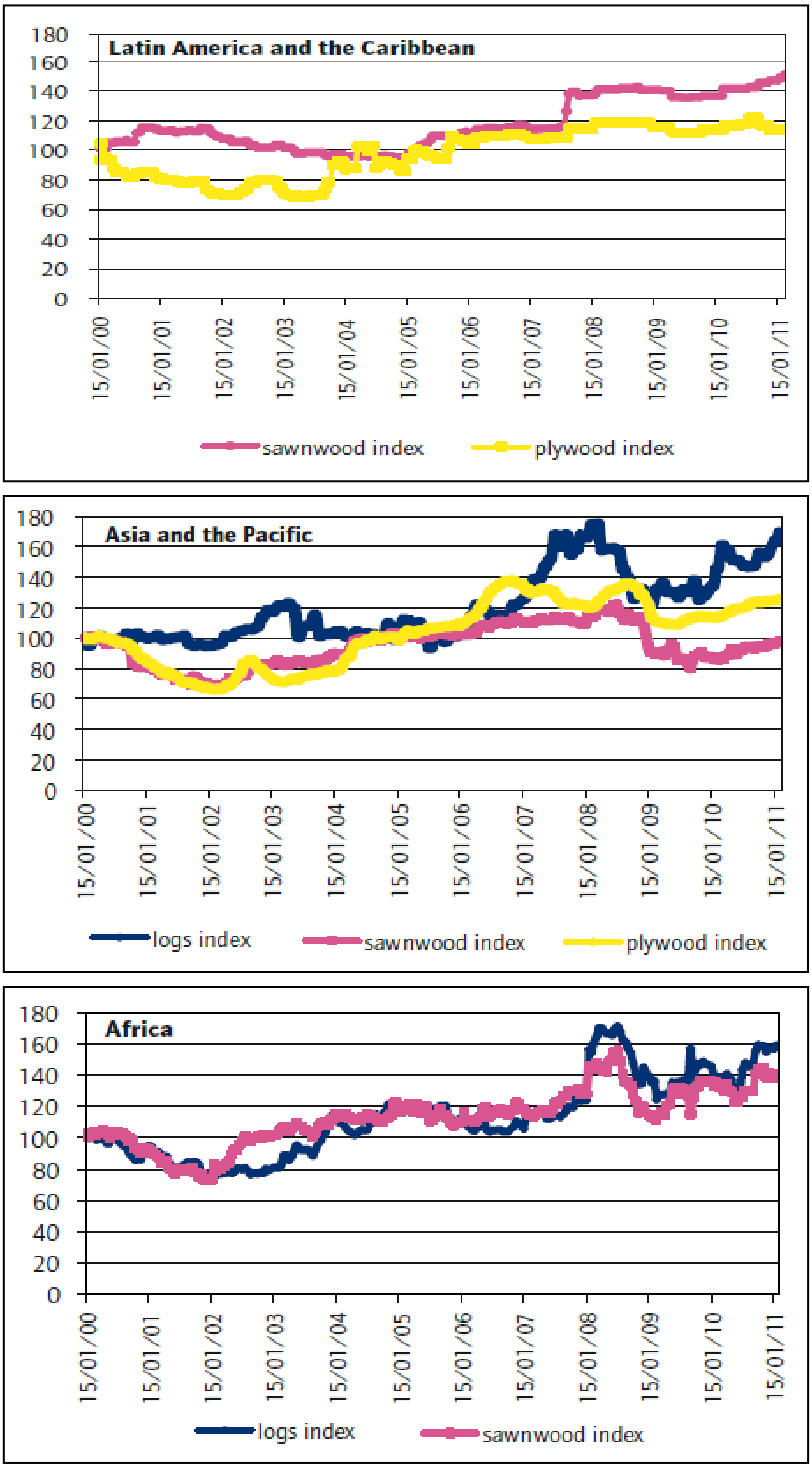
Source: FAO (2010), UNFPA 2011

The prices for timber like most commodities are volatile. However, over the past 10 years tropical timber products have experienced modest price increases in real terms (ITTO, 2012; see Figure 6):

- Logs: an average increase of about 5 % per year
- Sawnwood: African and Latin American prices increased about 3.5 % per year
- Plywood: Asian prices remained at 2000 levels and Latin American plywood prices rose by around 1.5 % per year

Figure 6: Increasing timber prices

Tropical timber price indices 2000–2011 (Jan 2000 = 100)



Source: *ITTO (2012)*

Due to the increasing demand and the decreasing forest area, it is likely that prices for timber will grow faster than the normal inflation rate. Therefore, many forest investment models assume an increase of timber prices (2 - 3 %). However, the economic model of the presented project is based on current market price levels and does not consider an increase of timber prices.

5.2 Forest product market in Paraguay

5.2.1 Value timber

The total wood consumption in Paraguay for industrial and energy use ranges between 8 to 12 million cubic meters per year. Current sustainable production does not exceed 3 to 4 million cubic meters per year. This leads to a significant supply gap. Hence, timber prices in Paraguay have increased in the last years.

As presented in Table 6, the price for *Eucalyptus grandis* logs have been raising by 30 % over the past few years.

Table 6: Price development for *Eucalyptus grandis*

Prices in USD / m³ logs loaded on truck

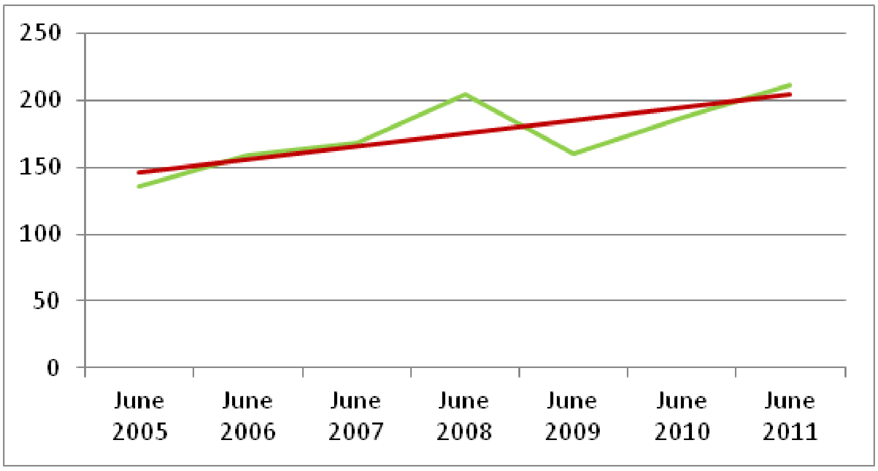
Year	Product category				
	Cat 1	Cat 2	Cat 3	Cat 4/5	Average
2010	47,85	35,89	27,91	23,13	33,70
2011	54,55	40,91	31,82	26,36	38,41
2013	56,18	44,81	38,95	35,08	43,76

Source: POMERA (2013)

A similar trend for *Eucalyptus* timber can be observed in Brazil. Statistics show that the average price for sawn timber of *Eucalyptus* has been growing at around 7.7 % annually as shown in Figure 7 below.

Figure 7: Prices for *Eucalyptus* air dried sawn timber in Brazil

Prices in USD / m³



Source: ITTO (2012)

The prices for native timber species also increased significantly between 2005 and 2013 (see Table 7).

Table 7: Prices development for native timber species

Prices in USD / m³ at forest road

Year	Product category		
	Cat 1	Cat 2	Average
2006	52,00	23,00	37,50
2011	123,00	55,00	89,00
2012	127,00	56,00	91,50

Source: FORCERPA (2013)

5.2.2 Fuelwood

The main consumer of fuelwood is the agribusiness. Fuelwood and chips are used for drying and processing grain. Similar to the price trends of value timber sawn wood, the prices for fuelwood have risen significantly between 2008 and 2011 (see Table 8). Between 2011 and 2013 the prices were stable due to lower demand on fuelwood by the agribusiness. The crop production in 2012 was very low because of climatic factors.

Table 8: Price development for fuelwood

Prices in USD / t standing tree
Conversion factor m³est into ton: 2,3 to 1

Year	Gs/m³est	Gs/t	USD/t	Gs / USD
2008	11.000	25.300	5,80	4.363
2009	26.400	60.720	12,22	4.967
2010	26.400	60.720	12,81	4.739
2011	38.500	88.550	20,36	4.350
2013	38.500	88.550	19,90	4.450

Source: Plantec

Prices for chips oscillate between 85 and 105 USD / t at industry gate.

Freight is an important factor for energy wood business. For fuelwood and chips a price of 12.50-15.00 USD/t/100km must be assumed. Thus it is crucial to identify sales stream that are located as close as possible to the site of production.

5.3 Target markets

The target markets for the presented forestry project are diverse. From today's view, the following markets will be targeted:

- **Local Paraguay market**: Fuelwood and chips for bioenergy, roundwood for rural construction, logs for sawmilling and plywood industry
- **Regional MercoSur market**: Sawn timber; eventually roundwood or chips for Uruguayan / Argentinean pulp industry along Rio Paraguay / Paraná

- **International market** (Asia, Europe, North America): Sawn timber; eventually further integration of value chain (semi-finished and finished products); eventually bioenergy, if technology development regarding wooden biomass continuous as fast as in the last years (e.g. torrefacturation or BtL - biomass to liquid).

5.4 Product prices

One of the most critical aspects regarding the projection of the economic performance of a reforestation project is to determine timber prices in the far future. Our timber price assumptions therefore are based on assessment of current prices paid in the local market in Paraguay as shown in the previous section.

Table 9 below summarizes the use of the forest species to be planted, the envisaged products and the target markets from today's view. The table also contains the prices which have been used for the economic calculations. These prices have been derived from the above stated reference prices.

Table 9: Commercial timber price characteristics

Tree species	Utilization	Products	Markets	Price used for calculations (USD at forest road)
E. grandis	**Quality timber** Constructions, furniture, plywood, bio energy, paper industry	**Logs,** fuelwood	**Local, regional,** international	Logs category 1: 56 USD/m³ Logs category 2: 45 USD/m³ Logs category 3: 39 USD/m³ Logs category 4/5: 35 USD/m³ Biomass: 30 USD/t
E. grandis x camaldulensis	**Biomass** (mainly) bio energy, rural constructions, paper industry	**Fuelwood,** logs	**Local**, **regional,** international	Biomass: 30 USD/t
Paraíso, Toona	**High quality timber** Furniture, frames for windows and doors, plywood, veneer	**Logs,** fuelwood	**Local, regional,** international	Logs category 1: 130 USD/m³ Logs category 2: 90 USD/m³ Logs category 3: 40 USD/m³ Biomass: 30 USD/t
Native species	**High quality timber** Furniture, parquet flooring, frames for windows and doors, plywood, veneer, biomass for energy	**Logs,** fuelwood	**Local, regional**, international	Logs category 1: 130 USD/m³ Logs category 2: 70 USD/m³ Biomass: 30 USD/t

Due to increasing demand for bioenergy, pulp and timber, increasing forest product prices are likely. Therefore, using current prices for the economic modeling is a conservative approach. All the more, hence the potential of value chain integration and the related value adding has not been considered.

6 Project Management

6.1 Commitment

The project will be developed within the long-existing consortium structure between PAYCO and UNIQUE. Both companies are fully committed to sustainable forest management, as evidenced in their adherence to best practice, attainment of forest certification and implementation of corporate social responsibility. In defining a strategy and approach for a large scale forestry project we have at all times followed these principles to develop a realistic and sustainable input / output model. We understand our managerial and operational approach as competitive and absolutely essential for long term financial sustainability while being environmentally and socially responsible.

6.2 Labor and technology

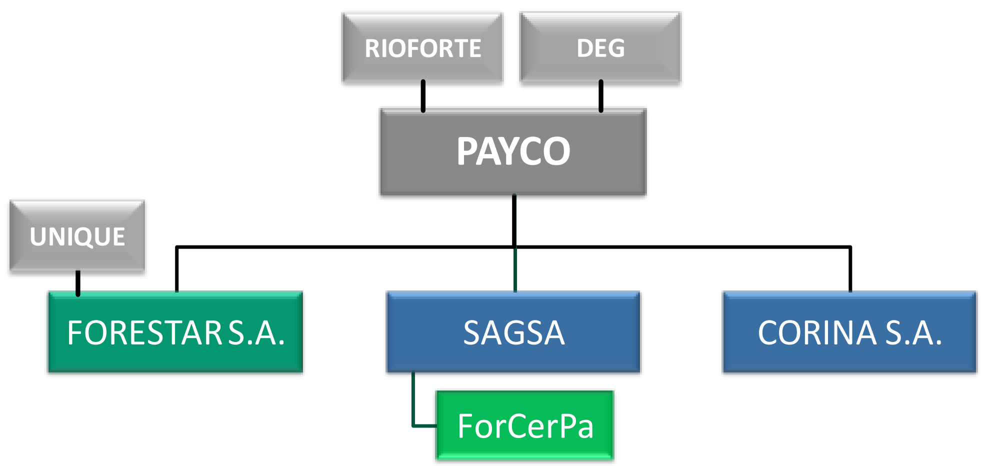
Where appropriate, the project should generate employment locally to support rural development as possible. Technologies being implemented are up-to date and reliable. Due to the innovative concept and the lack of professional forestry service providers it is assumed that the project will have to give technical advice to service providers. Sound planning, coordination and monitoring of the operations will be essential.

6.3 Management structure

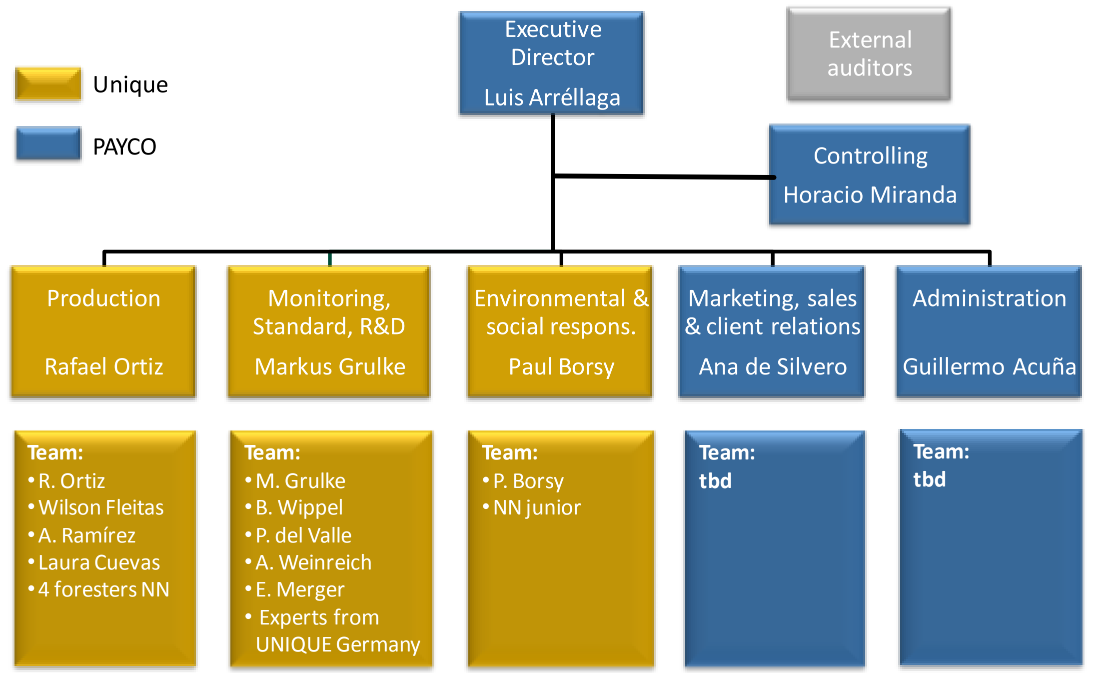
The proposed forestry production schemes in Golondrina can be integrated into the existing forest operations of PAYCO / UNIQUE. The following Figure 8 shows the organizational form of these operations.

Figure 8: Organizational form

Organizational form of PAYCO



Organizational and personnell structure of forestry operations



At the operational level there will be the managing director and 5 unit managers. PAYCO provides the position as managing director. The unit managers are recruited from senior staff of PAYCO and UNIQUE. External audits will check and ensure that the agreed standards of sustainable forest management are met.

PAYCO and UNIQUE realize the management as service providers at a fixed fee rate.

6.4 Units and responsibility

Each of the units has a number of departments (or working areas). Over time the number of departments and staff in departments will change depending on work requirements. For the management staff on department level, skilled Paraguayan personnel will be recruited.

Basically UNIQUE is responsible for all aspects related to production, monitoring and reporting, research & innovation, compliance with international standards, and environmental & social responsibility. PAYCO takes responsibility for finance, human resources, marketing & sales and for the overall management.

The responsibilities of all organizational levels are described in detail in Table 10.

Table 10: Responsibilities of organizational levels

Level	Areas of Responsibility
Board of directors	• To ensure best sustainable practice is followed • To deal with any macro-finance issues • To deal with any governmental level issues
Managing director	• To manage and control all aspects of the business
Unit Managers	• Planning, coordination and monitoring of unit-level operations / activities • Reporting to managing director and board of directors • Risk mitigation • Motivate and manage staff
Production Unit	
Plant acquisition	• Ensure high quality plant acquisition • Just in time delivery of planting material
Site preparation & plantation	• Soil analysis • Site preparation • Fertilization & Site fertility • Planting
Maintenance, protection & disease management	• Making fire breaks and fire break maintenance • Fire patrol and fire fighting • Pest monitoring and pest control • Weeding, tending and pruning
Harvesting operations	• Harvesting • Transport • Chipping • Supply chain logistics
Roads & infrastructure	• Land surveys • Road design and building • Road maintenance • Building maintenance
Monitoring & Standards Unit	
Monitoring of natural performance	• Permanent monitoring of plantation development • Optimization of natural performance • Design of field trials • Development of dynamic yield tables
FIS / GIS	• Introduction of Forest Management Information Systems (FIS) bringing together natural, financial and geographical information • GIS and mapping
Standards	• Permanent compliance check regarding underlying standards (FSC, IFC, eventually carbon standards) • Preparation of annual audits
Reporting	• Periodical reports on natural performance to managing director / board of directors • Elaboration of standard-relevant documents

Table 10: Responsibilities of organizational levels

Level	Areas of Responsibility
Research and innovation	• Conduct on site research to improve standard operation procedures • Link with universities and research institutes
Social and environmental responsibility	
Technical assistance to neighboring communities	• Assist in social and technical projects (agriculture, forestry, water, schools etc.) • Possible outgrower schemes
Social and environmental impact evaluation	• Monitoring of impacts of forest activities • Economic impacts to the communities • Monitoring of water quantity and quality • Protection of high vale forests, biodiversity, flora and fauna • Follow up on environmental impacts
Community Health and safety	• Assist communities in health and safety issues (water, diseases, fire management)
Communication with stakeholders	• Keep up relation with local authorities • Set up of a grievance mechanism
Commercialization, CRM & Communication Unit	
Product management	• Analyze national and international market demand • Develop wood assortment • Design Marketing Mix • Process coordination and control
Client acquisition	• Analyze preferences of relevant national and international market players • Establish contacts and obtain tenders • Negotiate contracts
Costumer relation management	• Customer care • Customer retention
Communication & Stakeholder Involvement	• Public relations • Extension • Community Relations, Liaison with community groups • Manage funded community projects
Administration Unit	
Human resources	• Staff acquisition • Staff management • Training and capacity building
Accountancy	• Bookkeeping • Payroll • Periodical financial statements
Financial monitoring	• Annual Budget • Budget control • Target-performance comparison • Financial reports

The presented project management system is based on the positive experiences with the current operational system of the consortium ForCerPa and the reforestation project started in Lomas. It considers existing and complementary skills and brings together experienced managers and forestry experts at very reasonable costs.

The management costs are calculated with 70 USD per ha net production area, assuming that the operations will be integrated into the jointly implemented large scale forestry project of 9,000 ha (see chapter 2). This competitive price level can only be offered by realizing economy of scale effects.

7 Financial evaluation

7.1 General considerations

Our financial model considers all investment related costs and revenues. **Prices for land are not included in our financial analysis.** Related to forestry production our financial analysis includes three major components.

- Silvopastoral value timber production with Eucalyptus species on a net production area of 431 ha based on a rotation cycle of 12 years to be implemented over 2 years.
- Silvopastoral biomass production on a net production area of 42 ha based on a rotation cycle of 6 years to be implemented within one year.
- Enrichment planting with Paraiso and Toona in degraded natural forest on a net production area of 400 ha. Paraiso has a rotation period of 10 years, while Toona has a rotation of 20 years. Natural forest management and revenues occur in the first year with opening the strips and then in 10 years intervals with the regular polycyclic management interventions. The implementation period of this production component is assumed over 2 years.

The envisioned tree species and management systems have different rotation cycles. Using one fixed assessment time period would not reflect the actual rotation period of the individual management systems in which costs and revenues actually occur (e.g. rotation period biomass 6 years, silvopastoral Eucalyptus rotation period 12 years). Therefore the financial analysis for the different management systems uses varying assessment timeframes. For the individual management systems we use one full rotation cycle (Table 11). On the total project scale (all forest management components), we use an assessment time period of **26 years** which reflects:

- four silvopastoral biomass production cycles,
- two silvopastoral value timber production cycles,
- one production cycle for Paraiso, Toona and natural forest management.

7.2 Input data for financial model

The financial projection is based on the following input data:

Table 11: Input data for the economic model

Item	Silvo-pastoral value timber	Silvo-pastoral biomass	Enrich-ment Paraiso	Enrich-ment Toona	Natural forest manage-ment
Net production area (ha)	431	42	80	40	400
Operative costs					
Plantation and first year maintenance (USD/ha)	1,100	1,200	1,400	1,400	-
Maintenance year 2-3 (USD/ha)	150	120	200	200	-
Annual maintenance (from year 4 onwards)	30	25	40	40	-

Table 11: Input data for the economic model

Item	Silvo-pastoral value timber	Silvo-pastoral biomass	Enrich-ment Paraiso	Enrich-ment Toona	Natural forest manage-ment
Coppicing (USD/ha)		250			
1st pruning (USD/ha)	40	-	40	40	-
2nd pruning (USD/ha)	60	-	40	50	-
3rd pruning (USD/ha)	80	-	30	60	-
1st thinning (USD/m³)	10	-	12	12	-
2nd thinning (USD/m³)	9	-	11	11	-
3rd thinning (USD/m³)	8	-	10	10	-
Final cut (USD/m³)	8	9	10	10	
Harvesting operations logs (USD/m³)	-	-	-	-	17
Harvesting operations fuel wood (USD/m³)	-	-	-	-	8
Harvesting operations fuel wood opening strips (USD/m³)	-	-	-	-	12
Pre and postharvest operations (USD/ha)	-	-	-	-	100
Harvesting fees (USD/m³)	2.6	1.1	2.6	2.6	3.3
Road maintenance (USD/ha/year)	5	5	5	5	5
Management costs					
Project preparation in year 1 (USD/ha total project area)			10		
Technical management and project administration (USD/ha/year)			70		
Product prices (USD at forest road)					
Biomass (USD/t)	30	30	30	30	30
Eucalyptus value timber (USD/m³) Category 1 Category 2 Category 3 Category 4/5	56 45 39 35				
Paraiso, Toona high value timber (USD/m³) Category 1 Category 2 Category 3			130 90 40	130 90 40	
Native trees species (USD/m³) Category 1 Category 2					130 70

7.3 Financial results

Based on the key financial parameters presented above the project will achieve an **Internal Rate of Return** (IRR after tax, excluding inflation) **of 18.3 %** over an assessment period of 26 years without considering land costs. An investment of **USD 1.02 million** is required to realize the proposed project activities. The break-even point (year in which cumulative cashflows turn positive) will be achieved 11 years after the project started.

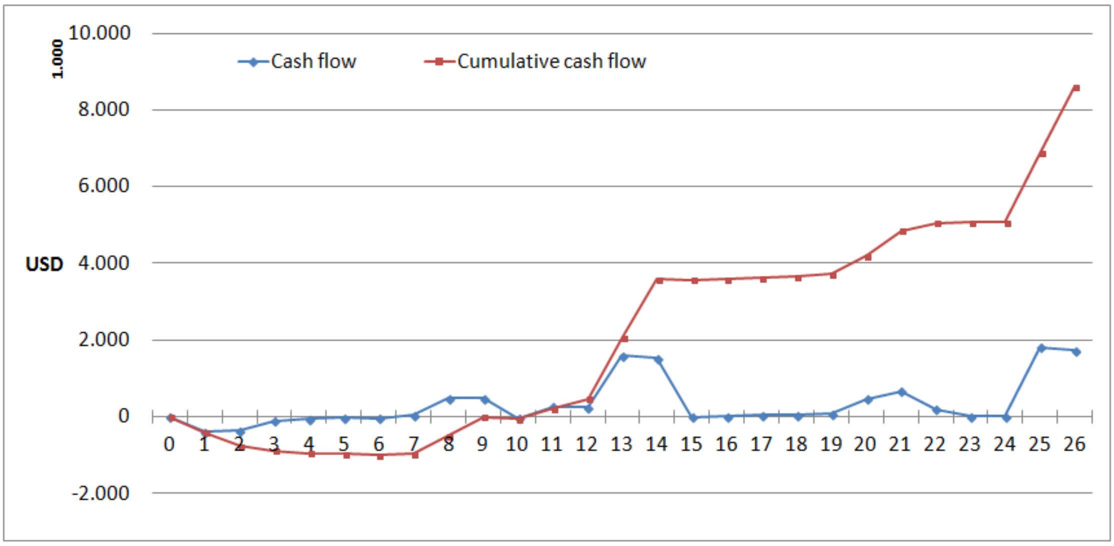
Table 12 presents the overall project profitability for 26 years as well as the financial profitability of the individual project activities. The assessment period for each activity has been set to reflect both one rotation period and the total rotations within the project duration.

Table 12: Key financial indicators for individual project activities

Project activities	Assessment period	Investment requirement (USD)	Break-even point	IRR after tax	Average annual net income (USD/ha)
Total project	**26 years**	**1,015,000**	**11 years**	**18.3 %**	**421**
Silvopastoral value timber					
1 rotation	14 years	641,000	9 years	20.8 %	677
2 rotations	26 years	641,000	9 years	20.9 %	730
Silvopastoral biomass					
1 rotation	7 years	62,000	7 years	5.8 %	88
4 rotations	25 years	62,000	7 years	13.0 %	222
Paraiso value timber	12 years	152,000	11 years	14.8 %	411
Toona value timber	22 years	102,000	21 years	7.6 %	314

Figure 9 below presents the cashflow for the entire project over a period of 26 years.

Figure 9: Cashflows reforestation and enrichment planting



The analysis shows that **silvopastoral value timber production** is the most profitable project component with an IRR of **20.8 % after 14 years** (one rotation period) and 20.9 % after 26 year, equivalent of 2 rotation periods. **Silvopastoral biomass production** achieves an **IRR of 5.8 %** after one rotation period and 13.0 % after four rotation periods, while Paraiso is the second most attractive individual project component (14.8 %). Toona profitability is significantly lower amounting to 7.6 %, mainly due to the long rotation period of 20 years.

Generally, the overall profitability increases with the increase of the assessment period and when more than 1 rotation period for value timber, biomass is considered. The lengthening of the total project period to more than 20 years will also allow a certification according to a carbon standard and generate carbon credits that may constitute an additional revenue stream. For a potential carbon certification the project developer must ensure that the project area will be maintained as forest for a minimum of 20 years. In chapter 8 the financial assessment of the carbon certification is presented.

7.4 Opportunities for enhanced returns

We have calculated the internal rate of return without considering any of the following leverage factors:

- Vertical integrated production: The first transformation from round wood to sawn timber / from fuel wood to chips or pellets can considerably leverage IRR.
- Timber price development: We have not considered any timber price appreciation. Timber is expected to increase in price.
- Marketing strategy: We have only considered current prices in the domestic market and not the potentially better price levels on international markets.
- Pre-selling options: Long-term supply contracts with big consumers of wooden biomass (agribusiness, iron smelting) and quality timber.

8 Enhanced returns including carbon business

8.1 Basics of the voluntary carbon market

The voluntary market mainly trades emission reductions that cannot be used for regulatory compliance. The market also serves as an incubator for innovative emission reduction activities that are not eligible under any compliance market regime. The voluntary market is tiny compared to the global compliance markets but is the largest market for land-based credits globally. In 2012, Ecosystem Marketplace (2013[3]) traced market transactions of **USD 523 million**, and a volume of **101 million tCO_2** at an average carbon price of **USD 5.9 per tCO_2**. **Land-based carbon credits** had a share of about 32 % (24 million tCO_2) of the total market volume. Carbon credits from **afforestation/reforestation** project amounted to 8.8 million tCO_2. The average prices for forestry projects were **USD 7.8 per tCO_2** in 2012. In general the price of a carbon credit is determined by several parameters such as standard type, social and biodiversity impact, vintage, project location and the relationship to the core business of the carbon purchasing party. Current global voluntary carbon market demand is mainly the EU and North America comprising more than 90 % of the total market volume. More than 50 % of all buyers are located in UK, France, Netherland, Germany and Switzerland preferring carbon credits from Latin America.

The greatest motivation for companies to purchase offsetting is corporate social responsibility (CSR), demonstrating climate leadership, PR and branding, and experiencing new climate related markets for profit-generation and impact investments to generate high social and environmental impacts.

Firms acquire carbon credits for various purposes. The following key strategies normally motivate buyers to invest in carbon offsetting:

- Carbon neutrality of entire business
- Carbon neutrality of the production of a certain product
- Compensation as an offer to final consumer (costumer pays a certain additional amount for product to be climate-neutral)
- Additional marketing effect: “xxx trees are planted at the acquisition of product XYZ”
- Carbon neutrality for certain business processes such as (logistics, car fleet; business travel; events)
- Investments in core business related to clean and carbon neutral value chains

8.2 Carbon project transaction costs and pricing

For the assessment of a potential carbon certification we include carbon related transaction costs as shown in Table 13. The cost assumption is based on our long-lasting experience in the development and certification of forest carbon projects.

The costs of setting-up a carbon project are relatively scale-invariant, thus it is crucial that project generate sufficient carbon credits that can cover the carbon related transaction costs for the development of the Project Design Document (PDD), certification, and client acquisition. Operational project costs increase with the physical size of the project and our

[3] http://www.forest-trends.org/vcm2013.php

experience with other land-based projects shows that carbon related revenue streams can cover a portion of the operational costs and reduce the investment requirement.

The Project Description Document (PDD) defines the information that needs to be provided to a third party auditor to validate the project against a carbon standard. A cost of 45,000 USD is assumed for the preparation of the PDD (see the table below). However, the PDD has been already prepared[4], thus the associated cost has been excluded for economic estimations.

Table 13: Carbon related transaction costs

Cost item	USD	Comment	Timing
Carbon related project development and certification costs			
Project Design Document (PDD) and third party validation support	45,000	Consulting service fee	Year 1
Third-party validation	25,000	Certifier fee estimate	Year 1
Third party verification	20,000 each	Certifier fee estimate	Year 5, 10,15, 20
Carbon credit registration costs	0.15 per issued carbon credit	Fee to be paid to Standard after carbon credit issuance (verification)	Year 5, 10,15, 20
Total over 20 years	**135,000**		

8.3 Financial evaluation – carbon certification

Carbon certification will only be eligible for silvopastoral project activities, while the restoration of degraded forest is not eligible due to the lack of existing carbon accounting methodologies[5].

Based on the growth performance as presented in the financial evaluation section the project will generate about **62,300 tradable carbon credits** over a period of 20 years. For the estimates of the revenues we assume the average voluntary carbon market price for forestry projects of **USD 7.8 per tCO_2**. The timing of carbon sales may vary and has significant implications on the overall profitability of the project.

Ex-post scenario

In terms of sales timing, in the first scenario we assume that sales occur after the carbon has actually been sequestered and certified (ex-post)[6], thus after 5 years 54,100 tCO_2 will be generated, while the remaining 8,100 tCO_2 can be sold 10 years after project start. Based on this assumptions the overall IRR (after tax, excl. inflation) of the project will increase from **18.3 %** in the project scenario “without carbon” to **20.5 %**. The total carbon related revenues will amount to USD 0.35 million (net revenues excluding carbon transaction costs USD 0.14 million). The overall investment requirement will decrease from USD 1.02 to USD 0.98 million.

[4] In the framework of the project “REDD+ business models” developed by UNIQUE in cooperation with WWF and co-financed by DEG.

[5] A protocol to determine a baseline scenario without project activities, assessment of additionality, quantification of carbon sequestration, and monitoring, as a basis for the certification according to a standard.

[6] Ex-post relates to the issuance of carbon credits after the periodic third party certification has taken place that is normally every five years.

Ex-ante scenario

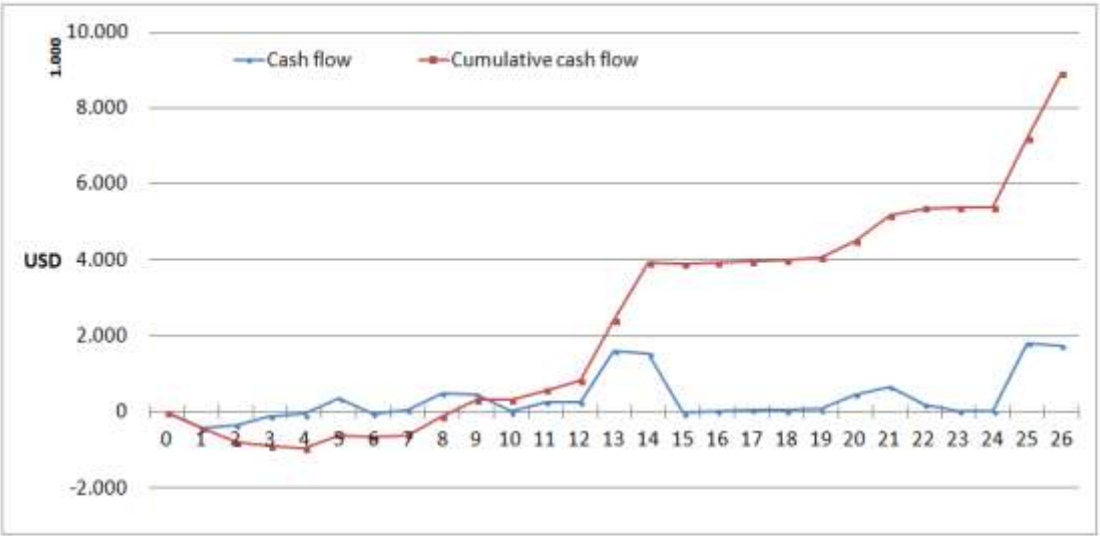
If carbon credits are sold as they occur on annual basis (ex-ante[7]) starting in year 1, the IRR can be increased to **21.7 %** and the total project investment requirement can be reduced to USD 0.73 million compared to USD 1.02 million in the base case.

Figure 10: Carbon related cashflow

Ex-post sales cashflow

Overall project investment requirment: **USD 0.98 million**

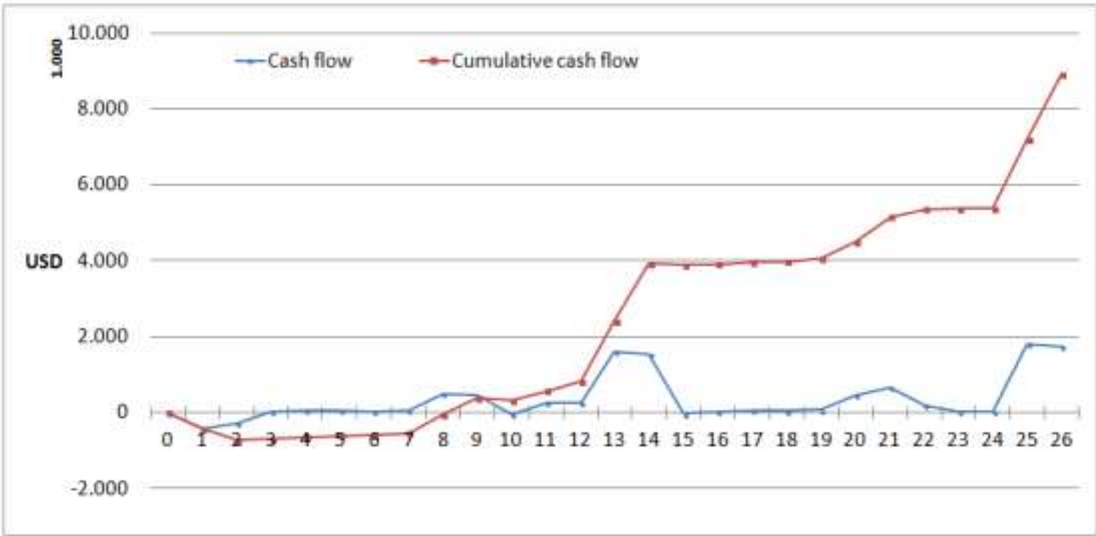
IRR after tax and excluding inflation: **20.5 %**



Ex-ante sales cashflow

Overall project investment requirment: **USD 0.73 million**

IRR after tax and excluding inflation: **21.7 %**



[7] In this scenario it is assumed that with the growth of the trees and carbon sequestration carbon sold on annual basis until a carbon long-term carbon equilibrium is achieved.

The analysis shows that carbon certification may significantly leverage the overall project performance, reduce investment requirements by 25 % and cover a significant part of the operational costs at the beginning of the project lifetime.

8.4 Required commitments of carbon certification

In order to certify a project the project developer has to commit himself to maintain the forest for at least 20 years, thus in case of the silvopastoral project activity value timber production will need to be maintained for at least 2 rotation periods, while the biomass production will need to be maintained for a minimum of 4 rotation periods.

In case of reversals (emissions of GHG emissions, e.g. due to fire or pest), the project developer is obliged to replace these carbon credits either through replanting of the same area, or other areas, or through the purchase of carbon credits from other projects.

9 Risk assessment and risk mitigation

The risk assessment shows:

- Production and market risks are relatively low. The remaining risk is on economic performance. A complete loss of the assets due to production or market factors can be excluded.
- Political and social risks exist. However, most of them can be mitigated with pro-active communication and stakeholder integration in combination with applying best practices and going for an international accepted certification scheme (e.g. FSC).

Table 14 summarizes the main risks of successful project implementation and risk mitigation strategies.

Table 14: Risks and risk mitigation

Risks Type	Risk assessment	Risk mitigation strategy
Production risks		
Inappropriate species selection	Low when systematic soil sampling is conducted and professional site-species matching	Adequate project preparation, soil analysis before planting, fertilization if necessary
Forest fire	Low to medium risk. Burning of pasture land in the dry winter season is a traditional land use. However, the proposed areas for forest operations are not bordering with local communities	Fire management with fire belts and fire monitoring; fire prevention as joint activity together with surrounding communities
Wind break damages	Low risk as most of Paraguay is low cyclone risk area	Site selection in low risk cyclone areas
Biotic diseases	Low risk in the case of Eucalyptus; medium for Paraiso	Disease monitoring / control; planting with different clones and seedlings
Market risks		
Price volatility	The prices for timber like most commodities are volatile	Reduced harvesting in low-price periods, integration of value chain, long-term master agreements with clients
Marketability of quality timber	Low risk due to increasing domestic and international markets for timber coming out of forest plantations	Selling the roundwood at international markets requires a sound marketing strategy
Marketability of wooden biomass	Volatile demand in Paraguay in function of agricultural crop production	Exploring of export markets (pulp mills in Uruguay, energy plants in Europe) to reduce dependency on domestic market
Economy of scale for high-volume low margin wooden products	This risk is considerable biomass (fuelwood)	Product diversification and market development

Table 14: Risks and risk mitigation

Risks Type	Risk assessment	Risk mitigation strategy
Political and social risks		
Expropriation of land	This risk is perceived to be low because of i) the reputation and standing of PAYCO, ii) the character of the project (ecological and social sound), iii) increasing global markets and iv) participation of DEG in PAYCO as a financial institution belonging to the German Government.	Sound and transparent project implementation
High tax hikes (from currently 10%)	Medium. Over the last decades taxes were stable	None as project has small impact on Paraguay`s fiscal policies
Land occupation by local landless people	Low to medium. In the past 10 years FORCERPA had two incidents of occupation of natural forests. Both could be solved after some weeks. Occupation of forest plantations has not occurred in Paraguay yet.	Applying best practice forest management; pro-active integration of surrounding communities (, offering jobs, outgrower schemes, sound communication and grievance mechanism)
Weak and bureaucratic administration	Forest institutions and the regulatory framework is regarded as weak and bureaucratic	Reforestation projects are mostly welcome in Paraguay, both by the government and by the society Initiatives by INFONA and the government support reforestation, the existing reforestation law is under revision to be re initiated. FSC certification supports the standing of the consortium within the forest sector Transparent acting and pro-active communication lead to an atmosphere where upcoming problems can be solved jointly with the relevant institutions. Since nearly 10 years the consortium partners Rioforte and UNIQUE demonstrate this: all occurring problems regarding the regulatory framework of forestry have been solved together with the responsible authorities. Delays in production / commercialization due to bureaucracy have not occurred.
NGO critics due to utilization of exotic species	Medium. Environmental organizations might criticize reforestation with fast growing exotic species	Applying best practices, FSC certification, communication strategies, invitation of environmental NGOs, monitoring system of environmental and social impacts

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