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CDM afforestation and reforestation baseline methodologies: An analysis of the submission and approval process

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Contents:

Abstract: Afforestation and Reforestation (A/R), also widely termed LULUCF have been an important field of conflict in the Clean Development Mechanism (CDM) of the Kyoto Protocol. The first methodology for A/R projects has been submitted only by October 2004 and the first project was registered only in November 2006, two years after the first project in the energy sector. Like energy efficiency and transportation methodologies, A/R methodologies also suffer high rejection rate. 20 A/R CDM methodologies evaluated by the CDM Executive Board have been analyzed in this paper with respect to their approval history. On an average it took 4-5 months for approval of A/R methodologies in contrast to the long approval time taken in case of other methodologies (9-10 months). Most methodologies has been rejected because of not properly defining land eligibility, incomplete baseline scenario selection, lack of methods to prove additionality and insufficient treatment of uncertainties.

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1 Introduction:

Afforestation and Reforestation (A/R), also widely termed LULUCF (Land use and land cover change) projects have been the bone of contention from the start of the Kyoto Protocol (for a good discussion on this issue see Jung 2004). Several official submissions regarding LULUCF have recently been made by countries from Africa, Asia and Latin America regarding the sustainable development benefits associated with forestry (Capoor and Ambrosi 2006). The Clean Development Mechanism (CDM) allows countries without emission targets to invest in greenhouse gas reduction projects and thus create Certified Emission Reductions (CERs). CERs are calculated by comparing emissions of the CDM project with emissions of a hypothetical "baseline scenario" that reflects business-as-usual (Michaelowa and Fages 1999). According to the CDM Modalities and Procedures for A/R projects (CDM A/R M&P), the baseline for an A/R CDM project "is the scenario that reasonably represents the sum of the changes in carbon stocks in the carbon pools within the project boundary that would have occurred in the absence of the proposed project activity". An A/R project is additional if "the actual net greenhouse gas removals by sinks are increased above the sum of the changes in carbon stocks in the carbon pools within the project boundary that would have occurred in the absence of the registered CDM afforestation or reforestation project activity" (UNFCCC, 2003). There is a wealth of literature on baselines (Michaelowa 2005a, OECD 2003, Ellis 2006). ECON (2005) analyzed the baseline methodologies submitted to the CDM Executive Board (EB), while Müller–Pelzer and Michaelowa (2005) assessed the submission and approval process of methodologies for energy efficiency projects.

Development of baseline methodologies for A/R is based on Art. 22 of CDM AR M&P (UNFCCC, 2003), which specifies three basic approaches: (a) Existing or historical, as applicable, changes in carbon stocks in the carbon pools within the project boundary; (b) Changes in carbon stocks in the carbon pools within the project boundary from a land use that represents an economically attractive course of action, taking into account barriers to investment; (c) Changes in carbon stocks in the pools within the project boundary from the most likely land use at the time the project starts.

2 A/R CDM methodology approval process

The Marrakech Accords (UNFCCC 2001) drafted the basic set of rules and modalities for CDM but these did not provide detailed methodological rules for developing a baseline methodology for CDM projects. Project developers are responsible for submitting a new methodology together with their Project Design Document (PDD) unless an approved methodology already exists for that project type (UNFCCC 2003). Due to the late finalization of CDM A/R M&P at COP 9 in 2003, the first methodology was submitted only in October 2004.

The 21th meeting of the EB in September 2005 agreed on a "Procedure for submission and consideration of proposed new methodology for A/R project activities under CDM". The methodology has to be submitted together with a draft PDD to the CDM EB via a validator (Designated Operational Entity, DOE). The secretariat shall forward the document to a member of the Afforestation and Reforestation Working Group (ARWG) to assess the quality of the submission and to grade it between '1' and '2' with a short note substantiating the appraisal. For '1' case the document is considered as received by the EB while under '2' it is rejected without a detailed assessment. A DOE can pre-assess the methodology and in this case no assessment of the ARWG is needed. The proposed new methodology is made available on the UNFCCC website for public input for 15 days and then made available to the ARWG at least 10 weeks prior to its next meeting. Upon receipt of the methodology two ARWG members are selected on rotational basis for assessing the methodology. The ARWG prepares a preliminary recommendation regarding the approval of the methodology to the EB taking into consideration public comments and recommendations of two expert desk reviewers. In this context, ARWG may request the project participant to provide technical information The preliminary recommendation is then sent to the project participant who must provide clarification within 10 days from receipt. After the receipt of the recommendations EB considers the proposal at its next meeting and the decision is made publicly available as 'A' for approval, 'B' for resubmission and 'C' for rejection. A 'B' case methodology with required changes can be resubmitted to EB only once and on its resubmission a 'B' case is reconsidered by ARWG without further desk review. If such case with required changes is not resubmitted within five months it is considered as 'withdrawn'.

It takes a minimum 4-5 months from a methodology submission to the final recommendations of EB, as experienced by the first submission. The first approved A/R methodology (ARAM0001) took 5 months from it submission to final approval. The two other methodologies (ARAM0002 and 0003) were also approved within 4-5 months of their submission which is quite satisfactory as CDM M&P specifies 4 months times to approve or reject a methodology. The average time for approving non-A/R methodologies has been very long, i.e. 9 to 10 months (ECON, 2005). However, the approval rate of methodologies is very low. At the time of writing of this paper there had been 9 rounds of baseline methodology submission in which a total of 25 methodologies had been submitted. Of these, only three methodologies had been approved by the EB. Figure 1 gives a detailed round-wise submission status and fate of the methodologies submitted so far, while Table 1 provides details.

While the bottom-up approach of developing methodologies has the advantage that they are developed for project types that are really of interest of project developers, it is cumbersome and lead to delays. Moreover there is a continuously high rate of rejection of methodologies (Michaelowa, 2005b) The submission of new CDM A/R methodologies has been a learning process for all involved in the CDM forestry issues. During the first year of methodology submission, the primary issues that caused new methodologies to be rejected included improper methods or lacking explanation regarding additionality, determining the project boundary, land-use scenario determination, consideration and selection of carbon and non-CO_2 greenhouse gas pools. Often recommended changes had not been implemented when the new methodology was submitted for a second time. Secondary issues that also caused new methodologies to fail included improper or lacking explanation regarding leakage, methods for calculating project emissions. Often, improper or inadequate description of models, formulas, algorithms and data sources was criticized, as well as methods for addressing uncertainties, as well as the overall quality, drafting and language (Schlamadinger 2005, Pearson, 2006).

This paper aims at analyzing the reasons for the rejections of A/R methodologies and strengths that made some methodologies get approval. The paper also attempts in deducing recommendation for improving the success rate of methodologies.

3 Impact of World Bank Biocarbon fund on methodology development:

The World Bank's Biocarbon fund provides carbon finance for projects that sequester or conserve greenhouse gases in forest, agro- and other ecosystems. The Biocarbon fund aims to test and demonstrate how LULUCF activities can generate high quality emission reduction environmental and livelihood benefits that can be measured, monitored and certified and stand the test of time (Pearson et al. 2005). Out of 20 methodologies on which the EB has decided, 8 are supported by the Biocarbon Fund. Of these three have been approved, (ARAM 00001, ARAM 0002, and ARAM 0003), two are rated 'B' (ARNM 0012 and ARNM 0017), two have been rejected and one is at the stage of clarification. It is clear that World Bank support has paved the way in submission and production of quality methodologies.

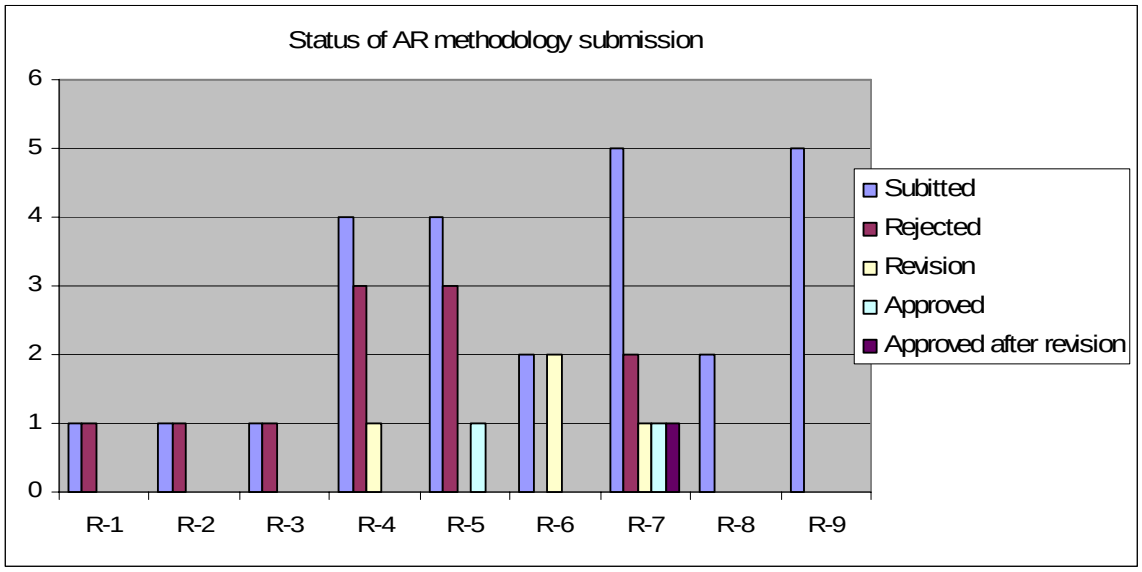

Figure 1: Status of CDM AR methodology submission

Table 1: CDM A/R project portfolio belonging to the submitted methodologies:

Round	Meth. No.	Title	Type[1]	Country	Size (ha)	Expected CO_2 removal /yr (in kt)	Status *
1	ARNM0001	The Mountain Pine Ridge (MPR) reforestation project	R	Belize	8700	61.5	C
2	ARNM0002	Reforestation Project Using Native Species Around AES-Tiete Reservoirs **(BioCF)**	R	Brazil	4188	176	C
3	ARNM0003	The International Small Group & Tree Planting Program (TIST) **(BioCF)**	A	Tanzania	5.75 million trees	272	C
4	ARNM0004	Treinta y Tres' afforestation combined with livestock intensification	R	Uruguay	10000	180	C
4	ARNM0005	The Mountain Pine Ridge reforestation project (Resubmission of ARNM0001)	R	Belize	8700	45	C
4	ARNM0006	Bagepalli CDM Afforestation Programme	A	India	1383	8	C
4	ARNM0007	Moldova Soil Conservation Project **(BioCF)**	A	Moldova	14949	132	**B**
5	ARNM0008	Kikonda Forest Reserve Reforestation Project	R	Uganda	8354	88	C
5	ARNM0009	Rio Aquidaban Reforestation Project(RA)	A	Paraguay	580	13	C
5	ARNM0010 **(ARAM0001)**	Facilitating Reforestation for Guangxi Watershed Management in Pearl River Basin, China **(BioCF)**	R	China	4000	33	**A**
5	ARNM11	Chocó-Manabí Corridor Reforestation and Conservation Carbon Project	R	Ecuador	523	6	C
6	ARNM12	Afforestation or reforestation project activity implemented on unmanaged grassland (Resubmission of ARNM0002) **(BioCF)**	A	Brazil	8790	176	**B**[2]
6	ARNM13	The Mountain Pine Ridge Reforestation Project (MPR Project) (Resubmission of ARNM0005)	R	Belize	8700	45	**B**[2]
7	ARNM0007 Rev ARAM0002	Moldova Soil Conservation Project **(BioCF)**	A	Moldova	14949	132	**A**

Round	Meth. No.	Title	Type[1]	Country	Size (ha)	Expected CO_2 removal /yr (in kt)	Status *
7	ARNM14	Treinta y Tres' afforestation combined with livestock intensification	A	Uruguay	10000	180	C
7	ARNM15	Reforestation as Renewable Source of Wood Supplies for Industrial Use	R	Brazil	11683	92	Clarification
7	ARNM16	Los Eucaliptus Afforestation Project	A	Uruguay	4212	844	C
7	ARNM17	Mexico Seawater Forestry Project **(BioCF)**	A	Mexico	10000	181	**B**[2]
7	ARNM18 ARAM0003	Assisted Natural Regeneration of Degraded Lands in Albania **(BioCF)**	A/R	Albania	5728	21	**A**
8	ARNM19	Reforestation around Pico Bonito National Park, Honduras **(BioCF)**	A/R	Honduras	2600	27	N/A
8	ARNM20	Afforestation for Combating Desertification in Aohan County, Northern China	A/R	China	3000	15	N/A
9	ARNM21	Chocó-Manabí Corridor Reforestation and Conservation Carbon Project (Resubmission of ARNM0011)	R	Ecuador	523	9	PC
9	ARNM22	Afforestation of the cropland through agroforestry practices in 3658 Ha. area in Khammam District of Andhra Pradesh, India under ITC's Farm Forestry Project.	A	India	3658	47.6	PC
9	ARNM23	Rubber outgrowing and carbon sequestration in Ghana (ROCS-Ghana)	R	Ghana	15000	166.5	PC
9	ARNM24	San Nicolas CDM Reforestaion Project	R	Colombia	8730	38.3	PC
9	ARNM25	Selva Central Climate Action Project		Perú	7000	35	PC

[1] A= Afforestation; R= reforestation; [2]= Recommended by ARWG (EB decision pending)

* A=Approved; B= to be resubmitted; C= Rejected; PC = Public Comments

BioCF = Methodologies supported by World Bank Biocarbon fund

4 Resubmission of rejected (C) or revised (B) methodologies:

Not only can methodologies rated as "B" cases be revised, but the EB and Conference of Parties (COP) have also encouraged project participants to revise and resubmit rejected

methodologies ("C" cases). Out of the two "B" cases (both supported by the Biocarbon fund) in their first submission (ARNM 0007 and 0017), ARNM 007 was resubmitted and got approval. Of 10 methodologies rated as 'C' only 4 were resubmitted a second time, when two of them rejected, one rated 'B' and one approved. Only one methodology was submitted a third time and got 'B' in its third attempt. Table 2 shows the fate of resubmitted methodologies.

There has been improvement in the successive resubmitted methodologies. ARNM 0001 rejected and resubmitted as ARNM 0005 was again rejected and resubmitted as ARNM 0013 and the improvement led to 'B' rating. Similarly ARNM 0002 rejected and resubmitted as ARNM 0012, got a 'B' rating. ARNM 0004 was resubmitted as ARNM 0014 but again rejected owing to ambiguous and poor drafting of the methodology. AR NM 0011 has been resubmitted as ARNM 0021.

Table 2: Resubmission of A/R CDM methodologies

Submitted first time: (Till round-8)	**2nd resubmission :**	**3rd resubmission:**
Total Submission : 17 Rejection (C):10 Revision: (B):2 (ARNM 0007, ARNM 0017) Approved (A): 2 Clarification: 3	**Total Submission:4** Rejection (C):2 (0005 - 0001and 0014 - 0004) Revision (B):1 (0012 - 0002) Approval (A): 1 (AR AM 0002 - ARNM 0007)	**Total Submission: 1** Rejection (C): 0 Revision (B): 1 (0013 – 0005 - 0001) Approval (A): 0

5 Regional participation

The CDM A/R Portfolio is dominated by Latin American countries. Out of a total of 25 CDM A/R projects linked to the methodology submissions 16 (64%) are from these countries. The possible reason for large-scale participation of Latin American countries is the availability of large areas for A/R, good CDM capacity building, and private entrepreneurs' ownership of land. In most of the Asian nations most of the forest lands (even degraded lands that could be eligible for CDM) are under government control or are largely controlled by communities with poor understanding of CDM and capacity building. Another major reason is perhaps the low priority of Host country DNAs towards forestry projects. This is evident from the fact that out of 81 DNAs so far established in developing countries, only 13 have communicated the definition of forests

to the EB for the purpose of CDM A/R activities. Table 3 gives the list of non Annex 1 countries who have submitted the national definition of forests to the EB.

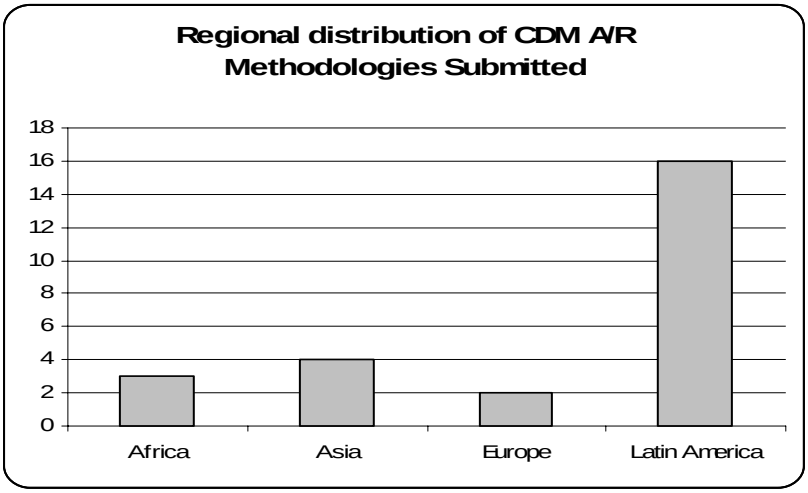

Figure 2: Regional distribution of CDM AR methodologies submitted

Table 3 Country Forest definition for CDM AR projects

	Country	For afforestation and reforestation project activities - Host Party's selected single minimum:		
		Tree crown cover value between 10 and 30 %	Land area value between 0,05 and 1 hectare	Tree height value between 2 and 5 metres
1	Albania	30	0.1	3
2	Cambodia	30	1	5
3	China	20	0.067	2
4	Colombia	30	1	5
5	Costa Rica	30	1	5
6	Dem Rep of the Congo	30	1	5
7	Honduras	30	1	5
8	India	30	0.05	5
9	Nicaragua	20	1	4
10	Republic of Moldova	30	0.25	5
11	Uganda	30	1.0	5
12	Viet Nam	30	0.5	3
13	Yemen	30	0.5	3

6 Analysis of shortcomings of submitted CDM A/R methodologies

The EB actually requires to address eligibility of the land, to select a baseline, to test additionality, to calculate project carbon uptake and leakage. Many of the submitted

baseline methodologies failed to address these issues in the way desired by the EB. In the following paragraphs the major criticisms that led to rejection or revision of methodologies are described in brief.

A methodology should present alternative land-use scenarios and assess (qualitatively or, preferably, quantitatively) the likelihood of each scenario at the time the project starts. ARNM0002, 0003 and 0008 do not properly explain how different baseline scenarios have been identified, and how the most likely scenario has been selected. ARNM0008 assumed that carbon stock in the baseline scenario is declining and therefore the net baseline GHG removal by sink is considered negative. ARNM0002 and 0003 did not identify a credible baseline scenario, as they assume that carbon stock of the baseline is low and constant. This excludes the fact that often natural regeneration occurs and baseline sinks are greater than zero. With regards to ARNM 0007, the EB criticized that the baseline scenario should not be assumed but result from the analysis of conditions in the pre-project situation.

Methodologies need to explain how sectoral policies are taken into account. Just giving a statement that all national/ sectoral policies have taken into account, is insufficient (ARNM0002, ARNM0003). CDM EB has issued a separate clarification regarding this issue (See Appendix 1).

At its 21st meeting, the EB agreed on a tool for demonstration of additionality in A/R CDM projects. Although the tool is not mandatory it is widely used by almost all project developers, albeit sometimes with slight modifications. Regarding ARNM 0011, the EB misses a clear separation between baseline determination and additionality test. ARNM 0005 does not provide a description as to how the economically attractive baseline scenario is “modelled”.

Table 4: Choice of baseline approach, selection of carbon pools and use of tools for eligibility and additionality by various methodologies:

Sl. No.	Meth. No. AR	Choice of baseline approach of 22 a, b or c	CDM Eligibility of land	Additionality tool used	Carbon Pools selected
1	ARNM 0001	c	Not provided	yes	Biomass
2	ARNM 0002	c	Not proper	Yes	All
3	ARNM 003	a	Not clear	Not adequate	All
4	ARNM 0004	c	Not provided	Yes	All except litter
5	ARNM 0005	b	Provided	Yes	All
6	ARNM 0006	c	Provided	Yes	All except dead wood
7	ARNM 0007	a	Provided	Yes	All
8	ARNM 0007 rev (ARAM 0002)	a	Provided	Yes	All
9	ARNM 0008	a	No test	Not proper	All
10	ARNM 0009	a	Insufficient	Insufficient	All
11	ARNM 0010 (ARAM0001)	a	Tested	Yes	AG and BG only
12	AR NM 0011	b	Not very clear	Yes (modified)	All
13	AR NM 0012	c	Not clear	Insufficient	Only AG and BG living biomass
14	ARNM 0013	b	Proved	Yes	All
15	ARNM 0014	c	Not clear	Yes	All
16	ARNM 0015	c	clear	Yes	Living Pool (AG & BG)
17	ARNM 0016	a	Proved	Not adequate	All
18	ARNM 0017	a	Proved	Yes	All except litter
19	ARNM 0018	a	Proved	Yes	Only AG and BG living biomass
20	ARNM 0019	a	Proved	Yes	Only AG and BG living biomass
21	ARNM 0020	a	Proved	Yes	AG,BG and SOC
22	ARAM 0021	a	Tool used	Yes	All except SOC
23	ARNM 0022	A	Tool used	Yes	Only AG and BG living biomass
24	ARNM 0023	C	Tool used in PDD	Yes	Only AG and BG living biomass
25	ARNM 0024	A	Tool used	Yes	All except SOC
26	ARNM 0025	A	Tool used	Yes	Only AG and BG living biomass
22 a,b and c are three alternatives of para 22 of decision 19-CP.9 (M&P for CDM A/R projects) and are described elsewhere in the text					
AG= Above ground; BG= Below Ground; SOC=Soil Organic Carbon					

The procedure to define land eligibility (see Annex 16 of the report of the 21st meeting of the EB) is as follows:

1. Project participants shall provide evidence that the land within the planned project boundary is eligible for A/R CDM following the steps outlined below.

(a) Demonstrate that the land at the moment the project starts is not a forest by providing information that:

i. The land is below the forest national thresholds (crown cover, tree height and minimum land area) for forest definition as provided by the host country DNA; and

ii. The land is not temporarily unstocked as a result of human intervention such as harvesting or natural causes or is not covered by young natural stands or plantations which have yet to reach a crown density or tree height in accordance with national thresholds and which have the potential to revert to forest without human intervention.

(b) Demonstrate that the project qualifies as A/R:

i. For reforestation projects, demonstrate that on 31 December 1989, the land was below the forest national thresholds (crown cover, tree height and minimum land area) for forest definition as provided by the host country DNA.

ii. For afforestation projects, demonstrate that the land is below the forest national thresholds (crown cover, tree height and minimum land area) for forest definition under decision 11/CP.7 as communicated by the respective DNA, for a period of at least 50 years.

Project participants shall provide one of the following verifiable information:

(a) Aerial photographs or satellite imagery complemented by ground reference data; or

(b) Ground based surveys (land use permits, land use plans or information from local registers such as cadastre, owners register, land use or land management register); or

(c) If options (a) and (b) are not available/applicable, project participants shall submit a written testimony which was produced by following a participatory rural appraisal methodology.

Merely giving a statement that an area is eligible for A/R will not sufficient. Area eligibility should be defined clearly using eligibility tools now developed by CDM EB

and are now mandatory (ARNM0001, 0004, and 0008 found to be lacking). As stated above eligibility is among the conditions for use of baseline methodology. ARNM0005 proved eligibility by satellite data. Assuming the eligibility of the land by merely visual interpretation e.g. what is today would have been the likely land situation some 15 years ago is not proper. The proponent must propose some independent mechanism to determine land eligibility (ARNM0003 deficient). A list of methodologies that have not sufficiently described the land eligibility is given in table 4.

Calculation of project greenhouse gas removal, baseline removal, leakage and net GHG removals by sinks has to be included in the PDD. The guidance document on how to complete the PDD indicates that the calculations are to be provided for each year in the crediting period (UNFCCC 2006). Thus a PDD needs to include an *ex ante* estimation of GHG removal as part of project activity. ARWG observed that many of the submitted new A/R methodologies often do not include an *ex ante* calculation of actual net GHG removal by sinks in the baseline methodology; instead they provide only a monitoring procedure for actual GHG removal by sinks and net anthropogenic removal by sinks (ARNM0001, 0002, 0005, 0006, 0009). ARNM 0013 still describes partly *ex post* estimation of baseline. In its 21st meeting, the CDM EB also issued a clarification that a methodology using a widely accepted CO_2 fix model for *ex ante* estimation is considered acceptable (ARNM 0007/ARAM 0002).

The “project boundary” geographically delineates the A/R project under the control of the project participants which may consist of more than one discrete area of land, provided

- Each discrete area of land has a unique geographical identification.

- The boundary is defined for each discrete area and does not include the areas in between these discrete areas of land.

ARNM0014 does not use the concept of project boundary. Thus, leakage could not be addressed properly. In ARNM0005, the term project boundary is incorrectly used to refer to the geographic limit of the general area of project instead of referring to the exact area of land on which the project takes place. ARNM0002 used coarse satellite data with a resolution of less than 100m.

Leakage is the emissions increase outside the project boundary. The terms “measurable and attributable” in the leakage rules (paragraph 51 of the CDM A/R M&P, see UNFCCC, 2003) should be read as “which can be measured” and “directly attributable”. This is an aspect with which many methodologies are struggling with for a number of reasons. ARNM 0001 does not address leakage due to market effects that decrease A/R activities elsewhere. ARNM0001, 0002, 0003, 0004, 0008, 0009, 0011, and 0014 do not consider an activity shift. ARNM0013) provided a tool for estimating different types of leakage (energy leakages, land management leakages, market leakages, A/R diversion, displacement leakages) and introduced an innovative tool to address market leakages. ARNM 0003 and 0005 tried to account for positive leakage, i.e. a decrease in emissions outside the project boundary but the EB stated it should not be counted. ARNM 0004 proposed to monitor the harvest of adjacent areas by aerial photographs but this was not accepted..

One or more carbon pools, and/or sources of greenhouse gases can be excluded. This is subject to the provision of transparent and verifiable information that the choice will not increase the expected net anthropogenic greenhouse gas removals by sinks. Selection of carbon pools by various methodologies is given in table 4. Regarding ARNM 0001 and 0002, selection of carbon pools is found to be not appropriate. With respect to ARNM 0004, it excludes changes in carbon stocks and all non tree carbon pool in project scenario is considered only in qualitative terms.

A methodology must include a description of key parameters, data sources and assumptions used in the baseline estimate, and assessment of uncertainties. In ARNM 0001, 0002 and 0006, uncertainties were not covered In ARNM 0004 and 0006, no significance level to assess statistical errors and maximum tolerable errors was provided. ARNM 0003 and 0011 provide only a superficial qualitative description of baseline assumptions. ARNM 0013 only used a 90% confidence interval while a 95% one should be used.

Establishing a baseline in a transparent and conservative manner means that assumptions are made explicitly and choices are substantiated. The question how forest will develop in the baseline needs to take into account the decision of the EB in its 24th meeting regarding A/R in the baseline scenario. In case the baseline is derived from economic

modeling, the precise description of model to be applied has to be given (ARNM 0005). ARNM 0016 did not provide a conservative estimate of removals associated with the baseline option and its treatment of non tree biomass is confusing.

Problems with formulas abound. ARNM 0003 was criticized for poor sampling and no description how sample trees are selected, as well as for using unpublished data or data from websites which was not considered accurate by the EB. In ARNM 0002, formulae did contain errors several times. Surprisingly, regarding ARNM 0013, the criticism was raised that requirements for fine tuning allometric equations, expansion factors etc. were more stringent than in the IPCC guidelines and thus would increase monitoring cost.

A good methodology needs to be written in very concise and clear manner. ARNM 0012 was rated as ‘B` mainly on the ground that this was not the case. ARNM 0006 was not described in an internally consistent and unambiguous way. Numerous formatting and language imperfections were noticed in ARNM 0017.

Project developers are advised to adequately address all of the above concerns. Due to the evolving nature of the negotiations, the CDM website (www.unfccc.int/CDM) should be regularly consulted for recent clarifications.

7. Applicability conditions

Applicability conditions of methodologies are a key parameter and in the context of energy methodologies there has been a tendency to narrow them down. ARNM 0005 applied for wide applicability in the context of tropical timber plantations aiming at restoring forests of high biodiversity value. ARNM 0001, 0002 and 0006 have used project specific information that have limited the applicability of the methodology ARNM 0003 could be widely applied in many countries with the baseline scenario of slash and burn agriculture and continued deforestation for fuelwood. ARNM 0014 is narrowly applicable to unfertilised temperate grasslands under extensive grazing by cattle and/or sheep. ARNM 0017 addresses severely degraded lands..

8. Strengths of proposed methodologies

ARNM 0013 has demonstrated additionality for different strata of the land. Methodology ARNM 0004 and its resubmission ARNM 0014 has rigorously assessed the additionality and provided a clearly explained decision tree for the assessment. It also uses a

sophisticated analysis of the sensitivity of internal rates of return (IRR) to parameters selected for investment analysis. ARNM 0012 provides detailed development of algorithms for carbon accounting. ARNM 0005 and 0013 include regular monitoring and recalculation of baseline sinks over time and uses species-specific and local biomass parameters rather than generic global parameters. ARNM 0014 estimates carbon on the basis of standard yield tables and is thus relatively straightforward (0014). ARNM 0016 proposes pre-sampling to estimate sample numbers likely required to achieve estimates of true mean values with a specified accuracy and confidence interval. ARNM 0017 stratifies project area separately based on natural conditions (baseline stratification) and project activity (project stratification). This makes it easier to estimate baseline carbon stock change. AM 0013 is very strict in dealing with certain types of uncertainties, e.g. in the use of periodically revised biomass related factors or in the establishment, management and periodic reassessment of Baseline Control Areas. ARNM 0002 monitors all carbon pools in the baseline and in the project scenario using sample plots.

9 A/R small scale projects:

Various analysts have suggested that due to high transaction cost CDM A/R small scale projects will not be a viable solution. Michaelowa *et al* (2003) in one analysis suggested that any project generating less than 20,000 CER will not be a viable project considering the transaction costs. Realizing this fact and in order to reduce transaction costs , the EB defined small scale simplified baseline and monitoring methodologies for selected small-scale afforestation and reforestation project activities (UNFCCC, 2005). The small scale A/R project activities under CDM will result in net anthropogenic GHG removal by sinks of less than 8 kilotonnes of CO_2 per year. Due to this low threshold, nobody has submitted any project using this methodology and it is unlikely that this would be done. Thus we do not discuss the.methodology here.

10 Characteristics of the approved methodologies:

The applicability conditions of the three approved methodologies are similar (see table 5). We describe their special characteristics that enabled them to pass the stringent approval process.

10.1 ARAM 0001: Reforestation of degraded lands

ARAM 0001 has been the first CDM A/R baseline methodology approved by the EB. This methodology is connected with the PDD "Facilitating Reforestation for Guangxi Watershed Management in Pearl River Basin, China". The methodology, baseline study, monitoring and verification plan and PDD were prepared by Institute of Forest Ecology and Environment, the Chinese Academy of Forestry, Joanneum Research, Austria, and Guangxi Forestry Inventory and Design. The project aims to reduce threats to local forests and generate income to the poor farmers by enabling the carbon sequestered by plantations to act like a "virtual" cash crop for the local project beneficiaries.

The approach selected by the baseline methodology is "Existing or historical, as applicable, changes in carbon stocks in the carbon pools within the project boundary". The methodology provides a detailed, stepwise approach for selecting the baseline scenario, looking at historical land use, and economic, social and policy reasons. It has to be shown that land use has stabilized and no significant changes have taken place in the immediate past and are unlikely in the foreseeable future. The choice of the algorithms/formulae follows the IPCC Good Practice Guidance for LULUCF (GPG). A conservative approach is adopted by setting the baseline to zero for lands without trees even though some biomass in shrubs and grasses is present. The additionality tool is used with only minor modifications. The selection of the pools within the boundary of the project seems adequate, specially taken into account the strata approach for the baseline estimation. The following project emissions as well as carbon pools included under the baseline and project scenarios are: emission sources and gas from project activity: (i) combustion of fossil fuel (CO_2); burning of biomass (CO_2, CH_4 and N_2O) and use of fertilizers (N_2O). Only above-ground and below-ground biomass are selected as carbon pool under baseline and project scenario.

The methodology requires extensive data sources that include historical land use cover data (compilation from publications, government information and information compiled through interviews with local people). In the accompanying project, a forest inventory map, Landsat images (1989/1990), a stratified land form map and a soil map from the local government have been used. Parameters for the investment analysis and other financial indicators together with cost components and revenues were obtained from local

statistics, published data or surveys. All factors and equations used in the baseline methodology were obtained from the IPCC GPG for LULUCF, national and local forestry inventory reports, the national GHG inventory or calculated. The allometric equations were obtained from the national forestry inventory. Overall, all data sources are adequate. To estimate baseline net GHG removal by sinks, leakage and actual Net GHG removal and anthropogenic removal by sinks methods from the GPG as well as related rules for A/R CDM project activities are used. The methodology presents an approach for including uncertainties of data into uncertainty of the final estimates.

Regarding leakage, emissions from burning of fossil fuels resulting from project-related transportation of staff, seedlings, timber and non-forest products are counted.

10.2 ARAM 0002: Restoration of degraded lands through afforestation /reforestation

The methodology is applicable to a wide variety of degraded lands with a continuing loss of carbon or a low steady state of carbon pools. The conservative assessment of zero carbon removals in the degraded lands of the baseline scenario (in which carbon is lost) permits a direct estimation of the net anthropogenic GHG removals without the need to monitor baseline removals, thereby saving monitoring costs. The accompanying PDD “Moldova Soil Conservation Project” aims to achieve multiple objectives in terms of the restoration of degraded lands through improvement in the vegetative cover, enhanced supplies of forest products to local communities, and increases in the GHG removals from the degraded lands. The project area covers several geographic units spread over throughout the country and is managed by communities. Project participants are the State Forest Agency - Moldsilva and the Prototype Carbon Fund of the World Bank.

As in ARAM 0001, "existing or historical, as applicable, changes in carbon stocks in the carbon pools within the project boundary" define the baseline. The choice is justified by widespread non-compliance with national and sector policies that highlight the need for restoration of degraded lands. Thus historical land uses persist that not only aggravate degradation of the affected lands but also adversely affect the productivity of adjoining lands. The methodology provides a detailed stepwise instruction for: (i) *Ex-ante* stratification, (ii) Identification of plausible scenarios and (iii) Selection of the baseline scenario. In addition, the methodology takes into consideration the national and sector

land-use policies to demonstrate that they do not impact the degraded lands considered under the project in order to ensure that the historical baseline approach is applicable to the project context. The data and information on vegetation parameters over the previous 10 year period demonstrate the evolution of degraded lands under the baseline scenario and the inability to regenerate these lands naturally in the absence of seed sources and natural regeneration. The steps of the methodology transparently identify the baseline scenario using multiple sets of physical and socioeconomic variables. Then, the additionality tool is applied. The *ex-ante* estimation of the actual net GHG removals by sinks can be done using the peer reviewed carbon accounting model (CO_2 Fix) or by using one of the forest management methods defined in the GPG and the approved methodology ARAM 0001. Each discrete parcel of land shall have a unique geographical identification. The boundary shall be defined for each discrete parcel and delineated to make the boundary geographically verifiable. The plot data shall be recorded, archived and listed in the PDD. The methodology covers all carbon pools, and emissions of N_2O from fertilizer use (CO_2, CH_4 excluded), CO_2 from combustion of fossil fuels (CH_4, N_2O excluded), CO_2, CH_4, and N_2O for biomass burning. The procedure for proving land eligibility is as per recent clarifications from EB. Leakage includes transportation emissions associated with the travel of staff and transportation associated with the project activities to areas outside the project. A good sampling framework is used, based on location specific allometric relationships.

10.3 ARAM 0003: Assisted Natural Regeneration of Degraded Lands in Albania

Like previous two approved methodologies this methodology uses the historical approach. The lands considered in this methodology are currently degraded. Baseline scenario (c) would likely result in a similar baseline scenario as approach (a) due to the high likelihood of the current land use to continue. Therefore approach (a) is considered to be appropriate according to the applicability conditions proposed. A baseline scenario is determined for each stratum. If no or only sparse natural regeneration with no potential to become a forest can be identified, then the determination of the baseline carbon stock changes is made. Otherwise, the project is considered not different from the baseline scenario. The project accompanying the methodology is implemented on degraded land in Albania. Uncontrolled grazing prevents the development of a vegetation cover. A

participatory approach within the community is taken to reach a common agreement on site selection and grazing control. The General Directorate for Forests and Pastures and the BioCarbon Fund are the project participants.

Through the use of the decision-tree or rule-based tool, it has to be demonstrated that the proposed project activity is additional and therefore not the baseline scenario.

Stratification is used to develop groupings of functionally homogenous areas to acknowledge differences in carbon stock changes within different environmental conditions. This allows addressing the full range of variables, including soil type, climate, species distribution, etc. which increases the accuracy of the methodology. Stratification of the project area is based on local site classification map/table, the most updated land-use / land-cover maps, satellite image, soil map, vegetation map, landform map as well as supplementary surveys, and the baseline land-use / land-cover is determined separately for each stratum. The *ex-ante* calculation of baseline net GHG removals by sinks takes into account different strata. The methodology presents two situations to be considered (a) no growing trees or woody perennials exists before the project start (b) no woody perennials or trees will start to grow at any time during project period. For these situations the baseline scenario is 0. For other strata baseline scenario has to be calculated using the method developed in the GPG. Only the carbon stock change in living biomass is estimated. Taking into account the uncertainty about the annual rate of carbon stock decrease in the baseline scenario, this methodology conservatively sets baseline carbon stocks in all carbon pools to be constant.

The project boundary is defined for all discrete parcels of land to be afforested or reforested and that are under the control of the project participants at the starting date of the project activity. The methodology also provides rules for including in the project area discrete parcels of land not yet under the control of the project but expected to become under the control of the project participants during the crediting period; The physical identification is done using GIS. The methodology considers only living carbon pools. This selection is considered conservative according to the applicability conditions specified.

In contrast to ARAM 0001 and 0002 the methodology thoroughly considers all possible leakages. Apart from leakages due to fossil fuel consumption it considers leakages due to

activity displacement of pre-project activity and measures all possible source of it i.e. due to conversion of grazing land, due to CO_2 emission resulting from fodder consumption, due to CH_4 emission from enteric fermentation and leakage due to fencing.

11. Conclusions

Contrary to the belief of some observers that development of forestry baseline methodologies is an almost insurmountable challenge, CDM A/R methodologies are now seeing the light of the day. The initial high rate of rejection of the submitted methodologies reflected poor integration of CDM modalities and procedures in the development of methodology. The specific reasons for rejection as discussed in the text led to a subsequent improvement in the methodologies particularly after approval of one methodology. Some of the methodologies have been very project specific with a limited applicability. Methodologies that have been approved are simple and generalist with wider applicability in the degraded lands that are continuously degrading specially in the tropical and subtropical regions. The applicability condition of the methodologies are almost similar. As three methodologies approved for similar type of projects, the EB can consider consolidating the methodologies that are to be proposed for such type of lands.

The methodologies specially designed for degraded lands should have measured all carbon pools. ARAM 0001 is deficient in this respect. Although developers of this methodology in order to make it more conservative argue that these C pools will be negligible, the very preamble of including A/R activities in CDM, apart from meeting carbon credits refers to the sustainable development and improvement of environment in the host country. Monitoring and measuring of this parameter of litter and soil organic carbon can serve as an indictor how the overall environment and ecosystem health has been improved as a result of implementation of these projects.

Table 5: Comparative assessment of applicability of approved CDM A/R methodologies

ARAM 0001	ARAM 0002	ARAM 0003
Lands are severely degraded with the vegetation indicators below thresholds for defining forests, and the lands are still degrading. The project activity does not lead to a shift of pre-project activities outside the project boundary, i.e. the land under the proposed A/R CDM project activity can continue to provide at least the same amount of goods and services as in the absence of the project activity. Environmental conditions and human-caused degradation do not permit the encroachment of natural forest vegetation. Lands will be reforested by direct planting and/or seeding. Site preparation does not cause significant longer term net emissions from soil carbon. Plantation may be harvested with either short or long rotation and will be regenerated either by direct planting or natural sprouting.	Lands are severely degraded with the vegetation indicators below the thresholds for defining forests, and the lands are still degrading. The project activity does not lead to a shift of pre-project activities outside the project boundary, i.e. the land under the proposed A/R CDM project activity can continue to provide at least the same amount of goods and services as in the absence of the project activity. Environmental conditions and human-caused degradation do not permit the encroachment of natural forest vegetation. Lands will be reforested by direct planting and/or seeding. Plantation may be harvested with either short or long rotation and will be regenerated either by direct planting or natural sprouting. Grazing will not occur within the project boundary in the project case. Baseline leads to conclusion that the baseline approach 22(a) (existing or historical changes in carbon stocks in the carbon pools with the project boundary) is the most appropriate choice and that the land would remain degraded in the absence of the project activity.	Severely degraded lands that are still, degrading or remain in a low carbon steady state; The project activity can lead to a shift of pre-project activities outside the project boundary, e.g. a displacement of grazing and fuelwood collection activities. Environmental conditions and/or anthropogenic pressures do not permit encroachment of natural tree vegetation that leads to the establishment of forests that meets CDM definition. A/R activities through promotion of natural regeneration or direct planting. Site preparation does not cause significant longer term net decreases of soil carbon stocks or increases of non-CO_2 emissions from soil. Carbon stocks in soil, litter and dead wood can be expected to decrease more due to soil erosion and human intervention or increase less in the absence of the project activity, relative to the project scenario. Soil drainage and disturbance are insignificant, so that non CO_2-GHG emissions from this type of activity can be neglected. The amount of nitrogen-fixing species (NFS) used in the AR CDM project activity is not significant, so that GHG emissions from denitrification can be neglected in the estimation of actual net GHG removals by sinks.

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Appendix 1

Latest version of relevant EB documents and clarifications regarding A/R CDM methodologies.

EB 24 10 – 12 May 2006	Annex 19 - Afforestation/reforestation in the baseline scenario
EB 23 22 – 24 February 2006	Annex 15 (a) - Revised CDM-AR-PDD Annex 15 (b) - Revised Guidelines for CDM-AR-PDD and CDM-AR-NM Annex 16 (a) - Small-scale afforestation and reforestation project design document (CDM-AR-SSC-PDD) Annex 16(b) - Guidelines for Small-scale afforestation and reforestation project design document (CDM-AR-SSC-PDD) Annex 19 - Guidance of national and/or sectoral policies and circumstances particular to A/R project activities
EB 22 23 - 25 November 2005	Annex 14 - Revised guidelines and form CDM-AR-NM (version 2) Annex 15 - Clarifications to afforestation and reforestation issues Annex 16 - Procedures to define the eligibility of lands for afforestation and reforestation project activities
EB 21 28 - 30 September 2005	Annex 16 - Tool for demonstrating the additionality of afforestation and reforestation Annex 18 - Procedures for submission and consideration for a proposed new methodology for A/R project activities Annex 20 - Clarifications regarding ex-ante estimations of actual net GHG removals by sinks and identification and justification of most likely baseline scenario
EB 18 23 - 25 February 2005	Annex 4 - Clarifications regarding submissions of proposed new baseline and monitoring methodologies for afforestation and reforestation project activities under the CDM (24 KB) Annex 5 - Criteria to be used in the screening process for AR proposed new baseline and monitoring methodologies

Source: http://cdm.unfccc.int/EB/Meetings

Appendix-2

Chronology of CDM A&R Project submission

Round	Meth No. (ARNM)	Public Comments closed & comments received from	Desk Reviewers	AR WG Meeting & Recommendation	EB Meeting & Decision
1	0001	26/11/04 Axel Michealowa	Bernhrd Schlamadinger Gerald Kapp	ARWG1 25-26 Jan 05 (ii) Revised as per EB18 (11/04/05)	EB 19 11-13 May 05**'C'**
2	0002	21/12/04 Robert Seaton	Bernhrd Schlamadinger Lucio Pedroni	ARWG1 25-26 Jan 05 (ii) Revised as per EB18 (11/04/05)	EB 19 11-13 May 05'C'
3	0003	31/03/05 Jol Hodgson, Brian Jantzi Richard Muyuingi	Craig Trotter Patric Gonzalez	ARGW4 13-14 June 05	EB20 6-8 July 05 **'C'**
4	0004	27/05/05 No comments	Carmenza Robledo Craig Trotter	ARGW4 13-14 June 05	EB 20 6-8 July 05 **'C'**
4	0005	09/05-27/05/05 Jutta Kill	Bernhrd Schlamadinger Patric Gonzalez	ARGW4 13-14 June 05	EB 20 6-8 July 05 **'C'**
4	0006	27/05/05 No comments	Cyril Loisel Vincent Eschenbrenner	ARGW4 13-14 June 05	EB20 6-8 July 05 **'C'**
4	0007	31 /05/ 05	Bernardus H.J. de Jong Wolfram Kägi	ARGW6 31Oct-2 Nov,05	EB 22 23-25Nov.05 **'B'**
5	0008	30/06/05-20/07/05	Axel Michaelowa Cyril Loisel	ARGW5 31 Aug-2-Sept,05	EB21 28-30 Sept,05 **'C'**
5	0009	20/07/05	Cyril Loisel Craig Trotter	ARGW5 31 Aug-2-Sept,05	EB 21 28-30 Sept,05 **'C'**
5	0010 ARAM 0001	20/07/05	Maria J. Sanz Raul Ponce	ARGW5 31Oct-2 Nov,05	EB22 23-25 Nov, 05 **'A'**
5	0011	20/07/05	Bernhrd Schlamadinger Wolfram Kägi	ARGW5 31 Aug-2-Sept,05	EB21 28-30 Sept,05 **'C'**
6	0012	15 /09/ 05	Bernardus H.J. de Jong Gerald Kapp	ARGW8 28-29 March,06	EB24 **'B'**
6	0013	15 /09/ 05	Raul Ponce Xioquan Zhang	ARGW7 07-08 Feb, 06	EB 23 22-24 Feb, 06 **'B'**
7	0007 Rev* ARAM 0002	'B' Case	'B' case	ARGW8 28-29 March,06	EB 24 **'A'**
7	0014	08/12/05	Craig Trotter Wolfram Kägi	ARGW7 07-08 Feb, 06	EB23 22-24 Feb, 06 **'C'**
7	0015	08 /12/ 05	N/A	Clarification?	
7	0016	08 /12/ 05	Craig Trotter Cyril Loisel	ARGW7 07-08 Feb, 06	EB23 22-24 Feb, 06 **'C'**
7	0017	08 /12/ 05	Xiaoquan Zhang Walter Oyhantçabal	ARGW8 28-29 March,06	EB23 22-24 Feb, 06 **B**
7	0018 ARAM0003	23 /12/ 05	Wolfram Kaegi Raul Ponce	ARGW8 28-29 March,06	EB 24 May, 06 **'A'**
8	0019	08 /03/06	N/A	ARWG 8	N/A
8	0020	08 /03/06	N/A	ARWG-8	N/A

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   Axel Michaelowa, Björn Dransfeld
   Hamburg, November 2006

7. On the impact of renewable energy support schemes on power prices
   Sven Bode
   Hamburg, September 2006

6. CO_2 emission reduction potential of large-scale energy efficiency measures in heavy industry in China, India, Brazil, Indonesia and South Africa
   Daisuke Hayashi, Matthias Krey
   Hamburg, November 2005

5. CO_2 emission reduction potential of large-scale energy efficiency measures in power generation from fossil fuels in China, India, Brazil, Indonesia and South Africa
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1. Lessons from the submission and approval process of energy-efficiency CDM baseline and monitoring methodologies
   Felicia Müller-Pelzer, Axel Michaelowa
   Hamburg, September 2005

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