The purpose of this paper is to provide background analysis on the critical role played by healthy and

3.3 The proportion of forest products from sustainably managed forests is significantly increased.

4. Mobilize significantly increased, new and additional financial resources from all sources for the implementation of sustainable forest management and strengthen scientific and technical cooperation and partnerships.

...

5. Promote governance frameworks to implement sustainable forest management, including through the United Nations forest instrument, and enhance the contribution of forests to the 2030 Agenda for Sustainable Development.

...

5.2 Forest law enforcement and governance are enhanced, including through significantly strengthening national and subnational forest authorities, and illegal logging and associated trade are significantly reduced worldwide.

The Sustainable Development Goals (SDGs) are also relevant. Agreed by the UN General Assembly in 2015 as the core of the 2030 Development Agenda,
, SDG 13 deals explicitly with climate change (see box).

[2]

13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.

13.2 Integrate climate change measures into national policies, strategies and planning.

13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning.

This paper provides an overview of the interaction between forests and climate change. Section 2 examines the roles forests play in regulating the global and local climate, the impacts of forests on climate change and the impacts of climate change on forests. Section 3 analyses the treatment of forests, including the measurement of forest-related greenhouse gas emissions and sinks, in the international climate agreements. Section 4 discusses a range of mitigation options: ways in which forests and forest policy can help to reduce the rate of climate change. Section 5 discusses adaptation: measures through which forests can help societies adapt to the impacts of climate change and ways in which forests themselves may need to be assisted to adapt

Forests play a critical role in the Earth's climate system, in a number of different ways. Most importantly for global climate change, they capture carbon dioxide from the atmosphere and convert it, through photosynthesis, into living biomass: tree trunks, roots, branches and leaves. Forests also store carbon in forest soils, absorbed through leaf litter, woody debris and roots; whether these inputs are sequestered in the soil matrix or biodegraded and returned to the atmosphere as carbon dioxide, and if so at what rate, depends on complex interactions involving soil minerals, plants and soil organisms, and organic

and oceans form a natural buffer against climate change (though increasing concentrations of carbon dioxide in seawater gradually acidify the oceans, with negative impacts on marine life).

Conversely, deforestation contributes to climate change (see Figure 2.1 – land-use change). When forests are burned or cleared for uses such as cropland, pasture, infrastructure or urbanisation, the net flow of carbon from the atmosphere into the forest ends, both in the present and for the entire projected future lifetime of the trees. Deforestation also causes the release of the stock of carbon that has accumulated, both in the trees themselves and in the forest soil. The speed of release of the carbon depends on how the forest is cleared and what the wood is used for: clearance by burning or for use as bioenergy causes an

Table 2.3 provides estimated figures for the different components since the 1960s, based on a review of recent studies. In 2017 forests absorbed an estimated 3.8 billion tonnes of carbon, about 38 per cent of emissions from fossil fuel use and industry. At the same time, land-use change accounted for 12 per cent of total climate-forcing emissions. The equivalent figures for the decade to 2017 were 30 per cent and 14 per cent.

Forests also influence local temperatures, providing a cooling effect through transpiration and shade. This can be particularly important in cities, where trees can help to counteract the urban heat island effect.[19] Additional regional and global cooling derives from the fact that through emissions of reactive organic compounds, forests can increase low-level cloud cover and raise reflectivity – though clouds can also contribute to warming. Under more cloud-free skies, at high latitudes and particularly in winter, forests reduce the earth's albedo and can thus contribute to local warming. The net effect of forests on regional and global climate warming and cooling depends on the combined impact of the rate and magnitude of evapotranspiration and carbon accumulation, changes to surface and cloud albedo, as well as land-cover-change impacts on aerosols and reactive gases; these are complex relationships which are difficult to model.

Forests regulate water supplies in many ways. High-altitude forests can intercept fog and cloud droplets, which may account for up to 75 per cent of total catchment run-off. Where such forests have been

resulting in a loss of more than half the area's merchantable pine volume by 2012.[21] In the long run, events such as these are not necessarily negative, however: disturbances help to increase landscape heterogeneity, foster greater species diversity and initiate ecosystem renewal or reorganisation.

However, climate change has the potential to increase both the frequency and the intensity of most of these disturbances, possibly exceeding forest ecological resilience and resulting in permanently altered forests or shifts to non-forest ecosystems. The year 2018, for example, saw a sharp increase in forest fires in temperate and boreal regions, with extensive and long-lasting wildfires in the US, Siberia, Australia and Europe. In California, 14 of the 20 largest wildfires on record have occurred over the past 15 years, and on average fires now burn more than twice the area they did in the 1980s and 1990s.[22] Although climate change is not the only factor behind this, fuel aridity – a combination of temperature and precipitation –

Fire	Fuel moisture Ignition (for example, lightning activity) Fire spread (for example, wind speed)	win57(d)5(ou)-6(ti)5(n53(s)-8eu)5(

Set against these impacts, there are some potential positive effects of climate change on forests. These include the carbon fertilisation effect: increased growth rates caused by higher concentrations of atmospheric carbon. Studies suggest that elevated carbon levels can encourage increases in leaf area, the rate of photosynthesis per leaf area, and carbon stored below-ground in roots and soil.[30] Higher concentrations of carbon dioxide also cause leaves to open their stomata less wide, so less water evaporates and the trees go on growing longer in times of relative drought or in the heat of the day. One study of global changes in leaf area, based on satellite observations, suggested that up to half of the Earth's vegetation-covered land was now 'greener' than 30 years ago, mostly due to rising levels of carbon dioxide

[29] Source: ibid.

[30] R. Ceulemans et al, 'Effects of CO2 Enrichment on Trees and Forests: Lessons to be Learned in View of Future Ecosystem Studies', 84: 577–590 (1999); Randall J. Donohue, 'Impact of CO2 fertilization on maximum foliage cover across the globe's warm, arid environments',

buildings) while at the same time avoiding opportunities to dilute national climate goals.[39] Arguments have been put forward, mainly by NGOs, that carbon sinks such as forests should not be included at all in

As noted above, parties to the agreement are required to submit NDCs outlining their commitments, targets and plans of action.[41] For all countries other than the least developed and small island developing states, these must include baselines against which their commitments can be measured. Sections 4 and 5 of this paper review the possible options countries face for forest-related actions on mitigation and adaptation; the remainder of this section looks at what parties have so far committed to in their NDCs. Mostly these were included in the intended NDCs (INDCs) submitted in the run-up to the Paris conference in December 2015, which became NDCs once the party concerned had ratified the agreement; submission

Countries aiming to mitigate climate change – i.e. reduce greenhouse gas emissions or increase their rate of absorption into carbon sinks – through actions related to forests face several different options, most of which are reflected in the UNSPF Global Forests Goals (see box).

1. Reverse the loss of forest cover worldwide through sustainable forest management, including protection, restoration, afforestation and reforestation, and increase efforts to prevent forest degradation and contribute to the global effort of addressing climate change.

    1.1 Forest area is increased by 3 per cent worldwide.

    1.2 The world's forest carbon stocks are maintained or enhanced.

    1.3 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally.

    …

3.

value of forests through expanding markets for wood products (4.5); and using wood for bioenergy – though here current policy developments may have the potential to accelerate rather than mitigate climate change (4.6).

Several studies have attempted to estimate the scale of potential mitigation options. In 2014, the IPCC

Forest ecosystem restoration, involving restoring one-quarter of degraded natural forest cover globally (600 million hectares) would restore primary forest characteristics, increasing the area of primary forests to 50 per cent of the global forest area, and increase the size of the global carbon sink by an estimated 1.9 $GtCO_2e$ per year. Promoting the expansion of natural forests (as opposed to planting monocultur P fo7 682.18 Tm0 g0

activities, including in particular forest ecosystem restoration and natural forest expansion, are assumed to take place in tropical forests, currently areas which are characterised by poor levels of forest governance and weak law enforcement. Implementing the type of measures discussed below in Section 6.2 is therefore of vital importance, as well as the provision of financial support, as discussed in Section 6.1.

Clearly, the starting point for forest-related climate mitigation options should be to reduce the pressures on existing forests. For most of the last ten years, the bulk of climate-related forest spending by both donors and forest countries has been devoted to a set of activities initially called 'reducing emissions from deforestation' (RED) and now expanded to 'reducing emissions from deforestation and forest degradation

2. The investment phase, scaling up policies and measures designed to address the direct and indirect drivers of deforestation and forest degradation.
3. Performance-based payments for verified reductions in emissions.

Donor countries have to date pledged billions of dollars to developing countries for REDD+ activities (see further in Section 6.1). Most has been dedicated to the first two phases. Among other outcomes, this has assisted in the development of forest monitoring capacities, a prerequisite for evidence-based forest policy; to date 39 countries, accounting for about 70 per cent of the forest area in developing countries, have submitted a forest, or forest emissions, reference level, most at the national level.[56]

Progress with the third phase has been slower. According to the REDD+ Web Platform maintained by the UNFCCC, just four countries – Brazil, Colombia, Ecuador and Malaysia – have reported verified reductions in emissions and only Brazil has reported receiving payments as a result[57] (though since 2016 Colombia has also received payments through the REDD Early Movers Programme jointly funded by Germany, Norway and the UK). The total reduction in emissions reported by these four countries currently amounts to 6.3 $GtCO_2e$ over the ten years from 2006 to 2015 (although only Brazil reported results for all ten years), almost entirely from Brazil. The total verified emissions savings for which Brazil received payments was much smaller, at 0.19 $GtCO_2e$ over the ten years.

The specific activities funded to reduce emissions cover a wide range of measures and vary from country to country; they often take the form of sub-national, or 'jurisdictional', projects. In Colombia, for example, in a programme funded by the REDD Early Movers Programme, the government has committed to increase productivity in the cattle sector and reverse the expansion of pastureland for cattle (currently the main

further 24 per cent.[63] A detailed study for the European Commission, published in 2013, estimated that 53 per cent of the global deforestation experienced from 1990 to 2008 was due to agricultural expansion.[64] Livestock (mainly cattle) pasture accounted for 46 per cent and crops for animal feed for a further 11 per cent. The remaining 43 per cent was due to crop production, including soybeans (19 per cent), maize (11 per cent), oil palm (8 per cent), rice (6 per cent) and sugar cane (5 per cent). The rapid expansion of soy and palm oil production since 2008 mean that these figures will be under-estimates of the situation today.

In general, the returns earned on investment in agricultural expansion are much greater than in leaving trees standing or managing them for timber production, though it is not always the case that deforestation occurs directly as a result of agricultural expansion. In some cases the land may be converted to agriculture after deforestation has occurred as a result of government policies promoting economic growth or rural development – as has historically been the case, for example, in Brazil.

The increasing liberalisation of trade policy has clearly affected the extent and magnitude of deforestation. Globalised demand allows 'the drivers of deforestation to be mobile' and the 'forces of the market to move them around the world,'[65] creating an ever-increasing incentive to convert forests into more profitable uses. Nevertheless, it is still true that the bulk of deforestation from agriculture is the result of domestic use in the producing country; in the European Commission study, about one-third of the deforestation embodied in crop production, and just 8 per cent of the deforestation embodied in ruminant livestock products, was traded internationally.[66] Oil crops such as soy and palm oil accounted for the majority (almost two-thirds) of the deforestation embodied in exported crop commodities. While South American countries had experienced approximately one-third of total global deforestation, they accounted for almost two-thirds of the global trade in crop products associated with deforestation, largely due to exports of soy, mainly to China.

A significant proportion of clearance of forests for agriculture has been illegal in nature. A comprehensive survey published by Forest Trends in 2014 concluded that 49 per cent of total tropical deforestation between 2000 and 2012 was due to illegal conversion for commercial agriculture. Nearly one quarter (24 per cent) was the direct result of illegal agro-conversion for export markets.[67] Brazil and Indonesia together accounted for 75 per cent of the global area of tropical forest estimated to have been illegally converted for commercial agriculture over this period. In Brazil, where cattle and soy had been the main drivers, at least 90 per cent of deforestation for agriculture in the Amazon was estimated to be illegal. In Indonesia, at least 80 per cent of deforestation for commercial agriculture – mostly palm oil – and timber plantations was estimated to be illegal.

Both private companies and governments have responded to the growing evidence of these impacts of agriculture on deforestation, and have adopted a variety of declarations and commitments to the objective of zero deforestation or zero net deforestation. This includes in particular:

[63] Curtis et al, 'Classifying drivers of global forest loss'.

- The Consumer Goods Forum, which in 2010 adopted a target of achieving zero net deforestation in its membership's supply chains by 2020 for a number of key commodities, including soy, cattle, p

palm oil produced within the state by 2025.[71] A number of regions and districts in Indonesia are working with RSPO towards similar targets, recognising possible weaknesses in the ISPO scheme and its lack of recognition by companies and governments outside Indonesia.

Action by consumer countries has also so far been limited mainly to the provision of development aid to support deforestation-free agriculture, both through bilateral programmes such as the UK's Partnerships for Forests programme, which mainly supports a series of public-private partnerships, and multilateral initiatives such as the World Bank's BioCarbon Fund Initiative for Sustainable Forest Landscapes. Two examples of REDD+ projects tackling agricultural drivers of deforestation, in Colombia and Brazil, are mentioned above in Section 4.1. Some European governments, however, are beginning to use demand-side measures to promote markets for sustainable, or deforestation-free, commodities, sometimes through joint action with industry, and to exclude particular commodities from their procurement policies or regulations governing biofuels (a major source of demand for palm oil and soybean oil, and biodiesel made from these feedstocks). Examples include the UK (on palm oil and soy), Belgium (cocoa) and Norway (palm oil); at the EU level, sustainability criteria for transport biofuels are still being finalised which seem likely to restrict the market for palm oil and soy.

In March 2018 the European Commission published a feasibility study on options for the EU and its member states to tackle the EU's impact on global deforestation.[72] Proposals included greater support for deforestation-free agriculture in producer countries, the wider use of public procurement policy in EU member states, the adoption of a due diligence regulation for forest risk commodities, and greater scrutiny of investments in agriculture in producer countries. In November 2018 the Commission announced that it would publish specific proposals for a way forward in the second quarter of 2019. This was partly thanks to pressure from the Amsterdam Declaration Partnership, a group of European countries aiming to promote and coordinate action on sustainable commodity supply chains.

In November 2018 the French government published an action plan to deal with imported deforestation, including proposals to stop importing products linked to deforestation and unsustainable agriculture by 2030, to help companies meet their own deforestation goals and to encourage financiers to take environmental and social issues into account for investment decisions.[73]

As well as reducing the pressures on forests from alternative uses of the land such as agriculture, any strategy for increasing carbon uptake by forests and reducing the rates of deforestation and forest degradation must also include sustainable management of existing forests. The idea of sustainable forest management (SFM), an attempt to reflect the environmental and social as well as economic benefits provided by forests, become widely accepted after the UN Conference on Environment and Development

[71] John Payne, 'Introduction to Sabah Jurisdictional Approach for Sustainable Palm Oil Production' (Sabah Jurisdictional Certification Steering Committee, 2016),
http://rt14.rspo.org/ckfinder/userfiles/files/PC4_4_2%20Datuk%20Dr%20John%20Payne.pdf.

[72] See http://ec.europa.eu/environment/forests/studies_EUaction_deforestation_palm_oil.htm.

[73] Ministere de la Transition Ecologique et Solidaire,
(November 2018); https://www.ecologique-solidaire.gouv.fr/sites/default/files/2018.11.14_SNDI_0.pdf.

in 1992 (the 'Earth Summit' in Rio de Janeiro), which first saw international commitment to the concept of sustainable development more broadly.

SFM covers a wide range of issues; as defined by Forest Europe, and since adopted by the FAO; it is:

> The stewardship and use of forests and forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil, now and in the future, relevant ecological, economic and social functions, at local, national, and global levels, and that does not cause damage to other ecosystems.[74]

The UN Forest Instrument (formerly known as the Non-Legally Binding Instrument on All Types of Forests), agreed under the auspices of the UN Forum on Forests (UNFF) in 2007, identifies seven key thematic elements of SFM: extent of forest resources, biolog o-3(,)-i0.00000912 0 612 792 ra4(d)3( )ym0 gM7W*nBT/F1 11.04 T

What is probably the most widely accepted view is that active forest management enhances carbon uptake, both because the rate of carbon uptake slows as forests mature, net primary productivity declines and natural mortality increases, and also because unmanaged forests increase the chance of massive carbon losses from disturbances such as fire, insects or disease infestations.[77] Harvesting mature trees and replanting should therefore increase the rate of carbon uptake, as well as generating timber for wood products.

Other studies suggest, however, that this is not necessarily true, particularly in old-growth forests, though it may be in plantations (possibly because of lower soil nutrient availability in plantations compared to natural forests). Many studies have shown that mature trees absorb more carbon than younger trees, mainly because of their much higher number of leaves, which enable greater absorption of carbon dioxide from the atmosphere.[78] As a 2014 study concluded, 'for most species mass growth rate increases continuously with tree size. Thus, large, old trees do not act simply as senescent carbon reservoirs but actively fix large amounts of carbon compared to smaller trees; at the extreme, a single big tree can add the same amount of carbon to the forest within a year as is contained in an entire mid-sized tree.'[79] While there will be a difference between the carbon sequestration rate of individual trees versus the entire forest, a 2008 study concluded that: 'in forests between 15 and 800 years of age, net ecosystem productivity (the net carbon balance of the forest including soils) is usually positive.'[80] The higher rate of carbon uptake of older trees is only partially offset by their higher mortality rates, and it should be possible to reduce this by management for conservation, e.g. by removing diseased or dead trees.

This conclusion is supported by other studies suggesting that, far from accelerating carbon uptake, harvesting may in fact bring it to a temporary halt. One study reviewing the impacts of forest disturbances (including harvesting, fires, storms and insect infestation) throughout the US concluded that in most cases snowoear f sts , the forest did not return to its status as a carbon sink for at least 10, and sometimes as much as 20, years, partly due to the large soil carbon losses associated with the event.[81] (The impacts are likely to be much larger for clear-cutting than for selective felling.) Similarly, a model-based study of forest carbon storage in the north-eastern US compared different types of forest management and concluded that the highest rate of carbon uptake and storage was achieved simply by leaving the forest alone: 'The results supported both our first hypothesis that passive management sequesters more carbon than active management, as well as our second hypothesis that management practices favouring lower harvesting frequencies and higher structural retention sequester more carbon than intensive forest management.'[82]

[77] See, e.g., Hektor, B., Backéus, S. and Andersson, K., 'Carbon balance for wood production from sustainably managed forests', , 93 (2016), or the studies reviewed and summarised in 'Maximising carbon storage through sustainable forest management' (American Hardwood Export Council, nd).

[78] See, for example, Luyssaert, S. et al, 'Old-growth forests as global carbon sinks',

Similarly, a recent study of carbon storage in forests in the US state of Oregon concluded that lengthening harvest cycles on private lands and restricting harvesting on public lands, together with reforestation and afforestation, had the potential to increase the net ecosystem carbon balance by 56 per cent by 2100, with the first two actions contributing the most.[83] (Co-benefits included improved water availability and a greater range of biodiversity, primarily from increased forest area, age, and species diversity.) SFM strategies may therefore need to be adapted to incorporate management practices primarily aimed at enhancing forest carbon stocks rather than producing production-grade timber – e.g. silvicultural treatments (tending operations, enrichment of gaps, etc.), species selection, modification of rotation cycles, planting densities, and thinning frequencies. This of course needs to be balanced against measures designed to encourage the greater use of wood products (see below, Section 4.5), but the Oregon study concluded that increasing forest carbon stocks on public lands would reduce emissions more than storage in wood products, since the residence time is more than twice that of wood products.[84]

On the other hand, a recent study of European forests using a complex computer model to calculate the amount of carbon, energy and water trapped or released by managing a forest, concluded that any climate benefits from carbon sequestration through forest management could be reinforced, counteracted or offset entirely by concurrent changes in surface albedo, land-surface roughness, emissions of biogenic volatile organic compounds, transpiration and sensible heat flux, meaning that forest management could offset carbon emissions without actually halting global temperature rise.[85] Examining a number of different pathways, the study concluded that managing forests with the objective of reducing near-surface air temperature, primarily by converting evergreen to deciduous forests, would also reduce the atmospheric carbon growth rate, though not by much, and would also reduce the wood available for harvest.

It is, accordingly, difficult to reach firm conclusions about the appropriate form of forest management to maximise carbon uptake and storage; and in any case these are likely to vary with the type of forest, ecosystem and local climate.

Alongside managing existing forests more sustainably, measures can be taken to increase the area of forest cover and, therefore, the global carbon sink. The UNSPF Global Forest Goals, the New York Declaration and the Sustainable Development Goals all call for, and in some cases set targets for, increasing forest area, Global Forest Goal 1.1 by 3 per cent worldwide by 2030. Accordingly, increasing attention is being paid in many countries to strategies for reforestation (defined by FAO as the re-establishment of forest through planting and/or deliberate seeding on land classified as forest), afforestation (the same activities, taking place on land that, until then, was not classified as forest), and the restoration of degraded forests.

Such initiatives have a long history. In the 1930s and 1940s nearly 3 billion trees were planted in the US by the Civilian Conservation Corps, one of the public works relief programmes established under the New Deal in the wake of the Great Depression. A more recent example is the Green Belt Movement, founded

[83] Beverly E. Law et al, 'Land use strategies to mitigate climate change in carbon dense temperate forests', 115:14 (April 2018).
[84] Ibid.
[85] Sebastiaan Luyssaert et al, 'Trade-offs in using European forests to meet climate objectives' 562 (2018).

detectable gains of vegetation that non-specialists would view as forest (tree cover higher than 5 m and minimum 50 per cent crown cover) are an order of magnitude less (33,000 km

The length of this carbon payback period matters, because any short-term growth in carbon emissions increases the likelihood of irreversible climate 'tipping points', and is also likely to be incompatible with the goals of the Paris Agreement, which require near-

One of the first two adaptation projects accepted in the UNFCCC Adaptation Fund (see below in Section 6), in September 2010, is a good example of this kind of strategy. The project aimed to improve water management and decrease water problems for the poor in the Honduras capital region of Tegucigalpa. It placed a strong emphasis on the role of forests in regulating water and the negative impacts of deforestation in water catchments. According to the project document, ecosystem management, including the creation of protected areas, needed to consider issues of water supply for cities and sensitive ecosystems such as cloud forests. The project developers recognised that there were no mechanisms in place to conserve the forests and green belts, which provided important ecosystem services and were threatened by deforestation and urbanisation.

As well as helping societies adapt to the impacts of climate change, forests themselves need to adapt to the kind of climate-related impacts reviewed in Section 2.3, including temperature rise, changes in rainfall patterns and water availability, fires, insects and diseases, as well as deforestation and land use change. Forest ecosystems differ in both their sensitivity – the degree to which they are affected by a change in climate, either positively or negatively – and their vulnerability – the extent to which they are able to adapt to these climatic and climate-change-induced changes.

Two broad kinds of adaptation measures can thus be identified: measures that aim to buffer forests from perturbations by increasing their resistance and resilience, and measures that facilitate ecosystem shift or evolution towards a new state that meets the altered conditions.[115]

Buffering measures tend to focus on preventing perturbations, such as fire (by e.g. managing fuel load) and invasive species (by e.g. preventing their spread or removing them). They can also include managing the forest actively after a perturbation, by, for example, assisting the establishment of adapted and acceptable species. These measures might, however, only be effective over the short term, becoming less and less so with accelerating climate-related changes and pressures. Furthermore, there are often high costs associated with such measures due to the intensive management that they require. They are likely to be more efficient when applied to high-value or high-priority conservation forests or to forests with low sensitivity to climate change.

Measures that facilitate ecosystem shift or evolution do not aim to resist changes, but rather to ease and manage the natural processes of adaptation. Resilience is crucial, not necessarily to keep the ecosystem in the same state after a disturbance, but to per000912 0 612 792 reW*n gl009and 12500912 0 000912 0 612 792 reW*n

Forest stakeholders have a central role to play in forest adaptation because they manage forests and depend directly on them and because adaptation must be based on local practices and knowledge; local people know their environment better than outsiders. Institutional changes are often needed to achieve this, for example by increasing local ownership and access to forests, protecting rights of ownership and tenure, and building institutional responsibility for adaptation.

The Tegucigalpa adaptation project mentioned above in Section 5.1 also included measures to promote 'adaptation for forests'. It aimed to increase connectivity between protected areas around the city, thereby increasing ecosystem resilience as the climate changed. This project is a positive sign of mainstreaming forests into adaptation policies, as well as adaptation into forest management.

Having reviewed a range of forest-related policy options for climate mitigation and adaptation, this section looks briefly at two key underlying prerequisites for their successful implementation; the provision of financial support, and improvements in forest governance and law enforcement. Once again these are reflected in the Global Forest Goals (see box).

4. Mobilize significantly increased, new and additional financial resources from all sources for the implementation of sustainable forest management and strengthen scientific and technical

As noted in Section 4.1, for most of the last ten years, the bulk of climate-related forest spending by both donors and forest countries has been directed to REDD+ activities. A variety of international institutions and initiatives have evolved to channel REDD+ funding to developing countries, including three World-Bank-administered funds (Forest Investment Programme, Forest Carbon Partnership Facility and BioCarbon Fund Initiative for Sustainable Forest Landscapes) and the UN-REDD partnership. In 2017 the Green Climate Fund – which is intended to be the main financial mechanism of the Paris Agreement – also began to draw up plans for its own REDD+ financing activities; activities it has supported so far include the results-payments to Brazil discussed in Section 4.1. Several donor countries maintain sizeable bilateral REDD+ programmes and some are increasingly collaborating in deploying their support – for example,

(though most had not been disbursed) by 2014.[118] The NYDF Assessment Partners report in 2018 estimated that US$1.7 billion had been delivered for the first two stages and US$4.1 billion pledged for results-

private donors, and also from a 2 per cent share of proceeds of Certified Emission Reductions issued under the Kyoto Protocol's Clean Development Mechanism projects. To date the only forest-related project the Adaptation Fund appears to have supported is the 'Ecosystem-Based Adaptation at Communities of the Central Forest Corridor in Tegucigalpa' project referred to above in Section 5, which has had US$4.4 million allocated.[126]

Other multilateral and bilateral donors also make financial support available for adaptation, however. This includes the Green Climate Fund, the Forest Carbon Partnership Facility and several of the major donors mentioned above. Since there are in reality many overlaps between forest-related mitigation and adaptation activities, many projects in fact aim to achieve both.[127]

Along with the provision of sufficient financial and capacity-building support, the other essential prerequisite for the successful implementation of almost all of the measures outlined above in Sections 4 and 5 is adequate standards of forest governance – yet the forest sector as a whole has long been characterised, in many countries, by severe and long-lasting weaknesses in governance and law enforcement, leading to widespread illegal activity, including logging, forest clearance and illegal export. This is the result of several factors:

- ¶ are a major underlying driver, and accordingly, the profile of land tenure issues has risen considerably in recent years. Despite widespread recognition of this issue's importance in the literature and global policy debate, efforts to address the dispossession of local communities and to resolve the conflict between national and customary law on property rights have been slow and uneven.
- ¶ significantly shapes the nature and extent of illegal activity. Studies suggest that in the right circumstances, initiatives to involve local stakeholders, such as local communities and NGOs, in decisions over the management and protection of forests can contribute to a reduction in illegal exploitation.[128] This also requires high levels of transparency and access to information. In many countries this is very far from the norm: basic information, such as forest concession boundaries or logging quotas, may never be made publicly available, vested interests and elites have captured the government agencies involved, at national or local levels, and the interests of local communities are marginalised or ignored entirely.
- ¶ , in some cases endemic to the conduct of business in the sector rather than a deviation from the norm, is a necessary precondition for the magnitude

[126] See https://www.adaptation-fund.org/project/ecosystem-based-adaptation-communities-central-forest-corridor-tegucigalpa/.

[127] Locatelli et al, 'Integrating climate change mitigation and adaptation in agriculture and forestry'.

[128] (Terea, S-for-S, Topperspective, 27 April 2016); https://ec.europa.eu/europeaid/evaluation-eu-flegt-action-plan-forest-law-enforcement-governance-and-trade-2004-2014_en; Christine Overdevest and Jonathan Zeitlin,

(Amsterdam Centre for Contemporary European Studies, SSRN Research Paper 2016/02).

of illegal activity; the actors involved may include central and local government officials, state-owned enterprises, the military and other enforcement agencies.[129]

- ¶ often stem from factors related to endemic corruption, including bribery, fraud, abuse of office, extortion, and cronyism.[130] Weak managerial capacity in the government agencies responsible for the oversight of forests is common, and can be both a cause and symptom of entrenched corruption.
- ¶ at the macro or micro level can also create incentives and scope for illegal activity. At the macro level, this may result from a failure to address major threats to sustainable resource management. Encroachment of agriculture is a key culprit – if forestry policy is set in isolation from

> administrative discretion in forest governance, including the award of concessions and harvesting permits, while creating new mechanisms for exposing corruption across the supply chain, whose effectiveness can be expected to grow as the monitoring, reporting, and review provisions of their timber legality assurance schemes kick into full gear with the onset of FLEGT licensing.[132]

It is generally recognised, however, that the FLEGT initiative has had less success in addressing questions of land tenure and human rights. This is a matter of substantial importance; much of the world's remaining tropical forests are occupied by indigenous peoples and traditional communities, and studies suggest that such areas see deforestation rates significantly lower than other government-controlled lands.[133] Only 10 per cent of these areas are legally under indigenous and community ownership, however; so securing community land and management rights represents a potentially effective, efficient and equitable climate action that governments can undertake to protect forests and increase the size of the global carbon sink.[134]

More broadly, the active participation and commitment of local communities is likely to be the single most crucial factor in determining how forests are used in the future. Implementation of the various options discussed above, including forest restoration, efforts to reduce deforestation, management for carbon storage and increased production of sustainably harvested wood products, requires the understanding and consent of local communities, which in turn requires effective protection of their rights and a genuine voice in decision-making processes.

These are important lessons for most of the policies and measures discussed above in Sections 4 and 5. In many countries, initiatives to halt deforestation, promote sustainable forest management, reforestation, afforestation, forest landscape restoration and the sustainable use of wood products will not succeed unless standards of governance are adequate to ensure the lasting positive impact of the programmes in question. As a 2018 survey of standards of governance put it, 'While not sufficient to address deforestation by itself, good forest governance is a necessary condition for forest protection and sustainable land use.'[135]

These issues are increasingly recognised in the international efforts to combat deforestation and protect forests, including the UNSPF's Global Forest Goad 5, the New York Declaration (which includes the commitment to 'strengthen forest governance, transparency and the rule of law, while also empowering communities and recognising the rights of indigenous peoples, especially those pertaining to their lands and resources') and the Katowice Declaration (which recognises 'the role of indigenous peoples and local communities in conserving and sustainably managing forests for the benefit of present and future generations').

Nevertheless, although standards of governance are often incorporated as required safeguards in many aid programmes and the requirements of the REDD+ institutions, the evidence suggests that only limited progress is being made in improving it; the survey concluded that:

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[132] Overdevest and Zeitlin,

[133]

(Rights and Resources Initative, September 2018).

[134] Dooley,

[135] Darragh Conway et al,

(NYDF Assessment Partners, 2018).

> Improvements in forest governance remain too slow to have a measurable impact on reducing deforestation. There is progress in increasing transparency around forests, improving law enforcement, and expanding demand-side measures to address illegal logging in a number of countries. However, these improvements fall short of what is needed to address the vast governance challenges that continue to allow deforestation and inhibit efforts to improve forest conservation and management.[136]

Further efforts will therefore be necessary if the measures discussed in the rest of this paper are to be effective.

[136] Ibid.