November 2015

# *Climate Finance for Ethiopia's Productive Safety Net Programme (PSNP):*

## Comprehensive report on accessing climate finance and carbon markets to promote socially and environmentally sustainable public works social safety net programs

Stefan Jirka[1], Dominic Woolf[1], Dawit Solomon[1], and Johannes Lehmann[1]

[1] Cornell University

Cornell University

# Climate Finance for Ethiopia's Productive Safety Net Programme (PSNP):

## Comprehensive report on accessing climate finance and carbon markets to promote socially and environmentally sustainable public works social safety net programs

This report was prepared on behalf of The World Bank by:

Stefan Jirka[1], Dominic Woolf[1], Dawit Solomon[1], and Johannes Lehmann[1]

[1]Cornell University, USA

November 2015

Please cite this work as follows:

Jirka, S., D. Woolf, D. Solomon, J. Lehmann. 2015. "Comprehensive Report on Climate Finance for Ethiopia's Productive Safety Net Programme (PSNP): Accessing climate finance and carbon markets to promote socially and environmentally sustainable public works social safety net programs." A World Bank Climate Smart Initiative (CSI) Report. Cornell University. https://ecommons.cornell.edu/handle/1813/41298

The PSNP is implemented by the Government of Ethiopia with support from the following development partners: Canadian International Development Agency, Irish Aid, European Commission, Royal Netherlands Embassy, Swedish International Development Cooperation Agency, UK Department for International Development, United States Agency for International Development, World Food Program and The World Bank.

## Abstract

Ethiopia's Productive Safety Net Programme (PSNP)—recognized as a model public works safety-net program—active for over ten years, provides food and cash payments to households suffering from food insecurity in return for labor that builds public infrastructure, including the rehabilitation of degraded lands. In addition to the target benefits of food security and infrastructure development, PSNP's participatory watershed management interventions deliver climate-change mitigation benefits by sequestering carbon in soils and biomass, and reducing emissions of greenhouse gases (GHGs) from the agricultural, forestry and other land use (AFOLU) sector. To date, Ethiopia's PSNP has been primarily funded by development assistance from bi- and multi-lateral donors. However, new opportunities from climate finance channels could be opened up by quantifying PSNP's climate-change mitigation impacts (frequently referred to as "carbon benefits").

This study, conducted within PSNP's Climate Smart Initiative (CSI), demonstrates that PSNP's participatory watershed management interventions usually deliver net positive carbon benefits across varied agro-ecological zones. On average, the 28 CSI sites are expected to deliver a mean carbon benefit of 5.7 tonnes of carbon dioxide-equivalent per hectare per year ($tCO_2e\ ha^{-1}\ yr^{-1}$) over a 20-year accounting period. These benefits are attributable, in order of importance, to (i) above- and below-ground biomass sequestration, (ii) soil organic carbon accumulation, (iii) reduced GHG emissions from livestock management, and (iv) abatement of other land-use related GHGs. Considering that Ethiopia's PSNP projects cover hundreds of thousands of hectares, this study provides compelling evidence to recommend that methodologies to quantify the carbon benefits be embedded in future PSNP 4 and related interventions, to facilitate access to climate finance. But, neither compliance nor voluntary carbon-offset markets are currently in a state to support ambitious carbon projects on a scale comparable to the size of PSNP. However, ongoing negotiations within the United Nations Framework Convention on Climate Change (UNFCCC) indicate that a binding international commitment to reduce global GHG emissions is likely to be reached in the near future. And it is probable that carbon offset markets will be one of the mechanisms available for countries to meet their GHG reduction obligations.

In consideration of the above points, we recommend that Ethiopia act now to that it is well-positioned to take advantage of anticipated carbon market opportunities as they arise. By developing one or more carbon market projects on a scale of tens to at most hundreds of thousands of hectares (a scale that is compatible with current market opportunities), PSNP's in-country capacity will be greatly enhanced, thus positioning Ethiopia to scale up rapidly as and when the carbon finance outlook improves.

However, it imperative to note that *all* carbon market projects must meet additionality requirements. This has specific implications for PSNP in that a program of work that is already

planned and financed would not be eligible for carbon finance. To demonstrate additionality, any carbon project established under PSNP will need to demonstrate:

(i) an increase in the geographic scale,
(ii) an improvement in implementation, or
(iii) an increase in the longevity of the project

that would not be achievable without the provision of the additional support from climate finance. It is also important to consider that project development, implementation and monitoring costs can be substantial, and PSNP should address this by focusing on large contiguous areas and deploying lost-cost and streamlined methods for monitoring, reporting and verification (MRV).

To lay the foundation for larger jurisdictional carbon accounting methodologies, necessary for cost-effective scaling up, PSNP should pursue development of standardized methods to quantify carbon benefits across extensive land areas commensurate with PSNP's wide geographic extent. One such type of initiative already under development independently of PSNP is the Oromia Forested Landscape Program (OFLP). OFLP can serve as a proving ground for jurisdictional carbon accounting approaches related to reforestation, avoided deforestation and degradation (REDD+) in Oromia Regional State. However, for PSNP's diverse suite of climate-smart agricultural practices, Oromia remains too large a scale for jurisdictional accounting in the near term, given the current complexities of developing GHG accounting methodologies for smallholder agricultural systems. Given that it will be several years before OFLP mitigation finance begins to flow even for REDD+ projects, PSNP should work in parallel to the OFLP to advance policy objectives of carbon finance support for PSNP in the near-term. A proposal should be developed and submitted to PSNP's development partners to support creation of a task team within the Climate Resilient Green Economy (CRGE) unit of the Ethiopian Ministry of Agriculture (MoA) for climate finance of PSNP.

Notwithstanding the anticipated potential of carbon markets to support PSNP, direct income from bi- and multi-lateral donors in the form of grants and loans remains the mainstay of climate finance opportunities at present. The Green Climate Fund (GCF) is an attractive emerging multilateral climate fund for Ethiopia's PSNP public works, being the main vehicle through which future mitigation and adaptation funds are expected to flow from developed to less-developed nations under the auspices of the UNFCCC. The GCF's six investment criteria, are all well-aligned with the objectives and scope of PSNP. In addition to bi- and multilateral climate-focused funds, the potential for demonstrated mitigation benefits of Ethiopia's PSNP to be used in support of negotiations for international development funding should not be overlooked. This is known as results-based finance and is increasingly used by international donors to justify expenditures for climate change mitigation.

# Table of Contents

## List of Figures

## Acronyms and Abbreviations

| | |
|---|---|
| AE | Accredited entity |
| A/R | Afforestation and reforestation |
| AFOLU | Agriculture, forestry and other land use |
| AR5 | Fifth Assessment Report of the International Panel on Climate Change |
| BAU | Business-as-usual |
| CCBA | Climate, Community and Biodiversity Alliance |
| CDM | Clean Development Mechanism of the United Nations Framework Convention on Climate Change |
| CER | Certified emission reduction |
| $CH_4$ | Methane |
| $CO_2$ | Carbon dioxide |
| $CO_2e$ | Carbon dioxide-equivalent |
| COP-21 | 21st Conference of Parties |
| CP1 | Kyoto Protocol first commitment period |
| CP2 | Kyoto Protocol second commitment period |
| CRGE | Climate Resilient Green Economy |
| CSA | Climate smart agriculture |
| CSI | Climate Smart Initiative |
| DFID | United Kingdom's Department for International Development |
| ERPA | Emission reductions purchase agreement |
| EU | European Union |
| EU-ETS | European Union Emissions Trading Scheme |
| F-gases | Fluorinated greenhouse gases |
| FCPF | Forest Carbon Partnership Facility |
| GCF | Green Climate Fund |
| GEF | Global Environment Facility |
| GEF-6 | 6th Replenishment Period of the GEF Trust Fund |
| GHG | Greenhouse gas |
| GoE | Government of Ethiopia |
| GWP | Global warming potential |
| ha | Hectare |
| INDC | Intended nationally determined contribution |
| IPCC | International Panel on Climate Change |
| ISFL | Initiative for Sustainable Forest Landscapes |
| JI | Joint Implementation mechanism of the United Nations Framework Convention on Climate Change |
| km | Kilometer |
| LDC | Least developed country |
| LDCF | Least Developed Country Fund |
| MDGF | Millennium Development Goals Fund |
| MoA | Ministry of Agriculture |
| MRV | Monitoring, reporting and verification |

| | |
|---|---|
| N | Nitrogen |
| $N_2O$ | Nitrous oxide |
| NDA | National Designated Authority |
| PoA | Programme of Activities |
| PSNP | Productive Safety Net Programme |
| REDD | Reduced emissions from deforestation and degradation |
| REDD+ | Reduced emissions from deforestation and degradation, conservation of forest carbon stocks, sustainable management of forests, and enhancement of forest carbon stocks |
| RIL | Reduced impact logging |
| SCCF | Special Climate Change Fund |
| SDGF | Sustainable Development Goals Fund |
| SSA | Sub-Saharan Africa |
| SSR | Source, sink and reservoir |
| $tCO_2e$ | Tonne of carbon dioxide-equivalent |
| UK | United Kingdom |
| UN | United Nations |
| UNDP | United Nations Development Programme |
| UNFCCC | United Nations Framework Convention on Climate Change |
| USA | United States of America |
| VCS | Verified Carbon Standard |
| VER | Verified emission reduction |
| WB | World Bank |
| yr | Year |

## Acknowledgements

This work was made possible through the generous financial support of The World Bank. We thank CARE-Ethiopia for coordinating and facilitating collaboration amongst Climate Smart Initiative (CSI) consortium partners. Field work to support findings in this paper was made possible through the assistance of CSI partners including Relief Society of Tigray (REST), Organization for Rehabilitation & Development in Amhara (ORDA), Farm Africa, SNV, Mercy Corps, and CARE-Ethiopia. Officials with the Ethiopian Ministry of Agriculture's (MoA) natural resources management directorate, the six regional government (Tigray, Amhara, SNNPRS, Oromia, Afar, and Somali) MoA offices, and the CSI woreda-level MoA offices are acknowledged for their guidance and support during field operations—without them this work would not have been possible. We also thank Jimma University for its excellent organization and support as an in-country research partner.

## Introduction – scope and structure of this report

This report analyzes and summarizes the current status and potential of novel financing mechanisms (through climate-change mitigation markets and funds) to support implementation of climate-smart agriculture (CSA) interventions in public works safety net programs, by way of example of Ethiopia's Productive Safety Net Programme (PSNP)[1]. The report illustrates how quantification of climate benefits generated through CSA can help access various international climate financing mechanisms. While Ethiopia's PSNP serves as a model case, the opportunities discussed are applicable to numerous public works safety net programs being deployed and expanded throughout Sub-Saharan Africa (SSA) and beyond. With issues of food security, sustainable development and poverty alleviation front and center in global negotiations for a new international agreement to address climate change, public works safety net programs that embed CSA principles are poised to deliver multiple sought-after outcomes. This report will provide policymakers, practitioners, and donors at the international, national and sub-national levels with an appreciation of how CSA principles can benefit the design of future public works safety net programs and their financing through climate mitigation and adaptation funds.

The report begins with an overview of public works safety net programs, specifically Ethiopia's PSNP, and linkages to food security and CSA. The report then shifts its focus to predicted impacts of climate change and opportunities for mitigation, specifically via CSA activities implemented in PSNP. Next, the state of global carbon finance is discussed—with a particular eye on market-based mechanisms for sustainable land-management activities in the agriculture, forestry and other land use (AFOLU) sector. Finally, the report evaluates opportunities for climate finance to support sustained implementation as well as scaling-up of PSNP activities in Ethiopia—and, by extension, other public works safety net programs that promote CSA activities.

## 1 Food security and social safety net programs

In much of the developing world, chronic poverty is an endemic issue facing national governments. One of the main implications of chronic poverty is that people have insufficient access to food and thus suffer from hunger and micronutrient malnourishment. No more so is this the case than in SSA, recently ranked as the most food insecure region of the world (Economist Intelligence Unit 2014), with around one-third of the population classified as under-nourished (FAO 2005). Mechanisms to increase food production while ensuring equitable distribution are needed to feed a growing global population and reduce food insecurity

[1] An executive summary tailored to policymakers and highlighting the key findings and recommendations in this comprehensive report is available at Jirka et al. 2015a.

(Godfray et al. 2010; Wheeler and Braun 2013), especially in Africa where the population is expected to increase four-fold to 4.2 billion by 2100 (Gerland et al. 2014).

In response to poverty and nutrition challenges, social protection programs that provide poor, vulnerable and marginalized members of society with cash or in-kind transfers to reduce impacts from economic, environmental or governance shocks have been developed and deployed across much of the developing world. Social protection safety net programs[2] in developing countries are credited with reducing food insecurity (HLPE 2012), for example during the 2008 food crisis (FAO 2012). In Africa, safety nets are deployed in at least 22 SSA countries (Monchuk 2013) to enable households to maintain food consumption in the face of shocks (so-called consumption smoothing) and move people towards economic self-sufficiency. Given the increasing need for and interest in advancing objectives targeted by safety nets (for example, from the international donor community) there is a high likelihood that such programs will expand in the coming decades, especially in SSA.

## 1.1 Public works safety net programs

Numerous instruments exist to achieve food security objectives through safety nets (see HLPE 2012). One of these, public works programs, is designed with the dual objectives of providing temporary employment and building and maintaining infrastructure projects (Subbarao et al. 2012), and has a long history of implementation as food-for-work programs, for example in South Asia. Importantly, the secondary outcomes that public works programs achieve in terms of new and enhanced physical infrastructure deliver benefits that create long-term value, helping to graduate individuals and communities out of dependency (Subbarao et al. 2012). For example, public works in the agriculture sector such as terracing, and soil and water conservation can, over time, improve crop yields, delivering additional food to households and potential income generating opportunities from sales of surplus harvests. Crucially, public works programs can also provide gender empowerment (Subbarao et al. 2012).

## 1.2 Ethiopia's Productive Safety Net Programme

Ethiopia's PSNP[3], active since 2004, is regarded as a flagship example of how a public works program can benefit the poor, reduce food insecurity, and build critical infrastructure. Led by the Ethiopian central government with contributions from a set of bi- and multilateral donors, it is the largest such program in Africa and is embedded in the government strategy for moving the country to middle-income status by 2025 based on carbon-neutral growth—the Climate Resilient Green Economy (CRGE) strategy.

PSNP is targeted geographically at the most food insecure areas of the country. On an annual basis it reaches over 7 million households, or about 10% of the population. Public works

[2] Where recipients are not required to pay-in to the system in order to receive benefits (i.e. they are non-contributory) these programs are referred to as safety nets (Grosh 2008).
[3] For more information and context on Ethiopia's PSNP see Solomon et al. 2015.

interventions in PSNP focus largely on soil and water conservation measures for the agricultural sector (which employs the vast majority of Ethiopia's population), as well as road and school building and irrigation works. In the period 2007 – 9 alone, over 167,000 ha of area enclosures and 270,000 km of soil and stone terraces were built or restored (see Figure 1), and 880,000,000 seedlings were planted to rehabilitate land (Coll-Black and Van Domelen 2012).

*Figure 1. Climate smart land use interventions including terraces, soil bunds planted with multi-purpose perennial legumes, cut-and-carry forage systems, and multi-story agroforestry systems at a PSNP agricultural watershed in Damot Gale Woreda, SNNPR, Ethiopia.*

### 1.2.1 Climate smart agriculture and Ethiopia's PSNP

Climate smart agriculture (CSA) is defined as a three-pronged approach to (1) sustainably increase agricultural productivity; (2) adapt and build resilience of agricultural systems to the impacts of climate change; and (3) reduce greenhouse gas emissions from agriculture (Lipper et al. 2014). CSA is gaining rapid traction amongst policymakers and practitioners as an approach to address the challenges of climate change, food security and sustainable economic development in the developing world. In response to a growing recognition that PSNP's agricultural public works interventions shared many of the key aspects of CSA, the Climate Smart Initiative (CSI) was launched within PSNP with the aim of contextualizing the implications of climate change into PSNP, both from a mitigation and adaptation perspective. Information generated by the CSI has provided valuable quantitative data on the climate change mitigation potential of Ethiopia's PSNP (see Woolf et al. 2015). This backdrop of PSNP as a successful, large-scale food security safety net program with a core design principle of embedding climate smart interventions into public works serves as a launching point of discussion for the remainder of this report.

# 2 Climate change overview

It is now clear that the Earth's climate is warming, and that it is doing so in response to changes to the atmosphere resulting from human activities. The recent International Panel on Climate Change (IPCC) assessment report (AR5) describes the evidence supporting these two claims as "unequivocal"—meaning that there is no longer any reasonable doubt. Many of the changes in the global climate that have been observed over the last half century are unprecedented over the previous millennia. The atmosphere and ocean have both warmed, snow and ice have diminished at the poles and in mountain glaciers, sea level has risen, and the concentrations of the greenhouse gases that drive this warming have increased. Surface temperature over the land and ocean has been successively warmer over each of the last three decades and are now higher than any preceding decade since instrumental recording began (Figure 2**Error! Reference source not found.**).

The atmospheric levels of the three main greenhouse gases responsible for this warming—carbon dioxide, methane, and nitrous oxide—have all increased to concentrations higher than at any time over at least the last 800,000 years. Atmospheric $CO_2$ has increased by forty percent since pre-industrial times, primarily due to fossil fuels (coal, oil and natural gas) emissions and secondly from lost carbon stocks in trees and soils due to land use change and land degradation. In 2015, global average $CO_2$ concentrations exceeded 400 parts per million for the first time in 2 million years. The ocean has absorbed roughly a third of the carbon dioxide emitted by human activity, which has thus-far provided a buffer to the rate at which the climate has changed, but also causes ocean acidification which is a major threat to marine ecosystems and to the fisheries that depend upon them.

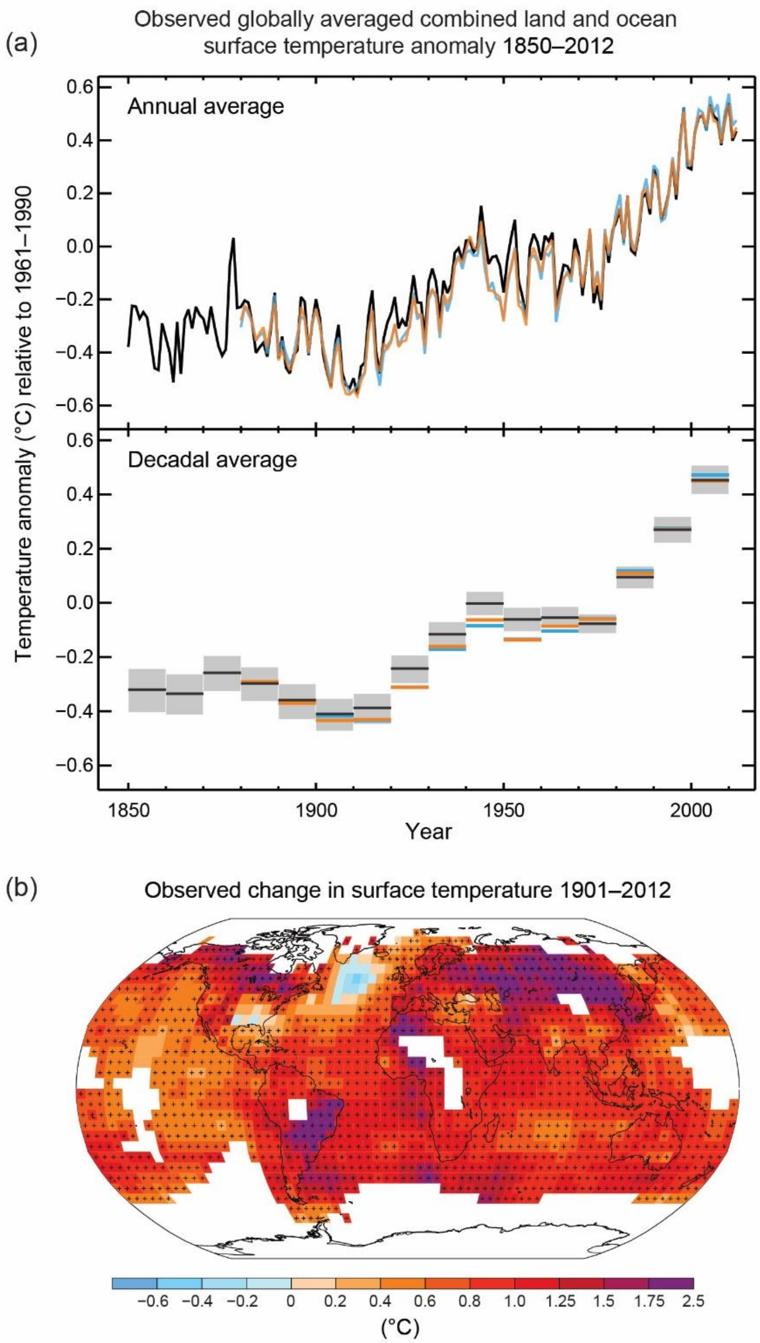


*Figure 2. (a) Observed global mean combined land and ocean surface temperature anomalies, from 1850 to 2012 from three data sets. Top panel: annual mean values. Bottom panel: decadal mean values including the estimate of uncertainty for one dataset (black). Anomalies are relative to the mean of 1961−1990. (b) Map of the observed surface temperature change from 1901 to 2012 derived from temperature trends determined by linear regression from one dataset (orange line in panel a). Trends have been calculated where data availability permits a robust estimate (i.e., only for grid boxes with greater than 70% complete records and more than 20% data availability in the first and last 10% of the time period). Other areas are white. Grid boxes where the trend is significant at the 10% level are indicated by a + sign. For a listing of the datasets and further technical details see the Technical Summary Supplementary Material. {Figures 2.19–2.21; Figure TS.2} (Source: IPCC 2013b)*

If greenhouse gases continue to be emitted, the global climate will undergo further warming accompanied by consequential changes in all components of the climate system including changing precipitation patterns and (likely) increases in frequency of extreme events such as droughts, floods, and storms. Under a continued high emissions scenario, global average temperatures will likely (i.e., with a 66% probability) rise by between 2.6°C to 4.8°C by 2100, although it could be higher or lower than this. A target rise in global average surface temperature of no more than 2° C has been widely advocated as required to maintain the Earth system within safe limits (although some researchers and more vulnerable countries also advocate for lower targets than this). Keeping warming to below 2° C means that, in total, humanity must not emit more than 800 billion tonnes of $CO_2$. Given that historical emissions have already reached 550 billion tonnes of $CO_2$, this leaves a maximum of 250 billion tonnes of $CO_2$ for total future global emission (roughly 25 years at current emission rates). Meeting these targets to limit warming within safe limits will require a concerted and protracted global effort,

At current global emission rates, the world will have exceeded its total budget within 25 years to keep warming below 2°C.

Carbon sequestration in trees and soils will be a critical component to achieving climate stabilization within safe limits.

and will require that net global greenhouse gas emissions are near-zero or possibly even negative (i.e. net sequestration of carbon) by the end of the 21st century. Achieving this depends on those countries with high emissions making drastic and timely cutbacks, but will also require developing countries to adopt policies such as Ethiopia's ambitious and forward-looking Climate-Resilient Green Economy (CRGE) strategy to ensure that they develop in a climate-smart manner that supports growth without high emissions. It is also important to note that achieving net zero or negative emissions by the end of this century is unlikely to be achievable without drawing down some excess $CO_2$ from the atmosphere (to compensate for an overshoot in emissions or to offset residual emissions that are very difficult or costly to eliminate). Sequestering carbon in soils and trees is almost certainly the most cost effective means to achieve this, making land restoration works such as those conducted by Ethiopia's PSNP a key part of an overall climate-change mitigation strategy. When carbon sequestration can be achieved while also improving the food security of communities and building their resilience to climate change, a win-win situation is created that is the very definition of being "climate smart"—mitigating climate change while simultaneously building resilience and adaptation.

## 2.1 Climate change in Ethiopia

Land temperatures over Africa are likely to rise more rapidly than the global average, particularly in the more arid regions. Climate model projections indicate that in a high global emissions (business-as-usual) scenario, 2°C warming could be exceeded by mid-century across much of Africa (including Ethiopia), and all of Africa by 2080. Without global mitigation efforts, temperature rises across Africa will reach 3 to 6°C by 2100, or 3 to 5°C in all of Ethiopia. These increases would be expected to cause extreme heat stress for people, crops, livestock and ecosystems, and to increase evapotranspiration and the frequency of heatwaves (Elshamy, Seierstad, and Sorteberg 2009). In Ethiopia, the highest temperature increase will be in the North of the country (Tigray, Afar, and Northern Amhara), regions that have historically already been the most prone to climate-related shocks (IPCC 2013).

> Without global mitigation, temperatures in Ethiopia will increase by more than 2 °C by mid-century, and 3-5 °C by 2100.

*Figure 3. Highly degraded landscapes affected by drought and erosion adjacent to PSNP-CSI sites in Ethiopia.*

Precipitation patterns predicted by climate models are more uncertain and show a wide range of results with respect to the direction of precipitation change (Conway and Schipper 2011). This combination of increased temperatures with unpredictable rainfall patterns makes Ethiopian agriculture especially vulnerable to climate change, particularly with 95% of its farmland being rainfed (Hagos et al. 2009). The most likely scenario with respect to changes in rainfall in Ethiopia under a high emissions scenario is that by 2100 there will be a wetter climate, more intense wet seasons, and less severe droughts—although with large regional variations of these trends and high uncertainty even about the direction of precipitation change. A general trend towards increased rainfall overall is expected because higher temperatures will lead to increased evaporation (particularly over the ocean), increasing the water vapor loading of the atmosphere. An increase in precipitation in Ethiopia would represent a reversal of the recent historical trend towards decreased precipitation, which was caused by recent cooling in the Eastern Equatorial Pacific (a trend that is not expected to persist under a warming scenario).

## 2.2 Anthropogenic emissions of greenhouse gases

The ongoing change in the earth's climate is primarily attributed to the release and accumulation of greenhouse gases (GHGs) in the earth's atmosphere. These GHGs prevent solar radiation from escaping the atmosphere and result in the gradual heating of our planet. The six GHGs that contribute to global warming most are, in order of largest to smallest contribution to net radiative forcing are carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$), and hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (F-gases) (Figure 4).

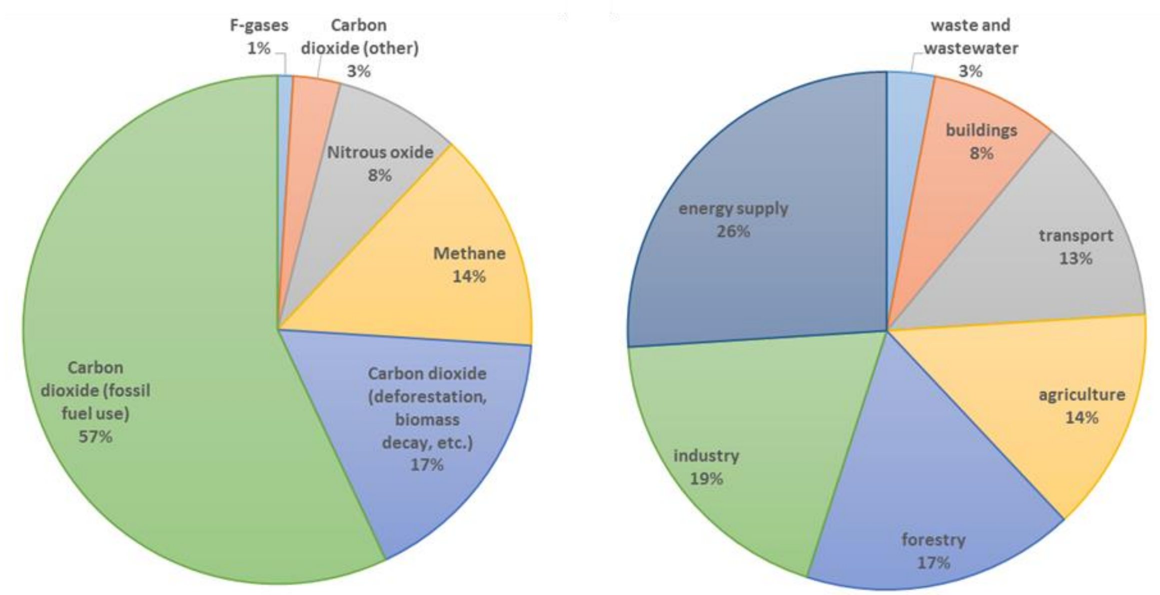


*Figure 4. The main GHGs (left) from manmade sources and the economic sectors (right) emitting them on an annual basis (source: Solomon 2007).*

Each of these GHGs are associated with different human activities. The majority of emissions are attributed to the burning of fossil fuels for energy. AFOLU is the next largest emitting sector after energy, and represents nearly one quarter of total emissions (Smith et al. 2014). Within

AFOLU, crop and livestock agriculture are the dominant sources of emissions and their contributions continue to rise relative to forests and other land use (Smith et al. 2014). Therefore, the importance of addressing emissions related to agriculture cannot be overstated.

The GHGs associated with AFOLU are dominated by $CO_2$, $CH_4$ and $N_2O$. $CO_2$ is primarily released through the burning and decomposition of biomass (wood, crop residues, etc.). $CH_4$ and $N_2O$ are mainly released via a set of pathways including enteric fermentation, manure management activities, nitrification/denitrification of nitrogen from synthetic N-containing fertilizers, organic fertilizers and soil conditioners, and nitrogen fixing rhizobia associated with leguminous plants, and decomposition of crop residues.

> GHG emissions from the agriculture, forestry and other land use (AFOLU) sector are second only to the energy sector and represent nearly one quarter of total manmade emissions annually. The contribution of emissions from crop and livestock agriculture continues to rise relative to forests and other land use.

## 2.3 Carbon dioxide equivalents

The impact that GHGs have on radiative forcing varies between gases and over different timescales, and is typically approximated by their global warming potential (GWP)—a measure of the potency of a GHG in the atmosphere relative to $CO_2$, over a certain time interval, usually 100 years. Because all GHGs have different GWPs, for ease of comparison emissions are typically reported using a shared unit—the carbon dioxide equivalent ($CO_2e$) which is the amount of $CO_2$ that would have the equivalent warming effect over a given time period, usually 100 years in carbon markets. $CO_2e$ are typically expressed on a mass basis i.e., the number of tonnes of $CO_2e$ that a given project would reduce. One tonne of $CO_2e$ ($tCO_2e$) is thus the unit of transaction utilized by the majority of carbon markets.

## 2.4 AFOLU and climate change mitigation

In addition to being a major contributor of GHG emissions, the AFOLU sector can also play a significant role in mitigating emissions by i) sequestering carbon in vegetation and soils, and ii) reducing emissions from GHGs associated with land use and land use change. Climate smart sustainable land management practices (as opposed to conventional land management practices which contribute to climate change as discussed in Section 2.2) can have an especially large impact in SSA which is dominated by smallholder agriculture (Pender et al. 2009). A selection of these practices and their GHG benefits are summarized in Table 1.

*Table 1. Examples of sustainable land management (SLM) activities and their potential GHG benefits.*

| Land use | SLM activity | GHG benefit |
|---|---|---|
| **Croplands** | Organic fertilizer use | Displaces GHG emissions from chemical fertilizers |
| | Low or no-till systems | Builds soil carbon |
| | Cover crops | Builds soil carbon |
| | Improved residue management | Reduces GHG emissions from residue burning/decomposition |
| **Grasslands** | Cut-and-carry forage systems | Reduces GHG emissions from grassland degradation |
| | Silvopasture | Sequesters carbon in trees |
| | Improved pasture management | Builds soil carbon |
| **Forests** | Agroforestry systems | Sequesters carbon in biomass |
| | Avoided deforestation | Reduces GHG emissions from deforestation and degradation |
| **Livestock** | Improved manure management | Reduces GHG emissions from manure decomposition |

It is important to note that the degree to which these practices deliver net positive (or in some cases negative) GHG impacts depends on the unique biophysical, climatic and cultural attributes of the locations where they are implemented. Nonetheless, meta-analyses of sustainable land-management practices show that they generally increase soil and aboveground carbon sequestration and reduce emissions from $CO_2$ (Branca et al. 2013). Box 1 describes how Ethiopia's PSNP is delivering quantifiable net carbon benefits through the implementation of climate-smart interventions.

Box 1. Carbon benefits of climate smart interventions in Ethiopia's PSNP

The Climate Smart Initiative (CSI) of Ethiopia's PSNP is intended to build resilience by embedding knowledge and climate-specific planning, to enhance food security and community well-being in a changing climate. One core focus area of CSI is measuring the mitigation potential of PSNP-implemented climate smart land use interventions. These include area enclosures, cut-and-carry forage systems, agroforestry, afforestation/reforestation, rangeland restoration, and integrated soil and water conservation practices. The suite of interventions deployed at any given PSNP site is tailored to its unique biophysical, climatic and cultural characteristics. CSI consortium partners predicted the mitigation potential of PSNP interventions using field measurements and modeling techniques at 28 sites within six Ethiopian regions. Using IPCC Tier 1 and 2 methodologies, the mean carbon benefit across all CSI sites was estimated at 5.7 $tCO_2e\ ha^{-1}\ yr^{-1}$ (Figure 5; see Woolf et al. 2015 for details).

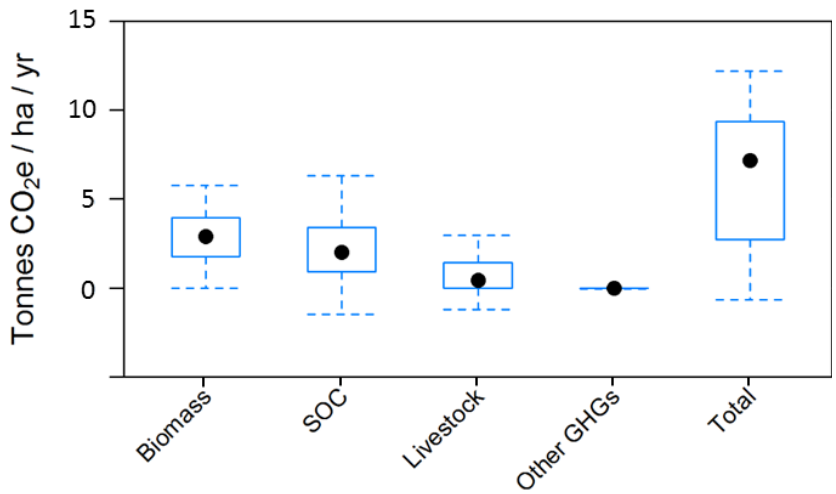


*Figure 5. Summary of IPCC Tier 1 assessment carbon benefits by GHG flux category aggregated over 28 modeled sites. Black dots indicate median values, and boxes show interquartile range. SOC is soil organic carbon. See Woolf et al. 2015 for details.*

Biomass and soil organic carbon accumulation were the largest sources of GHG fluxes contributing to the overall carbon benefit, contributing on average 2.3 and 2.2 $tCO_2e\ ha^{-1}\ yr^{-1}$, respectively, followed by reduced emissions of methane from livestock management at 1.3 $tCO_2e\ ha^{-1}\ yr^{-1}$. Contributions from other GHG fluxes (primarily attributable to fertilizer management) were negligible due to the low frequency of inorganic fertilizer use in Ethiopia. Variability between PSNP sites was substantial (standard deviation 6.1 $tCO_2e\ ha^{-1}\ yr^{-1}$) underscoring large differences across the landscape in potential carbon benefits. Causes of variability are attributed to i) type of sustainable land management intervention (e.g., grassland restoration has lesser impact than woodland reforestation), ii) differences in extent of implementation (e.g., types of trees and density of planting, allowance of firewood and timber extraction, effectiveness of livestock exclusion), and iii) bioclimatic and edaphic factors (e.g., low rainfall areas are less productive, sandy soils store less carbon). Nonetheless, at some sites the net carbon benefit exceeded 10 $tCO_2e\ ha^{-1}\ yr^{-1}$. When considering that Ethiopia's PSNP interventions cover hundreds of thousands of hectares, the potential for PSNP to have a meaningful impact on climate change mitigation is compelling.

# 3 Market-based mechanisms to incentivize GHG emissions reductions

Atmospheric GHG concentrations are nearing planetary limits of providing a safe habitable planet for humanity (Steffen et al. 2015). The need to slow, and if possible reverse, GHG concentrations to avoid the worst effects of climate change is therefore urgent. Some actions to achieve this climate-change mitigation can be provided at relatively low cost (such as improved energy efficiency, or on-shore wind and hydropower in suitable locations). However, achieving more ambitious targets required to keep climate risk within acceptable bounds will require that a comprehensive portfolio of measures be implemented that also includes more expensive interventions such as avoided deforestation and carbon capture and storage (Enkvist, Nauclér, and Rosander 2007).

Actions are being taken by economies across the globe to mitigate climate change. Market-based mechanisms put a price on GHGs in order to incentivize decarbonization and fall into two categories: carbon taxation, and cap-and-trade systems.

Economies across the globe are taking steps to mitigate rising atmospheric GHG levels. On the one hand, there are regulations limiting the amounts of GHG emissions that can be emitted by certain sectors (e.g., energy, transport) without including provisions for trading emissions allowances or purchasing offsets. These types of actions are non-market-based, i.e., they do not involve direct financial transactions. On the other hand, there are instruments that put a price on GHGs in order to incentivize decarbonization. These are termed market-based mechanisms and fall into two categories: carbon taxation, and cap-and-trade systems. At present, there over 60 carbon pricing schemes (carbon taxes and cap-and-trade systems combined) worth about US$30 billion[4] (Kossoy et al. 2014) that are implemented or being planned as part of regulations capping GHG emissions at the sub-national, national or international levels.

## 3.1 Carbon taxes

Carbon taxes guarantee a fixed price on carbon in an economic system (Kossoy et al. 2014). They generate revenues that can be used to fund low-carbon technologies and emissions reduction activities, and they also incentivize investments in upgrades to facilities or processes by emitting entities affected by the carbon tax. Fourteen national governments and one sub-national government currently have a carbon taxation program in place (Kossoy et al. 2014).

[4] Excluding the CDM. Market value is calculated by multiplying the 2013 cap by the allowance price.

However, carbon taxes do not directly support mitigation activities through offsetting programs and are therefore not currently relevant to Ethiopia's PSNP.

## 3.2 Cap-and-trade systems and carbon markets

Cap-and-trade systems are a type of market mechanism that place a limit (cap) on annual emissions by sector and then allow emitters to buy and sell (trade) excess emissions amongst regulated entities. Cap-and-trade systems are also referred to as emissions trading schemes. A key tenet of cap-and-trade is that the cap should be lowered annually to ensure that emissions fall over time. For example, in the European Union Emissions Trading Scheme (EU-ETS; created to help meet European Union (EU) country obligations under the Kyoto Protocol) the cap on emissions in 2020 is projected to be 21% lower than in 2005 (European Commission 2015).

Some cap-and-trade systems permit allowances (i.e., carbon credits) to be created and sold via activities that reduce GHG emissions and/or sequester carbon. Credits are generated by projects/activities undertaken by third parties, sometimes outside the regulated jurisdiction and in wholly different regions of the globe. Carbon credits (usually quantified as tonnes of $CO_2e$) can then be purchased by regulated entities to meet their cap. Such systems are dubbed carbon markets. In theory, carbon markets identify the most economically efficient i.e., low cost, way to reduce atmospheric GHG concentrations. For example, a power plant in a developed country may have to invest the equivalent of US$100/tonne $CO_2e$ to install new technologies that reduce its emissions to its cap whereas it can purchase carbon credits from a reforestation project in a developing country at US$5/tonne $CO_2e$ to achieve the same reduction.

While carbon markets work across many scales and have different governance structures and transaction frameworks they all enable GHG-emitting entities—whether governments, companies or other institutions—to offset their carbon footprint by investing in external projects or activities that reduce GHGs or sequester carbon. In carbon markets the GHG-emitting entity does not directly reduce its own emissions; rather it finances actions that reduce GHG emissions or sequester carbon and then applies the reductions against its own carbon footprint.

### 3.2.1 Types of carbon markets

Carbon markets were initially conceived as tools that allow the market to identify the lowest possible price to reach GHG emissions targets compelled by regulations. These are termed compliance carbon markets—regulated entities must comply or they risk adverse actions by the regulator. Compliance carbon markets are developed as mechanisms within treaties or laws that obligate GHG-emitting entities to reduce their emissions.

Compliance carbon markets are developed as mechanisms within treaties or laws that obligate GHG-emitting entities to reduce their emissions. At present, there over 30 compliance carbon markets at the sub-national, national or international levels. Together these markets are worth about US$30 billion.

Compliance carbon markets have only been implemented in certain jurisdictions (see Section 3.3) and cover a minor portion of total annual GHG emissions. But their utility as mechanisms to instigate investments in decarbonization has spawned creation of analogous voluntary carbon markets. These enable entities (companies, individuals, or any other GHG emitters) to voluntarily offset their carbon footprint.

Carbon markets that allow international offsetting are relevant to Ethiopia's PSNP—as well as other public works safety net programs—and are discussed further in the following sections.

## 3.3 Overview of compliance markets

At present there are around 20 cap-and-trade systems in force with established rules and another 15 under consideration at the regional, national and sub-national scales (Kossoy et al. 2014). Some—such as the EU-ETS and the six provincial Chinese pilot emission trading schemes—encapsulate a significant portion of global carbon emissions. Others, particularly those operating in smaller, less industrialized countries, only encompass a small fraction of global GHG emissions but are nevertheless important because they create proving grounds for novel trading mechanisms and, perhaps more importantly, demonstrate political will to confront the global challenge of climate change.

### 3.3.1 Kyoto Protocol and the Clean Development Mechanism

The Kyoto Protocol is by far the largest binding treaty to address global climate change with 191 signatory countries plus the European Union. It was adopted under the United Nations Framework Convention on Climate Change (UNFCCC), initiated in 1992. The Kyoto Protocol required signatories from industrialized (Annex 1) nations to reduce their emissions to pre-1990 levels during the first commitment period from 2008-12. The Doha Amendment to the Kyoto Protocol was signed in December 2012 creating a second commitment period (2013-20).

While considerably reduced in scope (only 12% of global annual emissions covered as opposed to over 50% under the first commitment period), the Doha Amendment maintains momentum towards a new binding treaty intended to replace Kyoto and encompass emissions reduction goals from the world's largest emitters, specifically the USA, China and India, by 2020. This post-Kyoto treaty is actively being negotiated ahead of the upcoming UNFCCC 21st Conference of Parties (COP-21) meeting in Paris, France in December 2015 (see Section 5.3.2).

To facilitate required emissions reductions under Kyoto, three market-based mechanisms were created: 1) Emissions Trading, enabling Annex 1 countries to trade surplus GHG allocations amongst themselves, 2) Joint Implementation (JI), enabling Annex 1 countries to invest in GHG reducing activities in other Annex 1 countries, and 3) the Clean Development Mechanism (CDM). The latter mechanism enables developing (non-Annex 1) countries to create Certified Emissions Reduction (CER) credits—one CER is equivalent to one tonne of avoided $CO_2e$—through the deployment of quantifiable mitigation activities. Annex 1 countries can then purchase CERs to meet their emissions reduction requirements. The CDM and its relevance to Ethiopia's PSNP is discussed in detail beginning in Section 5.1.

### 3.3.2 Other compliance carbon markets

In addition to the CDM, there are over 30 regional, national and sub-national compliance markets implemented or planned[5]. The most prominent of these is the EU-ETS, set up to help European nations meet their internal commitments under the Kyoto Protocol. It came into force in 2005. By volume of emissions covered, it is the by far the largest cap-and-trade program. During its second phase (coinciding with the first commitment period of the Kyoto Protocol 2008-12), the EU-ETS permitted international offsets totaling around 1.4 billion $tCO_2e$ to be purchased via JI and CDM projects. It rapidly became the largest source of demand for CDM CERs and was a driver of the international carbon markets. However, offsets from the AFOLU and nuclear energy sectors were explicitly prohibited. The EU-ETS is currently in its third phase of implementation (2013-20), coinciding with the Kyoto Protocol second commitment period. Prohibitions on international offsets from the AFOLU sector remain in place. Nonetheless, the EU is advocating at the UNFCCC level for inclusion of new mechanisms for international carbon markets that would cover entire economic sectors and utilize standardized methods to assess baselines and additionality (see Section 7.3), as opposed to the project-based approach used in the CDM and voluntary carbon markets. If incorporated at COP-21, such an approach may be very promising to the scale and scope of Ethiopia's PSNP.

[5] For a list of implemented and planned compliance markets see Kossoy et al. (2014).

After the EU-ETS, the recently formed California (USA) Cap-and-Trade Program is emerging as a major carbon market. California is the 7th largest economy in the world with a gross domestic product of US$2.25 trillion; its Cap-and-Trade Program is a significant new addition to the compliance market landscape. The program was created under the Global Warming Solutions Act (AB32), passed in 2010, which requires California to reduce its emissions to 1990 levels by 2020. The program covers 85% of California's GHG emissions and will deliver a 15% reduction over the "business-as-usual" (BAU) scenario via a 3% per annum declining cap until 2020. Offsets of up to 8% of a facility's compliance obligation are allowed, and while not currently allowed there are provisions for international offsets in the future.

The EU is advocating at the UNFCCC for inclusion of new mechanisms for international carbon markets that would cover entire economic sectors and utilize standardized methods to assess baselines and additionality. If incorporated at COP-21, such an approach may be very promising to the scale and scope of Ethiopia's PSNP.

Numerous other compliance markets have emerged at the regional, national and sub-national levels. These include: the New South Wales (Australia) Greenhouse Gas Reduction Scheme; the Regional Greenhouse Gas Initiative (comprised of nine northeastern US states); the New Zealand ETS; and six sub-national markets within China, which, in 2016 plans to launch a national carbon market that aims to reduce the amount of carbon per unit of GDP (aka carbon intensity) to 45% below 2005 levels by 2020 However, none of the compliance carbon markets discussed in this section allow international offsets and are thus not further discussed.

## 3.4 Overview of voluntary markets

Voluntary carbon markets exist outside of regulatory frameworks. They have been created to meet the demands of voluntary buyers of carbon credits, mainly from the private sector. The top motivations for participation in voluntary carbon markets are to fulfill corporate social responsibility (CSR) goals, to meet stakeholder interest, or to show leadership in climate change mitigation in an industry.

Voluntary carbon markets are for the most part operated by independent, third-party organizations that have a not-for-profit mission to combat climate change. Similar to compliance markets, they require that methodologies for specific GHG reduction pathways be validated before being available for use.

Of the dozen or so voluntary offset programs that are currently operational worldwide, two stand out as particularly relevant to PSNP: the Verified Carbon Standard (VCS) and the Gold Standard. For further information on voluntary carbon market trends see Box 3.

Of the dozen or so voluntary offset programs that are currently operational worldwide, two stand out as particularly relevant to PSNP: the Verified Carbon Standard and the Gold Standard

# 4 Key elements of carbon offset programs for PSNP

Carbon markets are supported by institutions—whether public or private, for-profit or non-profit—that have built programs containing the necessary elements to quantify, register and trade carbon credits. While there are numerous different carbon offset programs linked to the various active carbon markets as previously discussed, they all share similar elements[6] that ultimately enable them to verify claims about emissions reductions generated by carbon projects. In the following sections, we focus on those elements requiring special attention under Ethiopia's PSNP to successfully develop a carbon project.

## 4.1 Carbon standards

Carbon standards provide the guidelines, specifications and requirements that must be met to ensure consistency amongst projects that are accepted under a carbon offset program. Standards are developed by, and are part-and-parcel of carbon offset programs. There is considerable overlap between the key elements of carbon standards. They contain the requirements that GHG accounting methodologies and carbon offsetting projects must meet to be approved. They also lay out the process whereby a project moves through the various phases of development, review, implementation, and eventual credit issuance. Ultimately, the carbon standard to be followed by the project proponent will be the one linked to the carbon market that is selected for project development.

For Ethiopia's PSNP, an analysis of the most suitable carbon market would include trends in terms of prices and volume of carbon credits transacted, methodologies suited to PSNP public

[6] The main elements of carbon offset programs and their relevance to PSNP are discussed in detail in the Step-by-Step Guide to Developing AFOLU Carbon Market Projects.

works activities, and ease of project development, among others. This report provides some recommendations to this effect in Section 5.3.

## 4.2 Greenhouse gas accounting methodologies

In order for carbon markets to operate, GHG sources, sinks and reservoirs (SSRs) must be quantified. To this end, scientifically-based GHG accounting methodologies (referred to as protocols by some carbon offset programs) are developed. These methodologies document the steps to quantify carbon benefits of a given emissions reduction activity or project e.g., renewable wind energy, reforestation, etc., and may also be specific to certain regions of the world e.g., tropical rainforests.

Methodologies are reviewed and approved by carbon offset programs and as such must adhere to the standards established by that program. Methodologies must pass through a review process before being approved for use; the level of rigor and process for the review varies depending on the carbon offset program in which it is to be used. Nonetheless, the objective of all carbon accounting methodologies is to quantify the GHG benefit associated with the project and to provide guidance to project developers when planning and implementing projects.

Methodologies have been developed and successfully implemented for a wide variety of project types that reduce GHG emissions and/or sequester carbon. In the AFOLU sector, forest-based methodologies fall chiefly into the following categories: afforestation and reforestation (A/R); reduced impact logging (RIL); and reduced emissions from deforestation and degradation, conservation of forest carbon stocks, sustainable management of forests, and enhancement of forest carbon stocks (collectively termed REDD+).

*Figure 6. A tree nursery at a PSNP-CSI site with seedlings for reforestation and agroforestry activities.*

Agriculture-based methodologies are at present dominated by those that seek reduced methane and nitrous oxide emissions from manure and fertilizer use. There are far fewer agricultural methodologies that provide crediting mechanisms for agroforestry, cover crops, residue management, soil carbon accumulation, and crop switching—the sustainable agriculture activities typified by PSNP. Nonetheless, there are several methodologies applicable to PSNP that we detail in Section 7.1.

Following are a subset of the elements and requirements common to all GHG accounting methodologies that should be given careful consideration under current and future implementation of PSNP public works programs in Ethiopia.

### 4.2.1 Geographic boundary

The use of geospatial data and techniques to delineate the geographic boundary of areas where activities are to be implemented is a requisite for all GHG accounting methodologies in the AFOLU sector. Ethiopia's PSNP implementation entails suites of activities distributed across thousands of geographically unconnected locations across the country. Individual PSNP locations typically cover tens to hundreds of hectares and have minimal climate change abatement potential—and thus minimal ability to generate significant revenues via a carbon project. Collectively, however, the quantities of $tCO_2e$ generated by Ethiopia's PSNP become compelling for project developers and eventual sale of carbon credits.

The leading carbon offset programs contain mechanisms to group (or bundle) projects so that they fall within the overall project boundary. Given the current structure of PSNP activities ranging over a broad geographic area with non-contiguous boundaries, a grouped project approach must be taken with Ethiopia's PSNP for there to be any chance of positive financial returns on a carbon project. The articulation of the geographic boundary—and in particular decisions around the grouping of activity areas in a watershed, woreda or region—thus become critical for Ethiopia's PSNP.

An alternative to the grouped project approach (which has certain limitations discussed in Section 7.2), future implementation (i.e., PSNP 4) may consider concentrating activities in a larger contiguous area e.g., large watershed, where a grouped project approach may not be needed, and costs of carbon project development, monitoring, reporting, and verification could be lower than for a dispersed collection of small-scale interventions.

### 4.2.2 Project boundary

All GHG projects aim to have a primary effect which is the intentional reduction of GHG emissions or sequestration of carbon through a target set of sources, sinks and reservoirs. For example, an agroforestry project accumulating carbon in woody biomass and soils and reducing $N_2O$ emissions from chemical fertilizers. However, projects also have secondary non-target effects associated with implementation of project activities. For example, the agroforestry project may emit GHGs through the combustion of fossil fuels to transport seedlings and cultivate soils, and through the decomposition of crop residues used as organic fertilizers. All primary and secondary effects are delineated via the project boundary which dictates which SSRs must be quantified in order to calculate the net GHG benefit of a project.

### 4.2.3 Leakage

In some cases, the carbon project[7] may induce additional unintended effects outside the project boundary that can increase GHG emissions elsewhere. These effects are known as leakage and, if not properly addressed, could lead to reduced, zero or even net negative GHG mitigation i.e., increased GHG emissions under the project scenario. All carbon offset programs recognize the importance of identifying and mitigating leakage effects prior to project implementation, and providing protocols for quantification and mitigation of leakage that must be adhered to.

Leakage is of particular concern in AFOLU projects. It can occur when project interventions displace current land use activities. Potential leakage scenarios in AFOLU projects generally fall into the following two categories:

- Activity shifting leakage that occurs when project interventions displace GHG emitting activities to areas outside of the geographic boundary. For example, if lands outside the geographic boundary are deforested to create new grazing opportunities for livestock

[7] We adopt the common convention in this report of using the term "carbon project" to describe an AFOLU project to reduce GHG emissions. It should be borne in mind, however, that so-called carbon projects may also target other non-$CO_2$ GHGs.

displaced by area enclosures (i.e., exclusion from grazing lands), thereby increasing GHG emissions from deforestation;

- Deforestation leakage (a type of activity shifting leakage) that occurs if reduced deforestation and degradation (REDD) project activities shift deforestation/degradation to other areas; and
- Market leakage that occurs due to a shift in supply and/or demand (and thus price) of a commodity (e.g., firewood, timber, livestock) when project activities reduce the production of that commodity. For example, if timber plantations result in a surplus of timber thereby reducing timber prices and incentivizing conversion of existing plantations to lower biomass land uses.

Leakage risk must be assessed using established protocols, and where leakage potential is identified, mitigation activities must be designed and implemented. One type of leakage of particular relevance to PSNP's AFOLU projects is the potential for livestock to be displaced by area enclosures. Livestock leakage impacts of area enclosures could include: i) new (previously unused) grazing lands being utilized as pasture by local communities to compensate loss of grazing rights in the area enclosure; ii) increased stocking densities on other grazing lands, leading to increased degradation pressure outside the project area; iii) a reduction in stock numbers in response to lower forage availability without access to the enclosure; iv) an increase in stock numbers due to increased forage production through hay and/or agroforestry cut-and-carry systems in the area enclosure; or v) increased demand for crop residues as fodder reducing their availability for alternative uses such as soil mulches, composting, fuel or construction (see Woolf et al. 2015 for more details).

### 4.2.4 Business-as-usual and project scenarios

Net GHG emissions over time are commonly estimated in what are known as scenarios. These scenarios are measured relative to the initial state of the system at time zero. In order to quantify changes in GHG emissions resulting from a carbon project, it is necessary to estimate what the level of emissions would be in the absence of project implementation. This is known alternately as the baseline or business-as-usual (BAU) scenario. Under BAU, in the absence of a carbon project, the emissions relative to the initial state may remain the same or even worsen, for example, due to ongoing land degradation or conversion of forests to agriculture. Activities that are designed and implemented under a carbon project, are then evaluated in relation to BAU, with the net carbon benefits generated under the project scenario defined as the incremental difference between total emissions in the project and BAU scenarios (Figure 7).

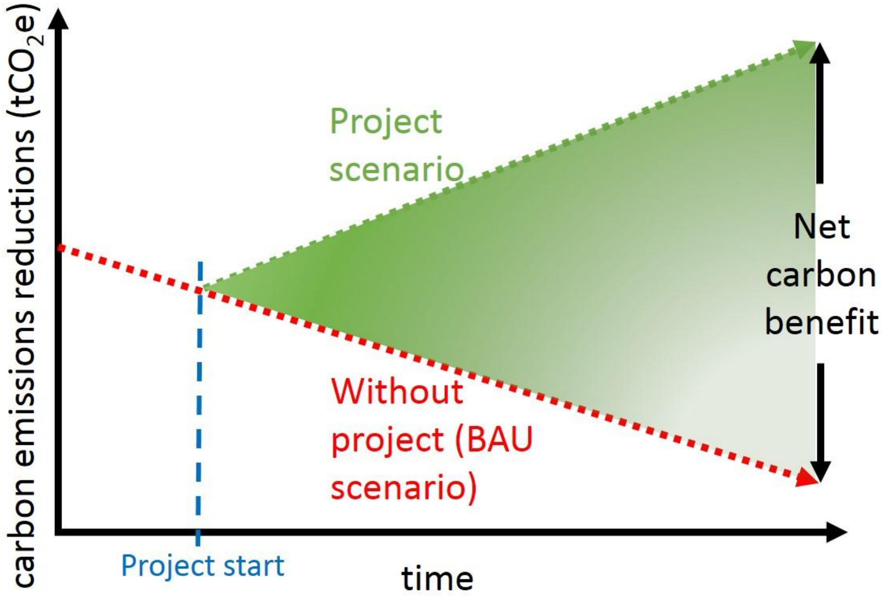


*Figure 7. Diagram depicting the net carbon benefits generated over time in the project scenario.*

It is also possible that, under BAU, GHG emissions might be reduced even without climate finance. For example, activities that are already planned under existing government programs, or activities that are required to meet existing or planned regulations would form part of the baseline or BAU scenario. This is particularly relevant to Ethiopia's PSNP 4, whose expected and already-financed interventions would therefore be considered as falling within the BAU scenario. In this instance only additional GHG mitigation activities above-and-beyond what is already planned or regulated would qualify as falling within a project scenario for the purposes of garnering carbon finance (see Section 4.2.5 on additionality for further discussion of this point).

Most carbon offset programs specify the steps to be taken when identifying alternative land uses under the BAU scenario[8]. These include an analysis of relevant national and/or sectoral policies, historical land use, socio-economic trends, and any regulations or policies mandating the implementation of land use practices. Barriers—related to investments, institutions, technologies, common practice, and others—that may prevent implementation of alternative land uses are then analyzed. The analyses laid out in the BAU scenario identification are subsequently used in the determination of additionality (see next Section 4.2.5).

> For Ethiopia's PSNP, identifying the business-as-usual scenario may be a complex task. Ethiopia is defined by highly variable agro-ecological zones and cultural and socio-economic circumstances. Scenario identification should focus in on those PSNP sites that share similar biophysical and socio-economic attributes, enabling them to be grouped under the auspices of a single project, or on specific interventions within PSNP that are designed specifically as carbon finance projects.

For Ethiopia's PSNP as a whole, identifying the BAU scenario may be a complex task. Ethiopia is characterized by highly variable agro-ecological zones and cultural and socio-economic circumstances, all of which would have to be assessed to identify BAU scenarios if climate finance was sought for a PSNP program-wide initiative at the national scale. Therefore, scenario identification should focus on either: i) PSNP sites that share similar biophysical and socio-economic attributes, enabling them to be grouped under the auspices of a single project, or ii) on dedicated interventions within PSNP that are designed specifically as carbon finance projects.

### 4.2.5 Additionality

A key requirement of all carbon markets is that the GHG project would not have advanced without revenues generated from sales of carbon credits. This requirement that project implementation is dependent on carbon finance is known as additionality. It may be that market conditions were already favorable and the project would thus have been profitable without the additional revenues from sales of carbon credits. Or existing/anticipated laws or regulations may mandate the implementation of activities in the region where a project is

[8] For example, the CDM "Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities" Version 1, or the "Tool for the Demonstration and Assessment of Additionality in VCS Agriculture, Forestry and Other Land Use (AFOLU) Project Activities, v3.0".

intended. Irrespective of the reason, if projects are viable in the absence of income from carbon markets, any mitigation of atmospheric GHG concentrations they achieve cannot be considered additional i.e., the project would have been implemented regardless of carbon market activities.

The steps to demonstrate additionality build on those used to identify the BAU scenario (see previous Section 4.2.4). Once the BAU scenario is identified, an investment analysis is

> A key requirement of all carbon markets is that the GHG project would not have advanced without revenues generated from sales of carbon credits. This requirement that project implementation is dependent on carbon finance is known as additionality.

conducted. There are various options for investment analyses, ranging from simple to complex. Independent of the method selected, however, the analysis should demonstrate that the project scenario is not more financially attractive than BAU, i.e., it is additional. Projects that cannot satisfactorily demonstrate additionality will not be eligible for acceptance in a carbon market. A more detailed analysis of how additionality applies for carbon projects developed in the context of Ethiopia's PSNP is given in Section 8.

### 4.2.6 Non-permanence and risk quantification

Carbon projects accrue climate change mitigation benefits over some time frame. For AFOLU projects, the benefits typically accrue gradually as trees grow, soil carbon is replenished, and/or AFOLU emissions are reduced inter-annually. Regardless of how GHG benefits were created, they are all potentially reversible if technologies fail, forests burn, there is a return to BAU management practices, or other unforeseen events occur.

While projects in all GHG sectors face some risk of reversals, AFOLU projects have inherently higher risks and are subject to due diligence requirements above and beyond non-AFOLU projects. These include natural risks (e.g., fires, floods, droughts), internal risks (e.g., financial viability, project management), and external risks (e.g., land ownership issues, illegal encroachment, community relations). Events in all of these risk categories can quickly nullify carbon offsets created by the project and are collectively termed non-permanence risks.

Most carbon markets require the quantification of non-permanence risks when developing a project through the use of tools spelled out in the carbon offset program. In the VCS, a risk buffer pool of carbon credits that are not tradable is mandated in case of project reversals; the higher the degree of risk as determined by the tool the larger a percentage of the total anticipated tonnes of $CO_2e$ must be kept in the buffer pool. In the CDM, non-permanence risk is addressed by requiring that carbon credits expire over a defined time frame (at the end of the commitment or crediting period in which they were issued) and are subsequently replaced by other credits.

Climate finance projects under PSNP would be required to quantify the non-permanence risk of their activities. As with identifying the BAU scenario and demonstrating additionality, the

> While projects in all GHG sectors face some risk of reversals AFOLU projects have inherently higher risks and are subject to due diligence requirements above and beyond non-AFOLU projects.

quantification of non-permanence risk for the whole of PSNP would be a complex task given the heterogeneity of activities and situations in which PSNP operates. The costs and complexities of such an endeavor might be best managed by concentrating efforts on geographically clustered interventions within PSNP rather than on the whole of PSNP, at least until carbon markets become sufficiently mature to justify a national-scale carbon project. Available tools will help guide project developers through the process.[9]

# 5 Carbon market trends in the AFOLU sector

Carbon markets support a wide range of GHG emissions reduction projects, only some of which are in the AFOLU sector. In the CDM, AFOLU projects only make up a tiny fraction of the market share of traded CERs (3% of CERs in 2007-11). Instead, the vast majority of CERs generated in the CDM to date have been from renewable energy, demand- and supply-side energy efficiency, and hydrofluorocarbon (HFC) destruction projects. In contrast, most voluntary carbon offset programs trade in a large volume of credits generated through the AFOLU sector. For example, AFOLU projects made up the largest GHG sector by volume of tonnes of $CO_2e$ under the VCS in 2013, largely due to the emergence of numerous large-scale REDD+ projects (Figure 9). This discrepancy in AFOLU project representation between the CDM and voluntary markets—and its relevancy to Ethiopia's PSNP—is discussed in the following sections.

## 5.1 CDM and AFOLU

The reasons that AFOLU projects are under-represented in the CDM are varied. The CDM has evolved into a complex system requiring large amounts of paperwork, and with numerous administrative and governance requirements. This complexity has been shown to contribute to

[9] For example, the VCS "AFOLU Non-Permanence Risk Tool, v3.2".

low submissions and approvals of CDM projects, especially for A/R projects (Thomas et al.

> The vast majority (97%) of Certified Emissions Reductions generated in the CDM to date have been from other sectors, not from AFOLU. In contrast, most voluntary carbon offset programs—while smaller than the CDM in terms of overall volumes traded—target a large percentage of their funds to AFOLU projects.

2010). It also leads to substantial (and often prohibitive) project development and transaction costs, representing a financial barrier to AFOLU projects located in the developing world. Further, the technical expertise needed to quantify emissions reductions and carbon sequestration in AFOLU (relative to other sectors like energy or HFCs) is an obstacle. These above-referenced barriers in the CDM are all applicable to Ethiopia’s PSNP. Multiple processes separated in space and time lead to emissions and removals. Establishing causal factors, whether anthropogenic or natural, can be difficult and costly, and requires the participation and financing of technical experts.

High project development constraints in the CDM are reflected in the low numbers of CERs generated by the AFOLU sector; by 2020, the accumulated CERs attributable to AFOLU are expected to total about 3%, most of which will come from methane avoidance in manure projects (Figure 8).

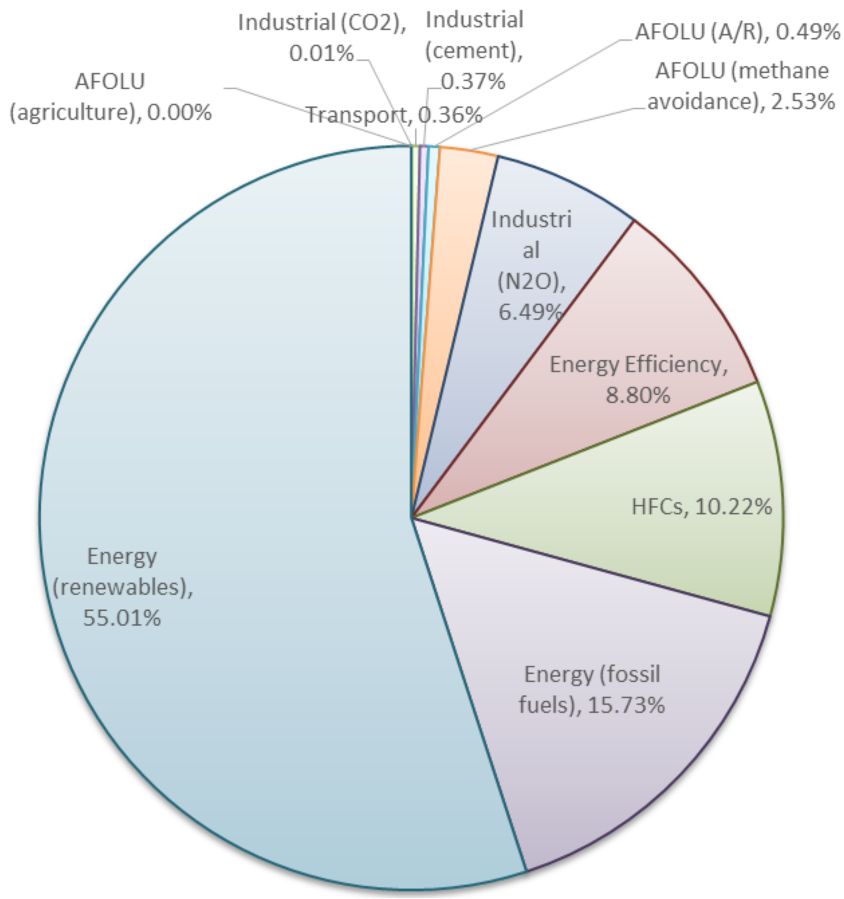


*Figure 8. Percent of CERs expected until 2020 from CDM projects by sector (source: UNEP DTU Partnership 2015).*

Proponents of the CDM have long recognized these constraints to AFOLU project participation, particularly in developing countries such as Ethiopia. Revisions have been made to attempt to redress the situation. Most notably, the more recently created Program of Activities (PoA) approach—permitting the bundling of numerous project activities under one administrative umbrella to reduce cost burdens—has led to an uptick in developing country projects, though not necessarily in the AFOLU sector (see Section 7.2 for further information on PoA).

## 5.2 Voluntary carbon markets and AFOLU

Voluntary carbon markets only trade a small fraction (<1%) of the volume of compliance markets but they are nonetheless important in several key ways. First, they serve as testing grounds for new methodologies, tools, and technologies that would otherwise not meet the regulatory requirements of the CDM or other compliance markets. Novel approaches to tackling climate change can thus be explored with the additional support of revenues from carbon credits. Second, they have a high representation of methodologies for the AFOLU sector and serve as important sources of finance for sustainable land management; whereas less than 1% of CERs on the CDM were comprised of A/R projects (and even fewer in other AFOLU categories) in 2013, roughly half of the voluntary market share was comprised of AFOLU projects (Figure 9). A large portion of this market share was attributable to an influx of REDD+ carbon credits.

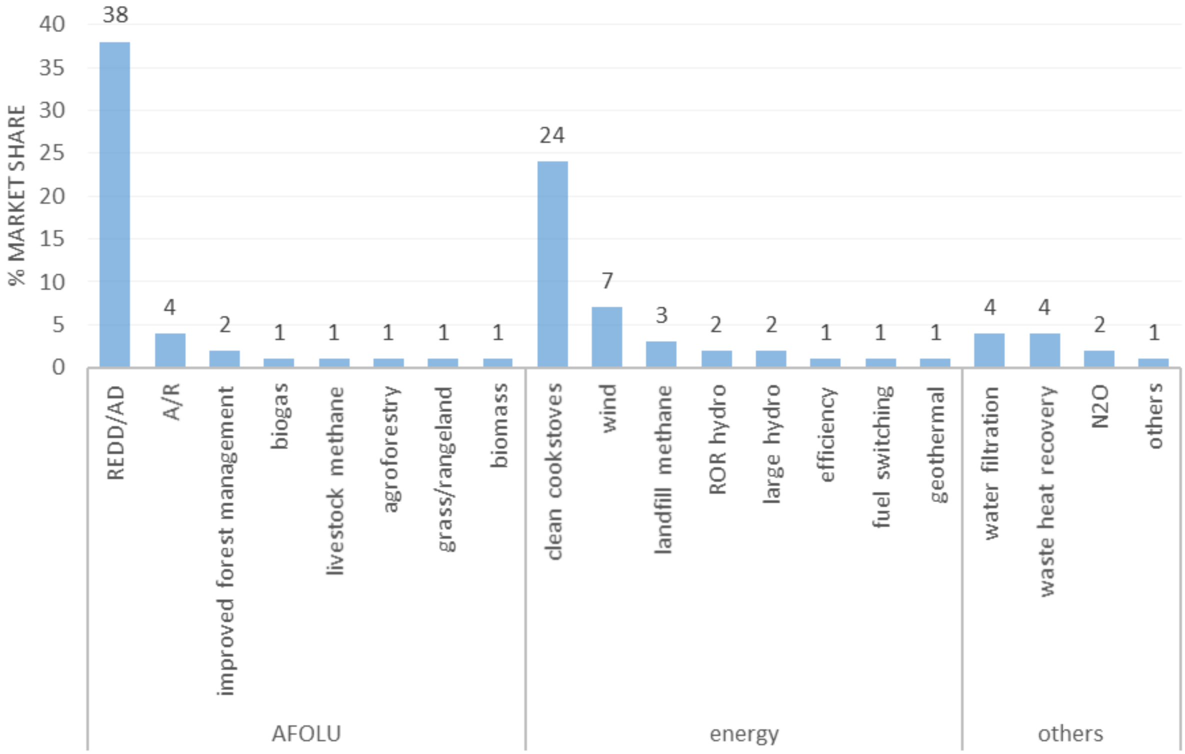


*Figure 9. Percent market share by GHG sector and sub-sector in the voluntary market in 2013 (source: Peters-Stanley and Gonzalez 2014).*

Given their flexibility and demonstrated interest from buyers, voluntary carbon offset markets are anticipated to continue to be an important avenue for development of carbon projects and novel methodological approaches in the AFOLU sector into the future. Interventions targeted at voluntary markets through Ethiopia's PSNP may be good candidates for project development, but only at a targeted sub-national or local scale given the smaller volumes of transactions in voluntary markets.

## 5.3 Carbon markets trends and outlook

Uncertainty in the international regulatory environment under the UNFCCC process over the last several years has driven creation of domestic market-based policies designed to take action on climate change. At present, there are about 40 national and 20 sub-national jurisdictions across the globe that are putting a price on carbon, whether in the form of emission trading, carbon taxation or some blended approach (Figure 10). And there are numerous other jurisdictions that are in the planning or implementation stages of carbon pricing instruments, including in major GHG emitting countries such as China.

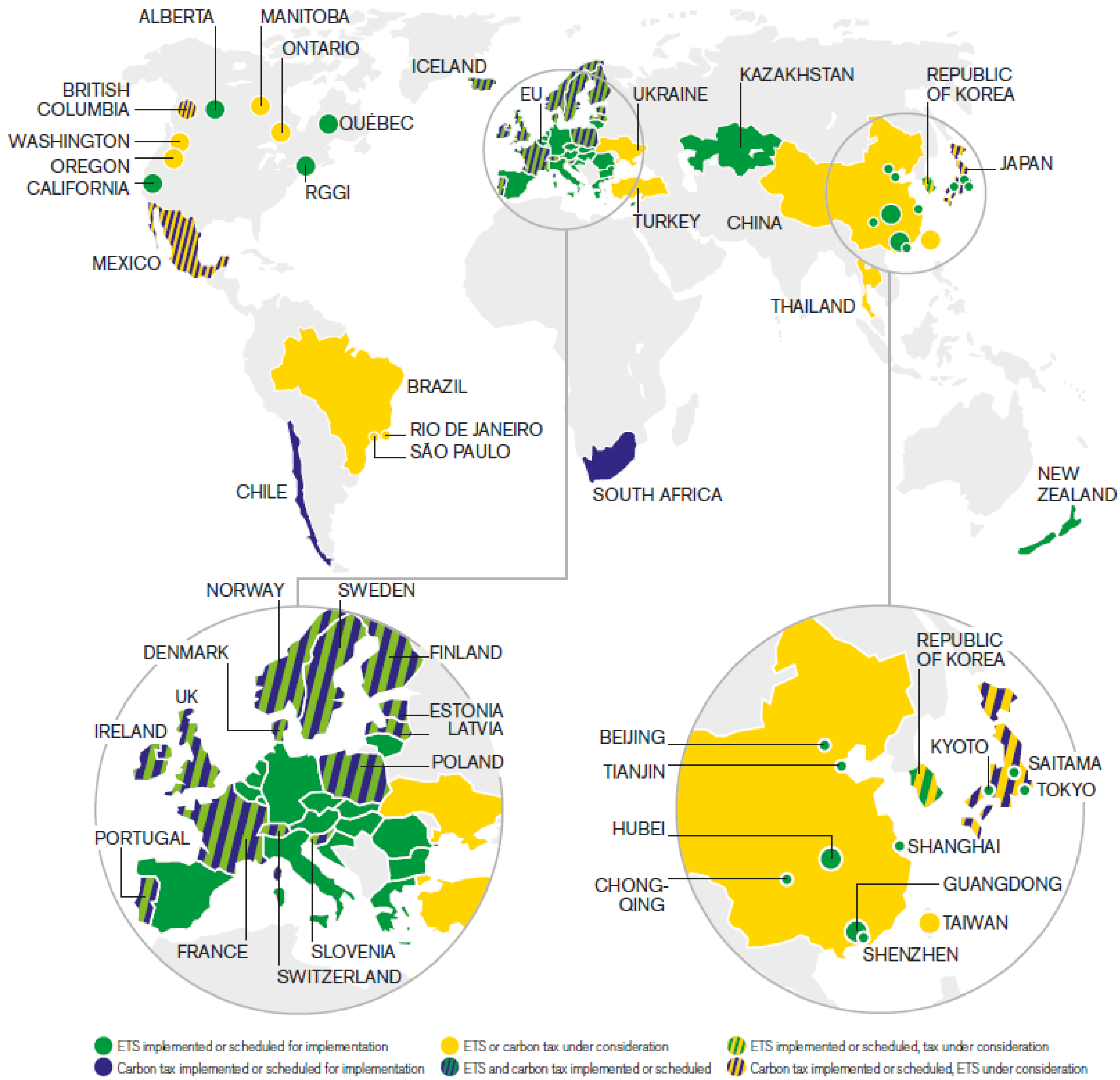


*Figure 10. Map of existing and planned regional, national and sub-national carbon pricing instruments. The circles represent subnational jurisdictions. The circles are not representative of the size of the carbon pricing instrument, but show the subnational regions (large circles) and cities (small circles) (source: Kossoy et al. 2015).*

But the political and technical landscape that underpins carbon markets and their success is highly dynamic and, as a result, future projections are difficult to make. As seen in the global economic recession from which certain regions are still emerging, carbon markets are tightly enmeshed with the prosperity of both public and private sector actors.

A new binding treaty emerging from COP-21 in Paris that caps emissions and/or sets a price on carbon would send a clear signal to carbon project developers that a robust carbon market can be anticipated. Ethiopian policymakers and PSNP managers should be cognizant of developments in the rapidly evolving UNFCCC process to make informed decisions regarding allocation of resources for eventual carbon project development within PSNP (see Section 5.3.2).

> A new binding treaty emerging from COP-21 in Paris that caps emissions and/or sets a price on carbon would send a clear message that a robust carbon market can be anticipated. As such, PSNP 4 managers should be cognizant of developments with respect to the UNFCCC process.

### 5.3.1 Geographic distribution of CDM projects

Because of the technical and administrative complexities inherent to the CDM discussed above (see Section 5.1), least developed countries have only managed to develop relatively few CDM offset projects. For example, Ethiopia only has two approved CDM projects as of 2015, one of which is in the AFOLU sector[10]. Instead, CDM projects are overwhelmingly located in larger, industrializing nations, particularly China and India, and to a lesser extent Brazil and Mexico; these four countries are host to over 76% of all CDM projects registered or in the pipeline as of early 2015 (UNEP DTU Partnership 2015). As a result over 80% of CDM projects are located in the Asia-Pacific region. Box 2 explores historical trends in the CDM in detail.

[10] The Humbo Ethiopia Assisted Natural Regeneration Project.

Box 2. Historical trends in the CDM

The first projects in the CDM were initiated in the early 2000's. However, significant quantities of CERs were not generated by those projects until 2006, in anticipation of the Kyoto Protocol first commitment period (CP1) which extended from 2008 – 12 (Figure 11). The price for CERS peaked in 2008 and then dropped slightly, remaining relatively stable at a price of about US$12 for several years (Figure 12). However, the price for CERs began to plummet in mid-2011. This situation is attributed to a combination of low or non-existent demand and surplus supply. The 2008 global economic recession, and the subsequent European debt crisis, led to a substantial contraction in international trade and industrial output. As a result, GHG emissions were significantly lower than anticipated across most emitting sectors including industry, transport, and energy production. Accordingly, many regulated entities in Annex 1 countries, particularly within the European Union, began to meet their targets under the Kyoto Protocol CP1. At the same time, there was a large spike (i.e., oversupply) in CDM projects coming online thus flooding the market with CERs. Since 2012 there has been relatively little market activity in the CDM with prices remaining at less than US$1 per CER. Nonetheless, estimates are that US$28 billion was transacted during CP1 for CER purchases, and that US$130 billion was invested in CDM projects.

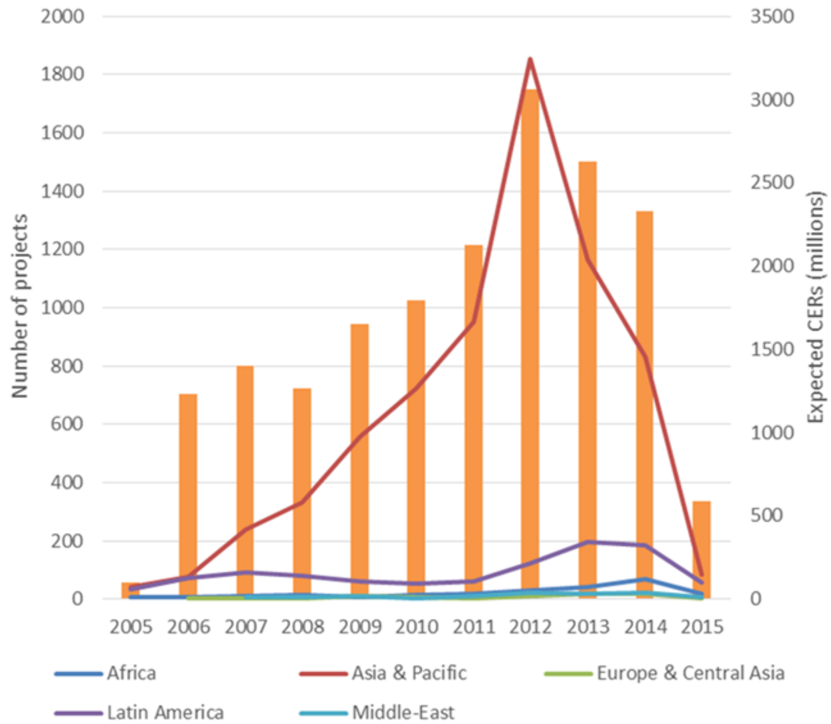


*Figure 11. CDM projects by region and expected CERs generated by those projects from 2005 – 2015 (source: UNEP DTU Partnership 2015).*

While a second commitment period (CP2) has been created (the so-called Doha Amendment) spanning 2013 – 20, just 27 countries have ratified the Amendment as of April 2015, and only a handful of those are Annex 1 countries. Per the requirements of the Kyoto Protocol, 144 countries must ratify the Amendment before the second commitment period can enter into force. The prospects for continuation of mandatory GHG reductions and demand for CDM CERs under the Kyoto Protocol and Doha Amendment are thus dim.


*Figure 12. Historical price of CDM CERs (orange line) and European Union Emission Allowances (EUAs; blue line). Note that CERs closely track the price of EUAs (source: Schoenberg and Weekes 2015).*

### 5.3.2 International climate negotiations and prospects for future carbon markets

Whether the CDM market—or some iteration of an international carbon offset trading mechanism—is revived hinges on outcomes from the COP-21 in Paris, France in December 2015. During that meeting, a new post-Kyoto international agreement to reduce GHG emissions is anticipated. Leading up to the Paris talks, countries have agreed to publically disclose what actions they plan to take to reduce their GHG emissions post-2020. These disclosures, known as Intended Nationally Determined Contributions (INDCs), offer insights into the levels of GHG reduction targets and whether offsets may play a role. With highly ambitious in-country targets, developed countries may seek inclusion of carbon trading mechanisms in a Paris agreement in order to reduce costs associated with reducing emissions.

But there are also detractors of the carbon trading approach. Some argue that by allowing offsets, sources of GHG emissions continue to emit business-as-usual rather than doing their share to cut emissions. They also argue that carbon trading benefits only a small number of host countries and does little to address the most vulnerable; for example, as of February 2015, China and India alone comprised over 70% of all registered CDM projects. While the CDM was originally intended to benefit the least developed countries, it has mostly benefited countries that are in a phase of industrialization.

Notwithstanding these objections from certain sectors, recent indications from negotiations leading up to COP-21 are promising *vis a vis* both a binding agreement as well as inclusion of market mechanisms. Specifically, the Director of the Sustainable Development Mechanisms

Programme at the UNFCCC recently stated that "…the question has gone past whether markets have a role to play. The question is now how big a role they will play, and how we can make the very best use of markets" (UNFCCC Secretariat 2015). This is the strongest sign yet that negotiators are in agreement that markets will be a part of a Paris treaty. Essential elements of an eventual carbon market mechanism will include: avoidance of double counting; linking existing regional, national, and sub-national markets under a common accounting framework; ensuring that projects contribute to net mitigation and sustainable development goals within the host country; and earmarking a share of proceeds from carbon markets for adaptation activities.

### 5.3.3 Other compliance markets and potential for PSNP

As stated in Section 3.3, there is no realistic potential for other compliance markets to play a role in supporting mitigation actions in Ethiopia in the near- to mid-term. For this reason, advocating for a strong climate treaty under the UN framework is the most promising avenue for a compliance market in which Ethiopia, and indeed other SSA nations, can participate.

### 5.3.4 Voluntary carbon markets outlook

Voluntary offsetting is more prevalent in regions covered by regulations governing GHG emissions (Goldstein 2015). Fully two-thirds of voluntary offset buyers in 2013 were companies located in the EU—already covered by strict compliance obligations under the Kyoto Protocol. A handful of major corporations in Japan—covered by several sub-national carbon pricing schemes—were also major voluntary offset buyers. Apparently, there are synergistic effects between compliance and voluntary markets where awareness built through regulations helps grow interest and participation, in some cases above and beyond regulatory requirements (Kossoy et al. 2014).

In parallel with this growing number of compliance carbon pricing programs covering an expanding portion of annual global GHG emissions, awareness of and participation in voluntary offsetting is also expected to grow (Kossoy et al. 2014). There is an established pattern of companies and GHG-emitting entities pre-emptively putting measures in place to reduce their carbon footprints—including through participation in voluntary carbon offset markets—ahead of planned regulations to reduce GHG emissions. A survey of carbon credit suppliers in the voluntary markets showed that by 2020 they anticipated that carbon markets would grow to 300 million tonnes of $CO_2e$ by 2020 (per year), representing around US$1.8 billion annually[11] in market value (Peters-Stanley and Gonzalez 2014). Box 3 explores historical trends in voluntary carbon markets.

[11] Based on historical market value of US$5.9/tonne $CO_2e$.

Box 3. Trends in voluntary carbon markets

Whereas the CDM has been in a slump since supply of carbon credits outstripped demand beginning in late 2011, the trend in voluntary markets has been more even-keeled. There was a slight downward trend in terms of volume of traded GHG reductions in 2013 but that rebounded slightly in 2014 (Figure 13).

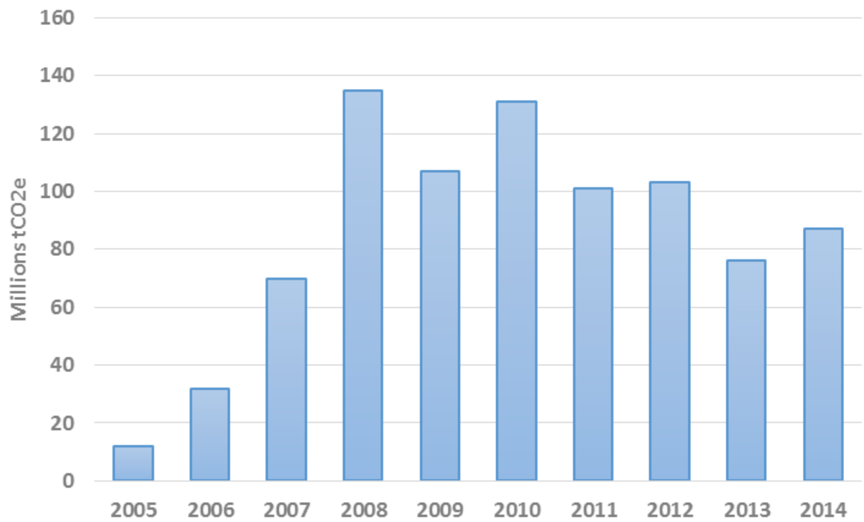


*Figure 13. Tonnes of $CO_2e$ generated by projects in the voluntary market sector from 2005 – 2014 (source: Hamrick and Goldstein 2015).*

The average price per tonne of $CO_2e$ in 2014 was nearly US$4—a full order of magnitude higher than CDM CERs. When viewed by sector, AFOLU carbon projects received the highest price per tonne of $CO_2e$ (Table 2). In fact, grassland management, improved forest management, afforestation/reforestation, and agroforestry were the top four in terms of prices garnered per offset credit. However, cumulatively only 5.6 million tCO2e were traded in those categories compared to REDD+ alone (also within the AFOLU sector) which traded over 26 million $tCO_2e$ while only receiving a price of US$4.3 per tonne of $CO_2e$. Clean cookstoves, energy efficiency, landfill methane and wind—all in the energy sector—rounded out the main categories of project type in 2014.

*Table 2. Average prices, volumes traded, and market value of carbon credits transacted in the voluntary market in 2014 by project type (source Hamrick and Goldstein 2015).*

| Project type | Average price per $tCO_2e$ (US$) | Volume (million $tCO_2e$) | Market value (million US$) |
|---|---|---|---|
| Grassland management | 11 | 1.3 | 14 |
| Improved forest management (IFM) | 9.3 | 0.5 | 5 |
| Afforestation/reforestation (A/R) | 9 | 1.6 | 14 |
| Agroforestry | 8.8 | 2.2 | 19 |
| Energy efficiency | 7.8 | 1.2 | 9 |
| Cookstoves | 5.8 | 2.4 | 14 |
| REDD+ | 4.3 | 26.7 | 115 |
| Landfill methane | 2.4 | 5.4 | 13 |
| Wind | 2.1 | 13.8 | 29 |

The Verified Carbon Standard (VCS) is by far the largest voluntary offset program in terms of volume of carbon credits traded, with over 50% of market share; in 2014 this represented around 33 million $tCO_2e$ in market volume (Figure 14). VCS has published numerous methodologies including those for the AFOLU sector, and has two new programs relevant to PSNP: one allows for additionality and baselines to be addressed on a landscape-scale, and another allows governments to access REDD finance on a sub-national or even national scale (see Section 7 for detail).

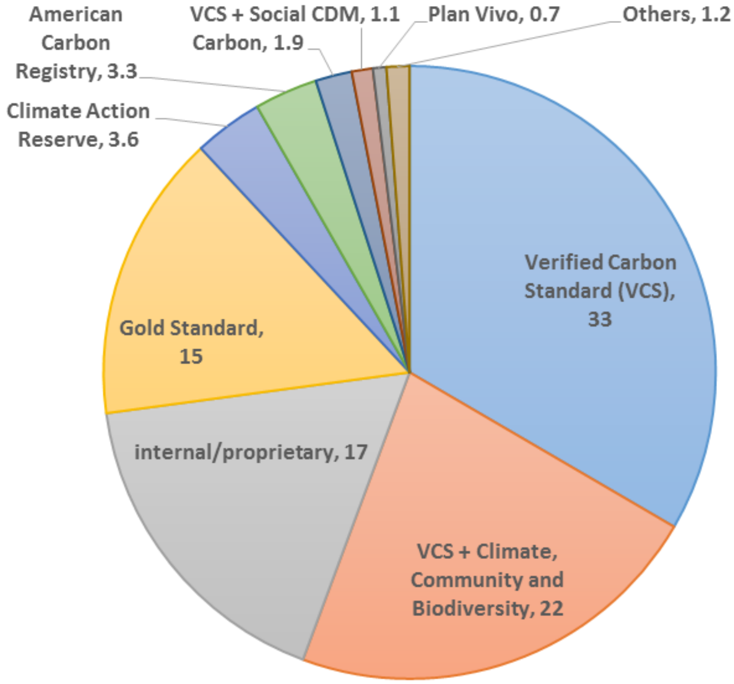


*Figure 14. Project standards utilized and % market share in 2014 (source Hamrick and Goldstein 2015).*

Internal or proprietary standards (which offer little opportunity to review practices, methodologies and other important aspects of standards) were the second most commonly deployed standard followed by The Gold Standard. The latter has AFOLU sector methodologies that are not as well-developed as VCS's, but in general it is attractive to offset buyers located in the EU. The other voluntary offset programs combined captured only a small percentage of market share and also focus most of their efforts on developed country trading.

# 6 Marketing the social and environmental benefits of carbon projects

Carbon markets solely transact in volumes of GHG reductions i.e., carbon credits. Yet, there are many potential co-benefits generated by carbon projects not reflected in the tonnes of $CO_2e$ transacted. Namely, the additional social and environmental aspects that a project can deliver to the community and region where it is implemented. This is especially true for AFOLU projects which often operate in a community-based context in developing countries.

The types of co-benefits potentially generated by AFOLU carbon projects are numerous. In the environmental realm these include biodiversity conservation, soil fertility, erosion control, and water management, and in the social realm improved health, increased agricultural yields, increased incomes, climate change adaptation, access to new opportunities for women and youths, and intangibles such as well-being and happiness. For example, an agroforestry project developed via a farmer cooperative could generate carbon credits for carbon sequestered in woody biomass and soils (the carbon component of the project), and simultaneously increase habitat for endangered species (environmental component) and improve farmer's incomes through new farm product streams and health outcomes through diversified sources of nutrition (social component). Such a project would likely be highly valued by voluntary markets for its ancillary social and environmental benefits, and therefore possibly receive a higher price for its carbon credits.

Ethiopia's PSNP—explicitly designed to create multiple community and environmental goods, many of them listed in the paragraph above—is well-placed to take advantage of market interest in carbon projects delivering co-benefits. Identifying mechanisms to monetize additional benefits is key to garnering a premium in the marketplace, and is discussed in Section 6.3.

> Social and environmental co-benefits are generated by AFOLU carbon projects in the community and region where they are implemented. Market analyses show that "gourmet" carbon projects with stacked benefits receive a price premium in voluntary carbon markets. Ethiopia's PSNP is well-placed to take advantage of market interest in carbon projects delivering co-benefits.

## 6.1 Quantifying co-benefits in the CDM

Whereas voluntary markets have been quick to develop and adopt mechanisms to market co-benefits of carbon projects, the CDM has been behind the curve. To remediate this the CDM Sustainable Development Co-Benefits Tool[12] was launched in 2012, enabling approved CDM projects to describe how their activities are creating co-benefits that contribute to the sustainable development within the host country. The tool is wholly voluntary. In contrast to some voluntary programs described in the following section, it does not allow for quantification and marketing of co-benefits.

[12] The CDM Sustainable Development Co-Benefits Tool is accessible at http://cdmcobenefits.unfccc.int/Pages/SD-Tool.aspx.

*Figure 15. Examples of social and environmental co-benefits generated by carbon projects include clean water provisioning (top left), diversified agricultural production (top right), and ecotourism (bottom). Photo credit: Jiro Ose, Concern Worldwide (top left).*

## 6.2 Quantifying co-benefits in voluntary markets

Market analyses show that "gourmet" carbon projects with stacked benefits receive a price premium in voluntary carbon markets. In the European voluntary market in 2013, for instance, buyers preferentially sourced carbon credits from projects with social and environmental co-benefits (Peters-Stanley and Gonzalez 2014). And this trend has been shown to generally hold true over the years (Kossoy et al. 2014).

While the voluntary markets transaction volumes are small relative to the scope of PSNP, this demonstrated interest in supporting projects that have ancillary community and environmental upsides potentially represents a disproportionately larger opportunity for PSNP than market size might suggest. Deciding on one or more co-benefits e.g., household income, health, educational attainment, or biodiversity, and developing the tools to monitor them as part of PSNP 4 activities could help to access future carbon payments, in the voluntary or compliance markets, and to improve marketability of CER's and prices attainable for them. Box 4 presents data quantifying one aspect of these co-benefits (soil fertility) using data generated in Ethiopia's PSNP-CSI.

Box 4. Soil fertility co-benefits of Ethiopia's PSNP

As with AFOLU carbon projects, public works safety net programs seek to create ancillary environmental, social and economic co-benefits. For PSNP, one of the top targets is to enhance food security and livelihoods. One way that this is achieved is through building public works infrastructure for soil-and-water conservation that increases soil fertility and thus agricultural productivity. Soil samples were collected up to 1 m depth from PSNP-CSI sites and key soil parameters were compared to nearby degraded soils without any interventions (see Solomon et al. 2015b for details). Figure 16 below demonstrates the statistically significant improvement in key soil fertility indicators at PSNP sites under cropping and woodland land uses.

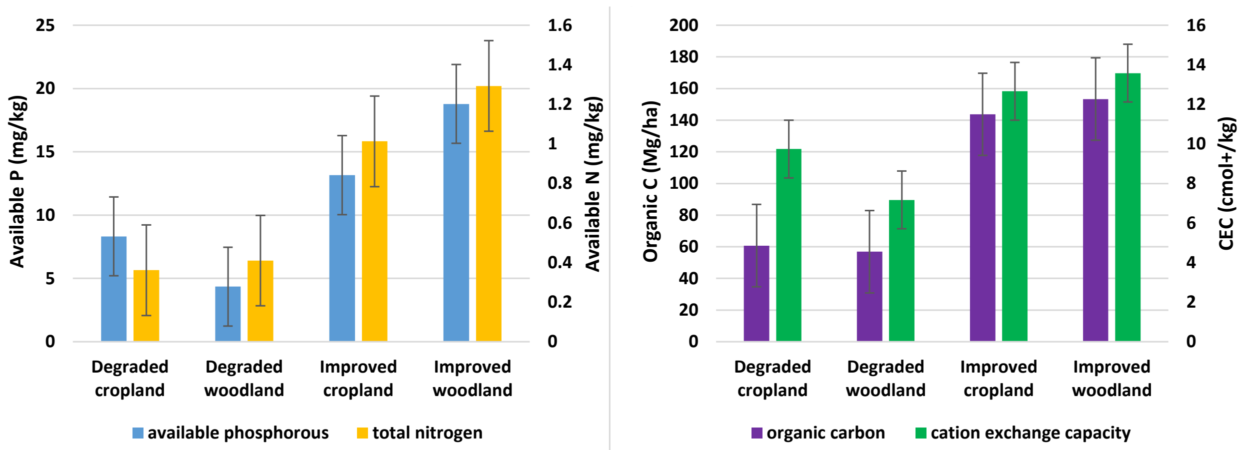


*Figure 16. Soil available phosphorous and total nitrogen (left graph) and soil organic carbon and cation exchange capacity (right graph) to 1-m depth in degraded vs. improved cropland and woodland land uses at 12 PSNP-CSI sites. See Solomon et al. 2015b for more details.*

Nitrogen and phosphorous—two critical macronutrients—more than doubled, as did carbon. Increasing soil carbon not only draws down atmospheric carbon dioxide but also enhances soil fertility. Soil carbon is comprised largely of soil organic matter which confers numerous positive effects on soil health such as soil structure, water retention, buffering capacity, and nutrient retention. The latter is measured by the cation exchange capacity (CEC)—the ability of soils to retain and exchange nutrients present as cations such as calcium, potassium and magnesium. CEC also increased significantly at PSNP sites.

These data support the conclusion that Ethiopia's PSNP public works interventions provide key ecosystem services and benefits including soil fertility and productivity as well as climate regulating benefits. Future focus should be placed on quantifying other PSNP benefits such as crop yields and productivity, farmer income and food security parameters as a function of the increased soil health at PSNP sites.

## 6.3 Methodologies to quantify co-benefits

Several organizations have developed methodologies to quantify carbon project co-benefits. The top two programs, as measured by market penetration, are the Climate, Community and Biodiversity Alliance (CCBA) Standard, managed by VCS, and Social Carbon. In 2014, over 75% of offsets transacted under VCS also qualified for the CCBA Standards. In Ethiopia, there are at least three AFOLU carbon projects under development or already approved that have combined their carbon project validation with the CCBA. PSNP 4 project developers should review CCBA requirements to assess options for quantifying the many social and environmental benefits that PSNP brings to communities across Ethiopia.

## 7 PSNP and carbon markets

PSNP is a large-scale program that bundles multiple sustainable land management activities—each with its own quantifiable GHG impact—across food insecure regions of Ethiopia. The ambitious national scale of PSNP has already demonstrated numerous widespread benefits for communities and the environment, not least of which is climate change mitigation. But this very breadth of the program represents a hurdle in accessing AFOLU carbon markets which, to date, have focused somewhat myopically on project-based activities at scales many times smaller than PSNP.

The ambitious national scale of PSNP has already demonstrated widespread benefits for communities and the environment, not least of which is climate change mitigation. But this very breadth represents a hurdle in accessing AFOLU carbon markets which, to date, have focused on project-based activities at scales many times smaller than PSNP. Recent advances in carbon markets, however, may allow for PSNP activities to be developed into a carbon project across an entire regional state within Ethiopia.

Nonetheless, published GHG accounting methodologies exist that are applicable to PSNP activities. These could be used to quantify carbon benefits and develop carbon projects on a case-by-case basis i.e., at the sub-watershed or kebele level, potentially accessing new revenue streams for PSNP. Perhaps more promising, however, are recent advances in carbon markets that 1) allow the grouping (aka bundling) of projects and 2) the development of “standardized methods” to determine the baseline scenario and demonstrate additionality across entire sectors such as AFOLU within a specified jurisdiction. This latter approach, in particular, is of great interest because it may allow for PSNP activities to be developed into a carbon project across, for example, an entire woreda, zone or regional state within Ethiopia, thereby matching the broad scale of the initiative and potentially accessing much higher levels of carbon finance compared to projects at the watershed level. All of these opportunities are discussed in the following sections.

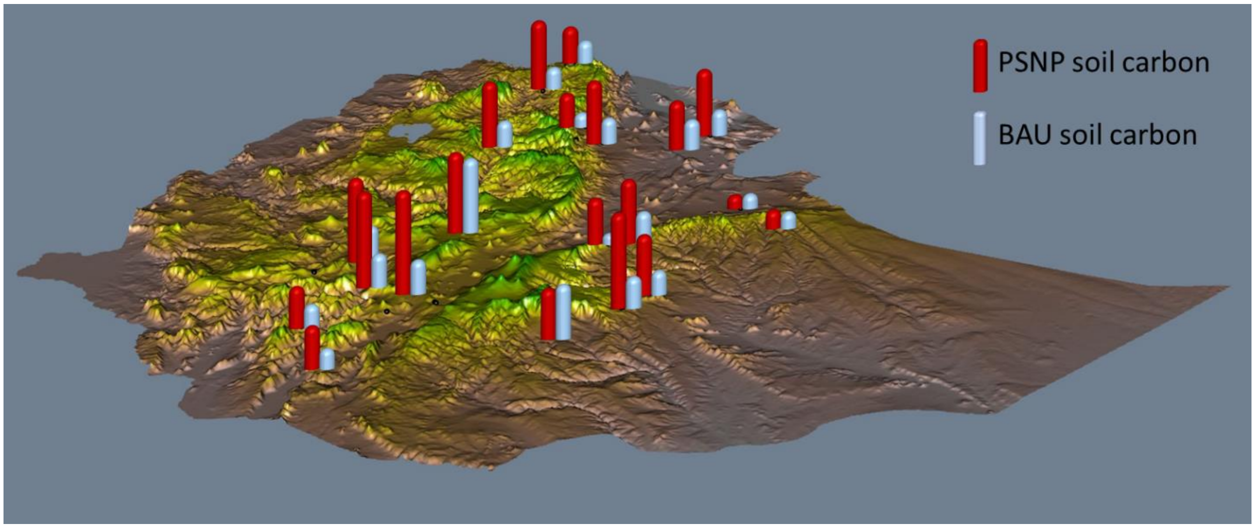


*Figure 17. Topographic map of Ethiopia, depicting soil organic carbon (SOC) stocks at PSNP-CSI sites under project (red bars) and business-as-usual (light blue bars) scenarios. Note that up to three times more SOC is stored under project scenarios. See Solomon et al. 2015b for details.*

## 7.1 Published greenhouse gas accounting methodologies applicable to PSNP

To date, GHG accounting methodologies approved by carbon offset programs have been tailored for scales suited to individual projects, typically hundreds to thousands of hectares. This is due to several reasons. First, is the afore-mentioned complexity of quantifying GHG emissions under baseline, BAU, and project scenarios, and measuring factors like additionality, leakage, and permanence; this is especially true for the AFOLU sector with multiple pathways for and synergies between GHG SSRs. Second, is the inherent risk associated with carbon offsetting—again in particular for the AFOLU sector—which could lead to reversals of any carbon benefits (see Section 4.2.6). As a result, carbon markets have conservatively restricted methodologies to smaller scales where confidence is higher in accurately assessing GHG reductions—and mitigating any risks—associated with project implementation.

Despite this mismatch in terms of scale, there are numerous approved methodologies that are germane to the types of sustainable land management activities implemented under Ethiopia's PSNP.[13] In the AFOLU sector, forest-based methodologies for activities including A/R, RIL, and REDD+ could all address certain components of PSNP. Agriculture-based approved methodologies are at present dominated by those that seek reduced methane and nitrous oxide emissions from manure and fertilizer use. There are far fewer approved agricultural methodologies that provide crediting mechanisms for agroforestry, cover crops, residue management, soil carbon accumulation, and crop switching (the sustainable agriculture

[13] A detailed spreadsheet listing published AFOLU methodologies and their relevance to Ethiopia's PSNP is available in the Step-by-Step Guide to Developing AFOLU Carbon Market Projects.

activities typified by Ethiopia's PSNP) though crucially a few do exist and have been successfully used to develop carbon projects that share characteristics with PSNP[14]. Box 5 explores the theoretical potential for Ethiopia's PSNP to generate revenues via AFOLU carbon projects.

[14] For example, the Kenya Sustainable Agriculture Land Management Project using VCS Methodology VM0017 Sustainable Agricultural Land Management. More information on the project is accessible at http://wbcarbonfinance.org/docs/biocf-Kenya-SALM-Flyer.pdf.

Box 5. Carbon finance potential for an area enclosure within Ethiopia's PSNP

As discussed in Box 1, Ethiopia's PSNP is generating real and quantifiable carbon benefits through implementation of CSA practices. Given the high interest in AFOLU projects the question arises, what are plausible revenue streams that PSNP could generate? Using the example of the CSI site in the Asore watershed, Alaba Special Woreda, SNNPR—a model site with well-established (20-year old) natural and assisted woodland regeneration—a carbon benefit of 12.1 $tCO_2e\ ha^{-1}\ yr^{-1}$ was predicted using an IPCC Tier 2 assessment; a more rigorous dynamic (Tier 3) modelling approach predicted a more conservative net carbon benefit of 7.8 $tCO_2e\ ha^{-1}\ yr^{-1}$ for soil and biomass carbon, although this approach does not account for livestock impacts (see Woolf et al. 2015 for details).

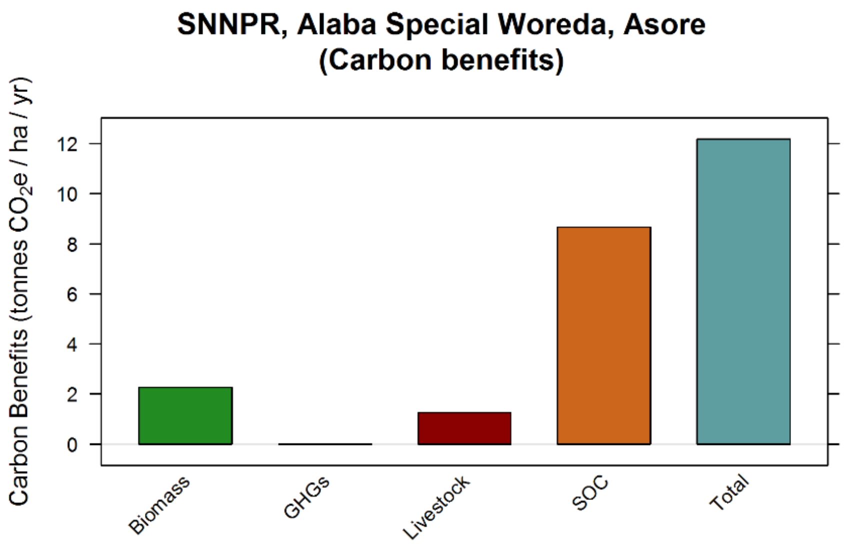


*Figure 18. Asore watershed, Alaba Special Woreda, SNNPR IPCC Tier 2 assessment of carbon benefits by GHG flux category. See Woolf et al. 2015 for details.*

Market analyses show that buyers in voluntary markets historically pay about US$9 per $tCO_2e$ for afforestation/reforestation (A/R) projects (Peters-Stanley, Goldstein, and Gonzalez 2014), a likely AFOLU categorization for the Asore site. Using this price and the dynamic model net carbon benefit, a theoretical sum exceeding US$43,000 annually could possibly be generated for a 616 ha site analogous to that under PSNP implementation at Asore. However, note that if this project were transitioned to a more diverse agroforestry system, potential revenues could increase by a factor of up to 1.8: buyers of agroforestry projects paid over US$16 per $tCO_2e$ for diversified agroforestry projects (Peters-Stanley, Goldstein, and Gonzalez 2014).

*N.b.*, these estimates represent potential gross revenues: it is important to note that this must be offset against the numerous cost categories for project development, implementation, monitoring and verification that result in substantially lower overall net revenues. Nonetheless, the 'take-home' message is that the carbon benefits generated by CSA practices deployed through public works safety net programs such as Ethiopia's PSNP are i) quantifiable through a combination of field assessments and rigorous modeling exercises, and ii) that these quantified values can be used to develop carbon projects for sale of carbon credits in compliance or voluntary markets.

## 7.2 Grouped projects approach in carbon markets

Recognizing the failure of the CDM to enable smaller scale projects in least developed countries access to CDM markets, the UNFCCC developed the Programme of Activities (PoA) approach in recent years. PoAs enable the bundling of many smaller projects under a single administrative umbrella organization thereby reducing the administrative burden on MRV as well as lowering costs associated with project development and validation. To date, there have been 276 PoAs registered and another 119 are undergoing validation (UNEP DTU Partnership 2015). Whereas less than 3% of non-PoA CDM projects were in Africa, fully 32% of PoAs are in that region (UNEP DTU Partnership 2015) suggesting that the PoA approach is at least alleviating the regional biases under the CDM.

> Carbon markets have moved to allow grouping of diverse activities under the umbrella of one project with the aim of lowering the administrative and financial burden involved in developing carbon projects, particularly for small-scale projects in the developing world.

Voluntary markets, including most prominently VCS, have also moved to allow bundling of diverse activities under the umbrella of one project. Similar to the CDM PoA, the VCS Grouped Projects approach was developed with the aim of lowering the administrative and financial burden involved in developing carbon projects, particularly for small-scale projects in the developing world. Under this approach, once a grouped project has successfully passed through the validation/verification process and been registered, individual project activity instances—termed Component Project Activities (CPAs) under the CDM—are allowed to come online without needing to complete the entire project life cycle *de novo*.

The key requirements for grouped projects in the AFOLU sector, as defined in the VCS Standard, Version 3.0 (Verified Carbon Standard 2011) are as follows:

a) the geographic area must be clearly defined using geodetic polygons;
b) the BAU scenario and additionality are demonstrated based upon the initial project activity instances reviewed at validation;
c) apply AFOLU non-permanence risk analyses that demonstrate that risks are relevant to the entire geographic area in order to determine a single total risk rating;
d) additional project activity instances must adhere to the conditions of the methodology applied to the project, have characteristics with respect to additionality that are

consistent with the initial instances, and are subject to the same BAU scenario as specified in the Project Description; and

e) leakage from shifts in activity outside of the geographic area or market leakage must be assessed according to the methodology applied to the project for the initial instances as well as all new instances.

While multiple methodologies are permitted under grouped projects, in practice this is difficult for two reasons: 1) it is not permitted to overlap methodologies on the same geographic area, be it the field, farm, or forest, i.e., if multiple methodologies are used they can only be applied to distinct geographic parcels within the grouped project and 2) the level of complexity of a project increases greatly as methodologies are added because additionality, BAU scenarios and other requirements must be separately demonstrated for each methodology (Carolyn Ching 2015).

### 7.2.1 Status of grouped projects approach for AFOLU

As of March 2015, only two PoAs in the AFOLU sector have been submitted for validation to the CDM in Africa (both afforestation projects in Senegal and Mozambique) and five grouped projects were registered in the VCS Project Database[15]. One reason for this paucity of grouped projects, is that this approach only emerged in the last several years so project developers have yet to take advantage of it in great numbers. There is, however, greater scrutiny placed on grouped projects during the validation phase which may pose an additional barrier to entry (Carolyn Ching 2015).

### 7.2.2 Grouped projects approach and PSNP

The highly integrated nature of sustainable land management activities across PSNP project sites means that SSRs overlap. Further, changes in SSRs due to sustainable land management are often synergistically linked e.g., reforestation in an enclosure leads to carbon accrual in woody biomass but also increases in soil carbon stocks. Thus, the requirement that only one methodology be applied for each distinct geographic area (outlined in Section 7.2) means that certain SSRs would be excluded. For example, if an A/R methodology was selected, then only woody biomass accrual would be allowed at the expense of the potentially quantifiable benefit from soil carbon accumulation. Fortunately, there is at least one VCS methodology published—VM0017 Adoption of Sustainable Agricultural Land Management, v1.0—that enables quantification of all SSRs impacted by PSNP 4.

[15] The VCS Project Database is accessible at http://www.vcsprojectdatabase.org/#/homehttp://www.vcsprojectdatabase.org/#/home.

The geographic boundary of the grouped project under PSNP 4 could in theory be set to the level of a regional state, or even the entire country. However, this would be difficult at a large scale given the diversity of ecological, economic and social conditions in such an area; the evidence presented for baseline scenario and additionality in the initial project instances would likely not be applicable to subsequent project instances in different regions. It is therefore advisable to set the geographic boundary to a smaller unit e.g., agro-ecological zone, livelihood zone, geographic watershed, or woreda, that encompasses similar sets of parameters as those used to set the baseline and demonstrate additionality.

Under PSNP 4, a grouped project could encompass a mosaic of SLM activities within an extensive project boundary. GHG benefits could be quantified for PSNP practices and project activity instances could be added by watersheds or kebeles, as resources are made available.

Under PSNP 4, a grouped project could encompass a mosaic of sustainable land management activities within such an extensive project boundary. An approved methodology e.g., VM0017, should be selected that permits the quantification of GHG benefits via reforestation, agroforestry, crop rotations, improved residue and fertilizer management, physical soil and water conservation measures, and/or other sustainable land management practices. Since implementing project activities across such a large area all at once would likely be difficult, project activity instances could be added by watersheds or kebeles, as resources are made available and as PSNP 4 progresses during its 2015 – 20 timeframe.

## 7.3 Standardized methods in carbon markets

While the grouped projects approach already in place under the CDM and VCS is worth exploring for potential development of (a subset of) PSNP 4 activities into carbon markets as described above (see Section 7.2), a newer approach is potentially more attractive. Namely, the development and use of standardized methods which are designed to streamline the process of demonstrating additionality and/or identifying the BAU scenario. Both the CDM and VCS have implemented mechanisms to develop standardized methods (in the CDM they are referred to as standardized baselines but are functionally equivalent).

Rather than working on a project-by-project basis, standardized methods define conditions and criteria for demonstrating BAU scenarios and/or additionality relative to an entire class of project activity—usually within a certain GHG emitting sector and region. Individual projects then need only meet these conditions and criteria that have been pre-determined in the standardized method.

In addition to the efficiencies of this approach, it also allows for the BAU scenario and additionality to be set across entire jurisdictions. For example, the first standardized method developed and currently under review at VCS is for reduced impact logging activities in East Kalimantan, Indonesia—an area considerably larger than SNNPR, Ethiopia. Hence, entire landscapes measuring millions of hectares are theoretically targets for development of carbon projects. This is in contrast to the current status where small land areas on the scale of hundreds to thousands of hectares typify non-REDD+ AFOLU projects.

Standardized methods are designed to streamline the process of demonstrating additionality and/or identifying the BAU scenario and are a newer, potentially more attractive approach for PSNP. Using standardized methods, entire landscapes measuring millions of hectares at the scale of the regional state in Ethiopia are theoretically targets for development of carbon projects.

### 7.3.1 Performance- versus activity-based standardized methods

The CDM and VCS allow for two types of standardized methods: performance methods and activity methods. In a performance method, benchmarks metrics are established for determining additionality and/or the BAU scenario. An additionality threshold of the metric is then set such that any project that meets or exceeds that threshold is deemed additional. For example, a standardized method for A/R in an Ethiopian regional state would need to collect data showing the extent of current A/R implementation (i.e., the BAU scenario) for parameters such as number of hectares reforested, mortality due to natural events/extraction, etc., within the State. These data would then be used to calculate average GHG emissions under the BAU scenario and also to justify the additionality threshold for eligible projects in that regional state e.g., a 15% increase in area reforested, 50% decrease in mortality.

In an activity method, a positive list of activities is created for a class of project activities, and any project that implements activities on the positive list is deemed additional. This approach could be simpler than the performance method for AFOLU projects under PSNP. Using the A/R example from above, a positive list could include activities such as alley cropping, windbreaks, silvopasture, and/or forest farming. Any of these activities could then be eligible for implementation under a carbon project.

It is imperative to note that development of standardized methods (particularly for performance methods in the AFOLU sector) is a data-, time- and resource-intensive process. This is necessarily so—the carbon offset programs approving standardized methods require sufficient assurances that GHG emissions outlined under BAU scenarios accurately reflect GHG fluxes that are then used to justify additionality and acceptance of project activities for carbon finance. At VCS, standardized methods undergo a rigorous internal review as well as two external assessments by independent, third-party assessors. The minimum realistic time frame for approval of standardized methods is on the order of 18 – 36 months.

Notwithstanding the rigor involved in establishing standardized methods, this is a promising approach for PSNP 4. An approved standardized method would allow the inclusion of PSNP activities distributed across the landscape at the woreda or even regional level, greatly lowering the cost of entry associated with determining the BAU scenario and demonstrating additionality for all projects within the standardized method jurisdiction.

### 7.3.2 Status of standardized methods for AFOLU in Ethiopia

To date, there are no standardized methods developed that are applicable to AFOLU in Ethiopia. The afore-mentioned VCS standardized method for reduced impact logging in East Kalimantan, Indonesia could serve as a template for development of a performance-based standardized method for Ethiopian AFOLU projects, though as previously mentioned an activity method is likely a more cost-effective approach for PSNP.

CDM standardized baselines approved (only 9 to date) and under review are dominated by the power-generation sector and to a lesser extent charcoal production and landfill gas. There are no AFOLU CDM standardized baselines under development. In Ethiopia, the two standardized baselines under review are for clinker production in the cement industry and for electrification of rural communities.

# 8 Additionality in the Ethiopian PSNP context

Additionality is the central tenet of carbon markets (see Section 4.2.5): without it carbon offset projects can neither quantify their climate change mitigation impacts, nor attribute these impacts to the availability of climate finance. Climate finance is only applicable to activities that are demonstrably additional (see Section 4.2.5). Additionality is therefore rigorously reviewed during project validation, and PSNP must carefully analyze the options to demonstrate additionality of any of its activities that seek climate finance.

First, it is vital to be clear about what type of activities would not be additional. Additionality cannot be demonstrated for PSNP projects that have already been completed, or that would occur in an ongoing PSNP program of work without carbon finance.

---

Additionality cannot be demonstrated for PSNP projects that a) have already been implemented, or b) would occur in an ongoing PSNP program of work without carbon finance.

However, additionality may be demonstrated for i) an expansion of PSNP, ii) improvements in implementation of existing or planned PSNP, and iii) securing the continuation of PSNP activities when sites are returned to community management after PSNP ends. All three of these scenarios must demonstrate that they are not possible without carbon finance.

---

However, there are three options that PSNP managers could pursue to demonstrate additionality, and thus potentially qualify for carbon finance:

i) An expansion of PSNP that would not be possible without carbon finance.
ii) Improvements in implementation of existing or planned PSNP projects that have additional carbon benefits that would not be achieved without carbon finance.
iii) Securing the continuation of PSNP activities when sites are returned to community management after PSNP ends.

These three options are discussed in the following sections.

## 8.1 Expansion of PSNP activities

Of these possible routes for additionality, option i) is the simplest and also the recommended approach for two reasons. Firstly, a shortfall in currently available funding for PSNP means that the program will not be fully implemented without further sources of finance (it is estimated that there is a shortfall in the order of one billion US$ to fully implement PSNP 4). Therefore, additional funding from other sources such as carbon finance would result in additional projects that could not otherwise be implemented. Secondly, seeking carbon finance to support additional activities that would not be implemented without carbon finance opens the possibility to keep development and MRV costs within manageable limits by introducing landscape-scale whole watershed management projects in which the carbon projects are concentrated into contiguous areas. This is important because in its current state, PSNP operates in a highly dispersed and geographically distant non-contiguous distribution of micro-watershed projects in diverse agro-ecological zones. Not only would the logistics and costs of managing a carbon project on such a dispersed set of sites be unnecessarily high, but it is also unlikely that a single methodology could be applied across all sites, because of large differences in baseline scenarios across the varied livelihood and agro-ecology.

## 8.2 Improvements in PSNP implementation

Option ii) would involve making changes to the way that PSNP sites are managed that increase carbon benefits beyond a BAU scenario in which PSNP activities are implemented according to currently prevailing practices. This could include e.g., enhanced measures to preclude livestock encroachment into enclosures; replacing forage grasses with forage trees; or increasing the amount of annual croplands converted to perennial crops or agroforestry. Although it is to be recommended that such measures be increasingly adopted in any case, because they would enhance the impact of PSNP, nonetheless using this as an approach to demonstrating additionality for carbon finance has some associated difficulties. Firstly, it does nothing to alleviate the problem noted above that a highly distributed network of micro-watersheds would entail high development and MRV costs for a carbon project. In fact, this issue would be exacerbated by the fact that marketing only the increased GHG mitigation of these projects relative to a BAU scenario in which these projects already deliver some (albeit lower) GHG benefits would entail having lower financeable (additional) carbon benefits per site. This would reduce the density per ha of GHG benefits being financed, while doing nothing to alleviate the high costs per hectare of a distributed network of projects.

## 8.3 Maintenance of climate-smart practices after PSNP wind-down

Option iii) entails seeking carbon finance to protect the benefits accrued in PSNP sites from a return to BAU practices (with commensurate land degradation) after the sites are returned

> In summary, the most promising approach to achieving additionality for PSNP to receive carbon finance would be to extend the PSNP program beyond what would otherwise be achievable, and to do so using targeted landscape-scale projects that minimize carbon project development and MRV costs.
> This approach could be further streamlined by use of jurisdictional standardized methods.

from PSNP to community management. This is premised on the assumption that the communities will tend to favor pre-PSNP management over the PSNP interventions, either because the opportunity costs of PSNP are higher than the benefits they receive from PSNP management, or because of a “tragedy of the commons” in which individuals acting independently according to each's self-interest behave contrary to the best interests of the whole group by depleting the common resource. The difficulties listed above for developing a carbon project consisting of highly distributed micro-watersheds and in diverse agro-ecological and livelihood zones would apply here also if such an approach were to be applied at the national scale. Furthermore, the large diversity of types of site would require that the threat to the sites would have to be demonstrated on a case-by-case basis rather than applying a common set of baseline assumptions across all PSNP sites.

Finally, it should also be noted that protecting existing carbon stocks would come under a REDD+ methodology, and for REDD+ to apply, lands must qualify as forest for at least 10 years prior to the project start date. Together, these constraints make this an unattractive option for a national scale approach. Nonetheless, the possibility of garnering some carbon finance for works that are already completed was seen as an attractive possibility by a number of regional PSNP practitioners, and it might be possible that selected sites that are old enough to qualify for REDD+, and which are clearly under threat from local community activities could be investigated for their potential as community (rather than PSNP) carbon projects.

# 9 Non-market-based mechanisms of climate finance

Whereas significant research and discussion has been placed on the potential for carbon markets to spawn investments in climate change mitigation and adaptation activities in developing countries, an analysis of carbon finance trends shows that this has yet to crystallize. Not carbon markets, but bi- and multilateral funding agencies continue to be by far the largest source of finance for mitigation and adaptation activities. In the period 2010 – 12, annual flows of climate finance through public institutions from developed to developing countries was between US$35 – 50 billion[16] (UNFCCC Standing Committee on Finance 2014). This amount dwarfs flows through carbon markets by at least an order of magnitude; in 2011, estimates in

Not carbon markets, but bi- and multilateral funding agencies continue to be by far the largest source of finance for climate change mitigation and adaptation activities.

[16] Private institutions in developed countries channeled an additional US$5 – 125 billion per year (UNFCCC Standing Committee on Finance 2014).

revenues from sales of CERs in the CDM range from US$3.5 – 4 billion (Kirkman et al. 2012). However, note that since then the market for CERs has dropped precipitously and revenues likely followed suit. Voluntary carbon markets are even smaller; in 2011 their market value was estimated at US$587 million (Peters-Stanley and Yin 2013). Box 6 further explores trends in direct climate finance.

Box 6. Bi- and multilateral climate finance flows

Since 2003, pledges for climate finance for both adaptation and mitigation activities have come overwhelmingly from countries in the global north (Figure 19). The UK, US, Germany and Norway top the list of donors with over US$20 billion committed. Other European countries as well as Japan and Australia have also made significant contributions. In some cases these funds are made available directly via country-to-country transactions (bilaterally) and in others they are channeled through multilateral institutions and funds.

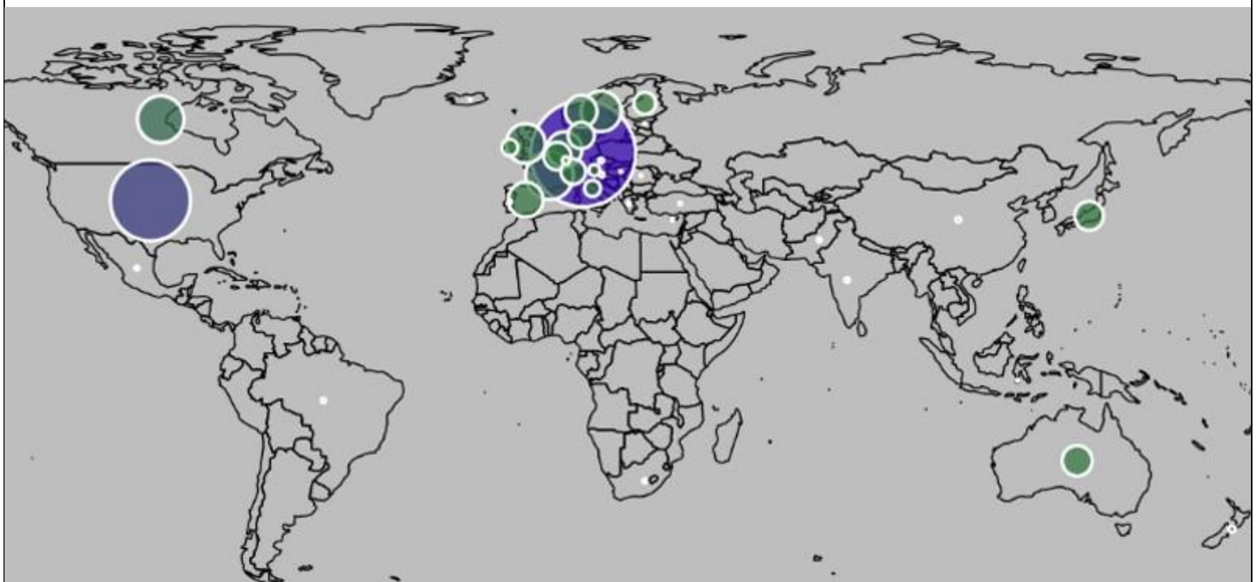

*Figure 19. Approved climate finance by donor source. Note that the size of the bubble represents the relative size of the contribution from the donor country (source: Overseas Development Institute 2015).*

Globally, funds from bi- and multilateral institutions are skewed towards supporting mitigation activities, mostly via the energy sector (Figure 20). The exception to this rule is Sub-Saharan Africa where nearly half of all funds pledged are for adaptation activities. Nonetheless, funds dedicated to mitigation in the region are still significant; in excess of US$1.2 billion since 2006 (Figure 21). Of this, one quarter was in the AFOLU sector (forestry and agriculture combined). Note, however, that all forest- related mitigation finance to date (US$298

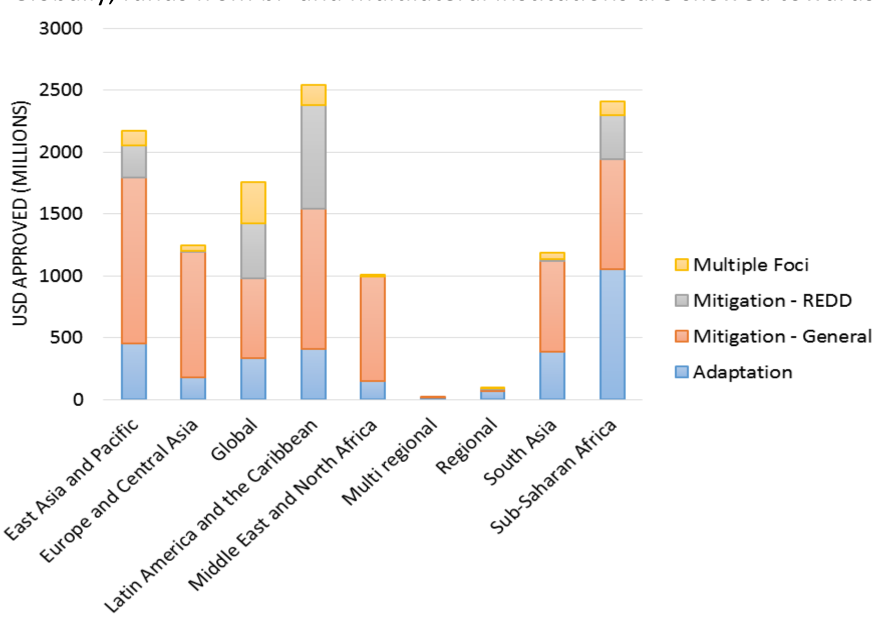


*Figure 20. Approved climate finance recipients by region and type (source: Overseas Development Institute 2015).*

million) was for REDD+ related activities. When REDD+ finance flows are excluded, the AFOLU sector received less than 3% of total SSA mitigation finance (Overseas Development Institute 2015).
Honing in on Ethiopia, since 2003 the country has received pledges totaling US$180 million as follows:

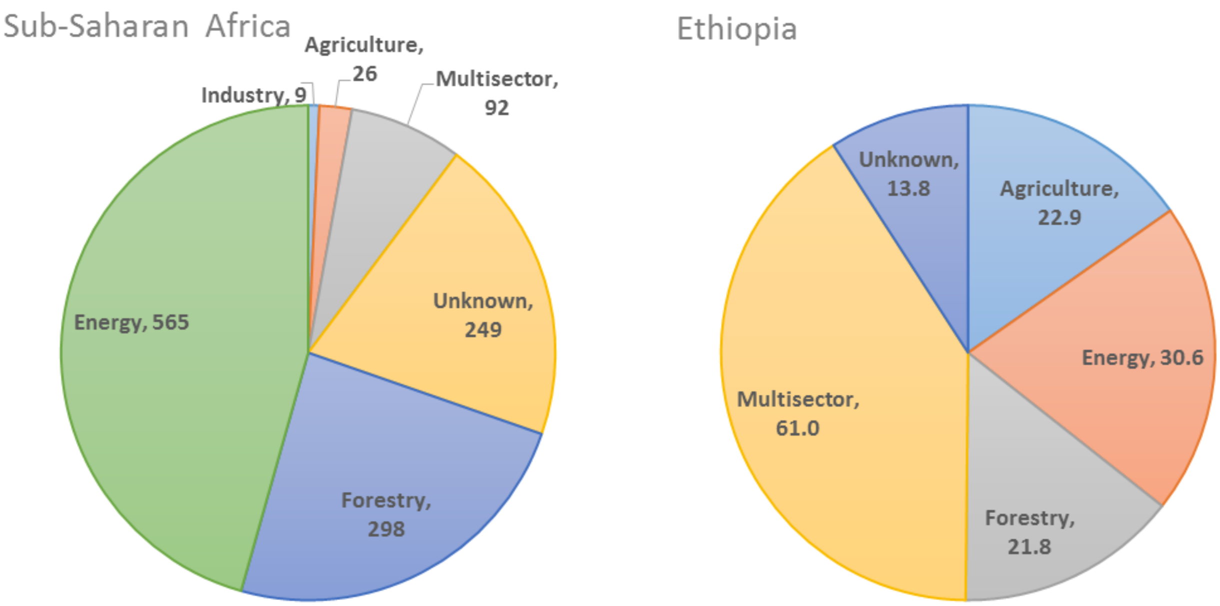


*Figure 21. Mitigation funding (in millions USD) approved for disbursement to SSA countries (left) and Ethiopia (right) (source: Overseas Development Institute 2015).*

US$34 million for adaptation, US$37 million (non-REDD), US$72 million for REDD-related mitigation, and US$41 million for cross-cutting themes (Overseas Development Institute 2015). When excluding exclusively adaptation-oriented, nearly one-third of Ethiopia's pledges are for activities in the AFOLU sector (Figure 21).

## 9.1 The Green Climate Fund (GCF): an emerging opportunity for PSNP

An emerging climate finance instrument with potential to support Ethiopia's PSNP 4 is the Green Climate Fund (GCF), initially conceived in 2009 at COP-15 where a goal of US$100 billion of annual funding by 2020 was set. The aim of such a fund was stated as supporting projects, programs and policies that advance climate change mitigation and adaptation in developing world parties to the UNFCCC. At COP-20 in late 2014 the GCF was formally launched with an initial round of financial pledges from industrialized nations totaling nearly US$10.2 billion[17]. As, and if, the fund continues to be capitalized to the level of the COP-15 aspirations, the GCF will become a prime source for finance of sustainable land management activities that address climate change mitigation and/or adaptation in the developing world.

The operational framework for the GCF is still being finalized. Nonetheless, some key aspects are already developed. Each country will have a National Designated Authority (NDA) responsible for nominating sub-national, national, or regional entities from the public or private

[17] More information on the GCF can be accessed here http://www.gcfund.org/about/the-fund.html.

sectors to become accredited to receive and disburse funding (so-called accredited entities), and to ensure that any activities supported via the GCF align with that country's internal policy and development objectives and priorities. The GCF aims for a 50:50 balance between support for mitigation and adaptation activities over time (Green Climate Fund 2014).

> An emerging carbon finance instrument with potential to support PSNP 4 is the Green Climate Fund. The six investment criteria used by GCF are all highly compatible with PSNP.

GCF highlights six investment criteria used to assess the fit with the fund's objectives: 1) climate impact potential; 2) paradigm shift potential; 3) sustainable development potential; 4) needs of the recipient; 5) country ownership; and 6) efficiency and effectiveness. The six criteria are all highly compatible with climate smart interventions implemented as part of PSNP.

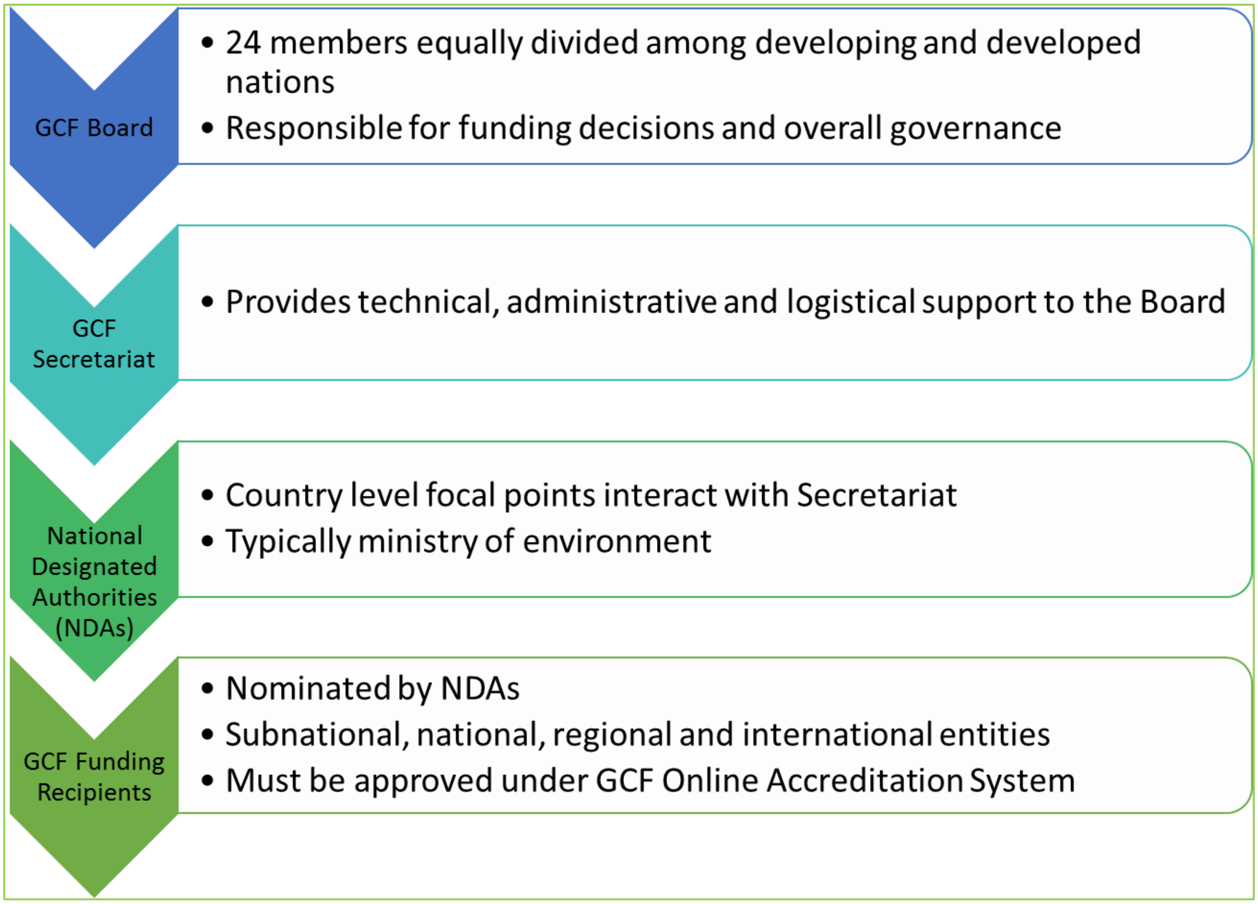


*Figure 22. Operational structure of the Green Climate Find.*

### 9.1.1 The Green Climate Fund and Ethiopia

Some key elements of GCF operational requirements are already in place in Ethiopia. First, the Ministry of Environment and Forest (MEF) is designated as the NDA responsible for nominating accredited entities (AEs) to allocate GCF resources for climate change projects. Second, as of July 2015 twenty AEs have received accreditation from the GCF.[18] Several of the approved AEs operate in Ethiopia and have the potential to channel funds to PSNP for additional implementation of climate smart activities. In fact, the International Bank for Reconstruction and Development and the International Development Association (together known as the World Bank (WB))—a central partner supporting Ethiopia's PSNP—is one of the newly listed AEs. The WB and other AEs are targets for PSNP 4 to seek further allocation of resources.

Initial funding in the form of "readiness" support began to flow to Ethiopia in July 2015 with a GCF award to the Ministry of Finance and Economic Development (MoFED) for US$300,000 to increase capacity for country ownership—a core principle of the GCF. With the readiness grant in place, other agencies within Ethiopia, as well as development partners, are situated to develop full project proposals, which GCF announced it will begin to award to applicants at its 11th meeting scheduled for November 2015 in Zambia.

While the GCF represents perhaps the best opportunity for financing additional implementation of climate smart agricultural practices through PSNP, there are other established funds that may support PSNP or elements thereof.

It is important to note that the Ethiopian government (GoE) intends to submit a proposal to GCF for multi-sectoral support. As such, PSNP administrators should maintain communications with GoE officials to ensure that submissions are coordinated and do not jeopardize the ability of either GoE or PSNP to garner funds from GCF for reasons of limited allocation of funds per country or otherwise.

## 9.2 Other funds with potential to support PSNP

While the GCF represents perhaps the best opportunity for financing additional implementation of climate smart interventions through PSNP, there are other established funds that may support PSNP or elements thereof. Bilateral funds linked to the international development arms

[18] An updated list of AEs can be accessed here http://www.gcfund.org/operations/accreditation/accredited-entities.html.

of industrialized nations such as the EU countries, Norway, USA, Canada, Australia and Japan all support climate change mitigation activities to varying degrees, and indeed have approved projects to this end within Ethiopia, including PSNP, of course. Outreach to government embassies of Ethiopia's development partners to discuss potential fit of PSNP 4 with bilateral funding sources is advised. Multilateral funds operated under the purview of UN or WB agencies may also represent funding opportunities for PSNP 4. These are discussed in the following sections.

### 9.2.1 WB BioCarbon Fund Initiative for Sustainable Forest Landscapes

The World Bank BioCarbon Fund Initiative for Sustainable Forest Landscapes (ISFL) became operational in November 2013 and has received US$380 million in commitments from four donor nations (Germany, Norway, UK, and USA)[19]. The aim of the ISFL is to support countries to adopt and promote climate smart agriculture and sustainable land use policies and practices, particularly in the forestry sector, in order to reduce GHG emissions from the AFOLU sector.

ISFL will operate at the jurisdictional (sub-national) level and aims to comprehensively implement policies and programs across the entire jurisdiction, rather than isolated project-level interventions. ISFL pledges of up to US$50 million will be made for results-based finance (payments for verified emissions reductions from implementation of programmatic interventions) and smaller pledges of around US$10 million for technical assistance. At current levels of ISFL capitalization, an initial tranche of 4 – 5 jurisdictional programs is anticipated.

In 2014, Ethiopia became the first country to receive a pledge of up to US$50 million through the ISFL for support of the Oromia Forested Landscape Carbon Finance Program (aka Oromia REDD+ Program). A small percentage of that grant will be paid in advance to develop the framework for program development and execution (Danyo 2014).

### 9.2.2 WB Forest Carbon Partnership Facility

The WB Forest Carbon Partnership Facility (FCPF) is a program designed to support and develop REDD+ initiatives in developing countries (FCPF 2015)[20]. Two FCPF funding mechanisms have been set up to achieve this goal: first, the Readiness Fund to help countries design and implement the policies and institutions to track and monitor GHG from the forest sector, and, second, the Carbon Fund which will make results-based payments for verified emissions reductions. At current levels of capitalization the Carbon Fund only anticipates 5 countries will be supported for results-based REDD+ payments.

To date, 24 developing countries have received REDD+ Readiness grants, Ethiopia among them. Readiness activities include "adopting national REDD+ strategies; developing reference emission levels (RELs); designing measurement, reporting, and verification (MRV) systems; and setting up REDD+ national management arrangements, including proper environmental and

---

[19] More information on the ISFL can be accessed here http://www.biocarbonfund-isfl.org/.
[20] More information on the FCPF can be accessed here https://www.forestcarbonpartnership.org/.

social safeguards," all of which entails a high degree of consultation with local communities, civil society organizations and indigenous peoples organizations.

### 9.2.3 Global Environment Facility

The UN Global Environment Facility (GEF) was established in 1991 as a partnership for international cooperation to support environmental sustainable development. To date, over 183 countries have participated, contributing funds and/or hosting projects, and US$13.5B in grants has been disbursed in 165 developing countries. The GEF manages three funds[21] relevant to climate change mitigation that may potentially support sustainable land management activities.

The process to apply for all GEF funds begins with outreach to the country-designated GEF Operational Focal Point[22] to determine fit with programmatic criteria and host country priorities. Once preparatory steps are finalized with the Focal Point, the project proponent develops a Project Identification Form which is reviewed by the GEF Secretariat for approval.

In addition to climate change mitigation, PSNP activities improve resilience and adaptation to climate change at the community level and therefore may fit within the GEF Trust Fund, SCCF and LDCF funding criteria. However, communications with the Ethiopian Focal Point are advised to determine availability of funding and programmatic fit before embarking on any proposal development.

### 9.2.4 Global Climate Change Alliance

The EU Global Climate Change Alliance (GCCA) was established in 2007 to promote dialogue and cooperation on climate change in developing countries[23]. The GCCA budget is presently more than US$335M. Ethiopia has received one grant from the GCCA for institutional capacity building around climate change resilience. A new phase of the GCCA from the 2014-2020 period is currently being implemented and includes a large focus on technical support for REDD and enhanced participation in mitigation efforts, among others. PSNP activities likely fall into one or more of the GCCA focal areas and scoping of funding opportunities is thus recommended.

### 9.2.5 Sustainable Development Goals Fund

The Sustainable Development Goals Fund (SDGF) was established by UNDP in 2014[24]. It is the successor fund to the Millennium Development Goals Fund (MDGF) also operated by UNDP. SDGF presently funds projects in 18 countries including one in Ethiopia. Focal areas include poverty eradication, water and sanitation, food security and nutrition. The latter focal area may

[21] More information on the GEF can be accessed here https://www.thegef.org/gef/home.
[22] In Ethiopia the Focal Point is housed within the Ministry of Environment and Forest. Further information on the current Focal Point including contact information can be accessed here https://www.thegef.org/gef/focal_points_list/E.
[23] More information on the GCCA can be accessed here http://www.gcca.eu/.
[24] More information on the SDGF can be accessed here http://www.sdgfund.org/.

fit with PSNP activities. However, to date only US$45M have been allocated to the SDGF and therefore any support to PSNP would likely be relatively modest.

## 9.3 Adaptation finance

By their very nature, activities that enhance climate change mitigation also often contribute to adaptation and resilience. For example, planting agroforestry tree species in area enclosures leads to carbon sequestration in biomass and soils (mitigation) but also stabilization of erodible slopes, diversification of dietary needs, and new income opportunities for communities (adaptation). For this reason, the funding opportunities previously discussed in Section 9 as applicable to PSNP, while chiefly targeting mitigation, do often list adaptation as desired co-benefits.

Nonetheless, funds and initiatives dedicated primarily to climate change adaptation are numerous. Given their breadth and the scope of this report, however, they are not further discussed. The website Climate Funds Update—jointly operated by the Heinrich Böll Stiftung North America and the Overseas Development Institute—maintains an up-to-date database of funds focused on adaptation (and mitigation) which can be accessed here http://www.climatefundsupdate.org/themes/adaptation.

# 10 Conclusion and Recommendations

Access to sufficient food in food-insecure regions will continue to be a global concern in the coming decades. This is especially true in SSA where the population is projected to increase four-fold by the end of this century. Some social safety net programs—designed to alleviate food insecurity—utilize public works as a means to build critical infrastructure such as irrigation works, farmland improvements and others which can enhance agricultural outcomes and deliver additional social and environmental goods. In parallel, such climate smart public works also create carbon benefits through replenishment of soil carbon stocks, sequestration of carbon in biomass, and reductions in GHGs associated with the AFOLU sector. Public works social safety nets that institute sustainable land management practices could utilize existing frameworks of carbon accounting to quantify the carbon benefits of their programs and to then seek out opportunities for financing of climate change mitigation. In addition to income from international development aid and host country governments, climate finance can serve as an important source of revenue to sustain and scale-up public works safety nets—ultimately furthering common goals of enhanced food security and livelihoods, improved natural resource management and climate change mitigation.

Ethiopia's PSNP—a model public works safety net program that creates multiple social, economic, and environmental benefits through climate smart interventions—is a case in point. Using a combination of geospatial techniques, field-based analytical methods and modelling, the climate change mitigation benefits of the program can be quantified on a subset of PSNP sites through the CSI. These carbon benefits can be used by PSNP administrators to pursue climate finance opportunities—whether from bi- and multilateral donor institutions seeking to support climate smart sustainable development priorities or public/private sector entities looking to purchase carbon credits through compliance or voluntary carbon markets. Indeed, data generated by CSI has already been used to secure support for PSNP 4 from bilateral donors.

Public works safety net programs that institute sustainable land management practices should embed methodologies to quantify the net carbon benefits that they generate. In addition to income from international development aid as well as host countries, climate finance can serve as an important source of revenue to sustain and scale-up public works safety nets.

## 10.1 Recommendations for climate financing of Ethiopia's PSNP

Looking forward, there are several important messages regarding the potential for climate finance to support Ethiopia's PSNP:

1) Carbon offset markets are not currently in a state to allow for ambitious proposals (although note that non-market mechanisms of climate finance are in a more robust state). The single largest compliance market that allows for international offset projects in the AFOLU sector—the UNFCCC CDM—is winding down in the Kyoto Protocol CP2. Voluntary markets, while more positive in their market outlook, remain small relative to Ethiopia's PSNP climate change mitigation potential and would likely only provide revenues for projects covering a small fraction of its land area.
2) Nonetheless, there are encouraging signs within the ongoing UNFCCC climate negotiations that i) binding international commitments to reduce GHG emissions will be reached at COP-21 in Paris at the end of 2015, and ii) that carbon offset markets will likely be one of the mechanisms made available for countries to meet their reduction obligations. Strong climate policy commitments have historically also been linked to growth and participation in voluntary carbon markets, and a successful COP-21 may therefore also bolster offsetting in the voluntary space by growing demand for carbon credits.
3) If carbon markets do grow substantially in the near future—as they must if climate change is to be kept within safe limits, and as seems probable given the growing pressure to reach a new global accord at COP-21 in Paris 2015—then Ethiopia should act now to insure that it is well-positioned to take advantage of market opportunities as they arise. It is, therefore, recommended that a modest carbon market project be developed for Ethiopia's PSNP. Using a grouped projects (VCS) or Programme of Activities (CDM) approach, such a project could encompass a mosaic of sustainable watershed management activities within an extensive project boundary; for example, covering up to four woredas across the PSNP regions and totaling thousands to tens of thousands of hectares. Such a project could have a market value of US$15-20 million over 20-30 years making it an ambitious and worthwhile initiative.
4) When planning a carbon project, site selection is critical. The highest carbon sequestration potential per hectare is in the wetter and more fertile regions, whereas food security issues

are more pervasive in the drier regions. The low hanging fruit will be to develop projects that generate the highest benefit to cost ratio in terms of carbon sequestration potential per unit area. However, the drier regions also stand to benefit greatly from the food security and ecosystem rehabilitation improvements that carbon projects offer. Therefore, there are strong rationales for initiating and incubating pilot projects in both more humid and in dryer regions, to build the in-country capacity for carbon finance across varying agroecological zones that will be key to contributing to Ethiopia's overall climate-smart development goals.

5) Carbon projects developed for this purpose in the near future must be sized to be compatible with the current volumes of transactions in carbon markets. It is not realistic to attempt to finance a project on the scale of the whole of PSNP through carbon markets at the present time. However, capacity built during pilot projects will position Ethiopia to act rapidly as and when the carbon finance outlook improves. A transition to national scale AFOLU carbon projects must wait until markets develop.
6) To insure compliance with the additionality requirement of climate finance, any carbon project seeking climate finance should be a demonstrably new project that was not already planned or financed by PSNP. As such, it should represent an opportunity to expand PSNP beyond what is possible with current funding constraints.
7) Project costs have historically often been comparable, or sometimes greater, than the funds accessed through climate finance. Therefore keeping project costs as low as possible, while maintaining the rigor demanded of climate finance mechanisms, must be a high priority. In this regard, it is highly recommended that carbon projects be developed only in large contiguous areas, rather than comprised of multiple bundled small projects that are geographically dispersed. It is also recommended that low-cost and streamlined methods for land-management data collection, remote-sensing analysis of biomass, and mid-infrared soil analysis that have been piloted within CSI be utilized for planning, monitoring and verification purposes.
8) To lay the foundation for larger jurisdictional carbon projects, Ethiopia's PSNP should pursue development of standardized methods in VCS or other relevant markets to quantify carbon benefits across much larger land areas more applicable to the scope of PSNP. These jurisdictional approaches should best be based on agroecological and livelihood zones to facilitate GHG accounting across reasonably homogeneous climatic, ecological, and socio-cultural regions; for example, the dry highlands of Tigray and Amhara, and the relatively wetter highlands of Oromia and SNNPR. The semi-arid and arid lowland regions of Ethiopia, although they are chronically vulnerable and their resilience to climate change can benefit from improved land management and rehabilitation, they are more challenging environments to establish carbon projects in the near future. Further research should be undertaken to establish the best climate smart practices with proven carbon benefits that are socio-economically viable at scale in these regions.

In the first instance, to keep costs manageable and commensurate with the size of current carbon markets, it is recommended that standardized methods be piloted in only one or a few pilot woredas. This approach is well-aligned with current CRGE unit of the MoA's programmatic agenda, which includes method development in 52 fast-track woredas. Institutional support for climate finance of PSNP should be best placed within the CRGE unit of the MoA because of their already existing expertise, infrastructure, and their cross-cutting remit with regard to climate change.

9) The Oromia Forested Landscape Program (OFLP) is a REDD+ pilot project that is breaking new ground to develop jurisdictional approaches that will be relevant primarily to large-scale forest ecosystems. Although some PSNP activities (i.e., area enclosures focused on forest regeneration within Oromia) could benefit from OFLP's outputs, there are strong rationales to pursue additional climate finance avenues within the wider PSNP context:
   a. For PSNP's diverse suite of climate smart land management practices on agricultural lands (including cropland improvements, agroforestry and sustainable forage production), Oromia is too large a scale, given the current complexities of developing GHG accounting methodologies for smallholder agricultural systems.
   b. OFLP is a much-needed effort, but it will probably take several years to establish the required methodologies before GHG-reducing activities can commence and mitigation finance begins to flow. But, PSNP and the government of Ethiopia (GoE) can benefit from gaining experience now by developing smaller scale project(s) using established methodologies and market channels in addition to developing standardized methods specifically tailored to PSNP's diverse suite of climate smart land management practices.
   c. The unique aspect of PSNP is that it opens a novel opportunity for food-security interventions to be a vehicle for climate change mitigation. The clear opportunity to access new funding from carbon markets and multi- or bilateral sources is compelling, not only for PSNP but other safety nets and food security programs in Sub-Saharan Africa and beyond. In this regard, PSNP could be a trailblazer by providing valuable lessons learned in the coming years to facilitate future scaling-up of land-based climate change mitigation efforts that are coupled with food security interventions. It could also provide an opportunity to enhance the long-term endurance and sustainability of such systems even beyond the life time of the food security program.
10) A proposal should be developed and submitted to the development partners to support creation of a task team within the CRGE unit under the umbrella of the MoA for climate finance of PSNP. CSI consortium partners can provide advisory support if required to help with establishment of such a task team.
11) Notwithstanding the potential of carbon offset programs to support PSNP, direct income from bi- and multilateral donors in the form of grants and loans remains the mainstay of climate finance opportunities at present. Indeed, Ethiopia's PSNP and its climate smart public works interventions are largely supported through such financing channels.

12) The GCF is an attractive emerging multilateral climate fund for Ethiopia's PSNP public works based on its fit with GCF's six top-level investment criteria, not least of which is a project's climate change mitigation and adaptation potential. To avoid jeopardizing or conflicting with potential submissions to GCF from the government of Ethiopia (GoE) for a larger multi-sectoral proposal, there should be communication between PSNP administrators and the GoE when preparing proposals for submission to GCF. With US$10.2 billion committed globally as of August 2015, any application to the GCF in the near future must be of a scale that is compatible with the total funds that would constitute Ethiopia's share of the fund. Clarification should be sought from the GCF, via the national designated authority (NDA), the Ministry of Environment and Forests (MEF), as to how much Ethiopia might be allocated. The size of a carbon project submitted to GCF will depend on the size of this potential resource, together with a high level (multi-sectoral) decision process of how projects should be best distributed amongst the various sectors of Ethiopia's economy. It is recommended that such a decision process involve input from and collaboration/coordination with the national CRGE unit.
13) The potential for demonstrated mitigation benefits of Ethiopia's PSNP to be used in support of negotiations for development funding should not be overlooked. This is known as results-based finance and is increasingly used by international donors to justify expenditures for climate change mitigation. For example, the UK Department for International Development (DFID) has already used results on PSNP's net carbon benefits generated by the Cornell CSI group to support the business case for release of funds from the UK International Climate Fund (ICF) to further support Ethiopia's PSNP.

# 11 Bibliography of related project documents

Further details about carbon benefits and climate finance for PSNP can be found in the following related project documents:

Jirka, S., Woolf, D., Solomon, D., & Lehmann, J. (2015). “Climate finance and carbon markets for Ethiopia’s Productive Safety Net Programme (PSNP): Executive Summary for Policymakers.” A World Bank Climate Smart Initiative (CSI) Report. Cornell University. https://ecommons.cornell.edu/handle/1813/41302

Jirka, S., Woolf, D., Solomon, D., & Lehmann, J. (2015). “Climate Finance for Ethiopia’s Productive Safety Net Programme (PSNP): Comprehensive report on accessing climate finance and carbon markets to promote socially and environmentally sustainable public works social safety net programs.” A World Bank Climate Smart Initiative (CSI) Report. Cornell University. https://ecommons.cornell.edu/handle/1813/41298

Jirka, S., Woolf, D., Solomon, D., & Lehmann, J. (2015). “Guide to Developing Agriculture, Forestry and Other Land-Use (AFOLU) Carbon Market Projects under Ethiopia’s Productive Safety Net Programme (PSNP).” A World Bank Climate Smart Initiative (CSI) Report. Cornell University. https://ecommons.cornell.edu/handle/1813/41297

Solomon, D., Woolf, D., Jirka, S., De’Gloria, S., Belay, B., Ambaw, G., Getahun, K., Ahmed, M., Ahmed, Z., and Lehmann, L. (2015). “Ethiopia’s Productive Safety Net Program (PSNP): Soil carbon and fertility impact assessment”. A World Bank Climate Smart Initiative (CSI) Report. Cornell University. https://ecommons.cornell.edu/handle/1813/41301

Solomon, D., Woolf, D., Jirka, S., De’Gloria, S., Belay, B., Ambaw, G., Getahun, K., Ahmed, M., Ahmed,Z., and Lehmann, L. (2015). “Ethiopia’s Productive Safety Net Program (PSNP) national baseline database (NBD): Georeferenced site, management, topography, climate, soil carbon, soil fertility indicators, yield and low-cost soil mid-infrared (MIR) analysis results”. A World Bank Climate Smart Initiative (CSI) Report. Cornell University. https://ecommons.cornell.edu/handle/1813/41299

Woolf, D., Jirka, S., Milne, E., Easter, M., DeGloria, S., Solomon, D., & Lehmann, J. (2015). “Climate Change Mitigation Potential of Ethiopia’s Productive Safety-Net Program (PSNP)”. A World Bank Climate Smart Initiative (CSI) Report. Cornell University. https://ecommons.cornell.edu/handle/1813/41296

# 12 References


Branca, G., L. Lipper, N. McCarthy, and M.C. Jolejole. 2013. “Food Security, Climate Change, and Sustainable Land Management. A Review.” *Agronomy for Sustainable Development* 33 (4): 635–50. doi:10.1007/s13593-013-0133-1.

C. Ching. 2015. VCS opportunities for PSNP.

Coll-Black, S., and J. Van Domelen. 2012. “Designing and Implementing a Rural Safety Net in a Low Income Setting: Lessons Learned from Ethiopia’s Productive Safety Net Program 2005–2009.” 70139. Washington, DC: World Bank. http://documents.worldbank.org/curated/en/2012/01/16398425/ethiopia-designing-implementing-rural-safety-net-low-income-setting-lessons-learned-ethiopia’s-productive-safety-net-program-2005-2009.

Conway, D., and E. Lisa F. Schipper. 2011. “Adaptation to Climate Change in Africa: Challenges and Opportunities Identified from Ethiopia.” *Global Environmental Change* 21 (1): 227–37. doi:10.1016/j.gloenvcha.2010.07.013.

Danyo, S. 2014. “Project Information Document (Concept Stage) - Oromia Forested Landscape Carbon Finance Project - P151294.” PIDC15459. The World Bank. http://documents.banquemondiale.org/curated/fr/2014/10/20315865/project-information-document-concept-stage-oromia-forested-landscape-carbon-finance-project-p151294.

Economist Intelligence Unit. 2014. “Food Security in Focus: Sub-Saharan Africa 2014.” The Economist.

Enkvist, P., T. Nauclér, and J. Rosander. 2007. “A Cost Curve for Greenhouse Gas Reduction.” *McKinsey Quarterly* 1: 34.

European Commission. 2015. “The EU Emissions Trading System (EU ETS) - European Commission.” May 8. http://ec.europa.eu/clima/policies/ets/index_en.htm.

FAO. 2005. “Food Security and Agricultural Development in Sub-Saharan Africa Building a Case for More Public Support.” Policy Brief No. 1. Rome. http://www.oecd.org/tad/agricultural-policies/36784159.pdf.

———. 2012. “Social Safety Nets and the Food Security Crisis.” Rome.

FCPF. 2015. “The Carbon Fund | The Forest Carbon Partnership Facility.” https://www.forestcarbonpartnership.org/carbon-fund-0.

Gerland, P., A.E. Raftery, H. Ševčíková, N. Li, D. Gu, T. Spoorenberg, L. Alkema, et al. 2014. “World Population Stabilization Unlikely This Century.” *Science* 346 (6206): 234–37. doi:10.1126/science.1257469.

Godfray, H.C.J., J.R. Beddington, I.R. Crute, L. Haddad, D. Lawrence, J.F. Muir, J. Pretty, S. Robinson, S.M. Thomas, and C. Toulmin. 2010. “Food Security: The Challenge of Feeding 9 Billion People.” *Science* 327 (5967): 812–18.

Goldstein, A. 2015. “The Bottom Line: Taking Stock of the Role of Carbon Offsets in Corporate Carbon Strategies.” Forest Trends.

Green Climate Fund. 2014. “Guiding Framework and Procedures for Accrediting National, Regional and International Implementing Entities and Intermediaries, Including the Fund’s Fiduciary Principles and Standards and Environmental and Social Safeguards (Progress Report).” In *2014a), Meeting of the Board, GCF/B*, 7:7.

Grosh, M.E. 2008. *For Protection and Promotion: The Design and Implementation of Effective Safety Nets*. World Bank Publications.

Hagos, F., G. Makombe, R.E. Namara, and S. Bekele Awulachew. 2009. "Importance of Irrigated Agriculture to the Ethiopian Economy: Capturing the Direct Net Benefits of Irrigation." 128. IWMI.

Hamrick, K., and A. Goldstein. 2015. "Ahead of the Curve: State of the Voluntary Carbon Markets 2015." Forest Trends.

HLPE. 2012. "Social Protection for Food Security. A Report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security." Rome: High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security.

Jirka, S., D. Woolf, D. Solomon, J. Lehmann. 2015. "Climate finance and carbon markets for Ethiopia's Productive Safety Net Programme (PSNP): Executive Summary for Policymakers." A World Bank Climate Smart Initiative (CSI) Report. Cornell University. https://ecommons.cornell.edu/handle/1813/41302

Jirka, S., D. Woolf, D. Solomon, and J. Lehmann. 2015b. "Guide to Developing Agriculture, Forestry and Other Land-Use (AFOLU) Carbon Market Projects under Ethiopia's Productive Safety Net Programme (PSNP)." A World Bank Climate Smart Initiative (CSI) Report. Cornell University. https://ecommons.cornell.edu/handle/1813/41297

IPCC. 2014a. "Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]." Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press.

IPCC. 2014b. "Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. [Barros, V.R., C.B. Field, D.J. Dokken, M.D. Mastrandrea, K.J. Mach, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]." Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press.

IPCC, 2013a: Annex I: Atlas of Global and Regional Climate Projections [van Oldenborgh, G.J., M. Collins, J. Arblaster, J.H. Christensen, J. Marotzke, S.B. Power, M. Rummukainen and T. Zhou (eds.)]. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA

IPCC, 2013b: Summary for Policymakers. In: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1–30, doi:10.1017/CBO9781107415324.004.

Kirkman, G.A., S. Seres, E. Haites, and R. Spalding-Fecher. 2012. “Benefits of the Clean Development Mechanism 2012.” In *United Nations Framework Convention on Climate Change. Available At:< Https://cdm. Unfccc. int/about/dev_ben/ABC_2012. Pdf*.

Kossoy, A., K. Oppermann, A. Platonova-Oquab, S. Suphachalasai, N. Höhne, N. Klein, A. Gilbert, et al. 2014. “State and Trends of Carbon Pricing 2014.” https://www.openknowledge.worldbank.org/handle/10986/18415.

Kossoy, A., G. Peszko, K. Oppermann, N. Prytz, N. Klein, K. Blok, L. Lam, L. Wong, B. Borkent. 2015. "State and Trends of Carbon Pricing 2015 (September)", by World Bank, Washington, DC. Doi: 10.1596/ 978-1-4648-0725-1

Lipper, L., P. Thornton, B.M. Campbell, T. Baedeker, A. Braimoh, M. Bwalya, P. Caron, et al. 2014. “Climate-Smart Agriculture for Food Security.” *Nature Climate Change* 4 (12): 1068–72. doi:10.1038/nclimate2437.

Monchuk, V. 2013. *Reducing Poverty and Investing in People: The New Role of Safety Nets in Africa*. World Bank Publications.

NOAA. 2015. “Climate at a Glance: Time Series | National Centers for Environmental Information (NCEI).” June 19. http://www.ncdc.noaa.gov/cag/time-series/global/globe/land_ocean/1/10/1880-2014.

Overseas Development Institute. 2015. “The Data - Climate Funds Update.” http://www.climatefundsupdate.org/data.

Pender, J., C. Ringler, M. Magalhaes, and F. Place. 2009. “The Role of Sustainable Land Management for Climate Change Adaptation and Mitigation in Sub-Saharan Africa.” Issue Paper. TerrAfrica.

Peters-Stanley, M., A. Goldstein, and G. Gonzalez. 2014. “Turning over a New Leaf: State of the Forest Carbon Markets 2014.” Forest Trends.

Peters-Stanley, M, and G. Gonzalez. 2014. “Sharing the Stage: State of the Voluntary Carbon Markets 2014.” Forest Trends.

Peters-Stanley, M., and D. Yin. 2013. “Maneuvering the Mosaic: State of the Voluntary Carbon Markets 2013.” Forest Trends.

Schoenberg, M., and T. Weekes. 2015. "The CDM: The power of markets should be reignited for the 2015 Paris climate agreement." Climate Change Capital Ltd. London, UK.

Smith, P., M. Bustamante, H. Ahammad, H. Clark, H. Dong, E. Abdalla Elsiddig, H. Haberl, et al. 2014. “Agriculture, Forestry and Other Land Use (AFOLU).” In *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.*

Solomon, D., Woolf, D., Jirka, S., De’Gloria, S., Belay, B., Ambaw, G., Getahun, K., Ahmed, M., Ahmed, Z., and Lehmann, L. 2015a. “Ethiopia’s Productive Safety Net Program (PSNP) national baseline database (NBD): Georeferenced site, management, topography, climate, soil carbon, soil fertility indicators, yield and low-cost soil mid-infrared (MIR) analysis results”. A World Bank Climate Smart Initiative (CSI) Report. Cornell University. https://ecommons.cornell.edu/handle/1813/41301

Solomon, D., Woolf, D., Jirka, S., De'Gloria, S., Belay, B., Ambaw, G., Getahun, K., Ahmed, M., Ahmed, Z., and Lehmann, L. 2015b. "Ethiopia's Productive Safety Net Program (PSNP): Soil carbon and fertility impact assessment". A World Bank Climate Smart Initiative (CSI) Report. Cornell University. https://ecommons.cornell.edu/handle/1813/41299

Solomon, S. 2007. *The Physical Science Basis: Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press.

Steffen, W., K. Richardson, J. Rockström, S.E. Cornell, I. Fetzer, E.M. Bennett, R. Biggs, et al. 2015. "Planetary Boundaries: Guiding Human Development on a Changing Planet." *Science* 347 (6223). doi:10.1126/science.1259855.

Subbarao, Kalanidhi, Carlo Del Ninno, Colin Andrews, and Claudia Rodríguez-Alas. 2012. *Public Works as a Safety Net: Design, Evidence, and Implementation*. World Bank Publications.

Thomas, S., P. Dargusch, S. Harrison, and J. Herbohn. 2010. "Why Are There so Few Afforestation and Reforestation Clean Development Mechanism Projects?" *Land Use Policy* 27 (3): 880–87.

UNEP DTU Partnership. 2015. "UNEP DTU CDM/JI Pipeline Analysis and Database." June 1, 2015. http://cdmpipeline.org/overview.htm.

UNFCCC Secretariat. 2015. "CDM: In Focus." May 4. http://cdm.unfccc.int/press/newsroom/latestnews/releases/2015/0705_index.html.

UNFCCC Standing Committee on Finance. 2014. "2014 Biennial Assessment and Overview of Climate Finance Flows Report." Bonn, Germany.

Verified Carbon Standard. 2011. "VCS Standard Requirements Document." Version 3.0. Verified Carbon Standard. http://www.v-c-s.org/sites/v-c-s.org/files/VCS%20Standard,%20v3.0.pdf.

Wheeler, T., and J. von Braun. 2013. "Climate Change Impacts on Global Food Security." *Science* 341 (6145): 508–13. doi:10.1126/science.1239402.

Woolf, D., Jirka, S., Milne, E., Easter, M., DeGloria, S., Solomon, D., & Lehmann, J. 2015. "Climate Change Mitigation Potential of Ethiopia's Productive Safety-Net Program (PSNP)". A World Bank Climate Smart Initiative (CSI) Report. Cornell University. https://ecommons.cornell.edu/handle/1813/41296

Cornell University

School of Integrative Plant Science
Soil and Crop Sciences Section
Bradfield Hall
Cornell University
Ithaca, NY 14853 USA

Please address questions and comments to:

Stefan Jirka: sj42@cornell.edu
Dominic Woolf: d.woolf@cornell.edu
Dawit Solomon: ds278@cornell.edu
Johannes Lehmann: cl273@cornell.edu