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Innovative Approaches to Land in the Climate Change Solution

Terrestrial Carbon Policy Development

The Terrestrial Carbon Group Project

Many countries are currently working to implement national strategies and action plans that result in land based climate change mitigation and adaptation outcomes. These actions are being driven by the many national, multilateral and bilateral commitments that have been made, particularly in regard to forests and deforestation, and of course the ongoing international climate change negotiations, where land is addressed in a variety of ways. For countries to be able to fulfil commitments to protect existing forest, they must be able to address key drivers of land use change and deforestation beyond the forest.

There is no single driver of deforestation, nor even a single driver of agricultural expansion. There are different types of agriculture (subsistence, smallholder and industrial) and different forces at work at different scales. There are different types of forest degradation and differences in how different soils respond to land use change. Again, this complexity is not necessarily a problem. Complexity is not the enemy of simplicity. Practical actions can be simple, effective and 'cut-through', while still appropriate in a complicated context. We rely on land every day to survive. It is an intricate part of our lives. Changing the way we manage land not only requires changing the way we live, but changing the way we think.

There are three key areas where innovative approaches to land could make a large contribution:

The 'plus' in REDD+	Addressing agriculture as a driver of deforestation	Increasing soil carbon in forestry and agriculture
Reverse forest degradation Encourage sustainable forest management Meet demand through off-site substitution	Recognise that agriculture itself has changing drivers Understand when intensive or extensive agriculture is appropriate Take practical action Reform trade rules Use innovative financing options	Recognise the different impacts of different land uses Address permanence and leakage Go beyond incentive payments Promote sustainable agriculture Recognise the potential of rangelands Roll-out and scale-up demonstration projects

More detailed information can be found in the report from which this policy brief is derived: "Innovative Approaches to Land in the Climate Change Solution (Terrestrial Carbon Group, 2011).

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Land is a crucial component of the climate solution. Human-induced climate change is caused by the build-up of greenhouse gases in the atmosphere. Greenhouse gases have only two other places to go: the oceans and the terrestrial system (including land and vegetation). This means that if the world is serious about avoiding dangerous climate change, terrestrial carbon emissions and sequestration must be part of the solution.

The objective of the Terrestrial Carbon Group is for terrestrial carbon (including trees, soil, and peat) to be effectively included in the international response to climate change.

The Terrestrial Carbon Group Project is publishing a series of Policy Briefs to inform the United Nations negotiations on how to include terrestrial carbon in developing nations in the overall climate change solution. We welcome your comments.

The information, analysis, and recommendations presented in this policy brief draw on:

- Interviews with representatives from 8 countries and 10 intergovernmental organisations and research institutes from late 2010 to mid 2011
- Discussions amongst representatives from 11 countries and 8 intergovernmental and research institutes at the 'Innovative Approaches to Land in the Climate Change Solution: Terrestrial Carbon Policy Workshop', held from 29 to 31 March 2011 in Lusaka, Zambia and co-hosted by the Terrestrial Carbon Group and the Common Market for Eastern and Southern Africa (COMESA) with funding from the Gordon and Betty Moore Foundation
- Two documents prepared by the Terrestrial Carbon Group Project with funding from the Climate and Development Knowledge Network (CDKN): *A 'State of Play' Assessment of Land Use in the International Policy Response to Climate Change*; and *A Compendium on Capacity for Implementing Land Based Mitigation: An overview of policy, institutional, economic, and scientific developments in twenty countries*

1 The 'plus' in REDD+: Enhancement of forest carbon stocks, including sustainable forest management

In this report, the 'plus' in REDD+ is taken to mean policy approaches and positive incentives on issues relating to sustainable management of forests and enhancement of forest carbon stocks in developing countries. This 'plus' is crucial. It will not be possible to achieve reduced emissions from deforestation and forest degradation, or forest conservation, without it. Global demand for timber is increasing. And timber remains an important alternative to more emission intensive materials such as steel (Profft et al., 2009). Finding ways to enhance forest carbon stocks in existing forests means either reversing forest degradation, implementing sustainable forest management and/or reducing pressure through off-site substitution of wood products.

1.1 Reverse forest degradation

As pressure from human activities such as agriculture need to be reduced to avoid deforestation, so too do human activities that lead to degradation. Forest degradation can be caused by a range of factors, including high impact logging fragmentation.

Strategies for reversing forest degradation will vary depending on the level of degradation itself. For minor degradation, allowing natural regeneration may be all that is required. For more severe degradation, the use of silvicultural techniques to accelerate tree regeneration or the active planting of new seedlings may be required (Sasaki et al., 2011). The most appropriate course of action will depend on the local context and the level of local participation.

1.2 Encourage sustainable forest management

So long as the world needs wood, better forest management will continue to be needed in order to enhance carbon stocks in existing forests. In the long term, sustainable forest management (SFM) strategies aimed at maintaining or increasing forest carbon stocks, while producing an annual yield of timber, fibre, or energy from the forest, are thought to generate the largest sustained mitigation benefit (Nabuurs et al., 2007). Options include:

- Combating low growth rates, stand yield and vigour through recommended silvicultural practices such as improvements in planting density, competition, control and thinning
- Concentrate harvests on a smaller forest area and meet timber needs through intensive management
- Legalise charcoal making in order to enable regulation and more sustainable production and management
- Rehabilitate degraded sites in arid and semi-arid lands by reducing overgrazing, improving household incomes and integrating forestry into overall land use management
- Use forest certification to encourage more sustainable forest management and manage international demand for timber, soy, beef and the impacts that this has on deforestation
- Encourage private-sector investment, as well as investment by and involvement of local and indigenous communities, other forest users and forest owners
- On a national scale, map standing forests and establish spatial zoning for different forest types and different uses

1.3 Meet demand through off-site substitution

Another way to reduce pressure on forests is to meet fuelwood, timber and other demands elsewhere. An example includes tree-based land-use systems such as agroforestry. Examples of major agroforestry practices in tropical and temperate regions include (from Nair et al., 2009):

- Alley cropping (with fast growing woody species)
- Homegardens (with multistory combinations)
- Multipurpose trees (such as fruit, fuelwood, fodder etc)
- Shaded perennial- crop systems (eg. with cacao or coffee)
- Shelterbelts and windbreaks (to protect from wind damage etc)
- Silvopasture (trees integrated into livestock systems)
- Riparian buffer strips (perennial vegetation)

2 Addressing agriculture as a driver of deforestation

Although REDD+ remains a very promising mitigation tool, its effectiveness will be limited without complementary measures to address agriculture as a driver of land use change, both within and beyond the forest. This is not least due to the resulting displacement that would occur of agricultural expansion from forest land to areas of other natural land cover (including cerrado, grasslands etc), in effect cancelling out 50% of the avoided deforestation emissions from REDD+ (Terrestrial Carbon Group, 2010).

2.1 Recognise that agriculture itself has changing drivers

Addressing agriculture as a driver of deforestation is complicated by the projected increases in global demands on land for food, fuel and fibre in coming decades. When trying to understand or anticipate drivers of land use change, it is too easy to come up with simplistic explanations of population growth, poverty or infrastructure. Between 2000 and 2005, the drivers of expansion shifted. DeFries et al. (2010) found that urban rather than rural population growth was associated with forest loss for this time. This is in contrast to the 1980s and 1990s when rural growth rates were found to be more important than urban rates. These results point to the importance of distant urban-based drivers and international demand for agricultural products and energy. It also suggests that small-scale production to support subsistence needs or local markets is no longer the dominant driver of deforestation in many places. Rather, it is urbanization that is leading to increased consumption levels and increased demand for agricultural products (DeFries et al., 2010). This link between urban population growth and forest loss is stronger in Latin America and Asia than Africa. Likewise, agricultural trade seems to be most strongly associated in Asian countries as a driver of deforestation (DeFries et al., 2010). The shift to more large-scale and mechanised agriculture has also played a role.

It is also important to realise that there are links between drivers of energy, food and water scarcity – and hence drivers of agricultural development. Energy and food are converging in a world where energy becomes food and food can become energy. More intensive farming practices usually mean more intensive energy use. Longer supply chains, transport and distribution infrastructure, biofuels and increased water use all drive these feedback loops. Improving producers' access to markets is an important area of investment, but it is also another factor that impacts on these converging sectors (Evans, 2010).

The drivers of agriculture will also vary for different agricultural systems and economies where the nature of subsistence, smallholder, industrial and commercial enterprises will all vary. Each type of agriculture will have different economics and will be influenced differently by trade rules, changing diets and supply and demand. There are also a significant number of landholders who are not part of the monetary economy. What all this points to the need for policy responses to be flexible and responsive to changing causes of land conversion over space and time (DeFries, 2010).

2.2 Understand when intensive or extensive agriculture is appropriate

Tensions between proponents of industrialized agriculture and smallholder agriculture are not only distracting but also constrain the development of any shared vision for agriculture globally (Negra and Wollenberg, 2011). Unfortunately, intensification in itself does not seem to result in land sparing, at least if not accompanied by specific policies and measures to deliver this outcome (Pirard and Treyer, 2010). Yield gains and intensification do not necessarily preclude expansion, and might lead to even further expansion because of increased profitability.

Many agricultural policies are disjointed and lack linkages with relevant non-agricultural policies. Closer coordination is needed between biofuel policies, forestry and agri-environmental policies (Lankoski and Ollikainen, 2011).

Where agricultural expansion is to be prevented, then rural economies will need to be diversified and alternative livelihoods created. If not alternatives are available, then business as usual will continue. In this context, rural poverty is an overarching issue with many connections to other factors, including sustainable forest management.

2.3 Take practical action

Tangible, practical and decisive actions can be just as important as grand plans. Practical actions for reducing emission in agriculture include improved crop and grazing land management, restoration of organic soils that have been drained for crop production and restoration of degraded lands. Additional actions include agro-forestry, set-asides, cropland conversion and improved livestock and manure management. Implementation of such measures will only be possible with appropriate policy programmes and economic incentives (Smith et al., 2007).

Changes in production systems to increase resilience and regenerative capacity in agriculture could include:

- Reducing post-harvest losses (UNCTAD, 2010)
- Using locally sourced inputs (UNCTAD, 2010)
- Renewable bio-energy systems (UNCTAD, 2010)
- Knowledge- and labour- intensive rather than agro-chemical and energy-input intensive systems (UNCTAD, 2010)
- Conservation farming
- Precision agriculture
- Integrated water management and integrated crop management (WBCSD and IUCN, 2008)
- Specific practices such as composting, cover crops, mulching, crop rotation, stubble retention, green manure and intercropping.
- Tree-based agricultural systems, such as agroforestry, for increasing productivity and sustaining smallholder livelihoods (ICRAF, 2009).
- Restoration of degraded areas to improve soil quality (FAO, 2010a)
- Improved management of communal water resources (FAO, 2010a)
- Informal seed systems to facilitate the exchange of plan genetic resources (FAO, 2010a)
- Greater roles for small-scale farmers and farmer organisations (UNCTAD, 2010)

2.4 Reform trade rules

The global trading system itself needs to be redesigned to maintain the economic viability of agriculture as well as environmental sustainability (Kissinger and Rees, 2009). In order to create an enabling environment and change the incentive structure as part of targeted agricultural and fiscal policies that strengthen sustainable agriculture practices, UNCTAD (2010) suggests that policy measures at the international level could include:

- More diversified international supply chains with reduced reliance on a small number of agro-companies
- Reformed international trade policies that are supportive of ecological agriculture
- Improved market access for developing country producers

The important thing is to ensure that any trade arrangements that open national agricultural markets to international competition must not come before basic national institutions and infrastructure are in place. Otherwise local agricultural sectors can be undermined (Kiers et al., 2008).

2.5 Use innovative financing options

There are innovative financing and insurance options that could be learnt from, more widely adopted and scaled up. Examples include insurance programmes (including insurance for inputs), marketing systems, access to credit and finance to builds assets, and diversified rural economies and markets. Diversified farm systems are also important; along with other mechanisms for reducing reduce risk. The private sector has a role, not least because the 'demand side' needs to be integrated into any action on supply. In order to incentivise alternative approaches to agriculture, national policy measures could include promoting:

- Non-traditional sources of finance, improved financial services and credit access (FAO, 2010a; UNCTAD, 2010)
- Greater focus on marketing and commercial services (FAO, 2010a)
- Insurance programmes and safety net programmes
- Modified tax and pricing structures (UNCTAD, 2010)
- Incentives to improve the management of previously cleared land (Gibbs et al., 2010)

Small farmers have a limited asset base to absorb carbon project risk (Shames and Scherr, 2010). For this reason, the FAO (2010a) suggests public financing for mitigation at the sub-sectoral or regional level, rather than smallholder scale (FAO, 2010a). Another solution could be a hybrid model, where the carbon payment is distributed between the farmer, the community, broader conservation initiatives and project monitoring and management (Shames and Scherr, 2010). Alternative sectoral approaches are possible too. Agribusiness and the food industry also both have the potential to reduce transaction costs by implementing mitigation projects within their existing supply chains and corporate infrastructure (Shames and Scherr, 2010; Negra and Wollenberg, 2011). Positive results can also come from policies that support micro-enterprise development, which reduces reliance on land and provides alternative livelihoods that require less space (Muriuki et al., 2010).

In the context of agriculture, financing mechanisms may need to overcome conceptual divisions between adaptation and mitigation and between climate change and development activities (FAO, 2010a). The adoption of improved agricultural practices can potentially result in both mitigation and adaptation (FAO, 2010b). Indeed, when it comes to agriculture, mitigation may be more of a co-benefit facilitated by additional incentives that build on other actions such as adaptation.

3 Increasing soil carbon in forestry and agriculture

3.1 Recognise the different impacts of different land uses

Soils are a major provider of ecosystem services (Sanchez et al., 2009). Meanwhile, soil carbon sequestration (enhanced sinks) holds 89% of the technical mitigation potential of agriculture (Smith et al., 2007). Soil carbon refers to the total carbon in soils and includes both organic and inorganic carbon (Walcott, 2008). The global soil carbon pool is about three times the size of the atmospheric pool and almost 4 times the size of the vegetation pool. This means that any proportional change in the soil carbon pool will have a significant effect on the global carbon budget (Nair et al., 2009). In terms of sequestration, most focus is on soil organic carbon (SOC), which has shorter timescales for cycling with the atmosphere than inorganic carbon (decades compared to thousands of years).

Soil organic carbon (SOC) is an extremely valuable resource. High SOC levels are essential for improvements in water and nutrient holding capacity, soil structure and biotic activity – all responsible for maintaining consistent yields and potentially improving productivity and reducing agricultural pressures on forests (Lal, 2004).

Of particular importance is how SOC changes with land use change. When land use change occurs, the equilibrium between carbon inflows and outflows in soil is disturbed. Eventually a new equilibrium is reached in the ecosystem. Even so, there are considerable uncertainties regarding the degree of change in soil carbon stocks following the transition from one vegetation type to another (Murty et al., 2002).

According to meta-analysis by Guo and Gifford (2002), soil carbon stocks decrease after land use changes from:

- Pasture to plantation
- Native forest to plantation (in some instances, a broadleaf plantation placed on to prior naturally regenerated secondary forest or pasture did not affect soil carbon stocks, whereas pine plantations reduced soil carbon stocks)
- Native forest to crop (soil c stocks are halved in the topsoil but not affected at depth)

Soil carbon stock increase after land use changes from:

- Native forest to pasture (when forest is cleared to establish pasture, consideration aboveground carbon in vegetation is lost, while there may not necessarily be declines in soil carbon)
- Crop to pasture
- Crop to plantation
- Crop to secondary forest

3.2 Address permanence and leakage

It is important to realize that there are non-permanence and leakage risks in agriculture just as there are in other sectors. While agriculture accounts for approximately 10-12% of total global anthropogenic emissions of greenhouse gases, proportionally, CO2 emissions account for only 9% of the total, while N_2O accounts for 46% and CH_4 accounts for 45% (Smith et al., 2007; UNCTAD, 2010). So, while carbon sequestration is important, so too is full accounting for all greenhouse gases. That said, it should be possible to design approaches that deal with leakage. Examples of modalities/procedures could include national/sectoral/sub-sectoral approaches, conservative approaches, buffers and insurance (FAO, 2010b).

Carbon is only one of the key elements of humus (Lal, 2004). Lal (2004) estimated that 1 Gt of carbon sequestration would require 80 million tonnes of nitrogen (N), 20Mt of phosphorus (P) and 15 Mt of potassium (K). This compares to the aggregate global consumption of fertilizer in 2008/09 of approximately 156 Mt for N,P,K (IFA, 2009). Sources for such elements could include biological nitrogen fixation, recycling from the subsoil, aerial deposition and the use of biosolids and crop residues (Lal, 2004). In addition, enhancing SOC stock increases the soils capacity to oxidize methane (CH_4), especially under no-till farming, but can also exacerbate emissions of nitrous oxide (N_20) (Lal, 2004). This is why it is important that fluxes of CH_4 and N_20 are also considered along with SOC sequestration (Lal, 2004).

The limit to carbon sequestration, after which soil carbon can no longer increase, is referred to as carbon saturation. This limit can vary depending on soil condition (Walcott, 2008). Soil sink capacity and permanence are related to clay content, mineralogy, structural stability, landscape position, moisture and temperature regimes and ability to form and retain stable micro-aggregates (Lal, 2004). The implication is that soil carbon sequestration payments would not be made in perpetuity, whether the saturation point is reached in 20 or 100 years. However, short-term payments may be feasible and deliver permanence where they result in the transition to more productive and resilient agricultural systems (FAO, 2010a).

3.3 Look beyond incentive payments

It is often assumed that incentive payments will lead to carbon sequestration taking place on marginal lands, due to lower opportunity costs. Yet, land with favourable soil and climatic properties may have a higher carbon sequestration potential than marginal land. In addition, more productive lands may have more crop residue and biomass to work with, potentially outcompeting marginal lands in terms of effectiveness at sequestering carbon, from both a biophysical and economic point of view (Antle and Stoorvogel, 2008). This challenges the assumption that carbon sequestration activities will be focused on marginal lands, at least where only economic forces are at play. In such circumstances, where poor farmers are located in marginal semi-arid areas with sandy soils and higher rates of land degradation, impacts on poverty are also likely to be relatively small (Antle and Stoorvogel, 2008). In other words, it won't necessarily remediate the reality that Lal (2004) described as "marginal soils with marginal inputs produce marginal yields and perpetuate marginal living".

Carbon payments alone are not likely to transform unsustainable systems into sustainable ones. Like most payment for ecosystem services, they are more likely to have a positive impact in an enabling economic and institutional context (Antle and Stoorvogel, 2008). It is also inevitable that some forms mitigation at the scale of smallholder agriculture will not be cost effective, meaning alternative approaches will be required (FAO, 2010a).

At present there is a lack of policy vision and strategy from the agricultural sector in countries in which soil carbon could have a place. A more diversified response is needed at the international level, beyond carbon markets. There is scope to encourage enhanced soil carbon through NAMAs, NAPAs and also non-UNFCCC mechanisms and green growth strategies. It may also be possible to develop policies that deliver an incentive for a related activity, rather than the actual production of soil carbon. In other words, carbon is the co-benefit, not the other way around.

3.4 Promote sustainable agricultural practices

In agriculture, modifying the management practices of existing land uses can be as significant as total land use change. For example, SOC can be enhanced through sustainable agricultural technologies such as no-till farming, composts and mulching, leguminous cover crops, water harvesting, agroforestry, integrated farming systems and the careful use of chemicals (Lal, 2004). Though improved agronomic yields in rain-fed agriculture, low SOC stock can be also enhanced. These improvements can come from improved water conservation, water harvesting and water-efficient farming systems (Lal, 2004). Despite this, it is important to note that there are no guarantees for the sequestration potential of no-till. The benefits can be overemphasised and there have been different results reported for no-till versus conventional-till farming, not all resulting in an increase in SOC pool in NT (see for example Christopher and Lal, 2009). There is also evidence that it is the combination of conservation farming practices, rather than isolated treatments, which can lead to improved CO2 mitigation potential - such as no-till, stubble retention and N fertilization combined. See for example Wang and Dalal (2004). In more recent work on vertisols in a semiarid subtropical region, Dalal et al. (2011), found that tillage effects on SOC and soil total N were small. While crop residue retention and N fertilisation did have benefits/ particularly in the early years, it does not seem that these benefits keep accruing over time.

3.5 Recognise the potential of rangelands

From a carbon point of view, grassland ecosystems, including rangelands, are very important. Grasslands occupy two-thirds of global agricultural area and represent a major terrestrial carbon stock which has the potential to be increased with appropriate management (FAO, 2009; Neely et al., 2009). Globally, there are approximately 120 million pastoralists who are responsible for more than 5000 million hectares of rangelands, which store up to 30% of the world's soil carbon (Tennigkeit and Wilkes, 2008). Estimates suggest that improved rangeland management has the biophysical sequestration potential of 1300-2000 $MtCO_2e$ up to 2030 (Tennigkeit and Wilkes, 2008). This technical mitigation potential of grasslands is greater than that for methane emissions from ruminant animals or manure management emissions (FAO, 2009). Grassland management interventions that can increase carbon inputs to the soil, increase above ground woody vegetation and reduce losses in vegetation include (FAO, 2009):

- Introduction of new species and varieties
- Fire management
- Restoration of organic soils and degraded lands
- Extending the use of perennial crops
- Increasing tree cover in silvopastoral systems
- Managing grazing intensity and duration/periodicity
- Improving pasture quality

As with smallholder cropland based carbon finance projects, the need for aggregating carbon assets and the potential role of organisations as 'aggregators' should to be considered (Tennigkeit and Wilkes, 2008).

Here, it is also worthwhile highlighting the potential role of livestock in extensive rangeland systems. The challenge for policy makers, researchers and practitioners will be to envisage new ways to integrate animals into ecosystems in order to foster regeneration, rather than reduce resilience. This is particularly the case in complex ecosystems that need "gentle continual disturbance" in order to flourish (Janzen, 2011, in press).

3.6 Roll-out and scale-up demonstration projects

A key barrier to action on enhancing soil carbon is the lack of evidence on what actually needs to be done. In turn, it is unclear what value soil carbon actually has in terms of productivity and sustainability. Greater evaluation is needed of both the costs and benefits of the range of options (and incentives) available to increase soil carbon.

The development of cost-effective, easy to use tools and methodologies and spatially-resolved, accurate data-gathering is needed to expand focus to all land classes (including complex landscapes), regions, and carbon pools.

While some have sophisticated measurement and monitoring capacity, in general, non-Annex I countries have limited data-gathering capacity and access to reliable existing datasets and conversion equations. Existing reports and international guidance provide a solid foundation for current and future work. However, there are significant differences in guidance for reporting emissions and sequestration across scales and sectors and streamlined processes are needed for approving consistent definitions, standards, and methodologies. Efforts to improve convergence and consistency can produce synthesized scientific knowledge, harmonized reporting guidelines and methodologies, compatible terminology, definitions, and classifications, and integrative modelling. Likewise, expanding and building regional and global networks can provide needed linkages across field research and technological advancements and facilitate access to tools, databases, technical support, infrastructure, and extension services.

Diverse local, national, and regional circumstances can be accommodated by developing a regionally-relevant mix of management practices, measurement approaches, conversion equations, and models as well as planning for changing regional climatic conditions.

Demonstration projects would be valuable where they contribute to the evidence of the benefits of soil carbon for factors such as productivity and soil fertility and a greater understanding of permanence.

Comprehensive soil inventories are needed to facilitate both this understanding and MRV. National soil inventories are a good first step, followed by adequate MRV systems. Greater capacity will be needed to implement these actions, including institutional capacity. The high cost of MRV also needs to be addressed.

NAMAs are a possible way to get started. Lessons can also be learnt from a range of existing responses including the CDM and A/R, Voluntary Carbon Standard, MRV in the forestry sector, the process of creating inventories of land use and emissions in individual countries, including projects to quantify soil carbon.

4 Where to from here?

4.1 Allow time for transition

Full implementation of all the essential functions and organisations required for a comprehensive system to deliver terrestrial carbon mitigation will require an evolutionary process, planning for which means taking a long-term view. It means considering not only the systems to be established today, but how these systems will be compatible with the later inclusion of other land uses (Terrestrial Carbon Group, 2009c). For example:

- The functions and institutions (including reserves, registers and exchanges) originally established for REDD+ will need to be "upwardly compatible" with the later inclusion of agriculture and other land uses.

- Common data requirements of different land uses should be determined to allow the coordination of data gathering and interpretation in these areas, even if one land use will not be phased into the accounting until after another. This will avoid duplication and maximise effectiveness of the resources available.

Generating the economic impetus for such action will inevitably require a mix of sources of funding including international funds, and international trading – under bilateral, multilateral and/or global arrangements - where the unit of product is based upon emissions reduced or carbon sequestered.

To be scalable and sustainable over the long run, long-term effective participation of both the public and private sectors in both developing and developed countries will be required. In practical terms, to achieve scale and sustainability, the system must be flexible and take into account evolving capabilities and resources over time. It must be capable of delivering the necessary mitigation potential from the AFOLU sectors, starting with REDD+.

Time needs to be allowed for new policies and frameworks to work. Too often reforms are abandoned before they've had a chance to evolve. As has been highlighted in this report, local context is important. Just as it is important not to generalise too much from context specific successes, so too is it important not to generalise too much from context specific failures.

4.2 Get the institutional framework right

At the national scale, institutions are needed to establish clear governance frameworks between national and regional governments and to create credible and transparent systems and institutions to certify and audit the production of carbon mitigation as well as to coordinate with international institutions. This does not necessarily mean new institutions are required. Circumstances will vary from country to country depending on current capacity, financial resources and whether responsibility for functions can be taken on by existing organisations without conflicts of interest. In an assessment of policy, institutional, economic, and scientific developments in twenty countries (Terrestrial Carbon Group, 2011b) it became clear that there were some common elements of successful national approaches. For example, characteristics of success include:

1. A national climate change plan or other overarching policy is used to signal the government's intent and ensure coordination between government policies, regulations and departments. Such coordination is made a priority and includes links between national and sub-national approaches.

2. A multi-sectoral approach is taken to addressing the drivers of deforestation and forest degradation. For example, agroforestry is promoted to enhance farm forest cover and secure future timber supplies.

3. Incentive systems are built upon the recognition that both voluntary fund-based approaches and market-based system approaches have different merits and will be appropriate in different circumstances.

4. Investments are fit-for-purpose and build upon existing equipment available, technical capacity and expertise, with human capacity being harnessed where possible.

5. Regional cooperation and coordination is undertaken to maximize policy effectiveness. Such cooperation is in conjunction with capacity development at the national level.

It is clear that linkages between agriculture and forestry add another important dynamic affecting the broader context and responses to it by both policy makers and individual decision makers on the ground. Common solutions for managing these linkages include better land use planning, scenario modelling, cross sectoral cooperation in the public and private sector and inter-district, inter-state and international cooperation across borders. Land-use planning involves determining which area of land will be used for what purpose so as to optimise sustainable development outcomes. Land use planning is inherently political. There will always be winners and losers, so decisions (and tradeoffs) must be made. Mechanisms are needed to allow decision makers to compare various pathways and directions. A key issue is the need for publicly available spatial data to allow for spatial planning and for stakeholder input into the process. Not all spatial planning is equal - there is good and bad - depending on how economic and ecological factors are reconciled. A publicly available online tool to allow for hypothetical 'scenarios' to be tested could be useful to simulate the consequences of decisions, raise awareness and envisage alternative futures.

4.3 Work Together

In addition to precedents for many of the types of institutions required at the international and national level, it is also possible to learn from early experience. Implementation of effective land based mitigation requires a high level of technical, scientific and inter-stakeholder cooperation, capacity building and support. At all scales, work is already being done to lay down this foundation through the efforts of forest countries with support from developed countries. The next step is to ensure greater coordination between and across these scales of implementation.

The international community will need to work together. There will be many different solutions relevant and appropriate for different local social, economic, environmental and institutional contexts. Greater transparency and public reporting of the successes or failures of implementation would be of benefit not just to policy makers in the future, but to other countries as well.

Cooperation between governments can help to overcome shortfalls in capacity. While some countries have strong policies and institutions, they may be weaker on finance and economics or science and technical capacity. The reverse may also be true, where a country may be strong on the science but have weaker institutions. Cumulatively, there is much capacity that could be better shared, particularly across Africa, Asia and Latin America.

5 Conclusions

This report has shown that there are many ways in which innovative approaches can be taken to land in the climate solution. What is clear is that no one mechanism will deliver a one-size-fits-all solution. The messy international policy framework is not necessarily a problem, so long as nations seek to reconcile and coordinate their commitments at the national level.

While terrestrial carbon has crucial mitigation potential, not all policy approaches have to directly target carbon itself. In some instances, it may indeed be more effective to view carbon as a co-benefit to other ecosystem services and sustainable land management and adaption and mitigation efforts should be coalesced. This is because policy responses will be more successful if they are framed with the broader context of land use and land management systems in mind.

It is apparent that much good work is being done. This work is threatened by duplication and constant reinvention. Cooperation at all levels, between ministries, countries, and regions is critical to prevent unravelling of work that has already been completed and creating resilient solutions that build on existing efforts. In this, artificial divisions between mitigation and adaptation approaches are counter-productive and again diminish the potential returns on existing efforts.

Governments need to be serious about allocating responsibility to a central organisation so that it can ensure that integrative approaches to land and climate change take place. They can also watch for 'orphan' issues that not necessarily profitable to the private sector and overlooked by the public sector. At the same time, governments also need to be serious about devolving responsibility to communities where appropriate, and allowing for true local participation and solutions.

Further Reading and References

For articles referred to in this policy brief, please refer to the report from which this policy is derived: "Innovative Approaches to Land in the Climate Change Solution (Terrestrial Carbon Group, 2011), available at terrestrialcarbon.org.