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Research Report

Forests and carbon: a review of additionality

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Summary

- Additionality is a core aspect of quality assurance of greenhouse gas (GHG) emissions reduction and sequestration activities. The concept is used in a climate change context to mean net GHG emissions savings or sequestration benefits over and above those that would have arisen anyway in the absence of a given activity or project.

- The underlying rationale is to distinguish activities which further contribute to climate change mitigation from those which, although they may be associated with carbon savings, offer no benefits above those expected anyway.

- Distinguishing activities which are additional requires establishing a 'business as usual' baseline. This requires determining a counterfactual for what would have happened if the project or activity had not gone ahead, and identifying the carbon pools and other greenhouse gas emissions sources and savings covered by the assessment.

- Additionality is a multi-faceted concept. At least nine forms of legal, regulatory and institutional additionality, three of financial and investment additionality, and three of environmental additionality can be distinguished.

- Aspects covered by additionality tests vary between mechanisms and standards. The coverage, methodology and evidence requirements of specific types of tests also vary.

- Differences in additionality tests between standards are unrelated to whether carbon units are issued ex-post or ex-ante. The same additionality tests can generally be used for ex-post and ex-ante carbon units.

- A trade-off exists between the rigour and cost of additionality tests. Differences between standards and mechanisms partly relate to this trade-off as is illustrated by the different tests applying to large-scale and small-scale projects under the Clean Development Mechanism (CDM), as well as approaches to establishing baselines. The rigour-cost trade-off affects both the quality and number of projects approved.

- In developing an industry Code of Good Practice for UK forestry carbon projects, focusing upon GHG and barrier additionality alone (i.e. adopting a similar approach to that for small-scale CDM forestry projects) could be controversial. It might be justified if the social cost of adopting further additionality tests were expected to exceed the social benefit, taking account of expected impacts on the level, quality and value of climate mitigation activities.

- A compliance additionality test could be important to include in developing the Code. This would be the case if projects driven purely by replanting conditions under felling licences are to be excluded.

- Investment additionality (whether a project would not be financially viable or the most financially attractive option without carbon finance) is a key aspect of quality assurance from the perspective of purchasers of carbon units. Applying a standard procedure in all cases to test for it can be problematic as project proponents have diverse approaches to quantifying financial viability and selecting projects, but giving project proponents freedom to provide their own evidence could potentially undermine the rigour of a test.

- Institutional additionality (whether particular carbon benefits are included within statutory reporting on GHG reduction targets) is important in considering incentives for forestry projects in view of its influence on demand and prices in the voluntary market. The precipitous drop in total EU voluntary carbon units of all types sold from 2.3 $mtCO_2e$ in 2007 to 0.2 $mtCO_2e$ in 2008 was reportedly due partly to double-counting concerns related to reductions also being covered by national reporting under the Kyoto Protocol.

- Including a test for institutional additionality in the Code may be important in distinguishing different qualities of carbon units if some involve cancelling or withdrawing from the market an equivalent number of other units. Where this occurs, an institutional additionality test could be important to incorporate in the Code particularly if an investment

test is also included due to the potential divergence in carbon prices.

- The Code could be extended from covering carbon sequestration alone to substitution benefits due to use of wood products instead of more energy-intensive materials (e.g. concrete and steel) and of fossil fuels. This could be important where such savings are significant, providing quantification and monitoring is cost-effective. Inclusion of carbon substitution benefits would increase complexity, but their exclusion risks unfairly advantaging carbon sequestration projects that do not necessarily offer the greatest overall climate mitigation benefits.

- To the extent that the concept of additionality is open to interpretation and is based upon comparisons of future hypothetical scenarios, its determination is necessarily imprecise and is likely to remain controversial, even where comparatively stringent tests are applied.

1 Introduction

Background

Additionality is widely considered to be a core aspect of quality assurance of emissions reduction and carbon sequestration activities. However, it remains a source of much controversy in relation to national carbon accounting, regulatory frameworks and carbon markets.

This short review aims to help clarify the concept of additionality, and provide an overview of how it is currently applied in both compliance and voluntary carbon markets, including tests used and underlying evidence base requirements. It provides background for considering how the additionality principle might be interpreted and applied in establishing standards for woodland climate change mitigation projects in the UK, including in developing an industry Code of Good Practice. Developing such a code and an independently verified system of quality assurance for the carbon benefits of woodland projects are considered of key importance in helping increase and sustain incentives for climate change mitigation by the forestry sector.

Structure

The main part of the review is split into two parts. Core concepts, and the underlying rationale for application to climate change mitigation activities are considered in section 2. Different types of additionality tests used, including associated methodologies and underlying evidence required are outlined in section 3. Section 4 concludes.

2 Core concepts and rationale

Core concepts

A concept with wide applicability, additionality is used to distinguish positive net benefits associated with an activity or project.[1] In the context of climate change mitigation, the concept is generally used to mean net greenhouse gas (GHG) emissions savings or sequestration benefits over and above those that would have arisen anyway in the absence of a given activity or project.[2] At international level, the idea that carbon benefits must be 'additional' is enshrined in Articles 3.4,[3] 6.1,[4] and 12.5 of the Kyoto Protocol.[5]

In principle, additionality could also be used more broadly to denote social, biodiversity, or other types of net benefits associated with a given climate change mitigation activity or project. However, the focus in this paper is more narrowly upon net GHG benefits.

The concept of additionality is used to refer to GHG or carbon benefits within the specified project boundary[6], with concepts of 'leakage' and 'displacement' referring to external effects outside the project boundary.[7] This differs from other contexts where 'leakage', 'displacement' and 'substitution' effects are also considered in determining additionality.[8]

The time frame used to assess the additionality of climate change mitigation activities depends upon the period over which carbon units are to be claimed or benefits accounted for, which may be shorter than the lifetime of a project. This contrasts with other contexts where it is usual to consider additionality over the lifetime of a project or intervention.[9] Additionality is considered from the current perspective based upon the starting date for a given climate change mitigation project or activity. Were a different starting date chosen, determination of the additionality of carbon benefits might change.

Additionality is often interpreted as a dichotomous variable, with carbon benefits classified as additional, or not additional, depending upon whether or not they exceed those expected to arise anyway in the absence of the particular activity. However, it can also be conceptualised as a continuous variable with the degree additionality distinguished.[10]

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[1] E.g. the Treasury Green Book (HM Treasury, 2003, p.53 and p.101) state 'The net benefit is the 'additionality' of the option' and 'An impact arising from an intervention is additional if it would not have occurred in the absence of the intervention.' Similarly, Scottish Enterprise (2007 p.2) defines additionality as 'the net changes that are brought about over and above what would have take place anyway.'

[2] E.g. Broadmeadow (2009, p.2) states that it means 'carbon savings must be in addition to reductions that would be made anyway.'

[3] Referring to LULUCF-related activities (forest management, cropland management, grazing land management and revegetation) arising from activities other than those resulting from direct human-induced land-use change and afforestation, reforestation and deforestation since 1990 reported under Article 3.3, Article 3.4(c) of the Kyoto Protocol states that: the Conference of the Parties shall '...decide upon modalities, rules and guidelines as to how, and which, **additional** human-induced activities related to changes in greenhouse gas emissions by sources and removals by sinks in the agricultural soils and the land-use change and forestry categories shall be added to, or subtracted from, the assigned amounts for Parties included in Annex I, taking into account uncertainties, transparency in reporting, verifiability, the methodological work of the Intergovernmental Panel on Climate Change...' (Emphasis added). See: http://unfccc.int/essential_background/kyoto_protocol/background/items/1351.php and http://unfccc.int/methods_and_science/lulucf/items/4129.php.

[4] Referring to emission reduction units acquired for the purpose of meeting national emission limitation or reduction commitments of Annex I countries under Article 3, Article 6.1(b) states that such units can be transferred providing: 'Any such project provides a reduction in emissions by sources, or an enhancement of removals by sinks, that is **additional** to any that would otherwise occur.' (Emphasis added).

[5] Referring to Clean Development Mechanism projects, Article 12.5(c) of the Kyoto Protocol states that emissions reductions must be certified on the basis of: 'Reductions in emissions that are additional to any that would occur in the absence of the certified project.' (Emphasis added).

[6] For Clean Development Mechanism projects, for example, UNEP state that 'The project boundary shall encompass all anthropogenic emissions by sources of greenhouse gases (GHG) under the control of the project participants that are significant and reasonably attributable to the CDM project activity' (Lee, 2005, p.182).

[7] For example, according to the IPCC 'Leakage is defined as the unanticipated decrease or increase in GHG benefits outside of the project's accounting boundary (the boundary defined for the purposes of estimating the project's net GHG impact) as a result of project activities' (IPCC, 2000, 5.3.1). Similarly, UNEP defines 'leakage' in the context of CDM projects as 'the net change of anthropogenic emissions by sources of greenhouse gases (GHG) which occurs outside the project boundary, and which is measurable and attributable to the CDM project activity' (Lee, 2005, p.182). VCS (2008a, p.7) defines leakage as 'any increase in greenhouse gas emissions that occurs outside a projects boundary (but within the same country), but is measurable and attributable to the project activities.'

[8] E.g. the Treasury Green Book (HM Treasury, 2003 p.53) states that additionality must '...be calculated with consideration of 'leakage', 'displacement' and 'substitution' effects', where 'leakage' effects 'benefit those outside of the spatial area or group which the intervention is intended to benefit' and 'displacement' and 'substitution' effects 'measure the extent to which the benefits of a project are offset by reductions of output or employment elsewhere.' Snowdon and Thomson (nd) similarly consider displacement (wider geographical re-distribution of income and employment) a main aspect of additionality.

[9] For example, under the heading 'What time period should additionality be calculated over?', Scottish Enterprise (2007 p.4) states that the time period used for appraisals and for evaluations '... should relate to the life of the intervention...'

[10] E.g. Plan Vivio standards state Plan Vivo Projects to be 'highly additional' (www.planvivo.org/fx.planvivo/scheme/planvivodocuments.aspx).

Classifications used in other contexts sometimes also distinguish types of additionality that relate to changes in the timing or quality of benefits.[11]

Distinguishing activities which are additional requires establishing a baseline (or base case)[12] for the 'business as usual' scenario.[13] This depends upon establishing a counterfactual for what would have happened had a project not gone ahead. As counterfactuals are hypothetical scenarios, and it may be impossible to determine precisely what would have otherwise occurred, often additionality can only be determined approximately.

Legal, regulatory and institutional, financial and investment, and environmental aspects of additionality are considered separately in the following subsections.

Legal, regulatory and institutional aspects

In the context of climate change mitigation, there are several forms of legal, regulatory and institutional additionality. Different forms are apparent at the level of the individual firm, offset purchaser, and government.

At the level of private enterprises and other individual organisations, only carbon benefits that exceed those associated with meeting statutory minimum standards are generally considered additional. For example, carbon benefits could be expected to be associated with activities designed to meet statutory energy efficiency requirements, but benefits would only be additional where they exceed the minimum level associated with meeting these statutory requirements. This form of regulatory additionality will be termed 'compliance additionality'.[14] Similarly, although changes at the level of individual firms may not be mandatory, carbon benefits may be expected to accrue as a consequence of incentives provided by existing regulatory frameworks, with only those benefits expected to exceed those resulting from these incentive structures considered additional.[15] This form of regulatory additionality will be termed 'incentive additionality'.

In some cases benefits may only be considered additional if they result from the application of a specific type or category of technology, which will be termed 'technological additionality'. A variety of legal, social, technological, or financial barriers may exist that prevent particular climate mitigation activities being undertaken, with projects only considered additional if they can be shown to overcome such barriers, forms which will be termed 'barrier additionality'. A closely related form to this arises where only activities which are not common practice in the area are considered additional, a type termed 'practice additionality'.

At government level, additionality principles may be applied to carbon accounting and national reporting of emissions reductions. This form will be termed 'reporting additionality'.

From the perspective of a prospective buyer of carbon credits, climate change mitigation activities may only be considered additional where they are undertaken independently from, rather than as part of, meeting statutory greenhouse gas reduction targets. This form, which depends upon carbon accounting rules and emission reporting frameworks adopted by governments, will be termed 'institutional additionality'.

At the level of firms, the government or the buyer of carbon credits, carbon benefits may only be considered additional if they occur after a specified date, or are associated with specific activities or projects that commenced after a particular date, aspects which will be termed forms of 'date additionality'[16] Similarly, carbon benefits may only be con-

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[11] E.g. Scottish Enterprise (2007 p.2) distinguishes three categories of additionality: scale (where in the absence of the activity or intervention there would have been less output), timing (where output would otherwise have occurred at a later date) and quality (where there would otherwise have been a different form of – e.g. lower quality – output). 'Absolute additionality' (where the alternative in the absence of an activity or intervention would have been no output) is classified as a type of scale additionality

[12] E.g. IPCC (2000, p.15) states 'The accounting of changes in carbon stocks and net greenhouse gas emissions involve a determination that project activities lead to changes in carbon stocks and net greenhouse gas emissions that are additional to a without-project baseline.'

[13] In the context of Clean Development Mechanism (CDM) projects, UNEP states 'The baseline scenario helps establish whether or not the proposed CDM project activity would have been implemented in the absence of CDM and, hence is a test of a project's *additionality.* The baseline provides the basis for determining whether GHG emissions (sequestration) from the proposed project are lower (or greater) than the emissions (sequestration) in the absence of the project; that is, whether the CDM project reductions are additional' (Lee, 2005, p.14).

[14] Although here different forms of legal and regulatory additionality are identified, 'regulatory additionality' is often used simply to refer to benefits that exceed statutory requirements (cf Reynolds, 2008). In a wider context, the baseline used to determine additionality is based upon regulatory requirements in environmental cap-and-trade schemes including several nutrient trading schemes in Pennsylvania (Radov *et al.*, 2007).

[15] E.g. in relation to emissions reductions in sectors covered by the EU Emissions Trading Scheme, recent government guidance on GHG policy evaluation and appraisal DECC (2008, 1.39) states 'emission reductions are only additional if they would not have been delivered by the price signal from the EU ETS alone.'

[16] In principle a form of 'date additionality' not directly related to legal or regulatory aspects could also arise if buyers considered climate change mitigation activities undertaken to date to provide the baseline and only new (future) carbon savings to be additional, thus preferring to buy ex-ante credits rather than ex-post credits.

sidered additional if they arise within a particular geographical area, or are produced by particular communities or social groups, which will be termed 'jurisdiction additionality'.

Of the forms of distinguished above, 'reporting additionality' is important in considering national level approaches to additionality in relation to carbon accounting,[17] but with only indirect bearing on the issue of carbon credits, it is not focused upon in this study. Being the least straightforward, 'institutional additionality' is considered further below.

In the 'institutional additionality' case, only credits providing carbon benefits in excess of those envisaged under statutory targets (or not counted in meeting these targets), are considered additional. Any credits used to meet government targets (e.g. included in national greenhouse gas inventories reported under the Kyoto Protocol) that are sold in voluntary carbon markets are not considered additional, and give rise to potential double-counting.[18] Lack of 'institutional additionality' and associated double-counting problems are considered to currently apply to most carbon offset activities undertaken within industrialised countries such as the UK that have legally binding emissions reduction commitments under the Kyoto Protocol (so-called 'Annex B' countries).[19] A market for credits relating to activities that help meet statutory greenhouse reduction targets may also exist,[20] but such credits may be considered of lower quality and command a lower price than credits for activities meeting institutional additionality.[21]

To the extent that changes reported nationally under the Kyoto Protocol are used to achieve international emission reduction commitments, for example, only those carbon savings not covered under national reporting could be considered to meet institutional additionality in relation to the Protocol. In the case of UK forestry, at present these relate mainly to benefits associated with non-grant aided private sector woodland creation, although the existence of such benefits meeting institutional additionality is likely to be only temporary in view of aspirations to extend reporting under Article 3.3 to cover all woodlands once geo-referenced verifiable data becomes available.[22]

Similarly, as the coverage of national GHG reduction targets adopted under the 2008 UK Climate Change Act[23] aims to be comprehensive, institutional additionality in relation to these targets would only apply to the extent that some activities (e.g. non-grant aided private sector woodland creation) are not currently covered. Domestic climate mitigation activities would not meet institutional additionality if not undertaking an activity necessitates substitute activity being undertaken in order for national targets to be met.

Financial and investment aspects

Financial and investment aspects of additionality are closely related. However, separate elements can be identified.

Investment additionality can be defined as cases where a project is not economically viable, or not the most attractive option without revenues from the sale of carbon units.[24] Financial additionality is used to refer to cases where a project would not have been financed without revenues from the sale of carbon units, with projects that would have been financed anyway (e.g. through international development assistance) not financially additional (*cf* Au Yong, 2009).

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[17] Note that additionality is not considered an issue for national reporting under Article 3.3 of the Kyoto Protocol, although it could be an issue under Article 3.4 (see: IPCC, 2000, 5.7, Table 5–10).

[18] Noting that no mechanism currently exists to specifically exclude particular woodland creation projects from the UK greenhouse gas inventory, Broadmeadow (2009, p.4) states 'It would therefore be difficult to demonstrate additionality and to prevent the possibility of double-counting.' In relation to grant-aided projects, Broadmeadow (2009, p.4) cautions 'At present it would be advisable for applicants not to enter into carbon projects linked to woodland planting under EWGS as there is a risk that the action could result in reputational damage to the applicant, their agent, the scheme or woodland planting activity, generally.'

[19] According to Kollmuss (2007) 'If a carbon offset project (say, a wind farm) is implemented by a private offset company in an Annex B country, the reductions it produces will automatically be double-counted: the purchasing individual or organization will count them, but because there is currently no regulatory system permitting those emissions to be "retired" (taken out of the system then and there), the reductions will also be counted in that country's greenhouse gas inventory. ... to date no Annex B country has a regulatory system in place that would prevent this kind of double-counting, which means the private offset project has effectively replaced another set of emissions reduction measures that the country would have had to take in order to meet its Kyoto requirements.'

[20] Despite lack of institutional additionality, Broadmeadow (2009, p.4) argues that nonetheless 'Anyone involved in funding woodland creation might rightly see themselves as making a contribution to reducing the UK's carbon footprint.'

[21] Some purchasers might similarly consider that only in rare cases where compliance credits (including those issued under the CDM and JI mechanisms) are not used in meeting national targets, do they meet institutional additionality.

[22] Net changes in greenhouse gases associated with grant-aided woodland creation projects, and with the FC estate are currently included in UK annual reporting under Article 3.3, with other woodland creation excluded at present (Broadmeadow, 2009).

[23] www.opsi.gov.uk/acts/acts2008/ukpga_20080027_en_1.

[24] Merger (2008, p.19) similarly defines additionality in this sense, relating to cases where 'without the additional financial means from the sale of CO_2 certificates the project can not be implemented.'

Investment additionality is likely to be a prerequisite for financial additionality where projects are financed only if they are expected to be financially viable. Sales additionality is used here to refer to cases where activities or projects commence before the date of registration under a particular standard or mechanism and the income from the sale of carbon credits is a decisive factor for project developers in the decision to proceed.[25] In many instances both expected investment additionality and financial additionality could be expected to be prerequisites for sales additionality (although it is conceivable that cases might arise where income from the sale of carbon credits is a decisive factor in the project being undertaken despite it not being expected to be economically viable).

The availability of project finance is often considered together with institutional and other factors as potential types of barriers to project implementation. Thus, financial additionality can also be considered a form of barrier additionality.

Environmental aspects

At least three forms of environmental additionality exist in a forestry context. Firstly, there is determination of additionality in terms of net impacts on greenhouse gas (GHG) balances, a form that could be termed 'GHG additionality'.[26] This is fundamentally dependent upon the breadth of impacts taken into account in determining the baseline and GHG savings associated with an activity. Considering a wider range of impacts[27] can be expected to improve the quality of additionality assessments, but also the cost.

In some cases, activities may only be considered additional where their output is associated with emissions per unit output below a specified level, a form termed here 'unit additionality'. Additionality can also be considered in terms of whether (in the case of afforestation and reforestation) forests are able to establish themselves in the absence of planned activities or project, or (in the case of avoided deforestation or forest degradation) would have been deforested or degraded, forms of what will be termed 'project additionality'.

Underlying rationale

The fundamental underlying rationale for the development of the concept is to enable activities contributing further to climate change mitigation to be distinguished from those which, although they may appear associated with carbon savings, do not offer benefits above those expected anyway. Benefits expected to have been generated by 'business as usual', including those associated with incidental and non-project factors such as new legislation, market changes, or environmental change, are not considered additional.[28]

Identifying which savings are additional can help avoid credits being issued for projects producing carbon benefits that would have arisen in any case, helping ensure the quality of carbon credits issued and avoid purchasers paying for no substantive gain in climate mitigation activity. Additionality is generally considered a key concept in determining the quality of carbon offsets (OQI, 2008) and of climate mitigation projects in general.

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[25] This is a form of what Costa *et al*. (2000) term 'intent' or 'program' additionality, which aims to exclude projects for which carbon benefits are purely coincidental.

[26] In principal, environmental additionality could also be assessed in terms of other environmental variables (e.g. impacts on water resources, soil fertility, etc).

[27] In some cases, for example, a narrow focus may be taken on carbon fluxes associated with above ground vegetation. In others, other greenhouse gas fluxes, below ground carbon pools including soils, or even substitution effects of wood products and fossil fuel may also be considered.

[28] The term 'deadweight' is also sometimes used for these. For example, the Treasury Green Book (nd, p.53) states 'Deadweight' refers to outcomes which would have occurred without intervention.' (Note however, in focusing upon benefits, this differs from the Green Book, nd, p.101, definition of 'deadweight' as 'Expenditure to promote a desired activity that would in fact have occurred without the expenditure.') Scottish Enterprise (2007 p.5) adopts a similar definition to the former.

3 Tests, methodologies and evidence

This section considers the various tests and methodologies used to assess different aspects of additionality, and associated evidence requirements. Tests explicitly applied to forestry projects under the Kyoto Protocol Clean Development Mechanism (CDM) and six different voluntary market standards are focused upon. Those (including Greenhouse Friendly, VER+, and the Voluntary Offset Standard) currently based entirely, or almost entirely, upon CDM or other UNFCCC methodologies are excluded from separate consideration.[29] (For a broader overview of explicit additionality tests applied under each of the main voluntary carbon standards, see Appendix A). Summary information for those examined is given in Table 1.

The types of additionality tests explicitly applied are summarised below in Table 2. Tests applying to small-case and to large-scale projects are distinguished in the case of CDM forestry, as separate protocols apply (see Appendix B). It should be noted, however, that in addition to additionality tests used explicitly under different standards, other tests are used implicitly. GHG additionality (quantifying net GHG benefits compared to a baseline), for example, underpins all the standards. However, as Table 2 illustrates, it is only focused upon explicitly as the principal focus of demonstrating additionality in the case of small-scale CDM projects.

Methodologies and evidence requirements under different standards for the different types of tests are discussed in the following subsections based upon a web search of published information. The following section considers constituent tests separately. (Accounts of the structure of additionality tools used, including the sequence in which different tests are applied, can be found in Appendix A and Appendix B).

Table 1 Carbon standards and associated forestry carbon units and project types.

Mechanism or standard	Type of unit	Crediting	Name of unit(s)	Type of projects
American Carbon Registry Forest Carbon Project Standard (ACRFCPS)	Voluntary	Ex-post	ERTs	A/R, IFM, REDD
Clean Development Mechanism (CDM)	Compliance	Ex-post	tCERs, lCERs	A/R
CarbonFix (CF)	Voluntary	Ex-ante	$VER_{Futures}$	A/R
Forest Carbon Standard (FCS)	Voluntary	Ex-ante	VERs	A/R
Green-e (GE)	Unrestricted	Unrestricted	VERs	F+
Plan Vivio (PV)	Voluntary	Ex-ante	Plan Vivio Certificates	D
Voluntary Carbon Standard (VCS)	Voluntary	Ex-post	VERs	ARR, APD, AUFDD, IFM, REDD

Project types: A/R = Afforestation and Reforestation; ARR = Afforestation, Reforestation and Revegetation; APD = Avoiding Planned Deforestation; AUFDD = Avoiding Unplanned Frontier Deforestation and Degradation; D = Developing country community forestry; F+ = Forestry and other project types; IFM = Improved Forest Management; REDD = Reduced Emissions from Deforestation and Degredation.

Table 2 Explicit Additionality tests applied to forestry credits under different standards.

Mechanism or standard	Type of projects	Legal, regulatory, institutional (incl. financial)	Investment	Environmental
American Carbon Registry Forest Carbon Project Standard (ACRFCPS)		**R**, **B**, **C**	I, S	
Clean Development Mechanism (CDM)	Small-scale	B		**G**
	Large-scale	**D**, **R**, B, C	**I**, S	
CarbonFix (CF)		**R**, D, B, C	I, S	**P**, G
Forest Carbon Standard (FCS)			**I**	
Green-e (GE)		**D**, **R**, B, T	I, S	U
Plan Vivio (PV)		**R**, **B**	**I**	
Voluntary Carbon Standard (VCS)		**R**, B, T		P, U

Types of tests: B = Barrier; C = Common practice; D = Date; G = Greenhouse gas; I = Investment; P = Project; R = Regulatory compliance; S = Sales; T = Technology; U = Emissions per unit output. Bold text = Test applied in all cases, normal text = applies in some cases.

[29] Additionality tests used for Joint Implementation projects are also omitted here as standards for these are still being developed, and CDM additionality tools are reportedly used in some cases (see, for example, the presentation in autumn 2008 by Flavio Gomes to the UNFCCC Technical Workshop on Joint Implementation at http://ji.unfccc.int/Workshop/9_September_2008.html).

Legal, regulatory and institutional tests

Date additionality

Date additionality tests used for projects under the CDM and the Green-e standard employ the same cut-off date, only considering projects starting in 2000 or later. (Where a date additionality test is used under the CarbonFix standard, this is based upon UNFCCC guidelines – so is likely to be the same as the CDM test).[30]

Compliance additionality

The structure of most of the regulatory compliance tests is fairly uniform across different standards.[31] However, there are some differences in the breadth of compliance tested and type of evidence required.

The test specified for Plan Vivio projects is relatively narrow in only considering compliance with legal requirements, while those under the CDM for large-scale projects, the CarbonFix standard and the Voluntary Carbon Standard a bit broader in considering legal and regulatory requirements. By comparison the test under the ACRFCPS is relatively broad in taking into account existing laws, regulations, statutes, legal rulings, and regulatory frameworks directly or indirectly affecting GHG emissions from a project or its baseline, currently in effect or expected to come into effect, that effectively require GHG emissions reductions. The Green-e standard is also relatively broad in considering compliance with public policy, regulations, guidance and industry standards. Evidence requirements of legal and regulatory compliance appear especially onerous under the CarbonFix standard as a responsible state authority has to certify that the forestation activity is not a legal or regulatory requirement (or if it is, that the associated laws or regulations are not systematically enforced).

Practice additionality

Where a common practice additionality test is used under the CarbonFix standard, it is based upon UNFCCC guidelines. The CDM test for large-scale A/R projects is initially designed to determine whether similar forestation activity not registered under the CDM already occurs within the geographical area of the proposed project. If so, project developers have to demonstrate essential distinctions with the proposed project for it to be considered additional. These may include a fundamental and verifiable change in circumstances since similar forestation activities were implemented (e.g. due to the end of promotional policies, or the existence of barriers). Similar forestation activities are defined as those of similar scale, taking place in the relevant geographical area and a similar environment – including with respect to the regulatory framework (UNFCC, 2007b). By contrast, the test under the ACRFCPS allows for the possibility that despite widespread deployment of the type of project, technology, or practice within the relevant geographic area, a project may still be additional. This is so providing the proposed project reduces GHG emissions below levels produced by common practices technologies within a comparable environment (e.g., regulatory framework, investment climate, access to technology/financing, etc.).

Technology additionality

Two quite different technology tests are used under different standards. The test used under the Voluntary carbon Standard simply involves showing that the project and its location are contained in the list of project types and applicable areas approved as additional by the VCS programme on the basis that all projects of this type would be considered additional under a barrier test. The test used under the Green-e standard involves showing that the technology used is near the top of the Green-e list of technologies on net GHG emission rates for similar technologies and practices producing similar products or services.

Barrier additionality

The breadth of barrier tests used to distinguish projects that would otherwise not be implemented differs between standards, as illustrated in Table 3.

Some overlap in classifications of the different types of barrier exists between different standards (see Appendices A and B for further details of aspects covered). However, on the whole, voluntary market standards take into account a narrower range of potential barriers than the tests under the CDM. A notable exception is the exclusion from the test for small-scale CDM forestry projects (where used) of economic/financial barriers. The latter are explicitly covered under barrier tests under the ACRFCPS and Plan Vivio (as well as the test applying to large-scale CDM forestry projects).

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[30] An example of an implicit date additionality test is that under the ACRFCPS (general eligibility requirements) a forestry project must have started after 1990 to be covered by the standard.

[31] The methodology for demonstrating compliance additionality is different under CDM, being related to baseline selection rather than being specified as a separate test. (A more prominent element in the additionality tool relates to initial testing of whether alternative land use scenarios comply with existing legal and regulatory requirements).

Table 3 Coverage of barrier tests under different standards.

Mechanism or standard	Type of projects	Types of barriers
American Carbon Registry Forest Carbon Project Standard (ACRFCPS)		Fi, Inv, Tec
Clean Development Mechanism (CDM)	Small-scale	Ecol, Inv, Inst, Pre, Soc, Tec, Trad
	Large-scale	Ecol, Fi, Inst, Pre, Prop, Soc, Tec, Trad
Green-e		Cap, Cu, Infr, Inst, Loc, Org, Su
Plan Vivio (PV)		Cu, Fi, Soc, Tec, Trad
Voluntary Carbon Standard (VCS)		Inv, Inst, Tec

Types of barriers: *Cap* = Capacity: *Cu* = Cultural; *Ecol* = Ecological; *Fi* = Financial; *Infr* = Infrastructure; *Inst* = Institutional; *Inv* = investment; *Loc* = Local; *Org* = Organisational; *Pr* = Prevailing practice; *Prop* = Property rights; *Soc* = Social: *Su* = Supply; *Tec* = technological; *Trad* = Tradition.

The focus of the barrier test under Plan Vivio is wider than those used under the other standards, explicitly taking account of barriers in the absence of broader project development (in addition to those in the absence of carbon finance). The structure of the barrier test under the ACRFCPS differs from other standards in requiring at least one of three different types of assessments (financial, technological and institutional).

Not specified explicitly in the other cases, evidence required under the barrier test for large-scale CDM forestry projects can be of a variety of kinds. It may include legislation, information on environmental resource management norms or rules, market data, sectoral studies or surveys, national or international statistical data, documents from the project developer such as minutes from Board meetings, correspondence, feasibility studies, financial or budgetary information, and documents written by independent experts.[32]

Financial and investment

Investment additionality

The protocol for applying investment additionality tests to large-scale CDM projects[33] is far more involved than those specified under Plan Vivio, the Forest Carbon Standard (FCS), or (where used) the ACRFCPS and Green-e standard. Under Plan Vivio it has to be shown that the project or activity could not have happened in the absence of carbon finance, with no particular methodology specified. A similar approach focusing on showing that carbon funding could be expected to incentivise project implementation is adopted under the ACRFCPS.[34] Under the Green-e standard it must be demonstrated that the project would have a lower than acceptable rate of return without revenue from the sale of credits for GHG emission reductions or, if the project or project activity produces goods or services in addition to GHG emission reductions, that it is not the least-cost option to produce these. Under the FCS the financial case for additionality is subject to independent verification by a panel of Chartered Foresters and forest managers. (No particular evidence requirements are specified under Plan Vivio, Green-e or the ACRFCPS).

Investment additionality tests under the CDM projects follow one of three different methods. If no financial benefits apart from CDM related income are generated by the project, simple cost analysis (Option I) is used to document incomes and costs associated with each of the land use scenarios considered credible alternatives, and to demonstrate that the project proposed will generate no other financial benefits.[35] If other financial benefits apart from CDM related income are to be generated by the project, either investment comparison analysis (Option II) or benchmark analysis (Option III) can be used (not both) based upon the financial indicator considered most suitable for the project type and context. In either case this may be based upon an indicator such as the internal rate of return (IRR – which may be on the project or on equity), the net present value (NPV), payback period, or cost-benefit ratio. Benchmark analysis may also be based upon indicators such as the required rate of return (RRR) on investment or equity.[36] The financial indicator for the project without financial benefits from the CDM but including any applicable subsidies/fiscal incentives[37] is then either compared with that for each of the other scenarios (where investment comparison analysis is used) or with the benchmark value (where benchmark analysis is used). Critical economic parameters and assumptions (e.g. concerning capital costs, lifetimes,

[32] Where a barrier test is used under the CarbonFix standard, it is based upon UNFCCC guidelines.
[33] Where used under CarbonFix, investment additionality tests are based upon UNFCCC guidelines.
[34] Note that the test under the ACRFCPS is specified as a possible element of the financial barrier assessment, rather than as a separate test.
[35] Where land exists within the project boundary that was not forest at the start of the project but previously had been since 1989, project developers also have to justify the conclusion that the project will not generate other financial benefits by identifying incentives, reasons, or actions allowing previous forestation and how regulations or conditions have since changed.
[36] The value of the benchmark indicator used can be derived from government bond rates increased by a suitable risk premium reflecting private investment and/or project type, substantiated by an independent financial expert, RRRs on comparable projects, or an internal company benchmark shown to have been consistently used in the past.
[37] for public investors, also including non-market costs and benefits.

discount rate or cost of capital) have to be clearly presented, and assumptions justified, with any differences in assumptions and input data with alternative scenarios well substantiated. Providing the comparison shows that the project is less economically or financially attractive than at least one of the alternatives (where investment comparison analysis) or than the benchmark (where benchmark analysis), sensitivity analysis is then used to identify whether this conclusion is robust to reasonable variations in critical assumptions. If, for reasonable variations in critical assumptions, investment analysis consistently supports the conclusion that the project without financial benefits from the CDM is unlikely to be financially attractive, this is considered a valid argument in favour of the additionality of the project.[38]

Sales additionality

Applying to A/R activities commencing before the date of registration under the CDM, developers of large-scale projects under the CDM have to provide documentary evidence that income from sale of CERs was seriously considered in the decision to proceed. It is preferred that legal, documentary or corporate evidence is provided, that had been available to third parties at, or prior to, the start of the project.[39]

The test under the ACRFCPS (where used) similarly aims to assess whether GHG reduction capabilities or benefits are a primary reason for implementation of the technology in question, and whether reduction/removal of GHGs is one of the goals of the project at the start date.[40] The test under the Green-e standard (where used) sets out to assess whether emission reduction funding is essential for the project to move forward.[41]

Environmental

GHG additionality

The GHG additionality test specified under the CDM for small-scale A/R projects involves demonstrating that 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 project.[42] If project proponents provide relevant evidence indicating that no significant changes in the carbon stocks within the project boundary would occur in the absence of the project, existing carbon stocks prior to implementation of the project are considered as the baseline (and assumed constant throughout the crediting period). If significant changes in carbon stocks within the project boundary are expected in the absence of the project, an approved simplified baseline and monitoring methodology for small-scale A/R projects must be used.[43] The current ones are shown in Table 5 (Appendix C), together with a list of the different carbon pools covered in each case.[44]

Project additionality

The focus of project additionality tests differs between the CarbonFix standard and the Voluntary Carbon Standard (VCS). Under CarbonFix it applies to woodland creation, and it has to be shown that a forest is not able to establish itself on the area to be planted without the planned project activities. Under the VCS, two different project additionality tests are used that apply to Avoiding Planned Deforestation (APD) and to Avoiding Unplanned Frontier Deforestation and Degradation (AUFDD) projects, respectively. In the former case project developers have to demonstrate that land would have been converted to non-forest use in the absence of the project, while in the latter project developers have to demonstrate that the project area is located in an area where deforestation/degradation is likely to happen during the crediting period.

Unit additionality

Where used, unit additionality tests are broadly similar under the Green-e standard and the Voluntary Carbon Standard (VCS). Under Green-e the test involves showing that projects reduce GHG emissions below levels of technologies commonly used to produce the same products/services, while the VCS test involves demonstrating that emissions generated per unit of output by the project are below the level approved by the VCS programme for the product, service, sector or industry.

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[38] However, where land exists within the project boundary not forest at the start of the project that previously had been (since 1989), project developers have to demonstrate that conditions have since changed affecting the financial attractiveness of forestation activities not registered under the CDM. In this case, a common practice test is also required if it is concluded after the sensitivity analysis that the project is unlikely to be most financially attractive. Alternatively, if the sensitivity analysis shows that the project is likely to be the most financially attractive, barrier analysis is required.

[39] Where a sales additionality test is used under CarbonFix, it is based upon UNFCCC guidelines.

[40] Note that the test under the ACRFCPS is specified as a possible element of the technological barrier assessment, rather than as a separate test.

[41] Note that the test is specified as one element of a broader 'financial test' (see: Appendix A).

[42] Where used under CarbonFix, GHG additionality tests are based upon UNFCCC guidelines.

[43] Addendum to Report of the CoP, 28th Nov – 10th Dec 2005, 6/CMP.1, C, Appendix B, paragraphs 2 and 3, p.90.

[44] A barrier additionality test is required as part of each of the simplified baseline methodologies.

4 Conclusion

As illustrated in the previous sections, additionality is multi-faceted. At least nine forms of legal, regulatory and institutional additionality, three of financial and investment additionality, and three of environmental additionality can be distinguished. These are summarised in Table 7 (Appendix D).

A range of different additionality tests are used in practice. These are often combined into a single additionality tool. Marked differences in tests applied exist between different standards, as well as in associated coverage, methodologies and evidence requirements.

Differences between tests under different standards do not appear to relate to differences between ex-post and ex-ante crediting. For example, exactly the same additionality tests used for ex-post credits from large scale CDM projects can apparently also be used for ex-ante carbon units under the CarbonFix Standard.[45]

Additionality is widely viewed as a key issue in establishing the quality of carbon credits, but views differ on the appropriate degree of rigour and associated burden of proof for project developers. In general a trade-off exists between effectiveness in establishing additionality and cost-effectiveness (Radov *et al.*, 2007). The trade-off between the rigour of tests applied and the cost of registration can affect both the quality and number of projects approved.

Differences in additionality tests applied can be viewed as partly related to different positions on a continuum of rigour-cost trade-offs. The link between the cost (which influences the capacity of project developers to afford project registration) and which tests are applied, is clearly illustrated in the differences between additionality tests applying to large-scale and to small-scale CDM projects. It also influences the approach to establishing baselines and monitoring carbon benefits. (For an overview of different carbon pools and GHG emissions sources covered under different standards, see Appendix C).

Some aspects seldom covered explicitly by additionality tests under existing standards, or not considered at all, can nonetheless also be very significant. For instance, testing for GHG additionality is seldom included as an explicit additionality test, even though is it a key element under each standard.

Although not currently subject to explicit additionality tests,[46] institutional additionality is also important to bear in mind in considering the broader issue of incentives for climate change mitigation by the forestry sector. In general, inclusion of climate change mitigation activities within national carbon accounting frameworks and reporting on greenhouse gas reduction targets could be expected to reduce the value of any associated carbon units in the voluntary carbon market. A precipitous drop in the total EU voluntary carbon units purchased from 2.3 $mtCO_2e$ in 2007 to 0.2 $mtCO_2e$ in 2008 was reportedly due partly to concerns of double-counting associated with reductions being covered by national reporting under the Kyoto Protocol (Hamilton *et al.*, 2009).

Inclusion of forestry carbon under national reporting might be considered to implicitly involve a transfer of property rights in carbon benefits from forest owners to the government. Recognition both of the public value of forestry carbon in meeting national targets under the Kyoto Protocol and of the consequent reduction in the market value has led some countries to consider potential revenue sharing arrangements to compensate forest owners.[47] By contrast, the UK position is that international commitments neither confer nor transfer carbon rights[48] (suggesting, by implication, that compensation is not appropriate).

In developing an industry Code of Good Practice for UK forestry carbon projects, focusing upon GHG and barrier additionality alone (i.e. adopting a similar approach to that for small-scale CDM forestry projects) could be expected to be controversial because activities would be accepted as additional even though they would have occurred without the sale of carbon units.[49] The approach might be justified were the social cost of adopting further additionality tests expected to exceed the social benefit. Whether this were

[45] It is the case, however, that time plays an important role in some tests (e.g. date and sales additionality tests).
[46] Implicit institutional additionality elements are included, however, under other sections of some standards. For example, there is a general requirement under the Voluntary Carbon Standard that project developers for activities in jurisdictions with binding emission limits provide evidence that an equivalent number of credits have been cancelled, or withdrawn.
[47] In the case of Germany, see: Elsasser (2008).
[48] See: Broadmeadow (2009, Q.11, p.4).
[49] On this perspective of additionality tests under the CDM, see: Paulsson (2009).

the case would need to take account of expected impacts on the level, quality and value of climate mitigation activities.[50]

Investment additionality (whether a project would not be financially viable or the most financially attractive option without carbon finance) is often considered a key aspect of quality assurance from the perspective of purchasers of carbon units. However, applying a standard procedure as a test can be problematic. This is due to project proponents having diverse approaches to quantifying financial viability and selecting projects, often considering different time-frames, applying different discount rates, and facing different opportunity costs (including costs of finance). Allowing for these diverse approaches by giving project proponents the freedom to provide their own evidence would reduce comparability and could potentially undermine the rigour of a test. Nonetheless, if an investment additionality test were agreed within the Code, it might help more efficient targeting of public funds in the sector by allowing assistance to be focused on projects otherwise not be expected to be financially viable or the most financially attractive option (taking into account any expected carbon finance).

Including a test for institutional additionality in developing the Code may be important in allowing different qualities of carbon units to be distinguished if some guarantee the cancelling or withdrawing from the market an equivalent number of other units (a general requirement under the Voluntary Carbon Standard, for example). Where these quality differences exist, an institutional test could be especially important if an investment additionality test is included in the Code in view of the potential divergence in carbon prices.[51]

A compliance additionality test could also be important to include. This is particularly the case if projects driven purely by replanting conditions under felling licences are to be excluded.

In addition to above-ground and below-ground woody biomass, and any carbon pools expected to decrease significantly as a consequence of carbon sequestration projects, a range of other sources of emissions and emissions reductions (e.g. from fossil fuel use, materials or fossil fuel substitution) might be covered by the Code where significant. This would depend upon their quantification and monitoring being cost-effective. Alternatively, the Code could simply incorporate good practice guidelines on minimising emissions from other sources and possibly also on maximising of other GHG benefits, while recognising the approach would not provide incentives for further improvements in practices. The inclusion of substitution benefits could make the Code more complex. However, exclusion of substitution benefits risks unfairly advantaging carbon sequestration projects that do not necessarily offer the greatest overall climate mitigation benefits.

To the extent that the concept of additionality is open to a variety of interpretations[52] and is based upon comparisons of future hypothetical scenarios, its determination is imprecise and is likely to remain controversial even where comparatively stringent tests are applied.[53] Where application of the additionality principle rewards those who would otherwise have harmed the environment (e.g. through deforestation), while not rewarding existing good practice (e.g. sustainable forest management), it may also be considered by some to conflict with considerations of justice.[54]

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[50] Akin to other trade-offs, an 'optimum' level of additionality testing in theory might be expected to occur at the point where the additional benefit of applying more stringent tests is exactly balanced by the additional cost. However, it is unclear to what extent these costs and benefits are quantifiable.

[51] For a survey of carbon valuation issues including a discussion of variations in carbon prices, see: Valatin (2010).

[52] In relation to the CDM, Schneider (2007) notes ambiguities (e.g. regarding what constitutes a 'common practice') and lack of transparent criteria in current additionality tools.

[53] This is certainly true to date. For example, Aldy and Stavins (2008, p.xi) report that the CDM is 'plagued by criticisms that it is crediting projects that would have happened anyway.' Summarising findings of case studies of additionality testing for Indian CDM projects, Michaelowa and Purohit (2007) note assessments by the CDM Executive Board vary, with projects more likely to be passed if developers package information in a way that hides the attractiveness of projects. According to Castro and Michaelowa (2008, p.50) 'Experts consider it easy to turn around numbers, choose the indicators and benchmarks that suit you best.' Comparing the investment additionality of 222 registered CDM projects using the difference in the internal rate of return (IRR) with and without CDM revenues, Au Yong (2009) finds that 26% of the projects have a IRR under 2%, and suggests the credibility of CDM projects could be enhanced by rejecting projects below a minimum (e.g. 2%) IRR threshold except where additionality is shown by other means.

[54] Similar issues in the context of payments for ecosystem services are highlighted in Valatin and Coull (2008).

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Appendix A Voluntary carbon standards

American Carbon Registry Forest Carbon Project Standard (ACRFCPS)

The ACRFCPS covers ex-post carbon units. Additionality (referring to ensuring that project benefits are above those that would have occurred without carbon market incentives) has to be demonstrated using a hybrid test comprising of three elements (Winrock International, 2009).

The first element is a regulatory surplus test. This is used to examine whether any existing law, regulation, statute, legal ruling, or other regulatory framework that directly or indirectly affects GHG emissions from a project or its baseline is currently in effect or expected to come into effect from the project start date which mandates the project or effectively requires the GHG emissions reductions.

Secondly, a common practices test examines whether there is widespread deployment of this project, technology, or practice in the field or industry/sector within the relevant geographic area. The proposed project must reduce GHG emissions below levels produced by common practices technologies within a comparable environment (e.g., regulatory framework, investment climate, access to technology/financing, etc.). It is recognised that what constitutes a common practice technology may differ between sectors and geographic areas, depending on the diversity of baseline candidates. [55]

Thirdly implementation barriers tests are used to examine whether there is any factor or consideration that would prevent adoption of the proposed project practice or activity. At least one of three barrier assessments (financial, technological, and institutional) must be used (with no requirement to pass all three). The financial test considers barriers such as high costs, limited access to capital, high risks associated with unproven technologies or business models, poor credit rating, and project failure risks. It assesses questions such as whether the project faces capital constraints that carbon revenues could overcome, whether carbon funding could be expected to incentivise its implementation, *or* whether carbon revenues are a key element in maintaining the project's continued economic viability after the implementation phase. The technological test considers barriers such as R&D deployment risk, lack of trained personnel and supporting infrastructure, lack of technological knowledge, and uncorrected market failures. It assesses whether GHG reduction capabilities or benefits is a primary reason for implementation of the technology in question, and whether reduction/removal of GHGs is one of the goals of the project at the start date. The institutional test considers barriers such as institutional opposition to technology implementation, limited capacity for technology implementation, lack of management consensus, aversion to upfront costs, and lack of awareness of benefits. It assesses whether the project faces significant organizational, cultural, or social barriers to GHG emissions reduction/sequestration that accrual of benefits from the project will help overcome.

CarbonFix Standard (CFS)

Under the CFS carbon credits ($VER_{Futures}$) are issued ex-ante. The additionality of a project must be demonstrated using one of two tests. Option 1 entails project developers providing an official statement from a bank giving evidence that the project would not be feasible without revenues from the sale of $VER_{Futures}$. Option 2 (which has to be followed for non-profit projects), involves an analysis of additionality based upon UNFCCC guidelines. Two further conditions must also be met to demonstrate additionality. Firstly, a responsible state authority has to certify that the forestation activity is not a legal or regulatory requirement (or if it is, that the associated laws or regulations are not systematically enforced). Secondly, it has to be shown that a forest is not able to establish itself on the area to be planted without the planned project activities. Where the project involves planting some areas without generating $VER_{Futures}$ (e.g. due to these areas being ineligible) the additionality of the entire project has also to be shown (CarbonFix, 2008).

Climate, Community and Biodiversity Standard (CCBS)

Additionality is mentioned explicitly only in the CCBA Project Design Standards in the 'Potential Tools and Strategies' section comprising '...suggestions which may help project developers to design projects that will comply with the CCB

[55] E.g. the common practice penetration rate or market share for a technology or practice may be quite low if there are many alternative technologies and practices, or quite high if there are few alternative technologies or practices.

Standards' (CCBA, 2008, p.36).[56] Carbon additionality is present in the concept of 'Net positive climate impacts',[57] and a form of regulatory compliance test is implicit in the requirements for establishing baseline projections.[58]

Forest Carbon Standard (FCS)

Under the FCS the additionality of a project must be demonstrated by showing that the activity would not have been possible without carbon offset finance. The financial case for additionality is then subject to independent verification by a panel of Chartered Foresters and forest managers.[59]

Gold Standard

Under the Gold Standard (covering energy efficiency and renewable energy projects), additionality must be demonstrated either using a UNFCCC tool (UNFCCC, 2006 or 2008), or another additionality tool approved under the Standard. As there have been no specific additionality tools approved within the Gold Standard to date (up to July 2008), in practice only the UNFCCC tools have so far been used (Gold Standard, 2008).

Green-e

For all cases two tests to demonstrate additionality are required under the Green-e standard. The first is a legal/regulatory/institutional (compliance) test whereby projects must reduce GHG emissions below the level required by public policy, regulations, guidance or industry standards. The second is a timing (date) test with only projects becoming operational after the beginning of 2000 being covered by the standard.

In addition, either a test to show projects reduce GHG emissions below levels of technologies commonly used to produce the same products/services, and/or a technology test and practice test to show technology used is near the top of the Green-e list of technologies on net GHG emission rates for similar technologies and practices producing the same/similar products/services must be undertaken. Where the former ('common practice test')[60] is undertaken, at least one further test is required (otherwise the technology test and practice test must be undertaken). The first of these further tests is termed a 'financial test'. Under this must either be demonstrated that emission reduction funding is essential for the project to move forward, or that it would have a lower than acceptable rate of return without revenue from the sale of credits for GHG emission reductions (or, if the project or project activity produces goods or services in addition to GHG emission reductions, that it is not the least-cost option to produce these).[61] The second of the further tests is a barriers test. Under this it must be demonstrated that the project faces either significant implementation barriers (e.g. institutional, organizational, cultural or local resistance to new technologies), or lack of infrastructure or institutional capacity to implement the project, or an irregular or uncertain supply of the resources required to implement it (Green-e, 2008, pp.5–6).

Greenhouse-friendly

The Greenhouse Friendly Standard established by the Australian government applies only to abatement projects within Australia and to projects where anticipated future revenue from generating greenhouse gas abatement is relied upon to ensure the financial viability of the project (DEH, 2006, p.19). While the geographical focus is different, it otherwise uses a similar procedure to those used to demonstrate additionality for large-scale CDM projects (UNFCC, 2008) and for large-scale CDM A/R projects (see Appendix B). The procedure is based upon the following four steps (DEWR, 2007):

Step 1: Regulatory/compliance analysis
Project developers must demonstrate that the proposed project is not being implemented to comply with Australian national or state law, regulation or licensing requirements.

Step 2: Investment analysis or Barrier analysis
Project developers must demonstrate that the proposed project can only be implemented if approved under Greenhouse Friendly. This can be done either by using investment

[56] CCBA (2008, p.37) states 'Various economic and financial tools can be used to prove additionality, including: payback period with and without carbon financing; economic analyses showing that, without carbon financing, the project would be less profitable than other competing land-uses; analyses showing that the project would not be realized because of barriers such as lack of financial capital, prevailing practices, lack of capacity or knowledge, and institutional or market barriers. Project proponents can also describe if there are similar projects in the area. If yes, are the projects financed privately or publicly? Is climate change financing used to make the comparable projects viable?'

[57] 'The project must generate net positive impacts on atmospheric concentrations of greenhouse gases (GHGs) over the project lifetime from land use changes within the project boundaries' (CCBA, 2008, p.22).

[58] CCBA (2008, p.22) states that project developers must 'Document that project benefits would not have occurred in the absence of the project, explaining how existing laws or regulations would likely affect land use and justifying that the benefits being claimed by the project are truly 'additional' and would be unlikely to occur without the project.'

[59] See: www.forest-carbon.co.uk/#/theforestcarbonstandard/4531698205.

[60] In this paper it is categorised as a unit additionality test.

[61] In this paper the former is categorised as a sales additionality test and the latter as investment additionality tests.

analysis or barrier analysis, with the former required unless it can be shown to be inappropriate. Investment analysis can use one of three methodologies. Where a project will generate no commercial benefit apart from revenue from sale of Greenhouse Friendly credits simple cost analysis can be used, with either investment comparison analysis or barrier analysis used otherwise.

Step 3: Common Practice analysis
Once additionality has been demonstrated using either Investment analysis or Barrier analysis, it must be confirmed by reference to current common practice. If similar projects are commonly implemented in Australia under comparable conditions without Greenhouse Friendly approval, this calls into question the claim that the project is financially unattractive or faces barriers that prevent its implementation (as contended in Step 2). Where this is the case project developers have to distinguish the proposed project from similar projects commonly implemented without Greenhouse Friendly approval, explaining why the other projects do not face the investment or other barriers facing the proposed Greenhouse Friendly project.

Step 4: Impact of Greenhouse Friendly approval
Project developers have to explain how the approval of the proposed project under Greenhouse Friendly will improve the financial attractiveness of the project (if investment analysis has been used) or alleviate the barriers identified (if barrier analysis has been used) to enableing the project to be implemented.

Plan Vivio

Under Plan Vivio additionality of a project is demonstrated by using regulatory and investment tests, and barrier analysis. In each case it has to be shown that the project could not have happened in the absence of carbon finance, that the project does stem from legal requirements or commercial land-use decisions, and that financial, social, cultural, technical or traditional barriers would have prevented project activity in the absence of project development and carbon finance.[62]

Voluntary Carbon Standard (VCS)

The Under the VCS, carbon credits are issued ex-post (VCS, 2008b, section 3.3, p.9). Additionality of a project must be demonstrated using one of three tests, the first step in each case being to check that the project is not required by law or regulation. The project test (test 1) entails a barrier test to check if the project faces at least one investment, technological or institutional barrier not faced by alternative projects, followed by a common practice test to check whether the type of project envisaged is common practice in the sector or region, and if it is, to identify barriers faced compared to existing projects. The performance test (test 2) involves demonstrating that emissions generated per unit of output by the project are below the level approved by the VCS programme for the product, service, sector or industry. The technology test (test 3) involves simply showing that the project and its location are contained in the list of project types and applicable areas approved as being additional by the VCS programme on the basis that all projects of this type would be considered additional under test 1 (VCS, 2008b, section 5.8, pp.16–17). As no performance standard additionality methodologies or project types under the positive technology list have so far been approved by the VCS Board (as of the beginning of March 2009),[63] only the project test (test 1) is apparently currently in use in practice.

For Avoiding Planned Deforestation (APD) projects, project developers also have to demonstrate that land would have been converted to non-forest use in the absence of the project (VCS, 2008a, p.6). For Avoiding Unplanned Frontier Deforestation and Degradation (AUFDD) projects, project developers also have to demonstrate that the project area is located in an area where deforestation/degradation is likely to happen during the crediting period. (VCS, 2008a, p.7).

Verified Emissions Reductions (VER+)

Additionality under the VER+ standard is tested using tools and guidelines developed for project activities under the Kyoto Protocol.[64] As projects are validated, verified and approved by the same organisation (TÜV SÜD), concerns about potential conflicts of interest have been raised.[65]

Voluntary Offset Standard (VOS)

The VOS covers CERs and ERUs, and VERs based upon CDM and JI standards, and pilot projects in developing countries consistent with these standards or agreed by the UNFCCC in the context of a post-2012 framework. Additionality is therefore based upon tests defined under the associated UNFCCC protocols.[66]

[62] See: www.planvivo.org/fx.planvivo/scheme/planvivodocuments.aspx and http://www.planvivo.org/fx.planvivo/scheme/manual.aspx.
[63] See: www.v-c-s.org/methodologies.html.
[64] See: www.tuev-sued.de/uploads/images/1179142340972697520616/Standard_VER_e.pdf.
[65] See: www.global-greenhouse-warming.com/VER-plus.html.
[66] The VOS simply states 'all greenhouse gas emission reductions or removals shall be additional to what would have happened if the project activity had not occurred following the guidelines established under the relevant standard.' See: www.carboninvestors.org/documents.

Appendix B UNFCCC additionality tools

Baseline and monitoring methodologies developed under the CDM for large-scale projects use a range of tests aimed at ensuring emission reductions are additional to any that would occur in the absence of the project activity. As outlined below, much more exacting procedures apply to large-scale projects than to small-scale ones.

Small-scale projects

Simplified modalities and procedures have been developed in order to reduce costs of assessments for small-scale projects.[67] Small-scale afforestation and reforestation (A/R) project activities are defined under the CDM as those expected to result in net anthropogenic greenhouse gas removals by sinks of less than 16 000 tCO_2 (4364 tC) per year, and that are developed or implemented by low-income communities and individuals (as determined by the host country).[68]

Such projects are considered additional if 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 project. (See the Addendum to Report of the Conference of the Parties, Montreal, 28 Nov–10 Dec 2005, 6/CMP.1, C, p.84, p.86).[69]

Unless no significant changes in the carbon stocks within the project boundary would have occurred in the absence of the project, an approved simplified baseline and monitoring methodology for small-scale A/R projects must be used (current ones are listed in Table 5, Appendix C).[70] In each case project proponents have to demonstrate that the activity would otherwise not be implemented due to the existence of one or more barrier, with this additionality assessment covering seven types of barrier. These relate to investment other than economic/financial barriers (including debt funding not being available, lack of access to international capital markets, or credit), institutional barriers (e.g. government policies or laws), technological barriers, and barriers relating to local tradition, prevailing practice, local ecological conditions, and social conditions (e.g. demographic pressure on the land).

Large-scale projects

Developers of large-scale CDM projects[71] can either adopt the UNFCCC Tool for the demonstration and assessment of additionality in A/R CDM Project Activities (UNFCCC, 2007b), the UNFCCC Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities (UNFCCC, 2007a), or propose an alternative methods to the CDM Executive Board.[72] In determining additionality of a project, both UNFCCC Tools follow a similar five step procedure. The five step procedure employed in the UNFCCC Tool for the demonstration and assessment of additionality in A/R CDM Project Activities (UNFCCC, 2007b) is as follows:

Step 0: Preliminary screening of projects based upon their starting date. For A/R activities commencing in 2000 or later, but before the date of registration under the CDM, project developers have to provide documentary evidence (preferably, legal, documentary or corporate that had been available to third parties at, or prior to, the start of the project activity) that income from sale of CERs was seriously considered in the decision to proceed. Evidence also has to be provided of the starting date of the A/R activity.

Step 1: Identification of credible alternative land use scenarios to the proposed project activity that could have occurred in the absence of the proposed A/R project activity, taking into account public policies and local circumstances including past land uses and practices, and economic trends. These include the continuation of the previous land use, A/R within the project boundary without being registered under the CDM, and, if applicable, forestation[73] of at least part of the land within the project boundary through

[67] Bundling several small-scale projects within a single project design document (PDD) is also allowed and can further reduce transactions costs.

[68] A definition based upon decision -/CPM.3, it replaces the previous cut-off of under 8,000 tCO_2/yr. If a small-scale A/R project under the CDM results in net anthropogenic greenhouse gas removals by sinks greater than 16,000 tCO2 per year, the excess removals is not be eligible for the issuance of tCERs or lCERs (see: http://cdm.unfccc.int/methodologies/SSCmethodologies/SSCAR/approved.html).

[69] Where project developers provide information indicating no significant changes in carbon stocks within the project boundary would have occurred in the absence of the project, carbon stocks prior to implementation are considered to provide the baseline.

[70] Addendum to Report of the CoP, 28th Nov – 10th Dec 2005, 6/CMP.1, C, Appendix B, paragraph 3, p.90.

[71] Defined as the default category as those projects that do not fit under the small-scale classification.

[72] Decision 12/CP.10.

[73] Defined as any establishment of forest through natural or artificial means.

extrapolation of observed forestation activities in the geographical area having similar ecological and socio-economic conditions to the proposed project site, or due to legal requirements.[74] With the exception of previous land uses, the credibility of all other alternative land use scenarios has to be justified. Justification has to encompass elements of spatial planning information (where applicable), or legal requirements, possibly including an assessment of its economic feasibility. Identification of credible alternative land use scenarios (sub-step 1a) has to be based upon data sources such as land use records, field surveys, stakeholder feedback, and participatory rural appraisal. Scenarios are then checked to ensure either that they comply with applicable legal and regulatory requirements, or these requirements are not enforced with non-compliance widespread (prevalent on at least 30% of the are of the smallest administrative area encompassing the project area), with those for which neither condition hold excluded from further consideration (sub-step 1b). The proposed project is not considered additional if there is no credible alternative scenario that complies with mandatory regulations with which there is general compliance (UNFCCC, 2007b, p.5).[75] The baseline methodology adopted has to justify selection and determination of the most plausible baseline scenario (sub-step 1c).

Step 2: Investment analysis to determine whether the project would be less economically or financially attractive than at least one of the alternative land use scenarios without the sale of temporary CERs (tCERs) or long-term CERs (lCERs). Three different methods are used for this (determining which to apply is covered by sub-step 2a):

Option I: If no financial benefits apart from CDM related income are generated by the project, simple cost analysis is used to document the incomes and costs associated with each of the remaining scenarios and demonstrate that the project proposed will generate no other financial benefits. (Where land within the project boundary that was not forest at the start of the project but previously had been since 1989, project developers have to justify the conclusion that the project will not generate other financial benefits by identifying incentives/reasons/actions allowing previous forestation and how regulations or conditions have since changed).

Option II: (investment comparison analysis) and Option III (benchmark analysis): if other financial benefits apart from CDM related income are to be generated by the project, either type of analysis based upon the financial indicator considered most suitable for the project type and context can be used (not both types). Investment comparison analysis may be based upon an indicator such as IRR (on the project or on equity), NPV, payback period, or cost-benefit ratio, and benchmark analysis on one of these or indicators such as the required rate of return (RRR) on investment or equity (determining which to use is covered by sub-step 2b).[76] Comparison of financial indicators (sub-step 2c) is undertaken by calculating the financial indicator for the project without financial benefits from the CDM but including any applicable subsidies/fiscal incentives (for public investors, also including non-market costs and benefits) and, where investment comparison analysis is used, for each of the other scenarios. Critical economic parameters and assumptions (e.g. concerning capital costs, lifetimes, discount rate or cost of capital) must be clearly presented in the project design document (AR-CDM-PDD), and assumptions justified and/or cited in a way that facilitates replication of the analysis and results, and any differences in assumptions and input data with alternative scenarios well substantiated. Providing the comparison shows that the project is less economically or financially attractive than at least one of the alternatives (where investment comparison analysis) or than the benchmark (where benchmark analysis), sensitivity analysis (sub-step 2d) is then used to identify whether this conclusion is robust to reasonable variations in critical assumptions. If, for reasonable variations in critical assumptions, investment analysis consistently supports the conclusion that the project without financial benefits from the CDM is unlikely to be financially attractive, this is considered a valid argument in favour of the additionality of the project. However, where land within the project boundary not forest at the start of the project previously had been (since 1989), project developers have to demonstrate that conditions have since changed affecting the financial attractiveness of forestation activities not registered under the CDM. In this case, a common practice test (step 4) is also required to show additionality if it is concluded after the sensitivity analysis that the project is unlikely to be most financially attractive. Alternatively, if the sensitivity analysis

[74] Activities resulting from national and/or sectoral policies or regulations implemented since adoption by the COP of CDM M&P [decision 17/CP.7, 11 Nov 2001] do not need to be taken into account.

[75] In the case of the combined tool, the proposed project is also not considered additional if there is only one credible alternative on the resulting list of credible alternative scenarios that comply with those mandatory legal and regulatory requirements with which there is general compliance (UNFCCC, 2007a, p.4).

[76] The value of the benchmark indicator used can be derived from government bond rates increased by a suitable risk premium reflecting private investment and/or project type, substantiated by an independent financial expert, RRRs on comparable projects, or an internal company benchmark shown to have been consistently used in the past.

shows that the project is likely to be the most financially attractive, barrier analysis (step 3) is required to demonstrate that the proposed project faces barriers which do not prevent the alternative scenarios occurring if the project is to be considered additional.

Step 3: Barrier analysis. This can be used as a stand alone additionality test or as an extension of investment analysis. It aims to identify whether the proposed project faces barriers that would prevent its implementation but not that of at least one of the alternative land use scenarios. The existence of such barriers provides grounds for demonstrating additionality if they would prevent the project from being undertaken if it were not registered as an A/R CDM project. A wide range of different types of barrier may be considered under the identification of barriers (sub-step 3a) depending upon the particular project and context under consideration. Financial barriers may exist if similar activities have only been implemented with grants or on non-commercial finance terms, or due to lack of debt funding, of access to international capital markets, or of access to credit. Institutional barriers may relate to risks associated with changes in government policies or laws, or lack of enforcement of land-use related legislation. Technological barriers may relate to lack of access to necessary materials, or lack of necessary infrastructure to implement a technology. Barriers related to local tradition may include traditional knowledge, or lack of knowledge, customs, practices or market conditions. Barriers related to prevailing practice may include lack of any similar type of activity in the region or country. Ecological barriers may relate to degraded soil, unfavourable climatic conditions, pervasive opportunistic species, grazing or other pressures. Barriers related to social conditions may include demographic pressures on land, social conflicts among interest groups, widespread illegal practices (e.g. illegal logging), or lack of skilled/trained workforce. Barriers related to property, use and inheritance rights may include the structure of rights within communal land ownership, lack of legal security of tenure, or the absence of clearly defined property rights. Barriers related to markets, transport and storage may include remoteness and undeveloped transport infrastructure, lack of efficient markets and insurance mechanisms resulting in high risks of price fluctuations, or absence of facilities to convert, store or add value to products. Evidence must be provided demonstrating the existence of any barriers identified. This may include relevant legislation, information on environmental resource management norms or rules, relevant market data, sectoral studies or surveys, national or international statistical data, documents from the project developer such as minutes from Board meetings, correspondence, feasibility studies, financial or budgetary information, and documents written by independent experts. Where land within the project boundary not forest at the start of the project previously (since 1989) had been forested, project developers have to identify incentives, reasons, or actions allowing past forestation, and show that legal, financial, regulatory, ecological or other local conditions have since changed creating a barrier preventing forestation without being registered under the CDM. For a project to be considered additional using the barrier test, the barriers identified have to be shown to not prevent implementation of at least one of the alternative land use scenarios (sub-step 3b).

Step 4: Common practice analysis. This is used to determine the extent to which similar forestation activity already occurs within the geographical area of the proposed project and check the credibility of conclusions concerning project additionality from the investment analysis (step 2) and (where applicable) the barrier analysis (step 3). If (excluding other CDM projects) similar forestation activities (defined as those of similar scale, taking place in a similar environment – including regulatory and geographical) exist, project developers have to demonstrate essential distinctions with the proposed project for it to be considered additional. These may include a fundamental and verifiable change in circumstances under since similar forestation activities were implemented (e.g. due to the end of promotional policies, or the existence of barriers). If similar forestation activity exists and essential distinctions cannot be made, the project is not considered additional.

Appendix C Carbon pools and baselines

Carbon pools covered by baselines for different types of small-scale CDM afforestation and reforestation projects are summarised in Tables 5 below, with carbon pools and other GHG emissions covered by baselines for large-scale CDM forestry projects summarised in Table 6.

Table 4 Carbon pools and other GHGs covered under voluntary carbon standards.

Standard	Project types	Carbon Pools	Notes
American Carbon Registry Forest Carbon Project Standard (ACRFCPS)		U	'Any' changes in carbon pools/GHG sources. Emissions from production of inputs included where increased amounts used. Emissions from use of project outputs excluded unless a direct component of project activity.
CarbonFix (CF)		**ANW**, **AW**, **BNW**, **BW**, **D**, **H**, **S**	Harvested wood can include timber and energy. 0.5% of future CO_2 fixation deducted to cover within project fossil fuel use (e.g. by machines and flights).
Forest Carbon Standard (FCS)		ST	
Green-e (GE)		U	Validation, monitoring and verification standards must be 'explicit, transparent and credible'.
Plan Vivio (PV)		U	Carbon accounting to be based upon 'best available evidence'.
Voluntary Carbon Standard (VCS)	ARR	**AW**, ANW, DW, H, L, **R**, S	Soil to be included if reduction in this carbon pool 'significant'. If timber is removed before clearing and used for wood products, the amount going into long-lived wood products must be accounted for.
	IFM1	**AT**, **DW**, R, S	
	IFM2, IFM3	**AT**, **DW**, **H**, R, S	
	IFM4	**AT**, DW, H, R	
	IFM5	**AT**, DW, H, L, R	
	REDD1	ANT, **AT**, DW, **H**, L, R, S	
	REDD2	ANT, **AT**, DW, **H**, L, R	
	REDD3	**ANT**, **AT**, DW, **H**, L, R	

Project types: ARR = Afforestation, Reforestation and Revegetation; IFM1= Conversion from conventional logging to reduced impact logging (RIL) with no effect on timber extracted; IFM2 = Conversion to RIL with over 25% reduction in timber extracted; IFM3 = Conversion from logged to protected forests; IFM4 = Extended rotation length; IFM5 = Conversion of low productive forests to productive forests; REDD1 = Conversion of forest to non-forest (annual crop); REDD2 = Conversion of forest to non-forest (pasture grasses); REDD3 = Conversion of forest to non-forest (perennial crop – e.g. oil palm, bananas, fruit trees, spice trees).
Carbon pools: ANT above-ground non-tree biomass; AT above-ground tree biomass; ANW above-ground non-woody biomass; AW above-ground woody biomass; BNW below-ground non-woody biomass; BW below-ground woody biomass; D dead biomass (e.g. dead branches, trees, litter); DW dead wood; H harvested wood (timber and wood energy); L litter; R below ground living biomass (e.g. roots); S soil; ST stem timber; U unspecified. Bold text = included; normal font = optional.

Table 5 Carbon pools covered by small-scale CDM afforestation/reforestation projects.

Project Location/Type	Reference	Carbon Pools	Notes (applicability)
Grasslands or croplands	AR-AMS0001	**AT, AWP, BG, BT, BWP**	Where the area of the cropland within the project boundary displaced due to the project is less than 50% of the total and the number of displaced grazing animals is less than 50% of the average grazing capacity. Version 05 (EB 42).
Settlements[77]	AR-AMS0002	**AT, BT**	Where areas used for agricultural activities within the project boundary and displaced due to the project are less than 50% of the total area. Version 02 (EB 42).
Wetlands[78]	AR-AMS0003	**AT, BT**	Where no changes in the hydrology of the land subjected to afforestation or reforestation. Version 01.
Agroforestry	AR-AMS0004	**AT, BT, S**	Where any decrease in the area cultivated with crops is no more than 20% of the total area cultivated with crops at the start of the project. Version 02 (EB 47).
Low quality lands[79]	AR-AMS0005	**AT, BT, S**	Version 02 (EB 46)
Silvopasture	AR-AMS0006	**AT, BT, S**	Where project activities are implemented on degraded croplands or grasslands subject to grazing activities. Version 01 (EB 47).
No significant changes in carbon stocks in the absence of the project		**U**	Existing carbon stocks considered as the baseline and assumed constant. (Addendum to Report of the CoP, 28 Nov– 10 Dec 2005, 6/CMP.1, C, Appendix B, paragraph 2, p.90).

Carbon pools: AT = above-ground tree biomass; AWP = above-ground woody perennials biomass; BG = below-ground grassland biomass; BT = below-ground tree biomass; BWP = below-ground woody perennials biomass; S = soil organic carbon; U = unspecified. Bold text = included.
Source: http://cdm.unfccc.int/methodologies/SSCmethodologies/SSCAR/approved.html.

Table 6 Carbon pools and other GHGs covered by large-scale CDM forestry projects.

Type of Project	Carbon Pools	Other emissions	Notes (applicability)
AM0001	**A**, **B**	**CB**, **CF**, **MB**, **NB**	Where site preparation not a cause of significant long term net carbon emissions from soil and carbon stocks in soil expected to increase less in the absence of the project Version 03 (EB 42).
AM0002	**A**, **B**, **DW**, **L**, **S**	**CB**, **CF**, **MB**, **NB**	Where environmental conditions do not permit significant encroachment of natural tree vegetation. Version 02 (EB 42).
AM0004	**A**, **B**	**CF**, **MB**, **NB**	Where no significant nitrogen-fixing species used (so that greenhouse gas emissions from denitrification can be neglected in estimating actual net GHG removals by sinks). Version 03 (EB 42).
AM0005	**A**, **B**	**CB**, **CF**, **CR**, **MB**, **NB**	Where natural regeneration not expected to occur and no significant nitrogen-fixing species used. Version 03 (EB 42).
AM0006	**A**, **B**, **S**	**CF**, **CR**, **ML**, **NL**	Where environmental conditions and human-caused degradation do not permit the encroachment of natural forest vegetation. Version 02 (EB 42).
AM0007	**A**, **B**, DW, L, S	**CB**, **MB**	Where the project occurs after a period of decreasing intensity of agricultural and pastoral activities expected to continue in the absence of the project. Version 05 (EB 47).
AM0008	**A, B**	**CB**, **CF**, **MB**, **NB**, **NT**	Where litter and dead wood—including harvest residues—are left at the plantation site, and wildfire is not common. Version 03 (EB 42).
AM0009	**A**, **B**, DW, L, S		Where manure from pasture and range grazing animals is allowed to lie as deposited and is not collected, stored or burned. Version 04 (EB 47).
AM0010	**A**, **B**, DW, L, S	**CB**, **CF**, **CR**, **MB**, **NB**	Where site preparation is carried out in a way to avoid levels of soil disturbance or soil erosion sufficient to significantly reduce the soil carbon pool over the project lifetime. Version 03 (EB 42).
ACM0001	**A**, **B**, DW, L, S	**MB**	Where establishment of project does not decrease availability of fuelwood. Version 03 (EB 46).
ACM0002	**A**, **B**, S	**CB**, **MB**	Where flooding irrigation not applied. Version 01 (EB 46).

Project types: AM0001= Reforestation of degraded lands; AM0002 = Restoration of degraded lands through afforestation/reforestation; AM0004 = Reforestation or afforestation of land currently under agricultural use; AM0005 = Afforestation and reforestation project activities implemented for industrial and/or commercial uses; AM0006 = Afforestation/Reforestation with Trees Supported by Shrubs on Degraded Land; AM0007 = Afforestation and Reforestation of Land Currently Under Agricultural or Pastoral Use; AM0008 = Reforestation on degraded land for sustainable wood production of woodchips in the eastern coast of the Democratic Republic of Madagascar; AM0009 = Afforestation or reforestation on degraded land allowing for silvopastoral activities; AM0010 = Afforestation and reforestation projects on unmanaged grassland in reserve/protected areas; ACM0001= Afforestation and reforestation of degraded land; ACM0002 = Afforestation or reforestation of degraded land without displacement of pre-project activities.
Carbon pools: A = above-ground biomass; B = below-ground biomass; DW = dead wood; L litter; S = soil. Bold text = included, normal text = included in some cases (e.g. unless a conservative approach taken).
Other emissions:
Carbon dioxide: CB = from burning biomass; CF = from burning fossil fuels; CR = from removing pre-existing non-tree vegetation.
Methane: MB = from burning biomass; ML = from livestock fed with forage produced by the project.
Nitrous oxide: NB = from burning biomass; NL = from livestock fed with forage produced by the project; NT = from use of nitrogen-fixing tree species. Bold text = included, normal text = included in some cases.
Source: http://cdm.unfccc.int/methodologies/ARmethodologies/approved_ar.html.

[77] This includes transportation infrastructure (land strips along streets, country roads, highways, railways, waterways, overhead power cables, gas pipelines, provided such land is functionally or administratively associated with the transportation infrastructure) and Human settlements (residential and commercial lawns, gardens, golf courses, athletic fields, parks provided such land is functionally or administratively associated with particular settlements) and is not accounted for in another land-use category.

[78] Restricted to (i) Degraded intertidal wetlands (e.g. mangroves); (ii) Undrained peat swamps degraded with respect to vegetation cover; (iii) Degraded flood plain areas on inorganic soils; (iv) Seasonally flooded areas on the margin of water bodies/reservoirs.

[79] Defined as 'low inherent potential to support living biomass', these are restricted to (i) Sand dunes; (ii) Bare lands; (iii) Contaminated or mine spoils lands; (iv) Highly alkaline or saline soils.

Appendix D Forms of additionality

Table 7 Forms of additionality applicable to forestry activities and projects.

Category	Form	Description
Legal, regulatory, institutional	Barrier	Overcomes implementation barrier.
	Compliance	Exceeds statutory requirements.
	Date	Activities occur after a particular date.
	Incentive	Exceeds benefits associated with incentives provided by regulatory framework.
	Institutional	Independent of statutory emissions reduction targets.
	Jurisdiction	Activities in particular location or undertaken by specific communities or social groups.
	Practice	Not common practice.
	Reporting	National carbon accounting / reporting additionality rules.
	Technological	Application of specific technology.
Financial and investment	Financial	Would not be financed without sale of carbon units.
	Investment	Not financially viable or most attractive option without sale of carbon units.
	Sales	Income from the sale of carbon credits a decisive factor in decision to proceed.
Environmental	GHG	Positive overall impact on greenhouse gas balances (net benefit of activity or project).
	Unit	Emissions per unit output below specified level.
	Project	a) Afforestation and reforestation: forests unable to establish themselves in the absence of planned activities or project. b) Avoided deforestation or forest degradation: forests would have been deforested or degraded in the absence of the project.

Additionality is a core aspect of quality assurance of greenhouse gas emissions reduction and sequestration activities, being used in a climate change context to mean net abatement over and above that which would have arisen anyway in the absence of a given activity or project. The underlying rationale is to distinguish activities which further contribute to climate change mitigation from those which, although they may be associated with carbon savings, offer no benefits above those expected anyway. Different aspects of additionality are distinguished in this report, and different approaches to testing for these and establishing associated baselines reviewed, in order to help inform development by the Forestry Commission of a Code of Conduct for forestry carbon projects in the UK.

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