Brasil Norte-Sul 2014

"Brasiliens Wälder, viele Gesichter"

Project Report

Hamburg, 2014

About this report

The present report was done at Universität Hansestadt Hamburg (UHH) and Universidade Federal do Paraná (UFPR) from September to November 2014. It provides personal notes by participants as well as impressions and opinions by students and accompanying persons. Important key notes were tagged in red boxes, links are marked blue.

Contextual pre-works and preparative lectures were held from April to June 2014. The actual expedition and all related field trips in Brazil and Peru were done in July and August 2014. Officially this is the 7th year of the "Brasil Norte-Sul" project and the 2nd time that a broad report was prepared as part of the project evaluation.

The authors herewith declare that they have completed the present contributions independently making use only of personal notes, photographs and the specified literature. Identification of references with regard to the statement and scope of the work is quoted. The report in this form was edited by Emilin Joma da Silva and composed, written and redacted by Goran Schmidt and contains contributions of the following participants:

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In case of any doubts or need of additional information, please take a look at the contact page in the end of the document. Updates and any news around the Brasil Norte-Sul project are steadily published on the project pages of our website.

Organization

Universidade Federal do Paraná

Universität Hansestadt Hamburg

Support

German partners

Bund Deutscher Holzwirte e.V.

Deutscher Akademischer Austauschdienst

Universität Hansestadt Hamburg

Brazilian partners

Biovert Florestal e Agrícola LTDA

Governo do Estado do Acre

Universidade Federal do Paraná

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Participation

Brazilian universities

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Universidade Federal de Santa Catarina

Universidade Federal Rural do Rio de Janeiro

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Universidade Estadual Paulista

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Last but not least, we especially thank all these people who helped us during the expedition, drivers, cooks, medics, workers, colleagues, students, friends, camping grounds etc. Without all these contributions, this project would not have been successful. If your name did not occur here, that does not mean, that you have been forgotten!

Index

About this report II

Organization III

Participation IV

Acknowledgements V

Index VI

1 Introduction 9

1.1 History 9

1.2 Reasons 9

1.3 International context 10

1.4 Brazil and the Southwest Amazon 10

2 Route and logistic 13

2.1 Comment on transport 13

2.2 Map 14

2.3 Schedule 15

3 Visit reports 17

3.1 Workshop start at Universidade Federal do Paraná 17

3.2 Mixed *Pinus* forest management of Mata Atlântica and Restinga impressions 18

3.3 Experimental intensity focused secondary forest management in Mata Atlântica 20

3.4 Industrial superlative in the production of pulp based on *Eucalyptus* spp. plantations 23

3.5 Nursery and environmental consultancy for ecological restoration and compensation services 25

3.6 Wood-based panel production and an integrated, industrial forestry management and monitoring system 28

3.7 The “Chico Mendes” Institute and its administration of Brazilian national parks – Chapada dos Guimarães 30

3.8 Seminar on forest technology and management in Amazônia at the Federal research enterprise on agriculture and forestry 32

Research project “Taboca do Acre” 33
Research project “Castanheira” 34
Research Projects “Lidar” and “Geotechnology” 34

3.9 Public research foundation for technological innovation in Acre 35

3.10 Sustainable forest management in South-West Amazon via private concessions (reduced impact logging in practice) 37

3.11 Forest plantations and agroforestry systems with native and exotic species from private incentives in Acre state 41

3.12 Showcase of community-based industrial production of natural latex for public health preservatives (ntfp utilization) 43

4 Conclusions 45

5 Contacts 46

List of figures XLVII

Annex XLIX

"A floresta nos une diante do perigo comum, nos faz mais fraternos. É por isso que o meu trabalho em defesa da Amazônia não pode parar."

"The forest unites us from common danger, makes us being fraternal. That's why my assignment to defend Amazônia cannot stop."

Chico Mendes, *15.12.1944 – ǂ19.12.1988

1 Introduction

The Brasil Norte-Sul project is a scientific, technological and cultural immersion in sustainable forests from the Atlantic South to the Pacific North of Brazil. The essential part of the project is an expedition which lasts approximately 30 days. This year the route enabled students from Brazil and Germany to have insights into the forestry sector of eight Brazilians states and parts of the Peruvian Amazon Forest.

1.1 History

The vast Brazilian territory results in notable differences between forestry practices in each region. The project was born in 2008 through the initiative of Prof. Dr. Renato Cesar Gonçalves Robert trying to form professionally advanced alumni, who are ready to work responsibly in difficult decisive situations. In the first edition, which was still supported by the WWF, only eight students participated. They went directly from Curitiba to Acre State. The student's experience motivated another generation to go straight forward to look for additional support. The following year already 30 students went to Acre, this time on the ground with stops and visits along the 4.000 km journey. This project so far was realized only through support by UFPR and the Acre state government. Since then, the expedition developed every year and in 2014 we completed the 7th edition, with record distances and a consolidated agenda. Without doubt the UFPR support (buses, drivers, fuel and accommodation) still is crucial for a successful realization. Nevertheless other factors as like supporting companies and others partners made the project feasible (Biovert, Floresteca, Instituto Federal de Educação, Ciências e Tecnologia de Mato Grosso Campus Cáceres, Universidade Federal do Estado do Acre, Universidade Federal do Mato Grosso, Universidade Federal Rural do Rio de Janeiro, Governo do Estado do Acre, Serviço Florestal Brasileiro, SESC Pantanal, Floresteca, Clube dos Engeinheiros Rio Branco-AC, Assimanejo)

1.2 Reasons

Students and alumni of Brasil Norte-Sul are the future decision makers in policy, education and industry. So the motivation to widen their horizon is evident. One of the principal goals was to concretize and exchange knowledge in forestry and wood

technology. The project especially focused contents which are not adequate to be taught in theoretical classes. During the expedition the participants entered the "green lecture auditorium" by visiting public and private forests, conservation units, partner universities, companies of forest based products as well as companies of non-timber-forest-products, institutions of technological innovation, cultural establishment and forest concession units where sustainable management inside the Amazon forest is implemented.

The network improvement of Brazilian and German alumni of forestry and wood sciences was another main objective. Through our long-term project, we established an extended multilateral community.

1.3 International context

The existing partnership between German and the Brazilian universities facilitates the exchange and mobility of the participants. Students from both countries and with very different cultural backgrounds have the chance to extend their knowledge "*in loco*" on Brazilians forestry politics, local communities and strengthens the international public debate between forestry professionals, academics, researchers and NGO's.

The project made it possible to get to know the social, economic and environmental reality of different regions in Brazil and their conditional biomes. The interactions between Brazilian and German students, as well as the group dynamics within the unusual ambient, strengthened the critical sense related to sustainable development issues in the Brazilians forestry sector. The exchange of values and knowledge between universities and local communities complemented the professional profile of the student disseminators. This hopefully leads to better vocational education and good practice in industry and policy.

1.4 Brazil and the Southwest Amazon

More than 1.6 billion people are dependent for their livelihoods on forest products to varying degrees. In remote areas with high degree of poverty, people depend even stronger on forests (Angelsen &Wunder, 2003).

Brazil offers an enormous variety of biomes on a total area of 8.5 million km², of which 4.7 million km² are primary and secondary forests and about 5.6 million ha planted forests (FAO, 2010). Enormous monoculture plantation areas of soya, sugar cane, rice

and agricultural crops dominate the central and Southern part of the country. These steadily increase, causally determined by ever-growing global demand for Brazilian agriculture products as well as national consumerist welfare advancement.

Anyway, Brazil has the potential to be the leading forestry nation in the world. Economic policy incentives are still too few, considering that Brazil occupies about Europe's surface (24 times Germany). An impression of the national Brazilian wood consumption in numbers:

Subsector	**Wood consumption from primary, secondary and plantation forests** *Eucalyptus* spp.	*Pinus* spp.	Others	Total
Pulp & paper	56.628.357	8.067.258	498.085	65.193.700
Panel industry	6.428.162	13.457.258	378.612	20.264.031
Sawnwood and timber	6.870.498	15.295.499	357.052	22.523.049
Charcoal	23.533.724	-	-	23.533.724
Biomass for energy	41.832.528	3.929.361	4.262.239	50.024.128
Modified wood	1.824.012	-	-	1.824.012
Wood chips	1.129.621	-	781.200	1.910.821
Total	**138.246.903**	**40.749.376**	**6.277.187**	**185.273.466**

(IBA, 2013)

In contrast, the Amazon macro-region, which accounts for nearly half of the Brazilian territory, shows the largest biodiversity worldwide. About 60 % of this region pertains to Brazil (FAO 2010).

The product variety from this region is splendid. Nevertheless, the economic share of this region in the national GDP is marginal. In Brazil the variety of forest products (and their derivatives) covers:

- coniferous and non-coniferous sawn wood from primary and secondary forests
- fast growing plantation wood
    - eucalypt (pulp, paper, sawn wood, energy, wood based materials)
    - *Pinus* (sawn wood, wood based materials, resins)
- non-timber-forest-product in different categories of utilization
    - nutrition (castanha nut, açai fruit, palm heart)
    - medicinal, pharmaceutical, therapeutical (andiroba oil, bee antibiotics)
    - artisanal (seeds for jewelry)
    - construction (bamboo, palm wood, bast fibers)
    - specialties (latex for several uses, vegetal oils for biodiesel)

As a consequence of the geographical, climate, ecological and cultural gradient the overall socio-economic and technologic situation in Brazil differs strongly along the North-South axis. Steady economic growth driven by the key sectors agriculture (including forestry), mining and heavy industries, led to a substantial prosperity in the South and South central parts of the country. However, regions which neither participated in economic growth nor in rising prosperity can be found in the whole North of Brazil. In the Northeast littoral region and its hinterlands, the so-called Sertão, in the rural regions in the federal states Amazonas, Roraima, Acre, Rondônia, the overall infrastructure is still less developed.

The state of Acre, Southwest Amazon, is a relatively isolated region of 153.000 km² extent of which 90 % are forests. This region is characterized by many principal rivers of the Amazon drainage basin, which act as natural transport ways for remote settlements. Of approximately 600.000 inhabitants, one half lives in the forests. The average population density in the West Amazon macro region shows to be around 3,8 inhabitants per km². Many of them live isolated from urban areas on indefinite land tenure. Their main income derives from timber, fuelwood and ntfp commercialization, subsistence small-scale agriculture, hunting and fishing. Typical products in this region are latex and Brazil nut (castanha), but surprisingly bamboo still does not play an economically role in these remote communities.

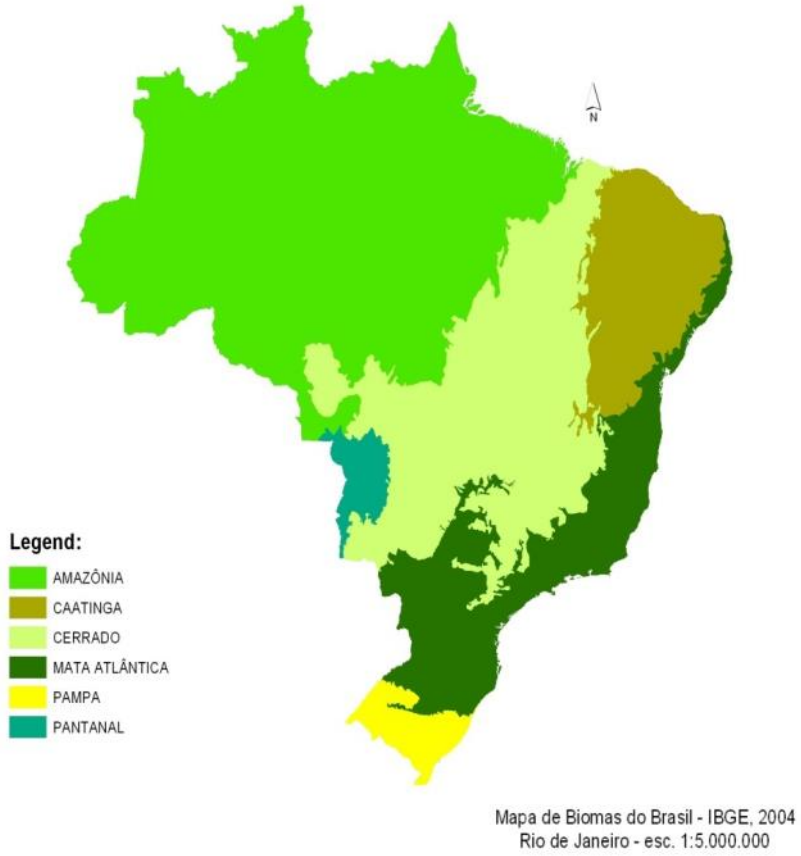

Figure 1 Map of the six Brazilian biomes (IBGE, 2004)

2 Route and logistic

2.1 Comment on transport

Figure 2 An endless seeming dirt road, part of the federal road network in Rondônia state, Brazilian Amazon region

In Brazil which reaches the extent of a whole continent visitors, researchers and expeditors usually need airplane connections to come closer to their destinations. Anyhow, to be able to achieve one of the goals of the project, it was important to cross the country on the ground. Via bus and different off-road jeeps a total trip distance of 13.000 km was absolved (see vehicle log annexed). This way it was possible to have a distinct and broad impression of the omnipresent changes of climate, ecological environment, socioeconomic reality and forestry and wood engineering strategy. The participants of the expedition learned about the interwoven dependencies of cultural, political and subsequently pragmatic methods to deal with the available resources (timber, ntfp, base chemicals, water, education and human capacities). We headed from the widely industrialized Southern part of Brazil (Curitiba, Sao Paulo and Florianopolis) into the agriculturally intense Central Brazil (Caceres, Cuiaba, Porto Velho) up to the sparsely populated North (Acre). From the economical traditionalist's point of view, this last mentioned region's infrastructure still is underdeveloped in terms of energy, natural resources and logistical access.

Concluding, the enormous distance of 13.000 km, which appears to be a Guinness-compatible record, was the essential key to overview the relevant Brazilian realities. Out of a synergy effected due to the diverse profile of the participants, connections between each branch sector (forestry, wood industry and climate change mitigation) made the 7th edition of the Brasil Norte-Sul expedition a crucial instrument in bilateral University education and research in Germany and Brazil.

2.2 Map

Figure 3 Map of South America showing the expedition's itinerary and stops

2.3 Schedule

Date	Institution	Contents	Local (City/State)
16.07.2014	UFPR	Introduction workshop for the participants	Curitiba/Paraná
17.07.2014	UFSC	Secondary forest low-impact management in Mata Atlântica	Florianopolis, Massaranduba/ Paraná
18.07.2014	Fibria	Reforestation area with *Eucalyptus* and forest logging operations	Jacareí/São Paulo
19.07.2014	Ilha Grande	Guided cultural program at an native island reserve	Angra dos Reis/Rio de Janeiro
20.07.2014	Biovert	Innovative tree nursery offering environmental services	Silva Jardim/Rio de Janeiro
21.07.2014	Jardim Botânico, EMBRAPA Rio de Janeiro, Parque Nacional da Tijuca	Botanical Garden since 1808, Public research institution, Conservation unit	Rio de Janeiro/Rio de Janeiro
22.07.2014	Duratex	Wood based particleboard producer with own forestry area with *Eucalyptus* trees	Botucatú/São Paulo
24.07.2014	Parque Nacional da Chapada dos Guimarães	National park	Chapada dos Guimarães/Mato Grosso
25.07.2014	Floresteca	Teak plantation management, harvest operations, wood quality	Cáceres/Mato Grosso
26.07.2014	SESC Pantanal	Guided reserve tour in the Pantanal biome	Poconé, Mato Grosso
28.07.2014	EMBRAPA Acre	Public research institution, Seminars on forestry technology and management	Rio Branco/Acre
29.07.2014	Seringal Quixada	Visit of a real scale Seringal	Rio Branco/Acre

		(rubber production community) and cultural-historic museum	
30.07.2014	FUNTAC	Public institution for technological research, overview on regional forestry technologies	Rio Branco/Acre
31.07.2014	Assimanejo/FUNTAC	Course on sustainable forest management in practice	Sena Madureira/Acre
01.08.2014	Empresa Floresta	Reforestation technology and agroforestry systems	Rio Branco/Acre
03.08.2014	Seringal Cachoeira	Active Seringal (rubber production community) and midnight “rubber trail” in the Amazon forest	Xapuri/Acre
04.08.2014	Natex	Natural latex processing factory for the production of condoms	Xapuri/Acre
05.08.2014	UNAMAD	Seminar at one of the principal forestry universities of Peru	Puerto Maldonado/PERU
06.08.2014	Maderera Bozovich,	Flooring production out of tropical hardwood (Cumarú)	Puerto Maldonado/PERU
07.08.2014	City of Cuzco	Cultural program introducing the history of the Inca empire	Cuzco/PERU
09.08.2014	Hotel Machu Pichu	Closing day	Cuzco/PERU
12.08.2014	Arrival in Curitiba		Curitiba/Paraná

3 Visit reports

The visits along the route took part during a three weeks period between 17.07. and 06.08.2014. Most of the communication during the expedition was done in English, Portuguese, German and Spanish. Fortunately, as a result of former cooperations some Brazilian students have knowledge of English and German language. Furhtermore, the organization team, Renato, Emilin and Goran do speak German, English, Portuguese and Spanish their own, so a continuos translation was possible during the whole trip. Some of the visited institutions have been of special interest for the students. Those have been documentated and are presented below.

3.1 Workshop start at Universidade Federal do Paraná

Institution/ Company	Universidade Federal do Paraná (UFPR)
Date	16th July 2014
Local	Campus Jardim Botanico, Curitiba, Paraná, Brazil
Contact	Prof. Dr. Renato Robert Sabina Dessartre Mendonça (postgraduate student)

For most of the German participants, the expedition part of the project was the first time in Brazil. The same night the German students arrived in Curitiba, a fraternization event with our Brazilian friends was organized. Early in the morning of the following day the German delegation was introduced to the Forestry and Wood Science Center (CIFLOMA) at the Federal University Paraná. Expedition-relevant laboratories as like the LAMEC (Forestry Mechanization Laboratory) were shown to the students.

Figure 4 German participants in front of the LAMEC laboratory at UFPR

A former student of Prof. Renato Robert, Ms. Sabina Dessartre Mendonça contributed to the Brasil Norte-Sul project offering an introductive workshop for the German guests. Sabina is a project alumna of the 2nd generation and graduated in Forestry at UFPR. Beneficially Sabina learned fluent English at University of Georgia where she

Figure 5 Brasil Norte-Sul workshop at UFPR

studied for an exchange year. Recently she is doing her M.Sc. at University of Eastern Finland (UEF).

Together with local students, the project participants explored the polytechnic campus and went for the typical canteen lunch (RU). At night, the time had come to get the expedition started. After we gathered everyone's baggage and equipment, we left Curitiba at midnight. The journey began.

3.2 Mixed *Pinus* forest management of Mata Atlântica and Restinga impressions

Institution	Universidade Federal de Santa Catarina, Parque Estadual do Rio Vermelho
Date	17th Jul 2014
Local	Around Florianópolis Santa Catarina, Brazil
Contact	Prof. Dr. Alfredo Celso Fantini

On the first day of the expedition we went to see the first biome, the littoral Restinga zones near Florianopolis in Santa Catarina. These form on nutrient-poor soils and are mainly composed of shrubs and small broad-leafed trees. Starting our journey at 05:30 am, we had a magic impression of the sunrise over the sand dunes. A historical POI, since even Antoine de Saint-Exupéry ran ashore in the 1940's here. Nowadays the Brazilian military uses this restricted region.

Figure 6 A magic impression – Sunrise behind Restinga dunes

Later that morning we visited the Parque Estadual do Rio Vermelho. This state park is located on the Island of Santa Catarina and has an area of around 1.500 ha of which half of it are forests, mostly with *Eucalyptus* and *Pinus* trees. Around 10 percent is covered by the primary Mata Atlântica – the Atlantic Rain Forest. Only 200 years ago

Figure 7 Map of Parque Estadual do Rio Vermelho (www.praiadabarra.com.br)

most of that area was a Laguna sand desert, since locals had extracted plenty of fuel wood.

In the 60´s a plan was made to prevent the sand moving by stopping deforestation and planting fast growing tree species like *Eucalyptus* and *Pinus*. The success of this tree plantation was too much: the area became biologically invaded by these two species spreading rapidly all over the coastline. Now the park is a protected area and the regulation system of the park envisages the removal of all exotic species. The main use of the park is indirect: research and recreation. Suggestions made by ecologists to eradicate each exotic tree, raises some questions of feasibility.

Prof. Fantini (UFSC) explained the difficulties of this measure. Taking out 100% of all exotic individuals causes immense costs. Additionally, the choice of suitable methods is questionable. Many seeds are transported by means of wind spreading. A controlled forest fire would even strengthen the pines rather than eliminating them, because fire favors pines sowing their seeds.

According to Prof. Fantini, the complete harvest of adult trees on an area of about 700 ha means extraordinary expenditures, but also may compensate by selling valuable timber. In 2006 such a clear cut was made, but today the same exotic species occur even stronger. Most of them derive from ground seeds which can survive a few years until they start germinating.

Figure 8 A sprouting pine seedling between pine needles

Factbox

→ Mata Atlântica strongly degraded and invaded by pine
→ Sustainable forest management of Mata Atlântica: lesson from the Amazon
→ Secondary forest project experiments with different harvest intensities

Together with the UFPR in Curitiba the UFSC started an experimental area in which students remove all *Pinus* saplings and cones manually. It is a long term project which may show the regenerating effect of this tedious task. The experiment in the Red River State Park demonstrates the aspects of well-meant environmental protection theories

and practice. Moreover it shows how complex the interaction of environmental protection, policy and forest management is.

3.3 Experimental intensity focused secondary forest management in Mata Atlântica

Institution/ Company	Universidade Federal de Santa Catarina, Parque Estadual do Rio Vermelho
Date	17th Jul 2014
Local	Around Florianópolis Santa Catarina, Brazil
Contact	Prof. Dr. Alfredo Celso Fantini

After the visit in the Red River State Park we went with Professor Fantini to a secondary forest project in the Atlantic Forest. He explained how important it is to inform forest owners about the ecological importance of their forests. Finding ways to make profit out of their forests in combination with a sustainable forest management plan may avoid a land use change. The greatest threat is the conversion into agricultural land, forestry monoculture plantation or pasture areas. Rice plantations and cattle farms on our way to the studied area made this threat visible.

Only the mountainous areas with difficult accessibility were still covered with primary forests. The deforestation of areas with slope higher than 30° is prohibited by the Brazilian forest law due to the elevated risk of soil erosion.

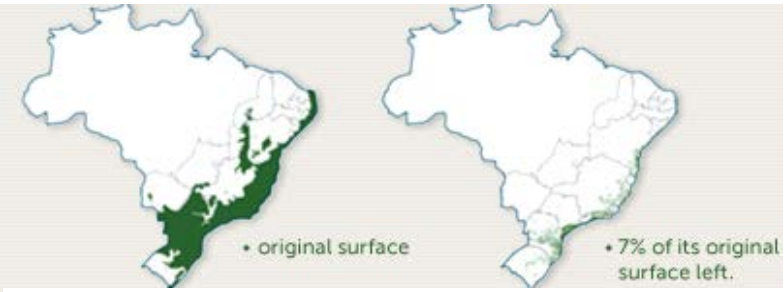

Figure 9 Historical development of Mata Atlântica (Anne Fontaine Foundation)

We also went to a secondary forest which was located on a hillside. The Atlantic Forest was once huge with a size of around 120 million hectares. Today it is smaller than 10 million hectares. Most of the leftover Atlantic Forest is divided into small units of less than 50 ha. This is believed to be a critical problem for the fauna. The lack of ecological corridors is endangering endemic species, like the Golden Lion Tamarin (*Leontopithecus rosalia*). These small areas are often crisscrossed by forest access roads. These roads often account for more than 10 percent of the total forest area. Although it is not allowed to clear the roadsides more than necessary, it is normal practice and a profitable way of forest degradation. On the other hand, small

roads are not ready to be used with heavy forestry machines since the shaded ground tends to dry slower than on wide roads.

Secondary forests differ from primary forests In terms of biodiversity, height and structure. Usually secondary forests are less high, have only one canopy layer and a few tree species are dominant. Normally the trees stand closer than in primary forests and there is more undergrowth. Logically there are no huge trees with high BHD. For many owners the lack of big trees, the difficult accessibility and the missing know-how lead to the impression that it is not valuable for them to use their forest land.

Figure 10 Big access roads ("ramal") divide the forest

There are two more phenomena which promote this development. The younger generation of forest owners tends to move to urban areas for studies or labor. Only few of them turn back to overtake their parent's forestry activities.

Another problem is a well-meant law which was adopted in 2006 – the Mata Atlântica law. This law should prevent deforestation by prohibiting the logging of native tree species. So for investors and forest cultivators it seemed economic non-sense to plant native tree species, not being able to harvest them in the future. As a consequence, only exotic tree species or even *Eucalyptus* monoculture plantations were established on former secondary forest lands.

Factbox

→ Identify and demonstrate crucial forest functions (e.g. soil protection)
→ Multiply the valuable advantages of standing secondary forest
→ Integrate harvest and reforestation techniques of lesser known secondary species into forest management plans

Our host, Professor Fantini, together with colleagues at UFSC and UFPR, explained briefly their mission. Professor Fantini explained that the opening of a closed canopy cover causes an immediate reaction. Spread seeds of pioneer species will succeed and create the first phase of a natural succession.

A central question is the extent of the canopy opening. For light-demanding tree species a less dense canopy cover would be advantageous. Too much light would cause negative effects, e.g. strong undergrowth, which limits natural restocking of commercially interesting timber species.

For land owners many fast-growing tree species are of greater economic profit. This situation differs to the forest management in Amazônia, where often only one to three trees per ha are cut. Increasing productivity usually means decreasing biodiversity. The

productivity of a forest means the increment of commercial extractable timber volume per ha and year. In the case of Mata Atlântica secondary forests a high productivity can be achieved with many fast growing tree species. Typical examples are: “Canela amarela” (*Nectandra lanceolata*) or “Guapuruvú” (*Schizolobium parahyba*). Besides timber production, the development of non-timber forest products like “palmito” (palm heart) is a great opportunity for forest owners. To harvest palm heart, the apical meristem of the palm tree is cut, which subsequently causes the death of the whole pioneer plant. Instead of using the endangered “Içara” (*Euterpe edulis*) palms, it is recommendable to cultivate “Pupunha” (*Bactris gasipaes*) or “Açaí” (*Euterpe oleracea*).

Figure 11 Student group entering the experimental site – Prof. Fantini in the front with a red folder

The visit in the secondary forest project showed us how important it is to communicate the developed strategies to forest owners. Only private initiative is powerful enough to effectively prevent secondary forests of the Mata Atlântica from deforestation and degradation in long-term.

3.4 Industrial superlative in the production of pulp based on *Eucalyptus* spp. plantations

Company	Fíbria Celulose S.A.
Date	18th Jul 2014
Local	Jacareí, São Paulo, Brazil
Contact	Eder Ferreira, PR-officer

A totally different forestry reality waited for us at Jacaréi where we visited Fíbria, a pulp industry which was set up in 2009 in the state of São Paulo/Brazil. The company is the result of a fusion of Aracruz Celulose and Votorantim Celulose and Paper. With seven factories in five Brazilian federal states, 17.000 employees and 5.3 mio t pulp produced per year, Fíbria is nowadays one of the most important global players in the international market for bleached pulp.

The raw material used for pulping derives from several sources. A total of 1.200.000 ha plantation area is necessary to supply the plant effectively. The largest share of 609.000 ha belongs to the plant's own *Eucalyptus* plantation. The difference is covered by around 450 farmers which produce the raw material on behalf of Fíbria. These impressive numbers, as well as technological developments in industrial processing and forestry made Fíbria the recent international market leader for *Eucalyptus* pulp production.

Figure 12 Clear cutting is the common management form

Just after the common institutional presentation, videos and a series of questions asked, we visited a part of the *Eucalyptus* plantation. Of course we had to take the bus, since even the distances inside the company area are tremendous. In the moment of arrival, it got obvious that only a few of us had seen a comparable "forest" before. According to the very generic FAO definition for forests, this plantation may be denominated as such. Anyway, the apparent characteristics of the plantation remembered more an agricultural area. Working intensely in a 24/7 three shift system, the factory produces up to 1.1 Mio t bleached pulp per year.

The harvest of the raw logs is made via harvester. Commonly harvesters have problems with slope terrains. Thanks to a steel wire support system, a maximum angle of 35° is tolerable for the mechanized harvest. Cloned trees, result of genetic modified seeds, grow five to seven years until they get cut. They have an average harvest volume of 0,18 m³. This high growth rate only is possible due to the typical high water consumption, as well as the continuous tilling of relatively poor soils. As a consequence, important ecological soil functions are disturbed and damaged. To be able to keep up the productivity on mid-term, an intense utilization of fertilizers is necessary.

Figure 13 Harvester cutting, debarking and sectioning young *Eucalyptus* logs at a slope area

Nevertheless the demand for pulp has been growing for years, not only in the Americas, but also in Central Europe. In the end, the visit at a *Eucalyptus* plantation was a great asset for the participants.

Factbox

→ Tremendous areas are used for the production of Eucalyptus in order to supply a pulp factory
→ Clearcutting and heavy soil erosion is compensated with fertilizers and agricultural methods
→ Special forestry techniques are needed to reach enormous growth rates in only five to seven years

On one hand, we had the opportunity to understand the practices on forest plantations which are a relatively recent result our own consuming behavior. On the other hand, it is important to mention that this does not differ too much to the German forestry situation where we have large monoculture woodlands as well.

Caused by this conflict, we were encouraged to think about several questions from a new point of view: Is this kind of forestry the future production system in Europe as well? What consequences on long-term may this have?Where is the actual separating border between agriculture and forestry?

Figure 14 Students in front of three years old *Eucalypus* trees, sandy, nutrient poor soil in the front

3.5 Nursery and environmental consultancy for ecological restoration and compensation services

Company	Biovert Florestal e Agrícola LTDA
Date	20th July 2014
Local	Silva Jardim, Rio de Janeiro, Brazil
Contact	Marcelo de carvalho (Initiatior and manager)

Biovert was founded in 1992 by Marcelo de Carvalho. The forestry engineer works with environmental consultancy, manages the nursery and takes care of many public and private stakeholders. Anyway, the main focus of Biovert is the seedling production of native Atlantic Forest vegetation. Besides the standard nursery business, Biovert works with parks and gardening, reforestation of degraded areas, urban afforestation as well as environmental compensation through carbon credits.

Reforestation issues always happen with native seedlings from their own tree nursery. With an active role, Biovert participated in the National Program for the Production of Native Forest Seeds, recently initiated by the Ministry of Environment (MMA).

Biovert possesses the largest nursery in Rio de Janeiro state. We visited the *Plathymenia* farm (*P. reticulata*, or "vinhático" is an important commercial timber tree in Brazil) , with about 1000 ha. The administration is located in the state's capital.

Figure 15 On-site substrate production

The students learned about the development of exotic and native forest seedlings as well as palms and ornamental species. Biovert does not work with genetically modified material and has an average of 80 species of which at least 15 are considered endemic and rare in Brazil. The overall capacity of 3 million seedlings per year is about to expand, due to the increasing market demand. Substrate production is directly integrated in the nursery process. The organic material derives from removed trees and plants from e.g. deforested construction sites.

Figure 16 Shoot production three weeks after germination

Marcelo showed us the whole production process of trees in the nursery - from the cradle to the market. He established a landscape pattern in his property structured throughout the various biomes of Brazil. That made it possible for us to get to know and visually see the different plants and plant communities like they naturally occur in the Brazilian biomes. We passed several small side projects, like high quality cattle farming cheese production. Marcelo told us about the challenges he was facing during the establishment of his company in the last 20 years. Due to the business model, Biovert is quite susceptible to unfavorable legislations of the Brazilian government. They strongly depend on Rio de Janeiro state. Biovert will only have clients, if law enforcement is sound and construction companies and real state agencies are pressured to mitigate the impact they cause by restoring areas.

Factbox

→ **Multiservice nursery with about 80 native species in seedling production**
→ **Compensation strategy for large-scale construction or infrastructure projects**
→ **Conflicts with forestry officials and unfavorable legislation made Biovert an independent and innovative forestry company**

Additionally, competitors put many obstacles in Biovert's way. Those of them who did not believe that the company was viable enough to guarantee additional health insurance, regulated vacations and a special bonus system for the employees, tried to hinder them.

After his presentation and a very straight discussion on Brazilian economic potentials, we were invited to a traditional lunch. Again, one may realize the ambivalent relation between forestry and cattle farming: Around five types of meat, and a really delicious dish. So we had to conclude that these above mentioned problems are not only caused by politics, and taxes, but also of cultural origin.

However, in Brazil, Carvalho is an energetic and visionary personality. With his lots of spirit, entrepreneurship and fascinating love to his country and its nature, he showed us how private activism can contribute to society. Anyone who left the nursery this day was filled up with hope that an alternative future of Brazilian forestry is possible.

Figure 17 Expedition group at Biovert, in front of the Silva Jardim valley

3.6 Wood-based panel production and an integrated, industrial forestry management and monitoring system

Company	Duratex S.A.
Date	22th Jul 2014
Local	Agudos, São Paulo state, Brazil
Contact	Carlos Eduardo Rossi (Occupational health and safety engineer) Erinton Zanlorenzi (Harvest supervisor) Paul Khristoff Friedrich Karno (Harvest supervisor)

On the sixth day we reached Agudos, located in the state São Paulo. The so far forestry focus of the expedition was now touched by the wood based composite industry. One of the traditional Brazilian companies in this sector is Duratex. We have been invited to get to know their industrial concept and business mentality. The visit was divided in four parts: *Eucalyptus* plantation management in practice, particle board production line, technology innovation and a discussion round.

Founded in 1951, the company is nowadays the eighth largest producer of wood panels in the world and exports to South and North America and Europe. Duratex manufactures wood panels from *Pinus* and *Eucalyptus*. The production line includes fiber boards, agglomerate panels and medium-, high- and super-high-density panels (MDF/ HDF/ SDF). The whole company employs 730 persons with commonly 24-hour shift systems.

Figure 18 Stumpy end of a young *Eucalyptus* log

The local plantation consists of 30.000 ha *Eucalyptus* monoculture and is located quite close to the processing industry. The whole company manages about 200.000 ha, which means Duratex has got to buy raw material from other sources as well.

The plantations in Agudos are managed with six-year rotation cycles and yield an average increment of 52 m³/ha/a.

In contrast to pulp production, trees for

particle boards can be cut very close to the ground level, resulting in higher yield and very low stubs. This is a considerable facilitation for the plantation manager.

After harvest, the trees have to be stored outside to lower the moisture content. That means cut stocks of 40 to 50 days and an immanent high risk of forest fires. On the other hand, the on-stock drying facilitates the processes of debarking, getting rid of branches and leaves. However, the raw material for MDF production is delivered without too much prior drying of course. The side products like bark and branches may be used as energy biomass or are sold as fuel.

Figure 19 Mechanized feller/buncher working in a "cut-to-length" harvest system

Factbox

→ Identify and demonstrate crucial forest functions (e.g. soil protection)
→ Multiply the valuable advantages of standing secondary forest
→ Integrate harvest and reforestation techniques of lesser known secondary species into forest management plans

To mitigate forest fire incidents, Duratex has its own fire brigade as well as a remote observation tower system. Anyway, a spontaneous fire may cause a loss of 30 to 40 ha at once. Another specialty of Duratex is their forestry monitoring system. The modular system allows real-time information from heavy forestry machines (feller-buncher, harvester, forwarder) to be able to assess the operator's effectivity. This technology has been developed and patented by Duratex and enables the forestry supervisor to constructively discuss with their employees to improve forestry operations. On the other hand, this kind of monitoring system is a harsh attack on the worker's personal integrity.

Figure 20 Duratex factory in Agudos

Due to the fact that Duratex exports a huge percentage of their products in different countries, their CoC was FSC certified. Main purchasers are furniture factories producing interior, doors and kitchen elements.

On the whole, the factory has three different production lines. Depending on the product, process

times differ. The production of MDF boards, measuring from gate to gate, takes either 18 h (dry process) or 24 h (wet process). HDF panels can only be produced in a wet process. As the wet process is highly water intensive, the representatives told us that they are trying to focus more on dry process. Other challenges are fluctuating bulk density values, caused by different growing cycles (five to eight years).

To produce panels of constant quality, one has to pay attention from the plantation onto the final conditioning of the panel produced. Although the factory's technology is not the state of art, Duratex shows to have experience with process control and tries to improve especially the forestry aspects of their production model.

3.7 The "Chico Mendes" Institute and its administration of Brazilian national parks – Chapada dos Guimarães

Institution	Federal Conservation Unit of Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio)
Date	24th July 2014
Local	Chapada dos Guimarães, Mato Grosso, Brazil
Contact	Cintia Maria Santos da Camara Brazão (Head of the National Park)

After a quite distance of our overall route, we arrived in Chapada dos Guimarães to get to know the structure of Brazilian national parks plus specific challenges of the young environmental institution ICMBio (Instituto Chico Mendes de Conservação da Biodiversidade). The Institute was founded in August 2007, based on federal law 11.516 and approved only two years later. Formally, ICMBio is an autarkic federal institution, i.e. political independent, but financially of quite moderate means.

Indeed, daily weather conditions should not be part of an academic project report. However it has to be mentioned that these days, along our track in Central Brazil, it seemed to have an unexplained coincidence between our arrival and extremely cold temperatures.

We entered the National Park via a tiny path made of recycled wooden planks, when an impressive view opened up. The canyons are full of waterfalls and lush trees.

The Chapada dos Guimarães National Park protects an area of 32.630 ha of the Cerrado Biome. It is located in the state of Mato Grosso and was created in 1989. The National Park pertains to the Chapada dos Guimarães community (35%) and the city of Cuiabá (65%). The park is categorized as a so-called permanent conservation area in the year 2002 by the Sistema National de Unidades de Conservação, which was itself created in 2000. Such protected areas have the aim to preserve the flora and fauna and special features of an area.

Figure 21 Entrance to ICMBio

In Brazil the Chico Mendes Institute is the main management program of all protected areas and each conservation area has a consultative council that includes the relevant local stakeholders. Until 2009 the management plan for Chapada dos Guimarães National Park was elaborated and published. Important contents are the biotic, abiotic, cultural, historic, social and economic factors of the park and the environment. The park is located at the meeting point of three different biomes; these are Cerrrado, Mata Atlântica and the Amazon rainforest. More than 659 varieties of plant species growing and some rare animals like tapir and jaguar.


Figure 22 The Cerrado ecosystems, savanna, waterfalls and shrublands at ICMBio's Chapada dos Guimarães National Park

One of the last untouched vast parts of the Cerrado is protected here, but is endangered by growing agriculture and extending settlements. The current park managers have to deal with many different problems like settlers, tourism infrastructure and fire mitigation management. Nowadays settling in the park is not allowed, though some farmers lived in the district before its status changed into a national park. These farmers get reparations from the government so they can start a new life somewhere else. However, problems with illegal settlements and subsidy agriculture lead to conflicts with authorities and police.

During dry season, huge natural fire incidents happen occasionally and endanger the natural vegetation. Small natural fires occur all over the year. Most fires are caused by fire incursions by agricultural fields. Today "slash-and-burn" is a normal practice so that pasture can grow faster. Especially for the park's flora, fire is dangerous because some places have no natural fire resistance and could be completely destroyed. The

park is understaffed considering the extensive area under protection. To extinguish the fires the fire brigades have to take long distances and often they arrive behind time.

Factbox

→ ICMBio is an independent, federal institution responsible for biodiversity and national park administration with only moderate financial means
→ The Chapada d. G. national park protects an unique national patrimony (32.630 ha) of Cerrado flora and at least 629 fauna species
→ Dry season and huge fires threaten the natural vegetation since emergency infrastructures are relatively weak

Around three percent of the park's area is open to visitors. They have to use a system of trails which is also used by the fire fighters. These trails are arranged without any system by the old settlers and it is a challenge for the current park mangers to work with these trails. There are concepts to develop the trails, e.g. to build a new by-pass road around the park. As ICMBio is a quite young organization, they struggle for financial support at MMA (Environmental Ministry) and others. To get a project like the by-pass done, time and additional funds are needed. The circular route would help to organize the Chapada dos Guimarães National Park more efficiently in terms of nature conservation.

3.8 Seminar on forest technology and management in Amazônia at the Federal research enterprise on agriculture and forestry

Institution	Empresa Brasileira de Pesquisa Agropecuária (Embrapa)
Date	28th Jul 2014
Local	Rio Branco, Acre state, Brazil
Contact	Daniel de Almeida Papa, (PR officer / forest management specialist)

An important milestone of the expedition is the arrival at Rio Branco, the capital of Acre. The city served as a vantage point and was our temporary home for some days. The first stop in Rio Branco was the Embrapa Acre regional unit. Embrapa is a public-private establishment in collaboration with the Ministry of Agriculture. With offices and laboratories in almost every state in Brazil Embrapa is working on different projects of sustainable development in agriculture and forestry.

Our presence at Embrapa was cherished with a seminar about recent research projects regarding forest management in the Amazon rainforest. Many projects strongly consider the needs and lifestyle of the native local population. As part of the workshop,

we visited the experimental plantations and forests. Some relevant projects are reported below.

Research project "Microtrator"

Local	Senador Guiomard, Acre, Brazil
Contact	Henrique J. Borges de Araujo

The first presentation was addressed to the development and testing of micro-tractors for timber extraction. Many areas in Acre State have been using heavy vehicles for agricultural purposes for more than 20 years. Soil compaction is a common consequence. In managed forests or extractivism reserves a reduced impact is targeted when logging trees. The use of micro-tractors is supposed to replace domestic animals, facilitate the work and not decrease soil quality. While the costs remain the same by using micro-tractors the productivity even increased.

Figure 23 Micro-tractors used to forward pre-processed timber from site to access roads

Research project "Taboca do Acre"

Local	Reserva extrativista Chico Mendes, Acre, Brazil
Contact	Elias Melo de Miranda

Another one of Embrapa top research topics since 2000 is "Taboca", which is the popular name of *Guadua* spp. bamboo. It is part of the natural vegetation in about 180.000km² coherent bamboo-containing forests. Although its role in forest succession and timber harvest seems to be crucial, bamboo still did not receive the necessary attention in forest management. The demand for bamboo products is increasing and the state government is showing more interest in research, especially in seed propagation and technological bamboo utilization. Additionally, Embrapa is offering training courses on the use, harvest, management and products of bamboo.

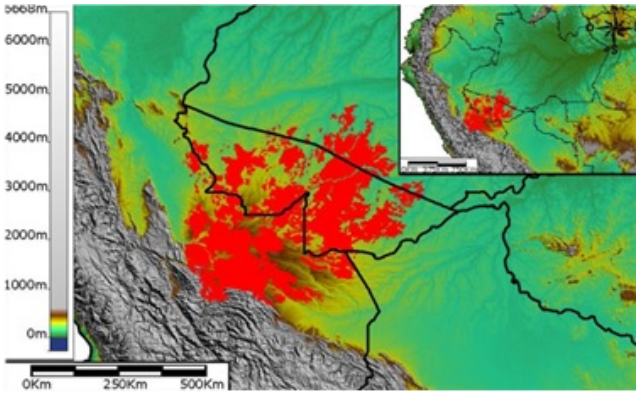

Figure 24 The extent of the "tabocal" in Peru, Acre, Amazônia

Research project "Castanheira"

Local	Reserva extrativista Chico Mendes, Acre, Brazil
Contact	Vanessa Santos Silva

The Castanheira tree (*Bertholletia excelsa*) plays an essential role in Acre's production of non-timber forest products, but not as a plantation tree. Caused by shifting cultivation, there are many solitaire trees, which raise the question of how long they will be able to reproduce over far distances. Consequently the Castanheira project aimed to study the relations in plantations, forest and grasslands to be able to forecast the development of the species. The so-called "ouriço" was collected, seedlings were grown and the degree of parental relation was identified with genetic methods. Vanessa concluded that even long distances do not affect the reproduction of castanheiras in population size.

Figure 25 Ouriço da castanha after harvest

Research Projects "Lidar" and "Geotechnology"

Local	Floresta Estadual do Antimary, Acre, Brazil
Contact	Marcos Vinicio Neves d'Oliveira Alisson Mello Munaretti

Light detention and ranging (or short "Lidar") is a forest management tool for biomass calculation in the rainforest. It is an optic technology based on laser, GPS and reflection from the ground. The ascertained 3D-images help to plan logging, give information about carbon storage and allow the researchers to create a nearly perfect digital model of the analyzed forest areas.

The "geotechnology" project focuses on ntfp and aims to take stock of all harvested products (castanha, andiroba, latex) and their belonging trees. This allows the local population to optimize their paths of work and gives a better overview of the value chain. The project also takes different social aspects, such as process optimization in local communities, into consideration.

After the workshop we had the possibility to take a walk around the research plantations and the primary research forest. This territory of around 1.200 ha is permanently monitored and gives the possibility for many experimental studies.

3.9 Public research foundation for technological innovation in Acre

Institution/ Company	Fundação de Tecnologia do Estado do Acre (FUNTAC)
Date	30th July 2014
Local	Rio Branco, Acre, Brazil
Contact	André Gomes da Silva (Responsible forest engineer) Suelem Marina de Araújo Pontes (Wood Technology)

FUNTAC, the Foundation of technology in the State of Acre, is concerned with the sustainable management of the state's forest through technological advance. FUNTAC is a governmental service provider and is taking care directly of a single sawmill and two reserve forests.

One of the biggest challenges for FUNTAC is the marketing of non-traditional wood species. Brazil has round about 350 different commercial wood species, but only 33 are used in the industry. Finding alternatives may help to save pressurized species and regions.

The foundation is divided in six different research areas. The first stop was made in a laboratory for wood technology. Since 2009 FUNTAC works with bamboo as well. The currently very popular topic is the vast bamboo stock in Acre and how to make use of it efficiently. Different types of ply bamboo were shown to be technologically feasible. In other experiments, the researchers tried to use recyclable "tetra pak" in the middle layer of ply bamboo. An issue which definitely needs to be discussed further.

Figure 26 Bamboo ply panels with tetra-pak layer

Another laboratory deals with alternative bioenergy. FUNTAC helps to develop renewable energy systems for isolated forest communities who are not connected to public electricity. A possible solution is the production of biodiesel out of ntfp. Subsidized by FUNTAC the farmer may extract the Murumuru palm's "nut" (*Astrocaryum murumuru*) from their

surrounding forests, separate oil and by-products to transform then to biofuel and cattle fodder. A serious challenge of this idea is the huge distance in between the communities. There is a critical number of households or people needed to purchase a steam boiler, resp. generator.

Factbox

→Community based technology development inside the Acre Amazon forest
→Rural research in the fields of bioenergy, construction materials, pharmacology, medicine, alimentation
→ Support for forest people by marketing their seeds and other products through a non-profit structured organization

The third laboratory focuses on ntfp and their use in the cosmetic-, food- and pharmacy industries. The shown extraction processes provides raw material containing all the complex active substances of herbal plants. The researchers of this lab work on simple extraction techniques, which can be used by the forest communities themselves.

Furthermore, seed micro-propagation of native tree species plays an important role in FUNTAC's research strategy. FUNTAC helps farmers to sell their seeds through their cooperatives. All of this is a non-profit activity and would probably not work without funds from the state's government. Other relevant areas of applied research at FUNTAC are:

- Forest fire monitoring
- Soil compaction and erosion through rain
- Geo-processing and pavements
- Analytical tools for physical and mechanical characteristics of wood

Acre is relatively tiny state with where slender subsistence farming is dominating rural areas. As a non-profit activity of the company FUNTAC helps forest locals to control and sell their ntfp (seeds) to a widespread market.

3.10 Sustainable forest management in South-West Amazon via private concessions (reduced impact logging in practice)

Company	Associação das Indústrias de Madeira de Manejadores do Acre (Assimmanejo)
Date	31st July 2014
Local	Near Sena Madureira, Acre, Brazil
Contact	André Gomes da Silva (Forest engineer, FUNTAC) Adelaide de Fátima Gonçalves de Oliveira (President, Assimanejo) Camila Oliveira (Assistente, Assimanejo)

It is a platitude that one only appreciates and protects things that are connected to an intense experience. To intensify theoretical lessons, the future forest and wood engineer must have a pragmatic insight into reality. He or she has to actually enter the forests to learn crucial practice. Fortunately, we were kindly invited by the Association of wood from forest management in Acre (Assimanejo) and the Acre's State Technology Foundation (FUNTAC) to get to know more about sustainable forest management.

Figure 27 Introduction to reduced impact logging in practice by Camila and Fátima

Early in the morning our team left the camping and headed northwest, direction Sena Madureira. A wide and stable asphalt road lead us into a lesser dense populated region north of Rio Branco. Some students already started to welcome the new day with Brazilian guitar songs. At the entrance to an access road ("ramal") we had to change vehicles for an open truck as well as some pickups to get along with the new conditions of a slender, bumpy and very dusty dirt track. After some hours and adventurous bridge crossings we finally arrived at the target area in the middle of the Amazon rainforest. On site it became obvious why our chaperones had taken close cabin cars. Everybody in an open truck had been wrapped into a brownish dust coat.

After lunch, the slight constrains (small wooden buildings, lack of electricity) did not impede Camila (Assimanejo) giving us an institutional presentation. A few decades ago, in the 1980's this area was one of the very first established experimental fields of FUNTAC to research on sustainable forest management. The first harvest rotation was already done recently, which is of historical meaning for FUNTAC and participating companies.

Figure 28 Forest engineering can be a quite dusty job in the Amazon

When it comes to rainforest protection, an often cited and popular example is "mogno". The South American mahagoni tree (*Swietenia macrophylla*) has been reforested in this area on about 12.000 ha. This tree species is accounted as CITES App. II and III in Brazil; IUCN classified it as endangered species. Anyway, in Brazil it is prohibited to cut down mogno as it would be possible with other trees. For every cut mogno, the responsible is obligated to plant three new ones. For more information the studies of Prof. Dr. Paulo Luiz Contente de Barros (UFRA) in the field of mogno reforestation are helpful.

After some time we had to take the jeeps to move to the logging points. The closer we got, the louder became the noise of the giant skidder machine. Despite its enormous tires and weight, the overall damage in the ecosystem is surprisingly low. During a small presentation the natural succession of a former secondary access road was shown the students. Already within three years 6-8 m wide pathways could be overgrown by the vegetation. Side roads that are only 4-5 m small could disappear even faster. To be able to stabilize the road infrastructure heavy machinery like the „D-50" forestry tractor are necessary.

Hereby the forest management planning process logically avoids taking routes that are hard to pass. This means areas with lower tree density are helpful in order to avoid damage of valuable younger trees or to guarantee low impact logging.

Figure 29 Map showing the division of the harvest area into UPAs and UTs

Managed forests in Acre are divided in so called „UPAs" (Annual Productivity Units). According to the management plan, each UPA allows one harvest per cycles of 25-30 yrs. The operational license for logging has to be authorized by the IMAC (Institute of Environmental Control in Acre). Further on, the UPAs are sub-divided into certain work units ("unidade de trabalho" - UT). These UTs

are monitored and an inventory is done. This way, trees of commercial interest and with a BHD higher than 35 cm are registered via GPS coordinates. Due to the long term harvest cycle the overgrown routes must be opened again in order to conduct access and transportation. The IMAC (Institute of Environmental Control in Acre) is also responsible for the inventory of the transportation ways, logging areas and especially for the permanence of conservation areas. The annual operation and management plan (POA) allows, according to a license, the logging of up to 20% of forest areas. Moreover, only 3% of the managed forests are allowed to be used for infrastructure issues.

Nowadays the forest management is supported by GPS-systems like „Modeflor" (Modelo Digital de Exploracao Florestal). The innovative system can locate harvest areas and timber yards precisely. It helps to identify trees ready for harvesting. The application of Modeflor led to a more cost-efficient management process.

However, the time period for harvest is very short due to the raining season. For the inventory management plan a team of experts is necessary. Large variation and different properties of tree species, as well as different flowering seasons make the inventory a real challenge.

The concession company manages to log 15 trees with an overall volume of 80-100 solid m^3. In order to experience the logging process in practice, the group was prepared with security rules and even a short prayer. Small, mobile teams of 5-10 people were formed and went closer to timber yard no. 24. A *Ceiba* tree with an altitude of approx. 30 m and a breast height diameter (BHD) more than 100 cm was selected to serve as example. Test hollow test ("teste de oco") showed the technician if the tree can be cut with common measures. Therefore he deeply entered the tree with the power saw at the base of the trunk. Then, the felling angle was determined and the first cut was made.

Figure 30 A freshly felled Samaúma (*Ceiba pentandra*) with its characteristic buttress roots

Before sawing, the tree needs to be fixed with a steel rope to be able to skid it out of the forest later on. The direction of the pulling skidder has to be determined precisely, so that the timber yard can be reached without redundant damages to the surrounding trees. At the yard diameter are measured and volumes are estimated. The whole logging procedure has to be approved and underlies official permissions.

A small group of the students observed the process from above, of course with a professional distance. Before defined exit routes define the escape direction in case of an emergency event.

The actual cutting moment cannot be seen at the bottom, but the top of the tree, where leaves and branches began to move. With a tremendous crash, comparable with an earthquake the trunk dropped on the ground. Students who never have seen such an event before were either impressed or emotionally touched.

Another truck ride brought us to the main road and back to Rio Branco. We went back to our camping side after a long day filled up with new information and many impressions. Mission accomplished.

Figure 31 The whole team in front and on top of a giant skidder machine; in the front a recently cut Cedro trunk

3.11 Forest plantations and agroforestry systems with native and exotic species from private incentives in Acre state

Institution/ Company	Floresta Desenvolvimento de Projetos Ltda.
Date	1st Aug 2014
Local	Rio Branco, Acre, Brazil
Contact	Markus Brose (Director)

Floresta – which means forest in Portuguese – is an enterprise founded in 2010. The group realizes governmental plans to reduce deforestation and advance afforestation in Acre and adjacent states. Their work is not only environmental, but also socio-economical. By rehabilitating and protecting the forest the economy and the people of Acre can profit by sustainable land management. Therefore Floresta is researching and experimenting with native and exotic tree species. Floresta is working together with other companies, with the Government of Acre, and has international partners.

We visited an experimental field in Rio Branco with several small plantations. These were created to gain experience with different tree species and to have a showplace to demonstrate the potential of forested land especially for interested land owners. Floresta collects data from these plots, as like growth figures and information on wood quality (e.g. density profile).

They experiment with native tree species like "Mulateiro" (*Calycophyllum spruceanum*) and Paricá (*Schizolobium amazonicum*) as well as exotic tree species like *Eucalyptus* spp. and Teak (*Tectona grandis*). New ideas are invented, for example to mix Teak and *Eucalyptus* in one plantation. Teak has no problem with long droughts while *Eucalyptus* competes for water with other trees close to him.

Figure 32 Students visiting a young teak plantation

Floresta plans to establish 50.000 ha of *Eucalyptus*, 20.000 ha of Teak and others (Paricá) on degraded land along the federal highways BR-317 and BR-364. Teak is mostly exported as fuelwood to India, or sawn to timber for the furniture industry, while

Paricá is ideal for the production of veneers in plywood. *Eucalyptus* and other tree species may supply biomass- based power plants with fuel or produce charcoal out of a local renewable raw material.

Furthermore agroforestry and agrosilviculture projects are established. This kind of additional land use management combines conservation and steady income for the land owners by other products than wood. For example special fruit trees like "Guava" (*Psidium guajava*), fruits like banana (*Musa* spp.) and many other ntfp like the before mentioned castanha - Brazil nuts (*Bertholletia excelsa*).

But also a combination of cattle farming and timberland is a great opportunity for Acre to integrate several value chains in one plot. Due to the historical sociocultural situation of the Acre population (mainly latex extractivists – "seringueiros"), agriculture did not play an important role in the past 150 years. Together with the ongoing land use changes in the "deforestation belt", agriculture is getting more relevant for Acre as well. Deforestation today is mainly caused by non-sustainable subsistence agriculture. But such deforested areas can be used as forest plantations and cattle pasture at the same time. In the shaded plantation the average temperature is four degrees lower than on savanna lands. Cattle need a place in the shadow to ruminate and relax. On the other hand there is no need of pesticides and even fertilizers could be reduced or may be even dispensed in the plantation.

Figure 33 Resting and ruminating cattle in the shadow of a small *Eucalyptus* plantation

Factbox

→ Private research with exotic and natural species to rehabilitate forest economy and agroforestry
→ Historically, tropical forest countries have grown their economies by cutting trees; Floresta's eco-commerce model shows an alternative paradigm
→ Combining private capital with carbon finance, Floresta and its partners will invest more than 500 million USD in sustainable conservation

3.12 Showcase of community-based industrial production of natural latex for public health preservatives

Company	Preservativos Natex S.A. (Fábrica de Preservativos Masculinos de Xapuri)
Date	4th August 2014
Local	Xapuri, Acre state, Brazil
Contact	Selma Castro (Director of Production Process)

Since the first non-indigenous latex extraction in the 19th century, the importance of this ntfp increased especially due to global developments. Although, latex has been exported to many countries, for example for wheel production during the peak periods, today it is a niche sector. When the precious seeds of *Hevea brasiliensis*, were illegaly exported to the UK and their tropical Commonwealth (Malaysia), the rubber tree was cultivated in large scale tree plantations all over the global tropical belt. Ironically this kind of plantation was not successful in South America (e.g. Henry Ford story) due to a fungal threat which is isolated in mixed dense forests.

In Acre, the rubber collection methods didn't change for many generations and still many local forest family's income bases on *borracha*, the natural latex. The former Brazilian latex industry in the Amazon region focused on export markets, a relevant national demand did not exist back then. Today, Natex integrates a production chain with community-based collection schemes and a high quality product of public interest. The preservatives produced at Natex are sold to the public health sector which then provides these for free to society. Furthermore, the factory has crucial importance in the region by offering nearly 200 employees and 700 collaborating families an

Figure 34 A typical cut and extracted latex from the *Hevea brasiliensis* tree

income.

Each family working together with the factory has its own patch of rainforest to harvest, called *Seringal*. Natex provides collecting boxes filled with ammonia, which keeps the latex viscous until it is sold at special collecting points. There, the latex quality is tested, which influences the factory price. Normally the price for 1 kg of raw latex is about 3 R$ (ca. 1 €). Natex pays the families up to 8 R$, so nearly trice than the normal market.

Once the collecting boxes arrive at the factory they are emptied and washed, then prepared for the next step. The latex passes another quality control and gets centrifuged for cleaning reasons. The now clean latex is normally stored in big tanks. For the condom fabrication the liquid latex is heated up to 30 °C and two layers of latex film are applied on shapes to produce the preservatives. Following this step, the condoms have to be cleaned, passed through an air quality control and wrapped. Roughly 19 mio pieces are produced per year. A great advantage of natural rubber is that it has much better properties than plantation rubber, which results in high quality products.

Figure 35 The finished and wrapped product

The condom production is not the factory's only occupation. Another very important part of their work is the dedicated involvement in the villages that the latex collecting families live in. They provide basic schooling, help with administration questions, health care and sexual education. Natex won many prices and is a showcase in ntfp utilization and commercialization in Acre. Natex is a privately owned and public subsidized factory.

Factbox

→ Condom factory with a decentralized, community based supply system with rubber from *Hevea brasiliensis*
→ Sexual education as part of a private-public strategic subsidy partnership
→ Showcase model of an industrially sustainable business in Acre

4 Conclusions

The participants of the Brasil Norte-Sul project expedition had a comprehensive impression of the above mentioned complexes and its immanent interdependencies.

The expedition contemplated experiences in different biomes all over Brazil, gave the students possibilities of a practical course in each visited biome. The learning process was also disseminated between the participating groups, into the academic communities and also into the local communities where the groups were hosted.

The students achieved the goals of the practical part of the project in only four weeks. First concerns about communication issues, were blown off easily by our patient translators. Especially those academics that were not used to foreign languages opened up and turned into valuable multipliers of the project's spirit. The group consolidates an important friendship between Brazilian and German forestry academics, not only at the moment of the trip, but also in the future. As part of the Brasil Norte-Sul project, a return visit in Germany is already planned for May 2015.

Figure 36 Brazilian and German participants trying to surround the "Queen of the Amazon forest" – a hundreds of years old Sumaúma tree (*Ceiba* spp.)

5 Contacts

For further information, photographs, video impressions or else media, please enter in contact either with our Brazilian partner, or directly. We are always happy for constructive critics, comments and other creative input. Do not hesitate to talk to us in English, German, Portuguese or Spanish.

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List of figures

Figure 1 Map of the six Brazilian biomes (IBGE, 2004) 12

Figure 2 An endless seeming dirt road, part of the federal road network in Rondônia state, Brazilian Amazon region 13

Figure 3 Map of South America showing the expedition's itinerary and stops 14

Figure 4 German participants in front of the LAMEC laboratory at UFPR 17

Figure 5 Brasil Norte-Sul workshop at UFPR 18

Figure 6 A magic impression – Sunrise behind Restinga dunes 18

Figure 7 Map of Parque Estadual do Rio Vermelho (www.praiadabarra.com.br) 19

Figure 8 A sprouting pine seedling between pine needles 19

Figure 9 Historical development of Mata Atlântica (Anne Fontaine Foundation) 20

Figure 10 Big access roads ("ramal") divide the forest 21

Figure 11 Student group entering the experimental site – Prof. Fantini in the front with a red folder 22

Figure 12 Clear cutting is the common management form 23

Figure 13 Harvester cutting, debarking and sectioning young *Eucalyptus* logs at a slope area 24

Figure 14 Students in front of three years old *Eucalypus* trees, sandy, nutrient poor soil in the front 25

Figure 15 On-site substrate production 26

Figure 16 Shoot production three weeks after germination 26

Figure 17 Expedition group at Biovert, in front of the Silva Jardim valley 27

Figure 18 Stumpy end of a young *Eucalyptus* log 28

Figure 19 Mechanized feller/buncher working in a “cut-to-length” harvest system 29

Figure 20 Duratex factory in Agudos 29

Figure 21 Entrance to ICMBio 31

Figure 22 The Cerrado ecosystems, savanna, waterfalls and shrublands at ICMBio’s Chapada dos Guimarães National Park 31

Figure 23 Micro-tractors used to forward pre-processed timber from site to access roads 33

Figure 24 The extent of the “tabocal” in Peru, Acre, Amazônia 33

Figure 25 Ouriço da castanha after harvest 34

Figure 26 Bamboo ply panels with tetra-pak layer 35

Figure 27 Introduction to reduced impact logging in practice by Camila and Fátima 37

Figure 28 Forest engineering can be a quite dusty job in the Amazon 38

Figure 29 Map showing the division of the harvest area into UPAs and UTs 38

Figure 30 A freshly felled Samaúma (*Ceiba pentandra*) with its characteristic buttress roots 39

Figure 31 The whole team in front and on top of a giant skidder machine; in the front a recently cut Cedro trunk 40

Figure 32 Students visiting a young teak plantation 41

Figure 33 Resting and ruminating cattle in the shadow of a small *Eucalyptus* plantation 42

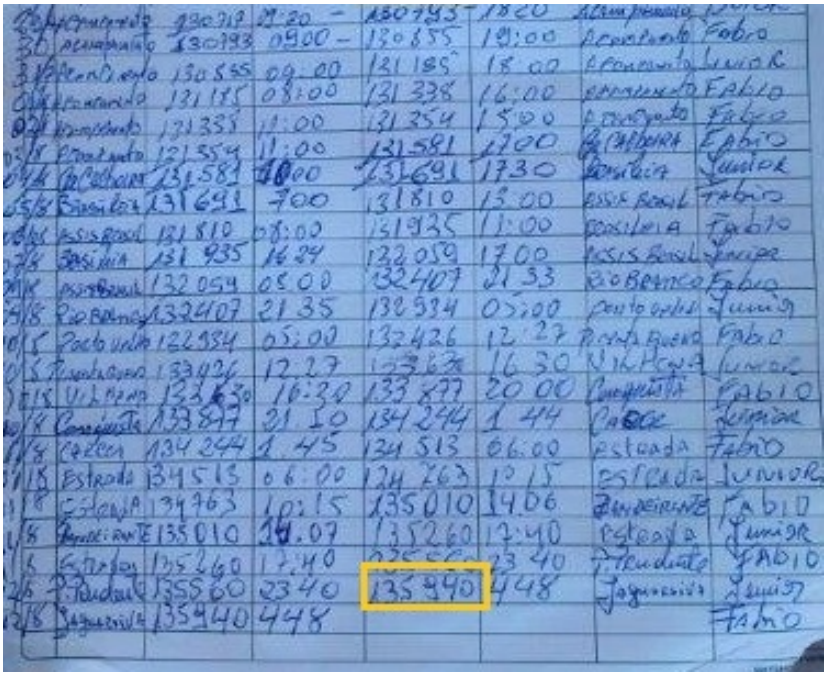
Figure 34 A typical cut and extracted latex from the *Hevea brasiliensis* tree 43

Figure 35 The finished and wrapped product 44

Figure 36 Brazilian and German participants trying to surround the “Queen of the Amazon forest” – a hundreds of years old Sumaúma tree (*Ceiba* spp.) 45

Annex

Relevant media (videos, photographs, etc.) at http://www.bamboo.gs/photos2.html and via contacting us directly.



Annex 1 The photograph shows the last lines of our bus log. The final kilometrage has been 135.940 km. Thanks to our drivers Fábio and Junior, we safely travelled around 13.000 km in Brazil and Peru