Abatement and independent verification costs of sinks CDM projects: An inventory of experience

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Abstract

Various models exist to anticipate abatement costs, model global change, quantify the relative importance of interactions between biosphere and atmosphere, and to explore alternative commitment strategies. The sinks module in these models is rudimentary and not founded on ample data derived from real project experience that should feed the models. This study aims to contribute to building up the field data knowledge base to improve the basis for these global integrated assessment models, based on real project experiences. In particular reference is made to the FAIR and IMAGE models of the National Institute of Public Health and the Environment (RIVM).

Some 49 projects were analysed: 40 for verification and certification costs and 9 for generic project costs associated with carbon sequestration/climate change mitigation activities. Results show that due to the high diversity in sinks projects for carbon sequestration/climate change mitigation and the low number of cases (9) it is difficult to discover trends. However, it is clear that costs per tonne are more than the 1 $/ton CO_2 that has been used in most models. The cost price per tCO_2 for plantation and conservation/rehabilitation projects varies between $1.74 and $8.72, with the exceptional case of $23.80 reported for one project without specifying cost items. The conservation project is the only one reporting costs less than a dollar a tonne; $0.81 per tCO_2.

For some of the analysed projects an indication was given of the proportion carbon sequestered in addition to the business as usual scenario which leads to costs varying between $7.85 and $23.45 per tCO_2. Although these tonnes should be considered to be truly additional, this is not to say that other reported values of carbon sequestered by projects are nót additional: this is simply hitherto unknown.

These values are derived using a simplistic calculation method on the basis of the total project costs, the number of hectares, tonnes sequestered over the life time of the project, ignoring all timing issues, different discount rates, and average storage capacity values used for some projects over longer periods of time. Hence, these values can only be seen as rough indicators and nothing more.

With respect to independent verification more cases were analysed (40) and results indicated that pre-assessments for Forest Stewardship Council certification, which can be compared to validation exercises, take 3 – 7 days on average, irrespective of the size of the project, main assessments take 11 – 29 days, depending on the complexity and sensitivity of the project, surveillance visits take 4 days, and the number of surveillance visits per 5 year period are 4. Hence, on average projects face 26 – 52 man days of independent verification work in a 5 year period.

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Acknowledgements

The peculiar situation arises that this study would not have been possible without the help of many individuals and organisations. Yet it is in precisely this situation that not all of those involved can or want to be acknowledged here as it was the explicit agreement that some projects and organisations would remain anonymous so as not to expose business-sensitive (mainly financial) information on the projects that were involved. It possibly underlines the importance of the information provided by those projects and organisations and the insight of those who collaborated.

However, some individuals and organisations have given their approval to be named. Therefore, the author likes to extend her gratitude to Mr.Jan Verhagen from Plant Research International, the FACE Foundation – in particular Mr.Hans Verweij, Mr.Igino Emmer and Mr.Remco Bax, and the Nature Conservancy – in particular Mr.Bill Stanley and Ms.Tia Nelson.

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Summary

Sinks have been 'a bone of contention' from the moment the Kyoto Protocol specified that they were allowed to assist Annex I Parties in meeting their Article 3 emission reduction targets. Ever since, a battle has been fought in both the policy arena as well as the science community what the role of sinks could be and should be whilst not jeopardizing the environmental integrity of the Kyoto Protocol.

Models have been developed to assess global change, the dynamics between biosphere and atmosphere, future global economic scenarios and the interactions with climate change aspects. Most models contain a sinks module but without exception these modules are rudimentary and mostly ill-founded. This is not due to the design of the models but rather due to the lack of field data derived from project experiences. This study makes reference in particular to the FAIR and IMAGE models of the National Institute of Public Health and the Environment (RIVM).

The study aims to analyse the costs of sinks abatement projects and forestry projects that have undergone independent verification for sustainability, with the ultimate objective to contribute to an enhanced data base that feeds sinks modules of global climate models. Data is collected on the following cost categories:

1. total project costs;
2. annual investments;
3. annual income;
4. internal monitoring costs;
5. validation costs;
6. verification/certification costs;
7. extension, training and education costs;
8. marketing costs; and,
9. overheads.

Some 49 projects were analysed: 9 climate change mitigation project in the sinks category and 40 projects that are certified against the Forest Stewardship Council's (FSC) Principles and Criteria. In the case of the sinks CDM-type projects, a questionnaire was sent out to the projects and/or organisations requesting general and financial information with the understanding that projects would remain anonymous and business-sensitive information would be handled with care and only with the consent of the projects. The questions were based on the cost categories

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above, that were identified by the RIVM as the most important ones to get a handle on. Interviews were held with projects where possible and after an initial round of discussions the book keeping structure of the various project required the 1st set of questions to be amended/refined as most projects have their own specific system of administering costs. Hence, various conversions had to be made to the data once they came in, in order to enlarge the comparability of project data.

To get a better feel for independent verification costs, an inventory was made of the man days used on pre-assessments (comparable to the validation of project design documents under the CDM), main assessments (comparable to the verification and certification phase of CDM-type projects), surveillance visits (comparable to annual monitoring inspections) and the number of surveillance visits per 5 year period: the period after which FSC certificates need to be renewed and which is compatible with the length of the 1st commitment period under the Kyoto Protocol.

The group of CDM-type projects that were analysed is composed of:

- 3 plantation forestry projects: 1 with exotic species, 2 with indigenous species;
- 5 natural forest projects with various components: avoiding deforestation, rehabilitation of degraded forest, and reforestation of pastures. One of the projects has an additional (small) component of rehabilitation of an old plantation area within the project boundary; and,
- 1 avoiding deforestation project.

All of these projects are located in the tropics (2 in Africa, the rest in Latin America), 2 in mountain areas where frosts occur (temperate-type weathers), and 1 in an area where there is a distinct dry season, habitat to a semi-deciduous high forest type. Due to the limited number of cases the CDM project information could not be grouped in clusters of similar projects or geographic regions.

From the 40 FSC certified projects 8 were located in Central America, 18 in Southern Africa, 11 in South America, 2 in Southeast Asia, and 1 in South Asia. No information is presented that is related to exact costs as fee structures vary per certifier. This would make it more complicated to compare projects across certifiers: hence, it was chosen to express costs as days required per assessment type. In this way, presenting the number of man days per activity, modellers who will use the data can choose the daily fee structure that they see fit: hence, costs are separated from labour.

In terms of general results it is worth noting that from the CDM-type projects that were analysed 7 started between 1994 and 1996, 1 started in 1997, 1 in 1998, and 3 in the period between 2000 and 2002. This in itself is interesting if we realise that the Kyoto Protocol that defines the CDM dates from 1997, and the decision that only afforestation and reforestation are eligible activities for the 1st commitment period dates from COP6/6bis in the year 2000. Furthermore, all projects have multiple benefits: NONE of them are set-up solely for the purpose of carbon sequestration or

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reducing emissions from deforestation. Five out of the 9 projects have distinguishable community components as well. This is a strong argument for taking an integral approach to promoting sustainable development, an area in itself which deserves to be explored further.

Finally, hardly any of the projects analysed in this study have any harvesting components, let alone clear fell operations: most projects work towards re-establishment of (natural) vegetation and possibly selective and limited harvesting serving as a management technique to establish a sound vegetation cover. And although direct human-induced activities are not the sole threat to permanent sequestration, the chances of reversal of sequestration (non-permanence) is significantly less in these projects compared to business as usual forestry projects. Therefore, besides contributing to the conservation and enhancement of biodiversity, for these projects non-permanence is but a small issue.

In terms of conclusions related to the main research question of this study it can be said that due to the high diversity in sinks projects for carbon sequestration/climate change mitigation and the low number of cases (9) it is difficult to discover trends. However, it is clear that costs per tonne are more than the 1 \$/ton CO_2 that has been used in most models. The cost price per tCO_2 for plantation and conservation/rehabilitation projects varies between \$1.74 and \$8.72, with the exceptional case of \$23.80 reported for one project without specifying cost items. The conservation project is the only one reporting costs less than a dollar a tonne; \$0.81 per tCO_2.

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These values are derived using a simplistic calculation method on the basis of the total project costs, the number of hectares, tonnes sequestered over the life time of the project, ignoring all timing issues, different discount rates, and average storage capacity values used for some projects over longer periods of time. Hence, these values can only be seen as rough indicators and nothing more.

Costs should NOT be extrapolated or generalised because there is a correlation between the project, the size of the project, the project type and various other aspects. Therefore, any claim of costs being X, Y or Z <u>per hectare</u> irrespective of the size or type of project activity, <u>cannot</u> be correct. Having said that, and looking at the limited amount of results of this study, there appears to be a stronger link between costs and project type, than costs and project size. However, the number of cases is too limited to accept this as a trend.

With respect to independent verification more cases were analysed (40) and results indicated that pre-assessments for Forest Stewardship Council certification, which can be compared to validation exercises, take 3 – 7 days on average, irrespective of the size of the project, main assessments take 11 – 29 days, depending on the

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complexity and sensitivity of the project, surveillance visits take 4 days, and the number of surveillance visits per 5 year period are 4. Hence, on average projects face 26 – 52 man days of independent verification work in a 5 year period.

Amongst the recommendations of this study are:

1. Start, or continue to collect data, not just of sinks projects but also from ‘ordinary’ forestry projects in the absence of sink CDM project cases, since the availability of data is a serious handicap to any modelling job: ultimately a model needs to be calibrated on “real life data”. Therefore, it is recommended that the initiative is taken to design a book keeping system, seek projects that are willing to collaborate, and start to collect financial project information in a structured manner;
2. Certification costs have to be integrated in the sinks modules. The results of this study show that projects face on average 26 – 52 man days of independent verification work in a 5 year period; and,
3. Barriers to the implementation of sinks CDM projects is of great influence on the outcome of any modelling exercise (the degree to which the potential of carbon sequestration on the land will be realised over time). As there is no sound understanding at present, this subject needs to be studied further.

The recommendations aim to lead to an improved data set on various cost items, and enhanced sinks modules in the climate models. This would assist the policy community to better understand the role of sinks in future climate regimes, with or without the Kyoto Protocol entered into force. To achieve this, scientists and research organisations need to be brought together to prepare a structured action plan to address the shortage of field data, with the ultimate goal to improve the sinks module in the global models required to anticipate the impact of the use of sinks in future climate regimes.

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1. Introduction

1.1 Background

1.1.1. The UNFCCC and the Kyoto Protocol

The United Nations Framework Convention on Climate Change (UNFCCC), in its Article 4(d) – "Commitments" – decides that all Parties shall "promote sustainable management, and promote and cooperate in the conservation and enhancement, as appropriate, of sinks and reservoirs …. including biomass, forests and oceans as well as other terrestrial, coastal and marine ecosystems" (UNFCCC, 1992). In consequence, the Kyoto Protocol – adopted in 1997 by the Conference of the Parties at its 3rd session (COP3) – included various references to sinks, most notably in its Articles 3.3 and 3.4 (Kyoto Protocol, 1997). However, sinks have always been "a bone of contention": not only **what** sinks could be used to offset greenhouse gas emissions of other sources (existing forests, new forests, agriculture, etc), but also to **what extent** they could be used (in relation to targets and caps), and **how** they could be used (under which rules, modalities and guidelines). For example, rules, modalities and guidelines for the use of sinks under the Clean Development Mechanism (CDM) are yet to be adopted at COP9 in December 2003 in Milan, Italy.

1.1.2. Controversy over sinks

There are ample reasons why sinks are so controversial, two of which will be mentioned here. The 1st one is relatively simple: carbon can be sequestered by sinks, but if the sequestration of carbon in biomass is reversed, all carbon will be released again to the atmosphere at some stage: either direct (e.g. biomass felled but not used as lumber) or over time (e.g. when used in wood products). This is referred to as "permanence" or rather the "non-permanence" of carbon sequestration. One can argue over the usefulness of such temporary storage of carbon in biomass and wood products but that goes beyond the scope of this introduction and this report.

The 2nd reason is more complicated and relates to the role of sinks in the terrestrial biosphere in the context of the global carbon budget. To put it plainly: science does not know exactly how much carbon is located where in the terrestrial biosphere part of the global carbon cycle. Despite the fact that emissions from land-use change (principally deforestation in the tropics) were 1.7 Gt carbon ($\pm$ 0.8 Gt C yr^{-1}) in the period 1980 to 1989, the total global carbon uptake in terrestrial ecosystems led to a

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sink over that same period of time. This was due to land-use practices and natural regrowth in middle and high latitudes, the indirect effects of human activities (e.g. atmospheric CO_2 fertilization and nutrient deposition), and changing climate (both natural and anthropogenic) (IPCC, 2000), but it is unknown how much is due to which aspect of that list. With other words: science cannot determine hitherto what proportion of biomass growth is resulting from natural processes and which ones from human-induced influences.

1.1.3. Sinks in future climate regimes & modelling abatement costs

The uncertainties related to these questions have led to significant debate in the policy arena and complications in reaching agreement in the negotiations (obviously together with a string of other issues; it wasn't 'just' sinks or just these 2 issues). It took a Special Report on LULUCF (IPCC, 2000) and various years of working on the detailed implementation rules of the Kyoto Protocol, but with the adoption of the Marrakesh Accords (the results of COP7, 2001) there should be no hinder as to ratifying the Protocol and see it enter into force. However, in the mean time the geo-political landscape has changed radically and entry into force of the Kyoto Protocol seems further away then ever, even with or despite the Marrakesh Accords.

But the negotiations on the implementation of the 'sinks rules' were still going on until very recently and COP9 was a 'grand finale' with respect to sinks project activities implemented under Article 12. Is should be noted here that in particular the sustainable development goal of CDM project is causing significant discord amongst (groups of) Parties. However, it is important to remember this goal when assessing eligibility of projects as the definition of the CDM left no doubt.

Looking ahead at negotiations that should lead to intergovernmentally-agreed climate regimes in future, with or without the Kyoto Protocol entered into force, sinks remain a serious peril ánd a threat. Therefore, it is important to understand the dynamics of different future global scenarios, and the sinks component, describing the interaction between world economics, the environment, and climate policy in particular.

The "Rijksinstituut voor volksgezondheid en milieu" ("National Institute of Public Health and the Environment" - RIVM) developed two models to contribute to the understanding of the dynamics and assist in decision making processes related to the current and possible future regimes.

The 1st model is called IMAGE (Integrated Model to Assess the Global Environment). It is a dynamic integrated assessment modelling framework for global change. The main objectives of IMAGE are to contribute to scientific understanding and support decision-making by quantifying the relative importance of major processes and interactions in the society-biosphere-climate system. (RIVM, 2003)

The 2nd model is called FAIR (Framework to Asses International Regimes for differentiation of commitments) which has the principle aim to assist policy makers in evaluating different options for differentiation of future commitments. FAIR is an

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interactive computer model that can be used to explore a range of alternative options for international differentiation of commitments in a quantitative way and link these to targets for global climate protection. (RIVM, 2003)

The sinks modules in these models are rather rudimentary in their basic assumptions because field data underpinning the sinks modules are sparse. Obviously this affects the outcome of the models to some degree. The RIVM is clear about the shortcomings of the models in their reports in this respect and has identified activities to be undertaken to improve the module. This project aims to contribute 'ground' or field data that may be used to enhance the modules in these models in future, and possibly in other modelling activities such as those of the Environmental Modelling Forum (EMF).

In general it has been argued often that "sinks credits", particularly those of projects situated in non-Annex I countries, will be cheap credits: that they can be considered 'low hanging fruit' that will be easy to pick and cash. The basis for the claims of cheapness is often diffuse and/or confused and not based on demonstrable results of project analysis. Some of the reasons for assuming sink credits are cheap may well be that to date only very limited project experience is available and that it is rather difficult to obtain exact financial information from projects and/or organisation.

Also the FAIR model of the RIVM assumes low costs for sink credits: "sink credits are assumed to be more cost-effective than credits from (energy-related) emission reductions; recent research suggests that common sinks projects in non-Annex I countries may cost around US\$1/tCO_2" – however, no references are cited for the 'recent research' – and the costs related to the implementation of afforestation, reforestation, and deforestation project activities under Article 3.3 of the Kyoto Protocol and forest management under Article 3.4 in Annex I as well as under CDM "are assumed to be negligible". (RIVM, 2002 (a)) Hence, the underlying purpose of this study is to aim to contribute data derived from real project experiences to ultimately assist RIVM (and possibly other modellers) to improve the sink modules in modelling exercises, and move away from general and often un-substantiated claims of low costs.

1.2 Purpose of the Study

The main objective of this study is to analyse the costs of sinks abatement projects that are situated in non-Annex I countries and countries with economies in transition, projects that would qualify under respectively Article 12 and Article 6 of the Kyoto Protocol: Clean Development Mechanism (CDM) and Joint Implementation (JI).

The main target audience of this report are policy makers of the Ministry of Agriculture, Nature Management and Fisheries and modellers of the RIVM, and possibly associated research institutes.

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1.3 Outline of this report

In this 1st chapter some background is provided with respect to sinks, the convention, the Kyoto Protocol and the role of sinks in future climate regimes. It also states the main purpose of this study.

In chapter 2 the methodology of the assessment is explained and the reason for particular choices. It reflects on the various cost categories and the 2 types of projects that have been analysed.

Chapter 3 presents the findings of the analysis. It reports on the projects that were studied for abatement costs and verification costs and on all the separate cost items. It also reviews some other findings that were encountered whilst conducting this study and that are only sideways related to the main purpose of the study, but still interesting enough to be reported.

Chapter 4 presents the main conclusions and chapter 5 some issues for discussion and suggestions for next steps.

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2. Method of analysis

2.1 Introduction

Various projects and organisations have been approached in the run-up of this study to request their willingness to collaborate. Most projects and organisations were willing, be it with the **explicit** understanding that they would have the right to look at the results before publishing, as a lot of the information that needed to be provided by the projects can be considered business-sensitive information. For that very reason, projects have not been named in this report, nor have all their contributions been acknowledged in the report as it would give away their identity. For the study and future use of the data it is not important who provided the data, as long as they are true project experiences: ultimately this data, together with other data yet to be collected, will hopefully contribute to discover possible global trends rather then releasing specific project information.

A first questionnaire was sent out to the projects for completion and with most projects/organisation contributing information on CDM projects interviews were held. Some adjustments had to be made to the questionnaire due to the book keeping structure of the projects, but most could come back with the relevant requested information. After the receipt of the completed questionnaires some conversions had to be made to align the project information (e.g. currencies, carbon or CO_2 numbers, numbers of years over which was reported, etc.) to enhance the comparability of the projects. Comparability would remain a central – often complicating – issue in this study.

In the sections following, specific reference will be made to the different steps of the methodology where relevant and appropriate.

2.2 Cost categories

As the results of this study are aimed to contribute to the improvement of the sink module of the FAIR and IMAGE models of the RIVM, a first look was taken at the private cost categories for investments for abatement of GHG emissions that are

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recognised in the study. They are listed in appendix C to RIVM report 461502026 (RIVM, 2002 (b)) and are: annual investment, operational costs, maintenance costs, costs and/or benefits in the form of sales of by/coproducts, and avoided input costs. See appendix A.

The report lists other costs categories that would need to be added to get a better picture of true project costs. Those are: monitoring costs, overhead costs, and a list of non-private or external costs (implementation costs, programme costs, marketing costs, costs for education/training/information, extension service costs, monitoring/compliance costs, certifications costs, overhead costs, and impacts on market prices (food, land, etc.) and market distortions). (RIVM, 2002 (b))

This study would strive to collect better data on the following cost categories:

1. total project costs;
2. annual investments;
3. annual income;
4. internal monitoring costs;
5. validation costs;
6. verification/certification costs;
7. extension, training and education costs;
8. marketing costs; and,
9. overheads.

The spreadsheet as sent out originally to projects can be viewed in appendix B.

The cost categories can be split roughly into two larger groups of cost categories: project costs (cost items 1-4 and 7-9) and independent verification costs (cost items 5 and 6).

Obviously obtaining information on these cost categories is complicated as the experience to date is very limited; there are barely any sinks projects yet. The 1st category of costs (project costs) can be obtained from climate change mitigation projects (and possibly 'ordinary' forestry projects in future studies).

However, the 2nd category is more complicated: as there is barely any climate change mitigation project experience of the sinks-type, the experience with independent verification costs of such projects is even less. Therefore, for this category of costs it was chosen to use the experience of independent inspection companies that have been conducting certification assessments against the principles and criteria of the Forest Stewardship Council (FSC).

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Box 1: the Forest Stewardship Council

The Forest Stewardship Council is an international non-profit organization founded in 1993 to support environmentally appropriate, socially beneficial, and economically viable management of the world's forests. It is an association of Members consisting of a diverse group of representatives from environmental and social groups, the timber trade and the forestry profession, indigenous people's organizations, community forestry groups and forest product certification organizations from around the world. Membership is open to all who are involved in forestry or forest products and share its aims and objectives.

The Forest Stewardship Council's principle activities are the development of forest management and related standards, communications and education, and through a separate program the accreditation and monitoring of certification bodies working to FSC standards.

Based on these standards, FSC has developed an international labelling scheme for forest products. In this way FSC provides an incentive in the market place for good forest stewardship. The forest inspections are carried out by a number of FSC accredited certification bodies, which are evaluated and monitored to ensure their competence and credibility.

The Forest Stewardship Council has developed rigorous procedures and standards to evaluate whether organizations (certification bodies) can provide an independent and competent forest evaluation (certification) service. This process is known as 'accreditation'. FSC accredited certification bodies are required to evaluate all forests aiming for certification according to the FSC Principles and Criteria for Forest Stewardship.

Accredited certification bodies may operate internationally and may carry out evaluations in any forest type. Certified forests are visited on a regular basis, to ensure they continue to comply with the Principles and Criteria. The performance of the certification bodies is closely monitored by FSC. Products originating from forests certified by FSC-accredited certification bodies are eligible to carry the FSC-logo, if the chain-of-custody (tracking of the timber from the forest to the shop) has been checked.

Source: http://www.fscoax.org/principal.htm

In this study 40 FSC certified projects are used because in terms of certification procedures the assessments are very similar to those that will be required under the Kyoto Protocol. Over more, because an FSC certificate indicates that the project is environmentally appropriate, socially beneficial, and economically viable the performance standard required under the Kyoto Protocol is guaranteed to be superseded by the FSC certified projects. Hence, no additional costs need to be anticipated for the Kyoto Protocol aspects. More about FSC certified projects in section 2.3.2.

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2.3 Projects

Two types of projects were required: sinks projects for climate change mitigation purposes and sustainable forest management projects that are FSC certified, and are described below.

2.3.1 Sinks projects for climate change mitigation

As stated before, the number of existing sinks projects is very limited. Initially it was the intent to analyse both CDM as well as JI projects. However, considering the even worse situation in terms of the number of projects for JI, it was decided that it was not efficient to analyse that category of projects: the focus was (and is) in this study subsequently on CDM.

Furthermore, the number of projects that could be contacted and were willing to share financial information in the available time frame was limited even further.

At this stage it is important to note that all projects that have been used in this study have additional objectives compared to those carbon-related ones mentioned above, such as the conservation of biodiversity, delivering benefits to local communities, research, etc.

2.3.2 Sustainable forest management projects

FSC certified projects have to comply with 10 principles and associated criteria (P&C, see Appendix C) that guarantee that forests are managed environmentally appropriate, socially beneficial, and economically viable. The standard has no focus on carbon sequestration; hence, the certification programmes that assess projects against the FSC P&C are NOT qualified to determine additionality, baselines, or quantities of sequestered carbon. Having said that, yield levels are assessed and therefore, in most cases estimates of biomass could possibly be made on the basis of the assessment results and good estimates could be available at relatively little extra costs and effort.

Still this certification scheme is useful to estimate costs for independent verification: the structure of assessments and surveillance visits (or third party monitoring inspections) is very similar to that required under the CDM rules, modalities, and guidelines (RMGs) as agreed and laid down in the Marrakesh Accord for non-LULUCF projects and as adopted by COP9 for forestation projects eligible under the CDM for the 1st commitment period (2008-2012). In addition, existing certification schemes are able to conduct appropriate assessments with only minor amendments to the existing inspection protocols.

For the results of all projects, see chapter 3.

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3. Results

3.1 Projects

As stated before 49 projects were analysed in total: 9 CDM-type projects and 40 FSC certified projects. The definition of the IMAGE 2.2 regions is used for the grouping of the projects. The regions are listed in appendix E to reference RIVM 2002 (b). The ones applicable to this study are: 03 CAM: Central America; 04 SAM: South America; 08 SAF: Southern Africa; 13 SAS: South Asia; and 15 SEA: Southeast Asia.

It is noted that the Marrakesh Accords limit the sinks options under the CDM for the 1st commitment period to afforestation and reforestation. However, most projects analysed in this study were initiated before the Marrakesh Accords came into existence. Hence, the scope of some project falls outside the range of eligible project types for the 1st budget period. Therefore, the projects are referred to as “CDM-type projects”, rather then CDM projects: it is working language to distinguish these projects from the FSC certified sustainable forestry projects. It was decided to include conservation projects is this analysis as it is hitherto unknown what rules may be agreed for possible future climate regimes and the RIVM models are not solely used for modelling scenarios under an operational Kyoto Protocol regime but are more generic.

3.1.1 CDM-type projects

The group of CDM-type projects is composed of :

- 3 plantation forestry projects: 1 with exotic species, 2 with indigenous species;
- 5 natural forest projects with various components: avoiding deforestation, rehabilitation of degraded forest, and reforestation of pastures. One of the projects has an additional (small) component of rehabilitation of an old plantation area within the project boundary; and,
- 1 avoiding deforestation project.

All of these projects are located in the tropics (2 in Africa, the rest in Latin America), 2 in mountain areas where frosts occur (temperate-type weathers), and 1 in an area where there is a distinct dry season, habitat to a semi-deciduous high forest type.

Due to the limited number of cases the CDM project information could not be grouped in clusters of similar projects or geographic regions.

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It was difficult to get projects engaged in this study as the 'added value' of this study to them is virtually none in the short term. Having said that, and although it took time, ultimately most project experts with whom contact was established have been very helpful and came up with the information.

An additional factor why it was hard to obtain all data is that fact that the number of projects to date is limited, which means that they get requests for collaboration very frequently. It is understandably that they cannot continue to free up time indefinitely.

Finally, it turned out that the administrative side of the projects, due to it being a new area of activities – forestry projects for climate change mitigation – is for most projects still in a state of flux. Except for a few, the projects indicated that the 'learning costs' had been significant in the start up phase and diluted the overall picture of project costs.

Through all of the above, the limited number of projects and the diversity of projects it is complicated to discover trends but this will become more obvious in the next sections. The results will be discussed per cost items of the questionnaire.

Next page: **Table 3.1 General Information and Costs CDM-type projects**

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Please, insert table 3.1 here which is provided as a separate file.

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3.1.2 FSC certified projects

A series of 40 FSC certified projects spread over various continents (Asia, Latin America, and Africa) was analysed and together they represent plantation forestry, natural forest management, and biomass-type plantations for charcoal production (very similar to bio-energy plantations).

The information on verification and certification could be grouped as 40 projects were analysed spread over 5 geographic regions. See also table 3.2.

Four main questions were asked per project:

1. number of man days for the pre-assessment;
2. number of man days for the main assessment;
3. number of man days for the surveillance visit; and,
4. number of surveillance visits per 5 year period.

No information is presented related to exact costs as fee structures vary per certifier. This would make it more complicated to compare projects across certifiers: hence, it was chosen to express costs as days required per assessment type. In this way, presenting the number of man days per activity, modellers who will use the data can choose the daily fee structure that they see fit: hence, costs are separated from labour.

The reasons for posing these particular questions are the following. The Marrakesh Accords prescribe validation of the project design document before a project can be registered as a CDM project and the COP9 decision for sinks affirms this approach for sinks projects. This type of assessment shows strong parallels with a pre-assessment for forest management certification. The main difference is the field visit that is a part of the FSC certification pre-assessment in most cases, resulting in a possible over-estimation of time and cost required for a validation. However, it gives a good insight in time/cost per pre-assessment.

During such an FSC pre-assessment the main issues are identified where a project may fail to qualify for the principles and criteria set by the FSC (see appendix C). These issues are then studied in more detail during a main assessment. Issues can be of various natures: social, environmental, and/or economic: all integral part of sustainability assessments. This is totally in line with the requirement of CDM projects to contribute to sustainable development.

The main assessment looks at all 3 elements (social, environmental, and economic) and at the particular issues identified during the pre-assessment. The team

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conducting the assessment is composed is such a way that it is qualified to assess all the issues: it has specialists on board that together cover the entire range of issues. The complexity of the project and the sensitivity of the issues determine the number of days required by the team to conduct the assessment (hence, not the project size!). But all together, this assessment strongly resembles the verification and certification exercise required under the Marrakesh Accords for CDM projects: hence, the question of the required number of days per main assessment.

Finally, the surveillance visit is something that will have to be conducted for sinks projects if particular policy choices are made. For instance, if the credits issued for forestation project activities will have a temporary nature (the T-CER concept), periodic verification of the continued existence of the sequestered carbon (or biomass) will be a prerequisite. In order to get an idea of the amount of surveillance visits that would need to be conducted during a commitment period, the last question was posed: number of visit in a 5 year period (coincidentally, FSC certificates also need to be renewed after 5 years and projects have to undergo a re-assessment).

From the 40 projects 8 were located in Central America, 18 in Southern Africa, 11 in South America, 2 in Southeast Asia, and 1 in South Asia.

The following table presents the main findings per question per geographic region, ignoring the type of project as this is not a leading factor in the time involved in assessments, but rather the complexity of the project and the issues identified during the pre-assessment. The projects are on top of that clustered to some extent on the basis of the number of ha.

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Table 3.2 FSC certified projects and number of days per assessment

	Number of projects	Area (rounded at x1000 ha)	Number of days per pre-assessment	Number of days per main assessment	Number of days per surveillance visit	Number of surveillance visit per 5 year period
CAM	3	2	3	11-19	3-4	4
	1	4	4	20	3	4
	1	8	3	13	3	4
	2	11 & 23	4	14	3	4
	1	30	4	25	3	4
SEA	1	1	4	16	6	4
	1	90	3	67[1]	5	4
SAS	1	5	4	19	3	4
SAM	1	5	4	19	3	4
	1	13	5	15	3	4
	3	11-14	4	22-24	3-4	4
	1	12	6	38[1]	8	4
	1	20	3	12	3	4
	1	24	5	25	5	4
	1	49	7	28	5	4
	1	49	4	23	4	4
	1	60	6	28[1]	5	4
SAF	1	11	4	13	3	4
	5	17-19	3-5	13-19	3-5	4
	2	26-27	4	13	4	4
	5	42-48	4	13-20	4-6	4
	4	76-129	4	13-19	4-9	4
	1	399	4	29	16	4

[1] This number of days is exceptionally high due to the high number of auditors on the main assessment team and the high number of peer reviewers: all due the high level of complexity of the project and the sensitivities surrounding it.

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3.2 Cost Items for CDM-type projects

In the course of working with the CDM-type projects, it became apparent that some of the categories or cost items in the original questionnaire were either not useful (e.g. net C yr^{-1} because of average storage capacity or fast initial growth, etc.) or could not be singled out from other categories simply because of the structure of the projects' bookkeeping.

In the presentation of the results below very little use is made of graphics, figures or tables. There is a very specific reason for that: with only 9 projects of such diverse nature it would be unrealistic to present fact and figures without an accompanying explanation of how this information should be used. However, it is very tempting for readers of this report to pull information out of its textual context if presented in such an illustrative way. Considering it would be out of sink to do so with data from just these 9 projects, a different approach to presenting the results is chosen and only summary tables are presented in table 3.1 and 3.2.

3.2.1 Size of projects and the total project costs

The total costs per project obviously varied strongly and are not only depended on the size of the project but also on the type of project. Some projects have multiple sites and some consist of singular forest areas.

In the plantation forestry projects category 3 projects were available for analysis of 18.000, 10,000 and 1500 ha. Total project costs varied from nearly $12 million to just under $1 million.

The 5 multi-component natural forest projects varied in size from 1000 ha to 12.000 ha and associated project costs varied from $2.7 to $21 million.

The avoiding deforestation project has a large trust fund of over $10 million that will yield over $6 million over the life time of the project: 30 years. But one has to bear in mind here that costs are not equal to availability of resources: there may well be a discrepancy at some stage between those two.

The total project costs as given by the projects reflect different project structures. For instance, one of the plantation projects works with a trust fund and lists the size of the trust fund as the total project costs, whilst another 2 projects list the costs of plantation establishment as contributed by the investor but does not include the costs made by the land owners that are responsible for all costs and maintenance of the plantation after the establishment (from year 3 onwards) up till the time of harvest. In this particular case the costs are those reoccurring for forest establishment (approx. $600 per ha in 3 years) in the 99 year on approximately 25-30 year intervals, excl. local costs for maintenance, thinnings, etc. Also the conservation/rehabilitation and

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conservation projects vary in what is listed as total project costs but 4 out of 6 list the trust fund value as the total project costs.

3.2.2 Project length and project type

The length or duration of the projects varies. Most projects report 30 or 40 years but a number of contracts are set up for the long run: 99 years. This last structure is used to guarantee long term commitment of land owners involved in the project and through that the carbon sequestration: these are community forestry projects whereby land users continue to be the land owners. The project investors help them to establish plantations on degraded lands and to maintain them once up and running. So the initial costs of establishment are borne by the project but after a number of years the land owners themselves are responsible for the maintenance. Comes time of thinning and/or harvesting, the owners get the timber revenues and the organisation any possible carbon credits. The land owners are then obliged to reinvest in replanting, assisted by the organisation.

Other projects own the land and can therefore, suffice with doing ‘just’ 30 or 40 year projects: by that time one can envisage the project to be so well established that it will not disappear again but that it is no longer justifiable to claim additionality. Especially when it comes to forest protection: the risk of deforestation will be diverted by then if the project is truly successful. In the case of plantation forestry, the project has become a no-regret option to some extent because the seed money for reestablishment comes from the harvest of the previous rotation. In forestry most often the initial investment is the largest barrier to the initiation of projects: once that barrier is cleared, the activity may well tip over financially by itself.

However, these differences in project type complicate the comparison of costs. It is hard to compare a project that occurs costs for a period of 3 years, every 25-30 years for 99 years with a project that has high initial costs (e.g. for land acquisition and the 1st forest protection measures (establishing clear boundaries, etc.)) and after that relatively low running project costs. Obviously discounting is an option but that will be discussed in a later section. If we would have access to a larger number of cases obviously one could start to stratify/categorise but with this small number of projects this is not sensible.

An additional complication caused by the project length is the comparison of the total amount of carbon stored. Obviously if one calculates the stored carbon of a plantation over a 30 year period you get a different picture compared to the same growth rates applied to plantations over a 99 year period and working with the Average Storage Capacity (ASC) of the sites. More about this in later sections.

Another complicating factor is the number of project areas. Some projects are composite: various little patches of forest being established by local communities. Other projects consist of one large united forest area. Obviously the dynamics in such projects are totally different and lead to different cost structures.

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3.2.3 Total amount of carbon sequestered and offsets

Four projects were able to list both the total amount of carbon sequestered and the amount of additional carbon. The values that are listed there are the 'risk free' tonnes of carbon. For these projects the baseline had virtually no impact on the amount of additional carbon values because the baseline is zero or close to in all those cases. In stead these projects have undergone an independent third party risk assessment, quantifying what proportion of the sequestered carbon is at risk of reversal. This so-called buffer varies in size per project according to the data submitted: 43% for one of the two projects in Eastern Africa and 24% for another project in Eastern Africa and two plantation projects in South America. If it relates e.g. to fire, the tonnes are transferred from the buffer to the pool of additional carbon once the year has past, the fire hasn't occurred and the carbon is still there.

Four projects are hitherto unclear on the proportion of truly additional sequestered carbon, or at least have not submitted any values, and one project indicated to be in the final stages of reviewing the assessment report that will provide these numbers.

3.2.4 Average annual investment costs in start-up phase

For 8 projects the average investment costs in the start-up phase could be determined. Six plantation projects and conservation/rehabilitation projects were in a range of \$200 to \$500 per ha per year. One conservation/rehabilitation is currently in a high range (\$ 1900/ha/yr), but this may well be caused by the fact that the area is small (1000 ha) and some costs are not related to the size of the project but rather general start-up costs. If these can be spread over more ha in future, the average investment costs will come down. The conservation project has low average investment costs (\$ 2.7/ha/yr), most likely because it is a very large project (634.000 ha) and there are no reforestation costs due to the type of project. Hence, few costs are spread over many ha.

3.2.5 Average annual investment costs in the phase after the start-up

As indicated before, 4 projects do not contribute to the maintenance of the forest after the initial establishment: this is the responsibility of the land owners. Hence, no good estimates are available for the average annual investment costs after the start-up for these project.

For 3 other projects estimates were received but seemed too unreliable to use for this analyse: e.g. costs after start-up higher then in start-up phase. The estimates may well be correct but this is then due to very specific circumstances that cannot be considered representative.

For the conservation project average annual investment costs come down from \$2,7 to \$0,87 per ha per yr after the start-up phase.

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3.2.6 Total amount of carbon sequestered per year or per ha

For 2 out of the 3 plantation projects no estimates per year are available because the life time of the project is 99 years. Dividing the total amount of sequestered carbon by the number of ha and the 99 years would give values that are totally unrealistic. These projects have used the average storage capacity (ASC) instead. This calculation tells you how much carbon has been stored on average on a location over a specific period of time; in this case 99 years. The calculation takes account of all fluctuations in carbon stocks, including removals such as thinnings and harvests.

The ASCs for the plantation projects in South America are 85 ton CO_2 for the pine plantations and 150 ton CO2 for the plantation of indigenous species. Although it is stated by the projects that removals (thinnings and possible harvesting) is integrated in the ASC, it is unclear what proportion of timber grown will be removed in that 99 year period.

For the conservation/rehabilitation projects in Eastern Africa the ASCs are 300 ton CO_2.

Three conservation/rehabilitation projects, all in the same climatic zone in South America in the tropical forest belt, reported different sequestration rates for different forest types and different stage of development of the forest: reforestation 3.5 t C/ha, natural regeneration 2.5 t C/ha, young secondary forests 5 - 20 years 1,5 t C/ha, medium secondary forest 20 - 50 years 1 t C/ha, more mature forests of over 50 years of age 0,6 t C/ha, and altered primary forests of approximately 100 years and over 0,3 T C/ha.

3.2.7 Internal monitoring costs

The internal monitoring costs were available for 8 out of the 9 projects and can be found in table 3.1. It is apparent that there is no correlation between the size of the project and the amount, when comparing projects. Obviously within the project there is a correlation between the type or methodology of monitoring, the intensity and the size of the project. However, this can not be distilled from the information as listed now and would need more study of costs associated with specific methodologies.

3.2.8 Training, extension, and education costs of project staff

Training, extension, and education costs of project staff have been reported for 8 projects is 2 different ways. Two of the plantation projects in South America and the 2 conservation/rehabilitation projects in Eastern Africa report costs per ha per year for the 1st 3 years of the project. After that no training is budgeted for.

Three conservation/rehabilitation projects in South America report budgets for the entire project length, and the conservation project reports a budget for the 1st 10 years.

If we for the sake of the exercise calculate costs per ha, irrespective whether it is spread over the entire project life time, the 1st 10 years, or the initial 3 years when the

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plantations are established, we find that average training costs vary from $2 – $5 per ha, with two projects reporting just under $18 and just over $30 per ha. Again this cost item seems to be related more to the type of project than to the size of the project.

3.2.9 Marketing costs

Only one project has specific marketing costs: one of the conservation/rehabilitation projects in South America. A cost of $ 30.942 is reported for the entire project.

3.2.10 Overhead

Overheads are reported for 8 out of 9 projects. Costs are obviously strongly related to the organisational structure of the projects or the portfolio of which they are part. It is hard to compare this set of projects. Some belong to one portfolio, others exist in isolation. As with the training cost item, overheads are reported in 2 different ways: 4 projects have reported costs per year for the 1st 3 year and another amount thereafter ('running overheads'), 3 projects have reported one budget for the entire project, and one project has reported a percentage of the total costs that is spend on "project management".

If we convert all submissions to overheads per year, this cost item varies between $23.018 and $57.105 per year. For the 4 projects that report a higher budget for the 1st 3 years, the amount is $115.787 per year. Also in the case of these overheads, there is no real trend to be discovered.

3.3 Validation, verification and certification

We now jump to the data set presented in table 3.2: the 40 FSC certified projects. Many of these projects report 2 areas: one is the total project area and the other one is the productive area. In some cases the ratio between the two is over 1:1, meaning that over half of the area consists of conservation area, riparian buffer zones, natural (forest) vegetation, etc. In this analysis the entire area is used for the grouping of projects in hectares since all of the area is submitted to inspections. This is the case for both FSC certification, as well as for future CDM assessments; conservation of biodiversity etc. needs to be assessed throughout the project area.

As stated before, results are listed in number of man days that are required to conduct assessments as fee structures vary per certifier. In this way, results of different projects could be compared irrespective of daily fee rates. If this data is ever used for modelling purposes, fee rates can be chosen by the modellers.

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3.3.1 Validation or Pre-assessment

All pre-assessments, which can be compared with validation assessments except for the field visit, vary between 3 – 7 days, irrespective of the size of the project area. On average, pre-assessments are conducted by one individual and the number of days reported here includes document reviews, field visits, and reporting time. The assessment identifies areas of particular interest and/or sensitivity. In one country this could be e.g. social/ethnic issues whilst in another country this could be e.g. wildlife issues. One the basis of this assessment the main assessment team is composed to ascertain all specialisations are on board.

The reason why all assessments take relative little time is because at this stage the projects themselves need to provide most information that will be verified during the main assessment. If projects are, lets say ‘economic with the truth’ in providing information, this may well backfire at the project itself if it comes to light during the main assessment. This will be the same for validation – verification exercises under the CDM: if a project gets away with a very good project design document (PDD), it will be registered as an eligible CDM project. But if it isn’t implemented conform the PDD, the verification inspection will detect the fallacies and disqualify emission reductions from being certified during the verification/certification inspection.

3.3.2 Verification and Certification or Main Assessment

The number of man days required for a main assessment, which can be compared with a verification exercise is NOT related to the size of the project, nor is there a correlation between the number of days and the project type. The number of days is solely dependent on the complexity of the project and the sensitivity of the issues detected in the pre-assessment.

All projects, varying in size from 1000 to just under 400.000 hectares, are assessed within a period of 11 – 29 man days (29 days for the 400 kha project) with two projects being reported as extremely complex/sensitive. For those two projects 38 and 67 man days were required.

The number of man days reported here includes all preparations, team composition, document reviews, field inspections of teams varying in size from 2-4 auditors, report writing, administrative handling (registration and certification) and peer reviews of the final report of at least 2 reviewers.

3.3.3 Surveillance visits or independent Monitoring

Surveillance visits (periodic inspections once certificates have been awarded) are conducted mostly within a time slot of 3 to 5 or 6 days, with an exceptional case of 8, 9 or 16 days. Without exception all projects undergo 1 surveillance visit a year on average, during the 4 intermittent years between main assessment and re-assessment for the renewal of the certificate. This renewal of the certificate and hence, the re-assessment is mandatory once every 5 years. This corresponds

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exactly with what is most likely to be the required modality for sinks under the CDM projects.

3.4 Other information and results

There are a few other interesting issues to report that are not related to costs, man days, or clearly visible from the presentation of end results in the table:

1. From the CDM-type projects 4 started between 1994 and 1996, 1 started in 1997, 1 in 1998, and 3 in the period between 2000 and 2002. This in itself is interesting if we realise that the Kyoto Protocol that defines the CDM dates from 1997, and the decision that only afforestation and reforestation are eligible activities for the 1st commitment period dates from COP6/6bis in the year 2000.
2. **All projects have multiple benefits**: NONE of them are set-up solely for the purpose of carbon sequestration or reducing emissions from deforestation. It can be said that at least 5 out of the 9 projects have distinguishable community components as well, whereby the local communities not only work at the project but also benefit in other ways from the project or in the case of 4 projects own the land, the forest and the project. **This is a strong argument for taking an integral approach to promoting sustainable development, an area in itself which deserves to be explored further.**
3. **Hardly any of the projects have harvesting components** integrated in the project design, let alone clear fell operations: most projects work towards re-establishment of (natural) vegetation and possibly selective and limited harvesting serving as a management technique to establish a sound vegetation cover. And although direct human-induced activities are not the sole threat to permanent sequestration, the chances of reversal of sequestration (non-permanence) is significantly less in these projects compared to business as usual forestry projects. **Therefore, besides contributing to the conservation and enhancement of biodiversity, for these projects permanence is but a small issue.**
4. One project has not provided specific details related to cost items but has indicated that the cost per tonne of sequestered carbon amounts $ 23.80 for that particular project.
5. One project, in its comments submitted together with the data, reports **a 44% increase in costs for the project that are associated with monitoring, sustainable development and restoration activities in order to achieve a performance level that can be considered consistent with the Kyoto Protocol** over and above ‘normal’ costs for plantation forestry activities.
6. One of the projects argues **it doesn’t make sense to compare projects as they all differ and are designed to accomplish different objectives that are not contemplated in other projects**. This is a valid comment and should be borne in mind whenever working with the results of this study.

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4. Main Conclusions

4.1 CDM project abatement costs

From the results as presented before in the text and tables, several things can be concluded. With respect to costs associated with CDM projects the conclusions are the following:

1. **The limited amount of CDM project experience makes it hard to detect trends** or even ranges for individual cost items: the projects are too diverse and too little in number to draw firm conclusions;
2. The **agreement to keep business-sensitive information confidential is further complicating a clear insight**;
3. It is clear that **costs per tonne are more than 1$** as assumed in various models and literature. If we just look at total project cost and the total amount of CO_2 sequestered, ignoring all timing issues (discount rates, average storage capacity calculated over longer periods of time, etc.) and not being bothered by additionality issues, the **cost price per tCO_2 for plantation and conservation/rehabilitation projects varies between \$1.74 and \$8.72, with the exceptional case of \$23.80 reported for one project without specifying cost items. Only the conservation project reports costs less than a dollar a tonne; \$0.81 per tCO_2**;[2] and,
4. For some of the analysed projects an indication was given of the proportion carbon sequestered in addition to the business as usual scenario which leads to **costs varying between \$7.85 and \$23.45 per tCO_2 and these tonnes should be considered to be the additional carbon sequestered over and above the business as usual scenario for those projects.**[2] **This is not to say that other reported values of carbon sequestered by projects are NOT additional: this is simply hitherto unknown.**

[2] These values are derived using a simplistic calculation method on the basis of the total project costs, the number of hectares, tonnes sequestered over the life time of the project, ignoring all timing issues, different discount rates, and average storage capacity values used for some projects over longer periods of time. Hence, these values can only be seen as rough indicators and nothing more.

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4.2 Independent Verification and Certification costs

With respect to costs associated with independent verification these are:

1. **All pre-assessments**, which can be compared with validation assessments except for the field visit, **vary between 3 – 7 days, irrespective of the size of the project area**;
2. **The number of man** days required **for a main assessment**, which can be compared with a verification exercise **is NOT related to the size of the project, nor is there a correlation between the number of days and the project type. The number of days is solely dependent on the complexity of the project and the sensitivity of the issues detected in the pre-assessment**.
3. **All projects, varying in size from 1000 to just under 400.000 hectares, are assessed (main assessment) within a period of 11 – 29 man days** (29 days for the 400 kha project) with two projects being reported as extremely complex/sensitive. For those two projects 38 and 67 man days were required.
4. **Surveillance visits are conducted mostly within a time slot of 3 to 5 or 6 days, with an exceptional case of 8, 9 or 16 days. Without exception all projects undergo 1 surveillance visit a year on average, during the 4 intermittent years between main assessment and re-assessment for the renewal of the certificate**.
5. **Taking the lowest and highest of the 'normal'** ranges (pre-assessment 3-7 man days, main assessment 11-29 man days, surveillance visit 3-6 man days 4 times per 5 year), **projects face on average 26 – 52 man days of independent verification work in a 5 year period.**

More generic conclusions worth reporting are the following – and most of these are not substantiated with data but findings resulting from working with the projects and the project staff whilst trying to gather the financial information:

1. Most CDM projects – not the 'normal' no-regret sustainable forest management projects that were studied to analyse independent verification costs – have had **substantial costs in the start-up phase due to "learning by doing activities"**, being the first projects in their kind. These learning curve costs do impact on the total project costs but it is unclear how much. Over time they may well come down as other projects take benefit from 'lessons learned' from these early action projects.
2. **Sequestration rates vary very strongly over time**, between forest types, and between the different development stages of the forest. Hence, using one

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growth factor or the average storage capacity is useful, but only as a quantification tool, and not as a number reflecting the true sequestration at a particular point in time: increment of biomass is not a linear function, nor static. This makes **a combination of one growth factor or ASC and discounting a rather unreliable reflection of 'the truth'**.

3. **Costs should NOT be extrapolated or generalised because there is a correlation between the project, the size of the project, the project type and various other aspects**. Therefore, any claim of costs being X, Y or Z for any particular project activity, cannot be correct. Having said that, and looking at the limited amount of results of this study, **there appears to be a stronger link between costs and project type, than costs and project size**. **However, the number of cases is too limited to accept this as a trend.**
4. **With respect to internal monitoring costs there appears to be a stronger link between costs and monitoring methodology than between costs and project size or type**. This means more projects per internal monitoring methodology need to be analysed to learn more about the possible trends.

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5. Discussion and next steps

5.1 Discussion

The RIVM models are using particular approaches and assumptions that may well be improved in due course in future. Not in order of importance, the following issues will be reflected on:

1. Estimates for the potentials for C sequestration in regions/countries in the IMAGE 2.2 model are based on economic dynamics – on the basis of their cost effectiveness – the degree of realisation of sequestration potential being a function of cost structures and carbon prices. And although possible others **barriers are mentioned in the reports, they are ignored in the modelling exercise at present**: the model analyses the effect of carbon prices on activities leading to carbon sequestration activities (RIVM, 2002(b)). This is recognised in the report itself by the authors of RIVM;
2. In the IMAGE 2.2 model it is assumed that barriers, defined in that study as any obstacle that can be overcome by policies, innovative projects, demonstrations and financial arrangement, lead to **a realisation of carbon plantations of 90% of the total potential (10% under a 100% implementation degree, instead of the 4% used for other abatement options**) (RIVM, 2002(b)). However, the report does mention the Waterloo study that estimates that only about 8% of the potentially available area is actually planted (Waterloo *et al*., 2003 as cited in RIVM, 2002(b)). Finally, in IMAGE 2.2 is opted to use a 100% implementation of the potential for 2010 and 2030 and compared it with respectively 10 and 30% (RIVM, 2002 (b));
3. In this context, for carbon plantations one **key variable** in the IMAGE 2.2 model **is the cost of land**. But it is acknowledged that data on land costs are difficult to obtain and are therefore, often ignored. The IMAGE 2.2 model uses World Bank data on land values derived from the present discounted value of the return to the land (the difference between the world market value of the output crops and crop-specific projection costs) (RIVM, 2002(a));
4. **Transaction costs, costs of monitoring or certification of sinks are not considered**, as these are assumed not to be part of the private costs (RIVM, 2002(b)).

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5.1.1 Data availability

Already mentioned various times, **the availability of data is a serious handicap to any modelling job: ultimately a model needs to be calibrated on "real life data".** There are several ways of tackling a shortage of data and there are things to say for each choice, but the temptation is large to use a top down approach and take whatever limited data is available and use it as the input for models. No matter how good the model is, the initial quality of the data determines the quality of the output. Therefore, it is important to **start, or continue to collect data, not just of sinks projects but also from 'ordinary' forestry projects in the absence of sink CDM project cases to study**.

This study, once again demonstrates how difficult it is to get data for many reasons: the number of project experiences is (still) limited, the bookkeeping is not perfect in this new field of project activities and projects aren't always easy to compare due to different bookkeeping techniques, the costs of learning-by-doing are (still) significant (although not easy to quantify exactly), the impact of the different project types on cost structures is so high that an even larger number of cases needs to be analysed, and different continents, climates, and project types add to the large number of cases required.

All this together builds a strong case to take a structured approach to inventory project costs, if we ever want to get a good handle on this. That would be something that would need a joint effort and a well planned approach, but is most likely very worthwhile. Therefore, **this study recommends to design a book keeping system, seek projects that are willing to collaborate, and start to collect financial project information in a structured manner.**

5.1.2 Certification costs

So far transaction costs have been ignored in the IMAGE 2.2 model but they may well put significant pressure on the total budget for running costs of projects. It is hard at this stage to say anything conclusive about the exact costs of verification and / or certification as hardly any project experience is available at the time. However, the numbers derived from the analyses of FSC certification could very well be indicative for what we can expect. It would therefore, be good to **integrate these costs in the modelling exercise.**

The results show that **projects on average face 26 – 52 man days of independent verification work in a 5 year period**, if the lowest and highest of the 'normal' ranges are taken (pre-assessment 3-7 man days, main assessment 11-29 man days, surveillance visit 3-6 man days 4 times per 5 year).

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5.1.3 Barriers and the implementation degree of sequestration potential

One aspect that is of critical importance to any modelling exercise is the degree to which the potential of carbon sequestration on the land will be realised over time. As for now, this is a black box. However, a few things can and should be said about it.

Models do tend to use 'technical' potentials: if an area is suitable to be converted into forest, it is used in the quantification exercise. If we look at project experience to date – *i.e.* projects under the CDM – we find that true plantation forestry options are most sparse of all project types, and íf plantation forestry is used this is for a large proportion due to co-benefits of the project, and in particular due to a strong community forestry component of the project. This also makes sense, because if a plantation forestry project is economically viable in its own right, it will have a hard time demonstrating its additionality.

This means **we need to get a better handle on the barriers to the implementation**, or the reverse, get a better idea as to why particular project types are popular and why others remain 'on the shelf'. Waterloo *et al.* (2003) has made a first serious attempt to look at aspects influencing the degree of implementation of the carbon sequestration potential. They identified 8 criteria related to (1) the project framework, (2) additionality, (3) verifability, (4) compliance, (5) environmental sustainability, (6) socio-economic sustainability, (7) sustainable forest management, and (8) transparency. Their main findings include:

1. The criteria reduce the scale of potential forestry sector CDM projects by a magnitude of about 10: for the 70 countries used in the Waterloo study the area available for forestation was reduced from 86 Mha to 7 Mha when all criteria were adopted; and,
2. Socio-economic factors dominate the area reduction associated with the application of criteria.

Although still a rather experimental piece of research, first outcomes are very interesting and may have significant impacts on future modelling outcomes if taken seriously. Therefore, **this study recommend to further elaborate on barrier to implementation and see whether they can be quantified.**

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5.2 Next steps

Next steps would need to lead to an improvement of the data set that is used for modelling the potential role of sinks in future climate regimes, with or without the Kyoto Protocol entered into force. It would require stratification in terms of geographic regions, climatic zones, forest types, etc. For all strata projects of all different project types would need to be engaged that are willing to collaborate in the study and maintain a bookkeeping system that will allow comparison of cost information between projects. Additionally, the Waterloo study (Waterloo *et al.*, 2003) would need to be elaborated, be based on more case studies, and be field trialled.

But for the near future, subsets of this work could be formulated as independent studies focussing on the most urgent aspects that need improving and that are achievable in isolation. One example would be e.g. to get a broader scope of species used: now only 8 fast growing plantation species are used and growth data are available for more then these. But various other subsets of the items discussed in this report could be developed into study modules.

The best way forward would be to **bring together relevant scientists and research organisations and prepare a structured research agenda to address the shortage of field data, with the ultimate goal to improve the models required to anticipate the impact of the use of sinks in future climate regimes.**

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Appendix A.

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Appendix C. Cost categories

Private cost categories for investments for abatement of GHG emissions. The cost categories printed in grey and bold are those covered by RIVM in this project.

A. Private costs

Costs related to the investments

- **Annual investment** (or capital) costs, to be calculated from annuitized project or specific investment costs (€/unit), economic and technical lifetime (yr), interest rate.
- **Operational costs** (such as additional labour costs due to an abatement option)
- **Maintenance costs** (related to specific machinery or building facilities, partly also labour costs)
- **Costs and/or benefits in the form of sales of by/coproducts**, additional and/or lost material inputs
- **Avoided input costs** (such as avoided energy or waste treatment costs)
- Monitoring costs for measuring emission abatement which need to be performed by an entrepreneur/ farmer
- Overhead costs (engineering and contracting costs, interest during construction delays etc.).

B. Non-private or external costs:

- Costs for implementation the ERM (to stimulate awareness and acceptation)
- Program costs (all costs for authorities as a result of specific ERMs)
- Costs for marketing the program
- Costs for education/training/information (to stimulate people to deal with a specific issue)
- Costs for extension service (to overcome lacks in awareness)
- Costs for monitoring/compliance (to determine the effect of ERMs on emissions)
- Costs for certification (certification of the amount of GHG abated)
- Overhead costs (legal costs, etc.)
- Impacts on market prices (food, land, etc.) and market distortions.

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Appendix B.

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General Information

Country	e.g. Paraguay, Nigeria, etc.
bio-climatic zone	e.g. mountain forest, tropical lowland, semi-arid, etc.
forest type	e.g. natural forest, plantation, mixed uneven-aged, etc.
area (ha)	
rotation length (yr)	in case of plantation
method of harvesting (if any)	e.g. selective logging, clear fell, no commercial harvest, etc.
stage of implementation of the project	e.g. start in…., 2/3 of area planted up, final stages of achieving contractual agreement,…
principle land use in the region	e.g. agriculture, grazing land, agroforestry, scattered small-scale farming, etc.
main objective of the project	e.g. sustainable forest management, carbon sequestration, rehabilitation degraded land, etc.
land tenure type	e.g. long-term lease, owned by project, owned by community, etc.
labour / land users	e.g. project staff, contractors, local communities involved in project, etc.

Costs / Benefits

total project costs	estimated or real
total amount of carbon sequestered	estimated or real
total amount of net carbon sequestered (off-sets)	estimated or real
annual investment	estimated or real
method of financing	estimated or real
annual carbon sequestered gross	estimated or real
annual carbon sequestered net (the additional carbon)	estimated or real
annual income (in $ per category)	e.g. carbon credits, timber, NTFP, etc. Estimated or real.
beneficiaries of income (in $ per category)	e.g. local community, investor, etc. Estimated or real.
validation costs	estimated or real
monitoring costs/yr	estimated or real
verification/certification costs/yr	estimated or real
normal extension, training and education costs	estimated or real
costs related to high/extra high environmental performance ("Kyoto Protocol plus" performance)	estimated or real
costs related to high/extra high socio-economic performance ("Kyoto Protocol plus" performance)	estimated or real
marketing costs	e.g. of project or carbon credits. Estimated or real.
Overhead	e.g. legal costs, costs for authorities, etc. Estimated or real.

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Appendix C.

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Forest Stewardship Council's Principles and Criteria

(source: http://www.fscus.org/standards_policies/principles_criteria/principle10.html)

Principle 1: Compliance with Laws and FSC Principles
Forest management shall respect all applicable laws of the country in which they occur, and international treaties and agreements to which the country is a signatory, and comply with all FSC Principles and Criteria.

Principle 2: Tenure And Use Rights And Responsibilities
Long-term tenure and use rights to the land and forest resources shall be clearly defined, documented and legally established.

Principle 3: Indigenous Peoples' Rights
The legal and customary rights of indigenous peoples to own, use and manage their lands, territories, and resources shall be recognized and respected.

Principle 4: Community Relations And Workers' Rights
Forest management operations shall maintain or enhance the long-term social and economic well-being of forest workers and local communities.

Principle 5: Benefits From The Forest
Forest management operations shall encourage the efficient use of the forest's multiple products and services to ensure economic viability and a wide range of environmental and social benefits.

Principle 6: Environmental Impact
Forest management shall conserve biological diversity and its associated values, water resources, soils, and unique and fragile ecosystems and landscapes, and, by so doing, maintain the ecological functions and the integrity of the forest.

Principle 7: Management Plan
A management plan -- appropriate to the scale and intensity of the operations -- shall be written, implemented, and kept up to date. The long term objectives of management, and the means of achieving them, shall be clearly stated.

Principle 8: Monitoring and Assessment
Monitoring shall be conducted -- appropriate to the scale and intensity of forest management -- to assess the condition of the forest, yields of forest products, chain of custody, management activities and their social and environmental impacts.

Principle 9: Maintenance Of High Conservation Value Forests
Management activities in high conservation value forests shall maintain or enhance the attributes which define such forests. Decisions regarding high conservation value forests shall always be considered in the context of a precautionary approach.

Principle 10: Plantations
Plantations shall be planned and managed in accordance with Principles and Criteria 1-9, and Principle 10 and its Criteria. While plantations can provide an array of social and economic benefits, and can contribute to satisfying the world's needs for forest products, they should complement the management of, reduce pressures on, and promote the restoration and conservation of natural forests.

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