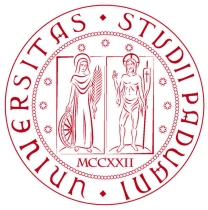

UNIVERSITY OF PADUA

Department of Territory and Agro-Forestry Systems

TESAF

Master Course in Forest and Environmental Sciences

The emissions compensation initiative by Trento Province: Monitoring of a small-scale REDD+ project in Brazil

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ACRONYMS AND ABBREVIATIONS

AA	*Associação Amazônia*
A/R	Afforestation/Reforestation
AFOLU	Agriculture, Forestry and Other Land Use
APDD	Avoiding Planned Deforestation and/or Degradation
APIZ	Indigenous People's Association of Zoró (*Associação do Povo Indigena Zoró*)
AR4	Fourth Assessment Report (of the IPCC)
AUDD	Avoiding Unplanned Deforestation and/or Degradation
BAU	Business As Usual
CCB	Climate, Community & Biodiversity Alliance
CCF	Community Carbon Forestry
CDM	Clean Development Mechanism
CIRAD	International Research Center for Agriculture and Development *(Centre Internationale de Recherche pour l'Agriculture et le Développement)*
CNS	National Council of the *Seringueiros* (*Conselho Nacional Seringueiros)*
CO2	Carbon dioxide
COP	Conference Of Parties
CPRM	Company Mineral Resources Research *(Companhia de Pesquisa de Recursos Mineirais)*
DBH	Diameter at Breast Height (1.30 m)
FAO	Food and Agriculture Organization
FAS	Amazonas Sustainable Foundation (*Fundação Amazonas Sustentável*)
FRA	Forest Resources Assessment
FSC	Forest Stewardship Council
FVA	*Fundação Vitória Amazônica*
GCF	Governors' Climate and Forest Task Force
GHG	Green House Gases
GIS	Geographic Information System
GPS	Global Positioning System
IBAMA	Brazilian Institute of Environment and Renewable Natural Resources *(Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis*)
IBGE	Brazilian Institute of Geography and Statistics (I*nstituto Brasileiro de Geografia e Estatística*)
IDESAM	Institute for Conservation and Sustainable Development of Amazonas (*Instituto de Conservacão e Desenvolvimento Sustentável do Amazonas)*
IGA	Incomes Generating Activity
IGO	InterGovernamental Organization
INCRA	National Institute for Rural Settlement and Agrarian Reform (Instituto Nacional de Colonização e Reforma Agrária)
INPA	National Institute of Research in the Amazon (*Instituto National de Pesquisa na Amazônia*)
INPE	National Institute of Spacial Research (*Instituto National de Pesquisas Espaciais*)
IPAM	Environmental Research Institute of Amazonia (*Instituto de Pasquisa Ambiental na Amazônia*)
IPCC	Intergovernamental Panel on Climate Change
ISA	Socioambiental Institute (*Instituto SocioAmbiental*)
KP	Kyoto Protocol
MAPA	Ministry of Agriculture, Livestock and Supply (*Ministério de Agricultura, Pecuária e Abastecimento)*
MCT	Science and Technology Ministry (Ministério da Ciência e Tecnologia)
MMA	Ministry of the Environment (*Ministerio do Meio Ambiente*)
MRV	Monitoring, Reporting, and Verification

MST	Landless Workers' Movement *(Movimento Sem-Terra)*
MTS	Trento Museum of Sciences (*Museo Tridentino delle Scienze*)
NA	Nested Approach
NAMA	Nationally Appropriate Mitigation Actions
NC	Not Congruous/applicable
NGO	Non-Governmental Organization
NOx	Nitrogen Oxide
NPO	Non-Profit Organization
NWFP	Non-Wood Forest Products
OECD	Organization for Economic Cooperation and Development
ONFI	International section of the French Forestry Commission *(Office National des Forêts International)*
OTC	Over The Counter voluntary carbon market
PAs	Settlement Projects (*Projetos de Assentamento*)
PATN	*Provincia Autonoma di Trento* (Autonomous Province of Trento)
PDD	Project Design Document
PES	Payment for Environmental Services
PNMC	National Plan on Climate Change
QELRO	Quantified Emission Limitation and Reduction Objectives
RED	Reducing Emission from Deforestation
REDD	Reducing Emission from Deforestation and Degradation
RFI	Radiative Forcing Index
RR	Roraima
SOPs	Standard Operating Procedures
TFCG	Tanzania Forest Conservation Group
UN	United Nations
UNDP	United Nation Development Programme
UNEP	United Nation Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
USDA	United States Department of Agriculture
VCM	Voluntary Carbon Market
VCS	Voluntary Carbon Standard
VER	Verified (or Voluntary) Emission Reductions
WMO	World Meteorological Organization

MEASUREMENT UNITS

cm	centimetres
h	hours
ha	hectares
km	kilometres
km^2	square kilometres
km^2/y	square kilometres per year
m	meters
t d.m./ha	tonnes of dry mass per hectare
tC/ha	tonnes of carbon per hectare
tCO_2e	tonnes of carbon dioxide equivalent

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“Le REDD: une opportunité unique
de préserver les forêts naturelles,
pour qu’elles continuent de piéger le carbone
et permettent à la Terre de “respirer”
Les arbres auront alors plus de valeur debout qu'abattus.”

(REDD: a unique opportunity
to conserve natural forests,
so that they continue to sequester carbon
and allow the Earth to "breathe".
The trees will be worth more standing than felled.

WANGARI MAATHAI
Nobel Price for Peace (2004)
Ambassador of the Congo Basin forests
Co-Chair of the Fund for Forests of the Congo Basin
February 2009

SUMMARY

The thesis refers to an initiative of the Autonomous Province of Trento in the context of the carbon credits voluntary market in order to offset a portion of the Province's emissions, with actions implemented in the developing countries. The work carried out consists in the monitoring of the activities of the REDD+ project "Getting REDDy" in Brazil, sponsored by the associations *Trentino Insieme* and *Associação Amazônia*. The project area is located at the village of Xixuau, in the basin of the Rio Jauaperi, on the border between the states of Roraima and Amazonas. The project envisages the conservation of biodiversity and the protection of a portion of the Amazon Rainforest of 361.5 ha. The project aims also to the improvement of the living conditions of the local population (the Xixuau *riberinhos*) through the promotion of traditional income-generating activities, such as collection and sale of the Brazilian Nut (*Bertholletia excelsa*, Humb. & Bonopl.). Furthermore, some training courses were given to the population by skilled staff. The monitoring followed the guidelines of a checklist based on the requirements and criteria imposed by the call. Different sources have been used to verify whether the indicators were met: interviews and investigation tools of the social survey; bibliographic research and verification of the official documentation (agreements, photos, contracts, maps and databases); field observations and measurements, calculations and estimates in accordance with the equations and methods available in the literature. The project is eligible according to the criteria of the call. On the other hand, the question of its additionality is controversial because of the difficult prediction of the variables that determine the future deforestation in the project area, which have to deal with the local political institutions mainly. Nevertheless, the promoters of the project have largely framed the critical situation of the site and have consistently indicated the major factors and agents of deforestation, which pose considerable risks to the region where the project is located. The methods of implementation of the activities meet the criteria suggested by Trento Province and refer to both the local (such as for activities related to *Bertholletia* Nut) and the international (e.g. for comparison with the estimates and data from the IPCC) literature. The local population has been deeply involved in all the phases and no effect of leakage seems to have been generated. The baseline scenario proposed by the promoters seems to overestimate the annual rate of deforestation that could occur during the twenty years of the project implementation. The sampling performed in the forest during the monitoring reveals, however, that the carbon content of the forest biomass is underestimated. The calculation of the obtainable carbon credit carried out by the promoters follows anyhow a conservative approach. According to the project the official monitoring activities are entrusted mainly to the local population in the years to come, of course after a proper training. Since this work was completed around one year from the start of the project, it was not possible to check the monitoring activities in place. The permanence of the project seems to be guaranteed by the strong participation and heart-felt involvement of the locals in the project. In fact they ensure a solid continuation of the project activities, basing now on an even more deepened knowledge of its fundamental driving concepts. Despite the still under development call presents some uncertainties on the generation and the transaction of the carbon credits, Trento Province has an undoubtedly pioneer role and the REDD+ project "Getting REDDy" is a noteworthy initiative in the Italian voluntary carbon market.

RESUMO

A iniciativa de compensação de emissões pela província de Trento: Monitoramento de um projeto REDD+ de pequena escala no Brasil

Essa tese se refere à uma iniciativa da Província Autônoma de Trento, no contexto do mercado voluntário de créditos de carbono, a fim de compensar uma parte das emissões da Província, com ações nos países em desenvolvimento. O trabalho desenvolvido consiste no monitoramento das atividades do projeto REDD+ "Getting REDDy" no Brasil, promovido pelas associações Trentino Insieme e Associação Amazônia. A área do projeto está localizada na comunidade do Xixuaú, na bacia do Rio Jauaperi, na divisa entre os estados de Roraima e Amazonas. O projeto prevê a conservação da biodiversidade e a proteção de uma porção da floresta amazônica com uma área total de 361,5 ha. Além disso, o projeto quer alcançar uma melhoria das condições de vida da população local (os ribeirinhos do Xixuau) através da promoção de atividades tradicionais que geram rendimento, como a coleta e a venda da castanha do Brasil (*Bertholletia excelsa*, Humb. & Bonopl) assim como através de cursos de formação e treinamento. O monitoramento foi guiado por uma lista de verificação (*checklist*) baseada nos requisitos e critérios impostos pelo edital de Trento. Várias fontes foram utilizadas para verificar se os indicadores foram alcançados: entrevistas e instrumentos de investigação de levantamento social pesquisa bibliográfica e avaliação de documentos oficiais (acordos, fotos, contratos, mapas e bancos de dados); observações e medições de campo, cálculos e estimativas em conformidade com as equações e métodos disponíveis na literatura. O projeto é elegível de acordo com os critérios do edital, enquanto a questão da sua adicionalidade é controversa por causa da difícil previsão das variáveis que determinam o futuro do desmatamento na área do projeto.Seja como for, os promotores do projeto possuem uma visão extensa da situação crítica presente no local e têm indicado consistentemente os principais fatores e agentes de desmatamento que têm mais a ver com as instituições políticas locais e que colocam em risco toda a região. Os métodos de implementação das atividades satisfazem os critérios sugeridos por Trento e referem-se à literatura, tanto local (como por atividades relacionadas à castanha) como internacional (como, por comparação com as estimativas e os dados do IPCC). A população local tem sido profundamente envolvida em todas as etapas e nenhum efeito de vazamento parece ter sido gerado. O cenário de referência proposto pelos promotores parece superestimar a taxa anual de desmatamento que pode ocorrer durante os vinte anos de implementação do projeto. A amostragem realizada na floresta durante o monitoramento, no entanto, revelam que o teor de carbono da biomassa florestal parece ser subestimada. Todavia, o cálculo de créditos de carbono que podem ser obtidos, realizado pelos promotores, segue uma abordagem conservadora. O plano é que as atividades oficiais de monitoramento sejem entregues principalmente para a população local nos próximos anos, obviamente depois de uma formação adequada. Como este trabalho foi realizado apenas um ano depois do início do projeto, não foi possível, portanto, avaliar as atividades de monitoramento atuadas. A permanência do projeto na área parece ser garantida pela forte participação e o envolvimento da comunidade local no projeto, que poderiam garantir uma continuação sólida das atividades, como a partir de agora tem um conhecimento ainda melhor dos fundamentos. Embora o edital seje em fase experimental, ainda apresenta algumas incertezas sobre a geração e a transação dos créditos de carbono, a iniciativa de Trento é, sem dúvida, pioneira na realidade italiana e, portanto, digna de atenção.

RIASSUNTO

L'iniziativa per la compensazione delle emissioni della Provincia di Trento: Monitoraggio di un progetto REDD+ di piccola scala in Brasile.

La tesi fa riferimento a un'iniziativa della Provincia Autonoma di Trento nel contesto del mercato volontario dei crediti di carbonio, al fine di compensare una parte delle emissioni della Provincia stessa attraverso interventi nei paesi in via di sviluppo. Il lavoro svolto consiste nel monitoraggio delle attività del progetto REDD+ "Getting REDDy" in Brasile, promosso dalle associazioni Trentino Insieme e *Associação Amazônia*. L'area di progetto è situata presso il villaggio dello Xixuau, nel bacino del Rio Jauaperì, al confine fra gli stati di Roraima e Amazonas. Il progetto prevede la conservazione della biodiversità e la protezione di una porzione di foresta pluviale amazzonica pari a un'area complessiva di 361,5 ha. Inoltre si vuole ottenere un miglioramento delle condizioni di vita della popolazione locale (i *riberinhos* dello Xixuau) attraverso l'incentivazione di attività generatrici di reddito tradizionali, come la raccolta e la vendita della Noce Brasiliana (*Bertholletia excelsa*, Humb. & Bonopl.), nonché attraverso corsi di preparazione e formazione. L'attività di monitoraggio si è basata su una checklist stilata sui requisiti e criteri imposti dal bando. Ci si è avvalsi di diverse fonti per verificare se gli indicatori fossero stati soddisfatti: interviste e strumenti dell'inchiesta sociale; indagine bibliografica; ricerca e verifica di documentazione ufficiale (accordi, foto, contratti, mappe e database); osservazioni e misurazioni di campo; calcoli e stime secondo le equazioni e i metodi reperibili in letteratura. Il progetto è eleggibile secondo i criteri del bando, mentre la questione della sua addizionalità è controversa a causa della difficile previsione delle variabili che determinano la deforestazione futura nell'area di progetto. In ogni caso i promotori del progetto hanno ampiamente inquadrato la situazione critica in atto nel sito e hanno puntualmente indicato i maggiori fattori e agenti di deforestazione che hanno maggiormente a che fare con le istituzioni politiche locali e che mettono a serio rischio la regione in cui è localizzato il progetto. Le metodologie d'implementazione delle attività rispondono ai criteri suggeriti da Trento e si rifanno alla letteratura sia locale (come per le attività legate alla Noce di *Bertholletia*) sia internazionale (come per il confronto con le stime e i dati dell'IPCC). La popolazione locale è stata profondamente coinvolta in tutte le fasi e nessun effetto di *leakage* sembra essere stato generato. Lo scenario di *baseline* proposto dai promotori sembra sovrastimare il tasso di deforestazione annua che potrebbe verificarsi durante i vent'anni di attuazione del progetto. I campionamenti in foresta eseguiti durante il monitoraggio rivelano però che il contenuto di carbonio della biomassa forestale sembra essere sottostimato. Il calcolo dei crediti di carbonio ottenibili effettuato dai promotori, segue comunque un approccio conservativo. Il progetto prevede che le attività ufficiali di monitoraggio siano affidate principalmente alla popolazione locale negli anni a venire, ovviamente previa adeguata formazione. Poiché il presente lavoro è stato portato a termine a solo un anno dall'avviamento del progetto, non è stato possibile verificare le suddette attività di monitoraggio. La permanenza del progetto nell'area predisposta sembra essere garantita dalla forte partecipazione e dal sentito coinvolgimento dei locali nel progetto, i quali fanno presagire una solida prosecuzione delle attività, basata ora su un'ancora più buona conoscenza dei fondamenti che le determinano. Nonostante il bando, ancora in fase sperimentale, presenti ancora delle incertezze sulla generazione e la transazione dei crediti di carbonio, quella di Trento è un'iniziativa senza dubbio pioniera nella realtà italiana e perciò degna di nota.

RESUMÉ

L'initiative de compensation des émissions par la province de Trento: Monitoring d'un projet REDD + de petite échelle au Brésil

Dans un contexte international de lutte contre le changement climatique et grâce aux marché de carbone volontaires, ce mémoire fait référence à l'initiative de la Province autonome de Trento de compenser une partie des ses émissions de Gas à Effet Serre (GES) via des interventions dans les pays en développement. Le travail présenté intègre des activités de monitoring des activités du projet REDD+ «Getting REDDy» au Brésil, parrainé par les associations *Trentino Insieme* (italienne) et *Associação Amazônia* (brésilienne). La zone de projet comprend le village Xixuau, dans le bassin du Rio Jauaperí, à la frontière entre les Etats de Roraima et Amazonas. Le projet prévoit la conservation de la biodiversité et la protection d'une partie de la forêt amazonienne sur une surface totale de 361.5 ha. Parallèlement il propose l'amélioration du niveau et des conditions de vie de la population locale (les *riberinhos* du Xixuau) à travers la promotion des activités génératrices de revenus traditionnelles, telles que la collecte et la vente de la noix du Brésil (*Bertholletia excelsa*, Humb. & Bonopl.), ainsi que par la mise en place de formations et de programmes de sensibilisation. Le monitoring se base sur une évaluation des exigences imposées par l'appel à proposition de Trento. Nous avons utilisé différentes critères et méthodes afin de s'assurer de l'avancement du projet et du respect des conditions initiales de lancement : interviews et méthodes d'enquête sociale; recherche bibliographique et vérification des documents officiels (accords, photos, contrats, cartes et bases de données); observations et mesures *in situ*; calculs et estimations des émissions selon les équations et les méthodes disponibles dans la littérature scientifique. Le projet est éligible selon les critères de l'appel, tandis que la question de son additionnalité est controversée en raison de la prévision difficile des variables qui déterminent la déforestation future dans la zone du projet. Cependant, les promoteurs du projet ont particulièrement analysé la situation critique propre à la zone de projet indiquant les principaux facteurs et les agents de la déforestation (souvent les institutions politiques locales, qui mettent en péril la région). Les méthodes de mise en œuvre des activités répondent aux critères proposés par Trento et se réfèrent à la littérature à la fois locale (tels que des activités liées à la noix de *Bertholletia*) et internationale (par exemple pour la comparaison des estimations et les données du GIEC). La population locale a été profondément impliquée dans toutes les étapes du projet et aucun effet de fuite ne semble avoir été généré. Le scénario de référence proposé par les promoteurs semble surestimer le taux annuel de déforestation qui pourrait survenir au cours des vingt années d'exécution du projet. L'échantillonnage effectué dans la forêt pendant le monitoring révèle, cependant, que la teneur en carbone de la biomasse forestière semble être sous-estimée. Le calcul des crédits de carbone obtenus, effectué par les promoteurs, suit toutefois une approche conservatrice. Il est prévu que les activités officielles de monitoring soient confiées principalement à la population locale dans les années à venir, bien sûr, après une formation adéquate. Puisque ce travail a été achevé un an seulement après le début du projet, il n'était pas possible de vérifier la mise en œuvre de ces activités de monitorage. La permanence du projet sur la zone en question semble être garantie par la forte participation et l'implication de la communauté locale dans le projet, ce qui laisse présager une continuation solide des activités. L'initiative de Trento, n'étant encore qu'à ses débuts, présente encore quelques incertitudes quant à la production et la transaction de crédits carbone, mais elle est sans aucun doute pionnière en Italie et mérite donc une attention particulière.

Introduction

The one in which we live is the time at which the mankind realizes that it is crucial to take action in order to face the most actual environmental issues, like global warming, deforestation, global ecosystem services depletion and biodiversity loss (IPCC, 2007; Cox *et al*., 2008; Locatelli *et al*., 2011). From these widely diffused concerns, the United Nations Framework Convention on Climate Change (UNFCCC) devised different tools in order to encourage industrialized countries to reduce their Greenhouse Gases emissions. In 1997, with the Kyoto Protocol in the frame of the UNFCCC, some flexible mechanisms were conceived in order to allow countries meet their reduction obligations. In fact, Annex I countries could implement emission-reduction projects in developing countries, from which they could gain some *carbon credits* which can be counted towards meeting the Kyoto targets and also exchanged between countries.

Beside the institutional market of carbon credits connected to the UNFCCC, we have the voluntary one, which is dominated by the forest sector, since investing in forests and natural resources protection is much more popular than in carbon saving technological projects, at least for the single citizens and companies. In the sector of forests and environment, the projects based on the Reduction of the Emissions due to Deforestation and forest Degradation (REDD), implemented in the developing countries, play a key role in the carbon credits exchange as well as in the forest and biodiversity preservation (Santilli *et al*., 2005; Pinto *et al*., 2009; Karsenty *et al*., 2012).

This thesis refers to an initiative of the Autonomous Province of Trento (PATN), which, in the context of the voluntary market for carbon credits, committed to offset a portion of its emissions through interventions in developing countries. Accordingly to the call issued by the PATN in 2010, the project "Getting REDDy" about Reducing Emissions from Deforestation and forest Degradation + (REDD+) has been implemented in Brazil and Tanzania, promoted by the *Trentino Insieme* association. This work aims to carry out a monitoring of the project activities in the Brazilian section, one year later the launch of the project. This monitoring has allowed on one hand to check the progress of the project activities, highlighting their strengths and weaknesses, but it also gave the opportunity to analyze and review the adequacy of the guidelines and requirements of the call of Trento.

The thesis is organized into five chapters. After the present introduction, the first Chapter discusses a general framework of the topic of the REDD+ projects. The main information about the state of climate change and global warming are reported, referring mainly to the fourth report of the Intergovernmental Panel on Climate Change (IPCC) in 2007, as well as to the publications of Cox *et al.* (2008), Locatelli *et al.* (2011), Houghton (2005) and Angelsen *et al.* (2012). Following a discussion about the role of forests and the effects of their degradation and deforestation at both the local and the global level, the approach of international politics to the climate and environment issues is analyzed. The genesis and the evolution over time of REDD projects in the context of the international policies are then described, with a focus on the Conferences of the Parties of the United Nations Framework Convention on Climate Change (UNFCCC). The REDD+ projects are then split into their components: the founding principles as well as the problems associated with their implementation are presented and explained. In paragraph 1.5 a critical analysis of the REDD initiative is expressed, being the result of the investigation of the abundant literature that commented and evaluated the projects implemented to date. The theme of the voluntary market for carbon credits (VCM), in which the forest sector and REDD projects are widely employed, is deepened and the international

standards of validation and certification of projects are mentioned, including the Voluntary Carbon Standards (VCS) and Climate, Community and Biodiversity Standards (CCB Standards). In the frame of the voluntary carbon market, the Trento's initiative is then exposed and the projects which applied and won the 2010 call are listed.
In Chapter 2, a comprehensive presentation of the project "Getting REDDy" is provided, as it is the case study of the thesis. The project activities for the Brazilian section are set forth. The project area, or the Amazon rainforest of the Xixuau village (Roraima State), is first geographically localized, and then it is described by a climatic, geopedologic, morphological, and vegetational point of view. The characteristics and the general conditions of the ecosystems belonging to the concerned area have been shown, referring to the extremely broad biodiversity that characterizes them, as well as to the rare species and/or threatened and those worthy of natural and scientific interest. The issue of deforestation ongoing in the area is tackled, analyzing and explaining the driving forces, the factors and the agents' categories. The local community, that is both responsible and focus of the REDD+ activities, is carefully described. In fact the origins, the current conditions, the activities, the practices and the customs of the *riberinhos* living Xixuau are presented. Finally, extensive information is provided about the Trento's proponent association (*Trentino Insieme*- TI) and the Brazilian partner association (*Associação Amazônia* - AA) which is responsible for the implementation of the project activities on site. In Chapter 3 information sources and survey methodologies are illustrated. To determine whether the requirements of the call were met and consequently to evaluate the status and quality of the project operations, a check list has been created (described in Section 3.1 and reported in Annex VI). The methodologies used for the verification of the project compliance are several: interviews and social survey towards the locals and the main stakeholders; literature review and inspection of the official documents, field observations and measurements. The latter consisted of dendrometric measurements for estimating the carbon stocked in the forest project; the projection of baseline and project scenarios, and the computation of the obtainable carbon credits.
In the fourth chapter, the results which emerged from the overall monitoring are reported in detail for each point of the check list. At the end of each of the five sections (basic principles of eligibility and additionality; verification of the conditions of the project area; monitoring of the implementation methods; accounting of the credits offset) a discussion of these results is proposed.
In the fifth and last Chapter general considerations about the whole thesis work are presented. The strengths and the weaknesses of the project are pinpointed. A comment on the call of Trento is given at the end of the chapter, as a sum of the results of the monitoring activity.
Finally it is noteworthy to stress that this work aims to present the personal view of an un-official wide monitoring exercise; a formal evaluation of the project will be the competence of the Trento administration, being the financier of the project.

1 Framing the research context

Climate change and global warming are among the most serious environmental issues of our time. The Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC) of 2007 states that in the 100-year period going from 1906 to 2005 the average global temperature has already registered an increase of 0.74° C. Moreover, the future scenarios outlined by the IPCC AR4 indicate that the maximum limit for the average global temperature increase is 2°C, with serious implications for natural ecosystems, human life and the whole Earth. If such a limit would be exceeded, climate change could became irreversible (Cox *et al.*, 2008). Most of the observed increase in global average temperature since mid-20th century is *very likely*[1] due to the increase in anthropogenic Green House Gases (GHG) concentrations (IPCC, 2007). Forests play an important role in both adaptation and mitigation to climate change, as they provide local ecosystem services (that reduce societies' vulnerability to climate change), as well as the global ecosystem service of carbon sequestration, relevant for mitigation (Locatelli *et al.*, 2011). Deforestation and forest degradation (with all their consequences) cause about 20% of the global GHG emissions (IPCC, 2007; Houghton, 2005). The ever-accumulating evidences that the Earth is on a path to potentially catastrophic climate change make the pursuit of the objective of reducing emissions inducted by deforestation and forest degradation a moral imperative for human society (Angelsen *et al.*, 2012).

1.1 The role of forests, forest degradation and deforestation[2]

Forests directly contribute with their resources to the livelihoods of around 90% of the 1.2 billion people living in extreme poverty, and therefore constitute a major source of national wellness. In addition, they provide immensely important environmental services, such as maintaining soil stability, recycling of nutrients, protecting water flow and quality, and serving as the repository of the bulk of terrestrial biodiversity (forests host the 90% of the global biodiversity) (WB, 2004; Parker *et al.*, 2009, Santilli *et al.*, 2003). The forest ecosystems role *vis-à-vis* of the climate is multiple: they maintain a high level of evapotranspiration from the canopy, so having a refreshing effect, and absorbing and stocking the atmospheric carbon dioxide thanks to photosynthesis (Bonan, 2008). When forests are growing, they remove large quantities of CO_2 to stock them in biomass, soil and litter. When they are at the equilibrium, forests mainly tend to maintain such stock of carbon. On the other hand the stocked carbon is released again in the atmosphere in case of deforestation (Chenost *et al.*, 2010). Forests cover about 30% of the land surface and hold almost half of the whole world's terrestrial carbon (Houghton, 2005), while tropical rainforests all alone cover the 15% of the total Earth surface (Fig. 1), thus stocking almost the 25% of all the carbon in the terrestrial biosphere (approximately 470 billion tonnes of carbon in their biomass and soil – Fig. 2) (Bonan, 2008; Pan *et al.*, 2011).

[1] According to the likelihood ranges used to express the assessed probability of occurrence where there are uncertainties in specific outcomes: very likely correspond to the > 90% of probability (IPCC, 2007).

[2] Deforestation is the direct, human-induced conversion of forest land to non-forest land. Degradation is the persistent reduction of canopy cover and/or carbon stocks in a forest due to human activities such as animal grazing, fuelwood extraction, timber removal or other such activities, but which does not result in the conversion of forest to non-forest land (which would be classified as deforestation), and qualifies as *forests remaining as forests*, such as set out under the *IPCC 2003 Good Practice Guidance* (VCS, 2012).

The Amazonian forest encompasses about one third of the whole tropical forest of the world and it hosts one third of the total alive species of the planet (IDESAM, 2011; Campos, 2009). Unfortunately, according to the estimates of the Food and Agriculture Organization (FAO) of the United Nations, during the period from 2000 to 2010 there has been an annual forest loss of 13 millions of hectares, which was concentrated mainly in South America, Africa and South Eastern Asia (or

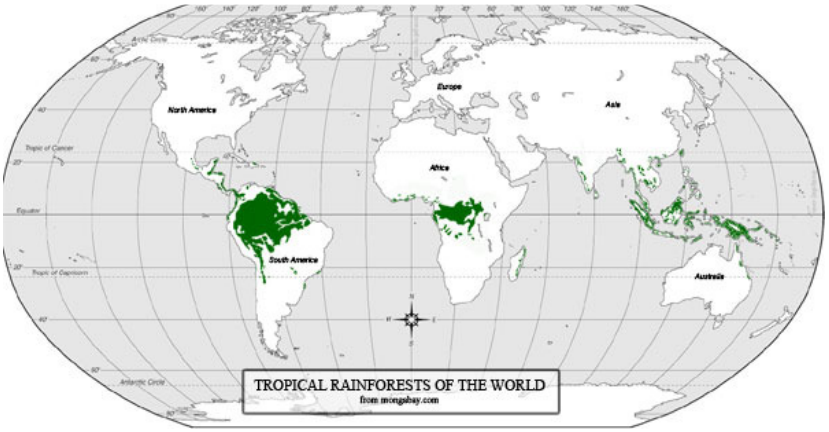

Fig. 1 Geographic distribution of the tropical rainforests (the green spots) all over the world surface (www.kids.mongabay.com/elementary/002.html)

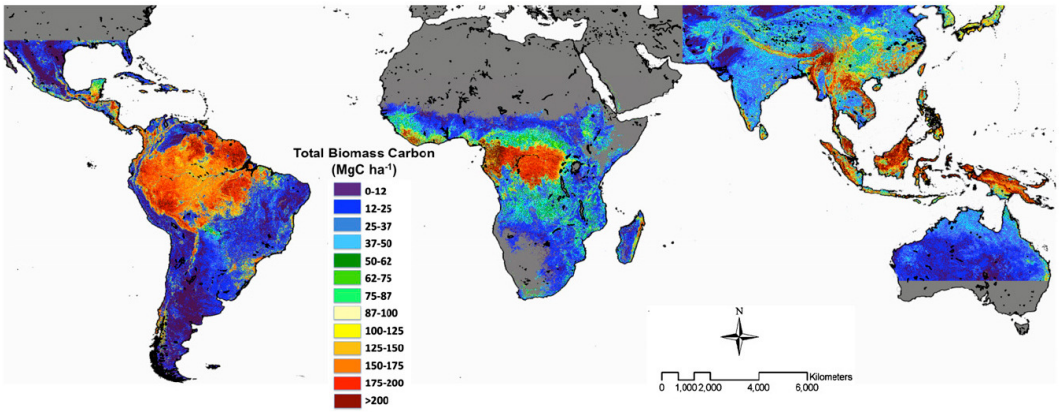

Fig. 2 Evidence of the very high carbon content of the tropical forests (www.news.mongabay.com/2011/0531-carbon_map.html)

rather where the tropical and primary forests are distributed - Huntingford *et al.*, 2013 – Fig. 1). The tropical America hosts most of the humid forests, with an estimate of 669 millions of hectares. Unfortunately, it looses and degrades more forest surface than the other regions: between 2000 and 2005 the tropical America was responsible for about the 60% of the world tropical forest gross loss (Bellassen, 2008). According to the Forest Resources Assessment (FRA) published by FAO in 2010, some South America's countries showed a considerably declining trend of the deforestation rate in the time period from 2005 to 2010[3], despite this the tropical America remains among the regions reporting the largest values of annual net forest loss. Forest degradation is more difficult to measure, and even if from 2010 FAO has initiated a special study to identify the elements of forest degradation and the best practices for assessing them, we still don't have clear statistics about forest degradation trends. The deforestation process is "multicasual" (economic, social, institutional, cultural,

[3] i.e. The FRA 2010 database reports that Brazil in the period 2000-2005 lost the 0.57% per year of its forest area, while in the period 2005-2010 the percentage of annual forest area loss was 0.42%. Similarly, Chile registered a net forest loss of 0.37% and per year from 2000 to 2005, while it became a value of 0.23% per year from 2005 to 2010. In general, South America reported a rate of annual forest loss which changed from 0.49% to 0.41% according to the two periods 2000-2005 and 2005-2010. (www.foris.fao.org/static/data/fra2010/FRA2010GlobaltablesEnJune29.xls).

etc. are influencing factors) and it gets highly variable either from year to year, but also from country to country, depending to local dynamics (Angelsen, 2008a; Calmel *et al*., 2010; Parker *et al*., 2009). Starting from the small scale, local communities usage of forests as food, fuel, logs and croplands source, can became a factor of pressure to the forest cover, in combination with poor conditions of life. At a larger scale, the agriculture sector is the dominant cause. This is even more true for the case of the Latin America where the deforestation pressure is exerted by the industrial-scale agriculture for the production and exportation of soya and beef meat (in 2005 the 70% of the deforested area were converted to pastures) (Parker *et al*., 2009; Bellassen *et al*., 2008; Karsenty *et al*., 2012). Even if they are more difficult to be detected and understood, the underlying factors of deforestation play a fundamental role in such process: it's known that international prices of agricultural raw materials have for long been known as the drivers of deforestation. In the Brazilian Amazon there are evidences of a strong link between deforestation rate and the trend of the prices of beef and soya at the farm gate. Another important underlying driver belongs to the institutional aspect, or rather the issue of the land tenure. It has been proved that a land management keeping safe the property rights results in reduction of deforestation (Bellassen *et al*., 2008). New pressures are emerging in the Amazon basin in the form of infrastructure, roads, mining and oil extraction (Karsenty *et al*., 2012). Finally, even if there are evidences of tropical rainforests resilience against CO_2-induced climate change (Huntingford *et al*., 2013), the reduction of deforestation has to be an integral part of the worldwide climate change mitigation actions, since they entail all the principal sources of carbon emissions (Cenamo *et al*., 2010).

1.2 Forests in international policies related to climate change

The 70's of the 20th century were the period of the rise of the awareness about climate and environment concerns. In fact the starting point of a long series of discussions on environmental issues was in 1972, when several countries of the world (but also some multilateral agencies, Intergovernmental Organizations – IGOs - and Non-Governmental Organizations – NGOs) meet during the United Nation Conference on Environment in Stockholm, Sweden. The United Nation Environment Program (UNEP) was so thereupon implemented. Some years later, in 1988, the UNEP and the World Meteorological Organization (WMO) established the Intergovernmental Panel on Climate Change (IPCC)[4]. The second worldwide conference on environmental issues was in 1992 at Rio de Janeiro, Brazil. A lot of topics were here discussed, such as the water scarcity and the biodiversity threats, but the most important outcome was the creation of an international agreement called United Nations Framework Convention on Climate Change (UNFCCC). Such treaty expresses the willingness of the joined nations to cooperatively stabilize GHG concentrations at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level "*should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner*"[2]. The Parties acknowledged that the countries had "common but differentiated" responsibilities and different capabilities. The basic idea was that, as they are the source of most past and current greenhouse gas emissions, industrialized and developed countries are expected to do the most to

[4] The IPCC is an organism composed of a group of international scientists which was charged by the UN General Assembly to prepare an integrated state-of-the-art report on the sciences, impacts and responses to global climate change by 1990.

cut homeland emissions. Such most responsible countries were identified in Annex I of the Convention. The Annex I lists 35 countries which are the industrialized members of the Organization for Economic Cooperation and Development (OECD) plus 12 countries with "economies in transition" from Central and Eastern Europe. Annex I countries were expected by the year 2000 to reduce emissions to 1990 levels. During the COP-1 in Berlin in 1995 Parties agreed that the commitments in the Convention were "inadequate" for meeting the Convention's objective. In a decision known as the Berlin Mandate[5], they agreed to establish a process to negotiate strengthened commitments for developed countries. They proposed the adoption of a *protocol* to elaborate policies and measures for the Annex I Parties, as well as set Quantified Emission Limitation and Reduction Objectives (QELROs). Such protocol was adopted in Kyoto, Japan, on December 1997 and it was therefore called the Kyoto Protocol (KP). Due to a complex ratification process, it entered into force on February 2005. KP sets binding reduction targets up to 5% of the emissions compared to the 1990 levels over its first commitment period (from 2008 to 2012)[2]. Annex I countries would undertake commitments for emissions reductions, while non-Annex I countries would do it on a voluntary basis (more recently expressed as NAMAs – Nationally Appropriate Mitigation Actions: the policies and actions that developing countries agree to take to reduce their greenhouse gas emissions) (Angelsen *et al*., 2012). In Doha, Qatar, on December 2012, the Doha Amendment to the Kyoto Protocol was adopted. This launched a second commitment period, starting on 1 January 2013 until 2020. To allow countries meet their reduction obligations the *flexible mechanisms* were created. Among these, the Clean Development Mechanism (CDM), as defined in the 12th article of the KP, allows Annex I countries to implement emission-reduction projects in developing countries. Such projects result in the creation of *carbon credits* which can be counted towards meeting the Kyoto targets and also exchanged between countries[6]. The emission reductions could be implemented with activities related to energy, industrial and agricultural sector. In the forest sector only Aforestation/Reforestation (A/R) projects are contemplated. In fact, dealing with deforestation and forest degradation would be too difficult, because of the uncertainties and criticalities proper of the natural ecosystems (proving additionality and intentionality, leakage effects, non permanency, assessing transaction costs, discounting of credits) and the consequent not guaranteed results (Karsenty *et al.*, 2012; Brotto and Pettenella, 2010).

1.3 Moving ahead with forests: the RED/REDD/REDD+ projects

Discussions about forests in the international frame continued in the COP-9 in Milan, 2003, where a conceptual breakthrough took place. Here a group of Brazilian researchers with some NGOs, sustained by the Brazilian government, submitted a proposal to include the deforestation avoidance projects in the tropical countries as KP mechanisms (Campos, 2009; Santilli *et al*., 2003). Such proposal, modified then by Santilli *et al*. (2005), considers what they could do to limit average global temperature increases and the resulting climate change, and to cope with whatever impacts were inevitable[7]. Recognizing the problem, the Convention wanted to stabilize greenhouse gas concentrations at a level that would prevent dangerous anthropogenic (human induced) interference with the introduction of the *compensated reduction* concept. This mechanism wanted to be a means of both

[5] FCCC/CP/1995/7/Add.1/Decision1/CP.1 (UNFCCC, 1995)
[6] www.cdm.unfccc.int
[7] www.unfccc.int

stabilizing and reducing deforestation emission and it allowed developing countries participation to the KP framework (Santilli *et al*., 2005). In fact, contrary to the Annex I countries, nations as Brazil, Indonesia, Bolivia, Peru, Colombia and central Africa's States, have no incentives to reduce or avoid emissions from deforestation, while it was demonstrated that at that time the annual rates of deforestation in Brazil and Indonesia alone would equal four fifth of the emission reductions gained by the KP implementation (Santilli *et al*., 2005). In 2005 at the COP-11 in Montreal the Coalition of Rainforest Nations, led by Papua New Guinea and Costa Rica, proposed something similar: the credits carbon projects based on the Reduction of the Emissions due to Deforestation (RED) in the developing countries. Such countries could this way enter in the international negotiations, since they contribute in regulating the climate change with their forests (Pinto *et al*., 2009). The concept was further elaborated, expanded and officially adopted during COP-13 in Bali, Indonesia in 2007 in the form of REDD (in the same COP the AR4 of the IPCC was presented). The mechanism was described as "*policy approaches and positive incentives on issues relating to Reducing Emissions from Deforestation and forest Degradation in developing countries*"[8] The addition of the second "D" to the acronym resulted from the observation that forest degradation in some developing countries was as threatening as deforestation to the forest ecosystems, and a significant precursor to deforestation (Karsenty *et al*., 2012). The acronym evolved in REDD+ because three additional elements were added to the definition of such mechanisms which now included also other interests as: "*the role of conservation, the sustainable management of forests and the enhancement of forest carbon stocks in developing countries*"[9]. From the basic aim of stabilisation of the GHG concentration in the atmosphere, REDD+ enlarges its objectives until the generation of so called *co-benefits.* They could be direct benefits, such as the creation of employment, improvement of local livelihoods, reinforcement of indigenous rights, locals' participation in decision making processes and provision of direct ecosystem services. They could also be indirect benefits: improved governance such as the strengthening of tenure rights and law enforcement, reduction of poverty, but also indirect ecosystem services (protection of biodiversity, soil and water quality, enhancement of higher capacity for climate adaptation) (Angelsen *et al.*, 2012). The COP-15 organized in 2009 in Copenhagen, Denmark, failed to conclude an overall climate agreement. In fact no decision was made on whether to agree upon a legally binding successor or complement to the Kyoto Protocol, and the accord (which was drafted by only five countries) did not establish any real target in order to achieve emissions reductions (Karsenty, 2012; Wynn, 2009). The discussions of the COP-17 in Durban, 2011, have led to both positive and negative results for REDD+: progresses have been made in how to set levels of baseline emissions and how to measure the emission reductions resulting from forestry initiatives, but the decision on social and environmental safeguards of the program was insufficient (the language is still "weak", vague, and this can have negative impacts on biodiversity and indigenous populations), while no progress was made concerning the sources of long-term funding (Kovacevic, 2011). During December 2012, in Doha, Qatar, there has been the 18th COP, which showed a shift in principles towards "losses and damages": the summit established for the first time that rich nations should move towards compensating poor nations for losses due to climate change (Harrabin, 2012; Holmgren, 2012). Up till now rich nations had agreed on financing to help developing countries to get clean energy and adapt to climate change, but they had

[8] Decision1/CP13/FCCC/CP/2007/6/Add.1 (UNFCCC, 2008).
[9] Decision1/CP16/FCCC/CP/2010/7/Add.1 (UNFCCC, 2011)

also been reticent to accept responsibility for damage caused by climate change elsewhere. It is a breakthrough, for the international agreements, but there is still a gulf between the science of climate change and political attempts to tackle it. Nevertheless, the deal, agreed by nearly 200 nations, starting from January the 1st, 2013, extends to 2020 the Kyoto Protocol, (Harrabin, 2012). Currently, the future of REDD+ as a governmental strategy is at an important moment for its definition. After years of negotiations and international pilot-projects the compensation mechanism failed to materialize on a large scale, mainly because of the lack of financial and regulatory commitments to REDD+ actions (2010; Nepstad *et al.*, 2012). But uncertainties should not bring to inaction (Angelsen *et al.,* 2012) and fortunately a lot of projects at different scale have been implemented all over the world, thus improving the development of this kind of initiatives. An inventory done by the ONF in 2010 (Calmel *et al.,* 2010) identified 134 REDD+ projects, mainly concentrated in Brazil and Indonesia. Only one third of them were under evaluation, while most of them were just in an early progress situation. According to Angelsen *et al.* (2012) REDD+ sub-national projects should be more than 200 all over the world, distributed in 43 countries. Otherwise, according to the Global Database by CIFOR[10] the REDD+ and Other Forest Carbon Projects, which are now under way in some 53 countries, are 335 (Fig. 3), with a total forest area involved of 4033063 M ha and a total carbon stock of 270.265 M Tonnes. The countries with highest number of projects implemented are Brazil (53), Indonesia (44) and Peru (38). In general, most of the projects seem to be implemented in countries with high forest cover, mainly humid forest hosting high biodiversity densities, and which record high historic deforestation rate. When investigating the reasons of the geographic distribution of such projects, it emerged that many of the current REDD+ initiatives are extensions of existing conservation projects, which are primarily interested in the conservation of biodiversity. In general, according to the drivers for the choice of the projects of donors and investors, the social and environmental benefits seem to be one of the fundamental factors of interest, and both social and environmental aims could be met in tropical forests in developing countries (Calmel *et al.*, 2010).

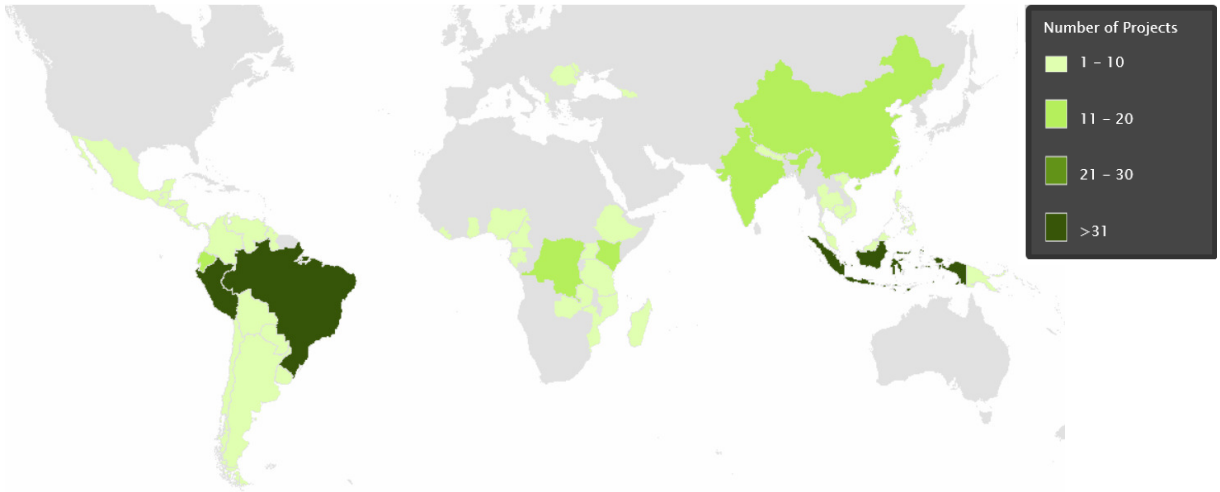

Fig. 3 Geographic distribution of REDD+ and other forest carbon projects (www.forestsclimatechange.org)

[10] www.forestsclimatechange.org/redd-map/

1.4 The features of REDD+

The main aspects and elements that should be considered when implementing a REDD project are (Cenamo *et al.*, 2010; Martins *et al.*, 2009, Verplanke and Zahabu, 2009):

- Baseline: REDD+ mechanism refers to a scenario which represents the GHG emission quantities due to deforestation in a *business-as-usual* situation (absence of the project). Any reduction below that future path earns credits for the difference which can be sold to other emitters struggling to contain increases to baseline levels.
- Additionality: the emissions reduction should only be accounted for REDD+ when clearly show that is attributable to the project activities and present an alteration in the baseline scenario.
- Leakage: net change in anthropogenic emissions by sources of greenhouse gases, occurring outside the project boundary and that are measurable and attributable to the project activity. If carbon emissions are simply displaced rather than avoided, there is no net benefit of the offset activity. For REDD, leakage means that interventions to reduce deforestation in one geographical area, cause an increase in deforestation elsewhere, through the relocation of activities. Leakage can occur at a regional, national or international scale. Addressing leakage is therefore an important element in the design of carbon projects and needs to be prevented and monitored as far as possible (Westholm *et al.*, 2009).
- Permanency: the longevity of carbon stocks considering the management and the possible natural disturbances that may affect them.

Some of the issues that affect the REDD+ implementation are:

- Financing: there are different financing strategies that could be adopted to enable the project actions (public funding based on voluntary donations; proposals tied to a market mechanism; a mixed approach where initial investments are supported by public funds or donations to support the readiness process of developing countries followed by migration to market mechanisms).
- Scale implementation: initiatives can be implemented at different levels with different implications, related mainly to the scale at which financing/credits will be released (Calmel *et al.*, 2010). According to the national approach (led by national governments) projects have to follow national strategies, adopting the national reference level and monitoring strategy. The State is the beneficiary of the generated carbon credits and it has the responsibility of distributing them among the stakeholders (Zhu *et al.*, 2010; Calmel *et al.* 2010). Such system guarantees a better control/avoidance of leakage and facilitates the monitoring activities (Cenamo *et al.*, 2010). The sub-national or project-based approach (characterized by projects which have small dimensions which are comprehended within the national boundaries), is similar to the CDM system. It is methodologically and practically simpler to implement; it is more efficient in fundraising and its activities could generate knowledge and capacity that can be replicated in other projects, even at national level. Unfortunately it can come across the risks of leakage and double counting of credits (Cenamo *et al.*, 2010; Seifert-Granzin, 2011). This kind of projects has been often criticized because some schools of thought state that since climate change is a unique challenge it requires unique solutions, or rather systemic, national solutions (UN-REDD, 2012). To match the previous two approaches, a hybrid system

has been proposed in the UNFCCC by a group of observers[11]. With the so called *nested approach* (NA), initiatives are implemented at a sub-national level, but referring to the national accounting and monitoring system. Such integrated approach enables immediate reductions of GHG emissions in developing countries at a scale compatible with their capabilities and levels of governance, but it requests robust and trustworthy accounting systems (Cenamo *et al.*, 2010; Gebara, 2012; Seifert-Granzin, 2011).

- Establishing the baseline: the methods used in the determination of the baseline decisively influence the magnitude and accuracy of carbon emission reductions. It's important to monitor the baseline over time in order to make the proper corrections if initial conditions change (political situation, deforestation rates, and socioeconomic circumstances). Two main methods are currently adopted and they consist respectively in: 1) accounting for historical deforestation rates, considering the average of previous deforestation rate and projecting it to a future baseline scenario, and 2) in forecasting and modelling the future deforestation trend, basing on the analysis of socioeconomic parameters that will interfere with the dynamics of deforestation in the future (Cenamo *et al.*, 2010).

1.5 Both sides of REDD+

According to McNeill (2006) in the policy arena the successful ideas are those which are more malleable than rigorous: they can be variously interpreted, so achieving the consensus of different audiences. As Angelsen *et al.* (2012) affirmed, this was the main reason for the success of REDD+ at the early stages. Since the Bali COP in 2007, when it was launched, a lot of projects (local or pilot) bloomed all over the world (Calmel *et* al., 2010). Anyway, as REDD+ remained ill defined and, in the long run, still many difficult issues were left unsolved, such "vagueness" resulted to be not convenient anymore and revealed a lot of underlying problems (as emerged during the numerous COP). Another successful feature is that REDD+ is a very inexpensive system compared to almost all other mitigation options (Angelsen *et al.*, 2012). REDD+ is a low cost system of emissions reduction and, even at a limited value of carbon, it can generate sufficient resources to efficiently reduce deforestation (Bellassen *et al.*, 2008). In fact, REDD+ makes forest conservation more profitable than forest clearing as a result of payments for environmental/ecosystem services (PES). As Einstein said: "*not everything that can be counted counts, and not everything that counts can be counted*" (Angelsen *et al.*, 2012). REDD+ is supposed to provide a win-win solution for most forest actors. It means that – in theory – it should produce only winners, since REDD+ aims to contribute to both environment and development goals, complying, at the same time, the economic purposes (Pielke, 2010). Anyway, in reality it is very unlikely that nobody will be negatively affected, but it is sure that positive outcomes will be spread over different stakeholder categories. Moreover, the cheap aspect of REDD+ could lead to the *greenwashing*[12], or rather the process for which green marketing is deceptively used to promote the perception that an organization's policies and aims are environmentally friendly[13]. To invest in such carbon compensation projects would give a "green" image but no efforts would actually have been done to reduce emissions. Another plausible

[11] FCCC/SBSTA/2007/MISC.14 (SBSTA, 2007)

[12] The greenwashing term has been coined by Jey Westervelt, an American environmentalist who, in 1986, accused the hotel industry of masking its lack of efforts toward reducing energy waste with a distorted green campaign (www.en.wikipedia.org/wiki/Greenwashing).

[13] www.en.wikipedia.org/wiki/Greenwashing

correlated downside could be the paradoxical fact that REDD+ seeks to reduce poverty and improve the lives of poor people by compensating them for reducing carbon emissions, while, in reality, large-scale commercial actors, not the poor, account for the largest share of deforestation (Rudel *et al.,* 2009). Sometimes, in the absence of public policies to structure REDD+, there is the risk for the *Carbon Cowboys*, or rather projects which offer unclear and obscure negotiation proposals (Nepstad *et al.*, 2012).
Even if there are still some gaps and weaknesses, experience has demonstrated that REDD+ makes the difference: the benefits and the co-benefits that it's able to produce have a heavier weight on the balance. There are good hopes for the future of REDD+: even if slowly, international negotiations are advancing towards more pragmatic and realistic agreements, while national governments and pro-REDD+ organisms continue to develop policies and strategies (Angelsen *et al.*, 2012). We have to recognize the worthiness of REDD+ also in his side effects, because it is leading to a greater global awareness of the importance of forests in climate protection, an increased transparency of forest-related information and decision making and , last but not least, it renewed the attention to forest tenure issues (Angelsen *et al.*, 2012).

Box 1 – Brazil: forests, climate change and REDD+

According to the UN FAO (confirmed by the Knowledge Database of the Governors' Climate & Forests Task Force – GCF[14]), 62.4% or about 519.5 Mha of Brazil is forested. Of this 91.7% (476573000 ha) is classified as primary forest, the most biodiverse and carbon-dense form of forest. Brazil has 7418000 ha of planted forest[15].

Deforestation

In 2009 McKinsey & Company affirmed that Brazil was the fourth largest emitter of CO_2 in the world. However, in the absence of deforestation it would occupy the 18th position in the list of top emitters of the world. On the already mentioned publication, is stated that the 55% of the Brazil's GHG emissions is due to forest sector. Between 1990 and 2010, Brazil lost an average of 2.765.850 ha or 0.48% per year. In total, between 1990 and 2010, Brazil lost 9,6% of its forest cover, or around 55317000 ha[12]. According to what mongabay.com reports[16] (Fig. 4), 60-70% of deforestation in the Amazon results from cattle ranches (Fig. 5) while the rest mostly results from small-scale subsistence agriculture. Large-scale farming seems to contribute relatively little to total deforestation. This is because soybean cultivation takes place mainly outside the rainforest in the neighbouring *Cerrado grassland ecosystem* and in areas that have already been cleared. It has been demonstrated that large-scale agriculture has an indirect but great impact on deforestation pushing ranchers and slash-and-burn farmers ever deeper into the forest frontier. Furthermore, it represents a key economic and political impetus for new highways and infrastructure projects, which also accelerate deforestation by other actors. Selective logging and fires that burn under the forest canopy commonly result in forest degradation, not deforestation. However, studies have showed a close correlation between logging and future clearing for settlement and farming[13]. As noticeable from the Figure 6, since 2004 the rate of deforestation in the Brazilian Amazon has fallen nearly 80% to the lowest levels recorded since the late 1980s. This decline has occurred at the same time that Brazil's economy has grown roughly 40%, suggesting a decoupling of

[14] www.gcftaskforce-database.org/NationPage/Brazil
[15] www.rainforests.mongabay.com/deforestation/2000/Brazil.htm (retrieved on March, the 20th, 2013).
[16] www.mongabay.com/brazil.html

economic growth from deforestation (with an opposite trend respect to the past)[13]. The Brazilian Amazonia States reduced their emission to an equivalent 1.5% of total global GHG emissions. This achievement was made possible through the combination of different factors, more specifically the implementation of laws and policy measures (including a 50% increase in protected areas and greater effectiveness of the actions of supervision actions) (Assunção *et al.*, 2012; Soares-Filho *et al.*, 2009; Nepstad *et al.*, 2009).

Fig. 4 Brazilian Amazon deforested and replaced by pastures (www.travel.mongabay.com/brazil/)

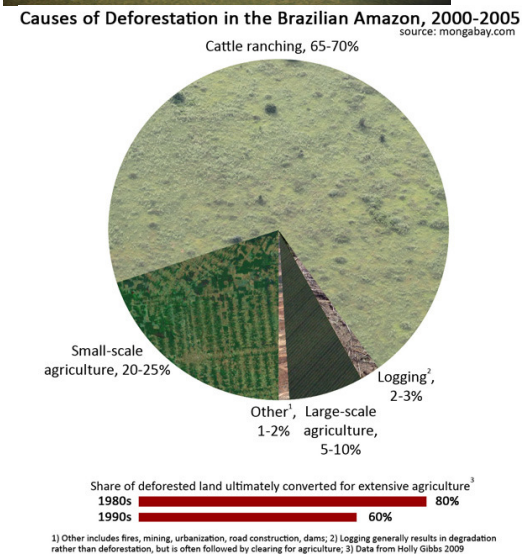

Fig. 5 Proportional percentages of the different causes of deforestation in the Brazilian Amazon (www.mongabay.com/brazil.html)

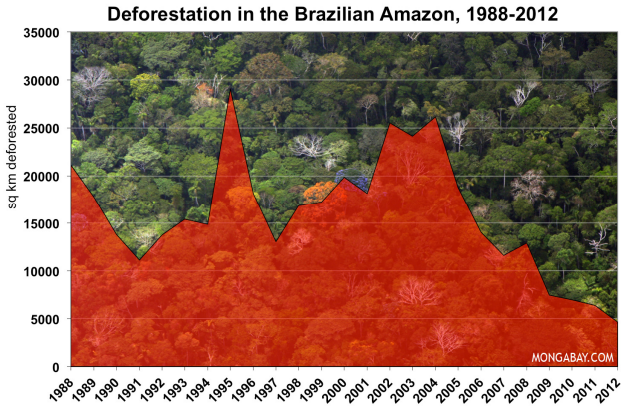

Fig. 6 Deforestation trend in the Brazilian Amazon from 1988 to 2012 (www.mongabay.com/brazil.html)

Environmental policies

Brazil has developed some important plans and policies to address deforestation and climate change. The most noteworthy strategy is the National Policy on Climate Change, established in 2009, with objectives of reducing deforestation in all biomes and increasing the use of renewable energy and biofuels, among other things[13]. The Policy created guidelines for meeting it's objectives including an emission reduction target for Brazil (36.1% - 38.9% by 2020), sectoral plans for mitigation and adaptation and identifies instruments and financial mechanisms to help achieve the goals[13] (Pavan and Cenamo, 2012). The National Policy also establishes a deforestation reduction target for the Amazon biome of 80% by 2020 from the average deforestation rate between 1996 and 2005 and a 40% reduction from the average deforestation rate between 1999 and 2008 for the Cerrado biome. The National Policy is regulated by Law Decree 7,390/2010 which outlines five sector-specific mitigation action plans (a set of integrated actions), among other things (Deforestation in the Legal Amazon and Deforestation and Fires in the Cerrado; Energy; Agriculture and Steel Sector). At the subnational level, the majority of the Brazilian Amazon States have completed their plans for control and prevention of

deforestation in alignment with the guidelines established by the National Policy. Many of the States have also been developing State policies on climate change and REDD+.

REDD+ projects

As previously mentioned (see par. 1.2), a group of Brazilian researchers put forward the proposal for the "compensated reduction" project. Since then, Brazil was actively involved in REDD+ evolution. The States of Acre, Amazonas and Tocantins (the last two were the pioneers in establishing climate change policies in Brazil) already have legal frameworks on climate change or environmental services and Acre and Amazonas already have specific regulations on REDD+ approved (Pavan and Cenamo, 2012). In several of the Brazilian Amazonia States pilot-REDD+ initiatives are underway, focused on the voluntary carbon market, developed by State governments in many cases in partnership with other non-governmental institutions (Pavan and Cenamo, 2012). Actually, according to the CIFOR Global Database of REDD+ and Other forest Carbon Projects, among the other types of projects, there are at least 11 REDD+ projects underway at national level[17]. Brazil is the holder of the first national REDD+ project in the Brazilian Amazon (REDD Project of the Juma Sustainable Development Reserve), validated by the Climate, Community & Biodiversity (CCB) Alliance standards, that falls within an agreement for transaction credits in the voluntary market (IDESAM *et al.*, 2008). The Juma project is implemented in the State of Amazonas, which had the lowest historical deforestation rates, but its sparsely populated forests were becoming more and more attractive for the agriculture and cattle production expansion, due to the trend of migration (IDESAM *et al.*, 2008). The project benefits local communities with direct payments through the program *Bolsa Floresta* (Locatelli *et al.*, 2011), which is one of the prominent Payment for Environmental Services (PES) system which values and compensates traditional populations and indigenous peoples for their role in conservation (Karsenty *et al*, 2012). Another relevant tool for achieving the goals of the National Plan of Climate Change is the Amazon Fund, which, created by a presidential decree on August 2008, is an important vehicle for supporting systemic initiatives aimed at reducing deforestation and promote sustainable development in the Amazon Biome (Karsenty *et al.*, 2012; McKinsey & Company, 2009). The Fund is owned and managed by Brazilian bodies with restricted intervention from the donor countries (Karsenty *et al.*, 2012). The fundraising mechanism based on the results achieved in the reduction of emissions from deforestation, got its first donation in 2008 from the Norway government (Cenamo *et al.*, 2011; Martins *et al.*, 2009). Since 2008, some States of the Brazilian Amazon (Acre, Amapá, Amazonas, Mato Grosso, Pará, and Tocantins) is part of the Governors' Climate and Forest Task Force (GCF). This latter, is a multi-jurisdictional collaborative effort of States and Provinces from Brazil, Indonesia, Mexico, Nigeria, Peru, Spain and the United States of America focused on strengthen technical, legal and institutional frameworks for programs to reduce emissions from deforestation and land use change[18].From a study of the Amazon Environmental Research Institute (IPAM) (Nepstad *et al.*, 2012) we know that the Amazon region alone was responsible for the reduction of 1.5% of total global GHG emissions. Anyway, not so many financial benefits came to the States in recognition of this outstanding achievement (Moutinho *et al.*, 2011). A greater financial support to Brazilian efforts is needed (Nepstad *et al.*, 2012), while it's fundamental to work deeply on structures, governances and coordination of

[17] www.forestsclimatechange.org/redd-map/
[18] www.gcftaskforce.org/about

institutional arrangements required for the implementation of REDD+ in Brazil, aiming mainly to assess land tenure, populations rights and corruption issues (Gebara, 2012).

1.6 The voluntary carbon market

Since the negotiations within the UNFCCC are long and complex and the framework for structuring a REDD+ mechanism is still not completely agreed, the forest sector performs a major role in the voluntary carbon market (VCM) (Brotto and Pettenella, 2010). The voluntary market entails all those transactions which are not tied to mandatory country targets and it co-exists with compliance markets driven by regulated caps on greenhouse gas emissions. In this sense, voluntary and independent initiatives for developing REDD+ projects and activities are emerging in parallel to the carbon market created by the CDM (Cenamo *et al.*, 2010). The volume of carbon credits transacted voluntarily in 2011 represents less than a 0.1% share of the global carbon markets. While companies have voluntarily transacted carbon credits to offset their emissions for over two decades, the vast majority of market activity has occurred within the last 5 years (Peters-Stanley and Hamilton, 2012). The credits issuing from REDD+ projects represent the second major volume transacted in the Over The Counter[19] (VCM) sales (Cenamo *et al.*, 2010). The voluntary compensation of the CO_2 emissions is mainly linked to the environmental sponsorship of various private sector, local authorities and government stakeholders (Cenamo *et al.*, 2010; Chenost *et al.*, 2010). The transaction could be done through a direct private exchange or through intermediates as brokers or NGOs (both local and international). Within the VCM, the development of projects ought to adopt methodologies focused on the quantification and monitoring of carbon credits, presenting them as a Project Design Document (PDD). As a way to give credibility to this process, many projects have been submitted to an external audit through an independent validation process based on internationally recognized standards. These standards include the Voluntary Carbon Standards (VCS), with a primary focus related to calculating carbon and methodological questions; and the Climate, Community and Biodiversity Standards (CCB Standards), which verify the positive impacts of the project also in terms of co-benefits related to positive impacts on communities and biodiversity (Cenamo *et al.*, 2011).

Because the voluntary carbon markets are not part of any mandatory cap-and-trade system[20], almost all carbon credits purchased voluntarily are sourced specifically for the OTC market. Credits are generically referred to as Verified (or Voluntary) Emission Reductions (VERs) – or simply as carbon offsets (Peters-Stanley and Hamilton, 2012).

Unfortunately, the VCM remains "illiquid", in fact: ready buyers are not always at hand, one or a few market players can dramatically influence pricing and prices are highly stratified and often unpredictable, even within similar classes of offset. The details of payment and offset delivery vary tremendously from one project to the next, as do the projects' design, risk, start date and other factors that contribute to their eventual price. On the other hand, the flexibility of the VCM rules, allows the spinning off of innovations in project finance, monitoring, and methodologies that also inform

[19] The Over The Counter (OTC) is the VCM which doesn't take place in any kind of platform and it is generally characterized by direct or bilateral negotiations.

[20] Cap and trade is an environmental policy tool that delivers results with a mandatory cap on emissions while providing sources flexibility in how they comply. Successful cap and trade programs reward innovation, efficiency, and early action and provide strict environmental accountability without inhibiting economic growth. (www.epa.gov/captrade/)

regulatory market mechanisms. For example, the voluntary carbon market has spawned its own standards, registries, and project types beyond the scope of existing compliance market mechanisms (Peters-Stanley and Hamilton, 2012).

1.7 The Trento Province's initiative in the voluntary forest carbon projects

Public institutions' initiatives are in many cases a reaction to a growing concern by the civil society (Pettenella, 2011). The Autonomous Province of Trento (PATN), Italy, in the frame of its Energy-Environmental Plan, decided to reduce its emissions of a value equal to the 2%, referring to the 1990 levels (Pettenella *et al.*, 2008). The project: "Towards a zero emissions Province" was approved in 2008. The province entrusted the Forest and Mountain Resources and Instruction Departments with the implementation of such Plan (PATN, 2010). The Energy Provincial Plan established that the whole emissions reduction amounted to 300000 tCO_2e.[21] and the 10% of these could be obtained by compensative actions (besides the local reduction commitment) (PATN, 2010). In details, it planned the realization of forest interventions in developing countries and, specifically, such interventions have to provide the protection of tropical rainforests, joining the climate and biodiversity defence with the economic and social improvement of the local populations (Pettenella *et al.*, 2008). Such actions entailed not only Afforestation and Reforestation (A/R) projects, but also interventions aimed at the reduction of deforestation and forest degradation. Of course, since the reduction amount isn't huge, they will be mainly small-scale projects. The reporting activities of the national results about the emissions reductions (inherent to the KP tools) obtained in Italian territory belong to the responsibilities of the central government (Ciccarese *et al.*, 2006). That's why this initiative of Trento is totally voluntary. Instead of buying the carbon credits already existing on the voluntary market, the PATN preferred to promote new forest projects. On September 2010, the Province published the announcement at which could apply the NGOs already accredited in the Trento territory. With this choice, it could choose the countries of intervention in relation to collaborations so far initiated and established by the Development Cooperation and define the type of intervention, with the possible enhancement of skills that the Province gained in the field of good forest management (Pettenella *et al.*, 2008). The role of the NGOs was to create, design and organize a project and, if chosen, to put it into operation. The financing total amount was 100000 € and the proportional part given to the NGOs would cover the 80% of the costs of the realization of the projects (the remaining 20% should be supplied by the NGO). The PATN, being the financing body, would acquire all the carbon credits, without the intervention of any intermediary third part. Since it was an experimental initiative, only one-year long projects were contemplated (PATN, 2010). Any failure related to time limits for completion of the intervention, involved the reduction or withdrawal of public funding and the recovery of any amount paid (PATN, 2010). From this first call, five projects were chosen and financed: they were all A/R projects distributed mainly in Africa (in Uganda, Kenya and Somalia), except for one REDD+ project (called "Getting REDDy") which was implemented both in Tanzania and in Brazil (see Chap. 2). To renew and reinforce its engagement in the climate change cause and in the carbon emission pulling down, the PATN published a new application call in 2012.

[21] tCO_2e = tonnes of CO_2 equivalent: it's the metric measurement unit for all the various GHG. In fact, their warming impact is measured in terms of equivalency to the impact of CO_2. For example, methane (CH_4) has a greenhouse potential 21 times greater than CO_2, therefore 1ton of CH_4 is recorded as 21 tCO_2e.

Tab. 1 Summary of the approved projects in the PATN call 2010.

Promoting Association	Project denomination	Project type	Country	Surface (ha)	CO_2 tons	PATN contributes (1000 €)
ACAV - Associazione Centro Aiuti Volontari	A/R project for the safeguard of the forests of the Koboko district	A/R	Uganda	160	22000	53
Trentino Insieme	Getting REDDy: carbon emissions compensation through deforestation avoidance	REDD+	Tanzania and Amazonia	655.5	30000	99.3
Fondazione Fontana	A/R compensation project	A/R	Kenya	150	35000	100
ASSFRON - Associazione Scuola Senza Frontiere	A help from Karamoja to safeguard the environment: A/R project with acacias	A/R	Uganda	30	3000	100
Water for Life	A/R project in Somalia on salty soils	A/R	Somalia	25	2200	100

2 Case study: "Getting REDDy" project in Brazil

The aim of the present thesis is the monitoring of the REDD+ project "Getting REDDy" which provides for the compensation of the emissions through the prevention of deforestation in Tanzania (Mounts Rubeho) and Amazonia (Xixuau village). Precisely, this work consisted in monitoring the Brazilian section of such project, after nearly one year from its implementation. The non-profit organization *Trentino Insieme* is the promoting association of Trento for both sections, while the local partners are respectively the NGO *Associação Amazônia* in Brazil (see Par. 2.3) and the Tanzania Forest Conservation Group (TFCG) in Tanzania. The technical and scientific consultant is the Trento Museum of Sciences (MTS). The general objective is to keep preserved 2200 ha of tropical forest, 1000 ha of which are located in the Brazilian Amazon. The forest will be protected for a period of 20 years and the project area has been outlined according to the deforestation rate and the carbon stocking capacity of the site. According to the project estimates, for a deforestation rate of 0.5% per year and a carbon content of both below ground and above ground biomass of 139.49 tC/ha, a 20-years long protection of an overall area of 361.5 ha would avoid the emission of 50 tCO_2e per hectare. It is important to precise that the value of the carbon content per hectare for the Lowland Ombrophyllous Dense Forest was taken from the first inventory carried by the Brazilian Ministry of Science and Technology (MCT, 2006). On the other hand, the value of the deforestation rate used for the baseline carbon stock computations, it was obtained by a consultation with two local organisations: the Rainforest Concern organisation[22] and the Ekos[23] Brazil institute with the Biofílica[24] Company, which had already worked at the implementation of the near REDD+ project in the Rio Jufari region. Consequently, the conservation of this site should sequestrate more than 15000 tCO_2e. The area has been calculated considering 300 ha of the effective area under protection, 60 ha representing a buffer of 20% of safety standard and 1.5 ha addressed to the compensation of the emissions due to the project activities. Beyond the forest protection and the biodiversity conservation, being a REDD+, the project aims to the amelioration of the local population conditions of life. This would be achieved improving the traditional knowledge and the locals' technologies through training courses and the adoption of improved tools for the environmental management and protection. Community organization and business training will be combined to improve the local capacity in forest management and forest product extraction. The amelioration of the forest management aspires to provide new income opportunities, thanks also to the development of the supply chain for the extraction, processing and commercialization of non-wood forest products, NWFP, (for instance: the Brazilian nuts produced by the *Bertholletia excelsa* H.&B. plant – Annex I). In details, the collaboration with the Vitória Amazônica Foundation (FVA) and the Federal Union Agroextrative Central of the Rio Unini inhabitants[25] were launched in order to sell the

[22] www.rainforestconcern.org/projects/brazil
[23] www.ekosbrasil.org
[24] www.biofilica.com.br
[25] The Agroextractive Central of the Rio Unini is the result of the effort and struggle of the residents of the Rio Unini and the FVA, since their aim consists in reconciling social development and nature conservation. The project, a pilot in the Rio Negro basin, brings back to the *riberinhos* the management of the Non-Wood Forest Production. Locals are directly benefited, because they control the entire production process of the Brazilian nut (collection, storage, processing and packaging), eliminating intermediaries, adding value to the product (drying, processing and packaging) and generating local employment and income (www.gta.org.br/newspost/castanha-do-amazonas-resex-do-unini; www.fva.org.br/).

harvested nuts in a more secure market with more fair prices, so eliminating the intermediaries (see "*regattãos*" Par. 2.2). Afterwards a consultation with a FVA expert, traditional warehouses (galpões) were built, therefore allowing a better drainage of the water of the collected and washed nuts, their drying out and stocking according to the date of collecting. The adoption of good practices of management and production aims both to get to a better final product and providing an increased yield of the can in which nuts are sold. According to the IUCN report (2009), one of the basic conditions for the success of such good practices is the existence of warehouses in the community. Research and development of new technologies will allow for the innovation in the quality and types of products that local communities produce. The training courses, given by a skilled staff, want to lead to a participative management of natural resources, to improve the knowledge about the environmental issues and to increase the technical and governance capabilities. Within the South-South cooperation principles the project tried to build a bridge of cooperation for the exchange of experiences and knowledge between Brazil and Tanzania, which both have high potential for the development and implementation of REDD+. Furthermore, the Mounts Rubeho community, in Tanzania, has already been working hard on the REDD+ subject during the last nine years. The partnership between the two countries was therefore created in order to guide the Brazil section during the REDD+-readiness activities. The involvement of local communities will only be possible through the existence of solid and active organizations, which are also necessary for organizing and strengthening the local populations.
In order to contribute to the 80% of the funding, the PATN earmarked 99300 € for this project.

2.1 General information about the project area

In the following subparagraphs a general description of the main characters of the study area will be given in order to illustrate the tangible context in which the "Getting REDDy" project is implemented.

2.1.1 Geographic localisation

The project has been implemented in the north central Amazonia, in the basin of the blackwater[26] Rio Jauaperí river (Fig. 7), a left side tributary of the Rio Negro. The Rio Negro, together with the Rio Solimões, contributes to the Amazon river's waters (EPE, 2010). The whole Rio Negro basin is one of the least studied regions of the Amazon rainforest. (Trolle M., 2003). Rio Jauaperí, in its central and lower section, marks the boundary between the states of Roraima on the West and Amazonas on the East. To be precise, the project is located within the area where the Xixuau community is settled (Annex II). This village is situated on the bank of a little lake formed by a minor narrow tributary on the Roraima side of the Rio Jauaperí river (S 0°48.023', W 61°33.476', 30 m.a.s.l.).

[26] Amazoniana rivers can be classified in terms of their water quality. Three different types can be distinguished: whitewater rivers are muddy in colour due to their high sediment content; blackwater rivers have dark transparent water because of the large amounts of dissolved humic substances; while Clearwater rivers drain areas where there is a little erosion (Saint-Paul *et al.*, 1999).

Fig. 7 Detail of the Hydrographic Map of the Roraima State.
Note: in the frame the lower and intermediate Rio Jauaperí basin is emphasized, while Xixuau location is pinpointed in the red circle (CPRM, 2002: modified by Portaccio A., 2013).

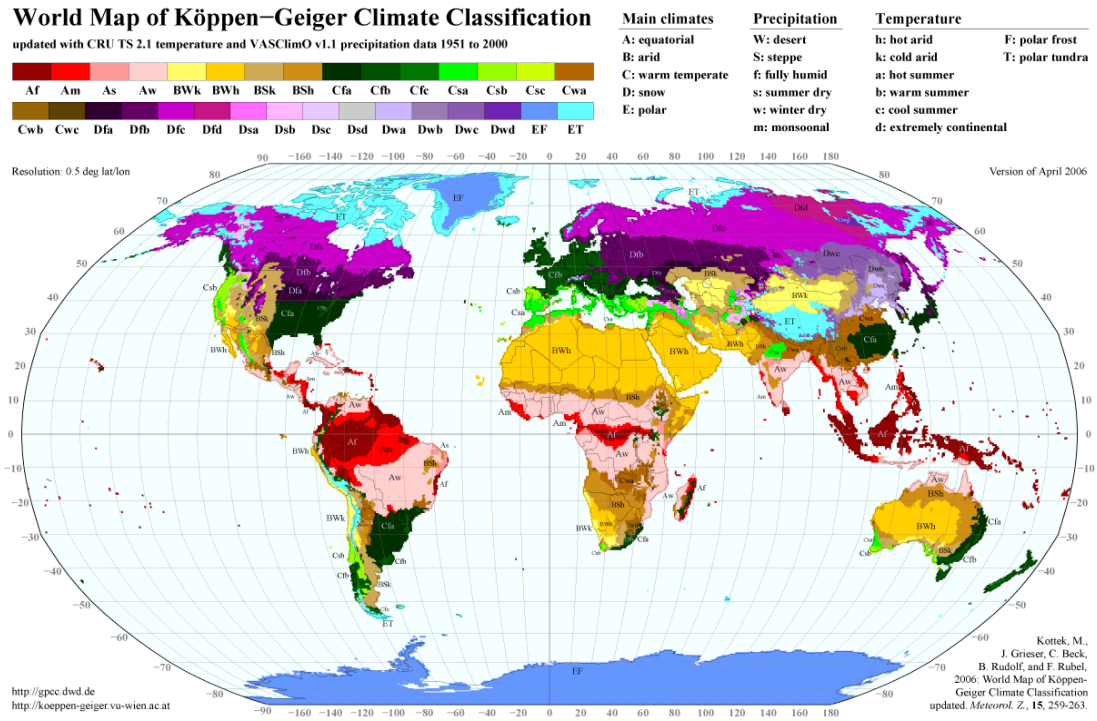

Fig. 8 World Map of Köppen-Geiger Climate classification updated with temperature and precipitation data: 1951 to 2000 (Kottek *et al.*, 2006).

2.1.2 Climate

According to the World Map of Köppen-Geiger Climate Classification, the climate of the Rio Jauaperí region is equatorial (Fig. 8). The thermal conditions of Roraima well represent the general conditions that occur in all tropical Amazon: in fact a slight variation in average temperatures is registered throughout the year, because of the intense radiation from the region near the geographic equator. According to Nimer (1979), in the southern part of Roraima, where the Rio Jauaperí is located, we can find the maximum absolute temperature of the state (38° C) and an annual thermal

range here is of 20° C (from 18° to 38° C). According to the study for the "Hydroelectric Inventory" for the basin of Rio Branco (another Rio Negro's tributary on the west side of the Rio Jauaperí), the average temperatures vary between 27.7° to 28.1° C (EPE, 2010). These values have been obtained by the two meteorological stations of Boa Vista and Cararcaraí in various periods from 1970 to 2009. Precipitations are concentrated in few months during the year (60% of annual precipitations is recorded in the period from May to August), so generating two pluviometric seasons: a dry and a rainy one. During the rainy season, the rivers' water rises of about 10-14 m and it inundates wide forest areas. The most severe months of the drought period are December and January, during which the rivers' water reaches its minimum level and rocks and riparian shores emerge. According to Nimer (1979), in the south of Roraima, in the Amazonian dense forest, total annual precipitation can pass 2000 mm.

2.1.3 Geology, geomorphology and soils

The Rio Jauaperí basin, in its lower and middle part, is developed on an area of Quaternary sedimentary rocks, recent/sub-recent alluvial soils and gneissic and granitic rocks of the Guiana's Shield (CPRM, 2002). Its surface, which constitutes the Marginal Depression of the North Amazonia, is characterised by gently wavy to hilly terrains. From a pedological point of view this zone of the Roraima state is characterised by sandy-textured *Latossolo Amarelo* (also named *Oxisol* in the USDA soil taxonomy and *Ferralsol* in the FAO one). This one is associated to the *Argissolo Amarelo* (*Acrisol* for FAO and *Ultisols* for USDA classification), which is a clay-rich soil containing often toxic amounts of aluminium. These are generally soils poor in micronutrients, with a very thin humus layer. They have a low natural fertility and they tend to loose nutrients in few crop cycles, reasons why they pose limitations to their agricultural use (CPRM, 2002; FAO *et al.*, 1998).

2.1.4 Vegetation

The study area is covered by mostly pristine rainforest (Trolle, 2003). It's dominated by Ombrophyllous Dense Forest Ecosystems, a typical formation of the Moist Tropical Forest of plains and lowlands (CPRM, 2002; IBAMA and CNPT/RR, 2006). This type of vegetation is characterized by: macro-and-mesophanerophytes (huge arboreous plants, which vary respectively between 30-50 m and 20-30 m of height), lianas and epiphytes (EPE, 2010). In the Xixuau project area and in the surroundings, we can find the following ecosystems and vegetation types:

- *Terra firme* forest: during the rainy season, the also defined dry-land forests aren't influenced by rivers. We can find them on low plateaus (60-200 m) and on well drained soils. Such lowland forest is characterized by a dense and uniform cover formed by trees of 30-40 m of height, with some few emergent trees (60 m). It creates a humid and shady habitat which hosts a high diversity of species with high density of individuals.
- Seasonal *Igapó* forest (Prance, 1979): it's a periodically inundated forest, flooded by regular annual cycles of black and clear water rivers. It's normally situated along water courses and it's composed by species that can survive underwater even for long periods (6-8 months). In order to withstand flooded conditions, trees developed some structural characteristics, such as: thick cork; waterproofing cuticle on the leaves' surface; quiescent leaves; aerial roots. The vegetation is dense but open and there are clear view and sparse undergrowth under the canopy. The biodiversity and the number of individuals are generally a little lower than those in the *Terra firme* forest.

- *Campirana (Arborizada)*: as in all this region of the Amazon basin, the forest is composed of a mosaic of different vegetation types. *Campirana* (which name means "false field") is characterized by open and spacious formations with thin trees up to 20 m high and it can be found in closed depressions, clayey and leached soils. Contrarily to the most forest formation in Amazonia, this vegetation type tends to show the dominance of one or few species. Another characteristic is the presence of a thick network of roots on the soil surface (EPE, 2010).
- *Capoeira*: it's the local term for the secondary forest at various successional stages. This forest is the result of the abandonment of a little patch of land (*Roça*), which was previously assigned to the cultivation of traditional horticultural plants for the family subsistence.
- *Lavrado*: it's comparable to a moorland environment, there are no trees here, but it's totally natural. Such vegetation type is typical of the northern part of Roraima and we cannot find it in the surroundings of our project area (Alexandre Soares Nascimento, personal communication).

2.1.5 Biodiversity

The Nature conservancy organization states that nearly one in every four plant species can be found in Brazil and the Amazon Basin, which harbours one-third of all species, is the planet's greatest reserve of life forms[27]. In just one hectare of Brazilian Amazon forest, we can find more than 300 different tree species (Campos, 2009). In general, the state of Roraima represents a meaningful biogeographical unit (Naka *et al.*, 2006). A study of the Brazilian Ministry of the Environment (MMA, 2006) states that the number of threatened plant species recorded in 2005 exclusively in the Amazon biome, were 65. Among these, in the Xixuau forest we find Brazilian-nut Tree (*Bertholletia excelsa* H.&B.) which is classified as "vulnerable"(VU[28]) in the IUCN Red List of Threatened Species from the 1998[29]. It is an important umbrella species[30] and it is characteristic of high biodiversity sites. As previously said a large part of the project area is covered by the *Terra firme* forest type: according to an environmental study done for the Jauaperí basin in 2006 (De Oliveira, 2006) the more abundant species are *piquiá* (*Caryocar vilosum*) and *angelim* (*Hymenolobium*). Among the canopy emergent species we can cite *bacaba*, *mata-matá*, *breu-vermelho, envira* (*Guatteria* spp.) and *pequiarana*. In the *Igapò* forest we can find some herbaceous species, mainly belonging to the families *Maranthaceae* e *Heliconiaceae*. Here the palm trees of the species Leopoldina pulchra (locally called jará) form little communities. The whole area is obviously rich of endemic species that produce edible fruits (i.e.: *Açai - Euterpe* spp; *Inga* spp.; *Oenocarpus bacaba*; *cupuaçu - Theobroma grandiflorum)* , oils, resins, dyes, medicinal herbs (i.e.: *lagrima*, *preciosa*,…) and which are source of precious timber essences (i.e.: *itauba - Mezilaurus itauba; araça - Terminalia januarensis; massandruba - Manilkara huberi*) and non-timber forest products (i.e.: the latex of the *seringueira*: *Hevea brasiliensis*).

[27] www.nature.org/ourinitiatives/regions/southamerica/brazil/index.htm

[28] The IUCN Red List of Threatened Species classifies the species according to the different level of endanger: CD (Conservation dependent), Data Deficient (DD), Least Concern (LC), Near Threatened (NT), Vulnerable (VU), Endangered (EN), Critically Endangered (CR), Extinct in the wild (EW).

[29] www.iucnredlist.org/details/32986/0

[30] The concept of umbrella species is that the conservation of such species confers protection to many other natural co-occurring species. For this reason umbrella species are normally used as indicators of high quality habitats and high biodiversity (Speight *et al.*, 2008)

The Amazon biome fauna include 58 of the world endangered or threatened species[31]. Going in details, the mammal fauna of the Xixuau area is typical of the Guiana subregion of the Amazon rainforest (Trolle, 2003). In the whole region have been registered more than 40 mammal species, among which the species included in the IUCN Red List are: the Bearded Saki (*Chiropotes satanas* H., 1807 – CR[22]); the Guiana Spider Monkey (*Ateles Paniscus* L., 1758 – VU[22]); the Giant Otter (*Pteronura brasiliensis* G., 1788 – EN[22]) and the Neotropical Otter (*Lontra longicaudis* O., 1818 – DD[22]); the river dolphins Boto (Inia geoffrensis B., 1817 – DD[22]) and Tucuxi (*Sotalia fluviatilis* G.&D., 1853 – DD[22]); the South American Manatee (*Trichechus inunguis* N., 1883 – VU[22]); the Jaguar (*Panthera onca* L., 1758 – NT[22]); the Giant Armadillo (*Priodontes maximus* K., 1792 – VU[22]); the Giant Anteater (*Myrmecophaga tridactyla* L., 1758 – VU[22]); the Lowland Tapir (*Tapirus terrestris* L., 1758 – VU[22]); the Bush Dog (*Speothos venaticus* L., 1842 – NT[22]). The Jauaperi basin shows a high aquatic biodiversity: the river is highly populated by fishes which are important for the subsistence of the inhabitants of the river communities. Another factor of interest is the presence of ornamental fishes, among these the Pirarucu (*Arapaima gigas* C., 1829 – DD[22]), which is one of the largest freshwater fishes in the world and it can be considered a “living fossil”, since its origins go back to 100 millions years.
During the dry season large riverside beaches appear, which are strategic for the reproduction of the local population of chelonians. Among the reptiles we can cite: the Geochelone tortoise (*Geochelone* spp.), the Big-headed Amazon River Turtle (*Peltocephalus dumerilianus* S., 1812 – VU[22]) and the Giant South America turtle (*Podocnemis expansa* S., 1812 – LC[22]), especially high demanded on the black market together with the rare Black caiman (*Melanosuchus niger* S., 1825 – CD[22]). Since the region is characterized by both flooded and non-flooded areas, the local avifauna is very rich in species (Naka *et al.*, 2006). Relevant is the presence of the Harpy Eagle (*Harpia harpyja* L., 1758 – NT[22]), the Maguari Stork (*Ciconia maguari* G., 1789 – LC[22]), the Rufous-capped Antthrush (*Formicarius colma* B., 1783 – LC[22]) and the Scarlet Macaw (*Ara macao* L., 1758 – LC[22]).
Since the project area borders on the lake along one side, the riverside ecosystem occupies the role of riparian stabilization.

2.1.6 Deforestation

The process of deforestation is becoming more and more complex as the demand of the global market adds to the local drivers of destruction. In fact, this combination of phenomenon has already led to intense deforestation in the states of south-eastern part of the Legal Amazonia (Acre, Mato Grosso, Pará and Rondonia), and in recent years the decline of forest cover and the lack of available lands have caused a trend of migration to the central-northern states, including the state of Roraima, which hosts the analyzed project. The ongoing destruction of ecosystems threatens the indigenous populations who depend directly on the forest and on the numerous vital ecosystem services. Local communities aren’t therefore a problem for the forest safeguard; on the contrary, their permanence in the area would guarantee the forest protection. The most relevant deforestation drivers are attributable to illegal, legal or fairly legal agents. In fact, in the whole Roraima territory as in the region of Rorainopolis and surroundings, deforestation has been already experienced because of the presence of timber companies and of mining firms (more or less approved by the institutions). The agriculture and cattle production expansion makes the large expanses of sparsely populated forests of the Amazon even more attractive. The

[31] www.biodiversitas.org.br/f_ameaca/

expansion of the industrial agriculture and the cattle ranches (already intense in the northern part of Roraima) is known to be strictly related to the presence of transport infrastructure. Soares-Filho *et al.* (2006) even state that the most important determinant of future patterns of deforestation in the PanAmazon[32] is the paving and construction of highways (*frontier* deforestation[33]). Two roads are located near the project area: the federal highway BR-174, which is the only road connection of the state of Roraima with the rest of the country, and the BR-431, another federal road which cross the Rorainopolis municipality's territory from Jundiá to Santa Maria do Boiaçu (only 45 km have been already paved up to nowadays, while other 80 km are planned to be built). While a third road, the BR-319, located between the Rondonia e Amazonas States, if paved, since it is connected to the BR-174, it should become the gateway for immigrants (Barni 2009; Fearnside, 2006). The already ongoing deforestation process in the Rorainpolis territory, is encouraged and facilitated by the Settlement Projects (PAs) implemented since the 1970 by the National Institute for Agrarian Reform. The land where the Xixuau village is located is considered a *terra devoluta* (Annex III), therefore it is not included in the private category, it hasn't a determined public use and its jurisdiction is contended by the Roraima state and the federal authority. This vacant land property makes more uncertain and threatened the protection of the forest, since the area may be subject to any use decided by the administrative authorities.

2.2 The Xixuau community

The project region is inhabited by the so called *Riberinhos* or *Caboclos.* The last one is an indigenous term which underlines the strong link with the forest, because *caa* means "forest" and *boc* "coming from". The Brazilian Amazon *Riberinhos* are a mixed-blood population resulting from the intermarriage of Indigenous people and Portuguese settlers and, to a lesser extent, people of African descent from north-eastern Brazil (Parker, 1989). In the whole area of the Rio Jauaperí basin there are about 600 inhabitants distributed into 8 traditional communities. The Xixuau was recognized as a community by the Rorainopolis municipality, after an inhabitants' formal request in 2004. Nowadays the village has approximately a maximum of 120 inhabitants. Most of the population is essentially young and the oldest don't pass the seventy years of age. The housing unit is composed of 5-6 people on the average, they live in the same house and they're usually linked by kinship ties. The firsts inhabitant of Xixuau village arrived more than sixty years ago (Alexandre Soares Nascimento and Francilane Silva Nascimento, personal communications), more people gradually arrived from various region of the Amazon basin (mainly from other localities of the Amazonas – as Manaus - and Roraima states). This high degree of mobility is mainly caused by the seeking for better living conditions, access to land and/or to join relatives. Often the householders move, accompanied by a part of or the whole family, for more or less short periods depending on some seasonal or temporary jobs in other community or municipalities. Since few times ago, the villagers didn't own any personal documentation, while still nowadays they don't have land titles (the Xixuau area belongs to the *terra devoluta* category, or rather a land

[32] The Pan Amazon is defined as the Amazon River watershed, the Legal Amazon in Brazil, and the Guiana region (Soares-Filho *et al.*, 2006).

[33] The frontier deforestation and/or degradation pattern can result from the expansion of roads and other infrastructure into forest lands. Roads and other infrastructure can improve forest access and lead to increased encroachment by human populations, such as subsistence farming and fuelwood gathering on previously inaccessible forest lands (VCS, 2012).

with no specify owner – Annex III). The residences (*malocas*) are stilt-houses generally made of wood, which guarantee a shelter during the river flood, except for the office and the church, which are of concrete or steel/tin plates. The roofs are made of palm thatch or asbestos panels. Houses are localised next to the river, which is the access way and source of subsistence. The trash collection entails that the organic trash is incorporated into the soil or deposited naturally in the forest; the non-organic trash is usually brought to Manaus, while the plastic is usually separated and burned. Families depend on a generator for illumination; it works from 1700 to more or less 2300 h in the night. The water is taken directly from the river, without any type of treatment needed, thanks to its pureness. The community is administrated and represented by a delegate (chosen every four years), which is responsible for the mediation between the community and public institutions. The predominant religion is the Christian Evangelical one and, as already said, there's a church in the middle of the village. A school was constructed by the State government to guarantee the elementary education (1st to 4th *série*) to the student of different levels which compose the class. Some children pursue their studies in the nearest urban centres of Novo Airão or Manaus, which are respectively 200 and 500 km far. This entails a great economic effort for the family, in fact: even if they usually rely on the hospitality of friends or relatives which live there, often children have to work after school to contribute to their support. Health care is another big issue in the *Riberinhos* villages, in fact there isn't an organized system provided by formally trained medics. Basic emergency assistance is provided by a community member which was trained in Manaus (thanks to the "Talía project" implemented by Associação Amazônia – see Par. 2.3.2) and in the village an ambulatory was constructed as a reference for the five neighbouring communities. The treatment of more serious problems requires transportation to the hospital in Manaus with *rabetas* (wooden canoes with small outboard motors) and *voadeiras* (a faster type of powerboat). The usual means of transportation around the community's territory are the normal wooden rowing canoes. The inhabitants of Xixuau carry on a combination of subsistence agriculture, gathering, hunting and fishing, and the products obtained this way are a source of food and income, when there's a surplus to sale. Agriculture is a very marginal activity, when practiced, it is addressed to the family subsistence (*Roça*, see par. 2.1.4) and it consists of the cultivation of annual horticultural plants (cassava for the *farinha* production, melon, sweet potatoes, and others) and, in an even smaller scale, banana trees. Normally, the patches of land are obtained by cutting the trees and burning what remains on the ground (Francinildo Teodorio Silva, personal communication). The provision of food and other products is periodically made in Manaus. The most important activity is the extractive one: from the forest people gather and harvest fruits, materials and animals. These activities maintain mainly a subsistence character, with the exception of the extraction and sale of the Brazilian nut, locally called *castanha* (*Bertholletia excelsa* H&B – Annex I). To sell it, the community depends on the regularity of the regional boats that travel along the river selling, buying and exchanging goods (*regattãos*). Another type of income activity is the little-scale selling of craftworks (made by women for most), such as utensils, baskets, ornaments and jewellery, which are made by raw materials taken from the forest (lianas, cork, wood, seeds). Fishing is the fundamental extractive activity: fish provides the major source of protein in the community indeed. A very important source of income is the ecotourism activity, with which locals offer expert guides, local transportation and all the hospitality services in the Xixuau

community. In October 2009 was created the Agro-extractive Mixed Cooperative of the Xixuau (CoopXixuau)[34]: an organization which is based on the responsible use of the region's natural resources and the development of low impact economic alternatives. It functions on a social enterprise model and it aims to stimulate collaboration among the inhabitants of the region. The cooperative members are exclusively the local inhabitants and they manage the activity of ecotourism, handcrafts selling and the Brazilian nut commercialization.

2.3 Promoting organizations

According to the PATN application document, the proponent NPO *Trentino Insieme* is an association already accredited in the Trento territory. As legitimized, the Trento's proponent organization avails itself of the collaboration with a local Brazilian partner, such as *Associação Amazônia* NGO. Both associations will be specifically introduced below.

2.3.1 The Trento's proponent: Trentino Insieme

Since 2004, *Trentino Insieme* (TI) operates in the international cooperation field. The association, being a non-profit organization, has carried out several projects in Brazil, Australia and Trento's territory. Its philosophy of solidarity is based on the aim of self-sustainability; otherwise its purpose is to accompany local communities in initiating projects for sustainable development. In Brazil, the association has promoted health care interventions, education and training course in favour of the local communities of Ceará. Here, TI has created a school, a library, a theatre, a computer room with 15 computer stations, a dental clinic for 2500 people and it keeps a support program for 30 children. In the Amazon, the organization works for the welfare of the local population, in order to hinder the exodus from forest areas and offer tangible income opportunities. With the support of the Autonomous Province of Trento, the association implemented the project "*Un futuro per l'Amazzonia*" which developed the Responsible Tourism activity in the community of Xixuau (Roraima). New facilities for visitors were projected and constructed thanks to the raised funds. In Australia the organization supported the indigenous peoples through the study of native languages, which risk extinction. It especially focused on the phonology of *Iwaidja* Aboriginal language and it investigated on the traditional ecological knowledge. In Trento, the association carries out educational programs about the issues of environmental conservation and the protection of indigenous peoples. Thanks to the participation to conferences and events over the years, an important partnership with the Trento Museum of Natural Sciences was made. This has facilitated the spread of biodiversity conservation and international cooperation principles.

2.3.2 The local partner: Associação Amazônia

Associação Amazônia (AA)[34] is a non-governmental organization recognized by the Federal Government of Brazil, who works for the conservation of the Amazon rainforest and the protection of local traditional cultures. AA was founded in 1992 on the initiative of the inhabitants of Rio Jauaperí and it is composed of the same locals. The organization operates at the forefront to hinder the environment threats related to deforestation and degradation, through the provision of economic alternatives for sustainable development. AA also operates scholar education and health care improvement. Following these objectives, the association collaborated to the building of the elementary school, of a computer room with satellite internet connection, of the

[34] www.amazoniabr.org

artesian wells, of the community gardens. Two little clinics were built in the São Pedro and Xixuau communities, respectively in 1995 and 2003. The NGO has installed solar energy panels and provided powered boats for river transport. Training courses were given to improve agricultural and environmental knowledge. Recently it has been given to a woman belonging to the Xixuau community the possibility to frequent the nursing studies in Manaus, in order to work as a nurse and guarantee health assistance to all the Jauaperí villages. The fight against malaria has led to a reduction of 95% of the cases. Furthermore, the association has brought new income opportunities for women and men of the Rio Jauaperí such as community-based tourism and scientific research, local crafts and forest products trade. The conservation aim is perpetrated with the voluntary control of the commercial fishing, of the illegal hunting and poaching activities and of fires. Such activities are independently managed through the recently creation of the local cooperative (CoopXixuau). Finally, AA hosts and supports the scientific research in the Xixuau-Xiparinã territory: local inhabitants are actively involved in such activities in order to integrate the traditional and scientific knowledge.

The model developed by AA has been approved by several government organizations, foundations, and national and international companies. It has the recognition of local and Federal government (City Hall Rorainopolis, Ministry of Environment, IBAMA Brazilian Institute of Environmental Administration and National Institute of Research in the Amazon - INPA). The association is also part of the Rio Negro Network, a network consisting of important local organizations including *Instituto Socioambiental* (ISA), *Conselho Nacional Seringueiros* (CNS), and WWF-Brazil, with the aim of sharing conservation strategies for the forests in the region.

3 Sources and survey methodology

The monitoring field work in Brazil was pursued in a total period of a month from November the 13th to December the 13th, 2012. To be precise, the period of stay in the Xixuau community has been a total of 24 days. Some information and data about the project activities were collected even at a later stage than the period of stay in Brazil, thanks to telecommunications or meetings in Trento.
The Trento's initiative is something pioneering and innovative at an Italian national level, and, because of these characteristics, it is still at an experimental level. As a consequence, a monitoring protocol for the elected projects wasn't established yet at the time of the inspection. Therefore, to achieve the performance measurement, a *checklist* was created (reported in Annex IV) taking inspiration from some standards of the main international certification entities[35]. This tool helped as guidance in investigating if the requirements of the public notice issued by Trento were respected and/or fulfilled.

3.1 The checklist elements

The layout of the checklist appears as a table, and it is organized in 5 sections, according to the 5 major issues stressed by the Trento's deed of 2010, which are written in block letters across the top of each section. In each section are listed the criteria (which were grouped in macro-criteria if needed) according to the points listed by the PATN. The criteria are in grey shaded rows, stretching across the first two columns of the table. Each page of the table is then divided into 4 columns:

- First column: list of the *indicators*. The performance indicators explain what the project has to achieve in order to fully meet the postulated criterion.
- Second column: list of the *verifiers*. These are simply elements of evidence that the inspector can use to ascertain if the indicators have been met. More than "verifiers" we should better speak about "ways to verify"; in fact sometimes the verifier is a real document (a photo, a written deal, a map, *etc.*). Sometimes the indicator could be verified by talking with the actors of the project and interviewing the different stakeholders or, more directly, making a field observation in the project area. The methods employed in order to make the monitoring will be illustrated in details in paragraph 3.2.
- Third column: notes and comments. In this space the inspector can write down his/her observations or questions or even some relevant information about the verifiers or how the indicator was met.
- Fourth column: the score. According to the factual observations and the inspector's professional judgement, a score will be marked for each criterion and indicator, using two different scoring systems. In the case of the indicator it will be put "Yes" if the indicator has been met, "No" if it hasn't been met and "NC" if the indicator is not congruous or not applicable to that situation. For each criterion a score between 1 and 5 will be indicated, where:
  1 = the performance on the criterion shows a poor stewardship, and it results in a fundamental failure to achieve the objective;
  2 = the most important criterion are met, but there are still some elements that should be improved. This doesn't result in fundamental failure to achieve the objective;

[35] I.e. the generic standards and check lists for forest management evaluation of minor certification bodies, approved by the Forest Stewardship Council (FSC) in countries where no FSC accredited national standard exists.

3 = the criterion is accomplished. The project shows a good stewardship of the activities, and it makes what it is expected to do;
4 = high level performance: some particular obstacles had to be overcome in order to achieve the compliance of the criterion;
5 = outstanding level in achieving the requirements through innovative or state of the art management.
The scores will be added together and averaged; a project shows a good requirement stewardship if it reaches a score of "3" on the average for every section.

3.2 Materials and methods for verifying

As already mentioned in the previous paragraph, different verifiers can be used to ascertain if the criteria are accomplished. In order to collect the needed data and the information, various tools and methodologies have been employed, which will be described in details hereinafter.

3.2.1 Social survey and interviews

To collect information from the stakeholders of the project, the main tools of the social sciences have been used, i.e. the social field surveys and the interviews. All the people met for this purpose are listed in Annex V. The two types of empirical surveys have been combined, according to the different contexts and actors. The main stakeholders involved in the Trento's initiative have been interviewed (by telephone or in person), and they are: the representative of the Administration of Trento (Scutari Marcello); some members of the organizations involved in the "Getting REDDy" project (Tosi Chiara, Evangelista Emanuela, Pizzini Rolando, Rovero Francesco); and one of the experts involved in the project training activities (Regina Marques). A representative of the Institute for Conservation and Sustainable Development of Amazonas (IDESAM) in Manaus (Soares Pedro) was also interviewed, in order to have a general view of the Brazilian context of forests, environmental policies, society and REDD+ projects. The interviews were based on a sort of questionnaire tailored each time on the information that the partner could give in order to fulfil the checklist requests.
During the stay in the Xixuau village, the information about the project were obtained following the guidelines of the social field investigation methods. This last is the technique most frequently applied in anthropology and ethnography, and its characteristic is to use talks and informal conversations as the preferential information channels. This kind of survey allows us to assemble as quickly as possible the most of actual information. On the other hand the main challenges are the understanding of which are the available resources and in which ways and within which limits we can use them (Croizier and Friedberg, 1977). It grants the primacy to the life experiences of the actors, and it wants the researcher to be involved in an *in situ* prolonged situation of interaction with the local populations (Olivier de Sardan, 1995). As Strauss (1987) said, the social field survey takes into account the context. Even if there aren't formalized procedures, we can say that, normally, the ethnographic survey is composed of two main parts: the observation and the talks (Beaud, 1996). The first one entails the so called "participatory observation" of the researcher, which becomes as witness as co-actor during the period that he stays in the reality he wants to study. The investigator is fully involved in the social relationships both verbal and non-verbal, both simple and complex. The talks, as defined by Olivier de Sardan (1995) "*discursive interactions deliberately provoked by the researcher*", want to bring the conversation closer to the means of

communication the most recognized by the local culture. The knowledge of the language is definitely an advantage, if not a basic requirement; before starting the field experience a basic study the Brazilian Portuguese was carried on, but, since this was not enough, the representative of the Italian section of the AA Chiara Tosi served as interpreter for most of the time. The conversation is based on open-ended questions, and it assumes an informal dialogic form, a bilateral speech (Olivier de Sardan, 1995). There isn't a strictly organized scheme, but the conversation subjects try to follow a general framework, a guide, which in our case was the checklist. The recorder to tape the talks was not used in order to deprive the ambiance from any official character and avoid discouraging the interlocutor spontaneity. During all the stay, a journal has been kept where all the contents of the talks were transcripted and all the interpretations, comments and new insights were noted down. Since the time spent there was not so long, the day after of the arrival a meeting with all the inhabitants was proposed, on an advice of Chiara Tosi, in order to introduce the aims of this work there. In addition to the meetings with the Xixuau inhabitants, another community belonging to the Rio Jauaperí basin has been visited, situated at approximately two hours by canoe of distance. The experiences in the Xixuau were compared to Samauma (this was the name of the neighbour village), thanks to the talks with other people and the analyzing of new features. During the stay in the Xixuau, I was invited to give a seminar about the importance of forests and their biodiversity in the climate change scenario at the elementary school. This was an opportunity to meet the children of the village and see even more closely which are the knowledge, the concepts, the culture, the perceptions and the behaviour of the local population.

3.2.2 Bibliography and documentation

The quest for information has also included a research of written sources. These entailed both a literature and documentation search. The local partner AA provided all the available official documentation, such as the official agreement about the REDD+ project among the two promoting associations (TI and AA), the deal guaranteeing the engagement of the Xixuau community in the project and the local administration (Municipality of Rorainopolis, Roraima) approval and permission for the implementation of REDD+. Furthermore, the documentation relating to the income-generating activities (projects, licenses, *etc.*) has been obtained, as well as the photos as proof of the execution of the activities set in the project idea concerted with the PATN. Other verifiers of the checklist's indicators has also been maps, satellite images, publications and official papers in the websites of the main public institutions (i.e.: Ministry of the Environment - MMA, Roraima State Government); of the national research institutes (i.e.: INPA, INPE and IPAM); of the major both Brazilian and international organizations and associations working in the environmental and sustainable development field (i.e.: CCF, CIFOR, FAS, FVA, IDESAM, ISA, Mongabay, OECD) and, finally, of the most important worldwide institutional organizations (i.e.: FAO, GCF, IUCN, UNEP, UNFCCC). Therefore, the sites of the association directly involved in the "Getting REDDy" project (AA, MTS) were also considered. The correspondences of the references and the default values used in the project have been verified and their veracity has been tested searching for pertinent scientific articles and publications. This work was done both before leaving for Brazil, during a preparedness period, and after the return in Italy. After having practically and concretely experienced the project, a more critical view on the question was achieved, so the literature research resulted to be more incisive.

3.2.3 Observations and measurements

Visiting Brazil, the village Xixuau and the communities of the Rio Jauaperí, the state and development of the "Getting REDDy" project activities and the general context in which it is implemented could be witnessed.

Furthermore, some field surveys in the forest of the project area have been made in order to verify if the default values of biomass and carbon content used in the project document for the evaluation of the baseline and project scenarios and the carbon credits computation fit the reality. In fact, since there is no forest inventory for the study area at the moment, direct dendrometric measurements were carried on in the forest. Trees only were considered as carbon pool. For practical purposes, tree biomass (expressed in Kg of dry matter) is often estimated from equations that relate biomass to the value of the diameter at breast height (DBH). Although the combination of DBH and height is often superior to DBH alone, measuring tree height can be time-consuming and will increase the expense of any monitoring program. Furthermore, databases of trees from around the world show that highly significant biomass regression equations can be developed with very high accuracy using just DBH (Pearson *et al.*, 2005). The reference equation is the updated one from Brown (1997), sourced in several primers for biomass/carbon content estimation (i.e. IPCC, 2003; Pearson *et al.*, 2005). Such an allometric equation (Eq. 1) was tailored expressly for moist tropical hardwoods forests[36], and it is applicable to trees having a DBH included between 5 and 148 cm.

$$Y = \exp[-2.289 + 2.649 \bullet \ln(DBH) - 0.021 \bullet (\ln(DBH))^2]$$

Eq. 1 Allometric equation for estimating aboveground biomass of tropical moist hardwood forests

Where: Y= aboveground dry matter [kg (tree)$^{-1}$]
DBH = diameter at breast height [cm]

In total three field excursions were made, always with the accompaniment of a local guide provided by the CoopXixuau. The first time a preliminary survey was mainly made, in order to take cognizance of the general situation and better plan the further measurement interventions. Efficient planning for fieldwork is essential to reduce unnecessary labour costs, avoid safety risks and ensure reliable carbon estimates (Pearson *et al.*, 2005). The applicants, during the delineation of the project boundaries, derived some GPS points indicating some *Bertholletia excelsa* trees along a sort of path which is normally used for the ecotourists' excursions, as well as by the inhabitants to go into the forest during the harvest season of nuts. A more or less detailed satellite map (Annex VI) with the GPS points was used to determine *a priori* how to proceed for the measuring, always following the advice of the local guides and of Chiara Tosi. According to the cooperative rules, the excursion in the forest didn't last more than half a day and, as the guides suggested, both the measuring sessions were done in the morning time in order to avoid being in the forest during the hotter or the darker hours of the day. The field crew was composed of me, as visiting inspector, Chiara Tosi, for the biophysical measurements, and a local guide who also helped as tree identifier (alternating Raimundo Alves Barroso and Francisco Alves dos Santos Nascimento). The field equipment consisted of a metric measuring tape of 20 m (for determining plot boundaries), a tissue metric measuring tape of 1 m (for measuring trees' DBH) and an aluminium one of 5 m (for measuring the smaller plot square); a digital camera; a machete-bush knife; a pen or a pencil (this last is better because it writes even on very humid/wet paper); a

[36] Tropical moist generally represent areas with rainfall of between 2000 to 4000 mm/year in the lowlands (Brown, 1997)

supporting board/writing tablet; some white flagging ribbons (for marking plot boundaries); and some sheets with the sampling plot data collection form.
For the sampling procedure the guidelines of the main handbooks available in the actual literature were followed (IPCC, 2003; Pearson *et al.*, 2005; USAID-CIFOR-ICRAF, 2009; Verplanke and Zahabu, 2009). To avoid any subjective choice of plot locations and since the project area is similar to a square of approximately 1.9 km for each side (Annex VI), the plots were carried out in a systematic manner along the already mentioned trail that passes through the area almost diagonally. In the bargain, this path crosses both the main vegetation types of the area, or the *Igapó* and the *Terra firme* forests (Par. 2.1.4.). Although it is not precisely defined, it seems that *Igapó* occupies a smaller area within the boundary of the project than the *Terra firme* forest. This was taken into account in the distribution of plots. Since the size and shape of the sample plots are a trade-off between accuracy, precision, time and cost, for our measurement we performed nested plots containing smaller sub-units of various shapes and sizes, which represent the most cost-efficient method. Nested plots are a practical design for sampling for recording discrete size classes of stems. They are well-suited to stands with a wide range of tree diameters or to stands with changing diameters and stem densities. Nested plots are composed of several full plots (typically two to four, depending upon forest structure), each of which should be viewed as separated. They could have a circular or rectangular shape. When trees attain the minimum size (measured by DBH) for a nested plot, they are measured and included. When they exceed the maximum DBH size, measurement of the tree in that nest stops and begins in the next larger nest. The appropriate plot size for this specific project was not measured, because this would have unnecessarily complicated the process. The plots had a square shape; they were composed of three nested squares. As illustrated in Fig. 9, in the inner square (having dimensions equal to 5x5m) were measured all the plants between 30 to 150 cm in height. This part of the procedure would have been useful to assess the state of the regeneration, but it hasn't been considered in the calculations. In the intermediate square (10x10m) and the outer one (15x15m), trees having DBH respectively ranging from 5 to 50 cm and from 50 to 148 cm have been measured. Such dimensions were chosen according to the allometric equation of reference.

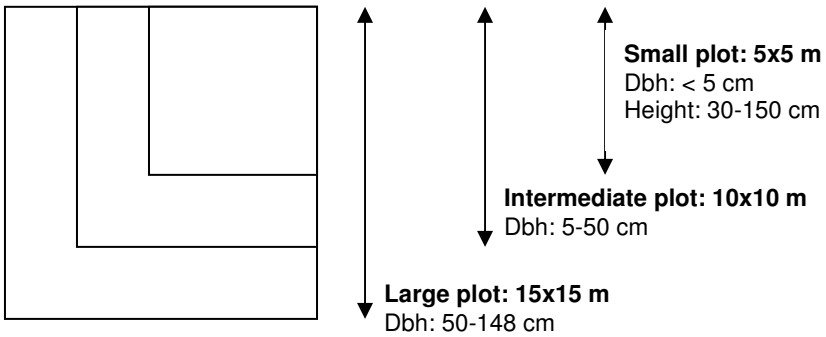

Fig. 9 Schematic representation of the stratified plots used for the dendrometric measurements in the forest project area.

We made 12 plots in total: the first 3 were carried out in the *Igapó* area, the others in the *Terra firme* one. As the plots had a general area of 225 m^2 each one, a surface of 1.5 ha has been sampled on the whole. The starting plot was located after 50 m of the boundary of the project area forest, and then the trail has been walked through for almost 2 km. Samples were separated by a distance of 200 m and located alternatively on the right and the left side of the trail.

Since a calliper wasn't available, a metric tape was used to measure the circumferences of all the present arboreous species of at least 1.30 m in height, noting down all the vernacular names suggested by the guide. The standing dead trees were measured too, but they were not taken into account for biomass computation. Epiphytes and lianas have been directly ignored.
In another location, all the data were reported in an Excel spreadsheet, the DBH has been derived and, using the allometric equation, the biomass for each tree has been calculated (in kg and in t of dry matter). This last was converted into carbon content (tC) using the conversion factor 0.47 (average carbon fraction of aboveground tropical and subtropical forests' biomass indicated in the IPCC tabs – 2006). Summing all the values, the mass of carbon stocked in each plot could be obtained. The analyses at the plot level were then extrapolated to the area of a full hectare to produce carbon stock estimates in tC/ha (calculating the proportion of a given plot within a hectare). With the 12 obtained values, the mean carbon stock value for the project area and the standard deviation of our sampling have been computed.
Of course, this work can't be considered an exhaustive compilation of the real carbon content for the project area. Nevertheless, those obtained with the previously described sampling activity could be useful as preliminary data for calculating the sample plot size for a complete and representative forest sampling. As a consequence, making the appropriate statistics, the required number of plots has been computed. The Equation 2 was applied, making two distinct considerations: uniform forest or stratified forest according to the two major vegetation types encountered (*Igapó* and *Terra firme*).

$$n = \frac{\left(\sum_{h=1}^{L} N_h * s_h\right)^2}{\left(N * \frac{E}{t}\right)^2 + \left(\sum_{h=1}^{L} N_h * s_h{}^2\right)}$$

Eq. 2 Number of plots (n) needed for L forest strata, with L ranging from 1 to several.

Where:
E = allowable error or the desired half-width of the confidence interval. Calculated by multiplying the mean carbon stock by the desired precision (that is, mean carbon stock x 0.1, for 10% precision, or 0.2 for 20% precision);
t = the sample statistic from the t-distribution for the 95% confidence level. t is usually set at 2 as sample size is unknown at this stage;
N_h = number of sampling units for stratum h;
h = area of stratum in ha or area of the plot in ha;
n = number of sampling units in the population;
s_h = standard deviation of stratum h.
In the second option I considered two cases: since we don't know the real extension of both the forest types in proportion to the whole project area, but we know that *Terra firme* occupies a wider area, I assumed that *Igapó* covers respectively ⅓ and $^1/_4$ of the total project forest.
The results will be given in the following "Results and discussion" chapter (Chap. 4).

3.2.4 Baseline/project scenarios and carbon credits estimation

Possibly, the most critical element of a REDD+ regime is how to set the baseline; the baseline is in fact the benchmark to judge the performance expected from a project (Angelsen, 2008b). The baseline gives the business as usual (BAU) scenario and therefore it has to include many elements, some of which are ultimately political

questions. The main issues that we have to face during the baseline determination are the prediction of the deforestation rate without REDD and which variables should be considered (Angelsen, 2008b). According to the current literature about REDD+, in order to make a quantitative projection of future deforestation (for the 20 years after the project implementation), the average deforestation rate for the area (percentage of the deforested area on previously forested land) was assessed as first. According to what the VCS AFOLU Requirements document (VCS, 2012) states: "*where the agent of deforestation is not the landowner and cannot be specifically identified, the criteria and procedures for identifying the baseline scenarios may be determined based on the most-likely-class of deforestation agents and the intent to deforest. This may be demonstrated through a historical analysis of similar deforestation within the region by the identified most-likely class of deforestation agents. […] The annual rate of forest conversion shall be based on the recent historical practice of the most-likely class and projection of the rate of their deforestation activities in the area".* All the websites and publications of the most reliable institutions and organisations were surveyed, and the data about deforestation for the Roraima State, the Rorainopolis municipality and the Legal Amazon region in general were collected. This way, several baseline scenarios could be defined, according to the different consulted sources.
The information was mainly collected from the databases of the INPE, the Brazilian National Institute for the Space Research, which carries out several projects. Thanks to the PRODES project, since 1988 the INPE has been monitoring the state of the Brazilian Amazon Forest by the satellite images. With DETER project, which is a quick survey done monthly by the INPE since May 2004, thanks to the data collected by the *Terra/Aqua* satellite and the WFI sensor of the CBERS satellite (having a spatial resolution of 250 m), it is possible to have an early warning system to support surveillance and control deforestation. For this reason DETER maps both shallow cut as areas undergoing deforestation by forest degradation. In fact, from DETER, the INPE developed the DEGRAD system, which gives indications about the growth of Amazon forest degradation. In order to express all the considerations about the forest baseline conditions, these three systems has been monitored. In particular, on the INPE website, the PRODES data about the forest cover surface and the extension of the annual deforestation from 2000 (Fig. 10) are available for both single States and single municipalities of the Legal Amazonia region. The annual rate of deforestation was computed doing the ratio between the deforested surface of the year and the forested land surface of the previous year, for the ten-years period antecedent the "Getting REDDy" project implementation; the trend has been observed, and the average was made.

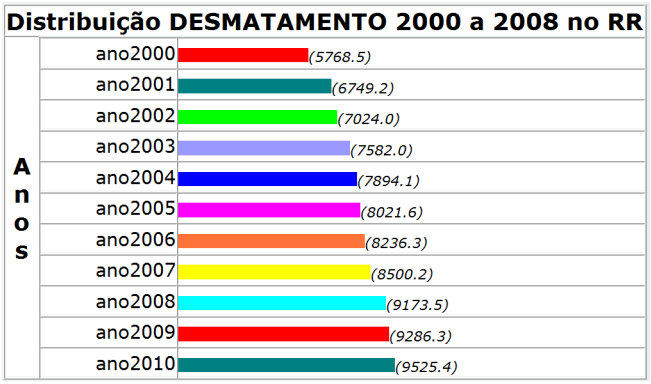

Fig. 10 Annual deforestation extension for the period from 2000 to 2010: example of the graphics outlined by the INPE-PRODES database (www.dpi.inpe.br/prodesdigital/prodesmunicipal.php)

The SimAmazonia I deforestation forecasting model was also examined (Soares-Filho *et al.*, 2006), since it is considered by many experts one of the most refined deforestation simulation models for the Amazon region (IDESAM *et al.*, 2008). This model divided the Legal Amazon region in several subregions (Fig. 11) which are defined from a socioeconomic stratification combined with GIS raster cells. For each of such subregions the potential deforestation was measured mainly focusing on the effect of road-paving on future trajectories of land-use change. For each subregion was reported the value used as input data of the net deforestation occurred in 2001[37] (the southern part of the Roraima State belongs to the subregion number 7 of the SimAmazonia I model). The BAU model of Soares-Filho *et al.* estimates the deforestation trend until 2050, when a wide area of the Amazon biome, included our project area, would totally loose its forests (Fig. 12). Since the deforestation will be equal to 100% in 2050, we could get to the annual deforestation rate dividing this percentage for the 50 years of the modelled period.

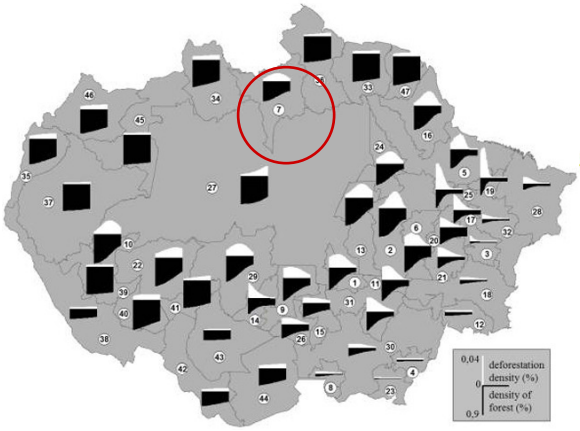

Fig. 11 SimAmazonia I subregions for the Legal Amazonia (www.csr.ufmg.br/simamazonia/)

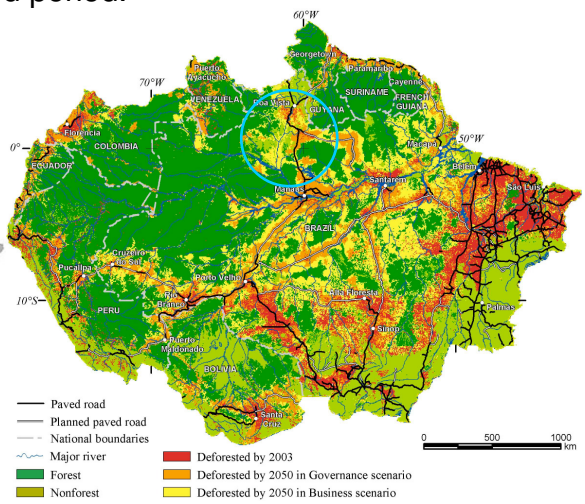

Fig. 12 SimAmazonia I future deforestation scenario for the Legal Amazonia (www.csr.ufmg.br/simamazonia/)

The values of deforestation suggested by the last FAO report on rainforests' state (FAO, 2011) were also considered. Unfortunately, it provides the values for the entire Amazon Basin or for the whole Brazil, but it has been anyway useful to assess the historical deforestation rate for the project area.

In the digital library of the National Research Institute of Amazonia (INPA) a technical report (Barbosa *et al.,* 2008) and a Master thesis (Barni, 2009) stressing the deforestation in Roraima were found. The first one deals with the deforestation historical data for the period from 1978 to 2006, detailing for municipalities and protected/indigenous areas. The second one, on the other hand, gives a shortlist of the future deforestation scenarios and the consequent evolution of the southern region of the Roraima State. It bases mainly on the assumption of the paving of highway BR-319 (Porto Velho-Manaus) which is connected to the BR-174, and will therefore open the access starting from the deforestation arc of the central Legal Amazon to huge areas of continuous pristine rainforest. The Barni's assumptions base on the socio-economic processes already experienced with the implementation of the Settlement Projects (PAs) by the National Institute for Agrarian Reform (INCRA) along the BR-174 and BR-431[38].

[37] www.csr.ufmg.br/simamazonia/

[38] Currently, within the two southern municipalities of Rorainopolis and Caracaraí, there are 32 PAs, most of which are in the earlier phases of creation/installation (INCRA, 2011). Agricultural colonization

According to the methodology for estimating reductions of GHG emissions from frontier deforestation[39] three approaches are available determining the future deforestation for the project area (Pedroni, 2012):

1. historical average approach: the regional rate of the baseline deforestation is assumed to be a continuation of the average annual rate measured during the historical reference period;
2. time function approach: the rate of baseline deforestation is estimated by extrapolating the historical trend observed within the reference region (or its strata) as a function of time using either linear regression, logistic regression or any other statistically sound regression technique. This approach requires multiple deforestation measurements throughout the past 10-15 years;
3. modelling approach: the rate of the baseline deforestation will be estimated using a model that expresses deforestation as a function of driver variables selected by the project proponents.

To select the most appropriate baseline approach, the criteria described by Pedroni (2012) were followed. When the historical deforestation rates showed a slight decreasing trend, both the hypothesis that emerged or did not emerged conclusive evidence from the analysis of agents and drivers explaining the decreasing trend were considered. In the first case it was supposed that the decreasing trend will change in the future due to predictable changes at the level of agents and drivers. Therefore, the third approach to draw the baseline was used, while in the second case, considering that no conclusive evidence emerged, the historical average approach method was applied. In the case of a constant trend of past deforestation, it was considered that the forest loss agents and drivers adequately explained such rates behaviour. Therefore, it was supposed that the constant trend was likely to continue in the future (first approach) or that it would change in the future due to predictable changes at the level of agents and drivers (third approach).

The SimAmazonia I scenario represented a special case, as it was already a future projection of the deforestation process. The average annual deforestation rate was thus extrapolated and applied to the project area.

The methodologies were applied with the necessary simplifications, since we were assessing a very small-scale project.

The atomic mass of carbon is 12, while that of CO_2 is 44. Therefore to convert from tons of carbon in tons of CO_2 we must multiply by 44 and divide by 12. In short 1 tons of carbon is equivalent to 3.67 tons of CO_2.

All the data and the baselines outlined will be reported in the next “Results and discussion” chapter (Par. 4, points 2.6. and 4.1).

For the estimation of the potential increase in GHG emissions and the consequent decrease in carbon stock due to leakage, a simply field observation was considered exhaustive.

All the project activities have been revised, and the eventual related emissions have been estimated. To compute the emissions of the aeroplane travel of the trainers or during the Tanzania-Brazil exchange, one of the CO_2 emissions calculators available

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through the establishment of planned land settlement projects is one of the principal methods chosen by the government of Brazil for carrying out the national program of land redistribution and agrarian reform (Darnel, 1973).

[39] Frontier deforestation is where humans and their infrastructure are encroaching into areas with relatively little pre-existing human activity. It is often linked to infrastructure development and it happens where poor legislation enforcement, prices for agricultural commodities, speculation for land titling and other drivers provide incentives to farmers and ranchers to clear the forest as it becomes more accessible (VCS, 2008).

in the internet[40] was used. This tool applies the Radiation Force Index (RFI), a multiplier equal to 2 for all the calculations about aviation. The RFI is a multiplier that allows considering the environmental effects of all the emissions of a plane flying at high altitude. These effects go beyond those concerning only the CO_2 emitted by the combustion of fossil fuels. The high altitude emissions of NOx (nitrogen oxide) have an climatic impact similar in size to CO_2 emissions. The IPCC evaluated the RFI for aviation in 1992 amounted to 2.7, within a range from 1.9 to 4.0. The RFI for 2000 was estimated to be approximately 2 (Sausen *et al.*, 2005).
Since the "Getting REDDy" project planned the protection of the forest, in the project scenario it was considered that, in the 20-years project period, the forest area will be kept constantly as at the beginnings. The project avoided emissions will result from the difference between the project scenario and the baseline deforestation scenario, discounted by the leakage and the project emissions.
According to the international convention, one carbon credit corresponds to one avoided tonne of CO_2. Therefore the variation of carbon stock obtained with the project implementation was converted in tonnes of CO_2 in order to directly obtain the credits' output.

[40] www.co2balance.it/co2calculators/

4 Results and discussion

All the results obtained by the monitoring activity, will be presented in this chapter. Following the structure of the checklist, and therefore following the points of the PATN call 2010, it will be evaluated if the indicators of each criterion have been met, justifying the statements with the used verifiers. At the end of each section, the results obtained will be discussed and evaluated.

4.1 REDD+ project's basic principles

In order to align as much as possible to the international standards of REDD+, the PATN required the projects to satisfy the principles of eligibility and additionality as first.

4.1A Principle of Eligibility

1a.1 ABSENCE OF CURRENT OR RECENT DEFORESTATION - According to the INPE satellite images catalogue[41], which shows a dense forest cover since 2006, the project area didn't wasn't deforested in the last 10 years. During the field survey it was noticeable that a restricted part of the forest, which is closer to the settlement, seems to host younger vegetation, with thin stem trees forming a high density forest. The Xixuau inhabitants confirmed that in the past, more than 10 years ago, there was a *roça* (see Par. 2.1.4), which is the result of slash and burn activities, where they cultivated bananas, coffee trees, and other agricultural species. This was then spontaneously abandoned, and forest regained ground very quickly (*capoeira* – see Par. 2.1.4).

1a.2 THE FARMING AREAS COULD BE THE 5% OF THE TOTAL PROJECT AREA – Within the project boundaries no areas were designated for agriculture. The only agricultural patches (*roças*) that can be found are very little[42], and normally located near the houses of the cultivator. At the moment of the survey, there were just one or two little *roças* placed just behind the house of their owners.

1a.3 NO WETLANDS OR PROTECTED AREAS ARE CONCERNED – The project area is not a wetland and, for example, in the land cover map of the CPRM (2002), that of Rosa-Freitas *et al.* (2007) and the IBGE[43] one, the vegetation of the project area is classified as Lowland Ombrophyllous Dense Forest. According to the IUCN-WCMC protected areas inventory[44], in Roraima just two protected area exist, which do not concern our project area. In the map of Greenpeace 2007[45] about deforestation and protected areas in the Legal Amazonia, the project area is included in the Federal lands. The CPRM economic-ecologic zoning report for the Roraima state (CPRM, 2002) states that the portion of the Rio Jauaperí basin where the project is settled, belongs to the Federal *terras devolutas*, characterized by forestry, agriculture, and other activities. According to the forest engineer De Oliveira (2006), the basins of Rio Branco and Rio Jauaperí are the missing tiles to complete the mosaic of protected areas.

1a.4 VULNERABILITY OF THE AREA – Since the project area belongs to the *terras devolutas* (CPRM, 2002), there are no guarantees for protection from deforestation,

[41] www.dgi.inpe.br/CDSR/
[42] The *roças* found in Xixuau have approximately the dimensions of a vegetable garden of ours, while they could normally be comparable to the little cultivated fields of ours.
[43] www.mapas.ibge.gov.br/tematicos/vegetacao
[44] www.protectedplanet.net/search?q=roraima brazil&commit=Search
[45] www.greenpeace.org/brasil/pt/

and the SimAmazonia I future deforestation model (Soares-Filho *et al.*, 2006) shows that the region will be heavily affected by deforestation in a BAU scenario.

1a.5 RESPECT OF THE KP FOREST DEFINITION - The project forest, being in the Amazon Rainforest, widely responds to the criteria for the definition of a forest of the KP[46].

1a.6 NO INFRINGEMENT OF A PRIVATE/COMMUNITY/TRADITIONAL PROPERTY – Since the project area belongs to the *terras devolutas* (CPRM, 2002), there are no land titles and the project does not infringe any private/community property. The project boundaries are situated in the *castanhal* (patch of land where the Brazilian nut trees are exploited) of Mr. Carlos Roberto Nascimento (Carlito). Of course, he is not the official but the traditional owner (recognized by the whole Xixuau community), because he was one of the first using it. The *castanhal* is totally free access, and all the other inhabitants can go there and harvest Brazilian nuts (previously communicating their harvesting intentions to Mr. Nascimento). Mr. Carlos Roberto Nascimento in person assured that he had allowed the REDD+ activity in "his" traditional *castanhal* and he gave his verbal permission.

1a.7 ABSENCE OF OTHER BENEFICIARIES OF THE CARBON CREDITS – The only beneficiaries of the carbon credits should be the Xixuau inhabitants, or rather the direct providers of carbon reduction and stock. This is a tough issue, since, as already said, they don't have the official property of the land (*terra devoluta*). This could lead to eventual problems in the future, if the competent jurisdiction will claim the land tenure and therefore the output credits and, as discussed with the IDESAM responsible, this is a common problem for the REDD+ project, mainly in Brazil. The PATN results to be the only purchaser of the credits and it do not exercise any rights on any other type of product/outcome resulting from the project activities. The same can be affirmed with regard to the promoting associations.

1a.8 NO TRANFER OF RESIDENCES HAS TO BE CAUSED – An aerial photo taken in 2002 by Erik Falk (Annex II) let verify that that the village did not change its settlement because of the project. The community asserted that no variations of residence were caused, and the forest does not show signs of a recent previous presence of houses.

1a.9 AUTHORITIES' AUTHORIZATION –There is a copy of the agreement of October, the 19th, 2010, between the Xixuau community and the promoting associations AA and TI, signed by the vice community president of that moment Justinho Filho de Souza. In such paper the community states its acceptance, permission, and its willingness to participate to the "Getting REDDy" project. The community president at the moment of the visit, Elton Leite de Encarnação, asserted that the engagement of the community is voluntary and it did not created disputes or conflicts. It was also verified that the project has been approved by the local authority; which is proved by a document of October the 20th, 2010, reporting the recognition and authorization of the project, signed by the Rorainopolis mayor in charge at that time (Carlos James Barros da Silva). The construction of the depositories for the collected nuts (*galapãos*) was authorized by the Municipal Secretary of Environment, Science, Technology, Tourism, and Sustainable Development of Rorainopolis of the time (Luciano Medeiros Noronha), with the signature of a written licence on November the 10th, 2011, which will be valid for 10 years.

[46] FCCC/CP/2001/13/Add.1/Decision11/CP7 (UNFCCC, 2001)

4.1B Principle of Additionality

1b.1 THE PROJECT ACTIVITIES ARE NOT ALREADY MANDATORY IN THE AREA OF IMPLEMENTATION – In February 2011 the congresswoman Rebecca Garcia presented the draft bill PL 195/11[47] (previously defined as PL 5586/2009) which aims to the creation of a national REDD+ system (MMA, 2012). Such a bill is still a proposition subject to conclusive considerations by the Commissions[48]. In the last years Brazil has decided to prepare a national program with guidelines, targets, and actions to address climate change. Formulated by a committee created specifically for this purpose, the National Plan on Climate Change (PNMC) summarizes the mitigation, adaptation, research, development, education, training, and communication measures, as well as the implementation tools required to address the issue at the national level (MMA, 2009). In any case, there are no obligations in force in the region of the project concerning the activities proposed by the project.

1b.2 FINANCIAL ADDITIONALITY – The "Getting REDDy" project is the first of its kind in the project area. Normally, the AA proceeds with its project just with donations or external funding. According to the UNDP Human Development Report 2013 (UNDP, 2013), the Inequality-adjusted Human Development Indicator for Brazil is equal to 0.531[49]. Moreover, according to Cenamo and his colleagues (2010), projects like the Xixuau's ones, which are located in remote regions with difficult access, low governmental presence, high future deforestation pressure and existing communities, the implementation costs will be quite high. The project, in fact, will have high logistical costs, large investments to structure activities monitor and control illegal activities, long term activities related to social and economic development of the existing communities, among others. Since AA is a NGO, TI has the simply character of a local private association and the Xixuau population economic organization is managed by the cooperative CoopXixuau, there would not have been enough money to implement the project without the financing of the PATN.

1b.3.1 ECONOMICAL BARRIERS – The Xixuau inhabitants, as most part of the *riberinhos* in Brazil, live mainly of agriculture of subsistence (at house scale) and of extractive activities. The most important economic activities are ecotourism, which is managed by the social cooperative of the village, and the sell of Brazilian nuts, which depend on the regularity of the regional boats of the *regattãos* (see Par. 2.2). The Brazilian nut prices are very instable, and they depend on the harvesting season and on the state of the nuts. Furthermore, since the *regattãos* function as intermediary between the collectors and the market, the price paid to the *riberinhos* is very low. The market seems to be not convenient, and the economic organization is therefore

[47] - 2011. Draft Bill 02.08.2011 n. 195. Institui o sistema nacional de redução de emissões por desmatamento e degradação, conservação, manejo florestal sustentável, manutenção e aumento dos estoques de carbono florestal (REDD+), e dá outras providências. Chamber of Deputies. www.camara.gov.br/proposicoesWeb/fichadetramitacao?idProposicao=491311

[48] - 2013. Update order of the draft bill n. 195/2011. 03.15.2013. The CINDRA, CAPADR, CMADS, CFT (mérito e art. 54, RICD) e CCJC (art. 54, RICD) – Proposição sujeita à apreciação conclusiva pelas Comissões – art. 24, II, RICD. Ordinary transmission order. www.camara.gov.br/proposicoesWeb/prop_mostrarintegra?codteor=1066022&filename=Tramitacao-PL+195/2011

[49] The Human Development Index (HDI) is a composite measure of health, education and income that was introduced in the first Human Development Report in 1990 as an alternative to purely economic assessments of national progress. It soon became the most widely accepted and cited measure of its kind, and has been adapted for national use by many countries. In the 2010 Report was introduced the Inequality-adjusted HDI (IHDI), a measure of the level of human development of people in a society that accounts for inequality in the distribution of human development across the population at the country level (www.hdr.undp.org/en/statistics/hdi/).

weak. According to Saunderlin *et al.* (2007) Brazil, and even more the remote, western half of the country, presents a strong association between the area of high forest and high poverty rate. These matters suggest that Xixuau local population would not have had enough economic means to autonomously implement the project.

1b.3.2 TECHNOLOGICAL BARRIERS – Before the project implementation, each family collected and individually conserved in a sack the harvested nuts; a place as a warehouse was missing to stock and protect the nuts from humidity/fungi. The means for the goods transportation were the canoes or *rabetas*, normally used for everyday life. All these matters suggest that Xixuau local population would not have had enough technological means to autonomously implement the project.

1b.3.3 PROFESSIONAL BARRIERS – Even if the Xixuau community and the *riberinhos* in general have a deep and wide knowledge of the forest and of all the related activities (which is remarkable also in the children and in the other communities); they still needed advanced practices and more technical and scientific notions.

1b.3.4 INSTITUTIONAL BARRIERS– At such small scale, there are no institutional guidelines or incentives for implementing similar projects. Moreover, the state of Roraima is one of the Brazilian Amazonia States which are not involved in the REDD+ initiatives and strategies. The Xixuau inhabitants fought a long time in order to obtain any sort of protection and conservation of their area, but the State, as well as the Federal Government, never granted anything beyond a “maybe” as an answer. Furthermore, the federal government has not created a law specifically directed to NWFP management (Pinto *et al.*, 2010). All these matters suggest that Xixuau local population would not have had enough institutional and legal means to autonomously implement the project.

1b.4.1 DEFORESTATION DRIVING FORCES – Because of the impoverishment already intensely occurred in other Legal Amazonia States, in the last years a trend of migration towards the State of Roraima has been occurring, mainly after the implementation of the PAs by the INCRA (Barni, 2009). This should lead to the development of infrastructures and economic activities of different types within the territory of the State. The main driving force of deforestation in the area is the presence of the federal highways BR-174 and BR-431, the imminent paving of the BR-319 and the land-use changes that follow (Barni, 2009; Soares-Filho *et al.*, 2006). Because of this, the model SimAmazonia I (already shown in Fig. 12) forecasts a total deforestation of the area up to 2050. According to the statistics of the project PRODES (INPE) Rorainópolis is the third municipality more deforested of the entire Roraima. Note, furthermore, that the first two provinces (Mucajaí and Cantá) are located very close to the capital of Boa Vista, while Rorainópolis is far to the south and is much more forested, which aggravates the data value. The map provided by DETER system (Fig. 13) in September 2010 (or rather when the project "Getting REDDy” was in progress) highlights a deforestation risk point close to the project site. The system DEGRAD instead, ranks Roraima among the States with less degraded surface of the Legal Amazon. Anyway, it is important to say that the variable compared was the quantity of degraded surface in km^2 but not proportioned to the entire state extension;

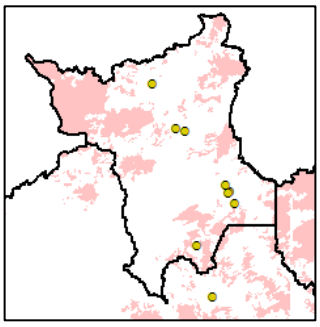

Fig. 13 DETER Roraima map with the deforestation alert points (yellow) and the clouds (pink spots) detected by the satellite on September 2010. (www.obt.inpe.br/deter/images/Deter/deter_201009.gif, modified by Portaccio A.)

Roraima is therefore compared to States such as Amazonas and Parà or Mato Grosso which are bigger. The fact that the Xixuau project area belongs to the federal *terras devolutas* shows that the land tenure is uncertain and forest protection is not assured.
Some villagers have expressed the concern that the State government has never wanted to give the status of "conservation area" or "extractive reserve[50]" to the Xixuau and surroundings, because it is a point of interest for the exploitation of timber and mining (as has already happened in the community of Santa Maria do Boiaçu in which a forestry company was illegally launched and closed by IBAMA during the firsts months of 2012 – Aluísio Barroso Nascimento, personal communication). According to the Study for the Hydroelectric Inventory for the Rio Branco basin (EPE, 2010), the area close to the Rio Jauaperí has already been exploited by mining firms searching for gold, diamonds, and, more recently, materials for the construction industry. Anyhow, even though all these just mentioned are important deforestation factors, there is not evidence of actual deforestation within the project boundaries. The local population does not affect forest at all (see "leakage", Par. 3.4). Each family can cut approximately 3 trees a year for construction of pile-dwelling houses or canoes. They usually pick them up in different sites in order to not affect too much the forest (Raimundo Mendonça Horta personal communication). The firewood (which is anyway a negligible amount) is carried out only on dead wood collected in forest.
Deforestation and forest degradation are serious risks, but until they will depend on aleatory and vague variables, we do not have enough elements to speak about inescapable and relentless deforestation.

1b.4.2 PROXIMITY TO DEFORESTED AREAS – The study by Soares-Filho *et al.* (2006) states that the risk of deforestation is proportional to the proximity to infrastructures. As visible from Figure 14, the road BR-431 should connect to the city of Santa Maria do Boiaçu (red marker on the Rio Branco), passing this way relatively close to the village Xixuau (blue marker). The Xixuau village is approximately 40 km far from Santa Maria do Boiaçu and the same distance will occur between Xixuau and the closer part of the BR-431 road. The locals' opinion is that a timber enterprise would not ever install in the middle of the forest before the building of a road which opens the new frontier. Anyway, the BR-431 paving was interrupted and its continuation is uncertain, but it seems that some people already settled along the road, and expanded the road impact (Francilane Silva Nascimento, personal communication) which is a result of the PAs implemented in 1995-1997 (Barni, 2009). Moreover the Radambrasil inventory estimated a very high biomass density in the South of Roraima, and, if it becomes easily accessible, it would be a good attraction for timber industries. In addition, the land would be available at much more affordable prices than that of the central Amazonia (Barni, 2009).

1b.5 ABSENCE OF PERMANENTLY DEFORESTED AREAS – No permanently deforested areas were found within project boundaries.

[50] *Extraction* is the activity of gathering nature's products, including hunting, plants and minerals. This is the oldest human activity, predating agriculture, breeding, and industry. From the definition of "extraction", during the 90s, thanks to the struggles of Chico Mendes, was coined the term *Extractive Reserve*, which is a place reserved for its residents, in order that they continue practicing extraction through management techniques and rules defined in a collective way (APIZ, 2008).

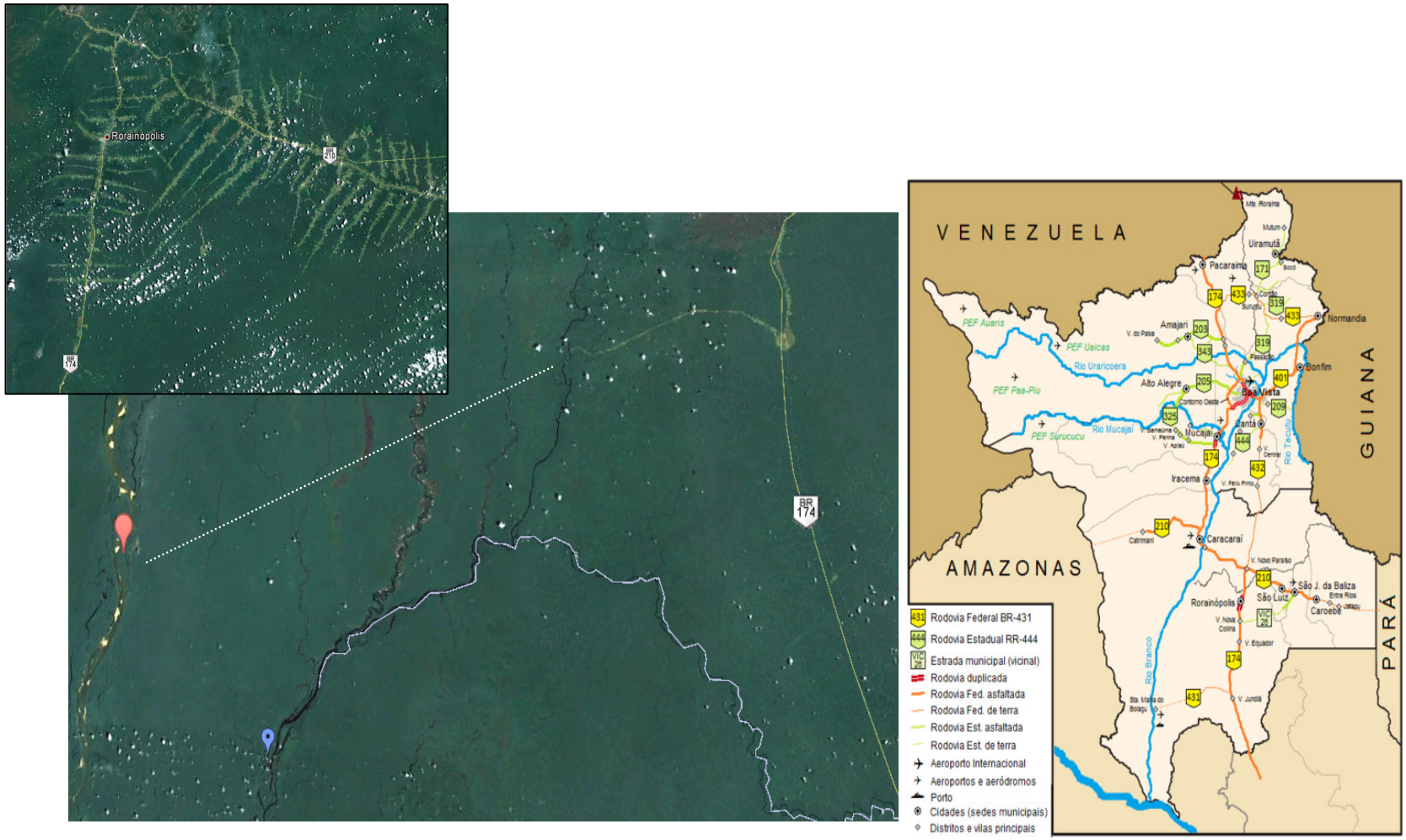

Fig. 14: Evidence of the fishbone deforestation trend along the BR-174 in Rorainopolis (little square on left top) and the the proximity of the interrupted BR-431 (left bottom square), the village of Santa Maria do Boiaçu (red marker) and the Xixuau village (blue marker).
Note: the white spotted line highlights the lacking part of the road. (both retrieved on April 2013 on Google Earth: www.maps.google.it/maps?hl=it&tab=Tl&q=linea%20tratteggiata). In the right square: the road map of Roraima (www.en.wikipedia.org/wiki/File:Mapa_Rodovi%C3%A1rio_RR_-_detalhado.png)

4.1C Discussion

The principle of eligibility seems to be respected in almost all its requirements. The first point 1a.1, which states that the forest must not have been deforested in the past 10 years, seems to be in discrepancy with the 1b.5 point, where the presence of deforested areas in the project site is recognised, since a clear delineation of them is required. In the PATN 2012 call, where the criteria for the two types of projects (REDD+ and A/R) are joined, this requirement is repeated, but another one is added and literary says: "*the area is not and will not be deforested in order to obtain carbon credits*". Thus, the objective of Trento, that no improper actions for the sole purpose of the credits allocation should occur, is explicit. In the AFOLU requirements last version (VCS, 2012) in order to be eligible for REDD projects, the project area shall qualify as forest for a minimum of 10 years before the project start date. The definition of forest may include mature forests, secondary forests, and degraded forests. Under the VCS, secondary forests are considered to be forests that have been cleared and have recovered naturally, that are at least 10 years old, and meet the lower bound of the forest threshold parameters at the start of the project. Maybe, the criteria could be more correct and less hazy if we substitute the actual point 1a.1 with "*the area could have been being qualified as forest in the 10 years previously the starting data of the project*".

In point 1a.7 the issue about credits property rights related to the land property rights is stressed. Probably, the initial uncertainty of the land property rights cannot be interpreted as a failure in the fulfilment of the requirement, because, as Agelsen *et al.* (2012) say, in many countries tenure reform goes hand-in-hand with REDD+. Tenure reform processes support REDD+ implementation; at the same time REDD+ can provide an incentive to push forward tenure reform (even if both processes face substantial constraints). This seems to be true also for the Brazilian "Getting REDDy" project, as the Xixuau population has acquired the capacity to claim their rights to use and own the land on which they live. This point will be better examined and discussed in depth in the "Permanence" section (Par. 4.5.A).

The additionality principle seems to be satisfied, except for the difficulty in estimating the level of the involvement in the process of deforestation. According to the VCS AFOLU requirements (VCS, 2012), the "Getting REDDy" project belongs both to the Avoiding Planned and Unplanned Deforestation and/or Degradation (APDD and AUDD) REDD activities. In fact, the main driving force is the planned forest conversion for infrastructure development, the highways, or the reduction of the forest estate to convert it to industrial-scale production of commodities, such as mining or timber exploitation (even if this last is a less robust probability). As a consequence of the road construction, unplanned deforestation and/or degradation could occur, since poor law enforcement and lack of property rights can result in piecemeal conversion of forest land. The matter of the "Getting REDDy" project is to assess how much this deforestation scenario is likely to occur as BAU, since the project area is located at a relative distance from the road under construction.

4.2 Description of the territory and of the project area

In this section it is checked if and at which level the things assumptions stated by the project report reflect the actual facts; the results of the parallel research about the analysed points are also reported in comparison.

4.2A Project area information

2.1 GENERAL INFORMATION - According to all the controlled verifiers, the project report well summarizes all the geographic and physical properties of the project area. A comparable and a little more detailed information was given in this work, at the second chapter (from Par. 2.1.1 to 2.1.4).

2.2.1 and 2.2.2 LOCAL COMMUNITY - According to all the controlled verifiers, the project report well summarizes all the information about the local community and the land-use it usually carries on in the project area and surroundings. A comparable and a little more detailed information was given in this work, at the second chapter (Par. 2.2).

2.3.1, 2.3.2 and 2.3.3 BIODIVERSITY - According to all the controlled verifiers, the project report well summarizes all the information about the local biodiversity. It mentions the most ecological important species, as well as the bioindicator species. It lists the present endangered species basing on the IUCN Red Lists, as suggested by the PATN call. A comparable or little more detailed information is given in this work, at the second chapter (Par. 2.1.5).

2.4.1, 2.4.2 and 2.4.3 DEFORESTATION - In the relative points, the project report gives just a brief description of the causes of deforestation in the project region. It mainly bases on the bigger driving forces such as industrial agricultural and breeding farms expansion which are, according to most of the international and national agencies, the principal scourges for the Legal Amazon and the entire Brazil. However, according to Barni (2009), the main agents for the loss of forest along the BR-174 (which construction began in the 70's under the military dictatorship) were especially the small scale farmers than the industrial ones. In the project presentation an estimate of the deforestation entity at the national scale is given (while the punctual deforestation rate value for the project area is given in the credits computation section). The other deforestation and degradation agents description (timber and mining exploitation, illegal poaching and fishing, and, above all, the roads construction), and the analysis of the factors (public policies and anthropic expansion) are stressed in the section about the BAU scenario. As Fearnside (2006) affirms, the deforestation process in the Amazonia pursues at a high rate for different reasons which depend mainly on the government decisions. Moreover, the continuously rising amount of paved transportation infrastructures is a guarantee of significant levels of future deforestation which is largely outside the control of government (Fearnside, 2006). During this thesis' survey and research, in the INPE database it was found that Rorainpolis is at the third place among the Roraima municipalities sorted by amount of deforested area. In fact, it accounts for 1093.7 km^2 of the 9656.3 km^2 of total deforested land in Roraima until 2011. The main deforestation and degradation agents are, without a doubt, the incontrollable illegal exploitation enterprises and the public agencies and institutions which are often corrupted, but they also are very difficult to analyse. More detailed information was given in this work in the second chapter (Par. 2.1.6), as well as in the previous "additionality" points (1b.4.1 and 1b.4.2, Par. 4.1). The collected data will be later stressed in the further points about the BAU scenarios evaluation (points 2.6 and 4.1).

2.5 ACTUAL CARBON STOCK ESTIMATION - Since it was too expensive as well as time-consuming to carry a forest inventory previously the implementation of the project, and no study had ever been conducted in the site by agencies competent in the field, the project promoters opted to use carbon stock estimates already available

in literature[51]. They based on the Juma REDD project (IDESAM *et al.*, 2008), as it is implemented on an area with similar vegetation types to those of the project region. For the carbon stock estimation of the Juma area they used the data available from the two main inventories carried out in the whole Amazon region – the RADAMBRASIL project[52] (RADAMBRASIL, 1978) and the Science and Technology Ministry inventory (MCT, 2006) – and the studies of Nogueira *et al.* (2008a and 2008b). Considering both the prevailing types of vegetation (Lowland Ombrophyllous Dense Forest and Ombrophyllous Dense Alluvial Forest) the lowest value was considered for the Xixuau area project, or rather 139.49 tC/ha. Even if it is conservative, it seems to be a too low carbon content for the non-degraded rainforest of the Xixuau area. To check this, a sampling activity within the project area was carried out (Par. 3.2.3). As an average carbon content was obtained a value equal to 200.1 tC/ha which is equivalent to an aboveground biomass of 425.78 t d.m./ha. Even if this is considered just a pre-sampling and therefore the results are not definitive, the obtained value was compared with the estimates of FAO (2011) – 220 tC/ha – and IPCC (2006) – 300 (120-400) t d.m./ha aboveground – respectively for the Amazon Basin Reinforest and the North and South America Tropical Rainforests. The field measurements seem to overestimate a bit the biomass density IPCC default value, while it is difficult to understand at what level is comparable with the estimate of FAO, as the latter also includes soil and litter as carbon pools.

2.6.1 PROBABLE BAU FUTURE SCENARIOS - The project promoters sufficiently pinpointed the actors which would play a fundamental role in the baseline scenario. In order to define the BAU scenario for the project region, they both mentioned the SimAmazonia I future deforestation simulation model (Soares-Filho *et al.*, 2006), and the consequences that would occur if the roads development plan will be finalized without any care about environment preservation. Since, as already said, unpredictable variables are underway, more than one scenario could be assessed, even more because there are different estimates about the rate of deforestation that can be found. Following the precepts of Pedroni (2012) different scenarios have been outlined considering that the found historical rates were adequate for the future or that some amendments should be made, according to the main socio-economic factors. The project area could be affected from deforestation in a more or less incisive way, depending on the velocity of the construction and colonization of the paved roads and of the settlement of timber/mining enterprises. More detailed results about the most probable baseline scenarios will be given at the point 4.1 (Par. 4).

2.6.2 THE BAU INFLUENCE ON THE LOCALS - The BAU situation evolution would bring negative consequences to the local community. Since they depend mostly on the forest ecosystem, with the degradation and the deforestation of this last, the Xixuau inhabitants would loose the source of their subsistence. This would cause both a relocation of their settlement, and the impoverishment of their life condition. Furthermore, with the absence of the project, the lack of opportunities for technical training would leave the local community totally at the mercy of market prices of the Brazilian nut supply chain. The Xixuau inhabitants' awareness that they are playing a key role in the global rainforest preservation context, would remain incomplete and

[51] In the last version of the VCS AFOLU requirements, the use of carbon stock estimates in similar ecosystems derived from local studies, literature and IPCC defaults is permitted, provided the accuracy and conservativeness of the estimates are demonstrated (Pedroni, 2012).

[52] The RADAMBRASIL was a big government program that occurred between 1973 and 1983. A total of 2719 points was used to conduct the inventory of biomass in the Brazilian Amazon (IDESAM *et al.*, 2008).

the incentives for the legal claim of their rights would lack. Moreover, the simple announcement of construction and improvement of highways would lead to a speculative rush for the lands, with "*grileiros*" (grabbers, illegal claimants of large lands – Annex III) often taking beforehand possession of wide areas in order to take advantage from the consequent rapid of the land prices once the road is complete (Feranside, 2006). Clarification of tenure rights should precede the growing demand on forest lands, but unfortunately, it is lagging far behind. Without progress in specifying property rights, conflict over forest lands will grow (ITTO & RRI, 2011). In general there could be consequences of social imbalance: indigenous and protected lands invasions, illegal appropriation of the vacant lands, unbridled timber exploitation, deforestation, environmental degradation, loss of biodiversity, and consequent increase in GHG emissions (Barni, 2009).

4.2B Discussion

The project presentation document gives an exhaustive description of the features and the conditions of both the area and the community which host the project implementation. The most redoubtable deforestation agents and drivers are adequately stressed. Regarding the estimates of the current carbon stocks, even though they have entrusted to the estimates of the most important (as well as the nearest) jurisdictional scale REDD project, the values may be too conservative for the project area of Xixuau. Unfortunately, no sample plots were carried out in the first year of project, even if they were programmed. In fact, collaborations in order to achieve the biomass estimates for the project area forest were launched with the INPA, but the times got dilated and planned works have not been finalized. Indeed, the implementation of a REDD project requires time, mainly in the case of the REDD-readiness phases in such a remote area. To remedy to the lack of a direct survey in the project area, the project promoters, during the editing of the new project ("Getting REDDy 2") for the application to the PATN call 2012, they used more robust estimates, taking them from the Jufari project [53].

According to the statistics (Eq. 2, Par. 3.2.3), the number of sample plots similar to those carried out during the field survey that could be useful in order to correctly estimate the carbon content in the project forest are (see Annex VII): approximately 76, if we consider the vegetation as uniform; and 83 in both cases of stratified vegetation (with *Igapò* accounting for ¼ and ⅓ of the total area).

A correct and coherent generic probable BAU scenario has been given, forecasting the evolution of the current variables. It would have been useful also to give more than one baseline scenario in order to have a wider perspective of the future probabilities and choose the more suitable one. Finally, it's important to say that the SimAmazonia I simulation, even if it is considered one of the most reliable model gives also one of the worst future scenario options. Its adoption will be useful in order to have an idea of an extreme evolution of the initial conditions, since it seems not to give a conservative scenario.

[53] The Jufari project will be implemented on an area of 30000 ha at the north-west of Manaus, between the Rio Negro and the rivers Jufari, Demeni and Padauri. For the carbon stock estimates, agreements were signed with the Department of Tropical Silviculture and Forest Management of the National Institute for Amazonian Research (INPA) and the ETH (Swiss Federal Institute of Technology Zurich).
www.jufari.org.br/default.asp?site_Acao=mostraPagina&paginaId=15

4.3 Monitoring of the implementation methodologies

In this section the completion and success of the project planned activities will be inspected.

4.3A Implementation criteria

3.1 SILVICULTURAL OPERATIONS - In the tropical rainforest it is difficult to clearly distinguish into different forest stands, while we can more widely speak about vegetation types. As already mentioned, the project area is dominated by *Terra firme* and *Igapò* dense humid forest, and, since the project aims to the integral protection of the forest, it is superfluous to speak about management in general. According to the Incoming Generation Activities, the gathering of the Brazilian nuts is carried respecting the traditional and the most environmentally friendly techniques. The management of the *Bertholletia excelsa* trees consists just in the partial and periodic pruning of lianas that usually infest the canopy of the plants (Annex I). No evidences of the need of special protection measures for certain forest formations or species emerged.

3.2 ENVIRONMENTAL ASPECTS - Since the project planned the only protection activity of the forest, nature normally runs its course, with no human intervention. Moreover, being the ecosystem extremely diversified, these areas have never experienced problems about invasive species or pests. The only wastes due to the project activities were related to the *galpões* building, and they consisted of the packaging material and the stain cans which were brought to Manaus. There is no evidence of negative impacts on the environment, mainly because the project undertakes the opposite goals, namely the preservation and protection of the forest ecosystem and the environment in general.

3.3 1 VALORIZATION/ATTENTION TOWARDS THE LOCALS - The whole community has been involved in all the phases of the project, and the inhabitants consensus has always been requested. All the activities which were carried on during the project implementation were based on the traditional knowledge of the locals.

3.3.2 IMPACT ON THE MOST SENSITIVE/VULNERABLE CATEGORIES - Women are considered a vulnerable category, since they wholly consecrate their life to the family and children. They have been involved in all the given training courses and one of the new activities arisen with the project has been assigned to them. They would be in fact responsible for the drying of the nuts during their stocking. Unfortunately, the *galpões* had not yet been finished during the harvest season of the nuts, so I could not verify that women have actually participated. Moreover, in a session of the training courses, the elders of the village were invited to transmit their traditional knowledge, so explaining all the usual activities and customs of their population, as they are increasingly neglected.

3.3.3 CREATION OF EMPLOYEMENT - New workforces and roles were created thanks to the project implementation, such as the expert for delineation of the project area, the local technical guide for the forest survey, the responsible for the construction of the nut warehouses, and others. It is also foreseen, with time, to form figures of para-researchers.

3.3.4 DIFFUSION OF SKILLS, KNOWLEDGE AND DIFFUSION - The training courses were provided by a specialized and qualified staff, belonging to both external and promoting associations. The training courses have improved, deepened and made more technical the already solid and rich local knowledge about the protection and management of the forest. The courses also served as a channel of transmission

for the traditional knowledge among the community members, and they have also contributed to develop a consciousness of community as well as an awareness of their rights, duties and tools that they could use in their advantage. The knowledge and culture have been strengthened to such an extent as to provide new ideas for action in order to improve the actual situation Xixuau, and most of the met inhabitants expressed satisfaction over the progress of the project activities. An activity which proved to be very formative and interesting was the twinning and the cultural exchange carried out with Tanzania. Encountering people involved in the same project, and having problems and issues as similar as different from their own has stimulated the willpower, the interest, and the knowledge of the inhabitants of Xixuau.

3.4 LEAKAGE PREVENTION MEASURES - The Xixuau settlement is outside of the outlined project area boundaries and no expansion of the village is forecasted for the future (i.e. the new family that came to settle in the Xixuau at the time of the stay, has positioned the *maloca* in the diametrically opposite side of the village). The only activities which were carried on in the project forest were the harvesting of the Brazilian nuts (which will be continued and improved), and the harvesting of deadwood or lianas for cooking on exceptional occasions or for handicraft production. These last activities entail the removal of such an insignificant quantity of wood that they can be neglected in the leakage accounting. Anyway, in order to address the arising of eventual negative leakage effects, in the 361.5 ha of the project area were included 60 ha as safety buffer.

3.5 1 PROJECT COSTS - The main cost items reported by the promoting associations reflect what it had been done on site during the project implementation.

3.5.2 PROJECT TIMING - Apart from the field sampling, the rest of the planned activities were carried out, although often with delays or variations in the timing of implementation, mainly due to the laboriousness and complexity of many bureaucratic procedures.

4.3B Discussion

As the field survey could confirm, the activities planned by the project promoters where actually implemented, even if sometimes with a little delay respect to the scheduled timing. Some silvicultural and environmental aspects mentioned by the PATN call seem to be more adequate to an A/R project than a REDD+ (i.e.: speaking about fighting against a pest or managing a forest stand seems to be more congenial to a plantation). Moreover, the concept of forest *stand* hardly befits to the pristine Amazonian rainforest which is largely still unexplored. This terminology could lead to a consideration of non applicability of the criterion to the actual situation of the project area implementation.

With regard to the socio-economic aspects, the work has been done in a workmanlike manner, and this testifies the strength of the social cooperation component that makes up the promoting association, as well as the good integration of the partner association in the local reality.

The network of partnerships, collaborations, and consultations which has been created is a very interesting outcome, as well as the effectiveness of the training activities promoted during the project (these aspects will be better stressed during the analysis of the section about “Permanence”, Par. 5.1A).

Even if, on one hand, the total lack of leakage is considerable as a positive and noteworthy trait of the “Getting REDDy” project, on the other hand it instils some misgivings. In fact, if we accord to Wunder (2008), the leakage can occur whenever the spatial scale of intervention is inferior to the full scale of the targeted problem.

This would lead to the conclusion that the deforestation problem in the project area is not as worrisome as denounced, since the project area is very small. After all, Wunder even says that: "*in areas where gradual clearing of forest islands in agricultural landscapes prevails, spatial prediction of deforestation is much more challenging, and addressing leakage will be more complex* (Wunder, 2008)". This is exactly the situation that is occurring along the roads BR-174 and BR-431. It is important therefore to protect the areas beyond the actually threatened one, and in this sentence the Xixuau project finds its implementing motivation. Anyway, the project area has been carefully outlined in order to avoid the inclusion of the village agricultural areas (*roças).*
An observation that was considered interesting was the evidence, even if very slight, of a "positive" leakage. In fact, in a reality as that of Roraima, where the government and the institutions are hesitant to recognise attention and grant protection to the natural environment, a project like this highlights new opportunities and hopes for the local population in general.

4.4 Accounting of the credits offset

For each criterion the amount of the carbon stored or issued during the period of the project activities will be reported, in order to finally achieve the corresponding credits obtained by the implementation of the project "Getting REDDy" in Brazil. All the results are compared with those expressed in the document of the project.

4.4A Results and comparison

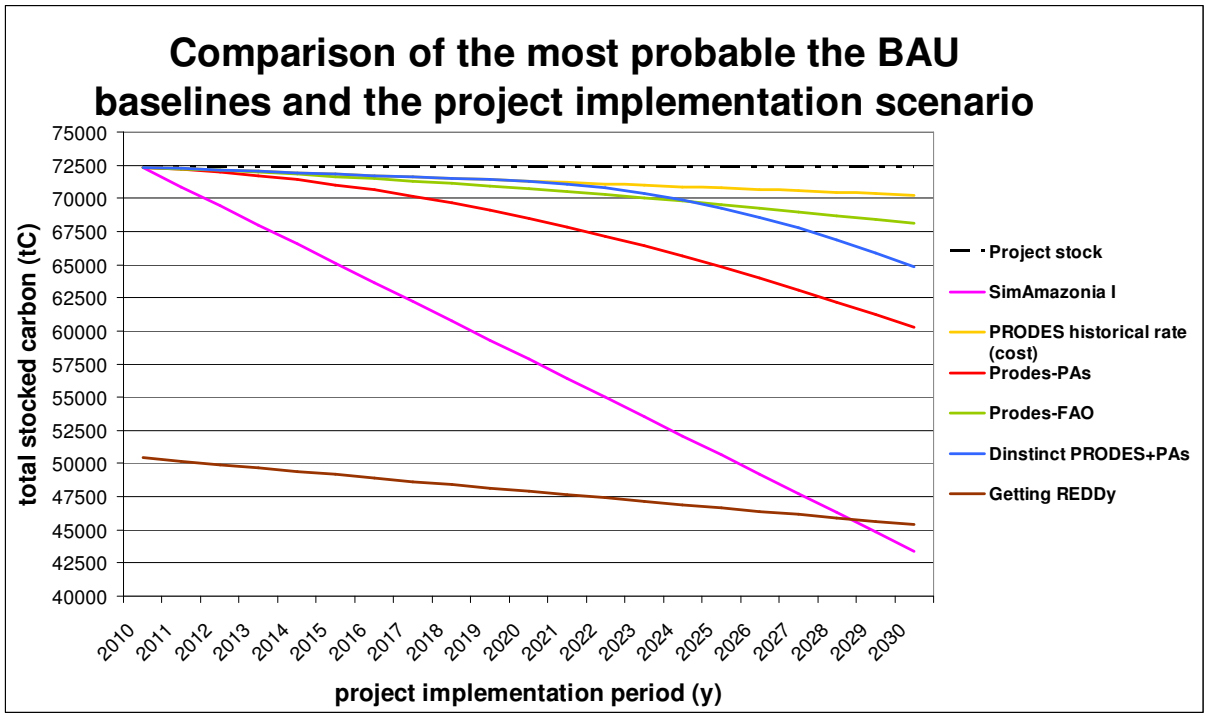

Fig. 15 Different carbon stocks obtained by several outlined baseline scenarios.

Note: the total carbon stock obtained with the integral protection of the forest provided by the project implementation and the project "Getting REDDy" estimation are also reported.

4.1 BASELINE SCENARIO - Getting REDDy baseline (brown line in Fig. 15) - In the project presentation, the promoting associations forecast a constant deforestation

rate equal to 0.5% per year during the project implementation period and a forest content of 139.49 tC/ha (equal to 512 tCO_2/ha).
In order to do all the appropriate considerations and outline the BAU scenarios, the forest carbon content was assumed to be equal to the value obtained during the field measurements, or rather 200.1 tC/ha. Thus the baselines outlines are 5 and a title was given to each of them, in order to simplify their illustration.
1) SimAmazonia I baseline (Fig. 15, pink line) – according to Soares-Filho *et al.* (2006), in 2050 the whole area will be totally deforested, because of the proximity to the constructed roads and the fact of not being a protected area, or worse, belonging to the *terras devolutas* category. This would affect our project region causing the deforestation of 7.23 ha per year, corresponding to an annual 2% deforestation rate.
2) PRODES historical deforestation rate (constant) (Fig. 15, yellow line) – according to Pedroni (2012), it was considered that the slight decreasing deforestation rate derived from the INPE-PRODES database for the decade 2000-2010, could not be justified by conclusive evidences. Therefore, the historical average deforestation rate (0.145%, 0.52 ha/y[54]) has been computed and it has been assumed that deforestation could continue with the same trend during the project years (first approach, Par. 3.2.4).
3) From PRODES to PAs baseline (Fig. 15, red line) – The slight decreasing trend of the Rorainopolis deforestation rate registered by the INPE-PRODES project was assumed to be explained by the existing drivers and agents analysed (i.e. stalemate phase of the construction of the BR-431). However, this trend was also supposed to change in the future (third approach, Par. 3.2.4), and as a deforestation driving force the implementation of PAs along the nearest road BR-431 and the extension of those already existing along the BR-174 were considered. It was therefore considered that, during the project implementation, the average historical deforestation rate (0.0145%) will increase up to the value of 1.6% already registered in the PAs of Rorainopolis (Barni, 2009).
4) From PRODES to FAO baseline (green line in Fig. 15) – It was considered the same previous supposition that the historical deforestation rate would change in the future, but it would follow a moderate increasing trend. This because the development of the area nearby the BR-431 it was thought to be similar to that occurred along the BR-174, where little farmers and not the industrial ones were the main deforestation agents. The infrastructure development was also assumed to occur at a slower rate, since there have already been some problems which slowed down the BR-431 construction. It was made the assumption that, during the 20-years period of the project, the deforestation rate will gradually increase up to reaching the average value (0.44%) observed in the whole Legal Amazon region by FAO in the decade 2000-2010[55] (FAO, 2011).
5) Distinct periods PRODES+PAs baseline (blue line in Fig. 15) –It was again adopted the third approach suggested by Pedroni (2012). The historical deforestation rate it was supposed to remain equal to that derived from the PRODES database for the first 10 years of the implementation of the project (2010-2010). This because the date of completion of the highway BR-413 construction, which was scheduled for 2018 (Barni, 2009), was considered; but, since it has already experienced some delays in its ending, such date was approximated to 2020. According to Barni (2009), the heavier development of the PAs in the BR-174 surroundings, occurred in a period inferior to a decade (2001-2007). It was considered that this could happen at the BR-

[54] It is important to mention that a comparable value was observed by Barbosa *et al.* (2008) as the annual deforestation rate of the forested but non-protected areas of Roraima.
[55] A deforestation rate value of 0.4% for the Brazilian Amazon was also reported by Barni (2009).

431 surroundings too. Therefore, our project area deforestation rate would rise up to that registered in the Rorainopolis PAs, during the last 10 years of the project implementation (2020-2030).

4.2 PROJECT SCENARIO - Since the “Getting REDDy” project’s aim is the protection of the forest, the whole project area was considered to be preserved from deforestation and degradation in the future. Therefore, the whole carbon stocked in the project area (72336.15 tC, considering a stock of 200.1 tC/ha) was assumed to last during all the project implementation period.

4.3 LEAKAGE EMISSIONS - Since no leakage was observed, nor future leakage is forecasted to occur, no computations were carried out in this section.

4.4 PROJECT EMISSIONS - The “Getting REDDy” project defined that 1.5 of the 361.5 ha of the project are would compensate the emissions due to the project activities (but these latter were not specified). Considering the journey of the three inhabitants of Xixuau to Tanzania (accompanied by two representatives of AA and TI), as well as the air travels of staff of the associations and the courses trainers, an overall amount of 49.27 tCO_2 was computed. Since it was too difficult to assess the actual emissions of the boat travels (by ferry, *rabetas*, and *voadeiras*) as well as those issued from the few three cut and the chainsaws employed for the *galpões* construction, the previously obtained value was rounded up at 60 tCO_2.

4.5 OBTAINABLE CARBON CREDITS - Considering that one avoided tonne of CO_2 corresponds to one carbon credit, and discounting the avoided emissions by those issued because of the project activities, the achievable carbon credits for each outlined baseline scenario was computed.
1) SimAmazonia I baseline: 89139 carbon credits;
2) PRODES historical deforestation rate (constant): 7906 carbon credits;
3) From PRODES to PAs baseline: 44192 carbon credits;
4) From PRODES to FAO baseline: 15753 carbon credits;
5) Distinct periods PRODES+PAs baseline: 27605 carbon credits.
The scenarios “SimAmazonia I” and “PRODES historical rate” show two extreme situations that do not appear to be appropriate to forecast the future evolution of the baseline. In fact, “SimAmazonia I” seems to largely overestimate the possible amount of the avoided CO_2 emissions, reporting an annual rate of deforestation even far superior to the rate that was recorded during the development of the PAs of the south of Roraima. On the other hand, the scenario in which the historical Rorainópolis deforestation rate was maintained, largely underestimates the baseline scenario, bringing half of avoided emissions than those calculated by the project “Getting REDDy”. In addition, it is believed, according to the given circumstances, that the present scenario will not remain the same. The scenario which forecasts a gradual increasing of the deforestation rate from an actual one to that proper of the PAs (From PRODES to PAs baseline), results in an amount of carbon credits which is around three times that estimated by the “Getting REDDy” project. Moreover, a so much rapid and consequential increase of the deforestation rate seems to be somewhat risky. Ultimately the BAU baselines that seem most plausible are the fourth (“From PRODES to FAO”) and the fifth (“Distinct periods PRODES+PAs baseline”) scenarios. The latter scenario seems to be the most likely, since it corresponds to a plausible evolution and is based on robust assumptions. The “From PRODES to FAO” scenario, as well as being equally likely, it is definitely much more conservative. In any case, the amount estimated in this thesis is more or less higher than that estimated by the initial project report (15000 carbon credits).

4.4B Discussion

The project "Getting REDDy" used an underestimating value for the forest carbon content; while the deforestation rate, even if it was provided by local agencies competent in the field, was a slight overestimation of the regional Amazon averages.

Tab. 2 Comparison of the parameters used for the baseline estimations in both the project document and the present thesis work

	Project document values	**Data found/collected during the monitoring**
Carbon content	139.49 tC/ha	Field survey: 200.1 tC/ha
		IPCC (2006): 300 (120-400) t d.m./ha
		FAO (2011): 220 tC/ha
Deforestation rate	0.5%	FAO (2011): 0.44%
		PAs (Barni, 2009): 1.6%
		INPE (2013): 0.145%
		SimAmazonia I (2001): 2%

Anyway, the project promoters got to an acceptable and conservative carbon credits' amount, which is comparable to the two most plausible BAU baselines generated in the present work. Moreover, the 1.5 ha defined in order to compensate the eventual emissions due to the project activities, widely cover the verified project emissions.
In the PATN call, at the point stressing the project scenario carbon stock estimation, they suggest to distinguish into "even forest managed with periodic cuts" and "uneven forest managed with selective cuts" in order to make a better evaluation. These criteria do not fit very well to the Amazon rainforest, as well as to the major part of the tropical rainforests, while they seem more suitable for a European silvicultural concept.

4.5 Permanence and monitoring

The validity of the carbon credits has to be guaranteed by the long run permanence of the project scenario within the project area. The success and the permanence of the out coming benefits of the project, have to be monitored, reported and verified according to previously planned activities.

4.5A Permanence

5a.1 BIODIVERSITY SAFEGUARD - Since the project's principal aim is to provide protection to the forest, the whole biodiversity of the area will be consequently safeguarded. The promoters affirmed that, with the future plots in the area, major knowledge about the local biodiversity could be enhanced.

5a.2 DISCLOSURE OF KNOWLEDGE AND SKILLS - Locals have actually enriched their knowledge and improved their techniques of sustainable management of the natural resources. The overall opinion of the Xixuau inhabitants is that the training courses were both useful and interesting; therefore, they are generally satisfied of these activities. As derived from the survey, the stressed subjects that have generated more interest, a more in-depth knowledge, and several positive outputs, were those relating to the collection and processing of nuts as well as the courses about deforestation and REDD. In fact, the Xixuau inhabitants assert that the selling of the Brazilian nuts ensures more incomes than the ecotourism activity. Therefore, a deeper and more technical knowledge about the gathering of nuts, the possession of structures more suitable to the early treatments and storage of nuts, as well as the possibility to manage the sale of the harvest, will bring to an improvement in the

locals' conditions. The interviewed people also stated that the given courses increased their awareness about the general progress and risks of deforestation (which seems to be more critical than they thought), and they judge their selves to be now more aware of the role that they can play in the protection of forest. All these progresses have been observed and confirmed by the trainers and the promoters that I have met.

5a.3 ADEQUATE INTERNAL RESOURCES - The promoting associations' staff, as well as the external experts invited for giving the training courses, seem to be qualified and skilled. When tasks required strength and knowledge that were beyond their means, they have relied on the organizations and the local agencies having expertise in the field (FVA, Ekos, INPA, *etc*.). In general, the promoting associations demonstrated that they deeply know the dynamics, the habits, and the customs of the local population.

5a.4 COOPERATION AND AGREEMENT BETWEEN PROMOTERS AND COMMUNITY - There is evidence that the promoting association is well integrated in the local reality of the project implementation. The relations established with the local population and local entities, such as CoopXixuau, are based on cooperation and harmony of shares. The aims of the project were also shared transparently with the jurisdictional authorities, even if new discussions have to be done, since, from the beginning of 2013, the mayor of Rorainopolis has changed.

5a.5 FUTURE WILLINGNESS OF THE POPULATION/LOCAL INSTITUTIONS - It is evident that the Xixuau population will continue to protect the forest during the project implementation period. The forest conservation is something innate in the way of thinking and behaving of the *riberinhos*. Moreover, now that they know that their actions have an impact at the global level, and that they can be rewarded for this (i.e. the sale of carbon credits), their engagement is strengthened. The given courses provided the basics and the means to get more informed: there has been a growing interest, also because they now have wider background knowledge that allows them to encompass and deepen what they have learned.

5a.6 IMPLEMENTERS' TECHNICAL SKILLS - *Trentino Insieme* relied on *Associação Amazônia* and the local cooperative for the implementation of the project activities. As already mentioned in Par. 2.3.2, AA has long been being inserted in the Amazonian *riberinhos* reality and is actually composed of the same members of the Xixuau. Moreover, AA has already been participating at scientific research projects in their region (i.e. study of the biology and ecology of the giant otter and the river dolphin). The cooperative CoopXixuau is very young: its creation dates back to two years before the implementation of the project "Getting REDDy". It is therefore currently in a stage of experience development and capacity improvement, and this is also possible thanks to the precepts provided by the training courses. The CoopXixuau and AA provided all the structures useful in order to carry on the project activities (i.e. rooms and *malocas*; accommodations for the external trainers; and others). The *galpões* for the storage of the collected Brazilian nuts have been built with one of the more resistant woods, to ensure a long lasting and a greater resistance in time. The community, although denoting an exemplary knowledge about forest, is currently in a stage of REDD readiness and capacity building.

5a.7 PROTECTION FROM ADVERSITIES - Since no specific adversities have been identified for the project area, no correspondent actions and methods to overcome them were actually planned. In the case of accidental fires (very rare), for instance, since the locals have already a traditional protocol of action, the locally known procedures will be applied.

5a.8 CARBON CREDITS OWNERSHIP - The ownership of the carbon credits is a hot point of the REDD projects in general, mainly because it entails a clear land tenure. The level of criticality of this topic is witnessed by the related copious profuse literature about this theme. For the Xixuau *riberinhos*, the land property represents a big question mark, since, as already said, they are settled on a "vacant land". Moreover, they have been repeatedly claiming the official protection of the area in which they lived (they proposed different forms of protection as: extractive reserve; scientific research centre; conservation are; and others), unfortunately, without any kind of results. During the Brazil-Tanzania exchange, the Brazilian took inspiration from the twinned Tanzanian people, which have obtained, thanks to the REDD activities, the concession of the land in which they live. Strong of this example, a delegation of the Xixuau inhabitants, accompanied by Emanuela Evangelista, renewed and strengthened their claims to the Rorainpolis mayor, asking for an official concession for use of the Xixuau land[56]. Although it does not worth as a guarantee for certain, this makes to presuppose that things might turn to a successful conclusion for the land issue of the Xixuau village. At the very least, there is the evidence that the locals have acquired the appropriate means to enforce their rights.

4.5B Monitoring

5b.1 ORGANIZATION/PLANNING OF THE MONITORING ACTIVITIES - Since the monitoring activities are scheduled every 2-3 years, it was difficult to assess the state of progress of the organization of such activities after just one year from the project implementation. Anyway the promoters planned to carry on the due monitoring through sample plots in forest as well as participatory meetings with the whole population.

5b.2 CARBON STOCK MONITORING - The verification of stored carbon with the project will be carried out every 2 or 3 years through some dendrometric measurements in forest plots. The operations team will be composed of some community members trained by the project staff. After the conclusion of the project, such verifying activities will be therefore carried out by the same community in co-responsibility with local partners. At the time of the inspection, no sample plots were established yet, but there was the evidence that some of the villagers had been being initiated to the field survey activities. If, in order to do the measurements, the project implementers will rely on the consultation with the local agencies competent in the field (such as INPA), the methods and the tools they will apply should be adequate for their aim.

5b.3 LOCAL COMMUNITY MONITORING - The Xixuau inhabitants will be involved in all the decision makings processes, and the project implementers will train some individuals in order to devolve upon them the monitoring activities. The community will have the responsibility for the safeguarding and the controlling of the natural resources. The CoopXixuau will finance and manage those responsible for such activities.

[56] The action of the delegation of the inhabitants of Xixuau has made headlines and represents a remarkable example in the local context, in fact the mastheads of the major local newspapers testifies:
www.fontebrasil.com.br/site/index.php?pg=noticias&id=13993
www.dirigida.com.br/news/pt_br/governador_recebe_representantes_de_cooperativa_do_xixuau_easycoop/redirect_10825712.html
www.boavista.sbcbrasil.com.br/Politica/governador-recebe-representantes-de-cooperativa
www.bvnews.com.br/noticia.php?intNotID=913
www.easycoop.com.br/cooperativismo/noticias/noticia.asp?id=19361

5b.4 BIODIVERSITY MONITORING - The safeguard of the biodiversity should be controlled by the institution of scouts or rangers among the inhabitants of the Xixuau, which will be responsible for the oversight of the protected area. They therefore aim to entrust the activity of the biodiversity monitoring to the community, in order to ensure a continuity of the work. It would be helpful if had determined precisely how to monitor which of course could be carried out in conjunction with the control of the stock of carbon in the forest.

5b.5 LEAKAGE MONITORING - Since it was not possible to hypothesize any kind of leakage effect, the promoters have not planned any activities of monitoring the leakage. It would however be useful to establish a check list or a series of control questions that can serve as a tool to verify that the actual situation is remaining the same.

4.5C Discussion

The permanence of the activity of a REDD+ project is one the most critical issues, since, as already mentioned at the beginning of this work, it have to deal with the natural environment, which is by definition unpredictable and multifaceted. In addition, the REDD depends very much on political order of the region where the project is located, which makes it even more difficult to ensure over time the activities implemented. The strength of the project "Getting REDDy" is in the work done with the local population. As stated during the COP 16 in Cancun in 2010[57], the importance of the participation, awareness, empowerment of the inhabitants of the project area is definitely a crucial point for the success of a REDD+ project. This has been repeatedly addressed in the bibliography also investigated within this work (i.e.: Angelsen *et al*., 2012; Campos, 2009; Verplanke *et al*., 2009; MMA, 2012; Parker *et al.* 2009, and others). The involvement and commitment of the local population are not insignificant, and this is confirmed by the effort entailed by the assiduous and zealous participation to the courses and activities. There is therefore evidence that the inhabitants of the Xixuau believe in this project and are willing to perpetrate it. This may further contribute to the improvement of the condition of the land population. Unfortunately, the land issue and the political reality definitely make it criticizes the permanence of the project, and are two crucial points actually difficult to overcome. These, in fact, require actions at higher levels, which are often inaccessible to projects at a small-scale as the “Getting REDDy” one. As also stated by IDESAM, the capacity building activities should be addressed to the local population precisely as well as to the political and administrative institutions.

As regard to the monitoring activities, it was difficult to assess their state of progress, since they are programmed for the 2-3 years after the project implementation, while the inspection was carried on just one year after. It seems that the chosen frequency of monitoring takes into consideration the carbon dynamics of the project and costs involved, as suggested by the IPCC (2003) which states that in the tropics, changes in the carbon stock in trees and soils can be detected with measurements at intervals of about 3 years or less. Anyway, according to IPCC guidelines (2003) it would be a good practice to develop Standard Operating Procedures (SOPs) for each step of the field measurements, which should be adhered to all times. For example, to monitor overall project site performance, one of several methods that can be used, is the visual site visit with photographic documentation. It is recommended to thoroughly inspect the total area and select and date the photographs taken. The field reports and photos should be part of the permanent record. A quality assurance and a quality

[57] FCCC/CP/2010/7 (UNFCCC, 2010)

control monitoring plan should be assessed basing on the concepts of accuracy, precision, and being conservative (Pearson *et al*., 2005). For instance, the measurement that will show how the project affects carbon stocks and emissions of non-CO_2 greenhouse gases over time should be controller checking independently 10-20% of the plots. Field data collected at this stage will be compared with the original data. Any errors found should be corrected and recorded. Any errors discovered should be expressed as a percentage of all plots that have been rechecked to provide an estimate of the measurement error (Pearson *et al*., 2005; IPCC, 2003). Of course, all the monitoring operations should be carried on depending upon the level of technology and resources available (IPCC, 2003). The choice of the "Getting REDDy" project of entrusting the locals of the monitoring activities, aims to the implementation of cost-effectiveness monitoring methods. This seems to be in accordance with the GOFC-GOLD procedures (2009). In fact, the GOFC-GOLD's opinion is that local communities already have extensive and intimate knowledge of ecosystem properties, tree species distribution, age distribution, plant associations, *etc*. which are needed for inventories. Moreover, there is growing evidence that local traditional inhabitants, with a very little professional training, can make quite adequate and reliable stock assessments. Of course intermediary organizations are required to support some of the tasks. These intermediaries would train local communities to carry out many of the steps necessary, and oversee the process at least in the first few years in which the forest inventory is carried out. More detailed guidelines could be found in the 2009 GOFC-GOLD sourcebook (Par. 3.4.2, "How communities can make their own forest inventories").

5 Conclusions

Thanks to the monitoring activity carried out in the field it was possible to evaluate the state and the quality of the implemented project activities in the small-scale REDD+ "Getting REDDy" in Brazil. In addition, the Trento Province 2010 criteria adequateness was evaluated.

5.1 The project "Getting REDDy" in Brazil

The monitoring of Getting REDDy in Brazil was carried out after only one year from the implementation of the project; it follows that the assessment of the state of the activities can only be partial and approximated. In fact, according to Angelsen and her colleagues (2012) it still takes 3 to 5 years to clarify whether the REDD+ in general is a formula that works or not. Nevertheless, the early observations have been useful to check the status of the ongoing project start-up activities. This has also enabled us to make the necessary assumptions and considerations of the case.
It is very important to make clear that the Getting REDDy project in Brazil should be considered more as a "REDD-readiness" project rather than a real REDD project, as its state of implementation corresponds more to the very beginnings of a REDD+.
The overall project has some strengths as well as weaknesses (Tab. 3). Although the baseline scenario suggested by the promoters considers the appropriate deforestation driving forces, the basic parameters used in the computations (such as the forest biomass carbon content and the rate of deforestation for the project area) do not seem to be very robust. The scenario obtained in the delineation of the project is however conservative if compared to the assumptions made in this present thesis work. In fact, the project document sets forth the creation of 15000 CO_2 credits for the twenty years of project implementation. Whereas in the two most likely scenarios, according to the considerations accrued in this work, the obtainable carbon credits would be at least 15753 (if the current rate of deforestation increases gradually to the values recorded by the FAO for the Legal Amazon) or 27605 (if the rate of deforestation remains equal to the current one in Roraima and then, after 10 years, it evolves towards the values occurred in the PAs around the BR-174). Surely, more in-depth estimates, maybe coming from inventories and sampling on site, should allow a more precise evaluation of the outputs of the project. At least, the project promoters' estimations are conservative, so no problems with the *ex-ante* financing are caused. Another controversial issue of this project concerns additionality. It is difficult in fact to determine whether the project is actually additional to the current reality, due to the high fickleness and unpredictability of the variables and difficult which characterize it. According to Cenamo *et al.* (2010), even if the current deforestation rate seems to be low, this does not mean that things will not get worse in the future; afterwards the forest preservation is not totally guarantee. The additionality of the Getting REDDy project in Brazil remains therefore an open question. Finally, the problems which actually affect the project are the vacant land tenure rights and the unreliability of the political institutions. According to Zhu *et al.* (2010) a clearly defined rights of ownership of emission reductions under differing circumstances of use, possession, concession, administration, *etc.*, of forested areas are the conditions that facilitate the REDD act. Cenamo *et al.* (2010) state that the issue of lack of governance, quite common in developing countries, is more serious and difficult to solve than the issue of leakage. Often, the effective action on the ground is blocked or constrained by national policies and institutions. Clarifying tenure and securing rights for forest-based people could also increase the viability of REDD+ policies and assure greater equity, effectiveness, and efficiency (Angelsen *et*

al., 2012). It results therefore fundamental that a change happens in the wider context, but as the concerned project is a small-scale one, all the considerations exposed above go beyond the real possibilities of the project.
Nevertheless the fact of being a small-scale project shows its silver lining. In fact, in general, these kinds of projects are playing an important role to generate reductions in GHG emissions and demonstrate the need to establish local arrangements as an efficient strategy to promote REDD+ (avoiding bureaucracy and seeking more active engagement of indigenous peoples and traditional) (Cenamo *et al*., 2010). Moreover, the small-scale facilitates letting most of the benefits go directly to the proper beneficiaries (the local population involved), more than to the intermediaries. As Angelsen *et al*. (2012) state, the biggest problem of the small-scale project is the difficulty to control leakage, which is, on the contrary, easier under the large–scale projects. Since in this case there are no leaking effects, the positive outputs of the project are maximized. Another strong point of the "Getting REDDy" project in Brazil is that the promoters invested a lot on the local population of Xixuau, putting them on the centre of every activity. In fact, a general critical point for REDD+ projects is to make in practice the principle that REDD+ benefits are related to capacity building, sustainable use of forest resources and land use that ensures social and environmental progress and secures the sustainable provision of goods and services (Karsenty *et al*., 2012). In this way the project meets the conditions specified in the frame of the COP-16, or rather that it must occur a "*full and effective participation of relevant stakeholders, in particular indigenous peoples and local communities*" (UNFCCC, 2010). A deep involvement of the local population should better ensure the permanence of the project activities in the site.

Tab. 3 Summary of the weaknesses and the strengths of the project

Weaknesses	Strengths
Non-robust parameters for the estimations	Conservative carbon credits offset estimation
Actual additionality difficult to be determined	Reduction in GHG emissions
Tenure rights issue	Promotion of the REDD+ initiative
Unreliability of the political institutions	Guaranteed benefits for the direct beneficiaries (local population)
	No leakage
	Permanence of the project activities ensured by the deep involvement of the local community

In general the project activities seem to be well established. Anyhow, the role of the present thesis was to monitor, report and verify the state of implementation of the project, while all the official evaluations will be left to whom it may concern.

5.2 The 2010 call of Trento Province

The call of Trento Province for the 2010 reflects the initial experimental phase of the Province's activity in the field. Indeed some technicalities and details were inappropriate to the tropical reality (as for example the detail about forest management and cuts within the silvicultural aspects). These have been eliminated in the subsequent call issued in 2012. In the 2012 Trento call is also avoided the redundancy of some of the criteria observed in the notice instead of 2010. Often, the same issues were addressed in different points of the announcement, which could weigh down the analysis as well as the treatment of the results. The 2012 call was streamlined: actually, the form sheets for the two different types of project A/R and REDD were combined. This has led of course to a better linearity of the requirements, but it can lead also to a lower specificity of the criteria depending on

the project. In both the calls is missing a specific point which stresses the subject of the IGA, in order to better control the implementing procedures.
In general, many doubts are still related to the carbon credits. In fact, the transaction modalities are not yet clear: it is difficult to determine how and how many credits are generated and how this assignment can be made official. Each project has estimated on its own the credits obtainable from the activities before the launching of the project. Since such credits do not generate market, but they belong to a closed and univocal transaction, their certification is not a mandatory and automatic operation, but it would still be necessary to check the projects' quality. It would be quite necessary to establish a mechanism for an official monitoring. According to what was said by Cenamo and his colleagues (2010) the implementation of REDD+ initiatives at the subnational scale (programs, projects and activities) should always be linked to a framework of monitoring, reporting and verification (MRV) at the national level. To ensure transparency and avoid double counting of emissions reductions between national and subnational levels, Trento should therefore engage itself in monitoring or officially entrust a third party for doing such activity.
Nevertheless, the initiative to join an already strong sector of cooperation for the development to a far-sighted vision about the future of environment and forests makes Trento a pioneer province in this kind of activities in Italy. The emissions compensation project of Trento could be an example for the other Italian institutions. Such kind of small-scale and local projects could enhance a more close to nature way of thinking and a more practically involved way of life, since the compensation initiatives works in a capillary and direct way.

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Annex I – The *Bertholletia excelsa* and the production chain of the Brazilian Nut

Taxonomy, phenology and ecology

Kingdom: *Plantae*
Phylum: *Tracheophyta*
Class: *Magnoliopsida*
Order: *Lecythidales*
Family: *Lecythidaceae*

Scientific name: *Bertholletia excelsa*
Species authority: Humb. & Bonpl.

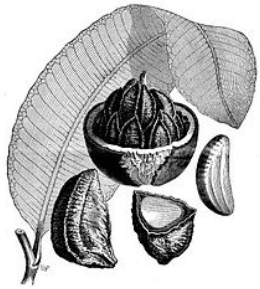


Fig 16 Brazilian nut botanic details
www.it.wikipedia.org/wiki/File:Brazilnut1.jpg

The Brazil nut tree is the only species in the monotypic type genus *Bertholletia*. It is also known with the names *Noix-du-Brésil*, *Turury*, Parà nut, *Castanha-do-Brasil, Castanha da Amazonia*[58]. The genus is named after the French chemist Claude Louis Berthollet[59]. The *Bertholletia excelsa* is typical of the *terra firme* ecosystem and is distributed all over the Amazon region, especially in Brazil, Bolivia, and Peru, so covering an estimated total area of 325 millions of hectares (Pinto *et al*., 2010). The Brazil nut trees generally occur in aggregated formations (known as *castanhais*), which can have from few to hundreds trees, but they can also be found as isolated individuals. The density of the *castanhais* can vary from 1 to 10 adult individuals per hectare (Ribeiro, 2011). A strong growth response to increased light availability has been observed for seedlings and saplings, therefore the *Bertholletia* can be classified as a gap-dependent species (Zuidema and Boot, 2002). The geographic distribution of this species has been favoured by the human activities, mainly in correspondence of *roças* and perturbed area (some studies have highlighted that various *castanhais* were associated with indigenous lands – *terra preta de índio*) (Ribeiro, 2011). The Brazilian nut tree is an emergent species, which can reach 50 m in height and 2 m of diameter (or exceptionally 5 m of diameter) (IUCN, 2009; Mori and Prance, 1990). It is a very long-lived plant, often reaching 500 years or more (even 1000 years). The stem is straight and commonly without branches for well over half the tree's height, with a large emergent crown of long branches above the surrounding canopy of other trees. The bark is greyish and smooth. The leaves are dry-season deciduous, alternate, simple, entire or crenate, oblong, 20–35 cm long and 10–15 cm broad. The flowers are small, greenish-white, in panicles 5–10 cm long; each flower has a two-parted, deciduous calyx, six unequal cream-colored petals, and numerous stamens united into a broad, hood-shaped mass. The Brazil nut tree's yellow flowers contain very sweet nectar and

Fig 17 *Bertholletia excelsa* tree (APIZ, 2008)

Fig 18 A. Portaccio, open flower of *Bertholletia excelsa*

[58] www.iucnredlist.org/details/full/32986/0
[59] www.en.wikipedia.org/wiki/Brazil_nut

can only be pollinated by an insect strong enough to lift the coiled hood on the flower and with a tongue long enough to negotiate the complex coiled flower. The flowers are normally visited by large-bodied bees (*Bombus, Centris, Epicharis, Eulaema and Xylocopa*) (Mori and Prance, 1990). In details, the Brazilian nut's reproduction depends on the presence of the orchid *Coryanthes vasquezii*, since the scent produced by its flowers attracts the small long-tongued orchid bees males (*Euglossa* species), because they use the same scent to attract the females. The large female long-tongued orchid bee pollinates the Brazil nut tree. Without the orchid, the bees do not mate, and therefore the flower does not get pollinated. For this reason the *Bertholletia* trees produce fruits exclusively in pristine forests, were bees live undisturbed, while plantations usually fail and they are not economically viable[57 58]. The fruits, which take approximately 12-14 months to mature, contain between 15 and 30 seeds. They appear like indehiscent globular capsules of 10-15 cm of diameter, which can reach 2 kg of weight. Appearing quite like a coconut endocarp, the *Bertholletia* fruits have a hard woody shell 8-12 mm thick (*ouriços,* urchins). The seeds, or rather the Brazilian nuts, have a triangular shape, they are 4-5 cm long, and they are packed in the fruit's shell like the segment of an orange. The most important scatter-hoarder and seed predator of Brazil-nuts is the Agoutis (*Dasyprocta leporina*). This large rodent is able to open the fruit thanks to the small hole at one end of it, it usually eats some of the nuts and bury the others for later use. The Agoutis uses to put underground seeds in shady places, therefore the young saplings may have to wait years, in a state of dormancy, for a tree to fall and sunlight to reach it (Peres *et al*., 1997). Other animals which are responsible of the dispersion of the nuts are birds and monkeys in general and the large rodent Spotted paca (*Cuniculus paca*) (APIZ, 2008). The Brazil nut tree has experienced major declines in its population because of deforestation. Therefore, since 1998, it has been included in the IUCN Red List of Threatened Species, and classified as “vulnerable” (VU)[28]. The sustainable harvesting of nuts by indigenous people in extractive forest reserves offers the most promising protection for the remaining natural stands[57].

Uses and management

The Brazilian nut plant has always been subjected to several uses. The lumber is of excellent quality, but its overexploitation which was bringing to the disappearing of wide areas of *castanhais*, convinced the Federal Government, in 1994, to prohibit the logging of the trees belonging to the *Bertholletia excelsa* species (Decree law 1282/1994)[60] (Pinto *et al.*, 2010). Nowadays, the uses of the Brazilian nut tree are typically linked to the production of non-wood products. The seed properly defined (*amêndoa*) is an important component of the Amazonia region inhabitants diet as well as it is widely commercialized all over the world, since it is rich in vitamins, fats and proteins. The extracted oil is largely used in the cosmetic industry, as a lubricant in clocks, as an ingredient or seasoning for other aliments, for making artists' paints. The residue of the nut oil extraction (*bagaço*) is used for the animals feeding. Parts as the cork and the shell of the fruit are employed as remedies respectively against gastrointestinal dysfunctions, and anaemia and hepatitis. The fruit shell is also used for the production of handicrafts.

The Brazilian nut production

Beyond the social importance for the Amazonia people of the Brazilian nut, its selling has a big value for the local economy. The production of Brazil nuts has been more than halved between 1970 and 1980, apparently because of deforestation[57]. In the

[60] This Decree was repealed in 2006 by Decree N. 5975, which maintained the ban on logging of chestnut (*Bertholletia excelsa*) in natural, primitive or regenerated forests (Art. 29) (Pinto *et al*., 2010).

periods 2000-2009, the annual production raised again at approximately 30 thousands of tonnes, so moving, on average, 3.6 million of Brazilian *Reais* per year (Ribeiro, 2011). The *Bertholletia* nut commercialization began in the 19th century. Brazil is now the second exporter of the Brazilian nut, following Bolivia. The 90% of the Brazilian production of the nuts is exported mainly towards United States, England, France, Germany, and Italy. It is difficult to assess the production per individual, since it changes a lot according to the years, ages and the trees[61] (APIZ, 2008). Almost all Brazil nuts consumed around the world still come from wild trees; in fact, the Amazon nut is the unique species of nuts and chestnuts whose commercial production comes almost exclusively from wild plants, and their marketing is an important, if not the only, source of income for thousands of families of indigenous, *riberinhos* and *quilombolas*[62] (Ribeiro, 2011).

Brazil nut management and supply chain

The period of the nuts gathering (*safra*) varies among the different States of the Legal Amazonia; in general, the urchins fall down in a period which goes approximately from November to March, therefore the harvesting lasts from November until April (IUCN, 2009; Pinto *et al.*, 2010). During the pre-harvest period, important managing activities have to be carried on in order to enhance the nuts production. In order to facilitate the harvesting and transporting phases, it is important to clean and make accessible the trails and paths which conduct to the nut trees (Pinto *et al.*, 2010). Besides facilitating the work of collecting, cutting the lianas that grow on trees and chestnut trees helps in increasing the production of nuts (APIZ, 2008). To avoid eventual incidents, the old urchins, which are still on the ground, have to be removed. Furthermore, it would be useful to do an official mapping of the *castanhais*, accompanied by a forest inventory, in order to estimate the potential natural nuts' stock, and plan the harvesting operation, without compromising the future *safras* (Pinto *et al.*, 2010). During the period of the fall of the urchins, it is ideal that the fruits are collected every day, in order to prevent their prolonged contact with the ground, the rain and the high Amazon humidity. In fact, the hazard of contracting fungi and other microorganisms, which can contaminate nuts and obstruct their marketing, is consequently increased. The nuts which enter in contact with light, air (oxygen), heat, and moisture are easily contaminated by fungi (mould) and other biological agents. The fungi of the genus *Aspergillus* are some of the major contaminants of Brazil-nut and cause large commercial losses. In fact, they produce a toxic substance, the aflatoxin, which can cause liver disease in humans and animals (Pinto *et al.*, 2010). The adoption of good managing practices does not guarantee the non occurrence of the aflatoxin, but it reduces the incidence of factors favouring the fungi development, such as humidity and temperature (IUVN, 2009). The seeds contaminated by aflatoxins usually have a white, green or yellow colour. The dark colour within the kernel also indicates contamination (APIZ, 2008).

[61] Young nut trees produce 30-50 urchins per year, while mature nut trees (200-400 years old) can even produce up to 1000 urchins in just one year (APIZ, 2008).

[62] A *quilombola* is a resident of a *quilombo* in Brazil. They are the descendents of Afro-Brazilian slaves who escaped from slave plantations that existed in Brazil until abolition in 1888. www.en.wikipedia.org/wiki/Quilombola

Fig. 19 A. Portaccio, the guide Raimundo Alves Barroso shows how to open the urchins

The fruits are collected manually, gathering those already on the ground, or using the instrument called "paw of jaguar" (*mão de onça*). The 10% of urchins should be left in order to guarantee the natural regeneration and nutrition of animals (IUCN, 2009). The fruits are then accumulated and directly opened on the forest ground, in order to reduce the weight during transportation. To open the hard shells (*quebrar*), a machete, a sickle, or an axe are typically used (Pinto *et al.*, 2010). The urchins should be opened with a machete clean and nuts should be placed on top of a protective material that can be tarpaulins, palm leaves or plastic bags. During this operation a pre-selection of the nuts is carried on: the spoiled or injured seeds are indeed withdrawn. The nuts are then put in bags or panniers which are loaded on the backs of the collectors on the way back to the village (APIZ, 2008). Once at the village nuts have to be in of running water (*igarapé*) or in tanks with clean water. In this step, a further selection of seeds is done, with the removal of rotten and seedless nuts, which are recognized because they float (José Ferreira Barroso, personal communication). The selected seeds have then to dry off naturally as first; therefore they are posed on a table or in apposite warehouses, which allows the drainage of the water in excess. They are successively put in a structure which helps to get completely dry, thanks to the stove effect. Here, in order to accelerate the process, the nuts have to be periodically overturned. Once completely dried, the nuts are packed into clean bags and stored into appropriate warehouses (*galpões*). Such sheds have to be constructed in strategic locations, considering the flow of large amounts of nuts, the distances between villages and other facilities for the nuts management and commercialization. The *galpões* should be elevated off the ground about a meter high; walls and floors must have spacing between the wooden boards of 1.5 cm to facilitate ventilation (APIZ, 2008). The producers-collectors, or the associations of producers (when they are organized, for instance, in cooperatives), usually do not target directly to the market, but they sell their products to intermediaries, said *regattãos*. *Regattãos* haul and resale forest products with low added value, establishing a bridge between the raw producers and the market. In general, they do not add any treatment to the products, so that their radius of action focuses on the intermediate levels of the chain (Pinto *et al.*, 2010). To be no more dependent on the figure of the intermediaries and get a fair price on the sale of Brazil-nut is the great dream as well as one of the biggest claims of the forest people. What are needed are a better organization of the communities and their associations, higher regulatory requirements and taxation, and the establishment of favourable partnerships (APIZ, 2008). The further passage of the Brazilian nut production chain, before reaching the final consumers, is represented by industries and factories of different level. These

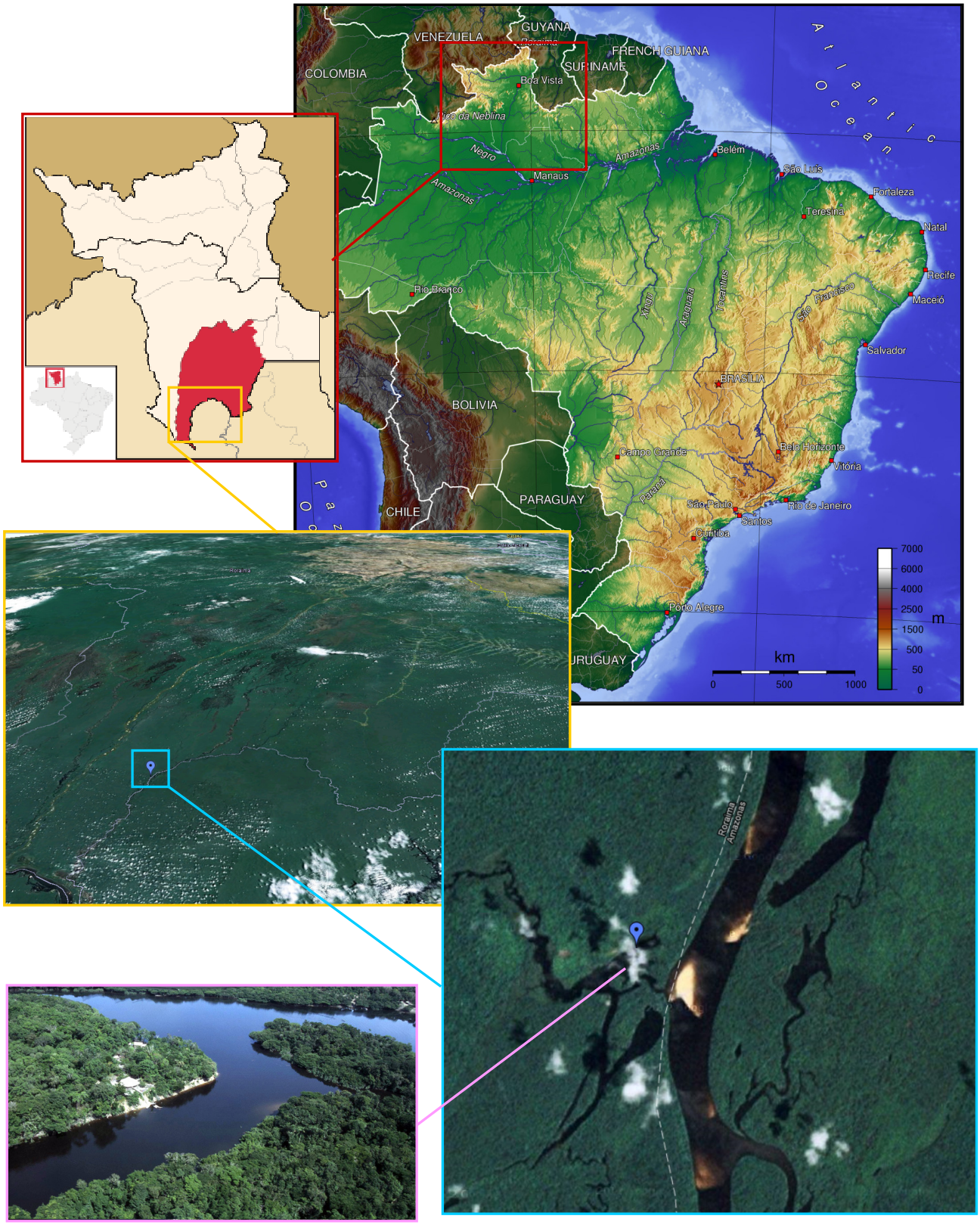
Fig.20 A. Portaccio, stove effect warehouse for the nuts' drying

latter operate more intensely in the manufacture of products with higher added value (i.e.: food-products, phytotherapeutic and phytocosmetic products).

Fig 21 Brazilian nuts with and without the rind

In 1976, the Brazilian Ministry of Agriculture, Livestock and Supply (MAPA) has developed some criteria in order to standardize, classify and trade the Brazil-nut in the internal market (MAP Decree n. 846/1976). The nuts were classified into groups, subgroups, size classes and quality types (Pinto *et al*., 2010). At the supermarkets as well as in the foreign market, the more sold Brazilian nuts types are those still having the outer rind (*castanha com casca*), which can be natural or dehydrated, and the nuts without the outer rind and with or without the internal brown film (*castanha descascada*). Furthermore, the nuts can be sold in bulk bags (20 kg) or in smaller bags. Recently, as widely used and employed, even the more elaborated products as the Brazilian nut oil, can be found in the market (APIZ, 2008; Pinto *et al.*, 2010).

Annex II – The Xixuau project area geographic location



In the black square: Brazil and the localization of Roraima; in the red square the province of Roranopolis is highlighted in red; in the yellow and light blues squares the position of the Xixuau village is pinpointed respectively referring to the boundaries between Amazonas and Roraima and to the Rio Jauaperí; in the pink square an aerial photo taken in 2002 showing a glimpse of the lake bank where the Xixuau village is settled.

Annex III – The *Terras devolutas* land tenure issue

In the Brazilian Federal legislation, the 5th article of the Decree-Law n. 9.760[63] of September, the 5th, 1946, defines "*terras devolutas*" (which can be translated in English as "vacant lands" – Lopes and Barbosa, 2006) as those public lands/properties that have never been legitimately incorporated into the private domain, even when they were occupied. Although they belong to the public lands category, the *terras devolutas* are characterized by the lack of determination and the absence of a precise public destination for the use of the good. In fact, they are not applied to any kind of public use neither federal nor state, nor provincial (Hermida, 2012). They are included in the dominical (*dominiais*) goods (Amorim, 2010; Lopes and Barbosa, 2006), or rather those public goods which are alienable by the Administration. It is difficult to well conceptualize the *terra devoluta* because its definition can only be made by exclusion and its main characteristic is the total absence of a title (Fabricio, 1981). To really understand the underlying concept, it is important to investigate the historical past Brazilian land tenure organization. The origin of this term dates back to the period of the conquest of Brazil by the Portuguese (1530), who decided to administrate the overseas colonies using their same feudal tenure system (*sistema sesmarial*). The distribution of productive lands was assessed by the Portuguese Crown, which directly accorded the land ownership rights (*sesmarias*) to lords, who could benefit as they pleased. This system's main aim was to stimulate the production: therefore, as soon as the owner of the land did not meet the deadlines of production to which the land was finalized, the right of possession could be withdrawn. The lands which were returned to the State as well as those which remained not assigned constituted the *terras devolutas*. After the independence of Brazil, achieved in 1822, all the territories became Brazilian State's properties. But only in 1850, with the Land Law n. 601 (*Lei de Terras*), the notaries and governmental institutions began to formulate rules for the land occupation. This law aimed to occupy free lands and give the property to particulars. By doing so, it was instituted the regularization of existing lands and the transmission by means of buying and selling. Private lands would be registered and, by exclusion, the unregistered lands would be the free lands that belonged to the State (*terras devolutas*) (Reydon *et al*., 2013). In the past as in the present, governments, theoretically, have always had legal means to distribute the lands to privates, but in practice such lands have been more often subjected to misappropriation (Bellassen *et al*., 2008). This fraudulent activity was called *grilagem*, from the term *grilo*, which means cricket. This because the swindlers' technique consisted of giving the false appearance of old documents to the recently made papers, putting them in closed drawers with several crickets. Weeks later, the false documents presented-dull-yellow spots ferruginous arising from feces of insects, and this, in addition to the presence of small holes on the surface and edges corroded, was supposed to indicate the ageing action[64]. The so called *grileiros* could therefore pretend to have a previous legitimate title to the lands in order to be recognized as their owners (Holston, 2008). Because of this phenomenon and because of a legal regulation of public lands full of gaps and shortcomings, the problems of bad land distribution in Brazil still remain unsolved (Amorim, 2010). In fact, Brazil is one of the countries with the highest land concentration (Reydon *et al.,* 2013): in 2009 the INCRA, the National Institute for Agrarian Reform, provided disturbing data: 1.6% of owners with

[63] Art 5/Decree-Law n. 9.760/46 "Provisions relating to the real estate and other measures" (www.planalto.gov.br/ccivil_03/decreto-lei/del9760.htm)

[64] www.multimidia.brasil.gov.br/regularizacaofundiaria/texto-grilagem.html

properties larger than a thousand hectares had 46.8% of the total area in the country, 51.4% of properties classified as large properties were unproductive. This means that more than 133 million hectares of land were still not meeting the productivity requirements and could have been expropriated for agrarian reform, according to the Constitution[65]. Furthermore, the lands remaining as *terras devolutas* are essentially abandoned, due to the inappropriate legal systems where often the State law clashes with the Federal law (Lopes and Barbosa, 2006). Numerous social conflicts have taken place over the years and still continue as a prove that the legitimacy of the *terras devolutas* tenure is still needed.

In 1984 the "*Movimento Sem-Terra*" (MST) was born as social organization of the landless, who were forced to work the land to the other under the most different forms such as sharecroppers, renters, or as mere employees. To solve their problems, they understood that the only solution was to own the land where you work. The MST was born as a form of consciousness-raising and organization of farmers who have seen that the ownership of a piece of land, could free themselves from exploitation by landowners and begin to organize their lives and those of their families in order to progress. Owning a piece of land meant to have work, food, income; living in a rural community meant to create minimum services for a decent life[66]. The land tenure issue results as a bigger social problem: the homelessness, which is a problem for a large part of the Brazilian population, creates other social encumbrance, such as violence and marginalization (Amorim, 2010).

Fig 22 Grilagem de terra www.ambiente.hsw.uol.com.br/grilagem.htm

Fig 23 A manifestation of the landless movement www.acervoescolar.com.br/historia-do-movimento-dos-trabalhadores-sem-terra-mst)

[65] www.comitatomst.it/node/882

[66] www.ipsaa.it/espdid/edpace01/material/matbr9.htm, www.mst.org.br

Annex IV – Check list

1A – PROJECT ELIGIBILITY: requirements to comply with the projects for the reduction of deforestation and degradation in the call Trento			
INDICATORS	**VERIFIER(S)**	**NOTES & COMMENTS**	***SCORE***
1a.1 - The area has not been deforested in the 10 years previously the starting data of the project and it will not be deforested because of the activities of the project		↓ ***Overall criterion score →***	
Evidence of lack of past or future deforestation	Satellite maps available at the site INPE; field survey: verification of deforested areas or activities that involve deforestation; official documents about the recent land-use		
1a.2 - Not more than 5% of the area was normally intended for farming for the food production before the project implementation		↓ ***Overall criterion score →***	
Absence of any agricultural areas and infrastructures, if present, its features have to accord to the criterion	Field survey; maps; official land-use documentation		
1a.3 - The area is not a wetland, which would be affected by the project, and it isn't an area protected by a regime that prohibits or that already makes mandatory the project actions		↓ ***Overall criterion score →***	
Absence of wetlands or protected areas in the project area	Maps and land cover data by the INPE, Greenpeace and CPRM; eventual legislations or official reports about protected areas in Roraima state; field survey; IBAMA website		
1a.4 - The project area is currently accessible and degradable by the different agents that might affect the area		↓ ***Overall criterion score →***	
Discrete to high potentiality of the degradation agents and alarming vulnerability of the area	Satellite maps; deforestation future projections of SimAmazonia I; field survey; discussion with local community; interview with the IDESAM representative		
1a.5 - The project activity must concern the sustainable management of a forest, as defined in the KP		↓ ***Overall criterion score →***	
"Forest" is a minimum area of land of 0.05-(1.0) hectares with tree crown cover (or equivalent stocking level) of more than 10-(30)% with trees with the potential to reach a minimum height of (2)-5 m at maturity *in situ*. Young plantations, growing plantations or populations which are below the limits because of exploitation, are included	Satellite maps; inventorial data of other publications for the same type of forest; field survey; field measurements		
1a.6 - The project will not infringe a private property or a community property or a soil with traditional civic uses		↓ ***Overall criterion score →***	

No presence or coincidence with lands which are already private/community property or which are subjected to traditional civic use	Discussion with local community; official documents about land-use			
1a.7 - The project promoters will acquire only the ownership of the carbon credits generated by the project		↓	***Overall criterion score →***	
Absence of other beneficiaries of such credits and absence of other benefits for the promoters beyond the credits	Promoting organization documents; transaction documents or other agreements			
1a.8 – The project activities will not cause a transfer of residence of the local population residing in the target area (see leakage)		↓	***Overall criterion score →***	
No evidence of transfers/moves/changes in the layout of settlements	Field survey; talks with local community; satellite maps; photos or documentation of the previous periods			
1a.9 - The activities in the project area received the approval and authorization of local authorities, including traditional authorities of the community		↓	***Overall criterion score →***	
The activity has been communicated and shared with the local authorities, which understood and approved it	Talks with local community (mainly with the president of the community); agreements or written contracts; disputes/conflicts			
1B - PROJECT ADDITIONALITY: the project represents an alteration of the BAU scenario and all the reduction/prevention of the carbon emissions are attributable to the project activities and couldn't happen without this project implementation				
INDICATORS	**VERIFIER(S)**	**NOTES & COMMENTS**		***SCORE***
1b.1 - The project activities are not tied to a requirement of the law of the host country		↓	***Overall criterion score →***	
Lawlessness about the project activities in the country or state/region/province/area of competence/administrative district (depending on current legislative organization in the host country)	Institutional websites and publications (MMA, ITERAIMA, IBAMA, Roraima Government); interview to the IDESAM representative; CIFOR publications about RED+ activities in Brazil			
1b.2 - Financial demonstration of additionality: without the funding of the PATN the project would not have been implemented		↓	***Overall criterion score →***	
At a baseline level there would have been no available funding to be allocated on behalf of the project activity (absence of other funding or grants to implement the project)	Interview with the promoting organisations: work of habit; discussion with local community: economic organisation; documents establishing funding with the same aim of the project; financial analysis with-without and relatives IRR/NPV etc. financial indexes			
1b.3 - The local population would have no means of economic, technological, professional and institutional capacities to implement this project in an autonomous way (presence of barriers)		↓	***Overall criterion score →***	

1b.3.1 Economical barriers: unfavourable market conditions; state of poverty; not convenient organization of the economic activities; weak local economic-social organization	Discussions with local community (traditional community chief and CoopXixuau directors); promoting associations' representative interviews; FAO statistics; institutional publications/database			
1b.3.2 Technological barriers: lack of appropriate materials/infrastructures (or their low quality/effectiveness/suitability); no facilities to transport and transform products	Discussions with local community; promoting associations' representative interviews; field survey; documentations about the *riberinhos* population (articles, monographies, IDESAM studies)			
1b.1.3 Professional barriers: lack of organization of locals and skilled labour force; not advanced practices/knowledge	Discussions with local community; promoting associations' representative interviews; FAS, FVA and IDESAM publications; interview to the course trainer			
1b.3.4 Institutional barriers: no laws, funding, facilities, aids, obligations imposed/provided by the government; uncertain political context of land use; land tenure issues	Government and institutional websites; interview to the IDESAM representative; CIFOR, CIRAD; FAO or others' documentations/publications; discussions with local community; promoting associations' representative interviews			
1b.4 – Without the project the processes of deforestation would have anyway continued in the concerned area		↓	***Overall criterion score →***	
High level of the involvement of the area in the deforestation process: *1b.4.1* Actual and strong driving deforestation forces in the area or in the surroundings: difficult to eradicate/stop them spontaneously	Discussions with local community; promoting associations' representative interviews; satellite maps; SimAmazonia I forecasts; FAO, IPCC, IDESAM database/point of view (past deforestation evolution and future estimates); scientific articles/publications; development level of the industrial/transport infrastructure sector			
1b.4.2 Proximity to the deforested/degraded areas and high expansion rate of the deforestation factors	Field survey (in the neighbouring areas); past and present satellite maps in comparison; past and forecasting estimates about deforestation (INPE and SimAmazonia I); discussions with local community; promoting associations' representative interviews; interview to the IDESAM representative			
1b.5 - The permanently deforested areas must be clearly separated from those in which the tree cover has been temporarily removed		↓	***Overall criterion score →***	
Clear definition of the land-use of the different subareas in the project site	Field survey; discussions with local community; promoting associations' representative interviews			

2 TERRITORY AND PROJECT AREA DESCRIPTION: **The project report must have related all the right information and the appropriated analysis of the project area conditions/situations**				
INDICATORS	**VERIFIER(S)**	**NOTES & COMMENTS**		***SCORE***
2.1 General information about the project area from a physic and natural point of view		↓	***Overall criterion score →***	
The project promoters have punctually reported the right characteristics of the project area (geographic location and pedologic/geologic/climatic features)	Field survey; scientific bibliography; satellite maps; promoting associations' bibliography of reference			
2.2 - General information about the local community		↓	***Overall criterion score →***	
2.2.1 The project promoters have punctually reported the right information about the local community.	Field survey; discussions with locals; IDESAM publications (i.e. Juma REDD project); scientific articles about Amazon *riberinhos*; promoting associations' bibliography of reference			
2.2.2 The project promoters have punctually reported the right information about the land-use within the project area	Field survey; discussions with locals; IDESAM publications (i.e. Juma REDD project); scientific articles about Amazon *riberinhos*; promoting associations' bibliography of reference			
2.3 - General information about biodiversity of the project area		↓	***Overall criterion score →***	
2.3.1 The project promoters have reported the right information about the ecosystems features and conditions, stressing the presence of ecological indicator and/or interesting species from a scientific/naturalistic point of view	Scientific bibliography (even local); discussions with locals; satellite images; field survey; concerning local and international websites consultation (i.e. FAO; CIFOR, INPA; FVA; WWF-Brazil; Greenpeace; mongabay, *etc.*); promoting associations' bibliography of reference			
2.3.2 The project promoters mentioned the presence of threatened ecosystems or vulnerable/threatened/endangered species	Scientific bibliography (even local); discussions with locals; satellite images; field survey; concerning local and international websites consultation (i.e. IUCN; FAO; CIFOR, INPA; FVA; WWF-Brazil; Greenpeace; mongabay, *etc.*); promoting associations' bibliography of reference			
2.3.3 The project mentioned the presence of eventual zones providing ecological services in the project area	Scientific bibliography (even local); discussions with locals; promoting associations' bibliography of reference			

2.4 - Deforestation's causes and state of progress		↓	***Overall criterion score →***	
2.4.1 Description of the principal immediate deforestation factors and agents	Discussions with locals; articles and publications; CIFOR essays; concerning local and international websites consultation (i.e. FAO; FVA; WWF-Brazil; Greenpeace; mongabay, etc.); IDESAM representative interview; promoting associations' sources			
2.4.2 Entity of deforestation	Discussions with locals (their experience/perception of deforestation); INPE images and data; satellite maps; FVA and Greenpeace maps; articles and publications; regional studies; concerning local and international websites consultation (i.e. FAO; FVA; WWF-Brazil; Greenpeace; mongabay, etc.); promoting associations' sources			
2.4.3 Known long term deforestation risks	SimAmazonia I; Discussions with locals (their experience/perception of deforestation); articles and publications; CIFOR essays; concerning local and international websites consultation (i.e. FAO; FVA; WWF-Brazil; Greenpeace; mongabay, etc.); IDESAM representative interview; promoting associations' sources			
2.5 - Actual carbon stock estimation		↓	***Overall criterion score →***	
Gross amount or diversified estimates for the different vegetation strata of the carbon currently stocked in the project forest	Promoting associations' sources and bibliography of reference; regional/state studies or estimates for the same vegetation types; FAO/IPCC estimates; values used in other REDD project implemented in the Brazilian Amazon (IDESAM); field survey and sample plots measurement results			
2.6 - BAU scenario (situation evolution without the project implementation)		↓	***Overall criterion score →***	
2.6.1 Scenarios at which the project area would probably undergo without the project implementation	INPE data; SimAmazonia I projection; promoting associations' sources; regional/state experiences and studies; IDESAM representative interview			
2.6.2 Influence of the BAU evolution on the local community	INPE data; SimAmazonia I projection; promoting associations' sources; regional/state experiences and studies; CIFOR/FAO essays; discussions with locals; IDESAM representative interview			

3 IMPLEMENTATION METHODOLOGIES: monitoring of the completion and success of the planned activities				
INDICATORS	**VERIFIER(S)**	**NOTES & COMMENTS**		***SCORE***
3.1 - Adoption of adequate and coherent silviculture operations		↓	***Overall criterion score →***	
3.1.1 The right forest stands have been pinpointed and subjected to management	Field survey; discussions with locals; CIFOR, INPA and IBAMA websites research; scientific articles (tropical sylviculture); Juma project document			
3.1.2 The planned management methods have been correctly carried on				
3.1.3 Evidence of the need of special protection measures for certain forest formations/species				
3.2 - The environmental aspects has to be respected in the overall implementation of the projects		↓	***Overall criterion score →***	
3.2.1 Environmentally friendly fight against eventual insects/parasites/pests/weeds	Field survey (state of progress of the activities); documentation of the activities implemented until the inspection time; regulations in force; NGO interview			
3.2.2 Environmentally friendly waste disposal				
3.2.3 Future assessment and control of invasive species				
3.2.4 Right forecast of negative impacts and implementation of avoiding/buffering activities				
3.3 - Valorisation of the socio-economic aspects		↓	***Overall criterion score →***	
3.3.1 Evidence of valorisation and attention towards the locals	Discussions with locals; field survey; documentation of the activities implemented until the inspection time; literature information about involvement of local populations (i.e. CIFOR; FAO; FAS;...); NGOs interview			
3.3.2 Identification of the most sensitive/vulnerable categories of the				

community, measures adopted in order to reduce the eventual negative impact of the project on them				
3.3.3 Creation of employment				
3.3.4 Evidence of the diffusion of knowledge/skills and technologies				
3.4 - Leakage prevention measures adoption		↓	***Overall criterion score →***	
3.4.1 Identification of eventual negative impact on the population because of the project implementation	Discussion with locals; IDESAM representative interview; literature (CIFOR; FAS;…)			
3.4.2 Identification of eventual negative impact on biodiversity because of the project implementation	Field survey; literature; IUCN or WWF websites			
3.4.3 Leakage avoidance/reduction/control measures adopted	NGO interview; literature (state of the art of leakage prevention); field survey			
3.5 - Timing and costs of the project		↓	***Overall criterion score →***	
3.5.1 Check of the main costs items	NGO interview; documentation; field survey (progress of the activities)			
3.5.2 Respect of timing of the different project implementation phases				

4 *EX ANTE* ESTIMATE OF THE CARBON CREDITS OFFSET: according to the reduced/avoided emissions because of the project implementation, the correspondent carbon credits will be computed making the correspondence 1 tC = 1 credit				
INDICATORS	**VERIFIER(S)**	**NOTES & COMMENTS**		***SCORE***
4.1 - Baseline scenario: probable future evolution of the business as usual conditions and related evolution of the carbon stock during the project implementation period		↓	***Overall criterion score →***	
Basing on the entity and the rate of deforestation and the major drivers in force, the total variation of the carbon stock has to be evaluated during the project implementation period (at least 20 years) considering the absence of the project activities	veracity of the sources of the project document; literature; INPE maps and database; INPA thesis and publications; SimAmazonia I; FAO and IPCC estimates			
4.2 - Project scenario: evaluation of the carbon stock obtained with the project implementation		↓	***Overall criterion score →***	
The total carbon stocked thanks to the project activity has to be evaluated according to the most suitable values	veracity of the sources of the project document; standard methodologies; field survey; NGO interview	È QUI IL PUNTO IN CUI PARLA DI FOR COET E		
4.3 - Taking into account of the leakage effect		↓	***Overall criterion score →***	
The eventual activities dislocated because of the project, has to be identified and their entity and the consequent carbon emissions has to be punctually computed	field survey; discussions with locals; publications about other REDD+ projects in Brazil			
4.4 - Project emissions		↓	***Overall criterion score →***	
The eventual emissions due to the project activities has been correctly considered and evaluated	field survey; NGO interview; project activities documentation; CO2 emissions calculator; discussions with locals			
4.5 - Computation of the carbon credits obtained with the project implementation		↓	***Overall criterion score →***	
The conservatively evaluated credits have to correspond to the tonnes of carbon stocked with the carbon project, obviously discounted of the carbon stocked in the BAU scenario and the emissions due to the leakage and the project activities	standard methodologies about voluntary carbon compensation projects; project calculation sheet; conservativeness of the estimates			

5A PERMANENCE: the validity of the carbon credits is guaranteed by the permanence in the long run of the project scenario within the project area				
INDICATORS	**VERIFIER(S)**	**NOTES & COMMENTS**		***SCORE***
5a.1 - Biodiversity safeguard		↓	***Overall criterion***	

			score →	
The implemented technologies and methods are suitable for the biodiversity protection in the project area	Field survey; literature and competent organizations'/agencies' websites (IUCN; WWF;…); IDESAM representative interview			
5a.2 - Adequate disclosure to the local community of knowledge and skills about the sustainable management of resources		↓	***Overall criterion score →***	
Local population have actually enriched their knowledge and improved their techniques of sustainable management of the natural resources	Discussions with locals; project activities documentation; courses trainer interview; competent organizations'/agencies' websites (FVA; FAS; FAO;…) consultation			
5a.3 - Adequate internal resources		↓	***Overall criterion score →***	
The promoters showed to well manage the project, to adequately know the project local reality; and to be composed of a qualified staff	Field survey; discussions with locals; NGOs and courses trainers interview; project activities documentation			
5a.4 - Relations of cooperation, harmony and agreement with the local population		↓	***Overall criterion score →***	
The promoters showed to be sufficiently integrated in the host community and there are evidences of a high level of engagement of the population. All the right institutions/entities have been involved and the knowledge exchange/disclosure methodologies were adequate	Discussions with locals; project activities documentation; courses trainer interview; competent organizations'/agencies' websites (FVA; FAS; FAO;…) consultation; FAO/CIFOR publications			
5a.5 - Guarantees that the local population/institutions will maintain and protect the forest		↓	***Overall criterion score →***	
Evidences that population and the local institutions will continue to protect the forest during the project implementation period, even because the instruments and the methods divulgated are sustainable, adequate and long-lasting	Discussions with locals (level of satisfaction and awareness); NGO and courses trainers interviews; IDESAM representative interview; field survey			
5a.6 - Adequate technical capacities of the structures/institutions/organizations/local cooperatives/community associations that have implemented the project		↓	***Overall criterion score →***	
Evidence of experience, adequate tools and skills of the involved organisms	Discussions with locals (AA and CoopXIxuau members mainly); NGOs representatives interviews; courses trainers interview; project activity documentation; field survey (infrastructures' state); literature (FAO; CIFOR;…)			
5a.7 - Appropriate capacities for protection from adversity (parasites, fire, *etc.*).		↓	***Overall criterion score →***	
The probable adversities have been adequately identified and the	Field survey; NGO representatives interview; discussions with			

methods to overcome them have been planned	locals; literature			
5a.8 - Possibility of acquisition of the carbon credits ownership		↓	***Overall criterion score →***	
Evidences that the out coming carbon credits are owned by the local inhabitants and the Trento province can acquire them directly from them	Discussions with locals; NGOs representative interview; IDESAM representative interview; literature (CIFOR, FAO, and others); project activities documentation			
5B MONITORING: the monitoring, reporting and verifying activities have to be carried on in order to guarantee an effective success of the actual benefits out coming from the project				
INDICATORS	**VERIFIER(S)**	**NOTES & COMMENTS**		***SCORE***
5b.1 - Organization and planning of the monitoring activities		↓	***Overall criterion score →***	
Evidence of an actual organization of the monitoring activities (sample plots; meeting and discussions with population; etc.), which timing is properly scheduled	Field survey; NGO and project documentation;			
5b.2 - Carbon stock monitoring		↓	***Overall criterion score →***	
Adequate materials and methods planned/implemented for the monitoring of the carbon stock changes	Field survey; project activities documentations; discussions with locals; NGO representatives interview; literature			
5b.3 - Local community monitoring		↓	***Overall criterion score →***	
Adequate survey methods planned/implemented for the monitoring of the local population involvement and awareness	Discussions with locals; project activities documentations; ; NGO representatives interview; literature; IDESAM representative interview			
5b.4 - Biodiversity monitoring		↓	***Overall criterion score →***	
Adequate materials and methods planned/implemented for the monitoring of the biodiversity effective protection	Field survey; project activities documentations; discussions with locals; NGO representatives interview; literature			
5b.5 - Leakage monitoring		↓	***Overall criterion score →***	
Adequate materials and methods planned/implemented for the monitoring of the leakage effects and reliable sources	Field survey; project activities documentations; discussions with locals; NGO representatives interview; literature			

Annex V – Met and interviewed people

Xixuau community

Elton Leite de Encarnação (Elinho) - *community president, CoopXixuau worker, AA member; participant of the Brazil-Tanzania exchange*
Raimundo Mendonça Horta (Castelo) – *CoopXixuau president, AA treasurer*
Justinho Filho de Souza (Tabaco) - *AA president, CoopXixua director; "Getting REDDy" project coordinator for the AA Brazil section; participant of the Brazil-Tanzania exchange*
Plinio Leite de Encarnação - *AA Vice president, ex Xixuau inhabitant*
Francilane Silva Nascimento (Pelado) – *CoopXixuau finance director; AA second secretary; carpenter; ex Xixuau school teacher*
Carlos Alberto Nascimento (Carlito) – *traditional owner of the castanhal in the REDD project area; Xixuau worker; AA member, veteran Xixuau inhabitant*
Aluísio Barroso Nascimento – *AA member; REDD community promoter, AA vice treasurer, participant of the Brazil-Tanzania exchange*
João Soares Gomes da Silva – *AA member; traditional owner of other lands outside the RED implementation area; veteran Xixuau inhabitant*
José Ferreira Barroso (Barroso) – *community vice president, Xixuau member; AA member; veteran Xixuau inhabitant*
Guide Pereira (Pãolinho) - *AA member; CoopXixuau worker*
Elizama Andrade da Silva – *Community secretary; AA member; CoopXixuau worker*
Francismar Nascimento Silva (Mar) – *not a Xixuau inhabitant but he followed the courses*, *belonging to the regional reality*
Geraldo Ferreira Barroso - *CoopXixuau worker; AA member*
Christopher Clark - *AA secretary; CoopXixuau worker*
Zuila Pereira Gama – *CoopXixuau worker; AA member*
Raimundo Alves Barroso (Guri) – *CoopXixuau worker (naturalistic guide during the forest survey); AA member*
Francinildo Tenorio Silva (Didida) – *Samauma inhabitant, ex CoopXixuau worker, carpenter; owner of a roça in his village*
Valdeci Alves Barroso (Dona Valdé) – *CoopXixuau worker, AA member*
Francisco Alves dos Santos Nascimento (Pim Pim) – *CoopXixuau vice president (naturalistic guide during the forest survey); AA member*
Mariana Dantas Silva - *CoopXixuau worker; AA member*
Queila Leite da Encarnação - *CoopXixuau worker*; *AA member*
Alexandre Soares Nascimento (Mambiti) – *CoopXixuau worker; AA member*;
Jose Gama da Silva (Zezinho) – *CoopXixuau worker and fiscal council responsible, AA member*
Manuel Filho da Souza (Ferro) – *Maral community inhabitant*
Nadia Alves Barroso de Lima – *CoopXixuau worker*
Francineide Santa Luzia – *Xixuau inhabitant, AA member*

Trento Administration

Marcello Scutari - *director of the Territory, Environment and Forest Department of the PATN; curator of the call 2010 and 2012 "Verso una Provincia ad Emissioni Zero"; technical advisor for the emission compensation projects*

Promoting Associations

Chiara Tosi – *Trentino Insieme association secretary; member of the Associação Amazônia NGO; responsible of the project planning and REDD courses trainer*
Emanuela Evangelista – *Coordinator of the Brazilian section of the "Getting REDDy" project; member of the Associação Amazônia NGO; responsible of the project planning and REDD courses trainer*
Rolando Pizzini – *president of the Trentino Insieme association*

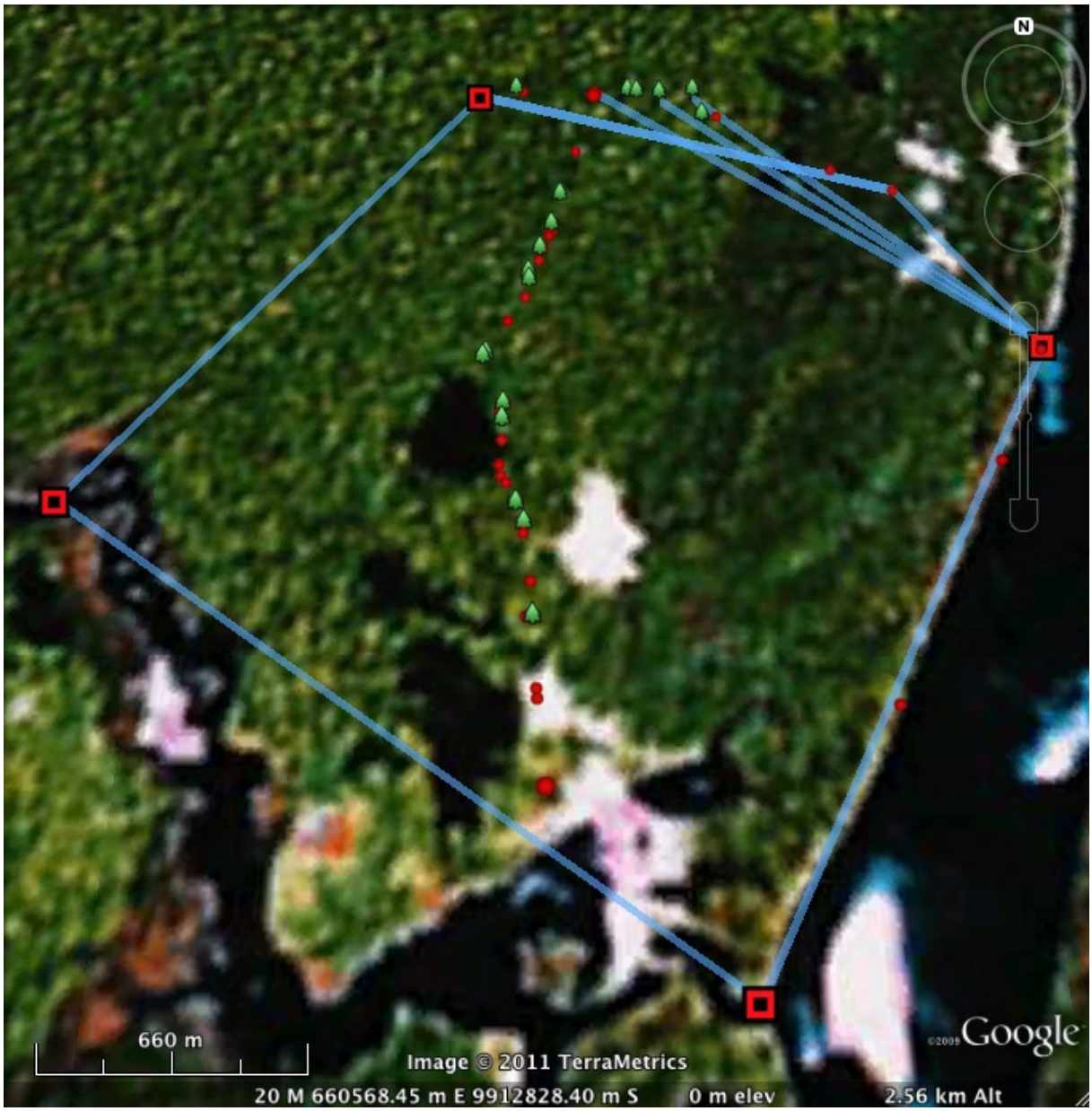
Francesco Rovero - *Biodiversity and Conservation Scientist of the Trento Museum of Natural Sciences; Coordinator of the Tanzanian section of the "Getting REDDy" project*

Others

Pedro Soares – *Coordinator of the "Carbono Neutro" program (PCN) of the IDESAM Amazonas*

Regina Nadaes Marques – *education and awareness REDD courses trainer, president of the cultural association Vagaluna*

Annex VI – Project area satellite image and GPS points



The square drawn in light blue defines the boundaries of the project implementation area. The GPS points, underlined with different symbols, were recorded by the applicants during the project delineation phase. The red spots indicate the trail which crosses the area, while the green trees symbols show the location of some *Bertholletia excelsa* plants. Of course, being along the path, such Brazilian nut plants are the most used by the Xixuau inhabitants during the nut harvesting season, therefore they are the object of the improved forest management activities promoted by the "Getting REDDy" project (source: Google Earth).

Annex VII – Field survey data and analysis

Data collected during the field measurements and the consequent analysis.

plot	species (common name)	crf (cm)	DBH (cm)	biomass/plot [kg]	biomass/plot [t]	biomass/ha [t]	C/ha [t]
1[67]	*tintarana*	91	29,0	596,6	0,597	59,7	28,0
	araça	18	5,7	9,7	0,010	1,0	0,5
	breiero	23	7,3	18,2	0,018	1,8	0,9
	tot values per plot				**0,6**	**62,4**	**29,4**
2	*paracaxi*	96	30,6	682,2	0,7	68,2	32,1
	mata mata	45,5	14,5	103,9	0,1	10,4	4,9
	araça	18	5,7	9,7	0,0	1,0	0,5
	paracaxi	154	49,0	2218,6	2,2	221,9	104,3
	cupiubera	150	47,8	2078,1	2,1	207,8	97,7
	tintarana	196	62,4[68]	4035,2	4,0	179,3	84,3
	cupiarana	102	32,5	794,0	0,8	79,4	37,3
	cupiarana	103	32,8	813,6	0,8	81,4	38,2
	tot values per plot				**10,7**	**849,3**	**399,2**
3	*ibauba*	16,5	5,3	7,8	0,0	0,8	0,4
	tintarana	136	43,3	1628,4	1,6	162,8	76,5
	pao di capoeira	21	6,7	14,4	0,0	1,4	0,7
	pao di capoeira	24	7,6	20,3	0,0	2,0	1,0
	breiero	33	10,5	45,9	0,0	4,6	2,2
	lacri	54	17,2	160,3	0,2	16,0	7,5
	pao di capoeira	38	12,1	65,7	0,1	6,6	3,1
	tintarana	130	41,4	1455,2	1,5	145,5	68,4
	lacri	79	25,2	418,3	0,4	41,8	19,7
	tintarana	187	59,6	3591,8	3,6	159,6	75,0
	tot values per plot				**7,4**	**541,3**	**254,4**
4	*breiero*	24	7,6	20,3	0,0	2,0	1,0
	ripera	24	7,6	20,3	0,0	2,0	1,0
	palmera	100	31,8	755,6	0,8	75,6	35,5
	breiero	22	7,0	16,3	0,0	1,6	0,8
	paracaxi	125	39,8	1319,7	1,3	132,0	62,0
	paracaxi	149	47,5	2043,8	2,0	204,4	96,1
	paracaxi	130	41,4	1455,2	1,5	145,5	68,4
	najazera	92	29,3	613,1	0,6	61,3	28,8
	tot values per plot				**6,2**	**624,4**	**293,5**
5	*paracaxi*	34	10,8	49,5	0,0	5,0	2,3
	paracaxi	23	7,3	18,2	0,0	1,8	0,9
	envira	89	28,3	564,2	0,6	56,4	26,5
	envira	24	7,6	20,3	0,0	2,0	1,0
	paracaxi	21	6,7	14,4	0,0	1,4	0,7
	paracaxi	56	17,8	175,7	0,2	17,6	8,3
	loro	109	34,7	937,4	0,9	93,7	44,1
	inzira	86	27,4	517,7	0,5	51,8	24,3
	loro	91,5	29,1	604,8	0,6	60,5	28,4
	paracaxi	60	19,1	209,2	0,2	20,9	9,8
	everera	85	27,1	502,7	0,5	50,3	23,6
	everera	64	20,4	246,2	0,2	24,6	11,6
	paracaxi	49	15,6	125,3	0,1	12,5	5,9

[67] The plots coloured of yellow belong to the *Igapò* forest type.
[68] The data in red highlight the plant having a dbh wider than 50 cm.

	tot values per plot				**4,0**	**398,6**	**187,3**
6	*paracaxi*	70	22,3	308,5	0,3	30,9	14,5
	envira	61,5	19,6	222,6	0,2	22,3	10,5
	ibauba	86	27,4	517,7	0,5	51,8	24,3
	ibauba	32,5	10,4	44,1	0,0	4,4	2,1
	x[69]	25	8,0	22,6	0,0	2,3	1,1
	inga	22	7,0	16,3	0,0	1,6	0,8
	x	33	10,5	45,9	0,0	4,6	2,2
	canela di velho	23	7,3	18,2	0,0	1,8	0,9
	paracaxi	57,5	18,3	187,8	0,2	18,8	8,8
	ibauba	32	10,2	42,4	0,0	4,2	2,0
	x	17,5	5,6	9,0	0,0	0,9	0,4
	x	38	12,1	65,7	0,1	6,6	3,1
	tot values per plot				**1,5**	**150,1**	**70,5**
7	*x*	24	7,6	20,3	0,0	2,0	1,0
	abiù	48,5	15,4	122,1	0,1	12,2	5,7
	x	110	35,0	959,0	1,0	95,9	45,1
	envira	37,5	11,9	63,5	0,1	6,4	3,0
	envira	35	11,1	53,3	0,1	5,3	2,5
	paracaxì	88	28,0	548,5	0,5	54,8	25,8
	x	28	8,9	30,2	0,0	3,0	1,4
	envira	40,5	12,9	77,3	0,1	7,7	3,6
	x	87,5	27,9	540,7	0,5	54,1	25,4
	envira	85	27,1	502,7	0,5	50,3	23,6
	tot values per plot				**2,9**	**291,8**	**137,1**
8	*loro*	20,5	6,5	13,6	0,0	1,4	0,6
	inga	21	6,7	14,4	0,0	1,4	0,7
	inga	26,5	8,4	26,2	0,0	2,6	1,2
	inga	19,5	6,2	11,9	0,0	1,2	0,6
	x	27,5	8,8	28,8	0,0	2,9	1,4
	castanha	416	132,5	25688,8	25,7	1141,7	536,6
	jutai	27	8,6	27,5	0,0	2,7	1,3
	ibauba	113	36,0	1025,8	1,0	102,6	48,2
	ibauba	100	31,8	755,6	0,8	75,6	35,5
	mata mata	37	11,8	61,4	0,1	6,1	2,9
	araça	34,5	11,0	51,4	0,1	5,1	2,4
	tot values per plot				**27,7**	**1343,4**	**631,4**
9	*ibauba*	20	6,4	12,7	0,0	1,3	0,6
	ibauba	17,5	5,6	9,0	0,0	0,9	0,4
	envira	52	16,6	145,7	0,1	14,6	6,8
	apurui	24,5	7,8	21,4	0,0	2,1	1,0
	envira	81	25,8	445,4	0,4	44,5	20,9
	envira	49	15,6	125,3	0,1	12,5	5,9
	pao morto	18,5	5,9	10,4	0,0	1,0	0,5
	x	22,5	7,2	17,2	0,0	1,7	0,8
	x	150	47,8	2078,1	2,1	207,8	97,7
	tot values per plot				**2,9**	**286,5**	**134,7**
10	*x*	42	13,4	84,8	0,1	8,5	4,0
	abiù	18	5,7	9,7	0,0	1,0	0,5
	envira	59	18,8	200,5	0,2	20,0	9,4
	mata mata	34	10,8	49,5	0,0	5,0	2,3

[69] The species of the plants marked with a “x” couldn’t be recognized by the guide.

	canela de velho	24	7,6	20,3	0,0	2,0	1,0
	envira	28	8,9	30,2	0,0	3,0	1,4
	tot values per plot				**0,4**	**39,5**	**18,6**
11	*açai*	19	6,1	11,2	0,0	1,1	0,5
	açai	50	15,9	131,9	0,1	13,2	6,2
	x	77	24,5	392,2	0,4	39,2	18,4
	envira	21	6,7	14,4	0,0	1,4	0,7
	mata mata	27,5	8,8	28,8	0,0	2,9	1,4
	abiorana	19,5	6,2	11,9	0,0	1,2	0,6
	x	132	42,0	1511,7	1,5	151,2	71,0
	paracaxi	95	30,3	664,5	0,7	66,4	31,2
	mata mata	22	7,0	16,3	0,0	1,6	0,8
	envira	18	5,7	9,7	0,0	1,0	0,5
	tot values per plot				**2,8**	**279,3**	**131,2**
12	*envira*	53	16,9	152,9	0,2	15,3	7,2
	açai	42	13,4	84,8	0,1	8,5	4,0
	paracaxì	27	8,6	27,5	0,0	2,7	1,3
	mata mata	30	9,6	36,0	0,0	3,6	1,7
	envira	23	7,3	18,2	0,0	1,8	0,9
	paracaxì	67	21,3	276,3	0,3	27,6	13,0
	paracaxì	18	5,7	9,7	0,0	1,0	0,5
	loro	18	5,7	9,7	0,0	1,0	0,5
	araça	23	7,3	18,2	0,0	1,8	0,9
	canela de velho	22	7,0	16,3	0,0	1,6	0,8
	x	34	10,8	49,5	0,0	5,0	2,3
	x	16,5	5,3	7,8	0,0	0,8	0,4
	apuruì	49	15,6	125,3	0,1	12,5	5,9
	abiorana	92	29,3	613,1	0,6	61,3	28,8
	paracaxì	21	6,7	14,4	0,0	1,4	0,7
	paracaxì	52	16,6	145,7	0,1	14,6	6,8
	envira	94	29,9	647,1	0,6	64,7	30,4
	x	20	6,4	12,7	0,0	1,3	0,6
	envira	46,5	14,8	109,7	0,1	11,0	5,2
	abiorana	31	9,9	39,1	0,0	3,9	1,8
	paracaxì	21	6,7	14,4	0,0	1,4	0,7
	tot values per plot				**2,4**	**242,8**	**114,1**

Average C content per hectare [t]	**200,1**
Standard deviation of the plots' C content	**174,96**

Number of plots necessary for a sampling activity in the project area, in the case we consider a non stratified forest or a forest proportionally stratified in *Igapò* and *Terra firme* vegetation types.

	Non stratified	**Igapò ⅓**	**Terra Firme ⅔**	**Igapò ¼**	**Terra firme 3/4**
e%	0,2	0,2	0,2	0,2	0,2
E	40,02467184	45,53297085	38,18857217	45,53297085	38,18857217
N	16066,66667	5355,555556	10711,11111	4016,666667	12050
s	174,964522	186,3434141	181,7472668	186,3434141	181,7472668
t	2	2	2	2	2
n	**76,1**	**83,4**		**83,1**	

Annex VIII – Photos

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1) Portaccio A., view from the canoe in the Rio Jauaperì near Samauma.
2) Espinosa K., children playing near the beaches formed during the dry season.
3) A tropical thunderstorm on the Rio Jauaperì (www.amazoniabr.org/it/).

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4) Portaccio A.,the bank of the Xixuau village.
5) Portaccio A., the traditional *malocas*.
6) Portaccio A., a recreational moment in the centre of the village.

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7) Portaccio A., the office and computer centre of the Xixuau.
8) Portaccio A., the Xixuau school.
9) The Xixuau clinic (www.amazoniabr.org/it/).
10) The community boat "*Certeza*" (www.amazoniabr.org/it/).
11) Espinosa K., the traditional canoe.
12) Portaccio A., the aluminium *voadeira*.
13) Portaccio A., the powered canoe (*rabeta*).

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14) Portaccio A., handcrafts' making.
15) Portaccio A., the women of the village selling the handcrafts.
16) Portaccio a., the abandoned station for the extraction of the cassava's *farinha*.
17) Portaccio A., grilling fish on the beach.
18) Portaccio A., when captured, fishes are suddenly killed to make them suffer the minimum as possible.
19) Portaccio A., fishing with the pitchfork.

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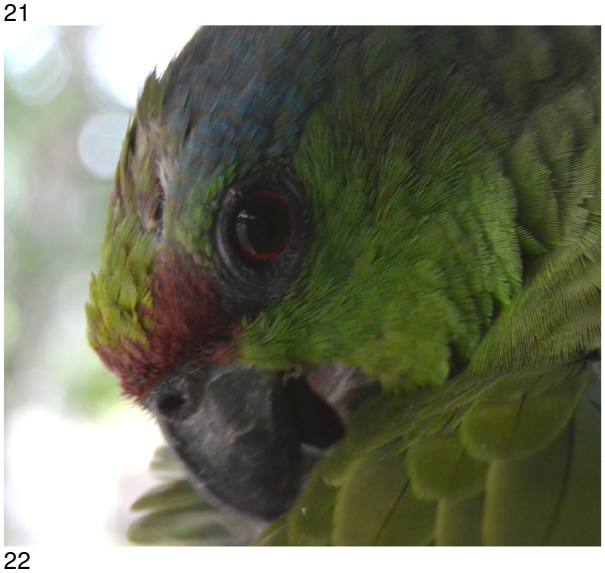

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20) Espinosa K., *tukunaré* fish.
21) Espinosa K., river dolphin in the Xixuau lake.
22) Portaccio A, Louro, the Amazon parrot living in the Xixuau village.

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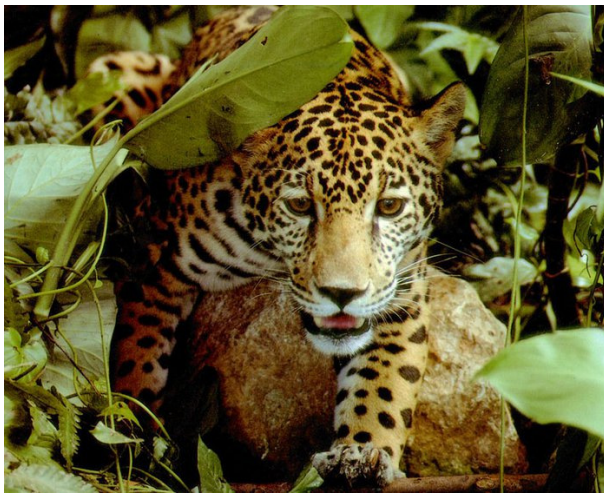
23) Espinosa K., a lizard photographed in the project forest area.
24) Portaccio A., a butterfly photographed in the project forest area.
25) A turtle on the summer river beach (www.amazoniabr.org/it/).



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26) A jaguar in the forest (www.amazoniabr.org/it/).
27) Portaccio A., a group of Giant otters in the Rio Jauaperì.
28) Portaccio A., a wild passion fruit (*maracujà*)
29) Espinosa K., a child of the Xixuau showing the *Bertholletia* flowers
30) Tosi C., nuts' warehouse under construction.
31) Tosi C., the team responsible of the nuts' warehouses construction.
32) Tosi C., "stove" warehouse under construction.
33) Evangelista E., the REDD training courses.
34) Tosi C., training courses with R. Marques.
35) Tosi C., transmission of the knowledge during the training courses.

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36) Tosi C., training courses with R. Marques.
37) Tosi C., training activity about the Jauaperì natural resources.
38) Tosi C., delineation of the project area.

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39) Tosi C., gps localisation of the *Bertholletia* trees in the project area.
40) Tosi C. visit of the Tanzanian Getting REDDy people in the Xixuau.
41) Tosi C. visit of the Tanzanian Getting REDDy people in the Xixuau.
42) Tosi C., visit of the Brazilian Getting REDDy people in Tanzania.
43) Tosi C., visit of the Brazilian Getting REDDy people in Tanzania.
44) Espinosa K., first meeting with the Xixuau inhabitants.

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45) Tosi C., measurement of the dbh during the pre-sampling activity.
46) Portaccio A., sizing the forest plots.
47) Tosi C., measuring the distance between the plots.

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48) Portaccio A., identification of the species during the sampling activity.
49) Tosi C., one day lesson in the Xixuau school.
50) Tosi C., one day lesson in the Xixuau school