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EMERGING COMPLIANCE MARKETS FOR REDD+: AN ASSESSMENT OF SUPPLY AND DEMAND

MARCH 2013
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The US Agency for International Development (USAID) has launched the Forest Carbon, Markets and Communities (FCMC) Program to provide its missions, partner governments, local and international stakeholders with assistance in developing and implementing REDD+ initiatives. FCMC services include analysis, evaluation, tools and guidance for program design support; training materials; and meeting and workshop development and facilitation that support US Government contributions to international REDD+ architecture.

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FOREST CARBON, MARKETS AND COMMUNITIES (FCMC) PROGRAM

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ACRONYMS

AB	Assembly Bill
ACR	American Carbon Registry
ACCU	Australian Carbon Credit Units
AFOLU	Agriculture, Forestry and Other Land Use
APD	Avoided Planned Deforestation
ARB	Air Resources Board
AUFD	Avoided Unplanned Frontier Deforestation and/or Degradation
AUMD	Avoided Unplanned Mosaic Deforestation and/or Degradation
A/R	Afforestation and Reforestation
CAA	Clean Air Act
CAR	Climate Action Reserve
CCB	Climate, Community and Biodiversity Standard
CCER	Chinese Certified Emission Reductions
CDM	Clean Development Mechanism
CER	Certified Emission Reductions
CFI	Carbon Farming Initiative
CMP	Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol (Decision making body of the Kyoto Protocol)
COP	Conference of the Parties (Decision making body of the UNFCCC)
CSR	Corporate Social Responsibility
EPA	Environmental Protection Agency
ERPA	Emission Reduction Purchase Agreement
ERU	Emission Reduction Unit
ESD	Effort-Sharing Decision
EU	European Union
EU ETS	EU Emissions Trading Scheme
FCI	Forest Carbon Index
FCMC	Forest Carbon, Markets and Communities Program
FCPF	Forest Carbon Partnership Facility
GCF	Governors' Forests and Climate Task Force

GCI	Global Competitiveness Index
GEF	Global Environmental Facility
GHG	Greenhouse Gas
GIZ	German Agency for International Cooperation (Deutsche Gesellschaft fur Internationale Zusammenarbeit)
$GtCO_2e$	Metric Gigaton Carbon Dioxide Equivalent
IFM	Improved Forest Management
JI	Joint Implementation
JNR	Jurisdictional and Nested REDD+
KfW	KfW Bankengruppe - German development bank (KfW comes from Kreditanstalt für Wiederaufbau, or Reconstruction Credit Institute)
LULUCF	Land Use, Land-Use Change and Forestry
MRV	Monitoring, Reporting and Verification
NAMA	Nationally Appropriate Mitigation Action
NDRC	National Development and Reform Commission
NGO	Non-Governmental Organization
NICFI	Norway's International Climate and Forest Initiative
OSIRIS	Open Source Impacts of REDD Incentive Spreadsheet
REDD+	Reducing Emissions from Deforestation and Forest Degradation in Developing Countries; and the Role of Conservation, Sustainable Management of Forests and Enhancement of Forest Carbon Stocks
REDD	Reducing Emissions from Deforestation and Degradation (only – i.e. excluding forest conservation, management and enhancements)
REL	Reference Emissions Levels
REM	REDD Early Movers
RGGI	Regional Greenhouse Gas Initiative
RMU	Removal Unit
ROW	REDD Offset Working Group
SBSTA	Subsidiary Body for Scientific and Technical Advice
SISA	System of Incentives for Environmental Services
tCO_2e	Metric Ton Carbon Dioxide Equivalent
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development

USG	United States Government
VER	Verified Emission Reduction
VCS	Verified Carbon Standard
VCU	Verified Carbon Units

1.0 EXECUTIVE SUMMARY

Background

The forest sector is a significant source of emissions contributing between 10 to 17 percent of global emissions.[1] Reducing emissions and sequestering carbon from forests is a cost-effective option to reduce global greenhouse gas (GHG) emissions.[2] But forests are more than carbon. The world's forests support the livelihoods of up to 1.6 billion people and provide habitat to 80 percent of the world's terrestrial biodiversity.[3] Sustainable management and protection of forests offers an opportunity to support climate-resilient economic development and protect biodiversity while accelerating poverty alleviation in some of the least-developed nations.[4] The Parties to the United Nations Framework Convention on Climate Change (UNFCCC) are negotiating policy to reduce emissions from deforestation and degradation and enhance carbon stocks (REDD+). To achieve this, there needs to be predictable, long-term finance available to incentivize conservation and sustainable use of forests, the protection of biodiversity, and support local communities whose livelihoods are linked to forests. Global economic studies dedicated to estimating the costs of REDD+ find that the annual funding needs are in the tens of billions of dollars.[5] When these figures are considered against the finite amount of public finance available, a significant funding gap is apparent. [6] As a result, the international community has identified the need for broad participation by the private sector. In 2011 at the seventeenth session of the UNFCCC Conference of the Parties (COP) in Durban, South Africa, the Parties reached the important decision that financing REDD+ could engage the private sector. The Parties agreed that "appropriate market-based approaches could be developed by the COP to support results-based actions."[7] Many market-based mechanisms for REDD+ are already either developed, under development, or anticipated in the future. Private sector capital has been responsive and has started to develop REDD+ activities and generate REDD+ credits.

This report assessed the policies and early REDD+ actions that represent the current status of market and results-based finance mechanisms for REDD+ around the world. This included potential demand from multilateral, bilateral, national and sub-national approaches, along with potential supply of "compliance-grade" credits based on empirical research and analysis of known REDD+ projects and programs. A synthesis of emerging compliance market demand and the supply pipeline will better inform public and private sector decision makers.

Demand Outlook

A total of 30 market or results-based mechanisms that may create demand for carbon credits were identified and analyzed for this report. This included multilateral, regional (trans-national), national and sub-national emissions trading schemes, along with other multilateral and bilateral initiatives to pay for or purchase

[1] The higher estimate of 17 percent comes from the IPCC's 2007 report and estimates emissions from the forest sector as a whole (IPCC (2007) AR4 Synthesis Report). More recent analysis by Winrock International that looked at satellite data to track deforestation find lower absolute and relative numbers than previously reported in the literature and estimates deforestation contributed to approximately 10 percent of global emissions over 2000 – 2005 (Harris N. et al, 'Baseline Map of Carbon Emissions from Deforestation in Tropical Regions', *Science* 22 June 2012: Vol. 336 no. 6088 pp. 1573-1576.

[2] For example, see the McKinsey Cost Curve for Greenhouse Gas Reduction, available at http://www.epa.gov/oar/caaac/coaltech/2007_05_mckinsey.pdf; and the Climate Works Forest and Land-use Sector Overview, available at http://www.climateworks.org/network/sectors/forests-and-land-use

[3] UNEP. Benefits of Forests, Forest Facts, Website of the UNEP, accessed November 20, 2012 at http://www.unep.org/wed/forestfacts/

[4] UK Deparment of Energy and Climate Change / Price Waterhouse Coopers, Climate Focus, IUCN, and Winrock International. Funding for Forests: UK Government support for REDD+. May, 2011, accessed October 31, 2011, at http://www.decc.gov.uk/assets/decc/internationalclimatechange/1832-funding-for-forests-uk-government-support-for-red.pdf

[5] IWG/IFR. Report on the Informal Working Group on Interim Finance for REDD+ (IWG/IFR). Discussion document. October 2009.

[6] Simula, M. Analysis of REDD+ Financing Gaps and Overlaps. REDD+ Partnership. December 2010, accessed October 31, 2011 at http://reddpluspartnership.org/25159-09eb378a8444ec149e8ab32e2f5671b11.pdf

[7] United Nations Framework Convention on Climate Change. Decision 2/CP.17. Outcome of the work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention, Paragraph 66

emission reductions or removals from REDD+ activities. The design features of these programs determined the scale of demand for credits. Design features of emissions trading schemes, including rules determining the eligibility of credits, caps limiting the quantity of credits used by regulated entities, approaches to managing non-permanence risk, and methods for accounting and crediting, were analyzed and commented on. Where emissions trading systems were sufficiently developed, these factors were taken into consideration to estimate demand.

The largest potential source of demand pre-2020 comes from a future UNFCCC agreement. For this demand to materialize, three key decisions are needed:

1) Emission reductions and removals from REDD+ need to be tradable and eligible for use to meet future emission reduction commitments.
2) The new REDD+ and global agreement needs to allow for a "prompt start" to a REDD+ mechanism to stimulate early action before an anticipated UNFCCC agreement comes into force in 2020.
3) The new agreement needs to have meaningful emission reduction commitments and a role for REDD+.

There are two national and one state level emissions trading schemes that are currently operational and may recognize REDD+: - Australia, New Zealand and California. The Australian legislation will allow international credits from 2015 on and is drafted broadly enough to extend to REDD+ if additional steps are taken by the Australian regulators. New Zealand also allows international credits, which could in theory include REDD+ if additional steps are taken by the regulators. However, for both countries this is more likely if there is also a REDD+ agreement under the UNFCCC that generates credits that can be used to help meet future national emission reduction commitments. California, on the other hand, is not dependent on this link and its emissions trading scheme explicitly mentions REDD+ as a potential source of offsets. However, additional (and more complex) rule making is needed in California before REDD+ is admitted. In addition to these emerging emissions trading markets, there are a number of bilateral and multilateral initiatives that will help generate some demand up to 2020, with Japan's initiative having the potential to generate the largest demand. Table 1 below presents estimates of demand for forest carbon credits. Given the significance of a UNFCCC agreement (and assumptions used to estimate demand volume), a sub-total of demand excluding UNFCCC demand is also included. It is important to note that these estimates of anticipated demand do not include potential demand from the Kyoto Protocol via its new linkage to future UNFCCC market mechanisms.

In addition to these schemes, a number of domestic schemes were identified that were either insufficiently developed to assess the inclusion or exclusion of REDD+ (e.g., a number of nascent state/provincial level programs in Brazil, Canada, China and the US) or prohibited REDD+ credits outright (e.g. the European Union Emissions Trading Scheme [EU ETS]).

Table 1: Demand -Annex 1 Forest Carbon Credits 2013-2020 (presented in thousands of credits)

	Low	Mid	High
Verified Carbon Standard (VCS)	30,100	71,200	112,800
Forest Carbon Partnership Facility (FCPF)	10,250	20,600	41,200
Australia Clean Energy Future	0	29,000	145,000
New Zealand Emissions Trading Scheme	0	4,688	32,813
California AB 32	0	48,400	64,500
Japan	0	54,000	134,750
Germany REDD Early Movers	2,120	4,200	8,480
UNFCCC	0	277,778	2,381,944
Sub-total excluding UNFCCC	*42,470*	*232,088*	*539,543*
TOTAL	**42,470**	**509,865**	**2,921,487**

Supply Outlook

The objective of the supply analysis was to gather data from compliance-grade projects and programs to develop a projection of the global supply pipeline of issued REDD+ credits for the period 2013-2020. Evidence was extracted from REDD+ mitigation activities that demonstrated a measureable potential to produce high-quality credits that may be considered "compliance-grade."[8] The study included activities being implemented at the project scale and program scale (known as "sub-national" in UNFCCC and "jurisdictional" under the VCS). A number of the activities identified met criteria to produce compliance-grade credits (referred to as Level I), while the remaining are preparing to meet such criteria (referred to as Level II). An empirical approach to projecting supply was designed for each level. When aggregated, the projections of supply volumes from activities in Levels I and II represented a probable scenario of the REDD+ credit pipeline for 2013-2020.

The method for gathering and screening data resulted in 80 different REDD+ activities included in two data sets, Level I and II data. To reflect current rules of pre-compliance and emerging compliance markets, the methodology assumed retro-crediting, which allowed for inclusion of verified project activities in vintages from 2008. This method is considered to most accurately capture the future pipeline of compliance-grade REDD+ credits based on REDD+ activities operating or in advanced stages of development. The results indicated cumulative issuance for the period 2013-2020 will be approximately 283 million credits, with average production over this eight year period at over 35 million credits per year. The analysis suggests that Indonesia will produce a significant share of REDD+ credits, as its carbon-rich peat forests allow for very high credit productivity (credits produced per hectare). REDD+ projects that avoid planned deforestation were found to produce the largest total number of credits due to high baselines.

[8] Compliance-grade REDD+ credits are considered to be those accounted and verified under a high-quality voluntary market standard that is either i) of comparable robustness to compliance market standards and/or ii) may be recognized as eligible to meet regulated obligations under a compliance market. Section 4 introduced the concept of compliance-grade credits and detailed each program individually. Of the group, the VCS is the dominant carbon accounting standard on the supply side, and for purposes of this study represents the sole source of compliance-grade non-Annex I REDD+ credits.

As the empirical model relied on the existence of site specific REDD+ activities it did not include any potential growth of the pipeline due to new activities. Pipeline growth is difficult to estimate as it is affected by a number of factors with the most significant being level of demand. Pipeline growth needed to meet each of the demand scenarios was calculated to be -22 percent (low-end demand), 22 percent (mid-range demand) and 240 percent (high-end demand). The average annual growth of Certified Emission Reductions (CER) issuance under the CDM over the last three years was also calculated as an additional reference point (46 percent). This growth rate was chosen as a benchmark and resulted in 819 million tCO_2e (Metric Ton Carbon Dioxide Equivalent) being estimated to 2020, which is only likely if demand forces will purchase (either through markets or other payment for performance mechanisms) emission reductions at their production costs or higher.

Comparative analysis of alternative, top-down approaches to forecasting REDD emission reduction potential offered a comparison to the credit supply estimates found in this report. A selection of emission reduction and removal estimates derived from global economic models was gathered from scientific and policy literature. The estimates gathered for comparative analysis using top-down models of theoretical supply suggest that emission reduction potential for the 2013-2020 period may be in the range of 59 million to 23 billion tCO_2e, with the high end representing biophysical potential rather than feasible supply of credits. Estimates produced under the Forest Carbon Index (FCI) model with risk adjustments have the lowest difference to the pipeline volumes produced in this report.

Market Outlook: Analysis and Conclusions

The supply analysis in this report focused on supply from compliance-grade projects and programs currently under development using the VCS. Some of this supply will certainly be matched by some of the demand segments described above. However, while a simple comparison of aggregate supply against aggregate demand has some utility, it is also challenging, as it contains a number of limitations as the market does not allow for an easy comparison of the supply and demand findings. Therefore, analysis is presented using an assumption that compliance-grade supply is a useful indicator to assess potential supply that could be matched with demand from emerging markets. The cumulative credit supply from the empirical study is charted alongside cumulative anticipated demand levels in Figure 1 and 2 below, with Figure 1 showing the relationship including UNFCCC demand and Figure 2 without it.

The findings suggested that between 2016 and 2020 demand could significantly exceed the estimated credit issuance potential (supply) of Level I and Level II REDD+ activities – if there is an ambitious UNFCCC agreement that allows for prompt start for REDD+. If UNFCCC demand is moderate or absent there is potential oversupply based on projections of supply growth. If no supply growth is assumed in these scenarios, the current pipeline may not produce sufficient supply, indicating supply and demand dynamics have the potential to balance with weak growth in supply (not modeled) and moderate or no UNFCCC demand.

Figure 1 Cumulative supply and demand if a UNFCCC agreement is realized (thousands of credits)

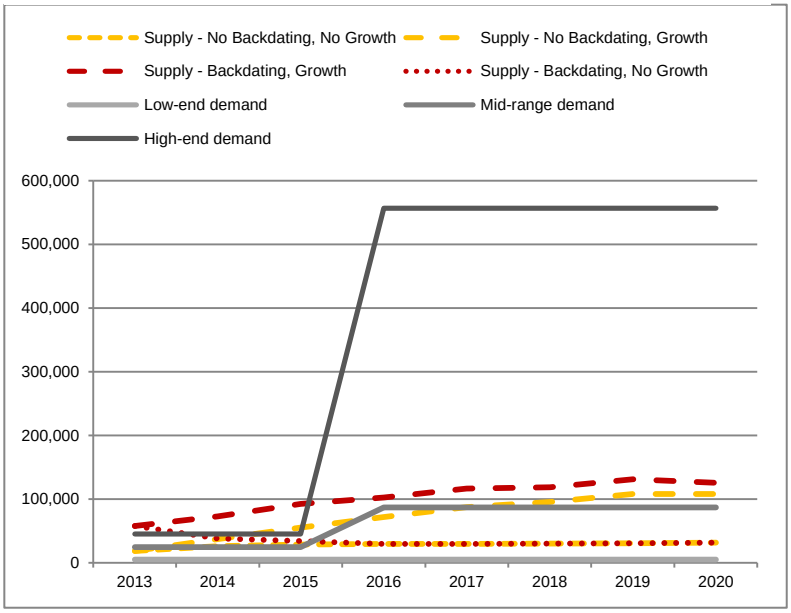
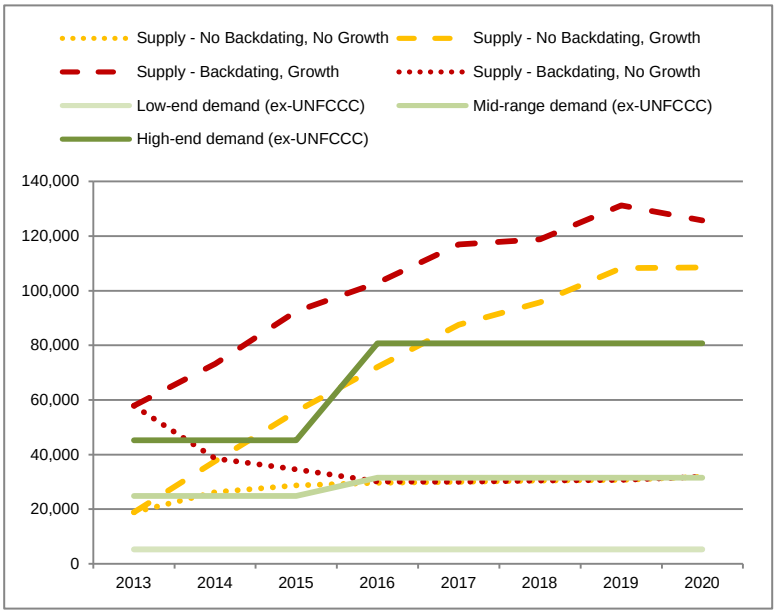


Figure 2 Cumulative supply and demand - excluding UNFCCC demand (thousands of credits)



The low-end estimates of demand suggested a significant oversupply of the current pipeline from 2013-2020, the mid-range estimates predict oversupply from 2013-2015, and high-end estimates predict oversupply in 2013, and potentially 2014, depending on growth. The scale of the market imbalance in the low-end scenario would pose dire consequences for current REDD+ operators seeking to generate revenues or exit investments through credit sales in the end-market. Clearly, such oversupply would be counter-productive in the eyes of regulators responsible for market design, as the resulting low carbon price would fail to stimulate low carbon investment.

However, the data and assumptions used in the analysis indicate an ambitious agreement is warranted. The Copenhagen Accord pledges were used to calculate potential UNFCCC demand, and the pledges are known to be insufficient to mitigate a high risk of 2^0C warming. The pledges represented anywhere between a 5,000 – 9,000 million tCO_2e emissions gap between what is pledged and what is needed by 2020. Given this gap – and the need to find additional reductions – there should be ample scope for a robust market mechanism for REDD+.

The main findings of the analysis are clear, but not surprising. Demand for REDD+ credits will be relatively weak compared to potential supply without an agreement under the UNFCCC, even though programs in Australia, Japan, and California could promote some demand. If the Parties reach an ambitious agreement in 2015 that does not allow for a prompt start for a REDD+ mechanism, or reaches a modest agreement that does not have a meaningful role for REDD+, demand will remain weak through 2020. A lack of strong demand until after 2020 could cause financial harm to governments, local communities, civil society and the private sector already engaging in REDD+ activities. It could also cause political fallout within countries engaged in REDD+ readiness activities and looking for signs that a REDD+ market is real. There are two ways to avoid this risk – develop new performance-based compensation vehicles for the 2013 – 2020 period and increase bilateral funding, and/or ensure an ambitious UNFCCC agreement is reached that includes a prominent role for REDD+ markets with prompt start provisions.

2.0 INTRODUCTION

2.1 BACKGROUND

Leveraging public funding to promote private sector investments in REDD+ is becoming a pressing issue. According to the 2008 Eliasch Review, the cost to halve deforestation rates by 2030 is in the range of $17 to $28 billion annually.[9] These estimates are derived from opportunity costs analysis, which is limited in scope[10] and therefore may not fully capture the level of incentive required to shift land-use towards REDD+ activities.

When these figures are compared to current public finance commitments to REDD+, a significant future funding gap becomes apparent. Between 2008 and 2012, public sector REDD+ financing has been estimated to reach approximately $7 billion, reaching a range of $1.3-1.5 billion per annum during the 2010-2012 period.[11] These figures are derived from bilateral and multilateral program commitments to fast-start financing and assume effective deployment of dollars pledged.

The medium and long-term deployment of REDD+ will not be possible without broad participation by the private sector.[12] Private sector interest in REDD+ has slowly increased since the 1990s.[13] This early evidence indicates potential to significantly increase REDD+ investments from the private sector through appropriately designed enabling and incentive mechanisms. However, designing mechanisms to attract private capital and close the funding gap requires an understanding of current and future markets for REDD+.

Since the late 1990s, early carbon projects, like the Noel Kempff Climate Action Project in Bolivia, have enabled private sector capital to flow to forest conservation activities by compensating developers for environmental benefits. In 2005, this concept was brought forward as a strategy to mitigate climate change under the United Nations Framework Convention on Climate Change (UNFCCC). At the 11th Conference of Parties (COP), at the urging of Papua New Guinea and Costa Rica on behalf of a group of developing countries that became the Coalition of Rainforest Nations, the COP invited submissions from Parties and accredited observers on issues relating to reducing emissions from deforestation in developing countries, focusing on relevant scientific, technical and methodological issues, and the exchange of relevant information and experiences, including policy approaches and positive incentives.[14]

In 2006, the UNFCCC's Subsidiary Body for Scientific and Technical Advice (SBSTA) 24 began considering matters related to reducing emissions from deforestation. In December 2007 at COP 13 in Bali, the Parties adopted a decision that articulated the scope of REDD+ and gave a directive encouraging early action.[15] This decision supported growing private sector interest in the potential for compliance markets for forest carbon. Leaders from the private sector, governments and intergovernmental organizations initiated voluntary market mechanisms intended to trial accounting and crediting rules. These efforts have brought about significant

[9] UK Office of Climate Change / Johan Eliasch (2008). Climate Change: Financing Global Forests, The Eliasch Review,aaccessed July 11, 2011 at http://www.official-documents.gov.uk/document/other/9780108507632/9780108507632.pdf
[10] Opportunity cost analysis does not account for implementation or transaction costs.
[11] Simula, M. 'Analysis of REDD+ Financing Gaps and Overlaps', REDD+ Parnership. December 2010, accessed October 31, 2011 at http://reddpluspartnership.org/25159-09eb378a8444ec149e8ab32e2f5671b11.pdf
[12] UK Deparment of Energy and Climate Change / Price Waterhouse Coopers, Climate Focus, IUCN, Winrock International. Funding for Forests: UK Government support for REDD+. May, 2011, accessed October 31, 2011 at http://www.decc.gov.uk/assets/decc/internationalclimatechange/1832-funding-for-forests-uk-government-support-for-red.pdf
[13] Simula, M. 'Analysis of REDD+ Financing Gaps and Overlaps', REDD+ Parnership.' December 2010, accessed October 31, 2011 at http://reddpluspartnership.org/25159-09eb378a8444ec149e8ab32e2f5671b11.pdf
[14] United Nations Framework Convention on Climate Change, Report of the COP 11, Agenda Item 6, Paragraph 81, available at http://unfccc.int/resource/docs/2005/cop11/eng/05.pdf
[15] United Nations Framework Convention on Climate Change, Decision COP 13, Bali Action Plan, Decision II, Paragraph 3, available at http://unfccc.int/resource/docs/2007/cop13/eng/06a01.pdf

advancements in standards supporting REDD+ accounting and crediting. In 2010 at COP 16, the Parties formally defined the scope of REDD+ as activities relating to reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries – with deforestation and degradation accounting for the first two "D's" and the remaining activities lumped under the "+."[16]

The Durban Platform coming out of COP 17 in 2011 outlined the intent to reach a new binding global agreement by 2015.[17] How (if at all) a future UNFCCC agreement may relate to a future commitment period under the Kyoto Protocol is still to be determined. COP 17 included a significant decision on REDD+ including that "appropriate market-based approaches could be developed by the COP to support results-based actions."[18] It leaves unresolved, however, the issue of what is meant by market-based approaches, whether sub-national activities could be supported by markets, and also skirts the issue of whether or not bilateral, or non-COP developed mechanisms, would be recognized under the UNFCCC. [19] These issues were also not addressed at COP 18 in 2012 – the Parties agreed to establish a new work stream on results-based finance that is to report back to COP 19 in 2013.[20]

However, in the shadow of the UNFCCC, a suite of national and sub-national compliance programs are emerging. Many of these early compliance programs are currently at early-stages in their implementation. Even so, the design of emerging program infrastructure and evidence from pre-compliance REDD+ activities offers insight into future market development. A review of compliance programs' design components and proposed infrastructure provides the basis to investigate potential levels and sources of demand.

On the supply side, a selection of REDD+ activities are currently producing high-quality credits that may be viewed as "compliance-grade," with a host of others under development. "Compliance-grade" refers to voluntary methods and procedures used to quantify emission reductions or removals that are highly credible and of comparable rigor to regulated or compliance schemes. Compliance-grade credits may or may not be recognized in a regulated market in the future. Data extracted from the performance of current and proposed REDD+ activities can be used to estimate short to medium-term (2013-2020) supply of compliance-grade credits.[21]

This report assesses the policies and early REDD+ actions that represent the current status of market-based finance mechanisms for REDD+. A synthesis of emerging compliance market demand and the supply pipeline will better inform public and private sector decision makers. By improving information this assessment intends to promote mechanisms to leverage public and private capital for REDD+.

2.2 ASSESSMENT METHODOLOGY

While there is heightened interest in market-based approaches and results-based financing as a tool for reducing deforestation, the suite of emerging compliance programs, bilateral activities and voluntary markets are fragmented and have yet to fully tap the private sector as a source of funding. This report assesses the

[16] United Nations Framework Convention on Climate Change, COP 16, Decision 1, Paragraph 80, available at http://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf#page=2
[17] United Nations Framework Convention on Climate Change, Decision 1/CP.17, Paragraphs 1, 2, *Durban Platform,* March 2012, accessed October, 2012 at http://unfccc.int/resource/docs/2011/cop17/eng/09a01.pdf
[18] United Nations Framework Convention on Climate Change, Decision 2/CP.17, Paragraph 66, *Durban Platform,* March 2012, accessed October, 2012 at http://unfccc.int/resource/docs/2011/cop17/eng/09a01.pdf
[19] O'Sullivan R. and Lee D., "Outstanding Challenges for a UN REDD+ Mechanism," in *Greenhouse Gas Market 2012; New Markets, New Mechanisms, New Opportunities*, Mansell A. (ed), (2012), International Emissions Trading Association, Geneva and Washington D.C.
[20] See COP 18 Decision "Agreed outcome pursuant to the Bali Action Plan," Paragraphs 25-33 (the Decision number was not yet assigned at the date of publication).
[21] Noting the lack of operational REDD+ markets makes it impossible to assess the fraction of these credits that may become eligible in a future compliance market.

REDD+ finance system, as represented by a set of market-based policy instruments, bilateral activities and independent verification standards which foster a flow of capital to REDD+ activities. The report examines the markets' design rules (when available) and gauges the state of supply and demand for REDD+ credits.

2.2.1 REDD+ Market

The REDD+ market as a whole can be seen as the accumulation of total demand and total supply. This is sometimes referred to as the "end-market." Credits are measured in a standard unit of metric tons of CO_2 equivalent[22] (tCO_2e). The standardized unit allows credits to be traded as financial securities where differences, such as standards used to certify or generate the credit, utility for meeting compliance obligations, project location and type, and other project attributes, are used to differentiate units and prices.

To understand the market in more detail, both the demand component and supply component need to be analyzed. The next two sections lay the groundwork for discussion by thoroughly examining the fundamentals of supply and demand, with a focus on how specific factors influence the potential for REDD+.

2.2.2 Demand Fundamentals

Demand for REDD+ credits is fundamentally created by two sources: i) regulations or policy that creates obligations to purchase credits, and ii) voluntary purchases of credits. Demand for REDD+ credits driven by regulations is currently in its infancy, with some speculative "pre-compliance" demand seen in California. It can, however, significantly outweigh voluntary demand – in 2011 the total market for emission reduction credits from all sources was $176 billion, of which $569 million was from the voluntary market.[23]

One way international, national and sub-national climate change programs which follow a market-based approach can create demand is by imposing a liability on emitters to surrender permits for GHG emissions. The number of permits – often called allowances – is usually capped in an amount corresponding to the program's target GHG emissions. Rules on trading permits, as well use of credits, also need to be defined. Credits are permits that are allowed into the capped system that represent emission reductions or removals and can be used to credit emissions. All emissions trading systems place some form of qualitative (e.g., certain project types or geographic regions) or quantitative limitations on their use. Establishing clear rules for the inclusion of REDD+ credits is the basis for developing an emissions trading system that creates demand for REDD+ credits. Generally, eligibility conditions for REDD+ credits state the type of emission reduction activities allowed under the scheme and outline parameters to ensure that emission reductions are real, permanent and accounted under an approved methodology. Allowing credits to be used to meet a cap creates demand for these credits, and sales of credits create revenue to support the REDD+ activity or project.

The initial injection of capital to finance REDD+ activities is referred to as primary capital. Primary capital is a critical component of developing supply as it provides the funding needed to finance REDD+ activities until they are financial sustainable with carbon revenues. But the ability to attract primary capital is significantly tied to the size of the end demand for REDD+ emission reduction. The scale of primary capital flowing to REDD+ activities is directly tied to investor perceptions of the ability to generate revenue through the secondary sale of credits in the voluntary or compliance markets. A high degree of liquidity in these credit markets, where trading and pricing is readily discovered, allows investors greater confidence in the realization

[22] Different GHGs affect the climate system differently – some are more effective at trapping heat than others, and different gases will remain in the atmosphere for different amounts of time. When GHGs are reduced, removed from the atmosphere, or destroyed the per-tonne impact of this will be different for each gas. For example, releasing one tonne of methane (CH_4) has the same climate impact as 23 metric tons of carbon dioxide (CO_2) over a 100 year period. The relative effect of a GHG can be expressed as the "global warming potential," with CO_2 used as the common element for comparison. CO_2 is also used as the base unit for credits and offsets, so destroying one tonne of CH_4 will generate 23 offsets or credits, measured in metric tons of CO_2, or tCO_2e.

[23] World Bank (2012). *State and Trends of the Carbon Market 2012,* accessed September 19, 2012 at http://siteresources.worldbank.org/INTCARBONFINANCE/Resources/State_and_Trends_2012_Web_Optimized_19035_Cvr&Txt_LR.pdf

and size of future revenues and return on investment. A strong credit market reduces investors' price risk and will stimulate early investments in REDD+ emission reductions by attracting capital to the sector.

It is important to note that under a functioning and sustained REDD+ market entities with an emissions reduction liability will not be the only primary capital investors in REDD+ activities or the only buyers of credits. In order for the market to mobilize the billions of dollars a year required to achieve significant reductions in emissions in forests, traditional financial investors, such as investment funds, must be active participants. To date, approximately 23 percent of the forest carbon market is motivated by buyers interested in possible financial returns from the potential grandfathering of compliance-grade voluntary credits to emerging compliance markets such as California.[24] As many of the emerging compliance programs have yet to formalize rules for inclusion of credits, this source of demand is currently an important driver of investment in REDD+ activities.

2.2.3 Supply Fundamentals

The future supply of REDD+ credits is driven by an operator's capacity for effective REDD+ implementation and the availability of primary capital (to finance) and secondary capital (to support returns generated from the financing). In academic literature and policy discussion papers, significant attention is paid to the former.[25] Within the body of academic and policy work, potential credit volumes are roughly estimated using average deforestation rates, regional carbon density figures, price signals and scenario assumptions of potential reduction in deforestation rates resulting from REDD activities (i.e. deforestation and degradation, thus excluding sequestration). Scenarios for REDD supply are derived from technical capabilities and resources required to meet thresholds for credit issuance, as well as overall governance that may affect the success of REDD+ activities. Prices paid for REDD+ credits will also impact supply, as higher prices allow increased REDD+ activities in areas with higher marginal abatement costs, while low prices or drops in prices reduce the number of financially viable opportunities and negatively affect the viability of existing REDD+ activities. At the macro level, the availability of capital is often folded into conversations of end-market demand, glossing over an important sub-component of REDD+ finance - the availability of primary capital.

Primary capital represents the initial injection of capital into a project or program and generally enables funding for planning and implementation of REDD+ activities. When sourced from the private sector, the availability of primary capital is largely influenced by perceptions of risk and return on investment. The performance of early public and private investments in REDD+ has enabled investors to analyze the risk-return profile of REDD+ in real monetary terms. The cash-flow structure and limitations to managing credit issuance have emerged as important determinants of the risk-return profile of primary REDD+ capital.

REDD+ has a long-term investment horizon and is similar to infrastructure and agriculture finance in this regard: REDD+ activities require large capital expenditures in the planning and implementation stages (typically one to three years) that are followed by comparatively smaller amounts through the operating period (with variations based on project type). A project's cash inflows are long-term, initialized at the first issuance and sale of credits, and recurring on subsequent credit issuance and sales (typically every two years in this sector). The schedule of positive cash-flows reflects accounting rules which only allow credit issuance after emission reductions or removals are monitored and verified for issuance (referred to as "ex-post").

Again, analogous to many infrastructure and agriculture projects, the nature of REDD+ activities offers limited control over the schedule of future production. REDD+ operators are unable to easily lower subsequent years' credit generation (and therefore production costs) in response to low credit prices. Scaling

[24] This is the percentage of buyers motivated by "pre-compliance" purchases as reported in Ecosystem Marketplace, 'State of the Forest Carbon Markets 2012: Leveraging the Landscape' October 2012.
[25] Boucher, D., 2008, Estimating the Cost of REDD: an Overview of Approaches, The Costs of REDD, World Bank work-shop, Washington, DC, accessed May 27,2008 at http://siteresources.worldbank.org/EXTCC/Resources/407863-1213125462243/Boucher.pdf

down credits generated from a particular area is difficult[26] without compromising the lifetime of emission reductions in that area. Reduced credit generation as a consequence of low prices is therefore more likely a consequence of a project starting to fail due to decreased revenue rather than deliberate management. Once capital is paid in and the project moves into implementation, emission reductions are generated. Referred to as "supply inelasticity," this inability to change project operations and cost base in response to a change in sales price means that uncertainty in demand is a significant market risk. Poor demand and low credit prices result in lower revenue while credits continue to be produced at the same cost. These credits may be put aside and sold at a later date if prices improve, but unless other revenue streams are able to be created, the consequence is negative cash flows. Depending on the resources available, continuous negative cash flows will eventually lead to insufficient funding to maintain the ongoing activities, resulting in failure of the REDD+ activities.

Given that the majority of REDD+ activities are characterized by limitations on managing production in response to price, there is high potential for the REDD+ credit market to encounter periods of over-supply or under-supply. From an investor's point of view, the future supply pipeline of credits is a critical starting point for REDD+ market analysis, and will be a subject of intense scrutiny going forward.

2.2.4 Assessment Approach

To evaluate the components and factors influencing emerging compliance markets for REDD+ this report assembles information and primary data made available by early REDD+ activities and emerging market infrastructure. Collecting data and information is intended to improve understandings of supply and demand dynamics, and provide an outlook to the nascent compliance REDD+ market. The assessment was carried out in three phases.

The first phase (covered in Section 3 and Appendix I) undertakes a review of demand-side components of the market. These sections investigate:

i) *Sources of demand*: A review of compliance markets, pre-compliance markets and bilateral sources of demand;
ii) *Quantity of demand*: The anticipated demand for REDD+ credits per source;
iii) *Credit eligibility criteria*: The likely criteria for REDD+ credits to be included in the market, such as restrictions or criteria on geographic location of the activity generating the credit, methodology, and scale (e.g. whether credits from project or larger scale accounting schemes are recognized);
iv) *Market rules:* The key elements of market design including rules on banking and borrowing, credits inclusion ceilings, acceptance of liability, compliance periods and qualifying vintages, and mechanisms for linking with other markets

The second phase of the assessment (presented in Section 4) looks at potential supply of "compliance-grade" REDD+ credits over the period 2013-2020. A selection of REDD+ projects are currently producing credits, and many other projects and larger scale programs (known as sub-national or jurisdictional) are being prepared to meet standards to enable credit issuance. The credits from these two groups represent the bulk of the short-term credit supply. A prediction of total credit generation supply was constructed by gathering primary emissions reduction data from project databases, project term sheets, investment circulars, and interviews with project developers, non-governmental organizations (NGOs) and intergovernmental agencies. While best efforts were made to collect as much information as possible, the data is likely not exhaustive or definitive as it is possible that some viable data was not encountered. In order to capture uncertainties in the size, timing and likelihood of an activities credit issuance, a series of discount factors are applied to the aggregate credit issuance. This approach is detailed in Appendix II.

[26] In theory, selective logging or thinning would enable operators to lower REDD+ credit issuance and raise revenue from timber sales, however in practice REDD+ operators do not have the equipment or capacity to carry out this activity in short time frames.

The third phase of the assessment analyses findings from the first two phases offers a glimpse of the absorption capacity of current demand levels and an indication as to whether current demand can promote the large-scale capital flows needed to finance REDD+. Section 5 illustrates demand and supply levels annually over the period 2013-2020. Early indications of a price curve are drawn from surveys of market participants.

3.0 FOREST CARBON DEMAND IN EMERGING COMPLIANCE & BILATERAL PROGRAMS

Market mechanisms under international, national and sub-national climate change programs can create large-scale demand for REDD+ credits by placing a limit on emission reductions and creating binding emission limitation commitments. The governing body's legislation determines the entities covered under the scheme and the means to comply with binding commitments. In addition to reducing GHG emissions, project-based emission reductions credits may be recognized as a means to meet emissions reduction obligations. These can come from projects that are located within or outside the geographic boundaries of the program. This creates demand for qualified credits. Aggregate REDD+ credit demand is a function of the number of programs that allow REDD+ as a project-based credit type.

The rules for inclusion and quality standards for compliance REDD+ credits will be determined by the compliance program's rules. The design features of these programs, including rules determining the eligibility of credits, caps limiting the quantity of credits used by liable entities, approach to manage non-permanence risk, and the method for accounting and crediting will all affect demand. Quantitative limits on usage of REDD+ credits and possible buffer withholding requirements will directly impact demand. Other factors like geographic preferences, eligibility requirements and rules for accounting are threshold issues, and can compound transaction costs and risks for liable entities that choose to use REDD+ credits to be compliant with emissions reduction commitments. These factors influence investor confidence, and affect the desirability and value of REDD+ credits compared to credits from other sectors or allowances. These considerations make the design of REDD+ crediting mechanisms as important as whether or not a market is created at all.

Each jurisdiction will ultimately determine their own rules for inclusion and quality standards for compliance REDD+ credits, but in order to create a functioning cross-border market a harmonization of these approaches must exist. Many expect the UNFCCC to deliver in the coming years an international REDD+ finance mechanism to propagate a universal benchmark for measured, reported and verified REDD+ credits. However, to date the UNFCCC process has not confirmed that REDD+ credits can be used in a future multilateral climate change agreement let alone the technical details of such inclusion. In response to the time taken to receive specific guidance from the UNFCCC a group of performance-based crediting programs in the voluntary market were specifically designed to account and credit emission reductions with a high degree of environmental integrity. Some authors argue where quality standards are sufficient to meet legally binding commitments and sustain a functioning market emission reductions credited under these standards may be characterized as "compliance-grade."[27] Under these programs, the standard for compliance-grade credits conforms to principles for compliance crediting created under the Clean Development Mechanism (CDM) and mitigation actions affirmed at COP 17, which state using a variety of approaches (including market-

[27] Murray, B., Olander, L., Kanak, D. Forging a Path for High-Quality Compliance REDD Credits, Nicholas Institute for Environmental Policy, December 2009, available at http://www.nicholas.duke.edu/institute/Compliance_REDD_Credits.12.09.pdf

based) actions must "meet standards that deliver real, permanent, additional and verified mitigation outcomes, avoid double counting of effort, and achieve a net decrease and/or avoidance of greenhouse gas emissions."[28]

Despite the fact that most emerging compliance markets have yet to formalize rules for the inclusion of REDD+ credits, market participants stated that nearly one-quarter of all transactions were driven by demand for compliance-grade credits to seek exposure for future compliance programs.[29] This form of demand, widely referred to as "pre-compliance" demand, represents speculation that there will be future end-market demand for REDD+ credits catalyzed by the inclusion of REDD+ in future compliance programs.

This section looks at the landscape of emerging compliance programs, and details the rules and design features influencing demand for REDD+ credits generated in developing countries (or "non-Annex I countries" under the UNFCCC). The section also considers bilateral initiatives as a source of financing for forest-based mitigation, and the potential for these efforts leading to future market integration.

3.1 EMERGING COMPLIANCE PROGRAMS DESIGN FEATURES

Incorporating credits from the forest sector into regulated cap-and-trade markets encourages investment in forest conservation and restoration. The treatment of REDD+ in compliance and voluntary market programs varies. Key design features that can vary within compliance markets and voluntary standards include issues such as i) whether or not forestry credits are included or not; ii) whether there are any limitations to the use of forest credits, such as quantitative caps, geographic preferences, or qualitative criteria; iii) how the risk of non-permanence is addressed; and iv) other factors that determine rules for sourcing credits, trading and use of credits for compliance. All of these design features can affect demand, either directly or by influencing investor confidence and the desirability of REDD+ credits as compared to credits from other sectors.

3.1.1 Eligibility

The first step in assessing REDD+ demand through compliance programs is to examine whether or not forest credits are eligible for use to meet regulatory obligations. This can include credits from both domestic as well as international sources. It can also include differentiating between different project or activity types. For example, the CDM rules only recognize afforestation and reforestation (A/R) projects – it does not extend to (other) REDD+ activities or projects. Differentiating between the five UNFCCC REDD+ activities is also possible,[30] as is creating new or different activity types such as "urban forestry," which is recognized in California.

If a market does not recognize forestry credits as being eligible for meeting compliance obligations this will significantly reduce demand for forestry credits within that market, essentially relegating it to the smaller voluntary market.

[28] United Nations Framework Convention on Climate Change, Decision COP 17, Decision 2, Paragraph 79, available at http://unfccc.int/resource/docs/2011/cop17/eng/09a01.pdf#page=2

[29] Ecosystem Marketplace / Bloomberg New Energy Finance (2011). State of the Voluntary Carbon Markets 2011, accessed July 12, 2011 at http://www.ecosystemmarketplace.com/pages/dynamic/resources.library.page.php?page_id=8351&section=our_publications&eod=1

[30] The five REDD+ activities included in the Cancun Accords are: (a) Reducing emissions from deforestation; (b) Reducing emissions from forest degradation; (c) Conservation of forest carbon stocks; (d) Sustainable management of forests; and (e) Enhancement of forest carbon stocks. See Decision 1/CP.16 *The Cancun Agreements: Outcome of the work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention*, paragraph 70.

3.1.2 Quantitative, Geographic, and Qualitative Limits

Some analysis, such the Stern Review[31] and the McKinsey cost abatement curves,[32] indicate that credits from REDD+ can be cheap compared to emission reductions from other sectors. While there is growing evidence that the cost of REDD+ is higher than originally predicted in these and other reports,[33] the potential for REDD+ to be cheaper than reducing industrial and other emissions regulated in industrialized country cap-and-trade programs exists. This can create both an opportunity and a risk. The opportunity is that REDD+ credits can serve a cost containment function, reducing overall compliance costs and/or allowing potentially steeper caps at no additional cost. There is also risk in the potential for large volumes of cheap REDD+ credits to create market oversupply, with the resultant price pressure decreasing the financial incentive for reducing emissions in other sectors.

One way to navigate this issue is to place limits on the number of forestry credits allowed into a system. These limits may be quantitative (e.g., reducing the percent of credits allowed from forest carbon and REDD+[34]), geographic (e.g., only credits from particular countries or regions are eligible[35]), or qualitative, which can be distinct from the fundamental criteria of environmental integrity (e.g., only credits from activities that meet additional quality control criteria are eligible[36]).

3.1.3 Non-permanence Risk and Liability

Non-permanence represents the potential reversibility of the forest carbon pool as a result of human or natural disturbance. There are a number ways to manage the risk of non-permanence, including temporary crediting, use of buffers insurance, and assignment of liability. Each of these has both advantages and disadvantages.

Temporary crediting is the approach outlined in the CDM to address risk of non-permanence in A/R projects.[37] While this approach is effective at ensuring emissions removals have been maintained over successive commitment periods, a high degree of liability is placed on Parties who choose to use this form of credit. The high risk to liable Parties and technical demands for reissuance mean forestry projects have had minimal market penetration in the CDM.[38]

Buffers and insurance are both compensatory mechanisms that guarantee to replace emissions reversals with emissions reductions or removals from another source or period. Third-party insurance policies can, in theory, compensate the holder for losses of credits due to reversals, but have not yet been trialed. The use of buffer accounts has been trialed at scale, in particular under the Verified Carbon Standard (VCS). Under the

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[31] Stern, N. The Economics of Climate Change: The Stern Review, Cambridge University Press, 2007.
[32] McKinsey&Company, Pathways to a Low-carbon Economy, Version 2, 2009, availableat https://solutions.mckinsey.com/ClimateDesk/default.aspx
[33] Simula, M. 'Analysis of REDD+ Financing Gaps and Overlaps,' REDD+ Partnership. December 2010, accessed October 31, 2011 at http://reddpluspartnership.org/25159-09eb378a8444ec149e8ab32e2f5671b11.pdf
[34] This approach is taken for CDM A/R projects under the Kyoto Protocol.
[35] This approach is taken by the EU for CDM credits in general in Phase 3 of the scheme, which limits the supply of credits to those from projects registered before the end of 2012, or from new projects located in least developed countries. See Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community; Article 11a(2) of the amended Directive restricts use and 11a(4) creates the exception for least developed countries.
[36] For example, Article 11b(6) of the EU ETS states CERs coming from hydroelectric projects over 20 MW "respect" "relevant international criteria and guidelines, including those contained in the World Commission on Dams November 2000 Report 'Dams and Development — A New Framework for Decision-Making,'… during the development of such project activities." See Directive 2004/101/EC of the European Parliament and of the Council of 27 October 2004 amending Directive 2003/87/EC establishing a scheme for GHG emission allowance trading within the Community, in respect of the Kyoto Protocol's project mechanisms.
[37] There are two types of temporary credits for CDM A/R projects – temporary CERs ((tCERs) and long-term CERs (lCERs). A developer must verify and re-issue tCERs, or re-verify lCERs from A/R projects, and if the forest is lost or the verification skipped credits are either not re-created or are cancelled. See Decision 5/CMP.1 *Modalities and procedures for afforestation and reforestation project activities under the clean development mechanism in the first commitment period of the Kyoto Protocol*, Annex, paragraph 1(g).
[38] Data on registered projects from www.unfccc.int. Data on projects under development and projected numbers of credits available at http://www.cdmpipeline.org/

VCS part of the emission reductions or removals from each forestry project are withheld[39] and pooled into a buffer account managed by the VCS Association. Should a reversal occur, a deduction is made from the pooled buffer account and emission reductions are retired in an amount equivalent to the reversal. The project where the reversal occurred is then charged with additional withholding from future credit issuance until the amount withdrawn from the pooled buffer account is replenished. To date, the buffer withholding approach trialed under the VCS has started to accumulate credits and has successfully managed one disturbance. The primary limitation of this approach rests on the the ability to compensate expansive short-falls, should wide-spread disturbance occur across many projects at the same time.

The CDM approach passes liability onto the buyer. The VCS approach spreads liability across all projects (by transferring set-aside from each project to a buffer pool). Another approach is to consider the source of reversal and how the forest activity is being accounted for in the overall emissions trading system. For example, in the first commitment period of the Kyoto Protocol, accounting in Annex I countries for afforestation, reforestation and deforestation did not differentiate between anthropogenic and non-anthropogenic emissions due to the difficulty to do so. However, in the second commitment period new rules were agreed upon to allow for afforestation and forest management activities to avoid liability where emissions increase occurred due to natural disturbances.[40] Both of these approaches are different to accounting for natural disturbances from CDM A/R activities, where any loss is simply accounted for via the temporary crediting approach irrespective of how the forest was lost.

3.1.4 Scale

A key element of emerging compliance schemes is the geographic (spatial) scale at which accounting, monitoring and crediting of emissions reductions or removals is undertaken. Policy makers must determine whether accounting and crediting should be at the project level, the sub-national level, the national level, or at multiple levels in a hybrid or "nested" approach. The CDM has so far focused on project level crediting, whereas accounting for forest and land use activities for industrialized countries occurs at the national and project scale. The UNFCCC REDD+ negotiations emphasize that REDD+ should ultimately be subject to national level monitoring, reporting and verification (MRV) and accounting, but also allows for sub-national efforts on an interim basis (though it is still unclear whether sub-national efforts could be linked to market finance or not).

3.1.5 Banking

"Banking" refers to holding allowances of credits issued in one year or compliance period for use in subsequent compliance periods. Early compliance markets without banking allowances experienced volatile price swings. This is because without banking, the credit or allowance supply of a given year must be absorbed by the demand by liable entities in that same year. This means supply shortages will cause higher than normal credit prices, raising the overall costs of abatement in a given period and conversely an oversupply will cause a price crash. This will affect the policy objectives of stimulating domestic reductions and also affect the financial viability of credit projects dependent on stable prices. The amount and types of credits or allowances that can be banked can also be regulated.[41]

[39] The quantity of reductions withheld is determined by perceived levels of reversal risks derived from both natural and human-induced sources.
[40] Decision 2/CMP.7, *Land use, land-use change and forestry*, Annex, paragraphs 33 and 34.
[41] For example, the Kyoto Protocol rules state that AAUs, CERs and ERUs can be carried over into subsequent commitment periods (with a limit on the amount of CERs, and ERUs carried over), but RMUs cannot. RMUs can be converted to ERUs, though ERUs created in this way cannot be carried over to subsequent commitment periods. See Decision 13/CMP.1, *Modalities for the accounting of assigned amounts under Article 7, paragraph 4, of the Kyoto Protocol*, Annex, paragraphs 15, 16, 27, and 29.

3.1.6 Crediting Period and Start Date

The compliance program will set the method to determine how long a project or activity may generate credits for – often called the "crediting period." The crediting period is the duration of time during which the mitigation activity will be implemented and emission reductions and/or removals will be generated. Under some programs the crediting period can be back-dated prior to registration. This means a project may be implemented before being formally registered with a program – so long as all the program rules are met.

3.1.7 Methodology Development

Methodologies, sometimes referred to as "protocols," are accounting procedures which detail steps to quantify emission reductions or removals. Under a project-based accounting system, methodologies are designed around a single activity type and engineered to uphold the environmental integrity and eligibility/applicability criteria established in the compliance program.

The development of methodologies can be pursued directly by the program, usually through consultation with experts. Methodology development can also be left to the private sector, with an accreditation body or peer review team assigned to ensure methodologies uphold the principles of the standard. Each of these approaches has been trialed. To generate credits, projects or activities must use approved methodologies.

3.1.8 Additionality

Additionality rules state that an eligible activity must result in emission reductions or removals that are in addition to those that would have occurred in the absence of the project. This ensures that the climate benefit of activity would not have occurred without intervention. Different schemes will use different approaches to assess additionality.

While there are differences in the details, project-based crediting schemes generally follow one of two broad approaches: a project-specific or standardized approach (often called "performance standards"). The project-specific approach calls for the assessment of the baseline activity based on one or more additionality tests.[42] Standardized methods set performance benchmarks, or metrics (emission rates or other characteristics defined based on similar activities), and clearly define common practice tests (e.g., lower than a specified level of market penetration for similar activities).

When moving to larger scales than the project-level, additionality can be more readily factored into the baseline development without the need for additional counter-factual testing. Additionality can also be part of a negotiated cap or overall emission reduction targets – again negating the need for, e.g., national level additionality tests.

3.1.9 Monitoring, Reporting, and Verification

Monitoring systems that allow for credible MRV (where the M typically refers to Monitoring but can also refer to Measurement) of emission reductions are important design elements for successful implementation of REDD+.[43] Monitoring and reporting systems typically employ a combination of remote sensing and ground-based surveys to classify land use and land cover and monitor change over time. Data that is collected can then be subjected to verification, an independent check of the accuracy and reliability of data.

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[42] For example, see the tests in the "CDM additionality tool," which evaluates whether the credit project is dependent on credit project revenue ("investment test") or whether it has overcome significant implementation barriers ("barriers test"), and that the technology or practice used by the project must not be in common use ('common practice test'). For more information see CORE, Carbon Credit Research & Education website, Additionality and Quantification Procedures, accessed September 20, 2012, at http://www.co2creditresearch.org/policy/AdditionalityBaselines.html

[43] Website of the UN-REDD Programme, International Support, Measurement Reporting and Verification, accessed September 20, 2012 at http://www.un-redd.org

A compliance system that includes REDD+ credits will need to specify the details of its MRV requirements for REDD+. This can include specifying certain accuracy or precision standards for data collection or specific techniques. A number of options exist for how verification protocols are structured.

3.1.10 Linking with Other Programs

Linking refers to connecting different trading schemes or credit mechanisms whereby one scheme recognizes the units issued or generated under another. The economic benefits of linking include reducing the overall costs of abatement and improved market liquidity.[44] Linking compliance programs also stabilizes the carbon price signal, making costs of emitting consistent around the globe. This can help ensure an even playing field across sectors with global reach. Linking can, however, be complex. The units connected via the link need to be fungible and the systems need to have connecting registry systems to allow the link. The use of CDM and Joint Implementation (JI) credits in the EU ETS is an example of the EU system linking with the international market mechanisms of the Kyoto Protocol. The units all comply with Kyoto accounting and are connected via the International Transaction Log and its counterpart in Europe. Linking two different systems (e.g., Kyoto and non-Kyoto, or two non-Kyoto systems) can create additional issues if the units or systems are different. For example linking systems that cover different sectors, set different emission reduction caps, and recognize different types of credits will have implications each system will need to consider.[45]

A group of Canadian provinces and the US State of California announced early on their intentions to link programs, and have since been working together to develop harmonized cap-and-trade legislation under the Western Climate Initiative. The Australian Government and the European Commission also recently announced an interim link their respective cap and trade programs with more comprehensive links planned. The interim link will enable Australian businesses to use EU allowances to meet a portion of their liabilities under the Australian Government's Clean Energy Future Program from July 1, 2015.

3.2 VOLUNTARY PROGRAMS

The Bali Action Plan adopted by COP 13 outlined the scope of REDD+ and gave a directive encouraging early action.[46] As a response, the voluntary market for REDD+ developed rapidly as a nursery for testing REDD+ methodologies and activities to demonstrate proof of concept and grow the nascent market. The voluntary sector enabled innovation in forest-carbon accounting and risk management to be fused to CDM-style standards for regulated credit issuance, thereby enabling the creation of "compliance-grade" REDD+ credits. Some voluntary standards – notably the VCS and the American Carbon Registry (ACR) – are also positioning themselves to be recognized in future compliance schemes. The potential for this has created interest in certain credits from certain standards as a way to gain exposure to future compliance markets, known as "pre-compliance positioning."

The voluntary programs in this section i) ascribe to standards comparable to the CDM and ii) are viewed as pre-compliance by market participants as evidenced by a significant scale of pre-compliance market activity (credit purchases). It is important to note that pre-compliance programs are voluntary and do not reflect designation as compliance eligible by a scheme, the ultimate determination of which is an outcome of legislative process within the scheme's jurisdiction.

[44] European Commission, PR 'Pathway towards linking EU and Australian systems,' accessed September 28, 2012 at http://ec.europa.eu/clima/policies/ets/linking/index_en.htm

[45] For a review of linking EU and Californian systems and the issues that need to be dealt with see Zetterberg L, *Linking the Emissions Trading Systems in EU and California*, (2012), FORES, Sweden.

[46] United Nations Framework Convention on Climate Change, Decision COP 13, Bali Action Plan, Decision II, paragraph 3, available at http://unfccc.int/resource/docs/2007/cop13/eng/06a01.pdf

3.2.1 Verified Carbon Standard (VCS)

The VCS is a well-respected GHG reduction and removal certification standard that dominates the voluntary market in general, and the forest market in particular. According to a survey of market participants, in 2011 the VCS captured 33 percent of the transaction volumes in the forest carbon markets, followed closely by the CDM.[47] The VCS was founded by the private sector and environmental leaders to provide a robust quality assurance standard able to quantify GHG emissions and issue credits from voluntary emissions reduction and removal activities under a variety of land use scenarios.

The VCS' Agriculture, Forestry and Other Land Use (AFOLU) guidelines outline requirements for methodology development and for crediting activities in tropical and temperate forests, grasslands, wetlands, agricultural and other areas. Under the AFOLU umbrella, a number of REDD+ methodologies have been approved for project level crediting. The VCS continues to show innovations in science and policy approaches to measuring carbon flows in forests. Within the AFOLU scope, the VCS recently released "Jurisdictional and Nested REDD+" (JNR) requirements which set out the first global framework for crediting REDD+ activities from policies, programs and the projects nested within states, provinces or nations.[48]

As both a standard and registry system, the VCS program enables a market for credits, called Verified Carbon Units (VCUs). On the demand side, buyers are assured VCUs are of the highest-standard of credit. The VCS has broad support in the voluntary sector and has established itself as one of two independent standards seen to generate pre-compliance credits. Due to this, approximately 23 percent of VCU demand represents speculation that emission reductions accounted under the VCS system may qualify as credits for future use in compliance programs.[49]

REDD+ demand		
Demand for REDD+ VCUs is difficult to predict as this source of demand is largely supported by voluntary and pre-compliance purchases, which may vary over time. Splitting out pre-compliance and other purchases is also challenging to quantify independently. In addition, much of the Improved Forest Management (IFM) VCU transactions are based in developed countries, and therefore are not within the scope of this report which focuses on REDD+ in developing countries. According to a market survey, in 2011 6.5 million forest based VCUs were transacted, and of this 3.77 million were derived from REDD activities.[50] This is a decline from 2010, when 14.1 million REDD VCUs were transacted.[51]		
Demand estimate 2013-2020		
Low-end: 30 million credits	**Mid-range: 71 million credits**	**High-end: 112 million credits**
Method and assumptions: To estimate future demand for REDD+ VCUs, annual REDD VCU transaction volume from market reporting is considered equivalent to annual demand. Transaction volume likely encompasses some degree of churning, or multiple transactions of the same VCU. However, because the scope of market reporting is limited, this assumption is deemed a fair translation of demand. The range of demand estimates are equal to the range of total REDD VCU volumes over the past two years, with the mid-range estimate equal to the median of the range. This represents total demand – no deductions were made to estimate what fraction of this may represent pre-compliance demand, as the third party reports do not clearly specify what fraction of total demand for pre-compliance is associated with VCUs.		

[47] Ecosystem Marketplace, 'State of the Forest Carbon Markets 2012: Leveraging the Landscape' October 2012
[48] Website of the VCS, Jurisdictional and Nested REDD+ (JNR). 'Develop a Project,' VCS Website, accessed September 4, 2011 at http://v-c-s.org/JNRI
[49] Ecosystem Marketplace, 'State of the Forest Carbon Markets 2011: From Canopy to Currency' September 2011
[50] Ecosystem Marketplace, 'State of the Forest Carbon Markets 2012: Leveraging the Landscape' October 2012
[51] Ecosystem Marketplace, 'State of the Forest Carbon Markets 2011: From Canopy to Currency' September 2011

3.2.2 Climate Action Reserve (CAR)

The Climate Action Reserve (CAR) is a domestic non-profit standard and registry. The CAR was founded in 2001 to encourage voluntary emissions reporting in California and to develop compliance-grade standards for quantifying and verifying GHG emissions reduction projects.

The CAR program was specifically designed to satisfy California's future emissions trading scheme standards, and is currently undergoing review to become a California Air Resources Board (ARB) accredited credit and project registry. As early as 2007, the ARB sent a signal to early actors by "adopting"[52] several CAR protocols including a "Forest" Protocol which enables accounting and crediting of emission reductions and removals from reforestation, IFM and avoided conversion project activities based in the United States.[53] The first international forest sector protocol, the Mexico Forest protocol is currently in draft form, and under public review.

REDD+ demand
Demand for forest-based mitigation in the CAR is largely supported by the California compliance program discussed in Section 3.8.1. During the transition from a pre-compliance to compliance integrated program, demand for voluntary emission reductions under the CAR will be difficult to ascertain.

3.2.3 American Carbon Registry (ACR)

The American Carbon Registry (ACR) was founded in 1996 as a GHG registry and is currently the third most common forest carbon standard by volume after the CDM and VCS, though ACR has greater market share in the US.[54] In 2011 and 2012, the ACR introduced international REDD+ methodologies and a Nested REDD+ Standard. The ACR is non-profit enterprise of Winrock International.

REDD+ demand
Given their recent entry into international REDD+, demand for REDD+ credits under the ACR is not able to be predicted.

3.3 EMERGING INTERNATIONAL MARKETS AND MULTILATERAL INITIATIVES

Multilateral initiatives include the UNFCCC, Kyoto Protocol, Forest Carbon Partnership Facility (FCPF) and the Green Climate Fund.

3.3.1 UNFCCC and Kyoto Protocol Market Mechanisms

The UNFCCC entered into force in 1994. As of the beginning of 2013, there are 195 member counties (known as Parties) that have ratified the Convention. The Convention is a framework for the cooperation for

[52] Adoptions were later unwound and protocols re-submitted with environmental impact assessment and formal review: Point Carbon Research, 'US Credit Markets in 2010', Carbon Market Analyst – North America, March 1, 2010.
[53] See Section 3.8 Project Location (Eligibility Rules), 'Forest Project Protocol Version 3.3', available at http://www.climateactionreserve.org/how/protocols/forest/dev/version-3-3/
[54] In 2011 CDM captured 28 percent, VCS 25 percent, and ACR 8 percent of the forest carbon market. The remainder was split amongst other standards, including internal standards. See Ecosystem Marketplace, 'State of the Forest Carbon Markets 2012: Leveraging the Landscape' October 2012.

Parties to "stabilize GHG concentrations at a level that would prevent dangerous anthropogenic interference with the climate system."[55] The Kyoto Protocol to the UNFCCC was adopted in 1997 and entered into force in 2005. It catalyzes domestic action on climate change by imposing a cap on GHG emissions from a wide range of sources in developed countries over an initial commitment period of 2008 to 2012.[56]

Kyoto Protocol

A core element of Kyoto architecture is the flexible mechanisms, which consist of emissions trading, and the two project based mechanisms the CDM and JI. These mechanisms enable countries bound to emission reductions targets (termed "Annex I countries") to meet part of their targets with reductions sourced from where they are most cost-effective, for example in developing countries (termed "non-Annex I countries").

CDM rules allow projects in the forestry sector to produce credits from emissions removals, limiting activities to two types: A/R. The CDM has an additional set of rules for A/R, including making their credits temporary[57] and requiring the replacement of all tCERs or lCERs at the end of the project's crediting period, irrespective of whether or not the forest remains intact. The EU ETS also has refused to recognize these credits within their domestic system. As a result, demand is limited to the World Bank managed BioCarbon Fund and small additional amounts of demand from some governments. Few forestry projects have been registered (less than 1 percent of all CDM projects), and they trade at a deep discount to other CER's.[58] At CMP 8 in Doha, Parties agreed to create a second commitment period of the Kyoto Protocol running from 2013 to 2020,[59] though the withdrawal of a number of countries means the second commitment period will only cover approximately 15 percent of global GHG emissions[60] and the process for amending the Kyoto Protocol means there will be a delay before it enters into force.[61] The Parties also agreed to recognize for purposes of meeting quantified emission limitation and reduction commitments "any units generated from market-based mechanisms to be established under the Convention or its instruments,"[62] thereby creating a direct link between potential supply of REDD+ credits under the UNFCCC and demand under the Kyoto Protocol.

UNFCCC

Separate to the Kyoto Protocol negotiations, negotiations on a future climate change agreement and REDD+ are also occurring under the UNFCCC. There is an expectation that the UNFCCC will deliver a mechanism to finance the collective and agreed goal of "slowing, halting, and reversing forest cover and carbon loss" that may include a pay-for-performance system for REDD+ actions that lead to measured, reported and verified emission reductions (VERs).[63] No other sector has been featured as prominently in negotiations and it is

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[55] Website of the United Nations International Convention on Climate Change, *Essential Background*, accessed October, 2012 at http://unfccc.int/essential_background/items/6031.php

[56] Website of the United Nations International Convention on Climate Change, *Essential Background*, accessed October 2012 at http://unfccc.int/essential_background/items/6031.php

[57] Temporary Certified Emission Reductions (tCER's) are valid to the end of the commitment period following the one they were issued in, at which time they are cancelled and new tCERs are issued. Long-term CER's (lCER's) are valid for 60 years but need to be re-verified every 5 years or they are cancelled.

[58] Nicholas Institute for Environmental Policy Solutions (February 2011). *Demand for REDD Carbon Credits: A Primer on Buyers, Markets, and Factors Impacting Prices.* Pp. 10, 17, 18, accessed May 22, 2012 at http://nicholasinstitute.duke.edu/economics/naturalresources/demand-for-redd-carbon-credits

[59] See CMP 8 Decision "Amendment to the Kyoto Protocol pursuant to its Article 3, paragraph 9" (the decision number was not determined at the date of publication).

[60] Boyle J. *A Mirage in the Deserts of Doha? Assessing the outcomes of COP 18*, IISD Commentary, December 2012 at 3, available at www.iisd.org.

[61] See Articles 20 and 21 of the Kyoto Protocol for procedures for amendments.

[62] CMP 8 Decision *Amendment to the Kyoto Protocol pursuant to its Article 3, paragraph 9*, Annex I, Part J inserting a new paragraph 12 *bis* to Article 3 of the Kyoto Protocol. (Decision number not assigned at the date of publication).

[63] O'Sullivan, R. et al, 'Should REDD+ be included in the CDM: Analysis of issues and options', Prepared for the CDM Policy Dialogue, June 2012, accessed October 2012 at http://www.cdmpolicydialogue.org/report/rpt110912.pdf

likely that a future agreement under the Durban Platform will include a mechanism to finance REDD+ performance.[64]

For a REDD+ finance mechanism to be included in this new agreement a number of issues must be resolved, including eligibility rules dictating the scale(s) at which results-based finance should be implemented, the relationship of reference levels to financing, environmental and social safeguard requirements, and the treatment of REDD+ emission reductions in relation to binding emissions reduction targets.[65] Developing countries will almost certainly not agree to binding caps on emissions from their forest sectors in a new agreement under the Durban Platform. Rather, REDD+ is likely to develop as an emission reduction or removal opportunity outside any globally agreed cap, potentially as a type of sector-based crediting mechanism.[66]

Including a new REDD+ market mechanism in a global agreement could significantly increase finance for REDD+ activities – if designed correctly. Without careful design a REDD+ market mechanism could place new demands on the global emissions trading system. At COP 18, the parties agreed to initiate a new work program on results-based finance for REDD+ activities which is to report back to COP 19 at the end of 2013.[67] There are high expectations for a future UNFCCC mechanism that will drive demand for REDD+ credits, though there are still a wide range of possible outcomes to the framework.

Estimating demand for REDD+ as a result of a future UNFCCC agreement is challenging. It requires estimating emission reduction commitments under a future agreement, the business as usual emissions against which reductions need to be made, the length of the commitment period, how many REDD+ credits may be eligible to be used for compliance. For the purposes of this report, it also requires an assumption that the new mechanism will contain a "prompt start" feature that allows REDD+ credits generated before 2020 to be recognized in the future agreement, thereby creating demand for REDD+ credits in the period from 2016 onwards. Each of the estimates is discussed in turn, and Table 2 summarizes all the options contained in the analysis.

i) *Emission reduction commitments:* Emission reduction commitments are still under negotiation. The pledges contained in the Copenhagen Accords were chosen as the estimated emission reduction commitments in a future agreement. The pledges are also likely inadequate to avoid 2°C of warming. Given more ambitious commitments are being called for, using the pledges contained in the Accords is therefore (hopefully) conservative. However, the pledges in the Accords often have different base years, conditions, and treatment of Land Use, Land-Use Change and Forestry (LULUCF) accounting which makes quantification and comparisons challenging. New analysis of the pledges is beyond the scope of this report, so the meta-analysis carried out by the United Nations Environment Program (UNEP) on the Accords contained in the *Emissions Gap Report*[68] were used.

The Emissions Gap Report creates four cases driven by pairs of outcomes linked to: i) whether emissions reduction pledges made by UNFCCC parties are conditional on higher level pledges of other parties[69] (and other conditions) or not; and ii) whether emissions accounting rules for forest carbon for Annex I countries and use of surplus emissions are strict or lenient. See Table 2

[64] O'Sullivan, R. et al, 'Should REDD+ be included in the CDM: Analysis of issues and options', Prepared for the CDM Policy Dialogue, June 2012. Accessed October 2012 at http://www.cdmpolicydialogue.org/report/rpt110912.pdf

[65] O'Sullivan R. and Lee D., "Outstanding Challenges for a UN REDD+ Mechanism," in *Greenhouse Gas Market 2012; New Markets, New Mechanisms, New Opportunities*, Mansell A. (ed), (2012), International Emissions Trading Association, Geneva and Washington D.C.

[66] O'Sullivan, R. et al, 'Should REDD+ be included in the CDM: Analysis of issues and options,' Prepared for the CDM Policy Dialogue, June 2012, accessed October 2012 at http://www.cdmpolicydialogue.org/report/rpt110912.pdf

[67] See COP 18 Decision "Agreed outcome pursuant to the Bali Action Plan," Paragraphs 25 – 33 (the Decision number was not yet assigned at the date of publication).

[68] UNEP *The Emissions Gap Report – Are the Copenhagen Accord Pledges Sufficient to Limit Global Warming to 2 ℃ or 1.5 ℃?*, November 2010

[69] For more detail on this concept, see Annex 8 (page 122) of World Bank '*State and Trends of the Carbon Market,*' May 2010, available at http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/ENVIRONMENT/EXTCARBONFINANCE/0,,contentMDK:23206428~menuPK:5575595~pagePK:64168445~piPK:64168309~theSitePK:4125853~isCURL:Y,00.html

below for a summary of the 4 cases. For the purposes of comparison, a fifth case was included in the analysis that looks at caps needed to have a 66 percent chance of meeting the 2^0 C target (see Table 3). To be conservative it was assumed that the 2020 pledges were maintained over the future commitment period (rather than becoming more ambitious).

ii) *BAU emissions from 2020:* For consistency the UNEP *Emissions Gap Report* was also used as a source of BAU emissions in 2020. For the purposes of this analysis, and to maintain conservativeness, the BAU estimate in 2020 was assumed to remain flat over the commitment period.

iii) *Length of commitment period:* To be conservative an initial five year commitment period was chosen.

iv) *Number of REDD+ credits eligible for use:* If a REDD+ market mechanism is created there may be restrictions on the number of credits a Party can use to meet its commitments. In the first[70] and second[71] commitment periods of the Kyoto Protocol the number of LULUCF CERs from CDM that could be used by an Annex I Party was limited to 1 percent of the Party's *base year emissions* multiplied by the length of the commitment period. The Kyoto protocol also has a further rule that use of any CDM or JI credits can only be supplementary to domestic action[72] – thereby creating another cap on the use of offsets. In the European Commission has interpreted this for EU purposes to mean up to 50 percent of the EUs *emission reductions* can come from CDM and JI credits, which is translated and applied to the EU ETS as up to 10 percent of a country's *approved cap* under the ETS.[73] In California, up to 8 percent of the cap can be used for offsets, and 25 percent of this number can come from REDD+. Two conservative scenarios are developed in this paper. In the first it is assumed that a future agreement will allow 49 percent of emission reductions to come from offsets, with 25 percent of this amount coming from REDD+. The second uses an allowance of 25 percent of emission reductions from offsets, with 10 percent of this allowed from REDD+.

Table 2: Four cases developed by UNEP estimating global emissions in 2020 based on the Copenhagen Accords

2020 BAU emissions = 56 $GtCO_2e$	Unconditional pledges met	Conditional pledges met
Lenient accounting rules	Case 1: 53 $GtCO_2e$ (range: 52-57 $GtCO_2e$) of emissions; 3 $GtCO_2e$ of reductions	Case 3: 51 $GtCO_2e$ (range: 49-53 $GtCO_2e$) of emissions; 5 $GtCO_2e$ of reductions
Strict accounting rules	Case 2: 52 $GtCO_2e$ (range: 50-55 $GtCO_2e$) of emissions; 4 $GtCO_2e$ of reductions	Case 4: 49 $GtCO_2e$ (range: 47-51 $GtCO_2e$) of emissions; 7 $GtCO_2e$ of reductions

[70] Decision 16/CMP.1, *Land use, land-use change and forestry*, Annex, part D, paragraph 14
[71] Decision 2/CMP.7, *Land use, land-use change and forestry*, Annex, part D, paragraph 19
[72] Decision 2/CMP.1 *Principles, nature and scope of the mechanisms pursuant to Articles 6, 12 and 17 of the Kyoto Protocol*, paragraph 1
[73] Commission of the European Communities, COM(2006) 725, *Communication From The Commission To The Council And To The European Parliament on the assessment of national allocation plans for the allocation of GHG emission allowances in the second period of the EU Emissions Trading Scheme accompanying Commission Decisions of 29 November 2006 on the national allocation plans of Germany, Greece, Ireland, Latvia, Lithuania, Luxembourg, Malta, Slovakia Sweden and the United Kingdom in accordance with Directive 2003/87/EC.*

Table 3 below summarizes the analysis using the different cases presented in the UNEP *Emissions Gap Report* along with an additional case representing a 2°C target and two different scenarios for restrictions on the use of offsets and REDD+ credits in a future agreement. To estimate demand for prompt start credits, total estimated demand during the commitment period is assumed to be spread out evenly over the period 2016-2024. Case 4 in Scenario 1 and Case 2 in Scenario 2 are taken as the high-end and mid-range estimates respectively.

Table 3: Different scenarios for estimating demand from a future UNFCCC agreement

Scenario 1: 49% of reductions from offsets, with 25% of these coming from REDD+ (in millions of tons)					
	Case 1	**Case 2**	**Case 3**	**Case 4**	**2° C**
2020 BAU emissions	56,000	56,000	56,000	56,000	56,000
2020 agreed cap	53,000	52,000	51,000	49,000	44,000
Reductions	3,000	4,000	5,000	7,000	12,000
Annual offsets to meet cap	1,470	1,960	2,450	3,430	5,880
Annual REDD+ offsets	368	490	613	858	1,470
Total demand for REDD+ offsets over the Commitment Period	1,838	2,450	3,063	4,288	7,350
Total demand for REDD+ 2016 – 2020	1,021	1,361	1,701	2,382	4,083
Scenario 2: 25% of reductions from offsets, with 10% of these coming from REDD+ (in millions of tons)					
	Case 1	**Case 2**	**Case 3**	**Case 4**	**2° C**
2020 BAU emissions	56,000	56,000	56,000	56,000	56,000
2020 agreed cap	53,000	52,000	51,000	49,000	44,000
Reductions	3,000	4,000	5,000	7,000	12,000
Annual offsets to meet cap	750	1,000	1,250	1,750	3,000
Annual REDD+ offsets	75	100	125	175	300
Total demand for REDD+ offsets over the Commitment Period	375	500	625	875	1,500
Total demand for REDD+ 2016 - 2020	208	278	347	486	833

REDD+ Demand		
Demand for REDD+ under the Kyoto Protocol and UNFCCC is linked to a future agreement under the UNFCCC. Demand may come from the Kyoto Protocol once the amendments enter into force and if a UNFCCC REDD+ agreement is reached. Due to the lack of data on the recently decided second commitment period and uncertainty over the timing of the Kyoto Protocol potential demand was not estimated. However, demand from a future UNFCCC agreement was estimated using the method described above.		
Demand estimate 2013-2020		
Low-end: 0	**Mid-range: 278 million credits**	**High-end: 2,382 million credits**
Method and assumptions A detailed description of the method and assumptions are set out above. In summary, the method and assumptions are that i) a UNFCCC agreement is agreed in 2015 that enters into force in 2020 with an initial five year commitment period; ii) the agreement allows "prompt start" for REDD+; iii) Parties' commitments reflect the pledges made in the Copenhagen Accords; iv) caps are placed on the number of offsets that can be used to meet reductions (49 percent high, 25 percent mid) and further caps on the number of these offsets which can come from REDD+ (25 percent high, 10 percent mid); v) demand during the commitment period is spread out evenly from 2016; vi) UNEP estimates that quantify the Copenhagen Accord pledges and resulting emission reductions are used as sources of underlying data, with two different cases chosen for the high-end and mid-range estimates.		

3.3.2 Forest Carbon Partnership Facility (FCPF)

The World Bank established the FCPF in 2007. The twin objectives of the FCPF are to build capacity for REDD+ in developing countries ("REDD+ readiness") and to pilot a program of payments for reduced emissions. The FCPF consists of two funds. The first, the Readiness Fund, focuses on capacity building, such as determining reference emissions levels (RELs), guiding national REDD+ strategy, and developing monitoring systems. As of June 2012, donors have collectively committed or pledged approximately $239 million to the Readiness Fund, and committed or pledged approximately $218 million to the Carbon Fund.[74]

The Carbon Fund will support demand for forest-based mitigation by compensating non-Annex I countries for verified emission reductions. Only countries participating in the Readiness Fund, who demonstrate advancements in MRV, a credible reference scenario, and an approach to crediting are eligible to receive payments.[75] The structure of these payments will conform to the mechanisms for compensated REDD+ currently being discussed within the UNFCCC process. Financial sponsors of the Carbon Fund will receive emission reductions in proportion to their contributions.[76] These emission reductions will be accounted and priced against a methodological and pricing approach developed by the FCPF that is currently being designed.

[74] Independent Evaluation Group, Program Review: Forest Carbon Partnership Facility, Vol 6 Issue 2, August 2012, available at http://www.forestcarbonpartnership.org/fcp/sites/forestcarbonpartnership.org/files/Documents/PDF/Oct2012/FCPF%20GPR%20IEG%20Review%20Final.pdf. Note that these figures do not include the additional $180 million for the FCPF announced by Finland, Germany and Norway on 10 January 2013. This should bring the total FCPF funding up to $260 million for the Readiness Fund and $390 million for the Carbon Fund. See the World Bank press release *New Funding for Climate and Forests Protection*, accessed January 10, 2013, at http://www.worldbank.org/en/news/2013/01/10/new-funding-for-climate-forests-protection

[75] Forest Carbon Partnership Facility Information Memorandum, June 13, 2008, pp. 1-2, accessed May 24, 2012 at http://www.forestcarbonpartnership.org/fcp/sites/forestcarbonpartnership.org/files/Documents/PDF/FCPF_Info_Memo_06-13-08.pdf

[76] Forest Carbon Partnership Facility Information Memorandum, June 13, 2008, p 29, accessed May 24, 2012 at http://www.forestcarbonpartnership.org/fcp/sites/forestcarbonpartnership.org/files/Documents/PDF/FCPF_Info_Memo_06-13-08.pdf

REDD+ demand		
The Carbon Fund has not purchased any emission reductions yet. In preparation for the Carbon Fund's activities, standard term sheets for emission reduction purchases are currently under review.[77] Five countries are expected to receive funding for emissions reductions from the Carbon Fund when they have demonstrated "readiness."[78] The volume of demand for emission reductions from the Carbon Fund is a function of the sum of funds available for purchases and the price paid for each emissions reduction unit. The amount of funds available for purchases is assumed to be pledged money minus administration costs. As per the FCPF's Charter, the Carbon Fund pays 35 percent of the "shared costs," which include the FCPC secretariat and services to REDD+ participating counties, with a life cap at $12 million.[79]		
Demand estimate 2013-2020		
Low-end: 10 million credits	**Mid-range: 20 million credits**	**High-end: 41 million credits**
Method and assumptions: Future demand is calculated by dividing the estimated funds available by the expected price paid by the Fund for a REDD+ emissions reduction. Funds available are assumed to be committed funds ($218 million) minus shared costs cap ($12 million). Given the absence of historical purchase price information or guidance to valuation of emission reductions, prices are assumed at $5 (high-end demand volume estimate), $10 (mid-range demand volume estimate), and $20 (low-end demand volume estimate).		

3.3.3 The Green Climate Fund

One of the outcomes of the UNFCCC COP meetings, held in Copenhagen in December 2009, was the Copenhagen Accord. While the Accord was only noted in the COP decision (i.e. it was not agreed by all parties), the Accord did proclaim that "the Copenhagen Green Climate Fund shall be established as an operating entity of the financial mechanism of the Convention to support projects, programme, policies and other activities in developing countries related to mitigation including REDD-plus, adaptation, capacity-building, technology development and transfer." Of the $100 billion goal for annual climate change mitigation and adaptation funding by 2020, it was stated that "a significant portion of such funding should flow through the Copenhagen Green Climate Fund."[80] The Green Climate Fund was formally established at COP 16 in Cancun in 2010, along with a transitional committee tasked with designing the key elements of the new fund.[81]

At COP 17 in Durban, South Africa, in late 2011, the COP took the recommendations of the transitional committee to adopt a fairly detailed decision describing how the Green Climate Fund will be launched, including an invitation to the World Bank to act as trustee for the first three years, and recognizing offers from South Korea, Germany, and Denmark to contribute start-up funding. The role of REDD+ was

[77] Slides from FCPF Carbon Fund Meeting – Third Meeting, March 24 and 26, 2012, *5b. Update on Roadmap to ERPA General Conditions,* accessed May 24, 2012 at https://www.forestcarbonpartnership.org/fcp/sites/forestcarbonpartnership.org/files/Documents/5b%20CF3%20Update%20Roadmap%20to%20ERPA%20GC%2003-24-12.pdf

[78] Website of the Forest Carbon Partnership Facility, *Introduction,* accessed May 24, 2012 at http://www.forestcarbonpartnership.org/fcp/node/12

[79] Independent Evaluation Group, Program Review: Forest Carbon Partnership Facility, Vol 6 Issue 2, August 2012, available at http://www.forestcarbonpartnership.org/fcp/sites/forestcarbonpartnership.org/files/Documents/PDF/Oct2012/FCPF%20GPR%20IEG%20Review%20Final.pdf

[80] United Nations Framework Convention on Climate Change, Decision 2/CP.15 *Copenhagen Accord,* December 18, 2009, accessed May 24, 2012 at http://unfccc.int/resource/docs/2009/cop15/eng/l07.pdf

[81] Decision 1/CP.16 *The Cancun Agreements: Outcome of the work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention*, para 102 and 109

formally included: "The Fund will finance agreed full and agreed incremental costs for activities to enable and support enhanced action on adaptation, mitigation (including REDD-plus), technology development and transfer (including carbon capture and storage), capacity-building and the preparation of national reports by developing countries."[82]

The administrative structure of the Fund is now being organized. The agreement is that the board will consist of 24 members, equally split between developed and developing countries. However, the design of the new fund has been slow with negotiations stuck on the procedures, modalities and governance of the fund, with some independent commentators predicting concrete action under the GCF being "potentially years away."[83]

REDD+ demand
Investment strategy and extent of capital deployed to REDD+ have yet to be determined.

3.4 BILATERAL PROGRAMS[84]

3.4.1 Japan

Under the Kyoto Protocol Japan committed to reduce emissions 6 percent below 1990 levels over the 2008 to 2012 commitment period.[85] The government will meet this goal via a combination of domestic reductions complemented by government purchase of Kyoto credits. Within Japan, the only compliance market is a cap-and-trade program covering the Tokyo area. The government has bought 98 million Kyoto credits during the first four years of the five-year commitment period.[86] However, Japan has stated that it would not sign up to a second commitment period under the Kyoto Protocol because it will not include the US and China.[87]

When looking beyond the Kyoto Protocol, Japan had pledged under the Copenhagen Accord to reduce emissions 25 percent below 1990 levels by 2020, conditional on "the establishment of a fair and effective international framework in which all major economies participate and on agreement by those economies on ambitious targets."[88] Japan has indicated that this 25 percent reduction target will rely heavily on its Bilateral Offsetting Credit Mechanism currently being designed purchase credits. Such a bilateral program may look more like public payments that are structured as payment for performance, or may evolve to resemble market-based systems like the California program. Japan is reassessing its future commitments given the impact of the Fukushima disaster resulted in a drop in nuclear energy which increased fossil fuels in the country's generation mix. Even so, Japan has indicated for a desire to launch a bilateral credit market with Indonesia which could include REDD.[89] Talks with Vietnam are in advanced stages.

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[82] United Nations Framework Convention on Climate Change, *Report of the Conference of the Parties on its seventeenth session, held in Durban from 28 November to 11 December 2011, Addendum, Part Two: Action taken by the Conference of the Parties at its seventeenth session, Contents: Decisions adopted by the Conference of the Parties,* March 15, 2012, accessed May 24, 2012 at http://unfccc.int/resource/docs/2011/cop17/eng/09a01.pdf

[83] Boyle J. *A Mirage in the Deserts of Doha? Assessing the outcomes of COP 18*, IISD Commentary, December 2012 at 7, available at www.iisd.org.

[84] Bilateral programs are defined as programs between two sovereign nations.

[85] Kossoy, Alexandre and Pierre Guigon. *State and Trends of the Carbon Market 2012.* The World Bank, May 2012. (section written by Yuji Mizuno), available at http://siteresources.worldbank.org/INTCARBONFINANCE/Resources/State_and_Trends_2012_Web_Optimized_19035_Cvr&Txt_LR.pdf

[86] Kossoy, Alexandre and Pierre Guigon. *State and Trends of the Carbon Market 2012.* The World Bank, May 2012. 2 (section written by Yuji Mizuno), available at http://siteresources.worldbank.org/INTCARBONFINANCE/Resources/State_and_Trends_2012_Web_Optimized_19035_Cvr&Txt_LR.pdf

[87] The Japan Times reported that a Foreign Ministry spokesman, Masaru Sato, stated that "Japan will not participate into the second commitment (period)", available at http://www.japantimes.co.jp/text/nn20121022a1.html

[88] United Nations Framework Convention on Climate Change. *Compilation of economy-wide emission reduction targets to be implemented by Parties included in Annex I to the Convention.* June 7, 2011. 5. PDF file. http://unfccc.int/resource/docs/2011/sb/eng/inf01r01.pdf

[89] Point Carbon (2012). *Japan eyes April start for Indonesia credit market.* accessed November 7, 2011at http://www.pointcarbon.com/news/1.2050016

REDD+ Demand		
The World Bank estimates Japan will generate a demand for up to 539 million tCO_2e international offsets from non-Annex I countries between 2013 and 2020. This includes demand for Kyoto credits along with demand under its proposed Bilateral Offsetting Credit Mechanism. [90] The Japanese government has not presented a credit investment or purchase strategy, so carving out the share of credit purchases from forestry is difficult to do. It has, however, demonstrated a positive stance on REDD, with Y5.2 billion earmarked in its fiscal 2011 budget for feasibility studies and pilot projects. Four of the five credit pilots selected for funding are international REDD projects. To capture a possible estimate of forest carbon credit demand, given a wide range of scenarios, limit adjustments will be applied to the World Bank credit demand estimate.		
Demand estimate 2013-2020		
Low-end: 0	**Mid-range: 54 million credits**	**High-end: 135 million credits**
Method and assumptions: The low-end estimate assumes Japan sources international credits from other credit sectors. The mid-range scenario is equal to the World Bank demand estimate for overseas credits (539 million units) multiplied by a purchase limit on forest carbon inclusion (assumed to be 10 percent) The high-end estimate is equal to the World Bank estimate multiplied by an optimistic forest carbon cap (assumed to be 25 percent)		

3.4.2 Norway

Norway's International Climate and Forest Initiative (NICFI) funds several bilateral and multilateral efforts aimed at reducing deforestation and testing results-based payment. The initiative is not currently designed to involve transacting credits or tradable credits, and there is no indication that this will change in the immediate future. Following is a summary of the activities:

- Brazilian Amazon Fund: This fund channels monies to implement the Brazilian government's Plan of Action for Protection and Control of Deforestation in the Legal Amazon. As the first contributor to the fund, Norway provided approximately $170 million in 2011 and has pledged $1 billion through 2015. Should emissions in a given year exceed the reference emissions level, no payment will be made to the fund in the subsequent year.[91]
- Indonesia: In May 2010, Norway pledged $1 billion to support Indonesia's efforts to reduce emissions from deforestation and degradation of forests and peat lands.[92] Two years later, Norway's environment minister has stated that Indonesia has not adhered to its announced moratorium on forest clearing, and the country will be unable to meet its emissions reduction target. Norway's continued financial support is predicated on performance both in policy and actual forest emission reductions.[93]
- Guyana: In November 2009, an MOU was signed by Norway's Minister of the Environment and International Development and the President of Guyana, pledging cooperation to protect Guyana's forests. Norway is financially supporting the Guyana REDD+ Investment Fund, committing up to

[90] World Bank (2012). *State and Trends of the Carbon Market 2012,* accessed September 19, 2012 at http://siteresources.worldbank.org/INTCARBONFINANCE/Resources/State_and_Trends_2012_Web_Optimized_19035_Cvr&Txt_LR.pdf
[91] Website of Norway Ministry of the Environment, *Norway and the Amazon Fund: Facts about the rainforest and the Amazon Fund*, accessed May 22, 2012 at http://www.regjeringen.no/en/dep/md/Selected-topics/climate/the-government-of-norways-international-/norway-amazon-fund.html?id=593978
[92] Website of Norway Ministry of the Environment, *What does the Norwegian Climate and Forest Initiative finance?,* accessed May 22, 2012 at http://www.regjeringen.no/en/dep/md/Selected-topics/climate/the-government-of-norways-international-/what-do-we-finance.html?id=557700
[93] Rondonuwu, Olivia. Reuters, *Indonesia forest moratorium won't meet climate pledge – Norway,* May 22, 2012, accessed May 22, 2012 at http://www.reuters.com/article/2012/05/22/us-indonesia-emissions-norway-idUSBRE84L0H920120522

$250 million through 2015. Payments are tied to Guyana's national scale performance in reducing emissions from deforestation and degradation.[94]

REDD+ Demand
NICFI will pay for emission reductions, but is not aimed at generating or purchasing credits or tradable credits.

3.4.3 Germany: REDD Early Movers Fund

Germany's Ministry for Economic Cooperation and Development has commissioned KfW and the Deutsche Gesellschaft fur Internationale Zusammenarbeit (GIZ) to implement a fund supporting REDD "early movers."[95] The REDD Early Movers (REM) fund supports pioneers in the REDD+ sector – countries who are taking risks and acting independently towards mitigating climate change through preserving their forests.

To qualify as an "early mover," a country must demonstrate that they have already made sufficient progress in putting in place the technical capacity and enabling policy and institutional environments needed for efficient forest conservation. Following the FCPF and UN-REDD guidelines, the REM Fund embraces the phased approach to adopting REDD+ presented by the 2009 Meridian Report[96] and endorsed by international negotiations in Cancun and Durban.[97] However, the REM recognizes that it will take some time to direct financing to REDD+ countries through the international mechanism and seeks to bridge the funding gap in order to incentivize demonstration activities.[98]

The REM Fund is aimed exclusively at early mover national REDD+ programs and large-scale sub-national initiatives. It intends to direct funding through bilateral payments, rather than through credit or emissions trading markets. Another contrast to other international REDD+ funds is that REM modalities make it possible to direct funding between the phases prescribed by the international negotiations. The REM works with two financing modalities: incentive-based payments exchanged for ex-ante emission reductions (accompanied by measures to monitor), and performance-based payments for ex-post emission reductions based on proven methodologies and verified by an independent party.[99]

The first phase of the REM has a funding volume of €32.5 million[100] (US $42.4 million[101]). The fund administrators suggest both the timetable of REM funding is flexible and will be assessed individually according to the stage of progress and the advisory service requirements of each early mover.

[94] Website of Norway Ministry of the Environment, *Guyana-Norway partnership on climate and forests,* accessed May 22, 2012 at http://www.regjeringen.no/en/dep/md/Selected-topics/climate/the-government-of-norways-international-/guyana-norwaypartnership.html?id=592318
[95] Federal Ministry for Economic Cooperation and Development (BMZ), GIZ, 'REDD Early Movers (REM) - Rewarding pioneers in forest conservation,' accessed September 29, 2012 at http://www.bmz.de/en/publications/topics/climate/FlyerREDD_lang.pdf
[96] Angelsen, A., et al. Meridian Institute, 'Reducing Emissions from Deforestation and Forest Degradation (REDD): An Options Assessment Report' 2009
[97] Federal Ministry for Economic Cooperation and Development (BMZ), GIZ, 'REDD Early Movers (REM) - Rewarding pioneers in forest conservation,' accessed September 29, 2012 at http://www.bmz.de/en/publications/topics/climate/FlyerREDD_lang.pdf
[98] Phase II: Implementing policy measures and demonstration projects.
[99] GIZ, Ragna J., Presentation, 'New International Programmes on REDD+ and FLEGT: REDD Early Movers and Forest Governance Programme,' accessed September 29, 2012 at http://www.euredd.efi.int/files/attachments/euredd/16.30-17.00_giz.pdf
[100] Federal Ministry for Economic Cooperation and Development (BMZ), GIZ, 'REDD Early Movers (REM) - Rewarding pioneers in forest conservation,' accessed September 29, 2012 at http://www.bmz.de/en/publications/topics/climate/FlyerREDD_lang.pdf
[101] Conversion as of October 15, 2012, 1 Euro = 1.3035 USD

REDD+ Demand		
Despite not generating end-market demand, REM modalities direct funding to national and sub-national programs in exchange for ex-ante and ex-post emission reductions. The performance-based modalities of the REM direct payments to emission reductions accounted using a proven methodology, and verified by an independent auditor. Bilateral activities, such as the REM, are likely to supplement market demand therefore absorbing some supply of emission reductions. For this reason, estimates of demand are included in this analysis.		
Demand estimate 2013-2020		
Low-end: 2 million credits	**Mid-range: 4 million credits**	**High-end: 8 million credits**
Method and assumptions: Future demand is calculated by dividing the total contributions committed to the REM Fund ($42.4 million) by the price for a verified emissions reduction over the period 2013-2020 (assumption: $5, $10, $20 / unit). This approach assumes Fund administration costs and transaction costs are managed independently, and that Phase 1 funding is allocated before 2020.		

3.5 REGIONAL COMPLIANCE PROGRAMS

Regional compliance programs include collaboration between nations (such as across the EU) along with collaborative efforts at the sub-national level, such as Regional Greenhouse Gas Initiative (RGGI) and WCI that operate at the state level. The EU ETS is reviewed in detail below and RGGI and WCI are included in Appendix I.

3.5.1 European Union Emissions Trading Scheme (EU ETS)

The EU ETS was launched in 2005 and is the largest emissions trading market in the world. The EU ETS caps the GHG emissions of specific sectors to levels 21 percent below 1990 levels, equivalent to a 20 percent overall reduction.[102] The initial design of the EU ETS excluded forest-related carbon in its first two phases[103], due to a range of concerns about the veracity of forest carbon credits, as well as their potential to flood the market and thus undermine industrial efficiency initiatives.[104,105] In 2009, a revised EU ETS Directive continued to exclude credits from forest activities for phase three, which extends through 2020, while allowing the possibility that REDD+ credits could be considered in the event an international agreement is negotiated.[106]

Despite this theoretical window, it will be very difficult for REDD+ to be allowed into Phase 3 of the EU ETS. This is based on i) a future climate agreement only being concluded by 2015 (at the earliest), and entering into force in 2020, making it challenging for the EU ETS to link to a REDD+ market under the UNFCCC before it commences (though a "prompt start" provision similar to the CDM could help facilitate this); ii) the historically strong stance against inclusion of forest carbon; and iii) sensitivities to oversupply in a currently oversupplied market. While voices within the European community are supportive of REDD+, and the 2009 Directive calls for assessments to the modalities for the inclusion of avoided deforestation and

[102] European Commission, Climate Action Website, 'Emissions Trading System', accessed November 1, 2012 at http://ec.europa.eu/clima/policies/ets/faq_en.htm
[103] The first phase ran from 2005-2007 and the second from 2008 -2012.
[104] Linacre N. *et al*, *State and Trends of the Carbon Market 2011*, (2011), World Bank, Washington D.C.
[105] Schneck J. *et al*, *Demand for REDD Carbon Credits: A Primer on Buyers, Markets, and Factors Impacting Prices,* (2011) Nicholas Institute for Environmental Policy Solutions, Durham
[106] Directive 2009/29/EC of the European Parliament and of the Council, Article 28 (f) and (g) (as amended)

degradation to the EU ETS[107], these concepts are only to be considered in the event that an international agreement is negotiated.[108] Any demand for credits to 2020 is considered to be insignificant and not included in the demand projections of this study.

Another potential window for REDD+ finance through EU climate policy is through the Effort-Sharing Decision (ESD) which establishes annual binding targets for EU member states in non-ETS sector emissions for the period 2013-2020. REDD+ is not currently included in the ESD, but a review of the appropriateness of including REDD+ is foreseen.[109] Acceptance of REDD+ into the ESD scheme is most likely dependent on the context of an international emissions reduction agreement.[110]

Notwithstanding the current exclusion of REDD+ in EU climate change finance mechanisms, the EU is calling for a 50 percent reduction in deforestation by 2020 and is supporting the use of REDD+ verified emission reductions through investments in multilateral funds. In addition to policy statements on reducing deforestation by the EU, the EU (and Switzerland) has added to efforts (started in Cancun) to include agriculture in the advisory board that counsels the COP on matters of climate, the environment, technology, and methodologies. This would promote a broader future market for agricultural credits beyond those in the CDM.[111]

REDD+ demand
ETS excludes emission reductions from forest activities in Phase 3.

3.6 ANNEX I NATIONAL COMPLIANCE PROGRAMS

3.6.1 Australia Clean Energy Future – Carbon Price Mechanism

Australia has committed to reducing emissions to 5 percent below 2000 levels by 2020. Australia's emission reductions target can be increased to 15 percent or 25 percent below 2000 levels, contingent on actions by other countries and development of international frameworks to combat climate change. These triggers include, for the 25 percent goal, the world agrees to an ambitious global deal capable of stabilizing levels of GHGs in the atmosphere at 450 ppm carbon dioxide equivalent (CO2-eq) or lower, and for the 15 percent goal, a global agreement which falls short of securing atmospheric stabilization at 450 ppm CO2-eq under which major developing economies commit to substantially restraining their emissions and advanced economies take on commitments comparable to Australia's .[112]

Australia is moving to phase in cap-and-trade. Carbon pricing in the initial compliance period, from July 1, 2012, to June 30, 2015, functions like a tax, fixing the allowance price initially at AUD23/ton (approximately US$23/ton), which increases by 2.5 percent per year. The subsequent second compliance period runs from July 1, 2015, through June 30, 2018. During this period, allowance prices float, subject to an initial ceiling of $20 above an international benchmark (with ceiling set to increase). From July 1, 2018, allowance prices are to be fully free-floating.[113] In August 2012, it was announced that a full two-way link between the Australia and

[107] Directive 2009/29/EC of the European Parliament and of the Council, Article 28 (f) (as amended)
[108] Directive 2009/29/EC of the European Parliament and of the Council, Article 28 (g) (as amended)
[109] von Unger, M., Streck, C., Lee, D. Options for Financing REDD+ in the EU: Status and Opportunities, The Nature Conservancy Climate Change Program, 2012.
[110] von Unger, M., Streck, C., Lee, D. Options for Financing REDD+ in the EU: Status and Opportunities, The Nature Conservancy Climate Change Program, 2012.
[111] UN Environment Programme (May 2011). *REDDy, Set, Grow – Part 1: A Briefing for Financial Institutions,* accessed July 11, 2011 at http://www.unepfi.org/fileadmin/documents/reddysetgrow_01.pdf
[112] "Fact sheet: Australia's emissions reduction targets." *Australian Government, Department of Climate Change and Energy Efficiency.* n.d. , accessedJune 13, 2012 at http://www.climatechange.gov.au/government/reduce/national-targets/factsheet.aspx
[113] Kossoy, Alexandre and Pierre Guigon. *State and Trends of the Carbon Market 2012.* The World Bank, May 2012., available at http://siteresources.worldbank.org/INTCARBONFINANCE/Resources/State_and_Trends_2012_Web_Optimized_19035_Cvr&Txt_LR.pdf

EU ETS will start no later than July 2018.[114] Under this arrangement businesses will be able to use carbon units from the Australian emissions trading scheme or the EU ETS for compliance under either system.

Australia's carbon price mechanism includes provisions for domestic and international credits, and will likely incorporate certain types of forestry credits. Domestic land-use credits eligible for use by liable entities to meet their emissions obligations will be generated under the country's Carbon Farming Initiative (CFI). The Clean Energy legislative package outlines rules for use of international credits (known as "eligible international emissions units"),[115] and the Clean Energy Regulator has provided an initial list of eligible international emissions units.[116] The definition of eligible international emissions units includes Kyoto units and is broad enough to include REDD+ credits issued under the UNFCCC or potentially foreign schemes established under foreign law (as a "prescribed international unit"). At CMP 8, the Parties agreed to recognize for purposes of meeting quantified emission limitation and reduction commitments "any units generated from market-based mechanisms to be established under the Convention or its instruments",[117] which may reinforce this potential link. Emission reductions credited under the Kyoto Protocol contain some limits on the types of CDM projects allowed though forestry credits from Annex I countries are allowed..[118] In contrast to the EU ETS there are no constraints to geographic location or projects registered post 2012.[119] Australia's regulator bans use of temporary credits, thereby excluding forestry projects under the CDM.

For REDD+ to be eligible in Australia there would need to be a REDD+ crediting mechanism established under the UNFCCC and/or Kyoto Protocol. It may be theoretically possible to also allow REDD+ credits generated under a developing country's legislation, though this is not likely to occur in practice if it is independent of the UNFCCC.[120] There may be separate restrictions on eligibility if a temporary crediting approach is used for REDD+ (based on current restrictions on temporary CERs). However, there are other approaches to managing non-permanence risk that can be put forward if or when this comes up in future UNFCCC negotiations. To facilitate the EU ETS link but maintain domestic credit demand and encourage links with other domestic emissions trading systems, the Australian Government has proposed a new sub-limit on the use of Kyoto units.[121]

REDD+ demand

During the first compliance period (2012-2015), each covered entity is allowed to meet up to 5 percent of its compliance obligation with Kyoto Australian Carbon Credit Units's (ACCUs). From July 2015 onward, international emissions units are allowable for up to 50 percent of an entity's compliance obligation. There is no limit on use of ACCUs from 2015 to 2020. Taking into account the abatement costs and potential

[114] "The Hon Greg Combet AM MP, Australia Government Minister for Climate Change and Energy Efficiency and the European Commission," accessed August 28, 2012, at http://ec.europa.eu/clima/news/articles/news_2012082801_en.htm

[115] Australian Government, *Clean Energy Act 2011,* Section 5 and Part 6, and see also *Australian National Registry of Emissions Units Act 2011* for the definition of "eligible international emissions unit" and "prescribed international unit."

[116] Australian Government, 'Eligible Emissions Units', Website of the Clean Energy Regulator, available at http://www.cleanenergyregulator.gov.au

[117] CMP 8 Decision *Amendment to the Kyoto Protocol pursuant to its Article 3, paragraph 9*, Annex I, Part J inserting a new paragraph 12 *bis* into Article 3 of the Kyoto Protocol. (Decision number not assigned at the date of publication).

[118] The Australia Government has proposed a 12.5% cap on use of Kyoto units: Climate Action News, Website of the European Commission. Accessible at: http://ec.europa.eu/clima/news/articles/news_2012082801_en.htm

[119] Australian Government, 'Eligible Emissions Units,' Website of the Clean Energy Regulator, available at http://www.cleanenergyregulator.gov.au

[120] The current legislation makes a distinction between Kyoto and non-Kyoto compliant domestic offsets, with only the former being eligible for compliance. If a developing country's REDD+ credits were not accountable under Australia's international commitments under the UNFCCC or Kyoto Protocol it seems unlikely that such credits would be eligible in Australia's domestic scheme - unless there were other compelling political reasons for doing so.

[121] While liable entities in Australia will still be able to meet up to 50 per cent of their liabilities through purchasing eligible international units, only 12.5 per cent of their liabilities will be able to be met by Kyoto units. Taken from joint media release: "The Hon Greg Combet AM MP, Australia Government Minister for Climate Change and Energy Efficiency and the European Commission," accessed August 28, 2012 at: http://ec.europa.eu/clima/news/articles/news_2012082801_en.htm

supply for ACCUs, the Australian Government's modeling suggests that Australian businesses will likely source a total of 348 million credits of international emissions units to 2020.[122]

As stated above, REDD+ credits are not currently included on the list of eligible international emissions units. There is scope for including REDD+ credits if an international REDD+ crediting mechanism is put in place under the UNFCCC and/or Kyoto Protocol. The UNFCCC negotiations are anticipated to conclude in 2015 with a future agreement entering into force in 2020. For REDD+ credits to be generated before 2020 and admitted into Australia a future UNFCCC mechanism would need to fast-track implementation and include a "prompt start" mechanism to allow credit generation before 2020. If REDD+ credits are allowed under the scheme, they will be competing for demand with other international credit sources, including Kyoto emission reduction credits (which currently see an oversupply).[123] An oversupply of emission reductions credited under Kyoto mechanisms means REDD+ credits (if they are deemed eligible) will certainly not be the only source of supply for Australian international credit buyers.

Demand estimate 2013-2020		
Low-end: 0	**Mid-range: 35 million credits**	**High-end: 174 million credits**

Method and assumptions: To estimate REDD+ demand, this method applies a series of limit adjustments to the Australian Government's demand estimate for international credits (348 million credits from 2015-2020). The low range estimate reflects a scenario where REDD+ is either not advanced quickly enough under the UNFCCC to become operational in time or it is not eligible in Australia. The mid-range estimates assumes i) either a UNFCCC agreement in 2015 contains a REDD+ market mechanism and prompt start provisions that creates demand from 2016-2020, or in the absence of this the Australian regulator determines (certain) international REDD+ credits may still be considered "prescribed international units"; ii) REDD+ credits are allowed under the Australian scheme; and iii) REDD+ absorbs 10 percent of forecasted international demand, reflecting proposed restrictions on Kyoto credits[124] through a cap on use by liable entities, or limitations imposed by market competition. The high-end estimate has the same assumptions as the mid-range, except it assumes REDD+ credits absorb 50 percent of the forecasted international demand. This reflects a high-end scenario with a less restrictive cap on use of REDD+ credits and REDD+ credits being competitively priced relative to other international credits. It should be noted that all scenarios assume no demand from 2013-2015 and an equal amount of annual demand spread across the 2016-2020 period.

3.6.2 New Zealand

New Zealand's commitment under the Kyoto Protocol is to maintain average 2008-2012 net emissions at 1990 levels.[125] The government has further committed to 2020 and 2050 targets, conditional on certain global agreements and actions including international rules addressing LULUCF. Emissions in 2020 are to be 10 percent to 20 percent below 1990 levels, and by 2050 the aim is to cut GHGs to 50 percent below 1990 levels.[126]

[122] Kossoy, Alexandre and Pierre Guigon. *State and Trends of the Carbon Market 2012.* The World Bank, May 2012, available at http://siteresources.worldbank.org/INTCARBONFINANCE/Resources/State_and_Trends_2012_Web_Optimized_19035_Cvr&Txt_LR.pdf
[123] World Bank (2012). *State and Trends of the Carbon Market 2012,* accessed September 19, 2012 at http://siteresources.worldbank.org/INTCARBONFINANCE/Resources/State_and_Trends_2012_Web_Optimized_19035_Cvr&Txt_LR.pdf
[124] The Australia Government has proposed a 12.5 percent cap on use of Kyoto units: Climate Action News, Website of the European Commission, available at: http://ec.europa.eu/clima/news/articles/news_2012082801_en.htm
[125] "International Climate Change Policy, The Kyoto Protocol." *New Zealand Ministry for the Environment.* March 4, 2011, accessed June 15, 2012 at http://www.mfe.govt.nz/issues/climate/international/policy.html#consultation
[126] "Targets." *New Zealand Ministry for the Environment.* April 5, 2011, accessed June 15, 2012 at http://www.climatechange.govt.nz/reducing-our-emissions/targets.html

The country's Emissions Trading Scheme (ETS) commenced at the beginning of 2008 and incorporated forestry in its provisions from the start. For the first two and a half years of the program (the first compliance period), domestic forestry was the only covered sector. Certain forest landowners have incurred compliance obligations for emissions associated with deforestation, and others have generated carbon credits from afforestation activities (further explained below). From July 1, 2010, the program has also covered emissions from transportation fuels, power generation and heating fuels (primarily upstream, such as coal mining and natural gas extraction), and heavy industry. Participants have the option of paying the government NZ$25 (approx. US$19.75) per credit instead of buying and submitting carbon credits, effectively imposing a ceiling price on the market.[127]

New Zealand compliance entities have been able to use unlimited international units to meet their emissions reduction liability with only qualitative restrictions. International units include Kyoto units and "approved overseas units,"[128] which could arguably include REDD+ units issued under a future UNFCCC mechanism – if approved. Qualitative restrictions limit use of ERUs or CERs from nuclear project activities, and both lCERs and tCERs.[129] A statutory review of the emissions trading system was conducted in 2011 and proposed changes have been made available for public comment. One such change follows the format for international credit eligibility dictated in the Australian and European schemes. Proposed changes in the consultation document suggest the New Zealand Government intends to introduce a legal mechanism that will allow the regulator to set quantitative limits on the use of international credits by liable entities.[130] The purpose of this mechanism is to ensure there is not a residual supply of international credits at the end of each reporting period, and does not appear to be a catalyst for raising domestic prices or increasing domestic supply.[131] However, in December 2012 at CMP 8 New Zealand stated it would not participate in a second commitment period of the Kyoto Protocol.[132] The CMP 8 decisions prevent Parties not engaged in the second commitment period from transferring or acquiring Kyoto units from 1st January 2013.[133] As a result, how the New Zealand ETS will engage in the international carbon market from 2013 onward is unclear.

REDD+ demand

If a comprehensive global agreement is reached, the New Zealand Government foresees a 75-105 million credit domestic supply short-fall for the period 2013-2020.[134] New Zealand is currently open to most Kyoto credits, with limitations imposed on some credit types. However, CMP 8 decisions seem to prevent New Zealand from purchasing Kyoto units after 1 January 2013. As with Australia, there is scope for recognizing REDD+ under a future UNFCCC agreement. For this to happen and demand to be created by 2020, a future UNFCCC mechanism would need to fast-track implementation and include a "prompt start" mechanism to allow credit generation before 2020.

Given that New Zealand is likely to be a net buyer of international credits, the potential demand for REDD+ in the New Zealand ETS will be partly determined by alternative sources of international offsets

[127] New Zealand Ministry for the Environment. *Report on the New Zealand Emissions Trading Scheme.* June 30, 2011, available at http://www.climatechange.govt.nz/emissions-trading-scheme/building/reports/ets-report/ets-report-final.pdf

[128] See Section 63 of the New Zealand *Climate Change Response Act* 2002, along with the definition of "unit" in Section 4 and questions and answers on the use of international credits, available at http://www.climatechange.govt.nz/emissions-trading-scheme/about/questions-and-answers.html

[129] See questions and answers on the use of international credits, available at http://www.climatechange.govt.nz/emissions-trading-scheme/about/questions-and-answers.html

[130] Ministry of Environment, *Updating the New Zealand Emissions Trading Scheme :A consultation document* , (2012) Publication No: INF646, accessible at http://www.climatechange.govt.nz/consultation/ets/consultation-ets-changes.pdf

[131] Ministry of Environment, *Updating the New Zealand Emissions Trading Scheme :A consultation document* , (2012) Publication No: INF646, accessible at http://www.climatechange.govt.nz/consultation/ets/consultation-ets-changes.pdf

[132] CMP 8 Decision *Amendment to the Kyoto Protocol pursuant to its Article 3, paragraph 9*, Annex I, Part A amending Annex B of the Kyoto Protocol, footnote 15. (Decision number not assigned at the date of publication).

[133] CMP 8 Decision *Amendment to the Kyoto Protocol pursuant to its Article 3, paragraph 9*, paragraphs 13 and 15 (Decision number not assigned at the date of publication).

[134] Calculation applied from NZ Fifth National Communication, taken from: World Bank (2012). *State and Trends of the Carbon Market 2012,* accessed September 19, 2012 at http://siteresources.worldbank.org/INTCARBONFINANCE/Resources/State_and_Trends_2012_Web_Optimized_19035_Cvr&Txt_LR.pdf

and any quantitative limits on the inclusion of REDD+ credits in the scheme, should they be allowed.		
Demand estimate 2013-2020		
Low-end: 0	**Mid-range: 8 million credits**	**High-end: 53 million credits**
Method and assumptions: To estimate REDD+ demand, this method applies a series of limit adjustments to the New Zealand Government's supply short-fall estimate (75-105 million units to 2020). The low-range estimate reflects a scenario where REDD+ is not eligible in the scheme. The mid-range estimates assume REDD+ credits are allowed under the scheme from 2016-2020 and absorb 10 percent of the low-end of the forecasted supply shortfall, reflecting a proposed cap on use by liable entities or limitations imposed by market competition. The high-end assumes REDD+ credits absorb 50 percent of the high-end of the forecasted supply shortfall, reflecting a less restrictive cap on the use of REDD+ credits, and the REDD+ credits being competitively priced relative to other international credits. It should be noted that all scenarios assume no demand for REDD+ from 2013-2015 and an equal amount of annual demand spread across the 2016-2020 period.		

3.7 NON-ANNEX I NATIONAL COMPLIANCE PROGRAMS

The emergence of non-Annex I domestic programs could drive demand for domestic REDD+ credits and may also provide opportunities for linking to other domestic schemes or an international REDD+ mechanism. Significant demand for domestic REDD+ credits in some countries (such as Brazil) may also affect global supply of REDD+ credits.

3.7.1 Brazil

Brazil is typically viewed only as a source of REDD+ credits for developed country markets, but has recently taken steps to create a domestic carbon market. The country has set a goal of reducing emissions 36.1 - 38.9 percent below the business-as-usual projection by 2020,[135] including from the forest sector. Mitigation actions target the forest and energy sectors, and are envisaged to be implemented as voluntary in nature.[136] However, the legislation asserting the target included consideration of a domestic emissions trading system, and the government has since studied how carbon trading might address emissions from power, transport, agribusiness and industrial sectors.[137]

The country's largest exchange, BM&F Bovespa, along with Spanish bank Santander, is looking at how to list carbon contracts. The aim is to foster carbon trading among Brazilian entities, as well as others in Latin America. Recommendations will also be offered to the government on regulatory measures needed to support a carbon market.[138]

[135] "Environment: Climate Change" Brazilian government website. Portal Brasil. n.d, accessed May 8, 2012 at http://www.brasil.gov.br/sobre/environment/climate-change/climate-change/br_template_completo?set_language=en

[136] UNFCCC, AWGLCA, 'Compilation of information on nationally appropriate mitigation actions to be implemented by Parties not include in Annex 1 to the Convention,' March 2011, accessed November 20, 2012 at http://unfccc.int/resource/docs/2011/awglca14/eng/inf01.pdf

[137] Volcovici, Valerie. "Brazil considers domestic carbon market." *Point Carbon* 6 May 2010, accessed 28 May 2012 at http://www.pointcarbon.com/news/1.1442709

[138] Teixeira, Marcelo. "Santander, Brazilian exchange partner on CO2 trade." *Point Carbon* May 17, 2012, accessed June 4, 2012 At http://www.pointcarbon.com/news/1.1898745

REDD+ demand
It remains to be seen whether and how a domestic trading program will allow forestry credits, while also maintaining regulatory additionality and comporting with possible caps in the domestic forestry sector.

3.7.2 China

China's 12th Five-Year Plan (2011-2015) commits to national tCO_2e emissions intensity reduction of 17 percent per unit of GDP from 2011 to 2015. As a Nationally Appropriate Mitigation Action (NAMA) under the December 2009 Copenhagen Accord, China has set a target to reduce carbon intensity 40-45 percent by 2020 from 2005 levels.[139]

The 12th Five-Year Plan also targets development of a national carbon market by 2015. On this basis, the National Development and Reform Commission's (NDRC) Climate Change Department announced in 2011 that carbon trading programs would be piloted in seven cities and provinces, with a goal of launching by 2013. These include the provinces of Guangdong and Hubei, and the cities of Beijing, Chongqing, Shanghai, Tianjin and Shenzhen. Experiences from these initiatives are to be incorporated into the design of a national system. There are also proposals to test carbon trading on a sectoral basis, such as for non-residential buildings or distributed heating facilities.[140] While the expectation had been that the province and city pilot programs would see targets based on emissions intensity, the NDRC has instead directed them to impose absolute caps.[141]

Comprehensive climate change legislation is currently under development. A draft version expands the list of GHGs (beyond the five-year plan's tCO_2e) and allows for emissions trading, as well as a carbon tax. It is expected that the bill will not become law for at least three years, with regulations developed thereafter. Any national system established would supplant the regional trading programs. The draft law provides a general framework and does not specifically mention use of carbon credits for compliance. Credits would be incorporated through regulations developed by NDRC.[142]

Infrastructure for the regional carbon markets and an eventual national market is being developed. NDRC has commissioned the Energy Research Institute to develop a registry, which will store, track and allow for transfer of carbon credits.[143] In addition, some 20 regional carbon exchanges have been established in recent years. Of these, the exchanges in Beijing, Shanghai and Tianjin are considered most viable.[144]

A credits component is currently being structured for the regional and subsequent national programs. As drafted, the credits program would be similar to the CDM, except that China's NDRC, rather than the CDM Executive Board, would have to approve all projects. Projects already approved under the CDM would be given priority for approval under the Chinese credit program.[145] Credits are termed "Chinese Certified Emission Reductions" (or CCER's). NDRC is cooperating with the State Forestry Administration to evaluate

[139] Point Carbon. "Focal Point: Towards a Chinese emissions trading scheme." *Carbon Market Monitor* 6 March 2012, available at http://www.pointcarbon.com/polopoly_fs/1.1857764!Carbon_Market_Monitor_2012-5_v9.pdf
[140] Han, Guoyi, et. al. *China's Carbon Emission Trading: An Overview of Current Development.* FORES and Stockholm Environment Institute, 2012, available at http://www.sei-international.org/mediamanager/documents/Publications/china-cluster/SEI-FORES-2012-China-Carbon-Emissions.pdf
[141] Chen, Kathy. "China tells pilot ETS regions to set absolute CO2 caps." *Point Carbon* January13, 2012, accessed June 5, 2012 at http://www.pointcarbon.com/news/1.1717739
[142] Chai, Hongliang. "China's draft climate change law: setting a path toward emission reductions." *Point Carbon* May 9, 2012, accessed June 6, 2012 at http://www.pointcarbon.com/research/marketsoverview/analysis/aus/1.1859181
[143] Chen, Kathy. "China to build CO2 registry for national trading scheme." *Point Carbon* October 26, 2011, accessed June 6, 2012 at http://www.pointcarbon.com/news/1.1636808
[144] Chen, Kathy and Stian Reklev. "China govt think tank outlines national ETS proposal" *Point Carbon* September 1, 2011, accessed June 6, 2012 at http://www.pointcarbon.com/news/1.1575155
[145] Chen, Kathy. "China readies rules for domestic CO2 credit markets." *Point Carbon* May 14, 2012, accessed June 5, 2012 at http://www.pointcarbon.com/news/1.1860172

how domestic forestry credits could be incorporated.[146] A forestry credits program would be consistent with the country's climate change mitigation goal to increase forest cover by 40 million hectares between 2005 and 2020. In support of this effort, the European Investment Bank is providing a loan of some $333 million.[147]

REDD+ demand
REDD+ inclusion has not been determined.

3.7.3 Colombia

A consortium of governments, multilateral organizations, and the Colombian Mercantile Exchange (Bolsa Mercantil de Colombia) is establishing a voluntary market platform for trading emission reductions. Financial support is being provided by the Inter-American Development Bank, the UN's Global Environment Facility (GEF), and other institutions. At the outset, the platform will serve to find buyers for 371,200 Colombian forest carbon VER's.[148] Demand development is focused on local companies, although foreign companies may also purchase credits.[149] Among the organizations involved is NGO Fundacion Natura, whose subdirector of local and institutional development, Roberto Leon Gomez Charry, says that Colombia-based demand will be driven by concerns about carbon-mitigation requirements that could stem from US and EU free trade agreements and by corporate social responsibility (CSR). The demand side of building the GEF voluntary market trading platform will be supported by the Bogota Chamber of Commerce (Camara de Comercio de Bogota). However, at this time there is no estimate of how many companies are actually estimated to participate in buying offsets through the platform.

With respect to compliance markets, the World Bank is funding a feasibility study for a transportation emissions cap-and-trade program among major Colombian cities.[150] Consideration of a credits component is not currently known.

REDD+ demand
The trading platform currently under development is not expected to create domestic demand on its own.

3.7.4 Republic of Korea

The Republic of Korea submitted to the UNFCCC, as part of their NAMAs, the intent to reduce emissions 30 percent below a business as usual emissions level by 2020.[151] Korean lawmakers subsequently passed domestic cap-and-trade legislation with strong bi-partisan support despite industry opposition.[152] While the creation of an emissions trading scheme is an important step forward, a number of key design features of the

[146] Chen, Kathy. "China mulls forestry credits in ETS: official." *Point Carbon* March 5, 2012, accessed June 5, 2012 at http://www.pointcarbon.com/news/1.1782836

[147] European Investment Bank News Release, 'China: EUR 250 million loan for forestry projects,' March 2012, available at http://www.eib.org/projects/press/2012/2012-030-china-eur-250-million-loan-for-forestry-projects.htm

[148] Volcovici, Valerie. Trading Carbon, *Colombia Gets Ready,* Nov. 2011, pp. 30-31, accessed May 21, 2012 at http://hps.realviewdigital.com/default.aspx?iid=55601&startpage=page0000034

[149] Universia Colombia, *Colombia avanza hacia su primer mercado de bonos de carbon,*Sept. 20, 2011, accessed May 21, 2012 at http://noticias.universia.net.co/en-portada/noticia/2011/09/20/869055/colombia-avanza-primer-mercado-bonos-carbono.html and translated with Google Translator.

[150] Volcovici, Valerie. Trading Carbon, *Colombia Gets Ready,* Nov. 2011, pp. 30-31, accessed May 21, 2012 at http://hps.realviewdigital.com/default.aspx?iid=55601&startpage=page0000034

[151] United Nations Framework Convention on Climate Change. *Compilation of information on nationally appropriate mitigation actions to be implemented by Parties not included in Annex I to the Convention.* March 18, 2011, FCCC/AWGLCA/2011/INF.1, available at http://unfccc.int/resource/docs/2011/awglca14/eng/inf01.pdf

[152] Sangim Han, South Korean Lawmakers Vote for Limits on Greenhouse-Gas Emissions, BLOOMBERG, February 8, 2012, available at http://www.bloomberg.com/news/2012-02-08/south-korea-moves-closer-to-setting-limits-on-carbon-emissions.html

domestic law have yet to be finalized. The quantity of emission reductions to be achieved is not yet clear, and the baseline or reference level or period for future emission reductions has not been defined.

The current regulations state the program will commence in 2015 and will consist of three compliance periods running through 2020, with 60 percent of the country's emissions capped. In July 2012, the Prime Minister suggested rules which would delay the use of international offsets until after 2020.[153]

In early 2010, Korea passed the country's "Framework Act on Low Carbon and Green Growth," legislation meant to make good on the country's Copenhagen commitment. The law established a pilot emissions trading scheme, known as the "Target Management Scheme." The program covers 70 percent of the country's GHG emissions including forestry. [154]

REDD+ Demand
Forest credit usage in the scheme is not known.

3.8 SUB-NATIONAL COMPLIANCE PROGRAMS

Many state and regional governments have developed compliance programs with the aim to link across jurisdictions, thereby affecting a broad climate strategy which bypasses national governments. Sub-national programs are significant in their ability to influence federal policy, as state based initiatives are often adopted later in federal legislation.[155] Aside from this, they can also generate significant emission reductions on their own. The main program relevant to REDD+ is California's, which is reviewed in detail below. Additional details on the Canadian programs in Alberta, British Columbia, Manitoba, Ontario and Quebec, as well as the US state of Oregon are included in Appendix I. Sub-national programs in the non-Annex I countries of Brazil (Rio and Sao Paolo) and China are also included in Appendix I.

3.8.1 California (USA)

The state of California's *Global Warming Solutions Act* of 2006, known locally as Assembly Bill (AB) 32, requires GHG emissions to be reduced to 1990 levels by 2020. It directs the California ARB to develop and adopt regulations to provide incentives for reducing the state's dependence on fossil fuels, to stimulate investment in clean and efficient technologies, and improve public health.[156] Regulations establishing a statewide cap-and-trade program were formally incorporated into the California Code of Regulations in 2012, and will cover 85 percent of the state's GHG emissions. The regulation commenced in January 2013. After the first compliance period (2013-2014), distributors of transportation, residential, and commercial fuels will enter the scheme, bringing the number of covered entities to about 600.[157]

The cap-and-trade program includes several cost containment mechanisms in order to ease the compliance burden, including the use of offsets (credits). The ARB has developed protocols supporting the creation of credits in US forests and urban environments, and is interested in expanding this program beyond US

[153] Media release announced on Prime Minister's website July 2012, http://eng.pmo.go.kr/pmo_eng/main/
[154] Norton Rose Group. *Asia Pacific climate change policy series.* May 2011. 2, available at http://www.nortonrose.com/files/asia-pacific-climate-change-policy-series-republic-of-korea-52311.pdf
[155] An example of this is the Australian State of New South Wales Greenhouse Gas Reduction Scheme (GGAS) which when launched in 2003 was the world's first regulated cap-and-trade scheme. Early experiences with GGAS demonstrated the efficacy of an emissions trading system and helped shape Federal policy. At the commencement of the national ETS in July 2012, the GGAS scheme closed. For more information, refer to http://www.greenhousegas.nsw.gov.au/
[156] State of California, *Global Warming Solutions Act of 2006,* 2006.
[157] World Bank (2012). *State and Trends of the Carbon Market 2012,* accessed September 19, 2012 at http://siteresources.worldbank.org/INTCARBONFINANCE/Resources/State_and_Trends_2012_Web_Optimized_19035_Cvr&Txt_LR.pdf

borders.[158] As a precursor to ARB's final cap-and-trade regulation adopted in 2011, ARB's 2008 Climate Change Scoping Plan articulated California's commitment to working at the international level to reduce global GHG emissions. Affirming "the importance of establishing mechanisms that will facilitate global partnerships and sustainable financing mechanisms to support eligible forest carbon activities in the developing world," the Scoping Plan embraces the opportunity to "provide incentives to developing countries to help cut emissions by preserving standing forests, and to sequester additional carbon through the restoration and reforestation of degraded lands and forests and improved forest management practices."[159] The final cap-and-trade regulation under AB 32 specifically recognizes REDD as a "sector-based" offset. A plain reading of the legislation seems to limit these sector-based offsets to REDD only – i.e. it does not on its face extend to the "+" side of REDD+. Contingent on developing a sector-based crediting mechanism, up to 25 percent of all credits submitted for compliance may be sector-based through 2017, with the limit rising to 50 percent through to 2020.[160]

The ARB has been working with two organizations, the Governors' Forests and Climate Task Force (GCF) and the REDD Offset Working Group (ROW) to develop a framework to establish links for international REDD to the AB 32 Program. As of October 2012, the ROW is nearing completion of a set of recommendations regarding: i) legal and institutional mechanisms required to enable California to recognize international REDD-based emission credits for compliance purposes; and ii) the key policy and technical elements a sectoral REDD program should achieve in order for REDD-based credits to be recognized in a compliance program.[161] The initial ROW recommendations are expected to be released for comment in the coming months, and after incorporating stakeholder input into the report, the final version is to be issued in early 2013 for ARB's consideration.[162] In summary, the inclusion of REDD into the AB 32 market is contingent on: i) development of a sector-based crediting mechanism; ii) institutional mechanisms to operate international agreements; and iii) policy and technical elements required to safeguard social and environmental integrity, including methods for measurement.

REDD+ demand

According to current regulations, during each compliance period a covered entity may use offsets to meet up to 8 percent of its compliance obligation. The cap on sector-based credits, with which REDD is included, is set at a sub-limit within the 8 percent credit cap. Sector-based credits can be used for 2 percent of a covered entities total compliance obligation to 2017, and 4 percent to 2020. Based on the emissions allowance budget, the maximum volume of demand for sector-based credits is 70.95 million units.

The current supply of early action credits and the future supply of compliance or sector-based credits will compete for the share of demand allocated to sector-based credits. If we assume no limit is applied to REDD+ under the sector-based sub-limit, then the demand for REDD credits is assumed to equal a share of the sector-based demand. This share will be driven largely by credit pricing. In the case of REDD+ the market price will not only reflect costs of production, but also transaction costs and risks associated with sourcing and validity of REDD credits.

Early action credits are allowed into the scheme with no sub-limit (8 percent max). Based on current rulemaking, credits derived from CAR methodologies backdated to 2005 may constitute supply for early

[158] California Air Resources Board (October 2011). Compliance Credit Protocol US Forest Projects. p,8, available at http://www.arb.ca.gov/regact/2010/capandtrade10/copusforest.pdf
[159] California Air Resources Board (December 2008) Climate Change Scoping Plan: A Framework for Change. p.115, available at http://www.arb.ca.gov/cc/scopingplan/scopingplan.htm
[160] California Air Resources Board, Final Regulation Order, Subchapter 10 Climate Change, Article 5, Sections 95800 to 96023, Title 17, California Code of Regulations, §95854(c), p 91 and §95993(a), p 264, accessed October 14, 2012 at http://www.arb.ca.gov/cc/capandtrade/september_2012_regulation.pdf
[161] FCMC, Briefing Paper for October 30 Webcast, 'California Climate Legislation: Cap-and-trade and International Forest Carbon Credits', accessed November 2012, at http://www.fcmcglobal.org/documents/AB32_Briefing_Paper.pdf
[162] FCMC, Briefing Paper for October 30 Webcast, 'California Climate Legislation: Cap-and-trade and International Forest Carbon Credits', accessed November 2012, at http://www.fcmcglobal.org/documents/AB32_Briefing_Paper.pdf

action credits, contingent on verification by an ARB-accredited verification body.[163] The potential supply of early-action credits derived from the CAR may absorb total credit demand in the first compliance period (ending in 2014).[164] In subsequent periods, supply from domestic sources will be more difficult to ramp up.[165] Coupled with the likelihood of REDD credits trading at discounts to other credits, the market may favor REDD as the dominant supplier of sector-based credits in the second and third compliance period.

Demand estimate 2013-2020		
Low-end: 0	**Mid-range: 48 million credits**	**High-end: 64 million credits**

Method and assumptions: The volume of demand for REDD credits is estimated by assuming the rules allowing REDD are never agreed upon at the low-end. For the mid-range and high-end, we assume the rule making to allow REDD into California will not be completed for the first compliance period but will allow REDD into the second and third. The mid-range estimate assumes REDD absorbs 75 percent of sector-based demand for the second and third compliance periods and the high-end scenario assumes REDD absorbs the maximum sector-based demand for the second and third compliance periods.

3.9 SUMMARY

3.9.1 Summary of Programs

A number of multilateral, bilateral, national and sub-national emission reduction programs are operational and in development around the world. Some of these establish emissions trading markets that could include emission reductions and/or credits from REDD+ activities in developing countries. However, at the time this report was published, REDD+ is not clearly allowed within any active or emerging compliance programs. The national programs reviewed can fall into three categories: i) REDD+ being *prima facie* eligible, but in order to operationalize this, additional progress is needed either under the UNFCCC (e.g. Australia and New Zealand) or domestic rule making (e.g. California); ii) a domestic scheme being insufficiently developed to assess the inclusion or exclusion of REDD+ (e.g. a number of nascent state level programs in Brazil, Canada, China and the US); or iii) REDD+ credits being prohibited (e.g. the EU ETS). Table 4 reviews the operational status of these programs, where programs are active or have scheduled to commence, and also describes key design features impacting REDD+ demand. It includes all the programs included in the body of this report, along with those included in Appendix I.

Table 4: Summary Table of Emerging Markets

	Program name	Program status	Eligibility of REDD+	Non-permanence rules
Voluntary	Verified Carbon Standard	Active: VCS AFOLU Guidelines launched 2007	Avoided deforestation, IFM project types allowed	Buffer account
	Climate Action Reserve	Active: launched in 2001, undergoing review for accreditation to ARB credit standard	Avoided deforestation, IFM projects to be allowed under Mexico Forest Protocol[166]	Buffer account
	American Carbon Registry	Founded as registry in 1996, introduced REDD+ methodologies in 2011.	Avoided deforestation, IFM project types allowed	Buffer account

[163] California Air Resources Board, Final Regulation Order, Subchapter 10 Climate Change, Article 5, Sections 95900, p 245, accessed October 14, 2012 at http://www.arb.ca.gov/cc/capandtrade/september_2012_regulation.pdf
[164] World Bank (2012). *State and Trends of the Carbon Market 2012,* accessed September 19, 2012 at http://siteresources.worldbank.org/INTCARBONFINANCE/Resources/State_and_Trends_2012_Web_Optimized_19035_Cvr&Txt_LR.pdf
[165] IETA, Greenhouse Gase Markets 2012: New Markets, New Mechanisms, New Opportunities, 2012.
[166] Draft under review as of November 2012, the latest version can be accessed at: http://www.climateactionreserve.org/how/protocols/mexico-forest/

Multilateral Initiatives	UNFCCC	Market mechanisms under negotiation	Under negotiation	To be determined
	Kyoto Market Mechanisms	Active: commitment period activated 2008	Not eligible, but A/R is eligible	Temporary crediting for A/R
	Forest Carbon Partnership Facility: Carbon Fund	Scheduled	Participation is determined by host country readiness	-
	Green Climate Fund	Under development: first meeting of the Board in 2012	-	-
Bilateral	Japan	Under development: bilateral credit program planned to achieve 2020 target	Unknown, but there are indications of intent to purchase REDD+ credits	-
	Norway	Active: public finance investments	REDD+ is targeted through bilateral funding	-
	Germany REM	Active: incentive and performance investments	REDD+ is targeted through bilateral funding	-
Regional Programs	European Union ETS	Active: launched in 2005	Not eligible	-
	Regional Greenhouse Gas Initiative	Active: auctions commenced in 2008	Not eligible	-
	Western Climate Initiative	Scheduled: legislation in place, launch in 2013	Not eligible	-
Annex I Programs	Australia Clean Energy Future	Active: tax/fixed price period 2012-2015; cap-and-trade launch in 2015	Scope for inclusion if mechanism developed under UNFCCC	Does not allow temporary credits
	New Zealand Emissions Trading Scheme	Active: launched in 2008	Scope for inclusion if mechanism developed under UNFCCC	Does not allow temporary credits
	United States of America (various bills & EPA action)	Inoperative: Bills did not pass through congress, EPA has not acted	-	-
Non-Annex I Programs	Brazil Carbon Trading (proposed)	Under development: law sets target, but does not outline market for forest carbon	-	-
	China National Carbon Market (proposed)	Under development: the Five-Year Plan outlines goal for national market by 2015	-	-
	Columbia Carbon Market	Under development: voluntary platform established support for forest carbon	-	-
	South Korea Cap-and-Trade Legislation	Scheduled: legislation in place, commencement in 2015	-	-
Sub-National Programs	Alberta GHG Regulatory Program	Active: launched in 2007		-
	British Columbia GHG Reduction Targets	Inoperative: legislation sets target, but scheme has not been enacted	-	-
	California AB 32	Scheduled: legislation passed in 2006, scheme commences 2013	REDD is eligible as a sector-based credit if additional regulations are passed	Buffer in early action credits
	Manitoba GHG Reduction Target	Inoperative: legislation sets target, but scheme has not been enacted	-	-
	Ontario Cap-and-Trade	Inoperative: legislation passed in 2009, but scheme has not been enacted	-	-
	Oregon Carbon Dioxide Standard	Active: Standard requires new power plants to credit; cap-and-trade failed to pass	Not eligible	-
	Quebec Climate Change Plan	Scheduled: legislation passed, scheme commences 2013	-	-
	Rio de Janeiro	Under development: consultation	-	-

	(proposed)	documents presented		
	Sao Paulo (proposed)	Under development: consultation phase	-	-
	Chinese Cities and Provinces	Under development: planning phases	-	-

3.9.2 Summary of Demand

A scheme's anticipated demand is assumed to start at the earliest date REDD+ credits are allowed. In California's AB 32, rules surrounding crediting and sourcing REDD+ credits are under development. Hence, California demand is assumed to commence in 2015. In Australia and New Zealand, the pathway for REDD+ to be brought into the schemes is largely by the development of a REDD+ mechanism under the UNFCCC. While many factors need to be addressed to include REDD+ into the mechanisms of this agreement, the 2015 target is considered to be the earliest date with which a REDD+ mechanism could be agreed upon. Therefore, the potential demand from the UNFCCC, Australia and New Zealand is assumed to commence in 2016. All other demand sources are assumed to commence in 2013. Table 5 below presents a summary of the estimates of demand for forest carbon credits. Given the significance of a UNFCCC agreement (and assumptions used to estimate demand volume) a sub-total of demand excluding UNFCCC demand is included. Figures 3 and 4 express this same information on an annual basis, including and excluding demand from a future UNFCCC agreement. It is important to note that the estimates that exclude demand from a UNFCCC agreement do not factor in follow on effects this may have on domestic demand in Australia, New Zealand, or Japan, and that some of the VCS demand may also relate to these other programs. The estimates also do not include potential demand from the Kyoto Protocol via its new linkage to future UNFCCC market mechanisms.

Table 5: Demand non-Annex 1 Forest Carbon Credits 2013-2020 (thousands of credits)

	Low	Mid	High
Verified Carbon Standard	30,100	71,200	112,800
Forest Carbon Partnership Facility	10,250	20,600	41,200
Australia Clean Energy Future	0	29,000	145,000
New Zealand ETS	0	4,688	32,813
California AB 32	0	48,400	64,500
Japan	0	54,000	134,750
Germany REM	2,120	4,200	8,480
UNFCCC	0	277,778	2,381,944
Sub-total excluding UNFCCC	*42,470*	*232,088*	*539,543*
TOTAL	**42,470**	**509,865**	**2,921,487**

Figure 3: Annual anticipated demand if a UNFCCC agreement is realized (thousands of tCO2e)

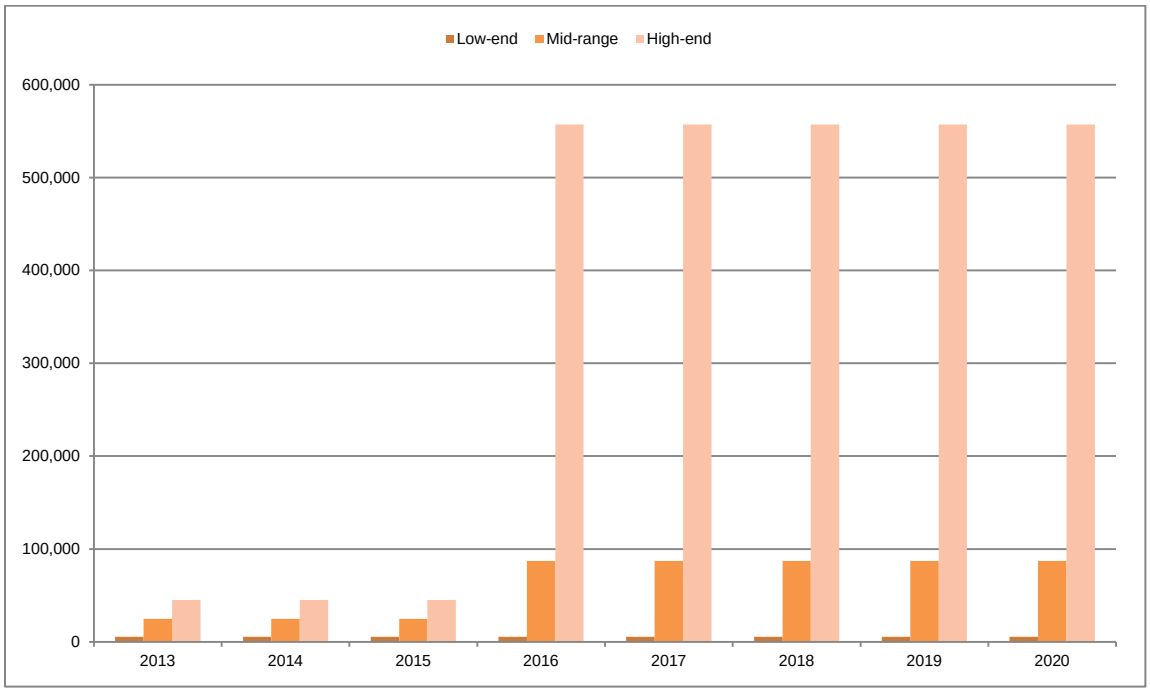
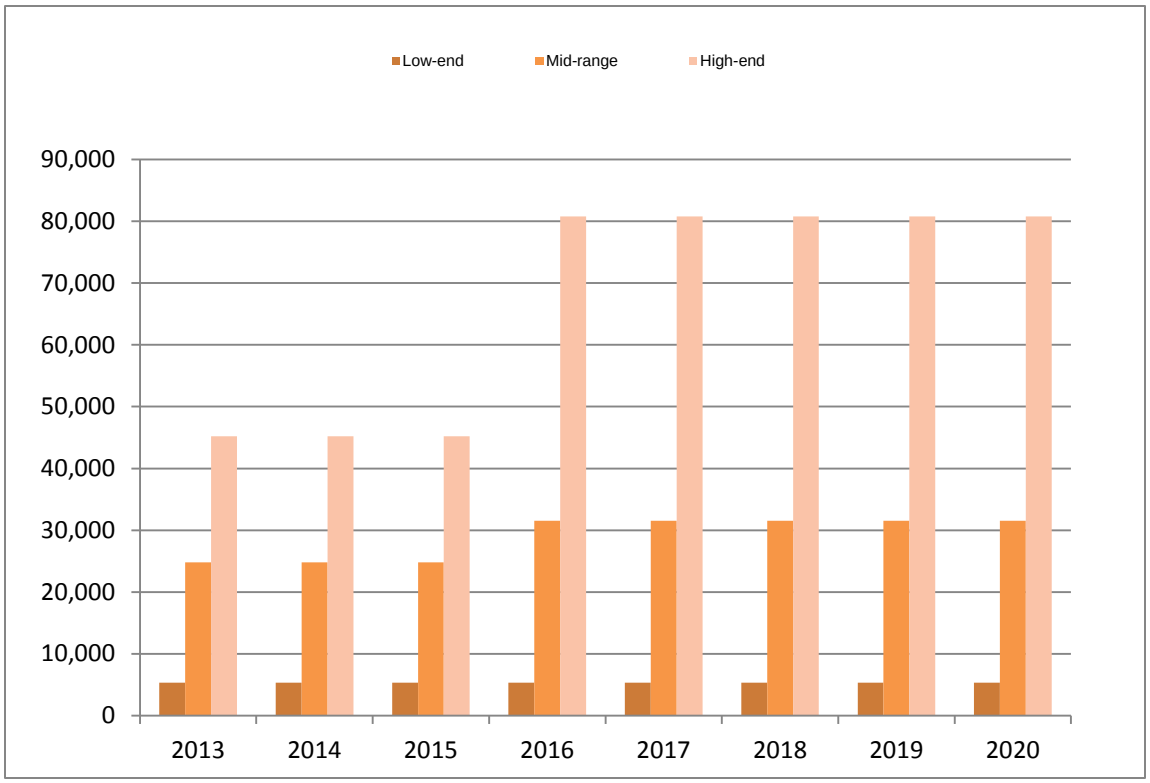


Figure 4: Annual anticipated demand - excluding UNFCCC demand (thousands of tCO_2e)



4.0 POTENTIAL REDD+ CREDIT SUPPLY FROM NON-ANNEX I COUNTRIES

To date, studies aimed at predicting future REDD emission reduction potential and credit supply have been built on global economic modeling approaches used to simulate markets for forest and agriculture commodities. For example, the Open Source Impacts of REDD Incentive Spreadsheet (OSIRIS), developed by the Collaborative Modeling Initiative on REDD Economics[167], supports a number of studies[168] estimating and mapping the climate, forest and revenue benefits of alternative REDD+ policy decisions. The general approach to emission reduction potential prediction in global economic models is to determine the biophysical potential for emission reductions in forest areas where the economic case justifies a switch from forest use (conversion) to forest protection. The use of global economic models in supply prediction is useful in providing a glimpse of the "full potential" of GHG emission reductions in forests based on simplistic opportunity cost and credit price assumptions.

While these models can be useful, they have their limitations, as they rely on coarse data and often simplistic and top-down accounting approaches. Many also do not incorporate many of the practical issues that will affect the actual supply of REDD credits, such as setting RELs to determine what fraction of emission reduction potential is eligible to be recognized as an offset or credit, or the political, finance and implementation challenges of REDD+. The price assumptions in these models are also speculative, as a clear price signal for compliance REDD+ credits has not emerged. For these reasons, global economic models are not an accurate method to estimate the potential supply of compliance-grade REDD+ credits.[169]

In the absence of a global market for REDD+, voluntary activities are being implemented, providing empirical evidence that can be used to estimate potential credit supply. From the call for early action at COP 13 in Bali in 2007[170], a large number of forest and land-use emission reduction activities have become fully operational and an even greater number are in stages of preparation. Data collected from various reporting sources on these activities can be used to forecast annual credit issuance. Credit issuance forecasts can be aggregated, which can provide an estimate of future REDD+ credit supply.

This section presents an empirical model for the estimation of the supply of compliance-grade REDD+ credits, based solely on analysis of data gathered from REDD+ activities that are either in operation or late stages of planning. The model will assess the pipeline of compliance-grade credit issuance from actual activities that use credible standards. Considered a bottom-up assessment, the model captures some of the political, finance and implementation issues which are currently not reflected in top-down models. Given that the model's scope is limited to the credit pipeline of activities planned or operating, this approach risks understating supply in the scenario where greater than expected compliance demand is created. Instead, the bottom-up approach of this model provides a very probable supply scenario over the short- to medium-term

[167] Comprised of the following members: Jonah Busch, Conservation International (CI); Bernardo Strassburg, Centre for Social and Economic Research on the Global Environment, University of East Anglia (CSERGE); Andrea Cattaneo, The Woods Hole Research Center (WHRC); Ruben Lubowski, Environmental Defense Fund (EDF); Fred Boltz (CI); Ralph Ashton, Terrestrial Carbon Group (TCG); Aaron Bruner (CI); Dick Rice (CI).

[168] Publications supported by OSIRIS can be found at the Conservation International/OSIRIS website, available at http://www.conservation.org/osiris/Pages/overview.aspx

[169] Michael J. Coren, Charlotte Streck & Erin Myers Madeira (2011): Estimated supply of REDD credits 2011–2035, Climate Policy, 11:6, 1272-1288.

[170] Decision 2/CP.13, *Reducing emissions from deforestation in developing countries: approaches to stimulate action*, paragraphs 3 – 5.

by extrapolating available project data in order to assess likely supply based on current information. The findings of the empirical model provide a reference point for assessment against the "full potential" supply forecasts of global economic models. To inform policy-making for a future REDD+ market, this section closes with a comparison of the empirical models credit issuance estimates with a selection of "full potential" production estimates derived from top-down global economic modeling.

4.1 EMPIRICAL APPROACH TO PREDICTING SUPPLY

The objective of the supply analysis was to gather data from compliance-grade projects and programs to develop a projection of the global supply pipeline of issued REDD+ credits for the period 2013-2020. The scope of this supply analysis follows the UNFCCC clarification of REDD+ activities set forward at Cancun in 2010, with the possible exception of A/R activities that were not included in the analysis. Early evidence was extracted from those REDD+ mitigation activities that demonstrated a measureable potential to produce high-quality credits that may be considered "compliance-grade."[171] The study includes activities implemented at the project scale and program scale (known as "sub-national" in UNFCCC and "jurisdictional" under the VCS). A number of these activities have met criteria to produce compliance-grade credits (referred to as Level I), while the remaining are preparing to meet such criteria (referred to as Level II). An empirical approach to projecting supply was designed for each level and the complete description of this methodology and assumptions is found in Appendix II. When aggregated, the projections of supply volumes from activities in Levels I and II will represent a probable scenario of the REDD+ credit pipeline for 2013-2020.

4.1.1 Approach to Predict Level I Credit Issuance

Activities qualified to the Level I group are those that: i) were successfully validated and/or verified to VCS requirements; and ii) registered on the VCS database,[172] as of October 2012. The VCS database offers links to project documents and verification reports providing ex-ante emissions reduction forecasts and ex-post monitoring reports. To arrive at a credit issuance forecast, Level I emission reduction forecasts based on the issued tons plus the ex-ante predicted tons that were discounted for implementation risk of 5 percent and risk buffer reported by each project. The aggregation of credit issuance forecasts from each activity comprises the Level I credit supply estimate.

4.1.2 Approach to Predict Level II Credit Issuance

The threshold for qualification to Level II activities is the design of the activity to meet criteria to issue compliance-grade credits and advancing development beyond the project concept stage (i.e., the project was at least under-going a carbon feasibility study). From these documents, the design or intent to meet compliance-grade criteria can be evaluated. The authors engaged market participants from the private sector, NGOs and intergovernmental agencies, and referred to case studies, research and online project databases to build a Level II database of project and program activities.

The method to model credit issuance from qualified Level II activities is more complex than the method described above for Level I because the availability of data can be limited or poor quality. Where ex-ante emission reductions are available, these forecasts were checked against benchmark emissions reduction productivity factors expressed in $tCO_2e\ ha^{-1}\ yr^{-1}$. The benchmark values were derived from the Level I and qualified Level II activities for each REDD+ activity category in each major forest type and REDD+

[171] Compliance-grade REDD+ credits are considered to be those accounted and verified under a high-quality voluntary market standard that is either i) of comparable robustness to compliance market standards and/or ii) may be recognized as eligible to meet regulated obligations under a compliance market. Section 3 introduced the concept of compliance-grade credits and detailed each program individually. Of the group, the VCS is the dominant carbon accounting standard on the supply side, and for purposes of this study represents the sole source of compliance-grade non-Annex I REDD+ credits.

[172] The ACR was reviewed, but all of the registered non-Annex I forest carbon projects are Afforestation or Reforestation so it does not feature at this level.

typology. When ex-ante emissions reduction forecasts are not available, or do not appear reasonable against benchmarks, the benchmark value is applied. Converting Level II ex-ante emissions reduction forecasts to realistic credit issuance estimates required adjustments to account for the real-world limitations and obstacles to meet implementation requirements and the standards of verification. Examples of these include attaining government approvals, assembling sufficient management capacity and securing carbon rights. To capture the number of credits Level II activities will produce in the future, a discount factor was applied to each activity's emissions reduction forecast. The discount factor is generated from a set of risk indicators and other key criteria of voluntary programs, details of these may be found in Appendix II. The discount factor was applied to the credit issuance volume for each REDD+ activity qualified under Level II.

To arrive at a global picture of the supply of issued REDD+ credits, the emissions reduction forecasts from Level I and II activities are aggregated after being adjusted for the backward looking nature of issuance versus the vintage year in which the emission reductions were actually produced. Since this study assesses supply to the market, the credit issuance forecast for 2013-2020 will include retro-credits generated from vintages prior to the first verification year that are issued within the period of model forecasting (going back to 2008).[173]

4.2 SUPPLY ESTIMATES

This analysis qualified 80 different REDD+ activities to the Level I and II data sets, with seven Level I and 73 Level II activities, of which three were jurisdictional programs and the rest were projects. The combined Level I and Level II adjusted credit issuance estimates form the total estimate of compliance-grade REDD+ supply to 2020, referred to as the "credit pipeline."

4.2.1 Total Supply with Issuance Delay and Backdating to 2008

Currently there are a large number of Level II REDD+ activities that have started and are at various stages of implementation but have yet to be verified to enable issuance. To reflect expected rules of emerging compliance markets, the methodology assumes that once the first verification is reached it will issue retro-credits for vintages between 2008-2012.[174] Therefore, the first issuance delivers a higher-than-average annual volume of credits receding to consistent annual volumes through the years 2016-2020. The method seeks to capture the future pipeline of compliance-grade REDD+ credits based on REDD+ activities operating or in advanced stages of development. Figure 5 displays annual credit issuance volumes aggregated from Levels I and II activities from 2013-2020. Table 6 details the volumes for 2013-2020.

[173] 2008 is designated as the first year in which emission reductions could be achieved in response to the Bali Action Plan encouragement of early action in REDD+.
[174] The VCS allows backdating to the commencement of activities, rules under AB32 allow backdating in early action crediting to 2005.

Figure 5: Annual Credit Issuance – Issuance Delay and Backdating to 2008 (tCO2e)

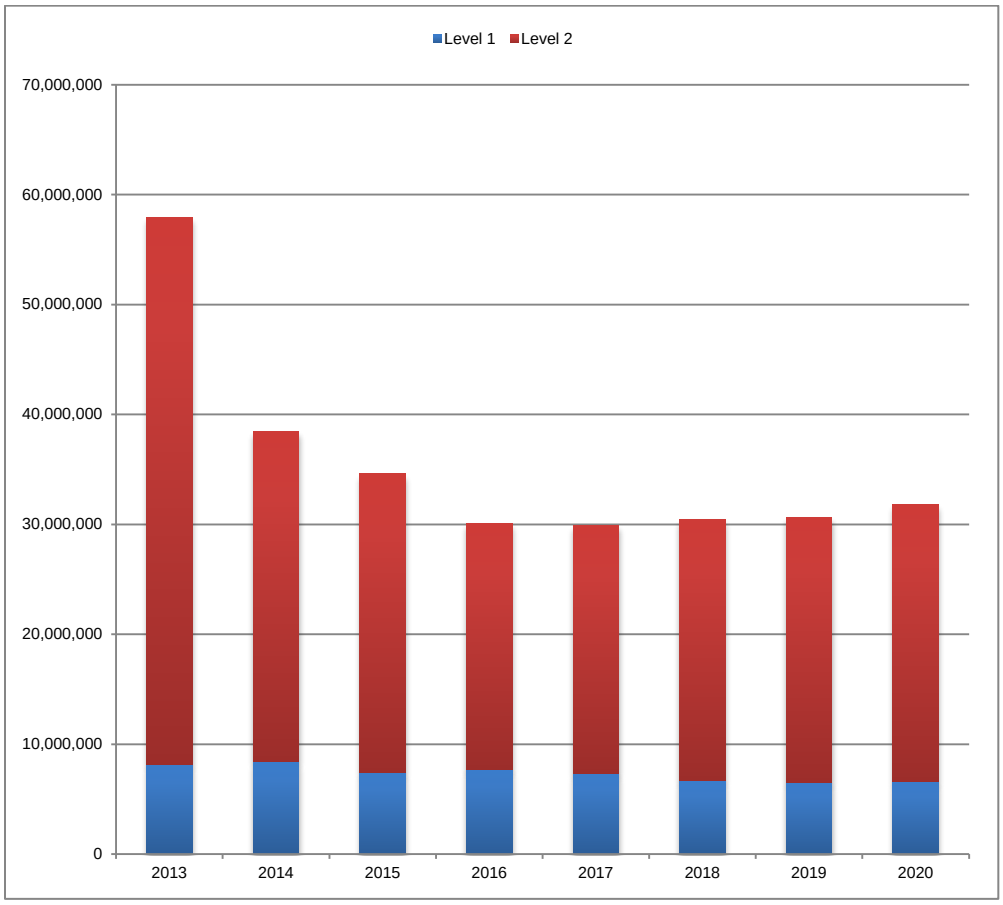


Table 6: Annual Credit Issuance – Issuance Delay and Backdating to 2008 (thousand tCO2e)

Issuance Date	2013	2014	2015	2016	2017	2018	2019	2020	Total Volume 2013-2020
Level I	8,138	8,379	7,372	7,716	7,318	6,671	6,502	6,561	58,656
Level II	49,773	30,108	27,211	22,363	22,618	23,774	24,133	25,252	225,232
Combined	**57,912**	**38,487**	**34,582**	**30,079**	**29,936**	**30,445**	**30,634**	**31,813**	**283,888**

The combined estimate shows total credit volumes of approximately 283 million credits up to 2020, with average annual production just over 32 million credits per year after the initial period of retro-crediting is concluded.

4.2.2 Total Supply with Issuance Delay with No Backdating

When backdating is removed from annual credit volumes, the supply estimates lower by 25 percent. While there is a precedent for allowing retro-credits in emerging compliance markets like California, rules for REDD+ crediting have not been finalized. Figure 6 shows credit issuance levels for Level I and II activities in a scenario where emission reductions are only able to be credited after issuance. Since this scenario will run from 2013 onwards, this also captures the credit pipeline if backdating is only allowed to 2013.

Figure 6: Annual Credit Issuance – Issuance Delay and No Backdating (tCO2e)

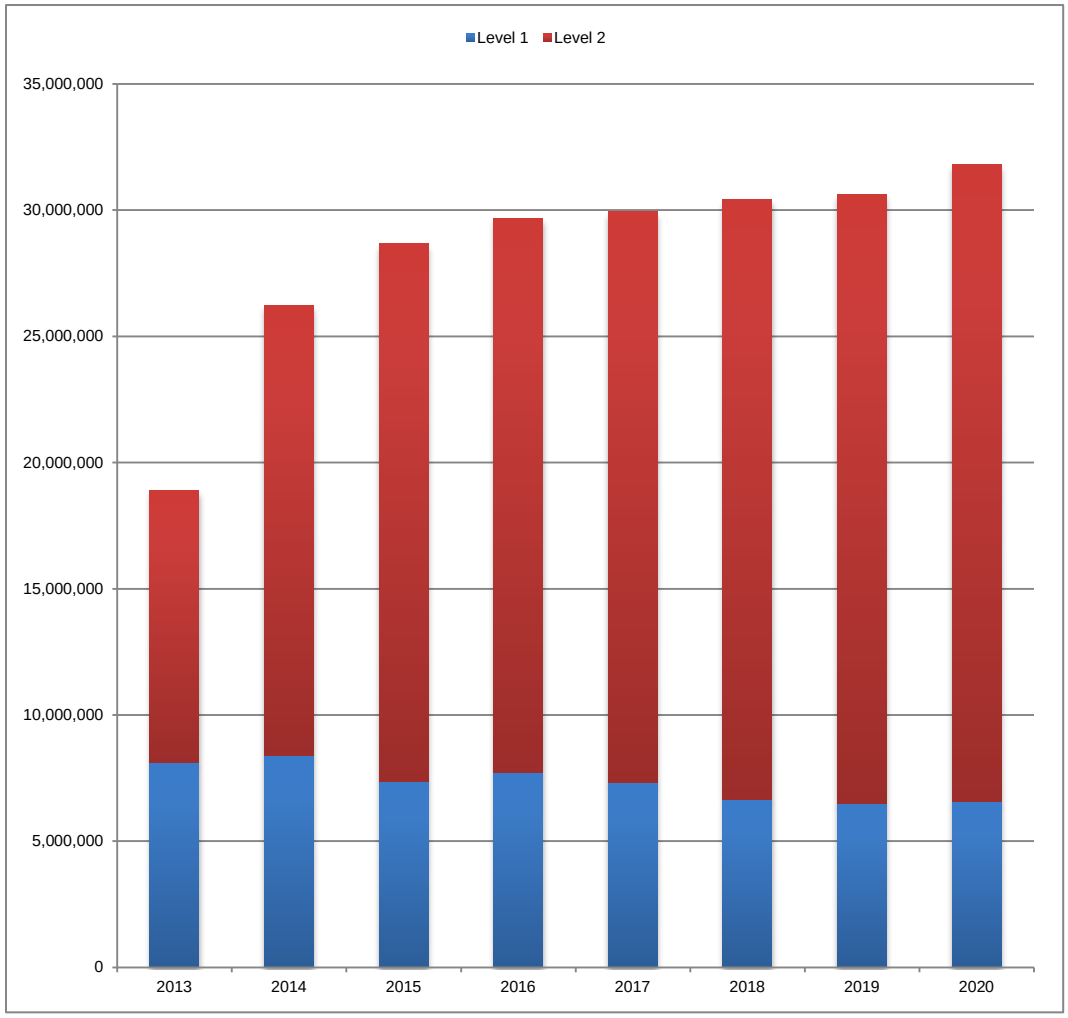


Table 7: Annual Credit Issuance – Issuance Delay and No Backdating (thousand tCO2e)

Issuance Date	2013	2014	2015	2016	2017	2018	2019	2020	Total Volume 2013-2020
Level 1	8,138	8,379	7,372	7,716	7,318	6,671	6,502	6,561	58,656
Level 2	10,748	17,840	21,291	21,969	22,618	23,774	24,133	25,252	167,625
Combined	**18,886**	**26,219**	**28,663**	**29,685**	**29,936**	**30,445**	**30,634**	**31,813**	**226,282**

4.3 SUPPLY ANALYSIS

A dissection of the credit pipeline offers policy makers a better understanding of REDD+ progress to date. The following analysis presents credit issuance estimates from countries, types of REDD+ activities and activities at varying stages of development.

4.3.1 Supply by Country

Estimates of volume by a host country can indicate countries where REDD+ activities are most common. The REDD+ activities recorded in this data set demonstrate that future production is likely to come from 23 different countries. Table 8 shows production volumes from the top 15 countries in the dataset.

Table 8: Credit Pipeline by Country (thousand tCO2e)

	2013	2014	2015	2016	2017	2018	2019	2020	Cumulative 2013-2020
Indonesia	23,351	17,568	18,375	13,343	13,101	13,305	13,602	13,482	126,126
Brazil	13,286	5,078	4,177	4,822	4,520	4,112	4,309	5,129	45,433
Peru	7,337	4,241	4,027	4,195	4,339	4,659	3,964	4,043	36,805
DRC	526	2,807	1,406	1,793	2,067	2,443	2,886	3,281	17,210
PNG	4,306	861	861	861	861	861	861	861	10,334
Cameroon	0	2,446	1,223	1,223	1,223	1,223	1,223	1,223	9,786
Kenya	1,097	1,097	1,097	1,097	1,097	1,097	1,097	1,097	8,776
Madagascar	3,000	578	562	562	562	562	562	522	6,909
Pakistan	0	1,316	676	688	699	711	722	734	5,546
Zimbabwe	356	1,040	386	386	386	386	386	386	3,712
Guatemala	1,166	309	233	233	233	233	233	233	2,870
Cambodia	748	260	233	240	243	253	267	295	2,538
El Salvador	946	150	148	145	142	139	136	133	1,940
Belize	249	113	802	121	105	114	123	134	1,761
Costa Rica	498	83	83	83	83	83	0	0	913

The analysis shows that, as expected, Indonesia will likely produce a significant share of REDD+ credits. The carbon-rich peat forests of Indonesia are a major driver of the country's high share of credit issuance and productivity (credits produced per hectare). For example, Indonesia's credit issuance is derived from 5 million hectares; while Brazil's lower credit volume is produced from over 8.7 million hectares. Despite its high potential, Indonesia only has one project in the data set that has reached validation, and a majority of the entries from Indonesia have yet to receive government approval.

Other than total volume and credit productivity, another key difference in credit issuance from Indonesia and Brazil is the number of REDD+ activities taking place in each country. There are 24 projects and one program in Indonesia, yet despite having larger land area under REDD+ management, Brazil only includes 13 projects and two programs in the data set. This is due to the inclusion of the large Acre jurisdictional program that accounts for 65 percent of the total supply from Brazil.

4.3.2 Supply by Activity Type

The scope of this supply analysis follows the UNFCCC clarification of REDD+ activities set forward at Cancun in 2010, with the exception that A/R projects were not included in the + side. With further detail and interpretation of REDD only activity types based on the VCS typology of emission reduction projects in the forest and land-use sector: Avoided Planned Deforestation (APD), Avoided Unplanned Frontier Deforestation and/or Degradation (AUFD), Avoided Unplanned Mosaic Deforestation and/or Degradation (AUMD), IFM, and Programmatic, which can include a combination of aforementioned activities. Table 9 indicates credit issuance volumes segmented by each of these project types.

Table 9: Credit Pipeline by Activity Type (thousand tCO_2e)

Project Type/Issuance Date	2013	2014	2015	2016	2017	2018	2019	2020	Cumulative 2013-2020
APD	22,499	14,652	17,180	12,012	11,903	11,406	11,704	11,588	112,944
AUFD	6,503	3,307	2,729	2,796	2,921	3,004	2,517	2,944	26,722
AUMD	13,430	17,111	10,617	11,005	11,169	12,042	12,311	13,065	100,750
IFM	8,007	1,771	2,410	1,832	1,903	1,954	2,063	2,176	22,116
Program	7,472	1,646	1,646	2,433	2,040	2,040	2,040	2,040	21,357

These findings indicate that APD activities are producing the largest total number of credits. While APD volumes are comparable to AUMD, APD produces significantly more credits per hectare than other types, particularly when a number of these include peat projects. This is also a function of the high degree of forest-loss under the baseline that is typical in an APD activity area.

4.3.3 Project/Program Size and Supply

The number of credits per project and program was also analyzed in terms of project size. While there was a spread of Level I projects across all sizes, there were a large number of smaller Level II projects. 51 percent of all Level II projects were estimated to issue less than 1 million credits between 2013 and 2020, and 33 percent were estimated to issue between 1 and 6 million credits over this period. The activities characterized as Programs were also not the largest – many Projects were estimated to issue larger volumes of credits than the three programs included in the analysis. See Table 10 for a summary of this analysis.

Table 10: Number of REDD+ projects and programs by volume of credits (million tCO_2e)

Total Issuance	Less than 1 m	1 - 6 m	6 - 11 m	11 – 16 m	16 - 21 m	21 – 26 m	Total
Level 1	1	2	2	0	1	1	7
Level 2 project	36	23	7	3	1	0	70
Level 2 program	0	2	0	1	0	0	3
Combined	**37**	**27**	**9**	**4**	**2**	**1**	**80**

4.3.4 Supply by Carbon Development Stage

Carbon development stages represent the progression of REDD+ activities from project carbon feasibility to verification and issuance of credits under an independent standard. Carbon development is distinct from stages of operational project implementation. Many REDD+ activities are implemented against general concepts of forest conservation or sustainable forest management for the purpose of generating credits, but may not formally prepare technical documents until a later stage, such as the demonstration of activities on the ground.

REDD+ activities are included in this report's data set when they have advanced beyond the concept phase and have progressed to a feasibility assessment by qualified technicians. Therefore, the earliest carbon development stage included in this study is "feasibility in development."

Table 11: Credit Pipeline by Carbon Development Stage (thousand tCO2e)

Carbon Development Stage/Issuance Date	2013	2014	2015	2016	2017	2018	2019	2020	Cumulative 2013-2020
Feasibility in Development	0	585	311	311	316	322	327	332	2,504
Feasibility Complete	15,605	13,690	8,750	8,483	8,092	8,107	8,189	8,202	79,118
VCS/CCB PD in Development	5,877	5,044	2,426	2,374	2,351	2,354	2,357	2,363	25,146
VCS in Validation	3,524	3,882	9,628	4,722	5,258	5,864	6,424	7,013	46,315
CCB in Validation	9,268	2,624	2,433	2,611	2,744	2,853	2,365	2,342	27,240
VCS/CCB in Validation	0	0	0	0	0	0	0	0	0
VCS Validated	3,006	2,928	2,969	2,842	2,753	2,836	2,660	3,050	23,046
CCB Validated	15,064	4,143	3,501	3,693	3,687	4,096	4,279	4,784	43,246
VCS/CCB Validated	3,686	3,450	2,931	2,839	2,766	2,737	2,745	2,414	23,568
Monitoring Underway	436	140	161	168	171	180	192	217	1,665
VCS Verified	349	904	374	938	702	0	0	0	3,267
VCS Verified / CCBA Validated	1,097	1,097	1,097	1,097	1,097	1,097	1,097	1,097	8,776

4.4 SUPPLY FROM JURISDICTIONAL PROGRAMS

Under the threshold for qualification to Level II, activities of either project or program scale were qualified when available documents suggested capacity and resources had been dedicated to planning or preparation of activities at a specific site. This means that only those activities which focused resources and calculated emission reduction potential for a defined area qualified for a dataset. The parameters for this approach were built around current rules in the compliance-grade standards discussed in Section 3, which prescribe methods for accounting emission reductions by monitoring change in carbon stocks of a defined area. Based on this, a

total of three programs were qualified to the Level II dataset (The District of Berau in Indonesia, the State of Acre in Brazil, and the Cotriguaçu pilot in the state of Mato Grosso in Brazil).

Many jurisdictional approaches to REDD+ are currently focused on governance aspects of REDD+, addressing forest security, land-tenure and property rights issues, while also raising capacity in government institutions to manage and protect forests that may be brought under REDD+. Groups such as the Governor's Climate and Forests Task Force (GCF) are multi-jurisdictional collaborations supporting the development of technical, legal and institutional frameworks for programs to implement REDD+ activities at the jurisdictional scale. There are 19 states and provinces in the GCF planning for REDD+, and there are many more district and national governments preparing for REDD+. However, to date only a handful of these programs have regulatory and institutional frameworks to support REDD+ in place. For this reason, estimating future crediting from these efforts is difficult.

The three programs qualified to the Level II dataset represent jurisdictional scale REDD+ activities that are partly operational, or where implementation has been planned in a specific area.[175] The Brazilian State of Acre is one such program.

State of Acre REDD+ Program

Stable leadership, good governance and innovative policies place the State of Acre in a strong position to be one of the first jurisdictions to offer compliance-grade REDD+ credits to international and domestic buyers. The state's REDD+ mechanism is being developed under the Program of Incentives for Environmental Services – Carbon (ISA-Carbon), the primary mechanism of the State's System of Incentives for Environmental Services (SISA) legislation, signed into law in 2010. Governance is based on a multi-stakeholder commission to supervise the program; one government institute for regulation, monitoring and carbon registry; and one agency for environmental services development, private-public business to fundraise and implement the IES Carbon Program.

The implementation strategy of ISA-Carbon Program is to focus limited resources on 5.4 million hectares considered to be under the greatest threat of deforestation. Implementation in these priority areas is considered to have the greatest impact and provides strategic guidance for implementation of REDD+ in subsequent stages.

4.5 GROWING THE SUPPLY PIPELINE

The approach adopted in this paper to build the credit supply pipeline was based on a "bottom-up" assessment of the REDD+ projects and programs that are active and publically documented. Using today's REDD+ activity data to build the future REDD+ supply to 2020 does not take into account the fact that there will be new REDD+ activities targeting compliance-grade markets that are unknown today but will enter the market in the future. The growth in new REDD+ activities is hard to predict because it is dependent on a number of factors, the most critical of which is whether there is demand for the credits.

Pipeline growth needed to meet each of the demand scenarios generated in Section 3 was calculated to be -22 percent (low-end demand), 22 percent (mid-range demand) and 240 percent (high-end demand). For comparison, and to provide additional benchmarks, the average annual growth rate of issued CERs over the last six and three years was calculated to be 116 and 46 percent respectively. Given the 240 percent growth needed to meet the high-end demand (or even 116 percent) may not be feasible for REDD+, a conservative growth estimate that represents a 46 percent growth up to 2020 was used. This growth rate results in 819

[175] Nested projects are able to use existing REDD+ standards for accounting and crediting.

million credits being issued to 2020. Table 12 details the volumes for 2013-2020 to achieve a 46 percent growth rate.

Table 12: Annual Credit Issuance – Issuance Delay and Backdating to 2008 (thousand tCO_2e)

Issuance Date	2013	2014	2015	2016	2017	2018	2019	2020	Total Volume 2013-2020
Combined Level I and II	57,912	73,234	92,422	102,876	116,932	118,846	131,287	125,759	819,269

4.6 COMPARISON TO ECONOMIC MODELS OF SUPPLY

As discussed in the introduction to this section, there are a host of studies aimed at predicting REDD emission reduction potential and credit supply using top-down approaches. The volume estimates from these studies should be treated carefully, as they use coarse data and an often employ a simplified approach to estimating the emission reductions – equating the biophysical potential to store carbon in a given area to emission reductions. In addition, many do not incorporate the practical issues that will affect the actual supply of REDD+ credits, such as setting RELs to determine what fraction of emission reduction potential is eligible to be recognized as an offset or credit. They can also neglect market forces, such as commodities markets, the availability of primary capital to catalyze REDD+ activities, and other governance aspects such as political will and the capacity of institutions to successfully implement REDD+ activities. However, with adjustments to account for risks and obstacles to implementation, these tools can provide a glimpse of the potential of emission reductions in forests over the medium- to long-term, and offer useful comparison to the results of this report's empirical approach.

The following analysis presents supply estimates from two global economic models, the Forest Carbon Index (FCI)[176] and OSIRIS for the period 2013-2020, as presented in a series of policy publications which analyze outputs of these models and apply adjustment to try and account for a number of the issues above plus various risks.[177] Table 13 and Figure 7 present volume estimates from a selection of scenarios defined in these studies. The scenarios include the full technical REDD+ credit supply potential and a set of adjustments to full potential through discounts to capture the risks and limitations of REDD+ implementation. The far right two columns of Table 13 display the difference between the projections of the global economic models and FCMC's empirical model with retro-crediting. OSIRIS is excluded from Figure 7 as the volumes predicted under OSIRIS dwarf the other models.

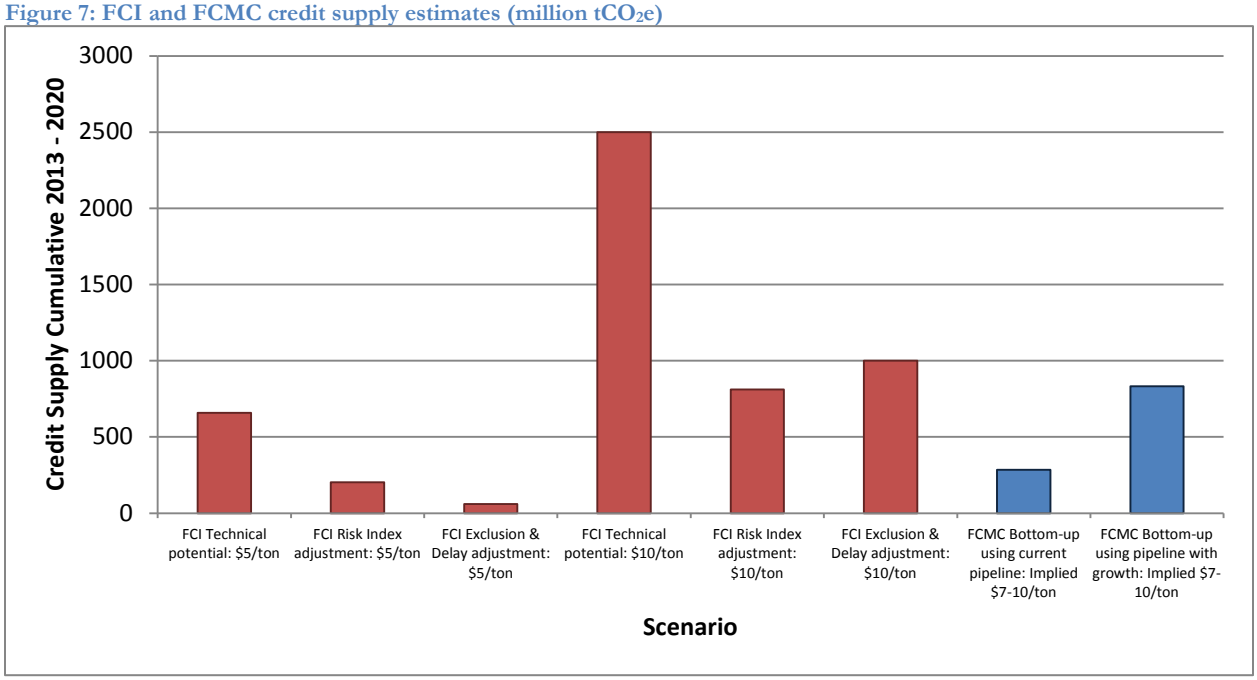
[176] The Forest Carbon Index is a GIS-based model developed by Resources for the Future and Climate Advisers that calculates the global potential to generate emission reductions from stopping or slowing deforestation. More information can be found at: http://www.forestcarbonindex.org/

[177] Coren, M., Streck , C., Madeira, E. 'Estimated supply of RED credits 2011–2035', Climate Policy, 11:6, 1272-1288.

Table 13: Top-down vs. FCMC credit supply estimates (million tCO_2e)

Model	Scenario	Price	Credit Supply Cumulative 2013 - 2020	Difference to FCMC bottom-up no growth	Difference to FCMC bottom-up with growth
FCI	Technical potential	$5 / ton	658	374	-175
FCI	FCI Risk Index adjustment	$5 / ton	202	-82	-631
FCI	Exclusion & Delay adjustment	$5 / ton	59	-225	-774
FCI	Technical potential	$10 / ton	2,500	2,216	1667
FCI	FCI Risk Index adjustment	$10 / ton	812	528	-21
FCI	Exclusion & Delay adjustment	$10 / ton	1,000	716	167
OSIRIS	Exclusion & Delay adjustment	Price path	23,200	22,916	22,367
FCMC Bottom-up	This study using current pipeline	Implied $7-$10 / ton	284	0	-549
FCMC Bottom-up	This study using pipeline with growth	Implied $7-$10 / ton	833	549	0

Figure 7: FCI and FCMC credit supply estimates (million tCO_2e)



Description of adjustments: The adjustments applied to the global economic models each intend to capture the limitations on credit issuance posed by political and technical capacities at the country level. The FCI Risk Index adjustment applies discounts to regional credit issuance based on published indicators of a country's

quality of governance, ease of doing business and conditions for investment.[178] The Exclusion & Delay adjustment considers technical and political capacity, and is based on a combination of World Bank development statistics, a country's political position towards REDD+, progress in readiness processes, technical capacity and governance.[179]

4.7 SUMMARY & CONCLUSIONS

Since the call for early action at COP 13 in Bali, numerous REDD+ activities have commenced around the globe. Today these early REDD+ activities offer high-quality, site-specific data indicating the emission reductions and credit issuance potential of REDD+. There are also a small number of jurisdictional programs that are moving toward compliance-grade issuance. This report collected data from a selection of public sources and verified it with operators of REDD+ activities. The result is an empirical model of the pipeline of compliance-grade REDD+ credits to be issued from activities in operation or late stages of planning. This model offers the market its first accurate short- to medium-term view of supply. The bottom-up approach is generally preferred in macro quantitative analysis because it is able to incorporate political, financial and implementation realities afflicting the market.

The method for gathering and screening data resulted in 79 different REDD+ activities included in two data sets, Level I and II data. To reflect current rules of pre-compliance and emerging compliance markets, the methodology outlined in Section 4.1 and Appendix II assumes retro-crediting allows for inclusion of verified project activities in vintages from 2008. This method is considered to most accurately capture the future pipeline of compliance-grade REDD+ credits based on REDD+ activities operating or in advanced stages of development. The results indicate cumulative issuance for the period 2013-2020 will be approximately 283 million credits, with average production over this eight year period at over 35 million credits per year. The analysis suggests that Indonesia will produce a significant share of REDD+ credits, as its carbon-rich peat forests allow for very high credit productivity (credits produced per hectare). As this empirical model relies on the existence of site specific REDD+ activities, the expansion of the pipeline at new sites was overlaid using the average annual growth of CER issuance over the last three years. This expansion will results in 819 million tCO_2e to 2020, which is only likely if demand forces purchase (either through markets or other payment for performance mechanisms) emission reductions at their production costs or higher.

Comparative analysis of alternative, top-down approaches to forecasting emission reduction potential from REDD offers a comparison to the supply estimates found in this report. A selection of emission reduction volume estimates derived from global economic models was gathered from scientific and policy literature. The estimates gathered for comparative analysis using top-down models of theoretical supply suggest that emission reduction potential for the 2013-2020 period may be in the range of 59 million to 23 billion tCO_2e, with the high end representing biophysical potential rather than feasible supply. Estimates produced under the FCI model with risk adjustments have the lowest difference to the pipeline volumes produced in this report. Assuming a $10 credit price, the FCI model estimates 812 million tCO_2e will be produced over the period 2013-2020, which is very close to the 833 million tCO_2e from this study's bottom-up approach when the growth rate is applied.

The empirical method applied in this report does not include A/R and may not have captured every project or program to come online in the next eight years, but the credit volume estimates represent a conservative estimate of potential volume of REDD+ credits flowing to the market. This projection provides an important element in the assessment of the REDD+ market system and its ability to attract primary capital from the private sector.

[178] Madeira, E., Coren, M., Streck, C., 'The Feasible Supply of RED Credits: Less than Predicted by Technical Models', Resources for the Future, Issue Brief, November 2010.
[179] For more information and detail to the method for calculating the adjustment, see source: Coren, M., Streck , C., Madeira, E. 'Estimated supply of REDD credits 2011–2035', Climate Policy, 11:6, 1272-1288.

5.0 REDD+ MARKET OUTLOOK

This section provides some further analysis on the supply and demand findings and conclusions. It examines the relationship between anticipated demand and anticipated supply, noting strengths and limitations in the analysis and findings, and offering some concluding analysis.

5.1 ANALYSIS OF DEMAND AND SUPPLY

The sources of demand for REDD+ credits that are quantified in this report can be grouped into four distinct segments:

i) International and domestic markets driven by an operational REDD+ market under the UNFCCC. This includes sovereign demand from a new UNFCCC agreement along with domestic schemes that will create a demand for offset credits to meet regulated market mechanisms linked to the UNFCCC, such as those found in Australia and New Zealand. In these countries, REDD+ is *prima facie* eligible, but in order to operationalize additional progress is needed under the UNFCCC. It could also include initiatives such as Japan's bilateral mechanism.

ii) Initiatives motivated by piloting or demonstration activities in advance of a fully operational market mechanism for REDD+ under the UNFCCC. This includes initiatives that create results-based demand for emission reductions, but may or may not result in transactions of credits used for compliance. This could include the FCPF and Germany's REDD+ Early Movers program. Norway's bilateral initiatives could also fall into this category, noting however that Norway will not be purchasing any credits, but rather paying countries to reduce their emissions.

iii) Compliance markets not directly linked from the UNFCCC. This group is currently limited to California. However, while REDD is *prima facie* eligible, additional rule making is needed by the Californian regulators to create compliance driven demand.

iv) Voluntary markets. This can include purely voluntary transactions, along with pre-compliance demand, which may have some overlap with groupings i) and iii).

In addition to these four groupings, there are two important potential sources of demand that could not be quantified:

v) Sovereign demand under the Kyoto Protocol's second commitment period resulting from a UNFCCC agreement on REDD+. While this may create some demand, a number of key countries have not agreed to a second commitment period so it will not be as significant as demand expected from a future UNFCCC agreement.

vi) Nascent domestic schemes that may create demand in the future (which may or may not be linked to the UNFCCC), but are insufficiently developed to assess demand or place in a particular group. This includes a number of emerging state level programs in Brazil, Canada, China and the US.

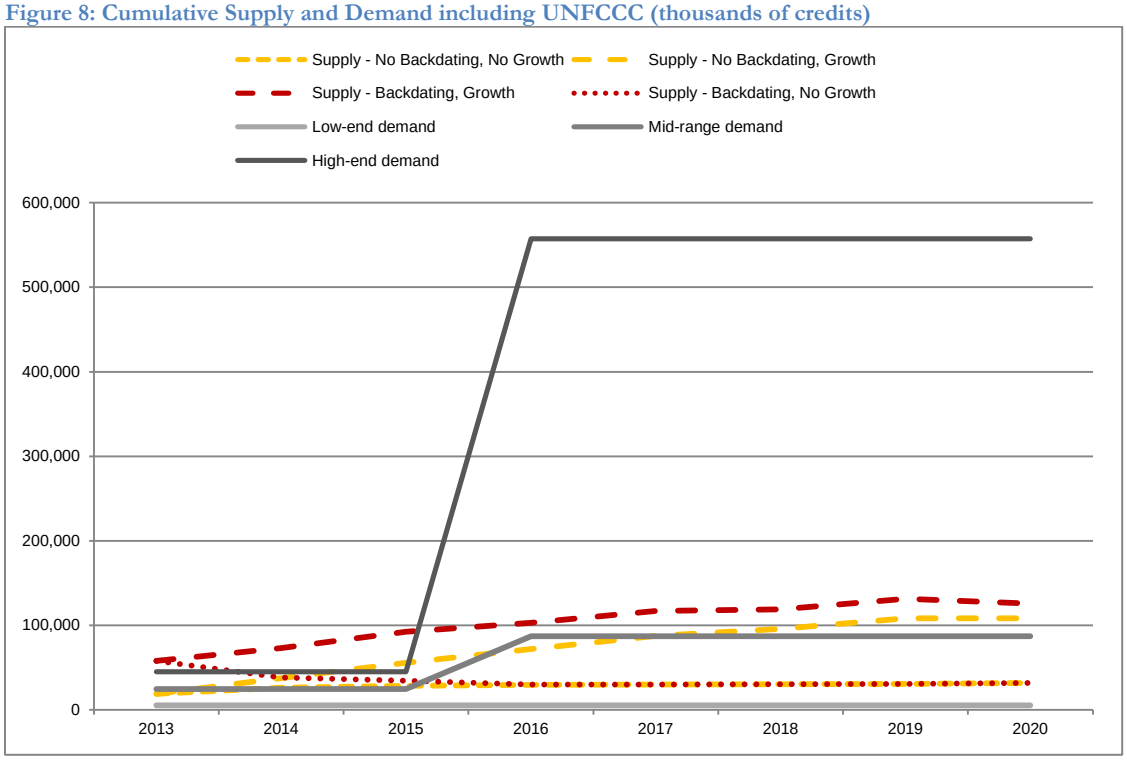
Given the significant demand a future UNFCCC agreement may generate, and the uncertainty around both the timing and rules of such an agreement, it is illustrative to show analysis with and without this source of demand.

The supply analysis in this report focused on supply from compliance-grade projects and programs currently under development using the VCS. Some of this supply will certainly be matched by some of the demand

segments described above. However, while a simple comparison of aggregate supply against aggregate demand has some utility, it is also challenging as it contains a number of limitations.

While there can be certainty over the quality of credits generated under the VCS, determining eligibility criteria for each of the demand segments is currently impossible. The only segment of demand where the eligibility criteria is currently known is the voluntary market – no other demand mechanism has developed its rules or criteria for recognizing REDD+ credits yet.[180] This makes it impossible to determine which fraction of the supply estimated in this report will in fact comply with most of the standards and eligibility criteria set in the demand side of the equation.[181] As a result, there may be some segments of the REDD+ market where demand exceeds supply, whereas other segments of the market may be oversupplied. Given differences in eligibility rules, a fragmented market may persist if REDD+ credits are not fungible across all market segments. This, however, is not a fatal flaw that prevents further comparative analysis of supply and demand dynamics – the potential to generate credits under a compliance-grade voluntary standard is a useful indicator of the potential to also generate credits under any similarly rigorous compliance standard. The following analysis that compares potential supply to potential demand therefore comes with the caveat that the current state of the market does not allow for an easy comparison of the supply and demand findings. The analysis is presented using an assumption that compliance-grade supply is a useful indicator to assess potential supply that could be matched with demand from emerging markets. The cumulative credit supply from the empirical study is charted alongside cumulative anticipated demand levels in Figure 8 and 9 below, with Figure 8 showing the relationship including UNFCCC demand and Figure 9 without it.

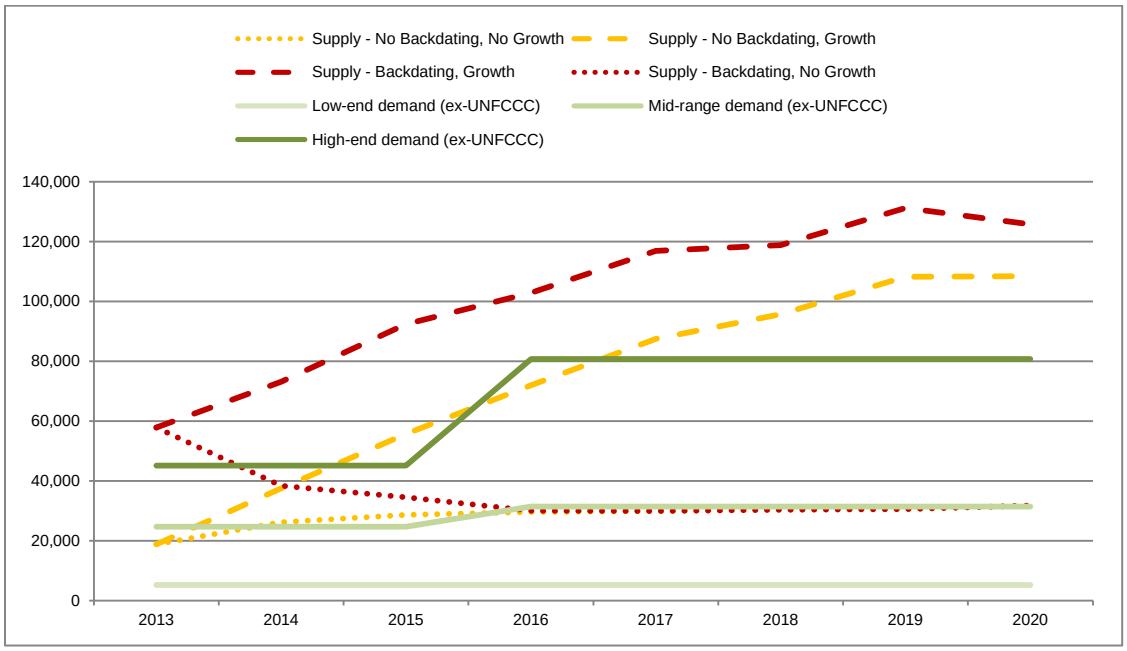
Figure 8: Cumulative Supply and Demand including UNFCCC (thousands of credits)



[180] For example, determining the scope of REDD+ activities eligible on the demand side is currently impossible. California will likely limit eligibility to credits from sectoral REDD activities - i.e. excluding activities falling under the + side, which may potentially exclude international A/R activities, and excluding stand-alone projects. It is unclear whether this will also be the case in Australia and New Zealand (which currently exclude CDM A/R credits) or the other sources of demand. The supply focuses on project based REDD. If the demand criteria requires credits from program or subnational activities, or does in fact include A/R under REDD+, direct comparisons to the supply estimates become problematic.

[181] An additional caveat is that of scale – the current supply pipeline is dominated by projects and there is little experience in assessing supply potential from sub-national or jurisdictional programs if this scale is required by sources of demand.

Figure 9: Cumulative Supply and Demand - excluding UNFCCC demand (thousands of credits)



5.2 CONCLUSIONS

To improve understanding of the current state of the REDD+ market, this report provides a projection of potential credit supply and probable scenarios of demand. As depicted in Figures 8 and 9, assumptions used in this report's modeling of REDD+ credit supply and demand suggests that between 2016 and 2020 demand could significantly exceed the estimated credit supply – if there is an ambitious UNFCCC agreement that allows for prompt start for REDD+. If UNFCCC demand is moderate or absent there is potential oversupply based on projections of supply growth. If no supply growth is assumed in these scenarios, the current pipeline may not produce sufficient supply, indicating supply and demand dynamics have the potential to balance with only weak growth in supply.

The low-end estimates of demand will result in significant oversupply of the current pipeline from 2013-2020, the mid-range demand estimates predict oversupply from 2013-2015, and high-end demand estimate predicts oversupply in 2013 and potentially 2014, depending on growth. The scale of the market imbalance in the low-end scenario would pose dire consequences for current REDD+ operators seeking to generate revenues or exit investments through credit sales in the end-market. Insufficient demand in the end-market would translate to a deflated price of REDD+ credits through the period of oversupply. Given the long-term cash-flow structure of REDD+ activities, an illiquid secondary market and deflated prices means that revenues from credits sales may not cover activity operating (production) costs. This places the project or program at risk of insolvency and heightens the risk to the primary capital investment. Prolonged periods of negative cash flows may push many REDD+ stakeholders to turn to other means of revenue creation – in cases of forest use or extraction of forest products this may equate to the abandonment of REDD+ in favor of converting previously protected forests to other land uses. Clearly, such oversupply would be counter-productive in the eyes of regulators responsible for market design: the resulting low carbon price would fail to stimulate low carbon investment.

Another gloomy consequence if the REDD+ credit market were to be oversupplied, is the heightened risk to the sector of not being able to produce a risk-adjusted return that would lead to the unavailability of the primary capital needed to fund REDD+ startup costs. When investors do not have a means to recoup primary capital investments through credit sales, there will be no willingness to lend/invest and limited

opportunities to pre-sell credits. In this case, the means for primary capital procurement would be through conservation-based grants and other forms of public finance. To sustain REDD+ activities during periods of oversupply, increases to bilateral funding and development of additional performance-based compensation vehicles may be relied upon to absorb excess supply and buoy the market for REDD+ credits.

On the bright side, progress in the design of a future UNFCCC REDD+ mechanism and certainty surrounding a market-based approach would spark demand and likely enable the market to sustain periods of oversupply. A positively sloping price curve, where demand is expected to outpace supply in the future, sends a signal to the market that prices will be higher in the future, and therefore incentivizes purchases at today's lower levels. Under compliance programs where banking is allowed this strategy enables entities to build a supply of credits for use in the future when prices are attractive. Data and assumptions used in the analysis also indicate an ambitious agreement is warranted. The Copenhagen Accord pledges were used to calculate potential UNFCCC demand, and the pledges are known to be insufficient to mitigate a high risk of 2°C warming. The pledges represent anywhere between a 5,000 – 9,000 million tCO_2e emissions gap between what is pledged and what is needed by 2020. Given this gap – and the need to find additional reductions – there should be ample scope for a robust market mechanism for REDD+.

The main findings of the analysis are clear, but not surprising: Demand for REDD+ credits will be relatively weak relative to potential supply without an agreement under the UNFCCC, even though programs in Australia, Japan and California could promote some meaningful demand. If the Parties reach an ambitious agreement in 2015 that does not allow for a prompt start for a REDD+ mechanism, or reaches a modest agreement that does not have a meaningful role for REDD+, demand will remain weak through to 2020. A lack of strong demand until after 2020 could cause financial harm to governments, local communities, civil society and the private sector already engaging in REDD+ activities, and political fallout within countries engaged in REDD+ readiness activities and looking for signs that a REDD+ market is real. There are two ways to avoid this risk – develop new performance-based compensation vehicles for the 2013 – 2020 period and increase bilateral funding, and/or ensure an ambitious UNFCCC agreement is reached that includes a prominent role for REDD+ markets with prompt start provisions.

APPENDIX I: ADDITIONAL EMERGING COMPLIANCE PROGRAMS

1.1 NATIONAL AND REGIONAL COMPLIANCE PROGRAMS

1.1.1 United States of America

The House of Representatives approved the American Clean Energy and Security Act (Waxman-Markey Bill) in June 2009. Parallel legislation in the Senate, the Clean Energy Jobs and American Power Act (Kerry-Boxer Bill), was approved by the Senate Environment and Public Works Committee in November 2009, but was never brought to the floor for a vote due to Republican opposition.

Both pieces of legislation were based on market-based cap-and-trade systems. Should this kind of legislation be passed in the US, the value of the resulting markets has been estimated at $65-130 billion by 2015,[182] and forest and land-use carbon was expected to play a significant role. The Kerry-Boxer bill targeted 720 million tons of annual emission reductions from deforestation in developing countries by 2020.[183]

The US EPA has taken a position that GHG emissions pose a health threat and, under the 2009 Clean Air Act (CAA), it has powers to set standards for large sources and suppliers in the United States.[184] Environmental Protection Agency (EPA) regulation can be seen as a "plan B" to US Federal legislation and may in the future, directly or indirectly, lead to demand for credits.

REDD+ demand
To date, a carbon price mechanism or emissions trading program has not been created. Hence, demand for international forest carbon credits over the period 2013-2020 cannot be determined.

1.1.2 Regional Greenhouse Gas Initiative (RGGI)

The RGGI is a collaboration among nine northeastern states to limit emissions from large power plants via a cap-and-trade program. The program held its first auction of allowances in 2008. As the program is oversupplied with allowances, prices languish around the auction floor price of $2 per credit. Lacking a stronger price signal, no credits have been created. However, the program includes provisions for credits.

A compliance entity can meet up to 3.3 percent of its compliance obligation with credits (and 5 percent or 10 percent if allowance prices reach certain thresholds). Five credit types are allowable, one of which is afforestation. As afforestation projects need only to be on lands without forest cover for ten years, what other programs term "reforestation" falls within the RGGI definition of "afforestation." All credits must be generated in RGGI member states, precluding the possibility of international REDD+ credits.[185]

[182] Nicholas Institute for Environmental Policy Solutions (February 2011). *Demand for REDD Carbon Credits: A Primer on Buyers, Markets, and Factors Impacting Prices,* accessed July 12, 2011 at http://nicholasinstitute.duke.edu/economics/naturalresources/demand-for-redd-carbon-credits
[183] The full Bill can be accessed at Govtrack, available at http://www.govtrack.us/congress/bill.xpd?bill=s111-1733
[184] EPR (2011), accessed July 18, 2011 at http://www.epa.gov/climatechange/emissions/ghgrulemaking.html
[185] "CO_2 Credits" *Regional Greenhouse Gas Initiative website.* RGGI Inc. n.d, accessed May 28 ,2012 at http://www.rggi.org/market/credits

REDD+ demand
International credits are not allowed.

1.1.3 Western Climate Initiative (WCI)

The WCI is comprised of one US state and four Canadian provinces that have signed agreements to use a market-based approach to reduce GHG emissions to 15 percent below 2005 levels by 2020. On December 14, 2011, Quebec confirmed that it had adopted a cap-and-trade regulation that would link with California, with obligations coming into force on January 1, 2013.[186] British Columbia, Ontario and Manitoba are anticipated to join after the program starts. California is the lone US state proceeding with WCI's cap-and-trade program. ARB states that the program has been designed for linkage with other programs, and on May 9, 2012, ARB released draft regulations to link California's program with Quebec's. The draft regulations will need to go through the same 45-day public comment period as other regulations and were considered for approval at ARB's regular meeting on June 28, 2012.[187] As of October 2012, the regulations are awaiting sign off by the California Governor to make the link operable. As proposed, the regulation would allow California covered entities to submit for compliance allowances and credits issued by the government of Quebec,[188] and would incorporate various other measures to harmonize standards, enforcement and market security.[189] On May 23, 2012, a California Senate budget subcommittee attached a measure to postpone linkage with Quebec to November 30, 2013, unless the legislature approves linkage sooner. Subcommittee chair Senator Joe Simitian emphasized that the move was to ensure proper evaluation and oversight, rather than to hinder California's climate initiatives.[190]

Quebec is the only other WCI jurisdiction aiming to begin its compliance obligation on January 1, 2013. Quebec and California regulators have worked to ensure that the programs are aligned in order to facilitate linkage. Although it is generally expected that Quebec and California will mutually recognize each other's credits, Quebec regulators have yet to announce project types for which they may issue credits.

REDD+ demand
The World Bank estimates that a full WCI operation would lead to a total potential forest carbon credit demand of 94 million credits during the 2013-2020 period. The potential levels and sources of demand from the participants of the WCI are addressed individually.

1.2 SUB-NATIONAL COMPLIANCE PROGRAMS (ANNEX I COUNTRIES)

1.2.1 Alberta (Canada)

The Canadian province of Alberta launched North America's first market-based regulatory program for GHG in July 2007. The program does not impose an absolute cap on emissions, but rather mandates reduced

[186] Government of Quebec (December 2011). *Cap and Trade System for Greenhouse Gas Emissions Allowances,* accessed April 16, 2012 at http://www.mddep.gouv.qc.ca/changements/carbone/Systeme-plafonnement-droits-GES-en.htm
[187] California Environmental Protection Agency. Air Resources Board. "Air Resources Board Announces Release of Draft Regulations for Cap-and-Trade Linkage with Québec." May 9, 2012, accessed May 27, 2012 at http://www.arb.ca.gov/newsrel/newsrelease.php?id=300
[188] California Environmental Protection Agency. Air Resources Board. "Proposed Amendments to the California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms to Allow for the Use of Compliance Instruments Issued by Linked Jurisdictions, Staff Report: Initial Statement of Reasons, Appendix A.2: Proposed Regulation Order for Linkage" Section 95943: Linked External GHG ETS, p. 76. 9 May 2012, available at http://www.arb.ca.gov/regact/2012/capandtrade12/appendixa2.pdf
[189] California Environmental Protection Agency. Air Resources Board. "Air Resources Board Announces Release of Draft Regulations for Cap-and-Trade Linkage with Québec." May 9, 2012, accessed May 27, 2012 at http://www.arb.ca.gov/newsrel/newsrelease.php?id=300
[190] Point Carbon. "California lawmakers seek delay to Quebec ETS link." *Carbon Market North America.* May 25, 2012, available at http://www.pointcarbon.com/polopoly_fs/1.1907267!CMNA20120525.pdf

emissions intensity. While there is no limit on the number of credits that can be used for compliance, only credits generated in Alberta are allowed.[191] Thirty-five credit project types are recognized, including "Direct Reductions in Greenhouse Gas Emissions Arising from Changes in Forest Harvest Practices." There is also an afforestation protocol, though it currently has been retracted for revisions.[192] Regulators are evaluating changes to pricing, emissions intensity targets and scope of coverage;[193] they are not known to be looking at inclusion of international forestry credits.

Demand for non-Annex I forest carbon credits
The scheme does not allow use of international credits.

1.2.2 British Columbia (Canada)

British Columbia passed its Greenhouse Gas Reduction Targets Act in November 2007, mandating the province reduce its emissions 33 percent below 2007 levels by 2020 and 80 percent by 2050. The law also required the government achieve carbon neutrality by 2010.[194] This requirement of the public sector has been achieved through the use of credits. The Pacific Carbon Trust, a government-owned corporation established to source credits, sells them to governmental agencies and others at a government-set price of $\$25/tCO_2e$.[195] Credits must be generated within British Columbia and can span a range of project types, including forestry.[196] According to Pacific Carbon Trust's database, its two largest projects were both "improved forest management" projects.[197]

British Columbia has yet to set a cap on industrial emissions, as planned under its WCI participation.[198] It is not clear when the province will advance its involvement in the regional cap-and-trade system. The government is also undertaking a comprehensive review of its carbon tax to evaluate the effects it has had across all sectors of the economy.[199] Surveys indicate substantial public backing for the province's climate change initiatives: 54 percent support the carbon tax and 70 percent believe their province should be a leader in emission reductions.[200] Amid current discussions, there has been no mention of including international REDD+ credits.

Demand for non-Annex I forest carbon credits
Inclusion of international credits has not been discussed.

[191] "ETS Design: Alberta." *Point Carbon.* n.d., accessed May 25, 2012 at http://www.pointcarbon.com/research/marketsoverview/marketsaroundtheworld/design/ab/
[192] Environment Alberta Website, Credit Credit System Protocols, Accessed November 2012 at: http://environment.alberta.ca/02275.html
[193] "Alberta mulls changes to CO2 rules." *Point Carbon.* n.d., accessed May 25, 2012 at http://www.pointcarbon.com/news/1.1895718?date=20120515&sdtc=1
[194] Government of British Columbia. *Climate Action Plan.* June 2008. 13, available at http://www.livesmartbc.ca/attachments/climateaction_plan_web.pdf
[195] "Frequently Asked Questions: Buying Credits from Pacific Carbon Trust." *Pacific Carbon Trust.* n.p. n.d., accessed May 27, 2012 at http://www.pacificcarbontrust.com/footer-links/frequently-asked-questions/
[196] Peters-Stanley, Molly. *Bringing It Home: Taking Stock of Government Engagement in the Voluntary Carbon Market.* Forest Trends' Ecosystem Marketplace, March 2012, available at http://www.forest-trends.org/documents/files/doc_3113.pdf>
[197] "Credit Showcase." *Pacific Carbon Trust.* n.p. n.d., accessed May 27, 2012 at http://www.pacificcarbontrust.com/our-projects/credit-showcase/
[198] Holmes, Miranda. *All Over the Map 2012: A comparison of provincial climate change plans.* David Suzuki Foundation, March 2012, available at http://www.davidsuzuki.org/publications/downloads/2012/All%20Over%20the%20Map%202012.pdf
[199] Schultz, Stacey. "British Columbia Rethinks Its Pioneering Carbon Tax." *National Geographic* May 3, 2012, accessed May 27, 2012 at http://news.nationalgeographic.com/news/energy/2012/05/120503-british-columbia-reviews-carbon-tax/
[200] "We have a winner: British Columbia's carbon tax woos skeptics." *The Economist* July 21, 2011, accessed May 27, 2012 at http://www.economist.com/node/18989175

1.2.3 Manitoba (Canada)

A 2006 MOU between Manitoba and California stated that Manitoba would consult with ARB and the California Climate Action Registry, and that the Manitoba intended to adopt legislation to enable carbon credit trading.[201,202] In 2007, Manitoba and British Columbia established an MOU pledging cooperation in designing a market-based mechanism for participation in WCI.[203] Manitoba passed legislation in June 2009 setting an emissions reduction target of 6 percent below 1990 levels by the end of 2012 and authorizing the creation of regulations "respecting the use of economic and financial instruments and market-based approaches directed to reduce emissions or achieve an emissions reduction target established under this Act."[204] To date, the regulation to create a cap-and-trade system has not been established.

Given that the cap-and-trade program has not been further developed, there is no information on the parameters of a credit program, the types of credits that may be allowed or the role forestry credits might play. The MOU with California specified interest in exploring credit opportunities from "sustainable on-farm practices" and livestock management."[205] The government has developed a voluntary, and reportedly underfunded, program to reduce farm-based emissions (such as changing practices for manure storage, fertilizer application, and tillage). In addition, the government has established a regulation requiring methane capture at the province's three largest landfills and, in December 2009, publicly committed to creating a stewardship strategy for boreal peatlands.[206]

Demand for non-Annex I forest carbon credits
The program has not been developed to date, so there is no immediate potential demand for international forest credits.

1.2.4 Ontario (Canada)

Ontario passed legislation in December 2009 to enable the creation of a cap-and-trade system.[207] However, the government has not yet launched the program citing inadequate emissions data. The Ontario government has also backed out of the original January 2012 start date for the linked WCI program, and has not set a new date to join. Despite this, Ontario Premier Dalton McGuinty reaffirmed his support for cap-and-trade during the fall 2011 election.[208]

As the legislation enables "instruments to be created by or in accordance with the regulations and governing the creation of those instruments," it may allow for credits if they are considered an "instrument."[209] No further information is available on the parameters of a credit program, the types of credits that may be allowed or the role forestry credits might play.

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[201] "Leading the Way on Climate Change" *Climate and Green Initiatives.* Manitoba Government. n.d., accessed May 28, 2012 at http://www.gov.mb.ca/conservation/climate/mb_doing/lead_way.html

[202] *Memorandum of Understanding between the Province of Manitoba, Canada, and the State of California, United States of America.* December 2006, available at http://www.gov.mb.ca/asset_library/en/premier/mou_california.pdf

[203] "Leading the Way on Climate Change" *Climate and Green Initiatives.* Manitoba Government. n.d., accessed May 28, 2012 at http://www.gov.mb.ca/conservation/climate/mb_doing/lead_way.html

[204] Government of Manitoba. "The Climate Change and Emissions Reductions Act," May 25, 2012, accessed May 28, 2012 at http://web2.gov.mb.ca/laws/statutes/ccsm/c135e.php?ccsm=c135

[205] *Memorandum of Understanding between the Province of Manitoba, Canada, and the State of California, United States of America.* December 2006, available at http://www.gov.mb.ca/asset_library/en/premier/mou_california.pdf

[206] Holmes, Miranda. *All Over the Map 2012: A comparison of provincial climate change plans.* David Suzuki Foundation, March 2012, available at http://www.davidsuzuki.org/publications/downloads/2012/All%20Over%20the%20Map%202012.pdf

[207] Ontario government. "McGuinty Government Paves The Way For Future Cap-And-Trade System." December 3, 2009, accessed May 28, 2012 at http://news.ontario.ca/ene/en/2009/12/reducing-greenhouse-gas-emissions.html

[208] Holmes, Miranda. *All Over the Map 2012: A comparison of provincial climate change plans.* David Suzuki Foundation, March 2012, available at http://www.davidsuzuki.org/publications/downloads/2012/All%20Over%20the%20Map%202012.pdf

[209] Legislative Assembly of Ontario. "Bill 185, Environmental Protection Amendment Act (Greenhouse Gas Emissions Trading), 2009," n.d., accessed May 28, 2012 at http://www.ontla.on.ca/web/bills/bills_detail.do?locale=en&Intranet=&BillID=2195

Demand for non-Annex I forest carbon credits
Forest credit inclusion has not been determined.

1.2.5 Oregon (USA)

Oregon was an original participant in the WCI. In 2011, Oregon was forced to withdraw because it failed to pass cap-and-trade legislation, therefore becoming incompatible with WCI modalities. The state still has pending legislation addressing climate change and requires emission reductions through the Oregon Carbon Dioxide Standard. The standard requires that all new power plants in the state mitigate or credit a portion of their carbon dioxide emissions. This can be met by paying a state-recognized non-profit to acquire and retire the credits. The Climate Trust was established in 1997 for this very purpose and it manages the credit obligation for all five regulated facilities.[210] For the 2011 compliance year, The Carbon Trust purchased 73,225 tCO_2e.[211] As of May 28, 2012, the organization's website states that it currently has $6 million available to purchase credits for Oregon plants.[212] For Oregon compliance, The Climate Trust is currently targeting purchase of credits from domestic forestry and soil carbon sequestration projects.[213]

Demand for non-Annex I forest carbon credits
There is no current focus for international credits.

1.2.6 Quebec (Canada)

The Quebec Climate Change Plan (CCAP) to 2020 is the successor to an earlier plan launched in 2006, which was a major step forward in climate change leadership. The CCAP 2020 includes new measures and will enable Quebec to achieve their target to reduce emissions 20 percent below 1990 levels. The CCAP includes a cap-and-trade program which will commence in 2013 and will cover about 75 industrial and power facilities.

The provisions dealing with credits are modeled from the California program, with a limit set at 8 percent of compliance obligations for each compliance period. California ARB staff recently outlined reasons for the proposed regulation to link with Quebec, indicating which credit protocols Quebec regulators will likely consider issuing. There is no mention of forestry protocols.[214] In the absence of Quebec-issued forestry credits, and subject to any linking rules, forestry credits may be able to reach Quebec compliance entities via the California program – either as US domestic forestry credits or international REDD+ credits.

Demand for non-Annex I forest carbon credits
Forest credit inclusion has not been determined.

[210] *The Climate Trust website.* The Climate Trust, accessed May 28 ,2012 at www.climatetrust.org
[211] Peters-Stanley, Molly. *Bringing It Home: Taking Stock of Government Engagement in the Voluntary Carbon Market.* Forest Trends' Ecosystem Marketplace, March 2012, available at http://www.forest-trends.org/documents/files/doc_3113.pdf
[212] *The Climate Trust website.* The Climate Trust accessed May 28, 2012 at www.climatetrust.org
[213] *The Climate Trust website.* The Climate Trust, accessed May 28, 2012 at www.climatetrust.org
[214] California Environmental Protection Agency. Air Resources Board. "Proposed Amendments to the California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms to Allow for the Use of Compliance Instruments Issued by Linked Jurisdictions, Staff Report: Initial Statement of Reasons," pp. 37-38. May 9, 2012, available at http://www.arb.ca.gov/regact/2012/capandtrade12/isormainfinal.pdf

1.3 SUB-NATIONAL PROGRAMS (NON-ANNEX I COUNTRIES)

1.3.1 Rio de Janeiro (Brazil)

The Brazilian State of Rio de Janeiro recently presented consultation documents for a mandatory GHG emissions trading system. The program would start in 2013 and cap industrial emissions. The first compliance period, 2013-2015, would grant allowances free to emitters. The second period, 2016-2020, would see partial auctioning of allowances, and the third period, 2021-2030, would see auctioning of all allowances. Talks are underway with other Brazilian states for linkage of prospective cap-and-trade programs, as well as for credit structures. Specifically, Rio and Sao Paolo officials are discussing linkage of planned carbon markets, and Rio and Acre officials are discussing use of Acre credits by Rio's covered entities.[215,216]

Rio state and city governments are also working on setting up an exchange for environmental commodities, to be known as "BVRio" (Bolsa Verde do Rio de Janeiro). They are currently determining which electronic platform to use.[217] The exchange has already started "pre-registrations" for a forest carbon market. Farmers who achieve greater forest cover than required by the country's forestry code will be eligible to generate credits saleable to those not meeting the minimum requirement.[218]

Demand for non-Annex I forest carbon credits
Forest credit inclusion has not been detailed.

1.3.2 Sao Paulo (Brazil)

Sao Paulo's stated target is to reduce GHG emissions 20 percent below 2005 levels by 2020, and the governor has mentioned potential use of carbon credits to achieve this. Sao Paulo and Rio officials are in the midst of discussions regarding setting up linked emissions trading programs.[219] Officials of Sao Paulo and Acre signed a memorandum of understanding in April 2012 to construct a program so that Sao Paulo could purchase forest carbon credits from Acre.[220]

Demand for non-Annex I forest carbon credits
Forest credit inclusion has not been detailed, but discussions are underway that would allow credits to be purchased from Acre Province in Brazil.

1.3.3 Chinese Cities and Provinces

As discussed in Section 3.7.2, emissions trading markets are in development in the cities of Beijing, Chongqing, Shanghai, Tianjin and Shenzhen, and the provinces of Guangdong and Hubei. As pilot programs, they are being launched at the direction of the central government to provide an experience base with which a national program may be built. The goal is to launch the regional programs from the beginning of 2013, but it

[215] Teixeira, Marcelo. "Rio releases ETS details, sets periods for 3 phases." *Point Carbon* March 29, 2012, accessed June 3, 2012 at http://www.pointcarbon.com/news/1.1814706
[216] Volcovici, Valerie. "INTERVIEW: Rio de Janeiro to launch ETS by 2015, eyes links." *Point Carbon* December 2, 2011, accessed June 3, 2012 at http://www.pointcarbon.com/news/1.1694123
[217] Teixeira, Marcelo. "Rio releases ETS details, sets periods for 3 phases." *Point Carbon* March 29, 2012, accessed June 3, 2012 at http://www.pointcarbon.com/news/1.1814706
[218] Shankleman, Jessica. "Brazil's economists predict 'huge' growth of carbon markets." *businessGreen* May 11, 2012, accessed June 4, 2012 at http://www.businessgreen.com/bg/news/2174000/brazils-economists-huge-growth-carbon-markets
[219] Volcovici, Valerie. "INTERVIEW: Rio de Janeiro to launch ETS by 2015, eyes links." *Point Carbon* December 2, 2011, accessed June 3, 2012 at http://www.pointcarbon.com/news/1.1694123
[220] Teixeira, Marcelo. "Brazilian states discuss carbon market link." *Point Carbon* March 18, 2012, accessed June 4, 2012 at http://www.pointcarbon.com/news/1.1833201

is not known how many, if any, will start on time. The programs are at various stages of development, and information about them is limited and spotty.

With respect to credits, at least two programs, Beijing and Chongqing, have indicated general direction. Beijing has stated that CCER's (discussed in Section 3.7.2) will be eligible for compliance and that facilities with emissions levels too low to be capped will be eligible to make voluntary emission reductions, generating CCER's for sale to capped entities.[221] Chongqing has specifically called out forestry credits (presumably domestic or local) as compliance-eligible. No specific details, such as the limit to forestry credit usage, have been provided, though tree planting is planned in order to generate forest carbon credits. This complements the city's goal of increasing forest cover by one million hectares from 2011 to 2015 (reaching 45 percent coverage from the 2010 level of 35 percent).[222]

Demand for non-Annex I forest carbon credits
Forest credit inclusion has not been determined. However, some jurisdictions are considering the inclusion of forest credits.

[221] Chai, Hongliang and Emilie Mazzacurati. "UPDATED: Beijing's march towards a pilot carbon market." *Point Carbon* April 18, 2012, accessed June 6, 2012 at http://www.pointcarbon.com/research/asiapacific/china/1.1833564

[222] Chen, Kathy and Stian Reklev. "Chongqing ETS to span heavy-emitting industries: report." *Point Carbon* April 27, 2012, accessed June 6, 2012 at http://www.pointcarbon.com/news/1.1848285

APPENDIX II: METHODOLOGY FOR EMPIRICAL SUPPLY MODEL

The methodology used to predict the REDD+ emission reduction supply pipeline categorizes the REDD+ mitigation activities into two levels based on their stage of carbon development.

> **Level I supply pipeline**: projects that have met the criteria to produce compliance-grade credits by way of completing VCS validation and/or verification as of October 2012
>
> **Level II supply pipeline**: projects that are earlier in their development than Level I, but meet a set of defined criteria to demonstrate preparation to produce compliance-grade credits

For each level, a different approach to projecting supply is applied to produce the predicted issuance. When aggregated, the projections of supply volumes from activities in Levels I and II will represent a probable scenario of the REDD+ credit pipeline for 2013-2020.

2.1 CONCEPTS AND ASSUMPTIONS

Scope of activities: Under the UNFCCC, REDD+ is split into five activities: a) Reducing emissions from deforestation; b) Reducing emissions from forest degradation; c) Conservation of forest carbon stocks; d) Sustainable management of forests; and e) Enhancement of forest carbon stocks.[223] As the VCS is considered the most developed and dominant voluntary standard for international REDD+, this report uses VCS categories of emissions reduction activities in the forest and land-use sector which match closely with the UNFCCC REDD+ definition. The VCS divides REDD+ activities into two broad categories: Reduction Emission from Deforestation and Degradation (REDD)[224] and IFM. The VCS further segments REDD activities to APD, AUFD, AUMD.[225] The analysis focuses on activities where forests remain forests, and thus does not include afforestation/reforestation activities in the predicted supply.

Scale of implementation: REDD+ activities may pursue implementation at one of two levels of scale:

1) Project scale – REDD+ initiatives and activities carried out within a specific area with defined boundaries that are smaller than a jurisdiction
2) Programmatic scale (known as "sub-national" in UNFCCC and "jurisdictional" under the VCS) –– REDD+ initiatives, policies, strategies and activities within a larger scale encompassing the whole state/province or country, led by the government and/or in partnership with civil society or the private sector[226]

Compliance-grade credits: Compliance-grade REDD+ credits are defined as those accounted for and verified under a high-quality carbon accounting standards that are either i) of comparable robustness to compliance market standards, and/or ii) may be recognized as eligible to meet compliance obligations within a regulated market. Section 3 introduced the concept of compliance-grade credits and detailed each program individually. Of the group, the VCS is the dominant REDD+ carbon accounting standard on the supply side,

[223] See Decision 1/CP.16 *The Cancun Agreements: Outcome of the work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention*, paragraph 70.
[224] There is another VCS type "Wetlands Restoration and Conservation (WRC)" that includes REDD activities on peat lands, for this report these types of projects are considered REDD.
[225] VCS definitions for each category and sub-category are included in the Appendix.
[226] Adopted from Governors' Forest and Climate Task Force Database of REDD+ Activities, available at http://www.gcftaskforce.org/docs

and, for purposes of this study, represent the benchmark used to define the projected supply of REDD+ credits.

Short-term focus: The approach is underpinned by the assumption that activities currently operational or in planning stages will represent the dominant source of short-term supply of compliance-grade credits between 2013 and 2020. This approach was used to provide comparison with the current demand picture and other REDD+ supply estimates derived from a global economic model.

Data access: The authors of this study recognize the challenges and limitations of relying on publically available data and limited interviews. But using a best-efforts approach, data was collected through engagement with external project databases, publicly available project term sheets, investment circulars, and interviews with project developers, NGOs and intergovernmental agencies, and thus, the analysis provides a valuable view of the future for supply REDD+ verified emission reductions, even within the limitations of the data availability.

2.2 LEVEL I SUPPLY PIPELINE

The Level I supply pipeline is the sum of annual credit issuance forecasts that have met the criteria to produce compliance-grade credits. To model the Level I pipeline, the steps below are followed.

Step 1 – Qualifying Level I REDD+ Activities

Activities which qualify as "currently meeting the criteria to produce compliance-grade credits" are those which have successfully been validated and/or verified to VCS requirements and are registered on the VCS database.[227]

Project documents for REDD+ activities validated or verified to the VCS criteria are available for public access on the VCS Project Database. The Database is the VCS central information source in which all projects are validated to VCS criteria, comprising all information from VCS registries including all VCUs issued under the program. The Database is the source for identifying activities qualified to Level I.

To procure credit issuance data for Level I activities this report has engaged the following sources:

Verified Carbon Standard Database (online access to database of project documents)

Source	Form of engagement
VCS Database	Online access

Step 2 – Develop REDD+ Emissions Reduction Forecasts

According to VCS rules, at the registration of the project the proponents are required to make public a Project Document comprising an ex-ante estimate of credit issuance.[228] Ex-ante estimates are net emissions reduction forecasts derived from using an approved VCS methodology, including applying discounts to account for leakage and secondary emissions. The validation rules call for a third-party audit of the project documentation, including its ex-ante estimates. For these reasons, ex-ante delivery volumes extracted from VCS Project Documents represent a modeled estimate of the emission reduction potential if the project is fully implemented and performs as expected over the life of the project.

[227] The ACR was reviewed, but all of the registered non-Annex I forest carbon projects are Afforestation or Reforestation so it does not feature at this level.
[228] VCS Procedural Document *Registration and Issuance Process: VCS Version 3*, dated October 4, 2012, v3.4, Section 4.2.3

Step 3 – Credit Issuance Adjustments

Using the limited number of projects that have issued credits, a comparison of ex-ante estimates to ex-post issuance indicates a high-level of accuracy in ex-ante projections. While these comparisons are based on a very short time period (and ex-ante estimates reaching back to before project registration that can be cross checked against actual performance), a probable estimate of future credit issuance must account for implementation risk. Therefore, a 5 percent discount will be applied to ex-ante estimates in order to account for under issuance for each Level I REDD+ activity in the pipeline.

Step 4 – Aggregation of Pipeline

The Level I credit supply for 2013-2020 is modeled by aggregating annual credit issuance forecasts for all REDD+ activities meeting VCS criteria, after applying the under issuance discount and subtracting the most recent VCS risk buffer to the ex-ante estimates.

2.3 LEVEL II SUPPLY PIPELINE

Level II supply is equal to the sum of annual credit issuance forecasts of activities that are currently in advanced stages of preparation to meet pre-compliance market criteria. The method to qualify activities and model credit issuance for Level II is more complex than the method used for Level I because the availability of data can be limited. Also, Level II activities do not have VCS validated ex-ante carbon credit issuance estimates on which to rely. Problems encountered have included some projects attempting to keep their emissions reduction forecasts private, and in other cases seeming to be based on information that may not be adequate in order to be registered under a compliance-grade standard.

To qualify activities to the Level II group and to generate probable credit issuance forecasts, the following steps are implemented:

Step 1 – Identifying Level II REDD+ Activity Candidates

To build a database of activities to qualify, the authors engaged market participants from the private sector, NGOs and intergovernmental agencies, and referred to case studies, research and online project databases. The format for engagement entailed interviews, online access and data procurement from open-access sources. A complete list of online sources is below.

To procure credit issuance and emissions reduction forecast data for Level II activities, the authors engaged developers and used the public sources below:

Source	Form of engagement
CCB project database	Online access
Social Carbon Standard project database	Online access
Plan Vivo project database	Online access
Carbon Fix Standard project database	Online access
Forest Carbon Portal project database	Online access
Plataforma Finanzas Carbono project database	Online access
FORCLIME project database	Online access
Governors' Climate and Forests Task Force Database	Online access
Forest Carbon Asia project database	Online access
The REDD Desk	Online access

IDESAM	Online access
World Wildlife Fund Indonesia	Direct query, online access to public information
UN-REDD	Direct query, online access to public information
USAID	Direct query, online access to public information
Code REDD	Direct query, online access to public information
Terra Global Capital	Direct query
Wildlife Works Carbon	Direct query
Macquarie Biocarbon	Direct query
FCPF	Direct query

Step 2 – Qualifying Level II REDD+ Activities

The threshold for qualification to Level II is the **a) intent to meet criteria to issue compliance-grade credits under the VCS**, and **b) advancement beyond the concept phase** (i.e., at least the carbon feasibility stage is started).

a. **Intent to meet criteria to issue compliance-grade credits** is evidenced by indications that financing will be raised through sales of compliance-grade verified emission reductions, or a prevailing REDD+ compliance market-mechanism (whether bilateral or market-based). Evidence for indications of intent is gathered through the evaluation of project documents and interviews with operators.

b. **Advancement beyond the concept phase** is evidenced by dedication of resources and organization capacity to planning and other activities to prepare for the development of verified emission reductions. Example indications of resources, organizational capacity and intent include:

   - project development plan prepared by qualified technicians
   - due diligence/carbon feasibility studies undertaken by qualified technicians
   - baseline study undertaken by qualified technicians
   - community and government stakeholders have granted consent to the project operators and have started the planning process

   When one or more of these indications of capacity, resources and intent are recorded in project or program documents, or attained through direct contact with project participants, the activity is considered to be Level II.

Step 3 – Develop Emission Reduction Forecasts

The forecast emission reduction data extracted from Level II activities is highly variable in quality and content. Many activities in late-stage preparations or under validation have comprehensive VCS-style project documents available that include ex-ante emissions forecasts. Activities at earlier stages of development may only offer general site-specific characteristics and planned project activities. To account for the varying quality of data, two distinct approaches were applied to enable reliable issuance forecasts.

1. **Ex-ante forecasts available:** The first approach is followed when the proponent or collaborating organization provides ex-ante emissions reduction amounts in published or unpublished documents. In these cases, ex-ante emissions forecasts are extracted and subjected to a quality or "reasonableness" check. This check computes an **average emission reduction per hectare per year ($tCO_2e\ ha^{-1}\ yr^{-1}$)** for the activity by dividing the total

emissions generated over the life of the activity by the area (in hectares) and then dividing by the project crediting period. The activity's estimated **$tCO_2e\ ha^{-1}\ yr^{-1}$** is then compared to a benchmark **$tCO_2e\ ha^{-1}\ yr^{-1}$** value, equal to the emission reductions per hectare per year and calculated for qualifying sets of activities of the same project type and forest type. The qualifying set of activities that was used for the benchmark emission reductions by project and forest type was created using the most developed projects in the database. For those activities whose data is considered as "outlier," the third party emission reductions are discarded and the benchmarks forecasts were used. The benchmarks were derived from a limited set of data, and it was not possible to capture all the factors that would determine the actual emission reductions for any specific REDD+ activity. Where these factors are applied they will, on average, produce reasonable estimates of emission reduction forecasts where the project estimates were unreliable.

2. **Ex-ante forecasts not available:** The second approach is applied when ex-ante accounts are not available. In these cases, the emission reductions were estimated using the benchmark data. For this group ex-ante forecasts are established by multiplying the benchmark value of **$tCO_2e\ ha^{-1}\ yr^{-1}$** by the activity's crediting area for each year.

Step 4a – Credit Issuance Adjustments – Risk Buffer Withholding

To align as closely as possible with the current VCS approach to non-permanence risk, a risk buffer, as outlined in the VCS, was deducted for the emission reduction forecasts for each REDD+ activity. The VCS rules[229] require risk analysis to determine a number of credits that must be deposited to an AFOLU pooled buffer account prior to credit issuance. The set-aside value is determined by the VCS AFOLU Non-permanence risk tool.[230] The tool considers internal and external risks to the permanence of emission reductions and then calculates the tons of emission reductions that must be deposited in the VCS risk buffer. The scope of this study precludes assessment of the internal risks and external risks of each REDD+ activity qualified to Level II. However, the average VCS AFOLU risk buffer of 19 percent[231] was deducted for each REDD+ activity unless there was a VCS risk buffer document available for the activity and then that was used.

Step 4b – Credit Issuance Adjustments – Uncertainty of Future Credit Issuance

In carbon markets (generally), there has been a tradition of under-performance for projects reaching issuance versus those submitted for validation. In the CDM market the percentage of projects that are submitted for validation versus those that actually reach issuance is approximately 25 percent, and the percentage of projects that are registered (validated) that reach issuance is slightly less than 50 percent. Given the stage of the Level II REDD+ activities, there will be a high degree of uncertainty on the ability for any activity to actually issue compliance-grade emission reductions. To capture the likelihood or probability that an activity will fail to produce compliance-grade emission reductions in the future, a **discount factor** was applied to each activity's emissions reduction forecast. The discount factor is generated from a set of indicators designed to reflect the risk of the REDD+ activity actually producing the verified emission reductions as forecast. Thus, the discount factor **when applied to the forecast emission reductions** is utilized to produce risk adjusted credit issuance forecast for each REDD+ activity qualified under Level II.

A Risk Assessment Tool with the following factors was used to assess the risk of each Level II REDD+ activities and generate a discount that was applied to the emission reductions derived in Step 3 above. After applying the discount from the Risk Tool to Level II projects, the discounted forecasts were 43 percent, of the undiscounted forecasts, which puts the under-performance

[229] VCS Procedural Document *Registration and Issuance Process: VCS Version 3*, dated October 4, 2012, v3.4, Section 6
[230] VCS Procedural Document, *AFOLU Non-permanence Risk Tool*, *VCS Version 3*, dated October 4, 2012, v3.4.
[231] As reported in the VCS JNR Permanence Steering Committee meeting notes December 2012

percentage in line with the CDM experience. This is a simplified version of a Risk Assessment Tool that can be applied on a set of projects where the data availability may be limited. The tool is displayed below and the combined risk factors are applied to each project.[232]

[232] This is applied be taking (1-discount$_{factor\ 1}$)* (1-discount$_{factor\ 2}$)* (1-discount$_{factor\ 3}$)* (1-discount$_{factor\ 4}$) times the emission reduction forecasts

<table>
<tr><th>Risk Factor</th><th>Description</th><th>Assigning Values</th><th>Allowable Values</th><th>Discount</th></tr>
<tr><td rowspan="2">1. Government Approval</td><td rowspan="2">Captures the uncertainty to credit issuance present when proponent has not received Government approval to carry out activities</td><td rowspan="2">If Government approval is demonstrated by license, permit, or contract with a Government Authority, then value equals 'Approved'.
If activity is Not Yet Approved (NYA), a 'Government score' is determined for each jurisdiction based on World Economic Forum indicators for legal and administrative frameworks to enable competitiveness and economic development, with credits or debits for country participation in Readiness programs, and the state of regulations and governance authorities to approve and govern REDD+ activities. (See section below for determination of Government Scores).</td><td>Approved</td><td>0%</td></tr>
<tr><td>NYA</td><td>Government Scores (see below)</td></tr>
<tr><td rowspan="2">2. Carbon Tenure</td><td rowspan="2">Captures the uncertainty to credit issuance present when proponent has not secured rights to carbon</td><td rowspan="2">If ownership of the bundle of rights to secure carbon rights is demonstrated, then value equals 'Yes'. Demonstration is considered rights secured through legal contracts in conformance with statutes or legal precedence and that are aligned with and supported by recognized land tenure laws.
If rights are under negotiation, or not yet secured, then value equals 'No'.</td><td>Yes</td><td>0%</td></tr>
<tr><td>No</td><td>10%</td></tr>
<tr><td rowspan="3">3. Management Capacity</td><td rowspan="3">Measures the level of management capacity and its adequacy to carry-out REDD+ activities. Capacity is determined through experience in design, implementation, carbon accounting and reporting to GHG programs.</td><td rowspan="3">To determine factor, assess the operator's capacity and their project experience. Operators may qualify to both, one or none of the criteria to demonstrate adequate capacity.
Adequate capacity is as follows: [233]
A. management team contains one individual with significant experience in all skills necessary to undertake activities (at least 5 years experience in each area); and
B. management team has a presence at the site, or is at maximum one days travel to site.[234]</td><td>AB</td><td>0%</td></tr>
<tr><td>A or B (only)</td><td>10%</td></tr>
<tr><td>N (neither)</td><td>20%</td></tr>
<tr><td>4. Carbon Development Stage</td><td>Indicates at what stage of development the REDD+ activities are related to developing the market standards related work needed to generate compliance-grade emission reductions</td><td>For each REDD+ activity a value was assigned based on the completion of documents, public commenting periods, validations and verifications as need to complete each stage within the carbon development process.
Carbon Development Stage — Discount
Feasibility in Development — 80%
Feasibility Complete — 70%
VCS/CCB PD in Development — 65%
CCB in Validation — 55%
VCS in Validation — 25%
VCS/CCB in Validation — 25%
CCB Validated — 50%
VCS Validated — 20%
VCS/CCB Validated — 20%
VCS Monitoring Underway — 15%
VCS Verification Underway — 15%
VCS Verified — 10%
VCS Verified/ CCBA Validation — 10%</td><td>See list on left</td><td>Ranging from 80% to 10%</td></tr>
<tr><td colspan="3">Credit Issuance Uncertainty Adjustment Factor =</td><td colspan="2">Combined Risk Factor</td></tr>
</table>

[233] Adapted from: VCS, Non-permanence Risk Assessment Tool, 'Project Management Risk Factors,' available at http://v-c-s.org/sites/v-c-s.org/files/AFOLU%20Non-Permanence%20Risk%20Tool%2C%20v3.2.pdf

[234] Adapted from: VCS, Non-permanence Risk Assessment Tool, 'Project Management Risk Factors,' available at http://v-c-s.org/sites/v-c-s.org/files/AFOLU%20Non-Permanence%20Risk%20Tool%2C%20v3.2.pdf

Governance Scores

To determine the appropriate discount for activities where the proponent has not yet been approved by Government to carry out REDD+ activities (see Government Approval indicator), a "Governance Score" for each activity jurisdiction is calculated. The Governance Score intends to capture a level of certainty to credit issuance as a function of the strength of the REDD+ activity's legal and administrative framework (beyond carbon tenure which is covered in risk factor 2). The score will also capture the challenges facing REDD+ credit issuance in jurisdictions which do not promote a sound and fair institutional environment for market competition and economic growth.

To calculate Governance Scores, a base score is assigned a percentage rank of the country using the "Institutional Pillar"' ranking of the World Economic Forum's Global Competitiveness Index (GCI).[235] This ranks the general legal framework, attitudes towards markets and freedoms, level of corruption, and effectiveness of regulation of the county in which the REDD+ activity is being implemented. Next, a series of credits or debits are applied to this base score, reflecting additional governance factors specific to REDD+ credit issuance in the country.

Base scores are determined by their "Institutional Pillars" rank in the GCI report. Each country's rank is considered in relation to the other 144 countries in the study. A country's rank is grouped into percentile ranges, equal to corresponding base scores detailed below.

Percentile	Base Score
+.79	100%
.50 - .79	90%
.25 - .49	80%
0 - .25	70%

Credits or debits are applied to base scores when governments meet certain defined criteria. These criteria and the credits or debit value applied to the base score are detailed below, adjusted scores cannot exceed 100 percent.

Indicator	Criteria	Credit / Debit
REDD+ legal / regulatory framework	The Government exercises a clear legal or regulatory framework for REDD+ activities, which includes a mechanism to approve REDD+ activities through a designated authority.	+ 10%
REDD+ readiness activities	The Government is engaged in REDD+ readiness by participating in the World Bank FCPF or the UN-REDD programme	+ 5%
REDD+ sponsorship	The Government is participating or sponsoring REDD+ activities which involve participation and/or funding from the private sector.	+ 5%
REDD+ pre-compliance activity delays	Government has impeded the progress of pre-compliance REDD+ activities, evidenced by partial rejections / approvals, or an application wait time greater than one-year.	- 10%
REDD+ pre-compliance restrictions	Government has severely restricted pre-compliance REDD+ activities, evidenced by blanket rejections of pre-compliance REDD+ applications, or public statements indicating pre-compliance activities will not have government support.	- 25%

[235] GCI is a survey which gathers the views of domestic and foreign-owned firms on a range of issues related to the business environment. The report can be accessed via the World Economic Forum website, available at http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2012-13.pdf

Step 5 – Aggregation of Pipeline

The Level II credit supply for 2013-2020 is modeled by aggregating annual credit issuance forecasts for all REDD+ activities qualified to Level II.

2.4 CREDIT ISSUANCE ADJUSTMENTS

In practice, the timing of actual issuance of credits will lag the "vintage" or year that emission reductions are generated (i.e., project activities having taken place). This is a result of a verification being on ex-post emissions and reductions and is particularly relevant for the first verification which usual includes multiple vintages. The first verification will include all vintages from the project start date, which may be several years prior to the end of the first verification period. After this there may be an annual or bi-annual verification.

Where several "vintages" of emission reductions from prior years' activities are included in the first verification, the first verification volume may be significantly higher than the annual average volume for the activity. These multiple vintages of "verified emission reductions" from the years between the project start date (going back to 2008[236]) and the first verification may be referred to as "retro-credits." Since this study is assessing supply to the market, the supply model will include retro-credits generated from vintages prior to the first verification year that are issued within the period of model forecasting. Determining the year of first verification for each REDD+ activity was based on an individual assessment of the activity's start date, with considerations for delays in preparing the validation and verification requirements. The assumptions for determining delay in first issuance from an activity's start date is detailed below, and after the first verification it was assumed that verification would be annual.

Project Start Date	Method to estimate first verification for Level II
2008[237]-2010	A three-year delay is applied to the year in which the first REDD methodology was approved under the VCS (2010).
2011-2012	A two-year delay is applied to the activity's start date to account for the minimum verification period (one year) and delays in preparing projects for verification.
2013+	A one-year delay is applied to the project's start date to account for the minimum verification period.

These adjustments for issuance delay were applied to the Level II activities forecast emission reductions to generate the issuance forecasts for the each REDD+ activity for each year. For Level I activities that had not reached issuance, a first verification date was assigned based on review of available data.

[236] 2008 is designated as the first year in which emission reductions could be achieved in response to the Bali Action Plan encouragement of early action in REDD+.
[237] Level II projects with start dates that appeared to be before 2008 were not included.

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