Carbon Assessment of Three Pilot Areas of the Guiana Shield Initiative: Iwokrama, Iratapuru and Matavén

A report prepared by
EcoSecurities Consulting Ltd.
for the

Ecological and Financial Sustainable Management of the Guiana Shield Eco-region Project

Implementing Agency: UNDP
Implementing Partner: IUCN Netherlands Committee

April 2009

This project is funded by the
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European Commission (EC)
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This project is funded by the EUROPEAN UNION

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Executive Summary

The importance of forests, in terms of their environmental economics, is underlined by the fact that they are moving centre stage in evolving and emerging environmental markets for ecosystem services. The most prominent of these are carbon markets and related policy developments, which build upon the key role that forests play in global carbon cycles and their influence on planetary climate change. Carbon markets emerged very much in the context of forest conservation and reforestation, and the concept of "carbon offsets" until today, for many is synonymous with the planting of trees or their protection.

Forests are the most extensive ecosystem in the Guiana Shield region. The Guiana Shield Initiative (GSI), managed by the Netherlands Committee for IUCN together with UNDP, has as one of its principal objectives to keep it that way by, *inter alia*, promoting the recognition of the economic value of ecosystem services. The GSI seeks to build up experience with this through entering into service agreements with indigenous stewards of forests for the maintenance of forest ecosystem services in exchange for payments. A number of pilot sites have been selected for this, of which three (Iwokrama, Iratapuru and Matavén) are being assessed for their carbon storage services in this report, as well as for a potential economic value that could be attached to this.

Forests in carbon markets

Though carbon markets in general have taken off successfully and continue to grow, the forestry sector has not yet been able to use this to its advantage. Forestry in regulatory markets has been subject to severe restrictions regarding eligible activities – only afforestation and reforestation (AR) are eligible under the CDM, as avoided deforestation was excluded in 2001 – and regarding market access – forestry CDM credits are still excluded from the EU ETS. Due to an overly strict approval process and the creation of expiring credits for which there is very limited demand the CDM also failed to be a financial incentive mechanism for reforestation efforts. At present, forestry projects constitute much less than 1% of the CDM pipeline.

Voluntary forestry offsets represent one of the most prominent sectors in voluntary markets. The relative share and overall number and credit volume of forestry projects is far larger in the voluntary than the CDM market (though still small compared to overall carbon market volumes). Unlike under the CDM, projects are not limited to forest planting but can include avoided deforestation and forest management activities as well.

One hope-bringing theme in current developments in carbon markets and policy is Reducing Emissions from Deforestation and Degradation (REDD). Under this label the protection of tropical forests is being (re)introduced and negotiated as a key component of forthcoming climate regimes, scheduled to replace the current Kyoto Protocol after 2012. The design of a REDD scheme will also be of high relevance for the countries in the Guiana Shield region and for the GSI projects, since REDD, next to the voluntary market, will largely determine whether or not an economic value can be given to their forests.

However, the REDD negotiations are, just like offset markets, focusing on additional emission reductions below a baseline scenario of deforestation and forest degradation.

The (parts of the) countries that comprise the Guiana Shield region have a relatively high forest cover, yet a low deforestation rate. This means that these countries would not be able to benefit from REDD as a financial mechanism (whether market or fund based).

The reason that the additionality principle is taken so seriously both in regulatory and voluntary carbon markets is that in all cases the demand side is driven by the objective of compensating for, or offsetting, greenhouse gas emissions that have taken place. This can only be done by an *additional* emission reduction, not by anything that would have taken place anyhow. For most project-based carbon certification standards both in regulatory and voluntary markets additionality is a key criterion.

Possible alternatives of developing carbon policy and market schemes that are not based on the additionality principle are politically not feasible for the foreseeable future: developing countries selling emission allowances through the adoption of a national target or basing carbon finance for forestry on the accounting of standing carbon stocks. Though the latter is what would make most sense from the forests' perspective and is clearly most in line with the GSI's objectives it will take a lot of effort to change forest carbon thinking away from the current paradigm of additionality.

Assessment of the carbon stocks and baseline of Iratapuru pilot site

Iwokrama

Iwokrama is a protected area in Guyana and is governed by a special government act, which gives it a special status. Its mandate is to show how tropical forests can be conserved and sustainably used to provide ecological, social and economic benefits to local, national and international communities. The Iwokrama Management is allowed to sustainably use the forest resources. Iwokrama's logging operations and management plans are FSC certified since 2007, and according to the management no reported illegal logging or mining activities are taking place within its borders.

The analysis of Iwokrama's baseline scenario results in the conclusion that any potential threats are likely to be kept under control by Iwokrama's management, given its special mandate and its capacity to generate future revenue through sustainable logging practices and to attract complementing financial resources. The conclusion is therefore that the Iwokrama project is not additional in the sense of the carbon market criterion.

Analysis of the carbon stocks in Iwokrama shows that pre-harvesting carbon stocks in the Iwokrama forests is estimated at roughly 116 million tonnes of C. Sustainable harvesting would lead to a net C loss of 581,745 tC at any point in time after reaching full operational capacity. The total C stock after harvesting is then approximately 115.1 m tC.

Iratapuru

The Reserva de Desenvolvimento Sustentavel Iratapuru is a protected area managed by the State Ministry for the Environment of Amapá, Brazil (SEMA). It is entirely covered in virgin rainforest and allows limited economic activities that are in line with the primary objective of conservation. Two communities (San Francisco and San Miguel) live in the reserve or utilise it, living off subsistence farming, hunting, fishing and Brazil nut collection.

The main potential baseline threats to the Iratapuru reserve were identified as being from logging, mining, roads and other infrastructural development and agricultural development. However, analyzing these threats resulted in the conclusion that they were either unlikely (logging, population growth), too speculative to forecast (roads, agricultural development) or likely to be insignificant (mining). There are currently no human interventions that significantly threaten the reserve's carbon stocks and there are no official plans for any such interventions. The Iratapuru reserve can therefore be considered non-additional in the sense of current climate change framework requirements.

The overall Iratapuru forest carbon content was estimated at 256,366,512 tC (180,585,216 tC in biomass + 75,781,296 tC in soils).

Matavén

The Matavén forest is the furthest north eastern section of the Colombian Amazon. It covers about 1.8 million hectare. The whole Matavén forest lies within one indigenous territory, called resguardo indígena (RI). This territory is auto-governed by the indigenous communities in the area, who have organized themselves in the association ACATISEMA. The GSI is seeking to enter into an agreement with ACATISEMA on the continuous conservation and maintenance of ecosystem services of a sub-area of the Matavén forest, called the Brazo Amanavén. This region comprises of still entirely intact forests and has a surface of around 100,000 ha.

Potential threats to the forests of the larger Matavén reserve are expansion of the area under mining concessions, encroachment by neighbouring cattle ranchers (both deemed to be insignificant) and oil exploration and exploitation (too speculative to include in the baseline scenario). None of these threats have any implications for the carbon stocks in the actual pilot area, which has specifically been selected by ACATISEMA for its pristine status and lack of threats. The conclusion is therefore that the Matavén pilot project is non-additional in the sense of current climate change framework requirements.

The overall forest carbon density of the larger Matavén reserve of roughly 1.8 M hectare was estimated at 534,600,000 tC (including biomass and soil carbon). The overall forest carbon density of the Brazo Amanavén pilot project area (roughly 100,000 hectares) was estimated at 29,700,000 tC.

Carbon stock monitoring

The forests of the three pilot sites are untouched primary and it is considered that they contain maximum carbon stocks. In other words, no increase of carbon stocks is expected. Monitoring of carbon stocks can therefore be limited to the monitoring of forest disturbances, i.e. situations where a decrease of stocks occurs. This can be done easily through periodic analysis for forest cover of satellite imagery, such as radar or Landsat TM images.

Situations of forest disturbance are unplanned and unwanted. Any resulting decrease in carbon stocks can therefore not be captured in a systematic monitoring approach. When a disturbance occurs an on-the-ground assessment will need to establish what carbon losses are and further losses or regrowth will need to be captured in an ad-hoc monitoring system with permanent sample plots in combination with remote sensing analysis.

In conclusion, the three GSI pilot projects assessed in this report for their carbon content, Iwokrama, Iratapuru and Matavén, would currently not be able to qualify for any trading of 'credits' due to their non-compliance with the additionality criterion. It is therefore impossible at this stage to attach an economic value to the carbon storage services these projects provide, based on actual carbon market prices. Overall, it seems unlikely that a post-Kyoto REDD deal or voluntary carbon markets will bring much prospect of carbon finance to the Guiana Shield region as a whole.

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1. Introduction

The idea of creating financial incentives for forest conservation – or for environmental stewardship more broadly – has been around for decades. The increasing popularity of the notion to couple the environmental agenda to economic and commercial monetary incentives is based on the recognition that more conventional approaches, such as public funding and regulation, have only delivered limited results. This is particularly true for tropical and developing countries where much of the world's forest carbon, biodiversity and fresh water is concentrated and where environmental destruction has been most severe in recent times. The drive towards more innovative and market-based environmental finance has thus occurred in the context of an accelerating global environmental crisis, compounded by the limited capacity of classic regulatory regimes, both on the global level and within individual countries.

One manifestation of the increasing framing of the natural environment in terms derived from market economics is the term "ecosystem services" (or "environmental services") and the idea that these should be valued in monetary terms through "payments for environmental services" (PES). The services most commonly mentioned in a market context are carbon storage (the focus of this report), biodiversity, erosion control, water purification and flow regulation, and landscape beauty. In many cases, forest ecosystems are the key providers of such services. This significance of forests has been recognized on a local, regional, and global level by the central place they occupy in a number of environmental treaties and regulations. For example, they are seen as a focal area to achieve synergies between the three Rio Conventions (Fehse, 2008, Ebeling et al., 2008).

Forests are definitely the most extensive ecosystem in the Guiana Shield region. The Guiana Shield Initiative (GSI), managed by the Netherlands Committee for IUCN together with UNDP, has as one of its principal objectives to keep it that way by, inter alia, promoting the recognition of the economic value of ecosystem services. The GSI seeks to build up experience with this through entering into service agreements with indigenous stewards of forests for the maintenance of forest ecosystem services in exchange for payments. A number of pilot sites have been selected for this, of which three (Iwokrama, Iratapuru and Matavén) are being assessed for their carbon storage services in this report, as well as for a potential economic value that could be attached to this.

The importance of forests, in terms of their environmental economics, is underlined by the fact that they are moving centre stage in evolving and emerging environmental markets for ecosystem services. The most prominent of these are carbon markets and related policy developments, which build upon the key role that forests play in global carbon cycles and their influence on planetary climate change. Carbon markets emerged very much in the context of forest conservation and reforestation, and the concept of "carbon offsets" until today, for many is synonymous with the planting of trees or their protection.

One central theme in current developments in carbon markets and policy is Reducing Emissions from Deforestation and Degradation (REDD). Under this label the protection of tropical forests is being (re)introduced and negotiated as a key component of forthcoming climate regimes, scheduled to replace the current Kyoto Protocol after 2012. The design of a REDD scheme will also be of high relevance for the countries in the Guiana Shield region and for the GSI projects, since REDD, next to the voluntary market, will largely determine whether or not an economic value can be given to their forests.

Many open questions still exist regarding the current form of a REDD agreement, including uncertainties of how such a scheme may or may not be linked to international regulatory carbon markets. Although it is possible that negotiators might opt for an entirely non-market solution for financing REDD, or for one primarily relying on a dedicated international fund, most indications are that carbon markets will play a central role because of their proven ability to mobilise private sector capital and lead to efficient investments.

But even more important for the Guiana Shield region will be the question of how REDD will deal with countries that have a low deforestation rate, as is the case in the region. The underlying principle of carbon accounting and valuation is currently that a reduction of emissions must take place that is additional to what would have occurred without carbon finance. This issue of additionality features heavily in the discussions in this report.

To put the economic valuation of the carbon stored in the three pilot sites into perspective the report starts in Chapter 2 with a general overview of carbon market evolution, before entering into the specific realm of how the forestry sector is treated in carbon markets and carbon policy. This is then complemented with a discussion of general criteria and requirements that carbon markets impose upon potential suppliers of forest carbon storage services in Chapter 3. The results of the assessment of carbon storage in the forests of Iwokrama, Iratapuru and Matavén, as well as a discussion of their potential baseline scenario and their additionality, are presented in Chapters 4, 5 and 6, respectively. A number of key conclusions are drawn in Chapter 7.

2. Forest conservation in current carbon markets and climate change policy

This chapter lays out the various aspects of current and emerging regulatory and voluntary carbon markets and the role that forestry, and in particular REDD, plays in them. This discussion helps to understand the important underlying principles along which the different carbon markets function and what this might mean for the GSI countries and pilot projects. The starting point, therefore, is an introduction into the logic and functioning of regulatory carbon markets, and their counterpart, voluntary carbon markets.

2.1. General introduction to carbon markets and climate change policy

Before turning to forestry carbon markets in general, and REDD markets in particular, this section focuses on laying out the underlying principles, current status, and emerging trends of various carbon markets.

2.1.1. Underlying principles of carbon markets

Carbon markets in many ways behave similarly to markets for other commodities, e.g. regarding the way demand and supply-side factors contribute to determining the size of the carbon markets and prevailing prices, but there are definitely some fundamental differences. One of the particularities of carbon markets is the intangible nature of their main traded product, "carbon", which is measured in tons of carbon dioxide-equivalent, **CO_2e** (CO_2 being the main anthropogenic greenhouse gas). This commodity is basically defined and created through rules and regulations (be they voluntary or based on laws and formal agreements). Another defining feature is the extremely important role of regulation in shaping supply, demand, and the trading framework on these markets – public regulation in the case of the main, regulatory, carbon markets and voluntary standards and commitments for voluntary markets.

The most important factor creating a **demand** for any type of carbon credit in the regulatory markets is a mandated emission reduction target. In many countries, most notably the European Union member states, the international targets adopted by national governments under the Kyoto Protocol are passed on to domestic emitters who then either have to reduce their own emissions or complement their internal reduction measures by purchasing carbon credits from third parties.

In contrast, voluntary market demand is created by a range of factors, including corporate social responsibility (CSR), individual ethics, public relations and corporate branding, sustainability reporting and anticipation of future regulation (Hamilton et al., 2007). The latter is particularly relevant in the US where many stakeholders are expecting (or already experiencing) the onset of regulatory emission reduction targets and want to prepare for these ("pre-compliance").

There are two basic sources of **supply** of carbon credits. The first of these is the sale of credits from entities that have been allocated a certain amount of emission allowances (mainly Annex-I governments under Kyoto and private companies under Emission Trading Schemes (ETS) in the EU and US). If such entities manage to emit less than what they have been allocated they can sell their excess allowances to other entities that have emitted more than what is covered by their allowances. The second source are credits generated from emission reduction ("offset") projects, mainly CDM and JI projects and emission reduction projects in the voluntary carbon markets. These latter types of "offset" credits are the main focus of this report (a brief discussion of the criteria and requirements for creating offsets under different standards is presented in Chapter 3). Markets for emission allowances and for project-based credits are fundamentally different in several aspects, although it is possible to link them. For instance, CDM credits can be used for compliance under the EU ETS and the EU linking directive provides the legal basis for this practice (Ebeling et al., 2008a).

Prices for carbon credits are determined by the interplay of supply and demand, and they differ depending on the exact type of carbon credits (e.g. if and under which scheme they can be used for compliance purposes) and its quality.

Depending on the market context a user of a carbon credit may be interested in the specific qualities of projects or be willing to simply buy “any” credit for mandatory compliance, including from a project-blind portfolio of projects. Certain **co-benefits** may be particularly valued by a carbon credit buyer who also wants to foster sustainable development, e.g. because of marketing concerns or corporate policy commitments.

2.1.2. Regulatory versus voluntary carbon markets

As mentioned above, regulatory and voluntary carbon markets differ fundamentally in the underlying motivation of carbon credit buyers. In a nutshell, compliance buyers buy credits because they are forced to do so by law in order to comply with legal targets. In contrast, voluntary carbon buyers are driven in their decisions by voluntary commitments to reduce emissions, e.g. for CSR or PR reasons.

The basis for international **regulatory markets** for greenhouse gas emission reductions was laid in 1997 when most of the world’s nations agreed to sign the Kyoto Protocol. This agreement, in its “Annex B”, established quantified emission reduction obligations for the industrialised countries which had previously signed the United Nations Framework Convention on Climate Change (UNFCCC) (the so-called “Annex I countries” of that convention). Most developing countries are similarly Parties to the UNFCCC and the Kyoto Protocol but do not have emission reduction targets (hence they are referred to as “Non-Annex I countries’).

The Kyoto Protocol also established three “flexible mechanisms” through which emission reduction projects can be implemented in countries where it is most economically efficient to do so, while at the same time aiming to contribute to sustainable development in these countries. These mechanisms are “International Emission Trading”, which allows for the trading of emission allowances between Annex-I governments, “Joint Implementation (JI)”, which allows crediting of emission reduction projects implemented in other Annex-I countries, and the “Clean Development Mechanism (CDM)”, which allows crediting of emission reduction projects implemented in developing countries.

The Protocol did not become legally binding until 2005 (through its ratification by Russia). Recently, doubts have emerged whether Canada, a significant emitter, will honour its Kyoto obligations, and it has also become clear that the Kyoto targets for several Eastern European countries were set high above their actual emissions, resulting in “hot air” (excess carbon credits) that risk flooding the 2008-2012 market. Despite these handicaps, the Kyoto markets appear to be working (see Table below). There has been significant investment into the CDM, with over 4,100 projects under development (as of November 2008), potentially capable of reducing emissions by up to 5.7 Gt CO2e by 2012 (although it is becoming increasingly clear that this potential will not be fully realised (UNEP, 2008).

At present, the largest active carbon market in the world is the EU Emissions Trading Scheme (EU ETS), established in 2005 as a means to help EU Member States meet their Kyoto Protocol targets. The EU ETS has experienced set-backs because of design flaws and the over-allocation of emission allowances, but seems to be maturing and leading to effective emission reductions across major emitting sectors. Recently, a domestic Japanese semi-regulatory market has been emerging, based on targets which build on semi-voluntary commitments by large energy utilities and industrial emitters, designed to help Japan meet its Kyoto targets.

Table 1 – Volume and value of various carbon markets

Source: Adapted from (Capoor and Ambrosi, 2008).

	Volume 2006 ($MtCO_2e$)	Value 2006 (Million USD)	Volume 2007 ($MtCO_2e$)	Value 2007 (Million USD)
EU ETS	1,044	24,436	2,061	50,097
CDM/JI	553	5,945	592	7,875

In parallel to the Kyoto markets a number of non-Kyoto regulatory markets are emerging. These are not directly linked to the Kyoto Protocol but to external governmental regulation for limiting GHG emissions. The non-Kyoto compliance markets include the Australian New South Wales market and emerging markets in the United States, such as the Regional Greenhouse Gas Initiative (RGGI) and the Western Climate Initiative (WCI), which is not yet operational. All of these are small in comparison with the EU ETS and CDM/JI markets. However, the potential for forthcoming US regional and federal markets to reach large volumes exists and already triggered an increasing number of "precompliance" VER purchases by US companies (PointCarbon, 2008).

Participants in **voluntary markets** – individuals, corporations and other organisations – decide to voluntarily purchase carbon credits and to use them as offsets for their own emissions. In particular, concerns about individual air travel and a growing sense of corporate social responsibility (CSR) have fuelled the growth of voluntary markets in recent years with more and more organisations trying to reduce their carbon footprint or even to become "carbon neutral". To date, buyers have been located mainly in the USA (68%) and Europe (28%) (Hamilton et al., 2008).

A growing number of project developers are implementing projects, many of them in developing countries, to create offset credits for the voluntary markets. Long perceived as a mere niche or shadow market of the larger regulated carbon markets, the voluntary market is slowly establishing itself as a significant market in its own right. It is estimated that the value of transactions in the voluntary carbon markets reached USD 330 million in 2007, up from USD 96 million in 2006 (Hamilton et al., 2008). Although rapidly growing, it should be noted that this market remains several orders of magnitude smaller than the regulatory carbon markets. Also, though awareness on quality standards in voluntary markets is increasing, there still remains a high level of opacity regarding the quality and total volume of credits traded. Projects in the voluntary market can be developed using different standards. Currently, the most widely used standards are the Voluntary Carbon Standard (VCS)[1], the Gold Standard[2], and the VER+[3] (see Section3.3).

2.2 Forestry in current carbon markets and climate change policy

Forestry offsets have been at the heart of carbon markets since the beginning in the early '90s and in some ways have maintained a central role until today. As the first carbon offsets in the history of

[1] For more information, visit: http://www.v-c-s.org

[2] For more information, visit: http://www.cdmgoldstandard.org

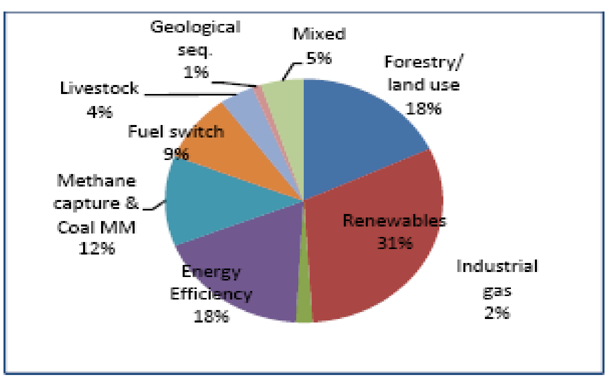
[3] For more information, visit: http://www.netinform.de/GW/files/pdf/VER+%20GHG%2030.pdf

carbon markets involved forest conservation, forestry featured prominently in many debates about the rationale, aims, and legitimacy of Kyoto and its flexible mechanisms, together with the North-South development debate. Forestry projects also continue to constitute the typical offset for many members of the general public and voluntary market buyers. Carbon forestry has always created great hopes because of its potential for environmental and social benefits and its symbolic nature of "repairing" some of the environmental damage inflicted to the Earth; but it has similarly stirred up fierce opposition because of its apparent distraction from industrial emissions, as well as alleged inferiority regarding "safe" and "measurable" emission reductions.

Forestry in regulatory markets has been subject to severe restrictions regarding eligible activities – only afforestation and reforestation (AR) are eligible under the CDM, as avoided deforestation was excluded in 2001 – and regarding market access – forestry CDM credits are still excluded from the EU ETS. Due to an overly strict approval process and the creation of expiring credits for which there is very limited demand the CDM also failed to be a financial incentive mechanism for reforestation efforts. As of April 2009, there were still only three registered AR project with 15 being at somewhat advanced development stages (i.e. validation or PDD[4] development stage). At present, forestry projects constitute much less than 1% of the CDM pipeline.

Voluntary forestry offsets represent one of the most prominent sectors in voluntary markets. Projects involving tree planting and forest conservation continue to be very popular and made up an estimated 36% of voluntary market transactions in 2006 (Hamilton et al., 2007). 2007 saw this market share drop to 18%, mainly due to the vigorous growth of the market in other project categories – overall traded volumes of forestry credits in fact continued to increase (Hamilton et al., 2008). Regardless, the relative share and overall number and credit volume of forestry projects is far larger in the voluntary than the CDM market (though still small compared to overall carbon market volumes). Unlike under the CDM, projects are not limited to forest planting but can include avoided deforestation and forest management activities as well (see for example the Voluntary Carbon Standard's forestry guidelines[5]).

Figure 1. Voluntary market transaction volumes by project type in 2007.Adapted from (Hamilton et al., 2008).



[4] Project Design Document
[5] For more information, visit: http://www.v-c-s.org

2.3 What is the outlook for REDD credits?

At the **UNFCCC** CoP13 in Bali 2007, Parties agreed on a road map that should lead to a regulatory system for Reducing Emissions from Deforestation and Degradation (REDD), including rules and modalities, to be adopted at CoP15 in Copenhagen in 2009. In all likelihood, a REDD system will become part of the larger post-Kyoto negotiations and would not enter into force before 2013. Although fundamental choices on the functioning of such a system still need to be made, including whether it should include a carbon trading mechanism or should be fund-based (or a combination), there is a high expectation that it will lead to a UNFCCC-regulated market for avoided deforestation offsets. In the meantime, the Bali road map encourages early action in the form of pilot activities that will allow input from practical experiences into the forthcoming process of defining pertinent regulations.

What this REDD framework will eventually look like will have great implications for the carbon trading potential of avoided deforestation projects.

- First, there is the question of whether an international REDD scheme will allow projects to be credited internationally. The current submissions by UNFCCC parties to the negotiation text shows a strong support for national deforestation baselines to be set for developing countries, and these countries to be issued credits on the basis of their performance against this baseline. The main reasons for national baselines are that national-level leakage from activities can be accounted for and that governments are incentivised to use a range of instruments to tackle deforestation that would be unavailable in a project context. However, should the system focus entirely on national crediting, this would add a significant layer of risk to any investments into avoided deforestation projects, as carbon revenue would be dependent on a host government's setup for passing on benefits from international carbon trading. Consequently, especially countries with poor governance might not see many project-based activities at all.
- Second, there remains uncertainty if early-action projects or activities, developed in a REDD pilot phase before 2013, would comply with the rules and modalities that will finally be adopted. There is a risk that these projects would not be rewarded any credits once a REDD is finally agreed upon, providing a distinct disincentive for early investments.

REDD projects may also feature prominently in **non-Kyoto regulatory markets**. Most importantly, as mentioned above, various sub-national initiatives in the US are rapidly moving through the design phase or have recently become active (e.g. CCAR, WCI, RGGI)[6]. Next to that, a series of federal draft legislative bills have been submitted, most of which would seek to establish a federal cap-and-trade system. Such efforts have received a significant boost after the recent presidential elections and could allow for the use of international project credits, including forestry and REDD. In fact, the US has never experienced the same criticism and hostility of environmental NGOs towards carbon forestry offsets as was the case in Europe, and, e.g. the currently tabled and well-received Waxman-Markey Bill explicitly recognises international forestry credits as eligible offsets. An example of recent supportive developments is an announcement at the State-level conference convened by the Governor of California in November 2008 to develop joint REDD approaches that could be integrated into regional climate schemes.[7]

[6] CCAR stands for *California Climate Action Registry (www.climateregistry.org),* WCI for *Western Climate Initiative (www.westernclimateinitiative.org)*, and RGGI for *Regional Greenhouse Gas Initiative (www.rggi.org).*

[7] See http://gov.ca.gov/press-release/11101. The meeting included an announcement to "… jointly develop rules to ensure that forest-sector emission reductions and sequestration could pass the strict criteria outlined in California's AB 32 Scoping Plan and potentially play a role in the Western Climate Initiative effort".

If the future of REDD projects in regulatory markets is uncertain, the **voluntary markets** are perhaps even more volatile, as is demonstrated by the significant negative effect the recent economic downturn has had on both prices and transacted volume. An economy in recession will allow companies, institutions and individuals less space for spending money on environmental concerns. On the other hand, climate change and emissions footprint concerns seem to have reached the mainstream of thinking in a number of developed countries, and it is likely that others will follow sooner or later.

Although "conservation carbon" remains a very attractive credit type in the eyes of many market players (as clearly demonstrated by the results of a recent comprehensive market survey led by EcoSecurities[8]), forestry offset projects have been exposed to considerable criticisms in voluntary offsetting. The main issues making buyers wary and dampening price expectations relate to the risk of non-permanence of emission reductions, leakage, and carbon accounting questions. It remains to be seen how well the risk-management approaches for forestry projects suggested for example by the VCS (particularly regarding non-permanence) will be accepted by the market. However, the renewed impetus given to avoided deforestation in the UNFCCC policy process is very clearly resonating in voluntary markets.

The further development of voluntary markets matters for REDD for at least three reasons:[9]

- Firstly, voluntary markets can create substantial demand for conservation credits, especially those with strong co-benefits, in their own right.
- Secondly, voluntary markets act as an important bridge between purely voluntary and pre-compliance emission reduction efforts for many companies heading towards regulatory caps (e.g. energy sectors in the US or aviation companies in the EU).
- Thirdly, if no international (UNFCCC) REDD agreement can be reached or if its implementation is significantly delayed, voluntary markets are the main fall-back option for REDD efforts, apart from emerging regional and domestic programmes.

2.4 What is the outlook for countries with high forest cover and low deforestation rates?

As described above, the REDD negotiations are, just like offset markets, focusing on additional emission reductions below a baseline scenario of deforestation and forest degradation. Yet the (parts of the) countries that comprise the Guiana Shield region share a very relevant feature in the REDD debate with a series of other tropical countries (e.g. Papua New Guinea and countries in the Congo basin): they have a low deforestation rate, yet a relatively high forest cover. This means that a) these countries would not be able to benefit from REDD as a financial mechanism (whether market or fund based) for managing their forests sustainably and maintain them even under future pressures; and b) these countries are under threat of becoming a magnet for REDD leakage from other countries, as they offer a refuge for unsustainable logging operations that cannot any longer operate in countries that do receive a financial incentive to maintain their forests.

It is therefore unlikely that a post-Kyoto REDD deal will bring much prospect of carbon finance to the Guiana Shield. It is still possible that a political compromise allocates the Guiana Shield countries

[8] The report of The Forest Carbon Offsetting Survey 2009 conducted by EcoSecurities, Conservation International, The Climate, Community and Biodiversity Alliance and ClimateBiz can be downloaded at www.ecosecurities.com

[9] See (Ebeling et al., 2008a) for further context.

with baselines that deliberately over-estimate future deforestation rates in order to buy support for an overall deal, but this would effectively result in the issuance of ‘hot air’, which buyer countries would be wary of Eastern European countries that were allocated hot air in the first Kyoto commitment period are being required by buyer countries to ‘green’ the purchased AAUs (the Kyoto term for a country’s emission allowances) through special activities that are funded through the carbon deal.

There is a clear perception of being treated unfairly among these countries that are threatened of being excluded from REDD carbon financed, even as they have stepped up their lobby in the UNFCCC process. Outside of this there are also unilateral attempts by governments to garner interest for the services the standing forests of their countries are rendering to the world, albeit not under immediate threat of deforestation. An example is the offer by President Jagdeo of Guyana to the world, and to European governments in particular, to not touch Guyana’s forests in return for financial compensation.

The underlying problem for the Guiana Shield countries is that the current paradigm for REDD is formed by those working with carbon markets, and who therefore think in terms of emissions and emission reductions, rather than by those who work with forests and who tend to think in terms of ecosystem services. In the latter view, forests provide services to nature and mankind continuously when standing (e.g. provide clean water, harbour biodiversity and act as a carbon reservoir) and they are therefore always valuable. By contrast, in the former view the service of carbon storage only becomes valuable if it would have been lost in the baseline scenario. It is the ‘forest as a utility’ view versus the ‘forest conservation as an offset’ view.

Clearly, the offset view seems more logical if it is considered what a REDD credit will be used for, which is to neutralize an ‘over’-emission by any government or company against a set emission reduction target. In this view the near-term effect of the act of offsetting on atmospheric GHG concentrations is evaluated. By preventing an emission that otherwise would have taken place the ‘extra’ emission is allowed, because the reverse situation (i.e. no extra emission but a BAU emission from the forest) would have resulted in the same GHG concentration.

However, though strictly speaking correct, this view is not consequently followed through in UNFCCC climate policy, as what constitutes an ‘over’-emission is determined by an arbitrary emission reduction target, which therefore results in an arbitrary amount of emission allowances. Such allowances can also be used as offsets, regardless of whether the emissions would in reality ever have taken place (if they wouldn’t, one generally speaks of ‘hot air’). Not that ‘hot air’ should be justified, but it demonstrates that a REDD mechanism need not necessarily be designed along the strict interpretation of offsetting as maintained in the CDM. The alternative would be for developing countries to also take on emission reduction targets, which in effect would be a free allocation of emission allowances since these countries still have a development path ahead of them. They could then sell these allowances, unless they squander them by deforesting their own forests. This solution, which is independent of a deforestation baseline scenario, is not on the negotiation table. Developing countries will currently not accept any form of emission reduction targets, which are seen as the sole responsibility of developed countries.

Finally, it should be mentioned that there are also alternative ideas coming forth from the ‘forest as a utility’ view, which are based on rewarding countries for their standing carbon stocks, rather than their reduced emissions. Though in itself logical and appealing, the approach is difficult to reconcile with the way carbon markets and policy are currently set up. In addition, some of those developed countries that will form the core of future demand for credits (e.g. USA, Japan and Germany) are themselves heavily forested. They would naturally demand recognition for their stocks, which could undermine the principal driver of financial transfers as incentives in the fight against climate change.

3. Requirements for generating project-based carbon offsets

This section briefly discusses the most important criteria for the generation of project-based carbon offsets certified by the currently existing and internationally recognized carbon standards. It also describes the importance of verification to ensure quality and credibility of the credit and provides descriptions of the most important standards in both the regulated and voluntary markets.

The basic concept behind carbon offsets is to provide a way for individuals and organisations to compensate for emissions through measures taken externally, in addition to any in-house abatement efforts. In voluntary markets, a buyer will have a choice in which offset to buy and from whom. A number of aspects, which are further discussed in the following sections, are of great influence on this choice:

- *Quality of the offset.* An offset's quality is determined by the criteria that have been applied in its generation, i.e. a framework that determines what can be called an offset and what not, as well as the acceptability of any potential impacts on the environment or humans that the production of the offset may cause.
- *Quality control on the offset.* A provider may claim that a high-quality offset is being created and delivered, but who guarantees that this is indeed so? Most offsets are therefore in one form or another verified in the field. This involves both the verification that the offset has taken place and that it indeed has been achieved using the promised quality criteria.
- *Credibility and acceptability of the offset.* Are the applied quality criteria really good enough? Will others believe in an offset I bought and accept it for my compliance or marketing purposes? A buyer's need to have these questions answered can be met by the application of a widely accepted standard of quality criteria and quality control procedures. Several such standards exist for regulated and voluntary carbon markets, as discussed below.

In compliance markets these aspects are not of relevance, as the choice of which types and quality of offsets are allowed will already have been made by the regulator. It should also be pointed out that not all 'credits' allowed in compliance markets need to be offsets in the sense as described here – they can be allowances or other types of allocated units, as described in the previous chapter.

3.1. Quality criteria

A number of universal quality criteria have emerged over the years in various project-based carbon trading markets, as summarised in the following list:

- Additionality
- Methodologies to account for offsets generated
- Acceptability criteria regarding environmental and socio-economic impacts
- Eligibility criteria

3.1.1. Additionality

This is by far the most important criterion, since it determines whether an offset is really an offset, regardless of its quality. An offset project that is additional must demonstrate that it has occurred as the result of incentives associated with the existence of carbon markets, voluntary or mandatory. The reason for this is that the goal of using the offset is to 'neutralize' an emission that has taken place. This can only be done by an *additional* emission reduction, not by anything that would have taken place anyhow. For an offset project to be registered in the CDM market it is necessary to demonstrate additionality through a number of approved "tests." These tests are designed to act as proxies for determining whether or not a project is beyond "business as usual." The most commonly used test is financial additionality, which is based on the assumption that if a project does not reflect a least-cost option, it is being incentivised by carbon markets. The other is a "barriers test," which allows project proponents to use qualitative "barrier" factors to argue that a project would not have occurred under business as usual. Finally, there is a "common practice" test, which requires an analysis of whether similar actors are doing similar activities as the proposed project, without the incentives of carbon markets, which would indicate a business-as-usual situation.

Additionality is closely linked to the criterion of offset accounting methodologies, as there is a quantitative aspect to additionality. How many additional emission reductions can be claimed from an activity?

3.1.2. Accounting methodologies

The 'business as usual' scenario is also called the 'baseline' scenario: how many emissions would have taken place without the project activity. When comparing the baseline to the emissions in the project scenario, the difference can be claimed as additional reductions. The way the baseline and project scenarios are quantified therefore has a great impact on how many offsets can be sold from an activity. It is therefore unsurprising that quantification methodologies form one of the key qualitative criteria that determine the credibility of an offset. The more parameters involved, the more applicability conditions there are and the more rigorous data requirements are of the methodology, the more credible the offset. In the CDM and VCS (see further below, project validation (= certification) and registration can only be achieved if a pre-approved baseline methodology is used. Such methodologies should also include the accounting for emissions caused by the implementation of the project, both within the project boundary and monitorable, and without and not monitorable. The latter category is commonly referred to as 'leakage'. An example for REDD projects is the displacement of deforestation activities to other forest areas, thereby reducing or negating the net climatic benefit of the project.

3.1.3. Acceptability criteria on environmental and socio-economic impacts

Are any environmental and socio-economic impacts of the project being taken into account? If not, is the offset acceptable if there is a risk of a clash between the desire to buy an offset and the buyer's ethical considerations? A high-quality offset will incorporate these criteria and will seek external statements that impacts are positive, or at worst negligible. For example, in the CDM the approval from the host country government is required who evaluates the project according to the country's criteria for sustainable development. For projects in the land use sector certification according to the standards developed by Climate, Community and Biodiversity Alliance (see below) provides a stamp of approval as to the high sustainable development benefits of the project.

2.1.4. Eligibility criteria

The quality of an offset can be improved by criteria that seek to avoid potentially negative situations, such as the offset providing a perverse incentive to third parties. For instance, reforestation projects could provide an incentive to landowners to first deforest their lands in order to then claim offsets from reforestation. To avoid this situation, the CDM includes a strict eligibility criterion that areas must have been deforested on 31 December, 1989. The VCS applies a moving date of 10 years before project start.

3.2. Quality control

Offsets are more credible if they are verifiable. To do this it is required to monitor the offsetting activities and verify how many of the offsets quantified on paper have really happened in the field. The design and rigour of the monitoring methodology can again impact the number of offsets that are awarded. Therefore, standards like the CDM and VCS require that a project is monitored according to a pre-approved monitoring methodology.

3.3. Credibility and acceptability

The highest level of credibility of an offset is achieved if a widely known and accepted quality standard is applied to a project. This means that a project needs to achieve certification and usually also registration under such a standard. Buying standard-certified offsets is particularly important for those buyers with a high public visibility or that need to comply with emission reduction targets requiring the standard. Below we give an overview of existing regulatory (CDM) and voluntary market standards.

3.3.1. The Clean Development Mechanism

Offset quality is highly formalised and strictly governed under the CDM, whose credits can be used in Kyoto compliance markets. Projects registered under the CDM must be approved by the Executive Board (EB) which requires undergoing a specified project cycle. CDM projects can generate CERs only if they are additional to any that would occur in the absence of the project activity. Those additional emission reductions need to be quantifiable and verifiable. Carbon accounting and monitoring approaches for the different project types have to be laid down in detailed methodologies. In order to claim carbon credits, a methodology approved by the EB has to be used. Altogether, the CDM is a highly regulated, rigorous standard which is very demanding to comply with and entails significant transaction costs.

3.3.2. Voluntary market standards

The very nature of voluntary carbon markets means that basically any kind of offsets can be provided as long as they find a buyer. No central authority is in charge of laying down rules and there is no obligation to comply with any potential standards. Up to this date, no formal standards have been widely agreed for voluntary offsets. In practice, there is a wide range of approaches with offset providers using their own criteria. In some cases these are well-defined, clearly communicated, and even verified by third parties. In other cases, it is not apparent which criteria are used or if well-defined norms exist at all.

The perceived lack of transparency on the voluntary market and related concerns about the integrity of VERs have triggered a trend towards the standardisation of quality assurances. This is especially important for corporate buyers which need to be able to demonstrate that credible offsets have taken place as they face increasing scrutiny by the wider public, their shareholders, and investors regarding their climate change strategies. Individuals or smaller organisations without the same outside pressures to establish the credibility of their offsets may require less stringent standards. Credibility and standardization is also of importance to those pre-compliance buyers that are facing the prospect of government regulation of their emissions and that wish to purchase VERs on a speculative basis, i.e. in the US and Japan. This category of buyers is currently of particular interest for REDD projects, since there are positive signals that such projects may be allowed in the US in a future cap and trade scheme and REDD credits can (still) be obtained cheaply.

The voluntary carbon offset market is currently witnessing a proliferation of efforts to develop consistent quality standards in order to promote markets and improve consumer confidence. The main initiatives are outlined below.

- The Voluntary Carbon Standard (VCS) developed by the International Emissions Trading Association (IETA) and The Climate Group is likely to become the main standard for the offset industry. According to The Climate Group, "the Voluntary Carbon Standard will ensure that all voluntary emissions reductions that meet its criteria are additional and represent real, quantifiable, and permanent emission reductions." The VCS takes many elements of the CDM and transfers them over into the voluntary market (though often providing more pragmatic and less bureaucratic solutions). This can be seen in its approach to additionality, the documentation and calculation of reductions, and the monitoring and verification provisions, involving external auditors. For more information on the VCS see http://www.v-c-s.org/.

- The Voluntary Gold Standard (VGS) has grown out of the CDM Gold Standard which can be applied to CDM projects in addition to Kyoto requirements. The VGS is restricted to renewable energy and energy efficiency projects. Projects have to be approved through a rigorous review process similar to that of the CDM. In addition to aiming at high-quality carbon offsets, the standard contains additional criteria to promote sustainable development benefits. For more information on the VGS see http://www.cdmgoldstandard.org/.

- The Chicago Climate Exchange (CCX) is a voluntary emissions reduction and trading pilot program. A considerable number of private and public institutions and corporations in North America have joined the CCX, committing to GHG reductions over time. They can also take advantage of internal emissions trading within the CCX, involving an exchange platform for VERs. Several offset project types can commercialise credits through the CCX if they conform to basic standards and are audited by accredited organisations. However, the quality of the standards, particularly with regards to additionality, has raised questions about the credibility of the CCX offset system. For more information on the CCX see http://www.chicagoclimatex.com/

- The VER+ standard was developed by TUV SUD, one of the leading companies to validate and verify emission reduction projects for both the Kyoto and voluntary markets. Based on the same principles as the Kyoto mechanisms (CDM and JI), the VER+ provides a platform for emission reduction projects to be verified for the voluntary market. Projects in developing countries are given greater flexibility under the VER+ allowing them to follow not only CDM but also JI guidelines for the generation of VERs. For more information on the VER+ see http://www.tuevsued. de/uploads/images/1179142340972697520616/Standard_VER_e.pdf

- The CCB standard is the result of an effort initiated by the Climate, Community and Biodiversity Alliance (CCBA), a partnership between corporations, research and non-governmental organizations, such as Conservation International, The Nature Conservancy, Weyerhauser, Intel and CATIE. Developed especially for land-based sequestration projects, the CCB standard is particularly focused on the positive social and environmental co-benefits of projects. The CCB standard sets minimum criteria for carbon benefits, though it does not contain a carbon quantification component. It therefore does not verify and issue carbon offsets. For more information on the CCB see http://www.climate-standards.org/

4. Assessment of the carbon potential of Iwokrama, Guyana

4.1. Project description

The Iwokrama Forest is nearly one million acres (371,000 hectares) of central Guyana in northeastern South America (Figure 2). The Forest is bordered to the west by the Pakaraima Mountain range that extends through western Guyana and eastern Venezuela and to the east by the isolated highlands scattered through central-east Guyana, Suriname and French Guiana. It is also bordered by savannahs in the southwest and northeast of Guyana and southwestern Suriname. The area is covered with lush, lowland tropical forest, and dominated by tall tropical trees with a dense canopy 20-30 metres high. The Georgetown-Lethem Road dissects the Forest, traversing about 72km (45 mi.) between the northeastern and southern boundaries.

Iwokrama International Centre has its origins in an offer made in 1989 by then President of Guyana, Desmond Hoyte, on the occasion of the Commonwealth Heads of Government Meeting in Malaysia. Iwokrama's mission is to promote the conservation and the sustainable and equitable use of tropical rain forests in a manner that leads to lasting ecological, economic, and social benefits to the people of Guyana and to the world in general, by undertaking research, training, and the development and dissemination of technologies.

In 1996 the National Assembly (Parliament) of Guyana passed the Iwokrama International Centre for Rain Forest Conservation and Development Act. In 1998 Iwokrama secured significant grants from ITTO, DFID and CIDA. However, from 2003 it witnessed a significant reduction in donor funding, forcing considerable cost cutting as annual operating costs were cut from US$2 million per year to US$1.2 million. A representative of the local North Rupununi communities sits on the International Board of Trustees.

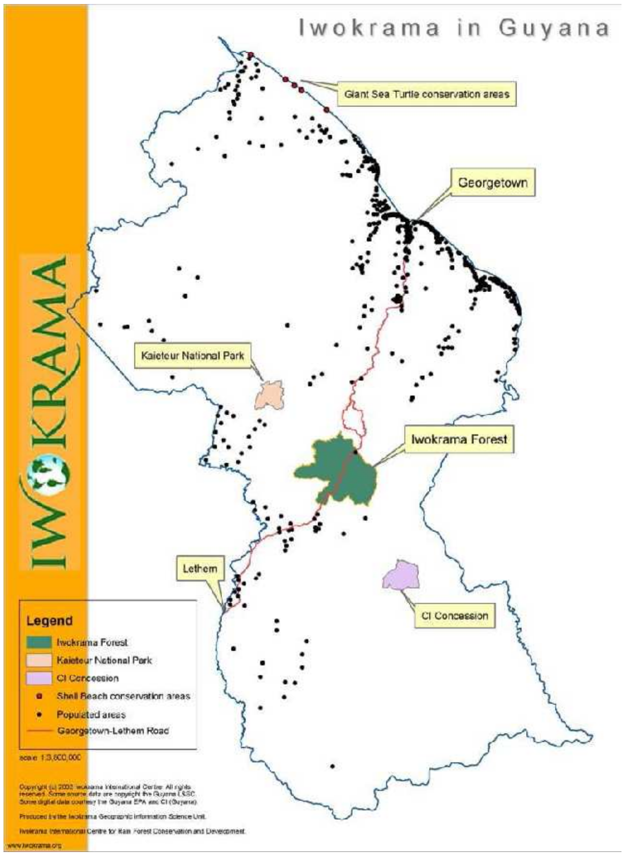
The GSI wishes to enter into an agreement with the Iwokrama International Centre for the continued management and maintenance of the ecosystem services the Iwokrama forest offers.

4.2. Stakeholders

The following actors were identified as stakeholders of the Guyana Shield Initiative in Guyana:

- Government> Forest Commission, DNA
- Iwokrama Forest
- Makushi people of Fairview Village
- Makushi people in the North Rupununi community
- IUCN, UNDP

Figure 2. Location of the Iwokrama Forest in Guyana.



4.3. Baseline

The establishment of a “baseline” or reference scenario of emissions is one of several underlying concepts for credible carbon and non-carbon ecosystem services projects.

Within the carbon markets, the baseline scenario represents forecasted emissions under a business-as-usual scenario, i.e. expected emissions if the emission reduction activities were not implemented. Besides assisting to prove the additionality of a project (see previous chapter), knowing the baseline scenario allows for the calculation of carbon reductions attributable to a project. The difference between the baseline and project scenario is commonly considered the amount of carbon that can be claimed by a project. For a future mechanism on reducing or avoiding deforestation this means that the baseline will most likely be based on historical emission rates, e.g. average emissions during 1990-2005. Any verifiable reduction during the crediting period below this reference scenario would result in carbon credits issued.

In a non-market situation, the baseline should still be determined in order to detect and verify any changes to a pre-project or pre-intervention phase. In the case of the GSI this would mean to determine the current carbon content of Iwokrama’s and also of Guyana’s forests, in order to ensure the existing stock is at least maintained, if not increased by management activities at the pilot site.

Especially in the discussion about reducing emissions from deforestation, the question has been raised whether a national baseline should be used, or whether a project-specific baseline scenario would be more adequate. The latter is expected to better reflect local conditions and capture high-risk areas. However, project baselines cause serious concerns about “leakage”, wherein protecting one piece of forest merely leads to shifting pressure to other forests (Aukland et al., 2003). The use of national reference scenarios on the other hand would account for any in-country leakage between different projects or forest areas (Santilli et al., 2005). This approach thus has the major advantage of making in-country leakage irrelevant; however, the disadvantage is that national baselines may be more difficult to monitor and determine. It is generally understood that relevant national frameworks will not have been developed yet when the first REDD pilot schemes and projects will be implemented, so that these will necessarily need to focus on conservation or forest management projects in key areas. In addition, even under future national baseline approaches, spatially limited projects would likely play a strategic role. The baseline situation as with regards to a potential REDD project on the carbon market is described in the following, both for the national situation as well as for Iwokrama in particular.

4.3.1. National situation

Guyana’s land area covers 21.5 million hectares approximately, of which 16m hectares is forest. The National Forestry Commission (GFC) is responsible for the management of 13.8m hectares out of that area; the rest is indigenous or private land. Guyana's forests are highly biodiverse: the country has some 1,263 known species of amphibians, birds, mammals, and reptiles, and 6,409 species of plants.

Logging concessions currently cover a total area of 6 million hectares, with 4 million hectares large scale concessions and 2 million hectares small scale “State Forest Permissions” (SFPs). A good 50% of state forest area has not been gazetted for concessions so far, and this corresponds to the area that has been offered to the UK government by Guyana’s president.

According to GFC, 1 million hectare of concessions has been granted over the last 5 years, meaning an average of 200,000 hectares new concessions per year.

Historically, Guyana's forests have been lightly exploited, largely due to obsolete equipment and lack of capital, but in the early 1990s the government began to make overtures toward foreign logging firms to harvest the country's "slow growing" and "heavy" hardwoods (ITTO) like greenheart. With the government providing very favourable conditions in form of the lowest logging fees and royalties in the world (about 10% of what most African and Asian countries charged at the time), logging firms soon flooded the country. At the same time illegal chainsaw logging expanded rapidly, and Guyana lost control over its forestry sector. In reaction to the sudden invasion of foreign logging firms, the government issued a three-year moratorium on new logging concessions in 1995, and enacted environmental legislation in order to regain control over the timber industry. With aid from international groups, the Guyanese government increased funding for its forestry commission (GFC) to better monitor logging activities (Butler 2006).

Nowadays, the GFC has established a Code of Practice (www.forestry.gov.gy), which is part of the national legislation and has to be followed by all forestry concessionaires operating in the country. Main features of this Code include a due diligence assessment of logging companies that apply for a concession, as well as technical specifications with regard to forest management, and environmental and social impacts.

These technical requirements include the use of reduced impact logging (RIL) principles, and specify a maximum annual allowable cut (AAC) of 20m^3/ha over a cutting cycle of 60 years. Logging companies are free to calculate different cutting cycles and adjust the AAC accordingly. However, GFC states that this is not commonly done, and forest management plans very often include an AAC of 20m^3, which usually cannot be met. According to forest concessionaires and Iwokrama management (pers. comm.), the maximum that is currently taken out on a national level (i.e., in existing, operational concessions) is 6-8 trees per hectare, comprising a volume of 8-18m3. This is due to two main factors:

- the slow growth of forests on the poor soils of the Guyana Shield region, leading to the presence of many small trees and only few big logs per hectare;
- the presence of only a few marketable species in the forest.

Background research and interviews with national market players showed that taking out more trees is not economically attractive for logging companies; it is difficult to commercialise anything beyond the marketable species, and it is hard to find buyers for smaller trees. In addition, the minimum harvest diameter as per specification of the GFC is 35cm. These factors together with high costs of workforce and transport in Guyana create a situation where the most economical option is indeed reduced impact logging and sustainable forest management with only a fraction of stocks being taken out per hectare and year. Deforestation rates are presently unavailable for Guyana, but they are likely low. In the first half of the 1990s, FAO figures as cited by Butler (2006) show that Guyana lost about 0.3 percent of its forest cover annually, one of the lowest rates in South America.

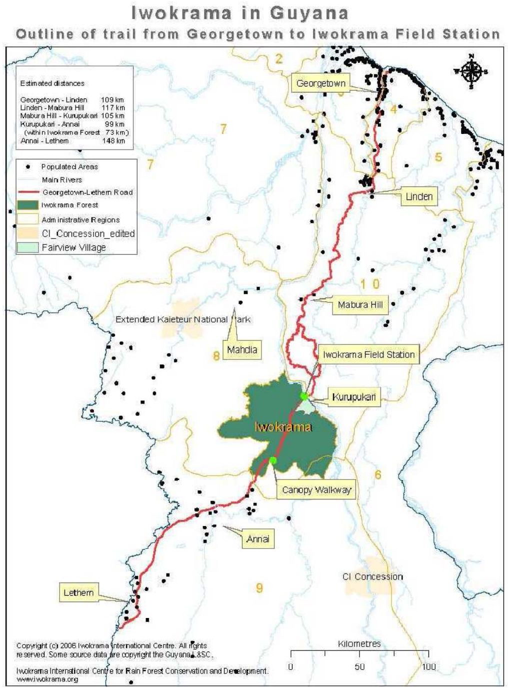
According to estimates from the FAO and the ITTO (as cited in Butler 2006) harvesting is probably 350,000-400,000 m3 per year from the 6 million hectares concession area. These organisations also back the notion that commercial logging is presently limited by lack of infrastructure and high harvesting costs, political uncertainties, and the dispersal of valuable tree stocks over a wide area. As a result, the historical national deforestation baseline is very low, if not negligible.

However, small scale gold mining is a problem in the land use sector. In Guyana, the entire subsurface of state land is available and free for mining, which is not considered a contradiction to forestry activities. Therefore, mining permits are given for the entire state area regardless whether on the same area there are operational forestry concessions. Mining activities are carried out mainly on a small scale, both legally and illegally, by individuals rather than companies. Small scale mining leads to punctual deforestation, since each of the miners is likely to harvest 2-3 trees on and around their claim in order to reach the subsoil, and to meet their demand of fire wood on site. According to the Geology and Mining commission (GGMC), at present there are 1500 small scale miners with legal mining permits. Our meeting showed that there seem to be many more illegal miners that come in from the Brazilian side, who have pretty much uncontrolled access to the forests, since the GGMC has not enough offices throughout the country to reliably monitor mining activities.

Planned future developments such as the upgrade of the main road from Lethem in Brazil to Georgetown might intensify this situation in the coming years (Figure 3). A paved road means better communication, faster reach, and easier access to and from Brazil, leading to more traffic and more uncontrolled activities that are difficult to monitor. This is likely to have impacts both in the amount and volumes of illegal mining activities in the region, as well as for the forestry situation. Forests in the southern regions, which at present are not attractive for exploitation due to high cost, could become more interesting for logging companies with a paved road that reduces transportation times and thus costs for transport from the south to the coast.

In the event of pavement of the road and of increased mining activities a projected national deforestation baseline could be significantly higher than the historical one.

Figure 3. The existing Georgetown-Lethem road, for which upgrading plans exist.



4.3.2. Iwokrama's situation

Iwokrama is one of two designated protected areas in Guyana and is governed by a special government act, which gives it a special status and mandate. Thus Iwokrama's situation is very different from the baseline conditions in the rest of the country.

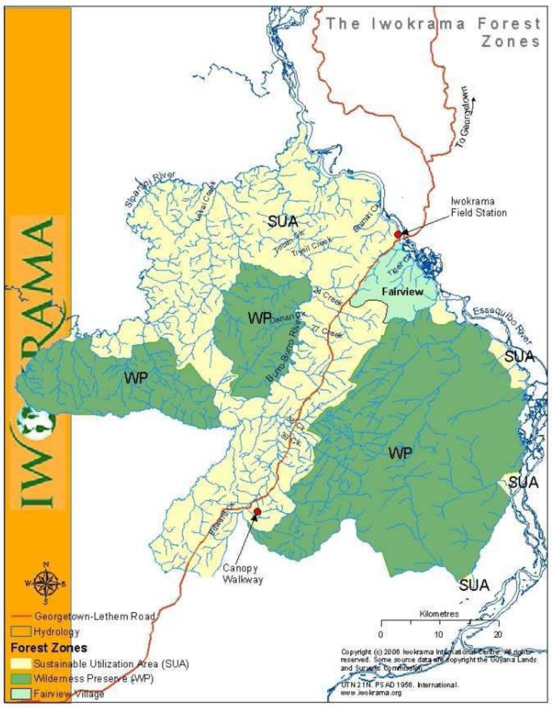
Iwokrama's mandate is to show how tropical forests can be conserved and sustainably used to provide ecological, social and economic benefits to local, national and international communities. The Iwokrama Management is allowed to sustainably use the forest resources. However, neither logging concessions nor mining permits can be granted within the borders of the 1million acre area (371,000 ha). Iwokrama is the best sampled and inventoried forest area in Guyana and has the most comprehensive documentation, field testing and monitoring systems in place. Iwokrama's logging operations and management plans are FSC certified since 2007, and according to the management no reported illegal logging or mining activities are taking place within its borders. Since logging activities are an integral part of Iwokrama's financing structure, it is not likely that they will be ceased in the coming years. The logging target already stated in the management plans is therefore a part of the baseline scenario so that a certain part of timber and carbon stock will be lost every year to these activities.

Iwokrama's management plan divides the total forest area into a Wilderness Preserve (WP) that covers 50.4%, and a Sustainable Use Area (SUA) that covers 49.6% of the total area (Figure 4). Within the SUA, 59% are actually available for logging operations and timber use, which corresponds to 29% of Iwokrama's total area. Within this area, the annual allowable cut has been determined to be 36,330 m^3 per year, which is the maximum amount of timber that will be taken out over a cutting cycle of 60 years. This corresponds to about 8 trees per hectare over 20-30 species. These numbers correspond to the emissions from deforestation occurring in the baseline, and are not expected to increase in future.

So far no uncontrollable illegal activities have been recorded within Iwokrama, although the strict monitoring and patrolling system has encountered sporadic illegal hunting and mining activities. The risk of an increase in these activities could be higher in future, because the main road between Brazil and Georgetown leads through Iwokrama, and an upgrading would also directly affect traffic into and through the forest. The management of Iwokrama sees this as one of the main challenges for effective control of access and illegal activities in future.

Since the situation in Iwokrama significantly differs from the national circumstances, in this case it is necessary to use a project-specific baseline scenario. Therefore the quantification of carbon stocks including losses through logging has been done for Iwokrama specifically (see Chapter 5).

Figure 4. Zonification of the Iwokrama Forest according to the management plan.



4.4. Additionality

The claim that a carbon market project to reduce greenhouse gases has to be *additional* requires that the reduction does not constitute business-as-usual (BAU) and would not have happened anyway. Under current carbon market schemes, additionality is another of the underlying basic concepts which are a mandatory requirement for any project that intends to generate tradable carbon credits.

Analysis of Iwokrama's situation yields that additionality is a critical point in this project- in this case, the establishment of a carbon market project would not impact current activities and emissions levels within Iwokrama. The intended project scenario therefore corresponds completely to the baseline scenario, i.e. continued forest protection and nature conservation with a limited amount of sustainable logging being practiced. This means that the GSI pilot project in Guyana is not additional in the sense of current climate change framework requirements.

Additionality is commonly demonstrated with the help of certain parameters, which are meant to clarify why the project is only carried out as a carbon market activity and would not happen otherwise. The most commonly applied test here is the cost analysis showing that the activity itself is not financially viable and only carbon revenue will make it happen. This situation changes when donor money is involved and the project has been approved without a carbon market component planned as integral part of the revenue scheme. In addition, Iwokrama aims to be financially self-sufficient from 2010 onwards, and it is likely that through income from timber sales and other economic activities this goal will be met. If not, donor funding is likely to fill the gap as it has before. Therefore it is most likely that the project will be implemented regardless of carbon revenues, and hence it is not financial additional.

Another way of argument is the presence of certain barriers that would prevent implementation of a project, unless this carries a carbon component to it. Given that the Iwokrama Centre has a particular mandate to conserve, maintain, and manage the Iwokrama forest, and all activities are based upon and planned around this mandate, no barriers to implementation can be identified at this point in time.

Thus, the project does not qualify as emission reduction activity under any of the current carbon schemes. It is unlikely that additional incomes through the carbon market can be obtained, unless voluntary buyers can be found that do not require project development according to existing standards and quality requirements.

However, the GSI's objective goes beyond quantifying additional carbon sequestration and the avoidance of emissions from existing carbon stocks- instead, the programme seeks to compensate pilot sites in the Guiana Shield for the basic ecosystem service of carbon storage per se, among others. Therefore, in line with the mandate of the GSI, Iwokrama is very well suited to serve as a test case and pilot study to collect experiences that can be applied to other activities whose additionality and baseline scenarios might look different, so that they could qualify for the carbon market.

4.5. Quantification of carbon stock in Iwokrama

For the purpose of establishing a baseline in terms of carbon stocks in Iwokrama's forests, it is necessary to differentiate after standing pre-harvest stocks and stocks that are lost through annual harvesting operations. The quantifications presented below are directly taken from existing literature on carbon stocks in Iwokrama, which is the most accurate and best suited data one would find on a project these days.

It is of great value that a detailed project-specific study into forest carbon stocks and fluxes exist for Iwokrama. This will surely not be the case for any of the other GSI pilot sites, though ter Steege's study may well be very usable for those sites as well.

4.5.1. Standing pre-harvest carbon stocks

Total pre-harvest stock

In a specific consultancy for Iwokrama Dr. Hans ter Steege of Utrecht University assessed the standing stocks of biomass and carbon in the various forest types present within the reserve (ter Steege, 1998). His main results are presented in Table 2. They show that preharvesting carbon stocks in Iwokrama were roughly **116 million tonnes of C, or 425 million tonnes of CO_2e** (conversion factor 3.67)**.** The carbon per hectare, and thus the total carbon, figures contain the above- and below ground living biomass, litter, dead wood and soil carbon pools.

Table 2: Forest types of Iwokrama and their approximate carbon stocks.
Source: ter Steege (1998)

Forest Type	Area (ha)	Carbon t/ha	Total Carbon mt/ha
Mixed forest			
or flat or gently undulating terrain	170120	334	56.8
on flat terrain along main rivers	4997	334	1.7
Liane forest	1736	250	0.4
Small crowned on flat to undulating sandy terrain	42479	250	10.6
on steep high hills	89132	286	25.5
Wallaba Forests			
on flat white sand ridges	7085	306	2.2
Poor Wallaba-Dakama forest on flat white sand ridges	3503	200	0.7
Low open Dakama-Muri scrub on flat white sand ridges	7431	67	0.5
Swamp Forest			
Low swamp forest	2975	400	1.2
Mora forest	13324	374	5.0
Marsh swamp forest	11665	374	4.4
Mixed forest/swamp forest	274	334	0.1
Swamp forest/wallaba forest	16582	400	6.6
Clearings	42		
Total	371345		115.7

Soil carbon pool

The findings in Table will not be quite comparable with carbon stock data from other forests or other land use types, since the standard methodology for reporting the soil carbon stock is to limit it to carbon contained in the top 30 cm of the soil (IPCC, 1996; IPCC, 2000; IPCC, 2005). By contrast, ter Steege's figures include soil carbon up to 1 m depth (all soil types) and up to 8 m depth (forest types on brown sands, white sands and loamy soils). For the purposes of comparing a project's baseline and project scenarios it is arbitrary to which depth the soil carbon pool is quantified, since any choice will be represented in both scenarios – the result that matters is the change of the pool over time in each scenario. The only relevant criterion for the choice of soil depth is that it should be sufficiently deep to adequately capture changes.

However, as discussed in Chapter 4.4, the GSI's objective goes beyond quantifying additional carbon sequestration; the programme seeks to compensate pilot sites in the Guiana Shield for the basic ecosystem service of carbon storage, not per se for the avoidance of emissions from existing carbon stocks. When applying the principle of rewarding the service of carbon sequestration is followed consistently the GSI should take all carbon stocks into account in the payment scheme, also those at 8 m soil depth. Therefore the numbers in Table 1 will be further used for Iwokrama's carbon stocks.

4.5.2. Impact of logging operations on carbon stock

Iwokrama started its FSC-certified logging operation in 2007. The cutting cycle that is applied to the forests in its Net Operable Area[10] (NOA) is 60 years, meaning that after harvesting the forest will be left to regenerate for 60 years. This is in line with the Code of Practice published by the Guyana Forestry Commission.

In a sustainable operation Iwokrama will thus harvest 1/60th of its Net Operable Area of 108,992 ha each year, which amounts to 1,817 ha per year. After 60 years of harvesting there will be a situation where 60 patches of 1,817 ha each will be in some stage of regeneration after logging. If the carbon loss-and-gain function of the harvesting intervention and subsequent regeneration of the forest over 60 years is known it will be possible to calculate the total carbon content of the NOA in the situation that the entire NOA has been harvested once and is entering the point of full sustainable harvesting. This situation is not the current situation, but for two reasons the point of full sustainable harvesting is preferred in the overall assessment of Iwokrama's carbon stocks. Firstly, the calculation of carbon stocks in 60 years will provide a more conservative estimate. Secondly, for contracting purposes is will be easier to deal with a stable carbon stock situation, rather than a yearly change due to new areas of forest being taken into production each year for the coming 60 years.

Ter Steege (1998) developed a simple carbon pool and flow model that he used for the modelling of carbon stock changes in the forest after a harvesting event. He did this for two scenarios, of which one is more applicable to the situation in Iwokrama. The most conservative result (i.e. leading to the highest reduction of Iwokrama's carbon stocks) that is still realistic indicates a maximum carbon loss after harvesting of approximately[11] 10 tC/ha (assumption: waste is left to decompose in forest[12]; see Figure 5 and Figure 6, peaking around 10 years after harvesting. The time lag is the result of

[10] The Net Oparable Area are the areas that are actually logged in the field.

[11] We do not have access to numerical modelling results by ter Steege. The estimate presented here is derived from the graphs printed in ter Steege (1998), Annex 5.

[12] This is the current situation. Mr. Das (pers. comm.) indicated that sawmill waste might be used as a biofuel in the future, but to be conservative it is assumed here that this will not be the case.

increasing dead wood, litter and soil pools that are fed with crowns, log wastage and forest damage from the harvested trees and subsequent decomposition thereof, thus partly compensating in the first years for the loss through timber extraction.

However, ter Steege made a key assumption that is not pertinent anymore to the current situation: he accounted for carbon stored in wood products outside of the forest. Though this is in principle a correct approach the current carbon market regulatory regimes assume that any biomass taken out of the forest system is immediately re-released into the atmosphere (i.e. burned). There may be possibilities that the Voluntary Carbon Standard allows accounting for wood products in the future, but due to still existing methodological difficulties we will assume here that this pool should not be accounted for. In any case it would also somehow go against the GSI's objective to include wood products in a payment scheme for ecosystem services, since these in a way represent a reduction in services. When not considering the wood products pool the carbon loss from the forest after harvest increases by approximately 25 tC/ha to a total of 35 tC/ha.

A second assumption made by ter Steege that needs to be clarified is that although the overall extraction rate is low at 5 m_3/ha, extraction actually takes place in pockets of much higher extraction rates (up to 50 m_3/ha). The modelling results are based on an extraction of 50 m_3/ha. They should therefore not be applied to the entire NOA in Iwokrama. To derive the average peak carbon loss per hectare after harvesting in the NOA it is necessary to know the likely extraction rate and apply the ratio of this figure and 50 m_3/ha to the above result of 45 tC/ha.

The aimed-for extraction rate in the NOA is 18.7 m_3/ha (Rodney, 2008), whereas the rate currently achieved in the field is around 12 m_3/ha (Das, pers. comm.). Interviews with logging concessionaires in Georgetown indicated that the norm for extraction in Guyana is below 10 m_3/ha. However, the site-specific information from Iwokrama is more applicable here than any generic information from the country level. Therefore the average between the targeted and currently achieved extraction rates will be used for the calculation of overall average carbon loss due to logging in the NOA. This is 15.3 m_3/ha, or about 30% of the 50 m_3/ha modelled by ter Steege. To spread his modelling results over the entire NOA a figure of 10.5 tC/ha (30% of 35 tC/ha) will be used as the peak carbon loss after harvesting.

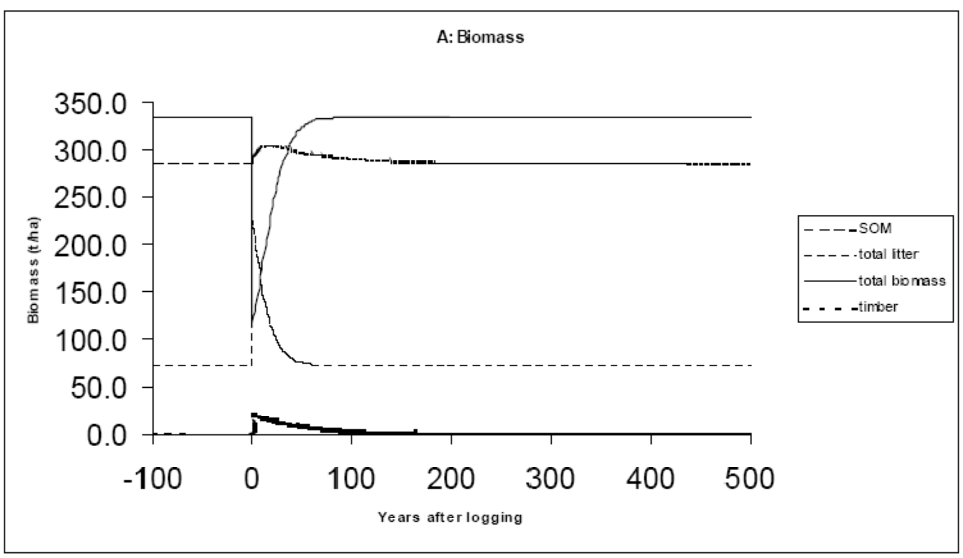


Figure 5: Behaviour of biomass and soil organic matter pools after harvesting event (50 m3/ha). Source: ter Steege (1998).

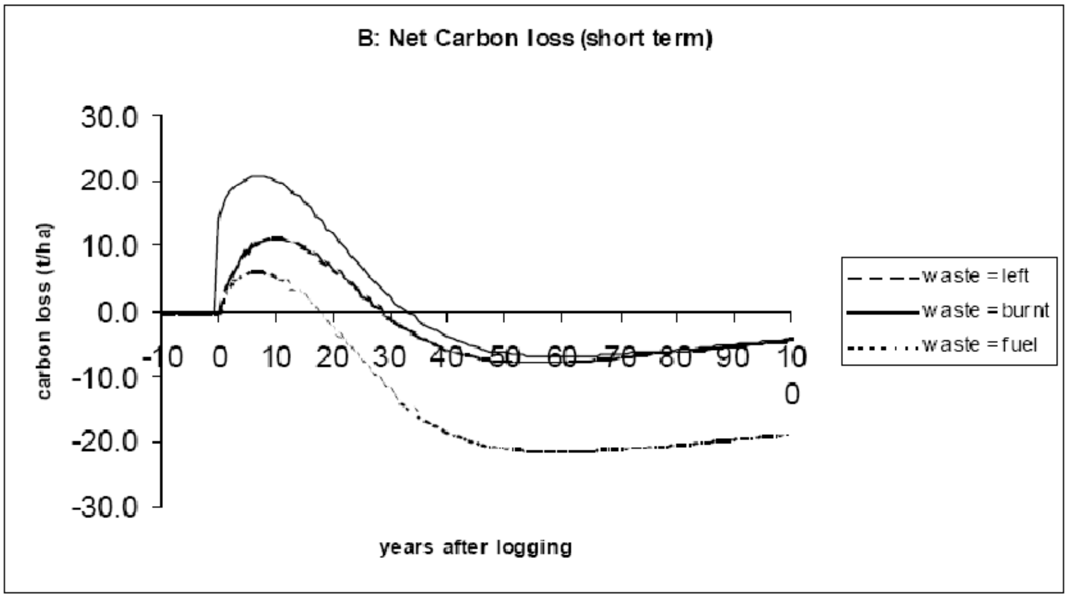


Figure 6: Carbon loss after harvesting event (50 m3/ha). Note that this includes carbon stored in long-term wood products. *Source: ter Steege (1998)*

Even though ter Steege's forest regrowth curve over the 60 year recovery period is not linear (see Figure) it is safe to assume that it does for the purpose of calculating the net carbon loss of the entire NOA at the point of full sustainable harvesting, since the system will then be in an overall steady state. Any loss of carbon by harvests will be compensated by regrowth in previously harvested areas. This is the principle of a sustainable harvesting system[13]. It therefore is irrelevant where in time, i.e. where along the curve the regrowth happens. Thus, assuming linear regrowth the calculation of the total net carbon loss due to logging in the NOA equals:

= 1,817 * ((10.5/60) + (10.5/60)*2 + (10.5/60)*3 + … + (10.5/60)*60)

The result of this calculation is a net C loss of 581,745 tC at any point in time after the point of full sustainable harvesting. This needs to be deducted from the total C stock calculated for Iwokrama before commence of harvesting (115,700,000 tC; *Table*), resulting in a total net C stock of approximately 115.1 m tC.

4.6. Monitoring of carbon stocks in Iwokrama

4.6.1. Areas outside the NOA

Iwokrama's forests are untouched primary forests (apart from those areas in the NOA) and it is considered that they contain maximum carbon stocks. In other words, no increase of carbon stocks is expected. Monitoring of carbon stocks outside the NOA can therefore be limited to the monitoring of forest disturbances, i.e. situations where a decrease of stocks occurs. This can be done easily through periodic analysis for forest cover of satellite imagery, such as radar or Landsat TM images.

[13] Though ter Steege's modelling results seem to imply that the soil carbon pool may be increasing in a 60-year cutting cycle (he used a residence time of 65 years in the soil carbon pool of carbon from the increase of dead biomass after harvesting) he indicates himself that this is somewhat arbitrary and that some publications point towards much shorter residence times. Here it will be assumed that the residence time will be 60 years.

Situations of forest disturbance are unplanned and unwanted. Any resulting decrease in carbon stocks can therefore not be captured in a systematic monitoring approach. When a disturbance occurs an on-the-ground assessment will need to establish what carbon losses are and further losses or regrowth will need to be captured in an ad-hoc monitoring system with permanent sample plots in combination with remote sensing analysis.

4.6.2. Areas inside the NOA

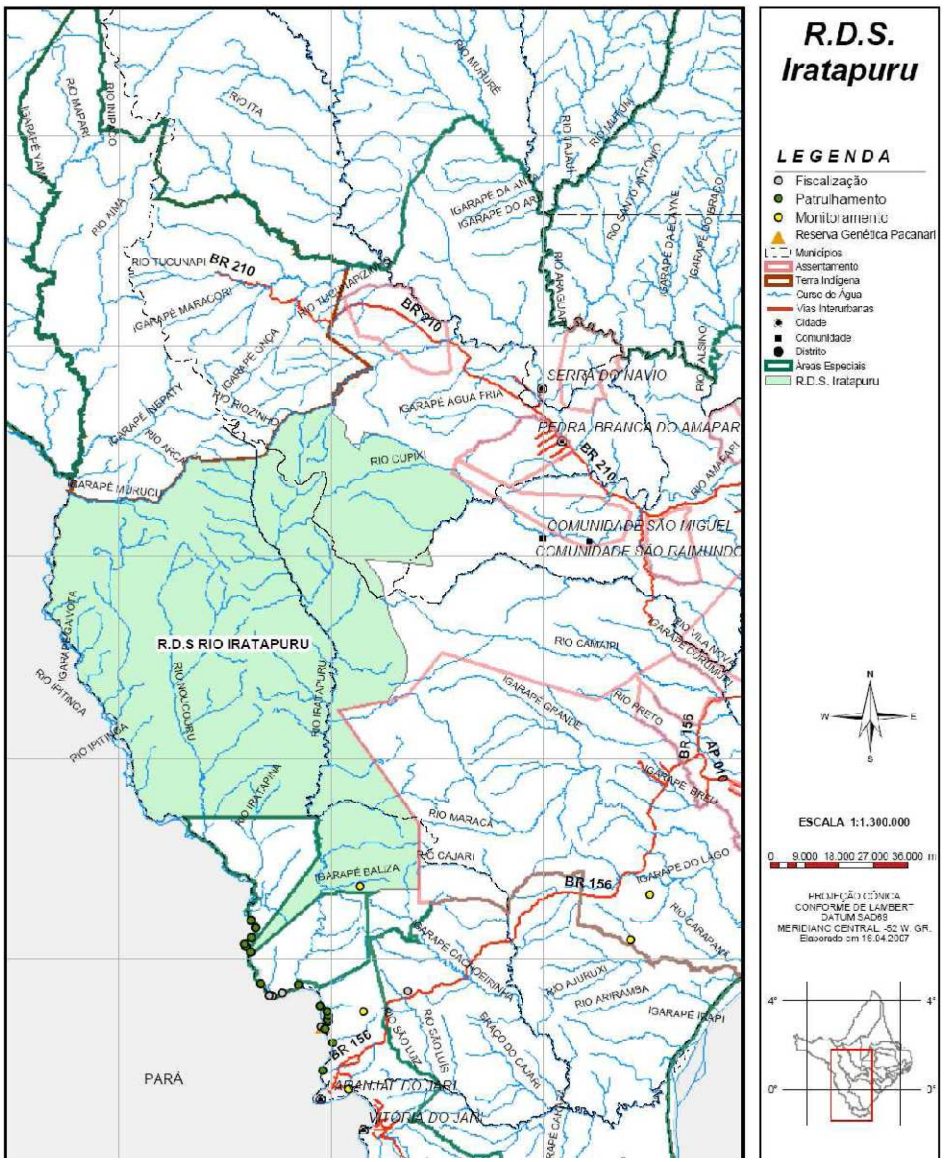
All practices that occur in the NOA are captured by the monitoring system that Iwokrama has to set up for FSC certification. The data captured in this system are sufficient to calculate the real carbon losses that occur in the field as a result of harvesting (as opposed to the modelled carbon losses used in this report). Also, any deviations in harvesting practices and consequent changes in carbon losses would be captured by the system. Therefore, no additional carbon monitoring system needs to be put in place within the NOA.

5. Assessment of the carbon potential of Iratapuru, Brazil

5.1. Project description

The GSI seeks to enter into a contract with the State Ministry for the Environment of Amapá (SEMA) to preserve the ecosystem services that the Reserva de Desenvolvimento Sustentavel Iratapuru (Figure 7) offers to mankind. This protected area is entirely covered in virgin rainforest and allows limited economic activities that are in line with the primary objective of conservation. Two communities (San Francisco and San Miguel) live in the reserve or utilise it, living off subsistence farming, hunting, fishing and Brazil nut collection.

Figure 7. General map of the Iratapuru reserve and surrounding roads and towns.



This report seeks to assess the baseline scenario of the RDS Iratapuru's carbon stocks, as well as to analyse if it would be feasible to (partly) finance the reserve's management through the sale of emissions reduction certificates from avoided deforestation on existing carbon markets.

5.2. Stakeholders

Based on the technical mission conducted in April 2008, the following actors have been identified as stakeholders of the Guyana Shield Initiative's engagement with the Iratapuru reservee in Amapá state, Brazil:

- Federal Government of Brazil:
  - IBAMA (Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis)
- Government of the State of Amapá:
  - SEMA (Secretaria de Estado do Meio Ambiente – the administrator of the RDS Iratapuru)
  - IEPA (Instistuto de Pesquisas Científicas e Tecnológicas do Estado do Amapá)
- Municipalities of Laranjal do Jari, Pedra Branca do Amapari and Mazagão
- Communities of San Francisco and San Miguel
- IUCN, UNDP
- ACT – Amazon Conservation Team, an NGO

5.3. Baseline scenario

The establishment of a 'baseline' or reference scenario of emissions is one of several underlying concepts for credible carbon and non-carbon ecosystem services projects. The baseline situation is described below both for Amapá State[14] and for Iratapuru in particular.

5.3.1. The baseline situation in Amapá State and the Iratapuru reserve

The main potential threats to the Iratapuru reserve that were identified during the technical mission (April 2008) were from logging, mining, roads and other infrastructural development and agricultural development. These threats will be discussed below.

Logging

At present there is no official logging industry operational in Amapá State, due to the lack of land titles to most of the land as well as a national investigation into corruption with logging licences that started in 2004 and that led to a complete halting of activities in the timber production chain (SEMA, *pers. comm.*). There is no system of logging concessions in place in Amapá. However, this is going to change in 2009, when the state intends to create forestry concessions in some 1.5 million hectares within the state forests, the first of which will be tendered out at the end of that year. This intention is described in the Annual Forestry Plan ('Plano Annual de Outorga Florestal' - PAOF) (Governo do Estado do Amapá, 2008**)** that Amapá submitted to the federal government (as of 2008 each state needs to submit such a plan annually), and that is currently in a public consultation phase. The state forests only cover about 20% of Amapa's forests; the rest are protected areas in

[14] In the context of the REDD policy discussions the national baseline for Brazil may either be established on the federal level, or it may be fragmentized into smaller, state-level baseline scenario. For the purpose of this report we assume the latter and discuss the dynamics of deforestation in the State of Amapá only.

various categories, which includes the RDS Iratapuru. The PAOF clearly identifies, lists and maps all protected areas, including a 10 km buffer zone around each one, and fully excludes them from the planned system of logging concessions.

There is no illegal logging industry of any significance in the state. Logging carried out by communities is on a micro-scale for subsistence purposes and does not form a threat to forests in protected areas.

Iratapuru is a 'Reserva de Desenvolvimento Sustentavel' (RDS), or Sustainable Development Reserve. This is a category of protected area that allows certain sustainable commercial activities and development of local communities. Which activities may and may not be carried out in an RDS is outlined in the 'Sistema Nacional de Unidades de Conservaçao da Natureza' (SNUC - Ministério do Meio Ambiente, 2004). In summary, what is in principle allowed is logging and collection of non-timber forest products (such as Brazil nuts), as long as these are subject to a sustainable management plan, do not affect the basic ecological functions of the reserve, maintain biodiversity and are in line with the fundamental objective of conservation. Mining is not allowed.

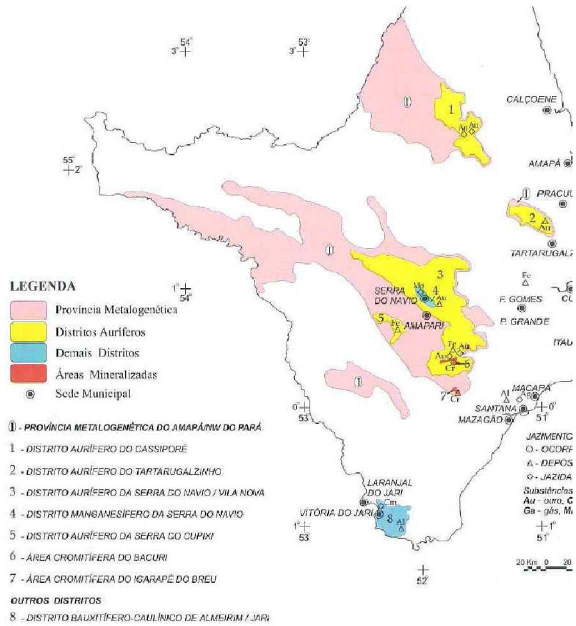
With respect to the possibility of future logging activities in the Iratapuru reserve, several key stakeholders affirmed that even though some plans for sustainable logging were discussed some five years ago, these have now been cancelled. The current vision is one of maximum conservation of the reserve, and only current extractive activities of Brazil nuts by the local communities would be maintained (SEMA; Community of San Francisco; Mayor of Laranjal do Jari – the municipality of which the main part of the reserve forms part – *pers. comms.*).

Mining

As in many parts of the Guiana Shield region extensive deposits of gold and other valuable minerals can be found in Amapá (Figure 8). The main concentration of formal extractive industry can be found in the municipalities of Serra do Navio and Pedra Branca do Amapari, both to the northeast of the RDS Iratapuru. There is, however, no threat from the formal mining industry to the forests and ecosystem services of the Iratapuru reserve, since mining is strictly prohibited in any 'Reserva de Desenvolvimento Sustentavel' (RDS).

However, the principal impact on forests in Amapá by mining activities comes from illegal mining activities in relatively small-scale operations: the garimpos (some of which can in fact reach a considerable size, hosting thousands of miners or garimpeiros). The majority of these garimpos are situated in the more remote north-western parts of the state. According to IBAMA there are 26 air strips linked to illegal garimpos in the Tumuqumaque National Park alone, of which some are also close to the RDS Iratapuru. These are monitored by the SIVAM (Sistema da Vigilencia da Amazonia – Amazonian vigilance system) of the national Air Force, which uses aerial photography to identify the sites.

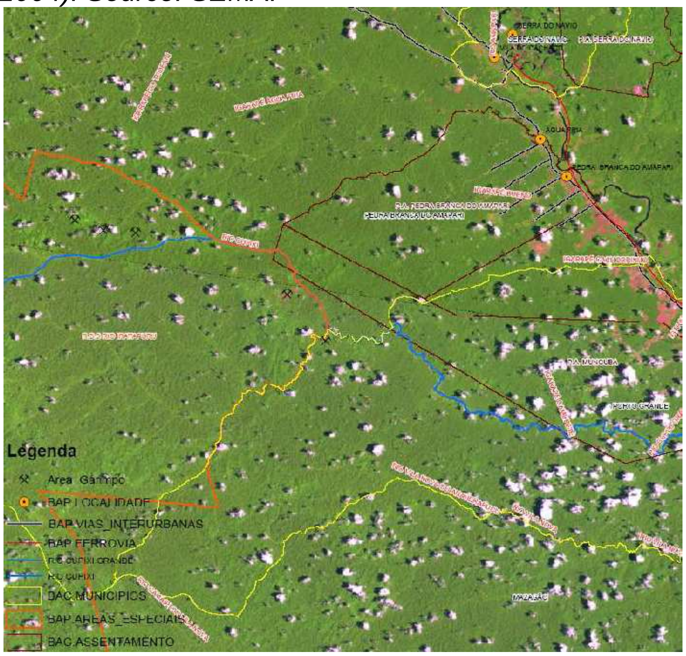
Figure 8. Deposits of metals and other commercially interesting minerals in Amapá state. Source: IEPA (2006).



SEMA has a map of garimpos in the RDS Iratapuru based on satellite imagery (Figure 9), which shows 4 garimpos within the boundaries of the RDS, and another one just outside, across the river Cupixi in the Northeast of the reserve. The location of these coincides with the 'Distrito aurífero da Serra do Cuxipi', one of the four larger recognized areas of gold deposits in the state (see Figure 2 – the yellow area marked no. 5). The IEPA map shows a larger area (in red) in which economically interesting mining deposits of different kinds may occur, and a significant part of the interior of the RDS Iratapuru is covered by this (i.e. the separate red area to the Southwest of the 'Distrito aurífero da Serra do Cuxipi'. Nevertheless, access remains a significant problem for the garimpeiros (SEMA, *pers. comm.*) and it is unlikely that this area would start seeing any significant exploitation in the near to medium-term future.

According to the community of San Francisco (visited on the field mission) there are no incursions by garimpeiros on the southwest side of the reserve. This is perhaps due to a lack of valuable deposits in this part (see again Figure 2), although it was mentioned that there is high activity of garimpeiros across the Jari river in Pará state, which also affects water quality in the Jari.

Figure 9. Map of garimpos in the RDS Iratapuru, based on satellite imagery (date: October 2004). Source: SEMA.



As a baseline scenario it is possible that without any intervention by the GSI project there would be an increase of illegal mining activities in the Serra do Cupixi part of the reserve, facilitated by access through the Rio Cupixi (though still difficult). Even though Brazil has since 2000 started to actively manage its protected areas with personnel on the ground there is still a great lack of staff, capacity and funding for this (SEMA, IBAMA, ACT, *pers. comm*.) and consequently it cannot be expected that future illegal mining incursions would have been prevented by better on-the-ground management and patrolling of the reserve.

Notwithstanding the fact that some garimpos can be relatively large and even one of the four garimpos within the RDS Iratapuru is clearly visible as bare land on SEMA's satellite image (Figure 3) these mining incursions are relatively point-wise in terms of the deforestation they cause. Compared to the overall forest cover of the reserve the forest loss so far caused by garimpos is in the order of 0.01-0.1% and even a doubling or tripling of illegal mining activities would probably not result in a reduction of more than 1% of the reserve's forest cover in the foreseeable future. In the context of establishing a baseline scenario of carbon stocks present in the Iratapuru reserve the deforestation threat from illegal mining is therefore not significant and does not merit further quantification at this point. As a comparison, the impact of variability and error in monitoring data on future carbon stock calculations is likely to be far greater than the impact illegal mining could achieve.

Still, mining may in itself still mean a significant emission of CO_2 and severely affect the provision of other ecosystem services (notably water quality), as well as result in disruption of wildlife due to hunting activities by garimpeiros, and for these reasons the project should invest all possible effort to prevent these illegal actions. However, it will from a carbon finance point of view probably not be large enough an emission reduction that it would be feasible to design a certified carbon trading project around it.

Roads and other infrastructure development
There are two roads that lead from the more populated eastern part of the state (where the capital Macapá is situated) into the west (see Figure 1). One passes Iratapuru to the southwest and south, the other to the northwest; both at significant distance. The southern road leads to Laranjal do Jari, the capital of the municipality that covers the largest part of the Iratapuru reserve. However, it does not provide any access to the reserve, and the main access route to Iratapuru from the south is by boat on the Jari river. Even though there are plans to pave the southern road this has so far been held up in the EIA process. In any case it is not expected that this will lead to a noticeable increased pressure on Iratapuru (SEMA, *pers. comm*.).

The northwestern road seems to have a somewhat larger potential impact than the southern, even though it is also relatively far away from the reserve and the main access route from that side seems to be the Rio Cupixi. According to IBAMA this road also affects the Floresta Nacional de Amapá (FLONA), which is located more or less equidistantly to Iratapuru on the other side of the road. In this area IBAMA connects problems with increased hunting and fishing activities to the presence of the road. On the other hand the towns of Serra do Navio and Pedra Branca are much closer to the FLONA than to Iratapuru, so it is probably not reasonable to assume a similar impact on Iratapuru. In any case, such activities would hardly affect carbon stocks.

One possible future threat that hypothetically might arise from the logging concessions for the Iratapuru reserve is the opening up of access into the forests through the establishment of logging roads. These roads would not extend into Iratapuru, but they would provide more opportunities for people to reach the borders of the reserve and to enter it illegally. On the other hand, well-managed logging concessions should prevent through-way, as well as respect the 10 km buffer zone around Iratapuru, which would still act as a significant barrier to access. How future logging concessions might affect the reserve in the long run is at this point in time merely a matter of speculation, and we will not consider this threat in this baseline assessment.

IEPA (2006) indicates that both the Rio Jari and the Rio Iratapuru are among those rivers in Amapá state with the highest hydrological gradients, implying that there might be a potential to generate hydro-energy from those rivers. However, no mention has been made by anybody or in any reviewed documentation regarding plans for future hydropower plants in these rivers. We therefore consider this not to be a threat to the Iratapuru carbon stocks.

Agricultural development
The Instituto Nacional de Colonização e Reforma Agrária (INCRA) has been in charge of allocating land to farmers in Brazil's Amazonian region for decades. In the 1990s this lead to a large influx of farmers into Amapá state and a significant increase of land clearing for new planned farms, or 'assentamentos'. In recent years this has slowed down distinctly, but there are still a number of larger assentamentos on the planning board (SEMA, *pers. comm.*). One assentamento seems to be planned between Pedra Branca and the Iratapuru reserve, since it features on Figure 3, yet it is not clear whether there is any real threat that this may become reality at some point. There are a number of side roads from the main northeastern road into this still forested area, which may mean that a start has been made in developing the wider area. On the other hand, none of the consulted stakeholders mentioned this specific assentamento at any point, nor that any threat to Iratapuru may be expected at all from assentamentos. It is also to be expected that the 10 km buffer zone around the state's protected areas as it is respected by the POAF should also be taken into account in agricultural planning.

The INCRA does not have, however, a very good image in terms of respecting environmental considerations. After all, it is promoting agricultural development at the cost of the Amazonian forests. Should the assentamento to the northeast of the Iratapuru reserve at some point in the future become a reality then this could pose a direct threat to the reserve from this direction, most likely causing illegal logging, hunting, fishing and increased mining activities, all facilitated by greatly improved access. In addition, INCRA has recently received some very bad press related to profiting from unnecessary deforestation through allegedly "conspiring with logging companies in deals to profit from clearing forest rather than make use of already deforested land" (CarbonPositive News, October 2008). They are under investigation by the Minister for the Environment, but such practices underline the potential threat to the reserve. Nevertheless, in lack of a perceived problem from the assentamentos by SEMA and other stakeholders we conclude that in the near to medium term agricultural development will not lead to any carbon stock losses within the Iratapuru reserve.

Population increase from growth of communities
A hypothetical future threat to carbon stocks could be population growth within the reserve. However, the current population of the communities is so small (not more than a few hundred people) and their impact on carbon stocks virtually zero (subsistence agriculture does not take up more than one or two hectares) that even a doubling or tripling of the population would not result in any significant carbon losses. In addition, according to the chief of the San Francisco community (pers. comm.) they are already struggling to keep their young people within the community, which indicates that such population growth is unlikely.

5.3.2. Conclusions on the baseline scenario

The near-complete intactness of the Iratapuru reserve implies that its carbon stocks are at or very close to optimal. There are currently no human interventions that significantly threaten these carbon stocks and there are no official plans for any such interventions (possible candidates that were analysed are logging, road access and hydropower schemes). The activities foreseen by SEMA, who manages the reserve, are limited hunting, fishing, Brazil nut collection and ecotourism. The only real short-to-medium term threat to the reserve's ecosystem services is from illegal mining, but this is unlikely to significantly affect carbon stocks (though almost certainly other ecosystem services). Under these considerations there is no reason to believe that carbon stocks would be significantly (in the statistical sense of word) reduced in future.

5.4. Additionality

The claim that a carbon market project to reduce greenhouse gases has to be *additional* requires that the reduction does not constitute business-as-usual (BAU) and would not have happened anyway. Under current carbon market schemes, additionality is another of the underlying basic concepts which are a mandatory requirement for any project that intends to generate tradable carbon credits.

Analysis of Iratapuru's situation yields that additionality is a critical point in this project. From the baseline analysis (see previous chapter), the establishment of a carbon market project would not impact current activities and emissions levels within Iratapuru. The intended project scenario therefore corresponds completely with the baseline scenario, i.e. continued forest protection and nature conservation with a limited amount of sustainable harvesting of non-timber forest products being practiced. This means that the GSI pilot project in Amapá is not additional in the sense of current climate change framework requirements.

Thus, it is unlikely that additional incomes through the carbon market can be obtained, unless voluntary buyers can be found that do not require project development according to existing standards and quality requirements.

However, the GSI's objective goes beyond quantifying additional carbon sequestration and the avoidance of emissions from existing carbon stocks - instead, the programme seeks to compensate pilot sites in the Guiana Shield for the basic ecosystem service of carbon storage per se, among others. Therefore, in line with the mandate of the GSI, Iratapuru is very well suited to serve as a test case and pilot study to collect experiences that can be applied to other activities whose additionality and baseline scenarios might look different, so that they could qualify for the carbon market.

5.5. Quantification of carbon stocks in Iratapuru

5.5.1. Aboveground carbon pool

The field mission to the RDS Iratapuru and to relevant state and federal government institutions in Macapá did not yield any detailed information regarding biomass and/or carbon stocks of forests in Amapá state, or elsewhere. Apparently hardly any known research has been conducted in Amapá on this topic. There was mention of a study to be funded by Conservation International that was to start sometime in 2008 and that was to include biomass data. Requests for results of this study were not answered so far, which probably indicates that these results are not yet available. The dearth of available data on the state level or even more specifically for the RDS Iratapuru require a search for data from other sites in the Brazilian Amazon in published literature, preferably generated near to Amapá and from comparable forest types and geomorphological conditions.

Several sources describe the forests, soils and terrain types of Amapá state and of the RDS Iratapuru. In its state-level vegetation map IEPA (2006) distinguishes only two forest types for Iratapurú: dense forest of low plateaux and sub-montane dense forest. A more detailed vegetation map for the RDS Iratapuru by SEMA and IEPA (2005) shows four forest types. Based on a map of terrain inclination in IEPA (2006) these seem to broadly coincide with the two major classes mentioned above. The map also includes a forest type that is strictly limited to the alluvial plains in the reserve, which remain quite narrow due to the undulated terrain. Fearnside (1992) provides information that 95% of Amapá's forests are of the types: sub-montane dense Amazonian (86%), alluvial dense Amazonian (7%) and lowland dense Amazonian (2%). Both IEPA (2006) and Fearnside (1992) are based on RADAMBRASIL data, a large national forest survey conducted in the 1970s.

Fearnside (1992) provides by far the most comprehensive and specific biomass data for Amapá state, including all living and dead biomass, both above-ground and below-ground, but not soil carbon. The results are based on the RADAMBRASIL data and on FAO inventory data, both of which only measured basic parameters such as standing volume and height of trees. To arrive at biomass estimates Fearnside used a number of assumptions and expansion factors, including wood density, crown expansion factor and root-shoot ratio. He also used multipliers for small trees, non-tree biomass and dead biomass. The resulting mean biomass loads for Amapá are (between square brackets the number of 1 ha survey plots the figure is based on):

- sub-montane dense Amazonian: 512 t/ha [30]
- alluvial dense Amazonian: 411 t/ha [1]
- lowland dense Amazonian: 507 t/ha [6]

In the context of providing an overall estimate of emissions from deforestation in the Amazon, there seems to have been an ongoing discussion between 1985 and 1992 between Philip Fearnside on one side and Sandra Brown and Ariel Lugo on the other side regarding correct biomass data for the Brazilian Amazon, and correct methods to derive these. Both sides published numerous studies on the subject (Brown & Lugo, 1984, 1992; Brown et al, 1989; Fearnside 1985, 1986, 1987, 1991, 1992b), producing average biomass values between 171-394 t/ha. In comparison the above-mentioned values for Amapá seem to be rather high. This may be explained by Fearnside (2001) who in an overview of the status of South American natural ecosystems distinguishes the Amapá moist forest as a distinct ecoregion within the Amazon tropical moist forest. Brown and Lugo (1992) also give a breakdown into sub-regions of their overall biomass value for Amazonia, which is based on the same RADAMBRASIL and FAO datasets as used by Fearnside. Here Amapá also has the highest biomass figure of the Amazon: 313 t/ha. However, this only includes aboveground tree biomass. When applying to this result the same multipliers for dead standing trees, small trees, non-tree living biomass, litter and dead wood and belowground biomass as used by Fearnside (1992) the total biomass would amount to 448 t/ha (Table 3). This is about 15% lower than Fearnside's estimate. The difference is mainly due to different methods for calculating tree volumes from the raw data.

Table 3. Application of multipliers given by Fearnside (1992) on aboveground tree biomass given by Brown & Lugo (1992), to derive at total biomass.

	Multiplier	t/ha
Trees aboveground biomass		331a
Hollow trees	0.9077	300
Small trees (< 10 cm dbh)	1.120b	337
All trees including belowground biomass	1.196b	402
Vines	0.0425	14
Other non tree	0.0021	1
Palms	0.0035	1
Dead aboveground	0.0903	30
Total		448

a Biomass figure for Amapá from Brown & Lugo (1992)
b these multipliers applies to the biomass figure obtained after applying the multiplier above it. All other multipliers are applied to the original aboveground tree biomass figure (331 t/ha).

Now, which biomass results should be used as a basis for the Iratapuru calculations? Other biomass studies in the Brazilian Amazon and in the wider Guiana Shield Region (Table 4) may serve to put Fearnside's and Brown & Lugo's results into context. They indicate a range of 300-400 t/ha[15], implying that Fearnside's estimates of over 500 t/ha may be overly optimistic.

Also, when looking at the results from those studies in the Brazilian Amazon that are based only on the aboveground tree pool (studies 1-5), then it appears that these are either roughly in the same ball-park or lower than Brown & Lugo's results for the equivalent region (also only aboveground tree pool). This gives a further indication that Fearnside's estimates are perhaps too high. We will therefore use the by comparison more realistic estimate adapted from Brown and Lugo (1992) of 448 t/ha for Amapá forests.

[15] Mainly based on studies 5, 7, 8 and 9, which cover all of the biomass pools. Study 5 does not include belowground biomass, but an estimate of total biomass may be obtained by multiplying with a factor 1.2

Table 4. Biomass estimates in the Brazilian Amazon and in other Guiana Shield forests by various authors. For estimates based only on aboveground trees a comparison is made for the results given in Brown & Lugo (1992) for the equivalent region in the Brazilian Amazon.

	Authors	*Location*	*Biomass estimate (t/ha dry weight)*	*Comparison Brown & Lugo*	*Comments*
1	*Higuchi et al. (1994)*	*Marabá, Pará*	*185*	*263*	*Aboveground trees only*
2	*Higuchi et al. (1994)*	*Caracaraí, Roraima*	*228*	*218*	*Aboveground trees only*
3	*Cochrane & Schulze (1999)*	*Tailândia, Pará*	*295*	*263*	*Aboveground trees only*
4	*Neeff & Santos (2005)*	*Santarém, Pará*	*193*	*249*	*Aboveground trees only*
5	*Uhl et al. (1998)*	*Paragominas, Pará*	*348*		*Aboveground only (all biomass pools)*
6	*Overman et al*	*Araracuara, Colombia*	*351*		*Aboveground trees only*
7	*Uhl & Jordan (1984)*	*San Carlos de Rionegro, Venezuela*	*338*		*All biomass pools*
8	*Ter Steege (2001)*	*Central Guyana, loamy soils*	*391*		*All biomass pools*
9	*Ter Steege (2001)*	*Central Guyana, brown sand soils*	*342*		*All biomass pools*

Unfortunately this estimate is not further broken down into forest types. This means that the distinction of forest types in the Iratapuru vegetation map by SEMA and IEPA cannot be coupled to specific biomass figures for these forest types, as would have been the case with Fearnside's data presented above. However, Fearnside's data for Sub-montane and Lowland Dense forests, which constitute the vast majority of the forests in Iratapuru, are so close to each other that they could easily be treated as the same value, i.e. when considering the variance in data that these means are derived from there is likely to not be any statistically significant difference between the two values. The biomass value for Alluvial Dense forest is significantly different through, but on the other hand the occurrence of this forest type is relatively insignificant according to the Iratapuru vegetation map. It could thus be argued that a weighted mean biomass value for Iratapuru would fall within the margin of error of the 448 t/ha that we propose to use, and that it would thus also not be statistically different. It does not make sense to focus on detail on the one hand, if on the other hand the majority of data used are quite rough, variable and prone to error.

In conclusion, the overall biomass and carbon content of the Iratapuru forests will be calculated at this stage is:

Iratapuru forest biomass = 448 t/ha * 806,184 ha[16]
= 361,170,432 t

[16] Governo do Estado do Amapá (2008)

Iratapuru forest carbon content = 361,170,432 t * 0.5[17]
= 180,585,216 tC

It is advised to include the conduction of a specific forest biomass assessment of the forests of Iratapuru as a condition in the ecosystem services purchase agreement, in order to gain more precision in the total amount of forest biomass and carbon content of the RDS.

5.5.2. Soil carbon pool

No specific data on soil carbon content for forests in the RDS Iratapuru or even for the state of Amapá exist to our knowledge. Fearnside & Imbrozio Barbosa (1998) provide an overview of 6 literature references for carbon stock results in Amazonian forest soils in a variety of locations (again, none of them are in Amapá). As it would not be correct to use the specific results of a location outside of Amapá for the Iratapuru soil carbon content calculation we prefer to use here a generic value for the legal Amazon and for all soil types that occur there: 94 tC/ha in the top 100 cm (Moraes et al, 1995; quoted in Fearnside & Imbrozio Barbosa, 1998).

The carbon content of the Iratapuru forest soils will thus be calculated at this stage as:

Iratapuru forest soil carbon content = 94 tC/ha * 806,184 ha[18]
= 75,781,296 tC

It is advised to include the conduction of a specific forest soil carbon assessment of the different forest types and soil types of Iratapuru as a condition in the ecosystem services purchase agreement, in order to gain more precision in the total amount of forest soil carbon content of the RDS.

5.5.3. Overall carbon content of the RDS Iratapuru

The overall carbon content of forest biomass and soils is estimated as:

Iratapuru total carbon content = 180,585,216 tC (biomass) + 75,781,296 tC (soils)
= **256,366,512 tC**

5.6. Monitoring of carbon stocks in Iratapuru

Iratapuru's forests are untouched primary forests and it is considered that they contain maximum carbon stocks. In other words, no increase of carbon stocks is expected. Monitoring of carbon stocks can therefore be limited to the monitoring of forest disturbances, i.e. situations where a decrease of stocks occurs. This can be done easily through periodic analysis for forest cover of satellite imagery, such as radar or Landsat TM images.

Situations of forest disturbance are unplanned and unwanted. Any resulting decrease in carbon stocks can therefore not be captured in a systematic monitoring approach. When a disturbance occurs an on-the-ground assessment will need to establish what carbon losses are and further losses or regrowth will need to be captured in an ad-hoc monitoring system with permanent sample plots in combination with remote sensing analysis.

[17] IPCC default value for carbon content of dry biomass (IPCC, 1996, 200)
[18] Governo do Estado do Amapá (2008)

6. Assessment of the carbon potential of Matavén, Colombia

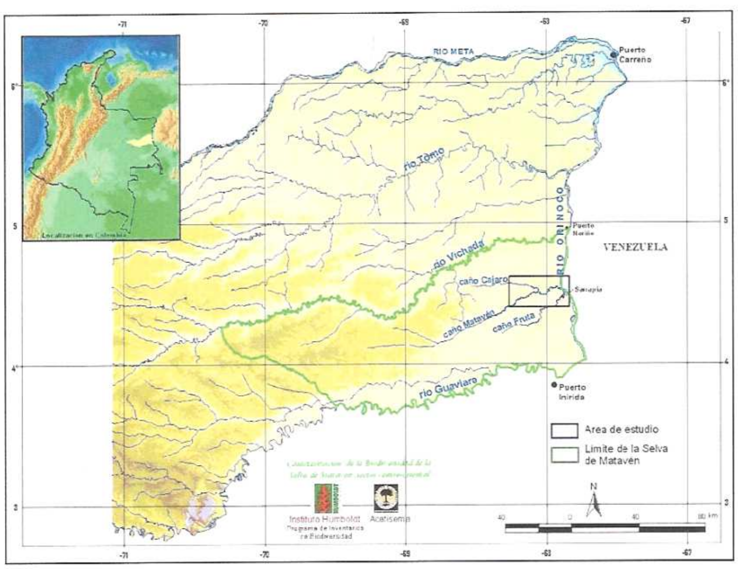
6.1. Project description

The Matavén forest is the furthest north eastern section of the Colombian Amazon. It is bounded east by the Orinico River, north by the Vichada River, south by the Guaviare River and west just short of the Chupave River (Figure 10). The Matavén area covers about 1.8 million hectare of forest with an immense biological diversity.

The whole Matavén forest lies within one indigenous territory, called resguardo indígena (RI). This territory is auto-governed by the indigenous communities in the area, who have organized themselves in the association ACATISEMA. This association has been set up to assist with the integral development and the cultural and natural preservation of the Matavén Forest. Currently, ACATISEMA is trying to get permission to become an indigenous reserve or a nature reserve, because they want to protect the heart of the forest against negative influences and developments from outside.

The GSI is seeking to enter into an agreement with ACATISEMA on the continuous conservation and maintenance of ecosystem services of a sub-area of the Matavén forest, called the Brazo Amanavén. This region comprises of still entirely intact forests and has a surface of around 100,000 ha.

Figure 10. General map of the Resguardo Indígena Matavén. Source: Instituto von Humboldt 2008 (the rectangle indicates the IvH's research area).



This chapter seeks to assess the baseline scenario of the RI Matavén's carbon stocks, as well as to analyse if it would be feasible to provide carbon finance to ACATISEMA for the continued sustainable management of the RI through the sale of emissions reduction certificates from avoided deforestation on existing carbon markets.

6.2. Stakeholders

Based on the technical mission conducted in November 2008, the following actors have been identified as stakeholders of the Guiana Shield Initiative's engagement with the RI Matavén:

- The Asociación de Cabildos y Autoridades Tradicionales Indígenas de la Selva de Matavén - ACATISEMA
- Ministry of Environment, Housing and Territorial Development
- Ministry of Mining
- Ministry of Mining, department of hydrocarbons

6.3. Baseline considerations

Potential threats to the forests of the larger Matavén reserve are:

Expansion of the area under mining concessions. There are currently only three mining concessions for relatively small areas. ACATISEMA is in principle opposed to further mining and claims their agreement to the current concessions was obtained under false pretences. The Mining Ministry in principle has the right to exploit the sub-soil, but on the other hand a stakeholder consultation must be conducted before mining concessions can be obtained, giving the communities a potential tool to block them. In a baseline scenario it is probable that further concessions would be established. However, the mineral that is being exploited is titanium, which is limited to river bank mining. The carbon impacts of such concessions would be relatively insignificant compared with the overall carbon density of the Matavén reserve. Nevertheless, prevention of the establishment of further mining concessions should be a goal and possibly also a condition of the contract between GSI and ACATISEMA. GSI funding should provide for legal assistance and community capacity building towards this goal.

Oil exploration and exploitation. The Office of Hydrocarbons (a more or less autonomous part of the Ministry of Mining) has awarded contracts for the technical exploration of oil resources in the larger area around (and including) Matavén, possibly to BHP Billiton. ACATISEMA mentioned that a proposed line of seismic exploration cuts through the westernmost part of the reserve. At this point it is not clear what the impact of such exploration activities would be. However, if it involves opening up access to this area the consequences could potentially be devastating in the long term. Even worse, if oil resources were to be found and exploitation would commence in serious this would presumably require a large amount of infrastructure development that could cause a great deal of forest loss and pollution. It is difficult to gauge at this point what the impact of oil exploration and exploitation on the baseline scenario would be since it is still very hypothetical and fully dependent on whether oil reserves will be found, where they will be found and what the proposed developments would entail. There is at this point insufficient basis for the development of a carbon project that would use this baseline scenario. Furthermore, it is not clear whether ACATISEMA and GSI have the power to prevent exploration from happening, meaning that there is not much merit in making forest carbon loss as a result of this threat a specific clause in the contract.

Encroachment by neighbouring cattle ranchers. A small area of the reserve's land was encroached upon and deforested by influential cattle ranchers to the south. The ranchers claimed this land to be outside of the reserve. Now that ACATISEMA is aware of this threat and on top of it, it is unlikely that further encroachment can be expected. Even if so, it would concern very small areas that do not bear significance in terms of carbon densities compared to the overall carbon figure for Matavén.

None of the above threats have any implications for the carbon stocks in the actual pilot area, which is an area of roughly 100,000 hectare called ‘Brazo Amanavén’. It has specifically been selected by ACATISEMA for its pristine status and lack of threats.

6.4. Carbon quantification

There are no site-specific forest carbon densities available. The nearest geographical locations where data are available for tropical lowland forest are San Carlos de Rio Negro in southern Venezuela (Jordan & Uhl, 1984) and Araracuara along the Caquetá river in Southern Colombia (Overman et al, 1994). This makes a precise estimate of carbon density of the Matavén pilot area impossible at this stage. Any diversity in forest types and their specific carbon densities cannot be taken into account in such a dearth of comparable information. At this stage only a broad indication of a carbon estimate can be given that does not do justice to reality.

The per-hectare biomass densities provided in the cited literature are provided in Table 5.

Table 5. Biomass estimates in the Colombian and Venezuelan Amazon by various authors.

	Authors	*Location*	*Biomass estimate (t/ha dry weight)*	*Comments*
1	Overman et al. 1994	Araracuara, Colombia	351	Aboveground trees only
2	Uhl & Jordan (1984)	San Carlos de Rionegro, Venezuela	338	All biomass pools

To derive at total biomass from aboveground trees only (for the estimate provided by Overman et al) the multipliers given by Fearnside (1992) are used (see Table 6). This results in 475 t/ha biomass.

Table 6. Application of multipliers given by Fearnside (1992) to derive at total biomass.

	Multiplier	t/ha
Trees aboveground biomass		351[a]
Hollow trees	0.9077	319
Small trees (< 10 cm dbh)b	1.12	357
All trees including belowground biomass	1.196	427
Vines	0.0425	15
Other non tree	0.0021	1
Palms	0.0035	1
Dead aboveground	0.0903	32
Total		475

a Biomass figure for Araracuara by Overman et al. (1994)
b these multipliers applies to the biomass figure obtained after applying the multiplier above it. All other multipliers are applied to the original aboveground tree biomass figure (351 t/ha).

The average of these two biomass density figures (406 t/ha) will now be used for the entire Matavén area and for the pilot site Brazo Amanavén. Converting this to carbon density results in 203 tC/ha.

A generic value for the legal Amazon and for all soil types that occur there is used here: 94 tC/ha in the top 100 cm (Moraes et al, 1995; quoted in Fearnside & Imbrozio Barbosa, 1998).

Total carbon density per hectare is therefore: 297 tC/ha.

The larger Matavén reserve is estimated at roughly 1.8 M hectare. This would result in an overall forest carbon density of **534,600,000** tC.

The Brazo Amanavén pilot project area has an estimated extension of 100,000 hectares. This would result in an overall forest carbon density of 29,700,000 tC.

7. Conclusions

It is the objective of the GSI to demonstrate through contracts with indigenous stewards of forests in the Guiana Shield region that forests do provide value through carbon sequestration, as well as biodiversity conservation and hydrological services. The carbon assessments in this report will hopefully contribute to these contracts. It is the GSI's intention to change the situation that the only tangible value of a forest is its timber, which all too often leads to over-extraction, resulting of degradation of the forest and eventually deforestation.

As demonstrated by the pilot projects, there is clearly willingness from forest stewards to enter into such contracts, which will provide them with payments in return for continued conservation of the forest and the ecosystem services it provides. In the case of the GSI these payments come from an EU grant that is administered by UNDP, but it is hoped that in future non-grant investors will seek to sign 'ecosystem services deals'. Indications exist that there is fledgling interest from the financial community, as demonstrated by the deal that Iwokrama closed in 2008 with Canopy Capital for the transfer of the ecosystem services rights of the forest.

However, the only way investment on a large scale can be attracted is when a return on investment can be made, which means that a demand must exists for the ecosystem services provided. For carbon, this demand currently comes from the international community and from voluntary offsetting actions by companies and individuals. As discussed in chapters 2 and 3, these all require, in one way or other, that forests would have been lost if not for their financial contribution.

Possible alternatives of developing carbon policy and market schemes that are not based on the additionality principle are politically not feasible for the foreseeable future: developing countries selling emission allowances through the adoption of a national target or basing carbon finance for forestry on the accounting of standing carbon stocks. Though the latter is what would make most sense from the forests' perspective and is clearly most in line with the GSI's objectives it will take a lot of effort to change forest carbon thinking away from the current paradigm of additionality.

Therefore, according to conventional carbon market wisdom, the three GSI pilot projects assessed in this report for their carbon content, Iwokrama, Iratapuru and Matavén, would not be able to qualify for any trading of 'credits' due to their non-compliance with the additionality criterion. It is therefore impossible at this stage to attach an economic value to the carbon storage services these projects provide, based on actual carbon market prices.

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9. Glossary

Additionality is the requirement by which, under the Kyoto Protocol and sound voluntary market standards, carbon credits will be awarded only to project activities where emissions reductions are "additional to those that otherwise would occur", i.e. additional reductions compared to the “baseline scenario”.

Afforestation and Reforestation (A/R) Projects under the CDM include the planting or assisted regeneration of forest on land that has not been forested for a period of at least 50 years (afforestation) or since 1990 (reforestation) through planting, seeding and/or the promotion of natural seed sources.

Allocation of emissions permits or allowances among greenhouse gas emitters to establish an emission trading market. The allocation of emission permits / allowances can be done through grandfathering (based on past emissions) or the auctioning of permits.

Annex-I Countries are the 36 countries and economies in transition listed in Annex I of the UNFCCC. Belarus and Turkey are listed in Annex I but not Annex B; and Croatia, Liechtenstein, Monaco and Slovenia are listed in Annex B but not Annex I. In practice, however, Annex I of the UNFCCC and Annex B of the Kyoto Protocol are often used interchangeably.

Assigned Amount (AA) and Assigned Amount Units (AAUs) is the total assigned amount of greenhouse gas that each Annex B country is allowed to emit during the first commitment period (see explanation below) of the Kyoto Protocol. An Assigned Amount Unit (AAU) is a tradable unit of 1 t CO2e.

Baseline Scenario represents forecasted emissions against which actual emissions are measured. This is often referred to as the “baseline scenario”, i.e. expected emissions if the emission reduction activities were not implemented. In the case of REDD, the main options are historical baselines (average emissions during a past period), modelled baselines (spatially explicit - e.g., land use models – or not spatially explicit – e.g., econometric models), and negotiated baselines.

Business-As-Usual (BAU) Scenario refers to the “baseline scenario” against which emission reductions are measured and carbon credits are issued.

Cap and Trade system is an emissions trading system, where total emissions are limited or “capped'. The Kyoto Protocol is a cap and trade system in the sense that emissions from Annex-B countries are capped and excess permits can be traded. In a strict sense, cap and trade systems will not include mechanisms such as the CDM, which will allow for more permits to enter the system, i.e. beyond the cap. The latter is, however, possible for compliance under the Kyoto Protocol as one of its “flexible mechanisms”.

Caps are legally binding limits to emissions from a country, sector, or organisation.

Carbon Dioxide Equivalent (CO2e) is a measurement unit used to standardise the global warming potential (GWP) of greenhouse gases. Carbon dioxide is the reference gas against which other greenhouse gases (e.g. methane) are measured.

Certification process is the phase of a CDM or JI project when permits are issued on the basis of calculated emissions reductions, verified by an accredited third party.

Certified Emission Reductions (CERs) are carbon credits generated through the CDM.

Clean Development Mechanism (CDM) is a mechanism for project-based emission reduction activities in developing countries. Certificates are generated through the CDM from projects that lead to certifiable emissions reductions that would otherwise not occur.

Commitment Period is the five-year Kyoto Protocol Commitment Period is scheduled to run from calendar year 2008 to calendar year-end 2012 (“First Commitment Period”).

Compliance is the achievement by a Party of its quantified emission limitation and reduction commitments under the Kyoto Protocol.

Designated National Authority (DNA) is an appointed authority necessary for the implementation of CDM projects. The DNA issues the Letter of Approval (LoA) needed for registration of a project. A project will need both a host country approval as well as investor country approval.

Designated Operational Entity (DOE) is a domestic legal entity or an international organization accredited and designated by the CDM Executive Board. The DOE validates and requests registration of a proposed CDM projects activity and verifies emission reductions of a registered CDM project activity.

Early Crediting can be applied to CDM projects implemented between 2000 and 2008 to achieve compliance in the first commitment period.

Emissions Trading allows for the transfer of AAUs (national allowances) across international borders or emission allowances between companies covered by a Cap and Trade scheme. However, it is also a general term often used for the three Kyoto mechanisms: JI, CDM and emissions trading.

European Union Emissions Trading Scheme (EU ETS) is the Trading Scheme within the European Union. The first compliance phase is from 2005 to 2007, while the second compliance phase covers the period from 2008 to 2012, equivalent to the First Kyoto Commitment Period.

Flexible mechanisms (or "Kyoto mechanisms") under the Kyoto Protocol are Emission Trading between Annex-B countries and the use of credits from JI and CDM projects for compliance.

Forest management refers to the management (or sustainable management, as opposed to destructive logging) of existing forests, in the context of a carbon project usually in order to enhance carbon stocks in the forest. This is different from afforestation and reforestation, although it equally represents a sink activity. Forest Management is not eligible under the CDM but is eligible under the JI.

Greenhouse gases (GHGs) are trace gases that control energy flows in the Earth's atmosphere by absorbing infra-red radiation. Some GHGs occur naturally in the atmosphere (e.g. H_2O), while others result from human activities or occur at greater concentrations because of human activities. There are six GHGs covered under the Kyoto Protocol - carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6). CO_2 is the most important GHG released by human activities.

Host Country is the country where a JI or CDM (or REDD) project is physically located. A project has to be approved by host country to receive CERs or ERUs.

Hot Air are excess emission allowances that have been allocated but do not reflect realistic baseline emissions because of an economic collapse or declined production for reasons not directly related to efforts to curb emissions (e.g. in Eastern European Countries around 1990).

Issuance refers to the instruction by the CDM Executive Board to the CDM registry administrator to issue a specified quantity of carbon credits for a project activity into the pending account of the Executive Board in the CDM registry.

Joint Implementation Mechanism (JI) is a mechanism for project-based crediting in Annex-I countries (as opposed to projects located in non-Annex I countries as in the CDM).

Kyoto Protocol was signed at COP-3 to the UNFCCC in Kyoto, Japan, December 1997. It specifies emission obligations for the Annex-B countries and defines the three so-called Kyoto mechanisms (or "flexible mechanisms"): JI, CDM and emissions trading. It entered into force in 2005. The Kyoto Protocol is a Protocol to the UNFCCC (the framework convention).

Leakage is an increase in emissions outside a project area due to project activities, e.g. the displacement of logging due to forest conservation activities.

Linking Directive of the European Union Emissions Trading Scheme (EU ETS) provides provisions relating to project approval processes and authorisation to participate in the flexible mechanisms. They also contain additional provisions relating to the establishment of the national emissions inventory.

Monitoring refers to the collection and archiving of all relevant data necessary for determining the baseline and project-based measuring of anthropogenic emissions by sources (or sinks) of greenhouse gases (GHG) within the project boundary (and leakage of emissions).

Non-Annex I countries (or Non-Annex B countries) are developing countries, signatories to the UNFCC but have no emission reduction targets.

Project Crediting involves the issuing of credits to an emissions reduction project, e.g. a CDM project.

Reserva de Desenvolvimento Sustentavel (RDS) is a legal category of land use in Brazil that allows sustainable commercial activity as long as it is in line with conservation objectives.

Reducing Emissions from Deforestation and Forest Degradation (REDD) is the term used in the current UNFCCC negotiations for avoiding emissions from the forestry sector, particularly in (tropical) developing countries.

Reference Scenarios (Baselines) establish a hypothetical emission level against which actual emissions are measured. In the case of REDD, the main options are historical baselines (average emissions during a past period), modelled baselines (spatially explicit - e.g., land use models – or not spatially explicit – e.g., econometric models), and negotiated baselines.

Registration is the formal acceptance by the Executive Board of a validated project activity as a project activity. Registration is the prerequisite for the verification, certification and issuance of credits related to that project activity.

Resguardo Indígena (RI) is a legal governance form in Colombia that allows indigenous communities a large degree of autonomy regarding the management of their land. However, this excludes the sub-soil resources, which belong to the state.

Sinks refer to the removal of greenhouse gases (GHGs) from the atmosphere through land management and forestry activities. These may be subtracted from a country's allowable level of emissions or credited under CDM and JI (with certain restrictions).

United Nations Framework Convention on Climate Change (UNFCCC) was established in 1992 at the Rio Earth Summit. It is the overall framework guiding the international climate negotiations. Its main objective is "stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic (man-made) interference with the climate system". The Kyoto Protocol is a Protocol to the UNFCCC.

Validation refers to the process of independent evaluation of a CDM project and its Project Design Document (PDD) by an accredited Independent Entity according to approved methodologies and regulations by the UNFCCC.

Verification refers to the process in which a recognised independent third party must confirm that claimed emissions reductions have occurred. This is a precondition for the issuance of carbon credits (e.g. for CDM projects) by the UNFCCC.

Voluntary Markets are markets outside regulatory carbon markets and do not involve international agreements. They are driven by voluntary commitments from organisations (e.g., energy companies, airlines) and individuals.