

## Grounding nature-based climate solutions in sound biodiversity science

***The current narrow focus on afforestation in climate policy runs the risk of compromising longterm carbon storage, human adaptation and efforts to preserve biodiversity. An emphasis on diverse, intact natural ecosystems—as opposed to fast-growing tree plantations —will help nations deliver Paris Agreement goals and much more.***

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The idea that natural ecosystems can help us fight both the drivers and impacts of climate change has been gaining traction over the past few years, including recent emphasis in the  
15 IPCC Special Report<sup>1</sup>. In particular, the Paris Climate Change Agreement calls on all Parties to acknowledge “the importance of ensuring the integrity of all ecosystems, including oceans, and the protection of biodiversity, recognized by some cultures as Mother Earth”, and 66% of signatories to the Agreement commit to “green” or “nature-based solutions” in their climate pledges<sup>2</sup> (Box 1). Such recognition of nature’s value—in  
20 particular through policies promoting forests as carbon sinks—was hard-won by negotiators and non-state actors and is vitally important. However, we are concerned by aspects of the narrative reaching policy makers and call on scientists studying biodiversity and ecosystem functions and services to fully engage with and inform the process by which high-level pledges are translated into on-the-ground actions.

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40 **Box 1: What are nature-based solutions?**

Nature-based Solutions (NbS) involve working with and enhancing nature to help address societal goals. They are “actions to protect, sustainably manage and restore natural or modified ecosystems, which address societal challenges (e.g. climate change, food and water security or natural disasters) effectively and adaptively, while providing human well-being and biodiversity benefits”<sup>3</sup>. They have also been described as solutions “inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions”<sup>4</sup>. The concept of NbS has recently emerged against the backdrop of our failure to either stabilise the climate or stem the tide of biodiversity loss. However, high level pledges for “nature” tend to translate into targets for afforestation, often monocultures with single non-native species, which can over the long term produce maladaptation to climate change, compromise carbon storage and negatively impact on biodiversity and sustainable development in general.

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## A focus on forests

When it comes to high level multilateral pledges for nature the current focus is on forests. The Bonn Challenge—launched by IUCN and Germany in 2011 and currently involving 56 nations—is a global effort to restore 150 million hectares of deforested and degraded land by 2020 and 350 million hectares by 2030<sup>5</sup>; the New York Declaration on Forests – signed in 2014 by 37 governments, 63 NGOs, 53 multinational companies and 16 indigenous community groups – pledges to halve deforestation by 2020 and end it by 2030<sup>6</sup>; and the Trillion Trees Partnership is a new 25-year initiative to restore one trillion trees by 2050, the number needed to reverse the global decline in tree cover<sup>7</sup>. Such initiatives have inspired a significant number of private companies to voluntarily commit to eradicating deforestation from their supply chain. Added to this, signatories to the Sustainable Development Goals have committed to stop deforestation by 2020, while the UN's Rio Convention on Biological Diversity also addresses deforestation, both in terms of biodiversity and enhancement of carbon stocks.

From a climate perspective, this focus on forests is vitally important. Global CO<sub>2</sub> emissions from land use change (mainly deforestation) represented around 12% of global emissions for 2007-2016, while the terrestrial carbon sink stored around 28% of emissions (3.0 ± 0.8 GtC per year) over the same period<sup>8</sup>. The restoration of 350 million hectares of forest by 2030 (i.e. the Bonn Challenge) would add to this, sequestering up to 1.6 GtC per year, equivalent to 14% of the global carbon emissions<sup>5</sup>. Because of this powerful role as both a source and a sink for CO<sub>2</sub>, forests have long played a key role in the international climate change policy (Box 2) and are increasingly in the limelight.

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**Box 2: Forests in climate policy**

85 Forest management for carbon stock enhancement was introduced in the context of the UN Framework Convention on Climate Change (UNFCCC) in 1992 and the concepts of afforestation and reforestation for climate change mitigation were first introduced in the Kyoto Protocol in 1997. The Bali Action Plan in 2007 brought the program on Reduced Emissions from Deforestation and land Degradation (REDD) to the negotiating table, with Forest Monitoring, Reporting, and Verification (MRV) under the UNFCCC reported as change in carbon stock over time. Parties rapidly realised that this metric leads to serious unintended consequences (e.g. potential for contravening land rights) and so the concept of “safeguards” was introduced to the negotiating text in Cancun, 2010. Subsequent negotiations attempted to widen the scope of the framework to include non-carbon benefits linked to the social, environmental, and governance benefits of the five activities covered by REDD+.

90 In the 2015 Paris Agreement, Parties are encouraged to adopt “...*policy approaches and positive incentives for activities relating to reducing emissions from deforestation and forest degradation, and the role of conservation and sustainable management of forests and enhancement of forest carbon stocks in developing countries; and alternative policy approaches, such as joint mitigation and adaptation approaches for the integral and sustainable management of forests, while reaffirming the importance of incentivizing, as appropriate, non-carbon benefits associated with such approaches*”. In response, 49 signatories collectively pledged to restore 57 million hectares of forest in their Nationally Determined Contributions<sup>9</sup>. Most recently, at the 24th Conference of the Parties of the United Nations Framework Convention for Climate Change (UNFCCC) in December 2018, the Polish presidency of announced the “Ministerial Katowice Forests for Climate Declaration”, which encourages all Parties to take action to conserve and enhance sinks and reservoirs of greenhouse gases, emphasising “healthy, biologically diverse, and resilient forests adapted to climate change”<sup>10</sup>. However, the Declaration does not specify that carbon emissions must be drastically cut in parallel with conserving and enhancing forests for mitigation and adaptation. We stress that the implementation of any forest-based agenda needs to coincide with severe cuts in fossil fuel emissions if we are to achieve the goals of the Paris Agreement.

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**The problem with monocultures**

The issue is how these high-level pledges for forests translate into action on the ground.

115 Existing international frameworks provide a definition of forests created for the purpose of assessing forest carbon stocks alone and as a result pledges tend to focus more on the

120 extent rather than the quality of forest to be protected, afforested or reforested<sup>2,11</sup>. This is  
problematic not least because intact forests have been estimated to hold more carbon than  
logged forests<sup>12</sup>. Furthermore, the approach encourages the establishment of monoculture  
plantations of fast growing species, including exotics. While such plantations may store  
carbon in the short term, their capacity to do so over the long term is impaired by changing  
conditions and disturbances<sup>13</sup> that are becoming more rapid and severe under climate  
change<sup>14</sup>. For forests to sequester carbon long term, they must be able to resist, recover  
and/or adapt to these changes<sup>14</sup>, and there is growing evidence that such functional  
125 resilience is strongly determined by factors such as ecosystem connectivity, heterogeneity,  
and diversity at multiple ecological levels<sup>15</sup>. For example, recent experimental studies  
demonstrate that compared to monocultures, diverse plantations of tropical forest are more  
resilient to wet and dry climate extremes<sup>16</sup>, while mixed species forests are more resistant to  
pests and disease<sup>17</sup>. Connectivity, meanwhile, is widely viewed as being critical to the  
130 adaptive capacity and integrity of intact forests and their biota in the face of environmental  
change<sup>18</sup>.

Therefore, to enable long term carbon storage mitigation, policy must move away from  
encouraging single species plantations and instead support practices that enhance the  
135 ecological attributes that underpin functional resilience. Such policies would be more in  
line with recent evidence that diversity (of species and/or traits) is key to preserving forest  
carbon sinks in the face of climate change<sup>19</sup>.

### **What about the rest?**

140 It is vital that the current emphasis on forests does not detract from other ecosystems,  
many of which are also very important for storing carbon. A new campaign to raise the  
profile of natural solutions to climate change advocates that restoring and protecting  
forest can “deliver 30% of the climate solution needed by 2030”<sup>20</sup>. Although the  
campaign strongly emphasises forests, it is based on a study showing that conservation  
145 actions in *all* major natural terrestrial habitats including grasslands, wetlands and  
agricultural lands could help provide up to 30-37% CO<sub>2</sub> mitigation needed through to  
2030 for >66% chance of keeping warming to < 2 °C<sup>21</sup>.

Mangroves, in particular, are one of the planet’s most efficient carbon storehouses,  
150 with mean long-term carbon burial rates (i.e. rates at which organic carbon  
accumulate in sediments) more than 45 times greater than any other terrestrial

ecosystem, including boreal and tropical forests<sup>22</sup>. Peatlands also hold vast reservoirs of carbon (25% of world's carbon) but cover only 2-3% of terrestrial areas<sup>23</sup>. Meanwhile, natural grasslands harbour substantial carbon stores within  
155 their soil and can be more resilient than forests to drought and wildfires making them the more effective and secure carbon sink in the long term<sup>24</sup>. However, these important carbon stores barely feature in climate change policy. For example, while 42% of signatories to the Paris Agreement include afforestation and/or restoration in terrestrial forest in the mitigation components of their NDCs, only 19% do the  
160 same for coastal habitats. Meanwhile, conservation actions in grasslands appear in only 11% of NDCs, and for montane habitats, in only 4%<sup>2</sup>. Moreover, some of these important naturally-treeless habitats are threatened by afforestation, which is particularly troubling given that the original habitat can often provide greater and more resilient carbon storage benefits<sup>25</sup>.

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In other words, forests must not be prioritised at the cost of continuing to destroy or replace other vitally important ecosystems. To achieve this balance there is a need to be more inclusive when discussing the importance of nature-based solutions to climate change and when encouraging policy makers to take them into account.

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### **Diversity is key for human adaptation**

In the drive to harness natural ecosystems to slow warming, it is also important not to lose sight of their essential role in supporting human adaptation to climate change. Prioritizing a variety of ecosystems and promoting their functional resilience will also secure a suite of  
175 ecosystem services vital for adaptation<sup>26</sup>, in addition to ensuring reliable mitigation services. Natural habitats in watersheds can secure and regulate water supplies and protect communities from flooding and soil erosion; mangroves, reefs and salt marshes offer protection from storm surges and coastal erosion; and agroforestry (planting trees among crops or crops within forest) can maintain and enhance yields in drier, more variable  
180 climates<sup>27</sup>. Moreover, there are many economic benefits of these nature-based adaptation solutions through avoided losses to climate change related disasters. For example, coastal wetlands in northeast USA are estimated to provide USD 23.2 billion per year in storm protection services<sup>28</sup>, while annual damages from flooding would double and costs from frequent storms would triple in the absence of reefs globally<sup>29</sup>. In other words, restoring and  
185 protecting nature really isn't just about storing carbon and slowing warming, it's also about cost-effective protection of ecosystems to help shield us from floods, droughts, landslides, storms, heatwaves, fire and other disasters increasingly common under climate change.

Ultimately, it is about working with nature in such a way that ecosystems continue supporting human development and well-being in the face of change (Box 1).

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### **Biodiversity and climate change integration**

All this highlights the need for much stronger links between ecosystem scientists, social scientists studying human adaptation and resilience, and those designing and implementing climate change policy. While the understanding of the role that biodiversity at all levels, including a diversity of habitats, can play in mitigating and adapting to climate change is growing rapidly, policy development and implementation for climate change and biodiversity remain largely separate. The result is a lack of robust targets for nature in climate pledges, beyond areas of forest to be planted or restored. As climate pledges get revised, it is important that this knowledge is informing the process and helps raise ambition for nature. Examples of what can be achieved by this integrated approach are already emerging<sup>2</sup>.

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### **Biodiversity at the heart of climate solutions**

Nature-based solutions were in the limelight this autumn at the Global Climate Action Summit instigated by California governor Jerry Brown, as well as both United Nations (UN) Rio Convention Conferences. On the back of the Global Climate Action Summit, nature-based solutions were identified as one of six key themes for the UN Climate Summit in September 2019. Meanwhile, the UN Convention for Biological Diversity (CBD) at its 14th Conference of the Parties formally decided to integrate climate change issues into national biodiversity strategies and vice versa<sup>30</sup>. This rapidly growing recognition of nature's importance in a warming world is to be celebrated. However, as agendas for nature get translated into actions, the importance of diverse, intact natural ecosystems must not be forgotten. In the fight against climate change, forests make excellent allies. However, unless a diversity of species-rich resilient ecosystems are restored and protected - guided by science and implemented through local stewardship - the battle cannot be won. We hope those advocating for action and funding in the wake of the UNFCCC meeting in Poland in December will bear this in mind.

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