HOUSES OF PARLIAMENT
PARLIAMENTARY OFFICE OF SCIENCE & TECHNOLOGY

POSTNOTE

Number 466 August 2014

Reducing Emissions from Deforestation and Forest Degradation (REDD+)

The UNFCCC REDD+ scheme aims to promote sustainable forest management in developing countries in order to reduce carbon dioxide emissions. Developed countries are expected to provide finance of approximately $20bn per year from 2020. This POSTnote summarises the extent to which REDD+ could contribute to meeting international climate targets, challenges to its implementation and technologies for tracking its performance.

Overview

- Clearing forests releases CO_2 to the atmosphere from the wood and soil, contributing to climate change; whereas conserving and enhancing forest can absorb CO_2 from the atmosphere.
- From 1990-2010, the highest rates of deforestation were in developing countries.
- UNFCCC REDD+ aims to transform forest management in developing countries using finance from developed countries. The UK committed £355 million in the three years to 2014.
- REDD+ requires forest governance, law enforcement, clarification of land and resource rights, and forest monitoring to work in the long term.
- There are still decisions to make on targets, finance, forest definition and distribution of funding.

Forests and Climate Change

Natural biological processes currently absorb about a third of all man-made carbon dioxide (CO_2). Trees absorb CO_2 from the atmosphere and use the carbon for new growth or transfer it to the soil. When forests are cleared for timber or agriculture, some of the carbon stored in the wood and soil eventually returns to the atmosphere and contributes to climate change. Deforestation currently accounts for up to 10% of global man-made CO_2 emissions, so conserving and enhancing forests can contribute to climate change mitigation.[1]

A goal of the United Nations Framework Convention on Climate Change (UNFCCC), to which the UK is a signatory, is to limit long-term global warming to 2°C. To have a 50:50 chance of achieving this, cumulative CO_2 emissions from 2011 onwards must stay below 1,200 billion tonnes.[2] Business-as-usual deforestation is expected to release 319-477 billion tonnes of CO_2 by 2100,[3] compared with more than 6,500 billion tonnes from business-as-usual fossil fuel use.[4] The 2°C target cannot be met without changing fossil fuel use, but forestry has the potential to contribute 7%-25% of global emissions reductions by 2020.[5] Forests also provide co-benefits such as biodiversity, protecting against floods and soil erosion, and providing resources like food and rubber to approximately 1.6 billion people.[6]

Recognising these benefits, Reducing Emissions from Deforestation in developing countries was suggested as a method of climate change mitigation at the 2005 UNFCCC negotiations in Montréal. At Bali in 2007, the scope was expanded to include other activities that affect forest carbon, referred to as REDD+ (Box 1). Discussions about REDD+ implementation and financing are included in ongoing negotiations towards a post-2020 global climate agreement due to be negotiated at Paris in 2015. REDD+ focusses on developing countries for two reasons. First, the majority of net deforestation takes place in developing world. Second, tropical forests, which are mostly in developing countries, offer the greatest mitigation potential. This is due to their greater potential for storing carbon as well as the amount of evaporation in tropical forests, which has a cooling effect. In some areas, the dark surfaces of non-tropical forests may have a local warming effect as they absorb more sunlight than other land uses (POSTnote 447), this local warming reduces their potential for mitigating climate change.[7]

Box 1. REDD+ Stands for (R)educing (E)missions from:

- **(D)eforestation**: where an area of natural forest is completely cleared of trees and converted to agriculture or another land use
- **(D)egradation**: where a forest's carbon storage is reduced by, for example, cutting down some of the trees
- **+**: conservation of forest carbon stocks, sustainable management of forests and enhancement of forest carbon stocks in developing countries.

Promoting Forest Management for Climate Change Mitigation

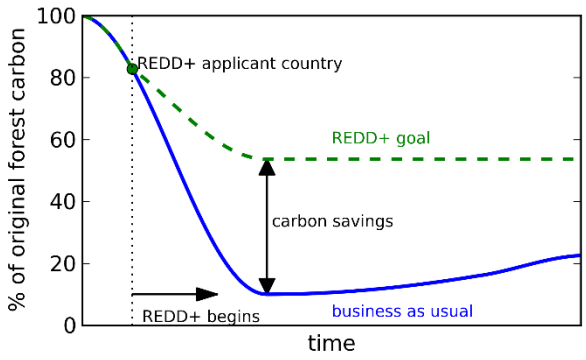
One of the benefits provided by forests is carbon storage. By assigning a monetary value to every tonne of CO_2 that is prevented from entering the atmosphere (POSTnote 354), REDD+ aims to shift development paths to promote greater carbon storage in forests (Figure 1). Carbon prices can be determined in a number of ways, such as through market-based cap and trade, carbon taxes or calculations of the economic damage from emissions.

Clearing a hectare of rainforest for oil palm plantations, one of the most profitable drivers of deforestation, is worth £2,600-6,400 to the plantation owners over 30 years.[8] There are no financial benefits for conserving the forest's carbon storage and REDD+ aims to correct this market failure through carbon payments. In April 2014, the carbon price under the EU Emissions Trading Scheme was around £4.70 per tonne, which translates to £660-1,050 per hectare over 30 years at current prices. Guidance from the Department for Energy and Climate Change suggests a substantial rise in the carbon price by 2030.[9]

Cost Estimates for Implementing REDD+

In 2008, the Eliasch Review estimated that halving deforestation emissions by 2020 would cost US$17-33bn per year, including costs of implementation.[10] Other economic analyses produced similar estimates with a carbon price under £6.65 per tonne. [11] However, a number of projects have identified difficulties (Box 2) that can increase costs and slow implementation.[12]

Figure 1. The desired effect of REDD+ on forest management in a developing nation.



A REDD+ applicant country may choose between business-as-usual development (POSTnote344), or may engage in REDD+ and aim to follow a different path (the dashed line). The vertical arrow shows the carbon savings from REDD+, for which payments would be received.

Box 2. Barriers to Implementing REDD+

Projects have encountered a number of barriers that have slowed REDD+ progress and require work to overcome, including:

- Local law, land and access or use rights are often poorly defined.
- Contradictory incentives, such as subsidies for agriculture or logging in forests or liquid biofuels encourage deforestation or degradation. However, many forest practices such as some use of wood-based biofuels could be consistent with REDD+.
- Corruption is perceived to be a problem in many tropical forest countries. Most REDD+ donors have requirements regarding transparency, accountability and participation of local stakeholders. These requirements are not globally defined.
- Forest statistics can be highly uncertain and irregularly reported so tracking performance accurately is not yet possible.
- REDD+ demands that forests are sustainably managed over decades to centuries, and such long-term guarantees are difficult to implement.

Implementation of REDD+

Readiness

Most developing nations are not currently able to implement REDD+ and so a phased approach was agreed at the 2010 Cancun climate negotiations. The first phase includes developing an action plan of policies and measures. The second phase includes implementing these actions and may include results-based demonstration activities such as conserving individual areas of forest. Early phases may also include improving forest statistics, developing legislation and clarifying land rights. The third phase consists of results-based actions that are fully measured, reported and verified. The majority of countries were in phase 1 or 2 as of 2013.

As global population and wealth grow, demand is set to rise for food, biofuel and forest products. This increasing demand is the largest driver of deforestation, with some countries responding to rising demand through policies that encourage agriculture or logging in forests.[13] Aligning policy in sectors such as agriculture is an important part of REDD+ readiness. For example, if non-forest land could produce sufficient food to suppress prices, then pressure on forests would be reduced. This would require increasing agricultural yields more quickly than at present.[14]

REDD+ is intended to scale up during 2015-2020 and suggested projects during this period are likely to require between 3 and 33 times more funding than is currently expected, if they were to be all fully implemented.[15]

Reference Levels and REDD+ payments

In the final implementation phase, it is expected that countries will first submit a reference level of expected forest development without REDD+. This is likely to be based on historical deforestation and expectations of economic development. If this level is agreed with donors, they will measure and report performance biennially. Finally, if performance is better than the reference level, they will receive payments for performance.

Setting accurate reference levels for each country is critical. Reference levels can be set in terms of carbon stocks, or carbon emissions. If a reference level is set as carbon stocks, a reference level that is too low would lead to overpayment. If a reference levels is set as carbon

emissions, then a reference level that is too high would lead to overpayment. In both cases, countries would have less incentive to conserve forests. Conversely, if reference levels for carbon stocks are set too high or for carbon emissions are set too low, they will be challenging to achieve and countries would not opt in. Agriculture and logging activities may relocate to countries that do not opt in. These effects would cancel out some of the benefits of forest conservation in countries that opted in at accurate reference levels. This is referred to as deforestation 'leakage'. Economic analysis under one set of assumptions found emissions reductions of 73-84% under REDD+, depending on the choice of reference level.[16]

Effects on People, Biodiversity and Ecosystems

Forests support biodiversity, provide local communities with forest products, and protect against floods and soil loss. However, as REDD+ payments are solely for avoided CO_2 emissions there is a risk that schemes ignore other social and environmental benefits of forests and have unintended negative side effects. REDD+ aims to learn from the experiences of previous forestry projects for voluntary carbon markets. For example, in the Guaraqueçaba project in Brazil, located on land previously used by indigenous communities and farmers, villagers claim that the project prevents them from using the land.[17]

To reduce the risk of such negative effects, REDD+ has safeguards to encourage sustainable forest management that preserves biodiversity and involves stakeholders by, for example, respecting indigenous rights. Countries must provide a summary of information on how these safeguards are being addressed.

There is wide agreement that safeguards are critical for long-term sustainable forest management. These safeguards include secure land tenure, usage rights and ensuring that forest benefits are well-distributed. Effective safeguards mean that local communities value their forest, and the cost of REDD+ implementation is reduced.[18,19] Some NGOs favour strong safeguards, but are sceptical about whether those in REDD+ are sufficient as past projects with stronger and more specific safeguards on paper have been criticised by local communities.[20] There is a risk that local groups will not be fully represented or may be exploited by more-powerful or better-informed interests. For example, in Papua New Guinea in 2008-2009, local groups were persuaded to sell rights to their land outside of any legal framework. NGOs, local groups and media were able to attract international attention and the Papuan government took action.[21]

Experience gained from REDD+ readiness can provide further evidence as to the feasibility and cost of implementation. As a donor, the UK has an interest in ensuring that REDD+ funding is well-spent so UK funding undergoes a due-diligence process. Ensuring transparency and responding to evidence from funded schemes can reduce the risk of unintended negative side effects.

Effects on the UK

As well as providing funding, the UK is linked to global markets that are affected by forest policy in tropical nations. The EU's primary contribution to deforestation is through demand for agricultural products, particularly soy and palm oil.[22] Prices for these products would be likely to increase if reductions in deforestation were not matched by increased productivity of non-forest land. About 7% of UK timber by volume comes from tropical countries, and UK companies emphasise that using timber from sustainably-managed forests provides income that encourages preservation of forests and their carbon storage.

UK industry expects that if REDD+ credits are traded in carbon markets then carbon prices will be suppressed. The City of London represents 93.5% of EU carbon exchanges, so would be expected to benefit from trading in REDD+ credits.[23] Outside of carbon trading, REDD+ is also expected to increase demand for consultancy, forest management and technological services. However, uncertainty about the details and implementation of REDD+ has led to limited involvement to date.

Technological Capability for Tracking REDD+

Methods for Reporting Performance and their Accuracy

Developing nations already report carbon stock changes in forests and other lands to the UNFCCC using methodologies that are expected to be adapted for REDD+ (Box 3). A major source of uncertainty in these calculations is the amount of carbon stored per hectare of forest, which depends on tree type, soil type and local conditions. Comparing results of research in Panama and Indonesia shows lower uncertainty once country-specific measurements are combined with detailed satellite imaging based maps (Box 4).

In general, deforestation emissions are much easier and cheaper to track than those from degradation or sustainable forest management. In the case of degradation, changes may be hidden from view by the canopy. In the case of sustainable forest management, there might be a large loss of carbon during a timber harvest, followed by decades of recovery as replanted saplings grow. However, because developing nations have to report performance every two

Box 3. Methodology for Reporting on Carbon Changes in Forests

There is best-practice guidance for estimating the amount of carbon emitted or absorbed by forestry and land use changes.[24] A three-tier system reflects a country's capability and the reliability and accuracy of the estimates. REDD+ funding aims to encourage countries to progress to higher tiers:

- Tier 1 is the most basic method where the deforested or degraded area within a country is multiplied by an emission factor based on global estimates for the activity, forest and soil type. Uncertainties are typically around 50% but can be more.[25]
- Tier 2 begins to use more detailed data, such as measurements of carbon from the country's forests, although it may still use some default global values.
- Tier 3 is the most complex method, which only uses country-specific information and may use detailed maps and emission factors calculated using extensive measurements. This can reduce uncertainty to 20% or less.[26]

Box 4. Improving Accuracy of REDD+ Carbon Accounting
Deforestation emissions were estimated in Panama from 1992-2002 by combining satellite maps with estimates of the carbon stored in different land types. With the methodology used in this study, a 50% change in deforestation rate would be needed over 10 years before savings become detectable, for two reasons.[27] Firstly, uncertainty in the carbon stored per hectare of forest caused an uncertainty of more than 50%. Secondly, more detailed maps of forest type and changes were required. However, a test study in Indonesia combined more detailed satellite maps with measurements of carbon from local forests and reduced this uncertainty to 5%.[28]

years, sustainable forest management could be discouraged if such temporary carbon losses are penalised.

Using Satellite Data
Satellites can provide information on forest cover change and sometimes forest type. Untouched primary forest tends to store more carbon as well as having 'irreplaceable' biodiversity.[29] However, disturbed forests can be managed sustainably to ensure that forests provide value to local communities while continuing to store carbon. In some cases, well-managed forests maintain their original levels of biodiversity.[30] Monocultures, where only one type of tree is planted, tend to provide immediate GDP growth, but store less carbon and have lower biodiversity.

Plantation monocultures can be seen in satellite images by their distinctive shape with trees organised in straight lines and in addition forest colour can also reveal tree type. Satellite radar sees through clouds and can be used to estimate forest carbon stock as denser forests return a stronger radar 'ping'. In 2020, a new radar will be launched that is expected to measure tree carbon to within 20% of its true value. Satellites that offer regular country-wide coverage could be used to report or verify country submissions to the UNFCCC. Some satellites sacrifice area of coverage for increased detail of images, and these can be used to detect illegal logging (Box 5).

Regular tree loss is a sign that forest is being degraded. However, there is a risk of false alarms as natural fires, drought and wind storms can also cause tree loss. In some cases, it could take decades to distinguish between forest degradation and sustainable management from space, as replacement trees take time to fully grow.

REDD+ allows the use of new technologies as they are introduced. Newer satellites and analysis techniques are expected to improve future estimates of carbon stock change, but on-the-ground measurements will still be required to validate satellite measurements and to track degradation, which is more difficult to measure from space. In the meantime, REDD+ donors will have to accept a degree of inaccuracy in estimates of avoided emissions if they wish to support schemes in countries with the lowest measurement capabilities.

The Future of REDD+

UNFCCC negotiators hope to sign a global climate agreement at Paris in 2015, entering into force in 2020. Key details of REDD+ are not yet fully decided, including how finance will be raised and distributed following full implementation. Without a global agreement encouraging demand for carbon services, REDD+ would likely be insufficiently funded to achieve its stated aim to 'slow, halt and reverse forest cover and carbon loss'. However, even without global agreement some countries could proceed with REDD+ activities. REDD+ projects may require 3-33 times as much funding as is currently expected from 2015-2020, which introduces an element of risk for prospective REDD+ applicant countries and could limit the speed at which and the extent to which REDD+ is implemented.

Box 5. Satellite Early Warning for Forest Law Enforcement
More detailed satellite imagery has traditionally been more expensive, although the European Space Agency's Copernicus programme will offer 5 to 22 metre resolution images free of charge, and launched its first satellite in April 2014. Commercial companies now offer resolutions as small as 31 cm. Both types of satellite can monitor forests, for example:

- The UK-DMC2 satellite measures the Brazilian Amazon every 2 weeks with a 22 metre resolution, and its findings are reported to the Brazilian government.
- The REDD-FLAME project, being developed with the help of UK industry, uses high-resolution satellite radar and in testing spotted the development of a 4.4 hectare clearance in the Mecuburi Forest Reserve in Mozambique. Scientists arrived weeks later and found the land freshly prepared for cultivation. Had park rangers been warned, they may have been able to prevent the logging.[31]

There is a trade-off between high resolution and area of coverage. Wide-area measurements are not currently accurate enough to fully verify biennial REDD+ performance reports due to the current.

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POST is an office of both Houses of Parliament, charged with providing independent and balanced analysis of policy issues that have a basis in science and technology. POST is grateful to Dr Mark Richardson for researching this briefing, to NERC for funding his parliamentary fellowship, and to all contributors and reviewers. For further information on this subject, please contact the co-author, Dr Jonathan Wentworth.