Nature-Based Solutions and the Green Economy

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1.0 Introduction

Broadly speaking, nature-based solutions refer to "actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits."[1]

There is significant and growing interest in the role nature-based solutions can play in a net-zero and climate-resilient society. This trend is illustrated by the development of an IUCN Global Standard on nature-based solutions[2] and the development of guidelines by the Nature-Based Solutions Initiative.[3] The rising interest in nature-based solutions is also matched by concomitant interest in a 'green economy,' an economy that improves human wellbeing and builds a more equal society whilst reducing environmental risks and scarcities.

This briefing explores the ways in which nature-based solutions may contribute to a green economy, and also identifies some of the challenges and contestations when it comes to enacting a green economy through nature-based approaches. The briefing is based on a series of web-based workshops convened by the British Academy over summer and autumn 2021, which brought together researchers, policy stakeholders and third sector organisations to discuss the place of nature-based solutions in a future society across different geographical regions of the world. Where possible, the briefing builds on – and draws in examples from – contributions made in the workshops.

1 IUCN. (2016). *WCC-2016-Res-069-EN Defining Nature-based Solutions.* https://portals.iucn.org/library/sites/library/files/resrecfiles/WCC_2016_RES_069_EN.pdf

2 IUCN. (2020). *Guidance for using the IUCN Global Standard for Nature-based Solutions.* https://doi.org/10.2305/IUCN.CH.2020.08.en

3 Nature-based Solutions Initiative. (2021). *The four guidelines for Nature-based Solutions.* https://nbsguidelines.info/

2.0 What is the green economy, and how does it relate to nature-based solutions?

A green economy, as above, is an economy that improves human wellbeing and builds social equity whilst reducing environmental degradation. The role of a green economy within sustainable development agendas is reflected in UN Sustainable Development Goal 8, which aims to "promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all," and SDG12, which has the goal to "ensure sustainable consumption and production patterns."

In a green economy, growth in employment and income are driven by public and private investment in economic infrastructure and assets, which reduce emissions and pollution as well as protecting and enhancing biodiversity.[4] The European Green Deal, for example, is a plan to transform the European Union into a competitive and resource-efficient economy in response to threats from climate change and environmental degradation. It aims to break the link between economic growth and resource use and reduce emissions from industry, in a way that is fair and just for all of society. The Asian Development Bank similarly notes that a green-led growth goes far beyond renewable energy infrastructure, to encompass a whole range of initiatives such as sustainable transportation, ecosystem restoration and community-based tourism.[5]

Green economy thinking also encompasses more progressive approaches such as the Doughnut economics ideas developed by Kate Raworth, which argues for a safe and just space in between social and planetary boundaries. New approaches to the economy can be seen in the interest of countries such as New Zealand and Scotland in economic models that prioritise societal wellbeing and a more harmonious relationship between society and nature. There is also a growing movement around degrowth, which believes that traditional assumptions of continuous economic growth are incompatible with a just and sustainable society and that managed reduction of energy and resource use is required to re-balance the economy with the living world.

Common across these diverse approaches is the importance of societal responses to climate change that take into account planetary boundaries (including the need to limit and adapt to the impacts of harmful global warming) and reduce inequalities. Legally-binding global agreements on climate change (and indeed biodiversity) will be vital in setting the obligations within which governments must implement a green economy.

In light of the above, nature-based solutions matter for global action on climate change, and for a green economy more widely, in the following ways:

- Nature-based solutions may help to mitigate the extent of climate change, and hence the levels of economic disruption and societal harm, by preventing carbon dioxide emissions or sequestering carbon to keep it out of the atmosphere;[6]

4 UN Environment Programme. (2021). *Green Economy.* https://www.unep.org/regions/asia-and-pacific/regional-initiatives/supporting-resource-efficiency/green-economy

5 Asian Development Bank. (2021, June 3). *A green economic reset will deliver an inclusive, lasting recovery for Asia and the Pacific | Asian Development Bank.* https://www.adb.org/news/features/green-economic-reset-will-deliver-inclusive-lasting-recovery-asia-and-pacific

6 NatureScot. (2020a). *Peatland ACTION Project.* https://www.nature.scot/climate-change/nature-based-solutions/peatland-action-project

- Nature-based solutions can help us to adapt to the effects of climate change by reducing harm and damage from extreme events such as flooding, sea level rise and extreme heat events. This use of natural and semi-natural features to reduce the impacts of natural and climate-induced hazards is known as ecosystem-based adaptation and ecosystem-based disaster risk reduction;[7]

- Nature-based solutions can also provide a wider range of benefits in support of a society that is resilient and better placed to cope with climate-related shocks and stresses,[8] thus meeting the equality and wellbeing aspects of green economy thinking. These benefits may include biodiversity conservation as a basis for healthy ecosystems; food security; and physical/mental health and social connectivity.[9]

It is also important to remember that COP26 and subsequent climate change actions come against an ongoing backdrop of rhetoric around 'building back better' from the COVID-19 pandemic. Recovery from shocks and stresses can be a moment for 'building back greener'. One aspect of 'building back greener' is to consider more fully how natural and semi-natural spaces can be embedded within planning and policy at local and national levels, to build resilient communities and support a just transition to a net-zero society.[10] The dual impetus of post-COVID recovery and the implementation of climate goals post-COP26 hence presents a major challenge, but also an intervention point where nature-based solutions can be more fully embedded within areas such as land use planning, environmental management and social policy in support of a green economy.

3.0 Nature-based solutions, green jobs and finance

Much of the attention around green jobs to date has been focused on jobs associated with reducing emissions, for example constructing wind turbines and installing energy-efficient systems such as heat pumps. However, van der Ree argues that our understanding of green jobs should also include work to protect and restore ecosystems, and to adapt to the effects of climate change.[11] van der Ree adds that under a changing climate, some new job types will be created, some jobs will be eliminated, and some jobs will be substituted for others. In any case, most jobs will be transformed, with workers, operators and managers in sectors including buildings and agriculture learning to manage new technology and operating practices. As such, whilst there is a long history of people working in and with nature, new skills

7 Sudmeier-Rieux, K., Arce-Mojica, T., Boehmer, H. J., Doswald, N., Emerton, L., Friess, D. A., Galvin, S., Hagenlocher, M., James, H., Laban, P., Lacambra, C., Lange, W., McAdoo, B. G., Moos, C., Mysiak, J., Narvaez, L., Nehren, U., Peduzzi, P., Renaud, F. G., ... Walz, Y. (2021). 'Scientific evidence for ecosystem-based disaster risk reduction'. *Nature Sustainability 2021*, 1–8. https://doi.org/10.1038/s41893-021-00732-4

8 Keeler, B. L., Bratman, G. N., MacDonald, G. K., Hamel, P., Hamann, M. H., Neverisky, N., Donahue, M. L., Guerry, A. D., Brauman, K. A., Arkema, K. K., Wood, S. A., McDonald, R. I., McPhearson, T., Johnson, J. A., Hobbie, S. E., Meza Prado, K. A., & Finlay, J. C. (2019). 'Social-ecological and technological factors moderate the value of urban nature'. *Nature Sustainability, 2*(1), 29–38. https://doi.org/10.1038/s41893-018-0202-1

9 Mell, I., & Whitten, M. (2021). 'Access to nature in a post covid-19 world: Opportunities for green infrastructure financing, distribution and equitability in urban planning'. *International Journal of Environmental Research and Public Health* (Vol. 18, Issue 4, pp. 1–16). MDPI AG. https://doi.org/10.3390/ijerph18041527

10 Douglas, I., Champion, M., Clancy, J., Haley, D., Lopes de Souza, M., Morrison, K., Scott, A., Scott, R., Stark, M., Tippett, J., Tryjanowski, P., & Webb, T. (2020). 'The COVID-19 pandemic: local to global implications as perceived by urban ecologists'. *Socio-Ecological Practice Research, 2*(3), 217–228. https://doi.org/10.1007/s42532-020-00067-y; Hinzpeter, K., & Sandholz, S. (2018). 'Squaring the circle? Integrating environment, infrastructure and risk reduction in Post Disaster Needs Assessments'. *International Journal of Disaster Risk Reduction,* 32, 113–124. https://doi.org/10.1016/j.ijdrr.2018.05.016

11 van der Ree, K. (2019). 'Promoting Green Jobs: Decent Work in the Transition to Low-carbon, Green Economies'. In C. Gironde & G. Carbonnier (Eds.), *The ILO @ 100: Addressing and Past and Future of Work and Social Protection* (pp. 248–272). Brill | Nijhoff. https://doi.org/10.1163/9789004399013_013

and types of work may be required to realise nature-based solutions that provide a breadth of benefits in support of a green economy.

Although empirical studies into the specific skills requirements and job creation potential of nature-based solutions are still developing, NatureScot - the public body responsible for Scotland's natural heritage – in 2020 undertook an initial investigation into nature-based jobs and skills.[12] This was followed up with the launch of a Nature-Based Jobs and Skills Action Plan.[13] Taking NatureScot's work as a starting point, we can consider that green job areas associated with implementing nature-based solutions may include:

- **Flood risk management**. Nature-based approaches to managing flood risk are attracting interest globally, as a replacement for or supplement to engineered and managed flood control. Putting this into practice, however, may require land management and stewardship skills at the site level to ensure water retention capabilities are maintained, as well as planning and coordination capabilities at the catchment or landscape level to integrate individual projects;

- **Planning for green infrastructure**. Green infrastructure here refers to a network of green and blue spaces which benefit people in multiple ways such as reducing flood risks, preventing heat islands, or supporting people's wellbeing. As green infrastructure requires authorities to think how green spaces can be connected to each other over a whole city area, implementing green infrastructure will require jobs and skills that span ecology and planning, and also jobs related to planting and maintaining natural spaces;

- **Ecological engineering**. Implementing nature-based elements into civil engineering and construction projects may be beneficial in the long run by, for example, enhancing resilience to flooding or reducing energy demand and emissions associated with cooling. Realising this, however, may require more labour-intensive inspection and maintenance regimes, bringing ecological expertise into the civil engineering and construction sectors, and upskilling or retraining construction workers to retrofit buildings or integrate natural elements into construction projects. Ecological engineering and construction may also create new demand for companies who can produce and supply construction materials for implementing nature-based solutions;

- **Peatland, woodland and coastal habitat restoration**. Peatlands, woodlands and coastal habitats such as seagrass meadows represent major carbon sinks, and as such jobs related to protecting and enhancing these landscape features may mitigate the extent of climate change.[14] These jobs may be 'on the ground' work to operate machinery and plant trees, or may involve project management and coordination;

- **Management of invasive non-native species**. Especially under a warming and changing climate, work to control invasive non-native species may be important to ensure ecosystems are healthy and able to function in a way that delivers mitigation and adaptation benefits in support of a green economy;

12 NatureScot. (2020b). *Research Report 1257 - Supporting a green recovery: an initial assessment of nature-based jobs and skills.* https://www.nature.scot/doc/naturescot-research-report-1257-supporting-green-recovery-initial-assessment-nature-based-jobs-and

13 NatureScot. (2021). *Nature-based jobs and skills Action Plan 2021-2022.* https://www.nature.scot/doc/nature-based-jobs-and-skills-action-plan-2021-2022

14 NatureScot. (2020a). *Peatland ACTION Project.* https://www.nature.scot/climate-change/nature-based-solutions/peatland-action-project

- **Low-carbon and regenerative agriculture and forestry**. Climate-positive farming practices, for instance agro-forestry and combining peatland and farming, may support diversification of otherwise economically marginal farming activities. Creation of new woodland may create labour demand for increased tree-planting. In both cases, additional skills and jobs may be required in monitoring and data collection to evidence climate mitigation benefits, and farmers may need to upskill or retrain to be able to take advantage of opportunities;

- **Environmental green finance and natural capital accounting**. Evidencing the contributions of nature-based solutions to the green economy in terms of carbon sequestration and enhanced resilience to a changing climate will require specialist skills in natural capital accounting. This may become especially important if monitoring and reporting is required under international agreements, or to access finance that is tied to climate action. At a project level, up-scaling and expanding nature-based solutions will require additional support in fundraising and managing finances.

(source: adapted and expanded from NatureScot, 2020b; and The Nature of Cities, 2021).

The kinds of jobs outlined above reflect the finding of the Green Alliance's work in a UK context into *Levelling Up Through Nature* that nature-based jobs may fall into two broad categories: degree-level managerial and planning positions; and entry-level vocational and technical positions.[15] However, if we consider that a key principle of a green economy is to create fair and decent work for all and to promote equity and justice, then it is especially important to consider how nature-based solutions may provide opportunities for the less qualified or less empowered workers who are likely to take on vocational and technical positions. Workers in this category may not have the financial resources to re-train, may not be able to adapt their skills as quickly as those with degree-level qualifications, and may be less able to re-locate or undertake remote working than those in managerial and administrative positions.

Again, the Scotland case illustrates some of the challenges in translating rhetoric around nature-based solutions and the green economy into tangible green jobs for those who need them most. The Climate Emergency Skills Action Plan produced by Skills Development Scotland notes that young people in particular may have negative or out-dated perceptions of land-based jobs in sectors such as agriculture and forestry, and may find it difficult to access information on qualifications or careers associated with nature-based jobs.[16] It may be especially challenging for young people living in urban areas to access entry-level nature-based jobs, which are more likely to be in rural areas and may not be conducive to remote or online working.[17] Brocklehurst et al. also note that many workers in sectors such as construction are self-employed, and hence may be unwilling or unable to take time off work to undertake re-training or up-skilling for sustainable or climate-friendly practices.[18]

An additional overarching challenge for realising nature-based jobs is the financing of initiatives. These are discussed in more detail in Sections 4 and 5. Financing may come from national or sub-national government investments, such as the Scottish Government's investment of £250 million in peatland restoration in Scotland and the

15 Green Alliance. (2021). *Jobs for a green recovery: Levelling up through nature.* www.green-alliance.org.uk/

16 Skills Development Scotland. (2020). *Climate Emergency Skills Action Plan 2020-2025.*

17 NatureScot. (2020b). *Research Report 1257 - Supporting a green recovery: an initial assessment of nature-based jobs and skills.* https://www.nature.scot/doc/naturescot-research-report-1257-supporting-green-recovery-initial-assessment-nature-based-jobs-and

18 Brocklehurst, F., Morgan, E., Greer, K., Wade, J., & Killip, G. (2021). 'Domestic retrofit supply chain initiatives and business innovations: an international review'. *Buildings and Cities, 2*(1), 533. https://doi.org/10.5334/BC.95

estimated $12 billion invested by the Chinese government in their 'sponge city' flood risk reduction programme. However, securing long-term funding beyond piecemeal projects or bringing in private sector support can be difficult, especially in lower-income country contexts where projects may be supported by Official Development Assistance or charitable organisations. The Overseas Development Institute makes the case for a triple dividend from investment in nature-based solutions and other resilience initiatives, arguing investment can (a) avoid losses when disasters strike; (b) stimulate economic activity due to reduced disaster risk; and (c) incorporate other economic activities within projects initiated for disaster risk purposes.[19] The Nature Conservancy is similarly involved in a number of projects financed around 'blue carbon,' which makes the case for multiple benefits arising from investment. Habitats such as salt marshes, sea grass meadows and mangroves can mitigate global climate change by capturing and storing carbon, whilst also providing local climate risk reduction and human well-being benefits.[20]

4.0 Nature-based solutions and the green economy: focus on the Global South

Nature-based solutions arguably have an even more pronounced role in supporting a green economy in the Global South. This is especially so in lower-latitude coastal nations, which are being hit hardest and first by climate change impacts such as increased frequency and intensity of extreme events, rising sea levels, coastal erosion, and intrusion of saltwater from the sea into previously freshwater environments. In such locations, rural communities – especially on the coast - may be more reliant on healthy ecosystems to support their livelihoods through activities such as farming, fisheries and forestry, and may have more limited financial capacity to adapt to environmental changes. The protection and enhancement of coastal ecosystems such as mangroves can therefore help to sustain livelihoods for coastal communities, by reducing the damage caused by extreme events and coastal erosion as well as maintaining the overall health of the local ecosystem.[21]

Nature-based approaches may also be important in contributing to a green economy for cities in the Global South, which are facing rapid rates of urbanisation and may struggle to protect ecosystems due to significant pressures from ongoing climate changes, politically-led economic development imperatives and a lack of mechanisms to enforce plans, policies and regulations.[22] Low levels of employment and high poverty rates mean natural- and semi-natural environments play an important role for water, food and fuel in cities in the Global South. Approaches to climate change adaptation grounded in nature-based solutions have hence been advocated as a pathway to reducing harm and damage from climate impacts in Global South cities, as such approaches can bring many other benefits in support of a green economy such as employment, poverty alleviation and health and wellbeing.[23]

19 ODI. (2015). *The Triple Dividend of Resilience.* www.worldbank.org

20 Herr, D., & Landis, E. (2016). *Coastal blue carbon ecosystems Opportunities for Nationally Determined Contributions. Policy brief.* www.bluecsolutions.org

21 Mazor, T., Friess, D. A., Todd, P. A., Huang, D., Nguyen, N. T. H., Saunders, M. I., Runting, R. K., Lowe, R. J., Cartwright, P., Gilmour, J. P., & Lovelock, C. E. (2021). 'Large conservation opportunities exist in >90% of tropic-subtropic coastal habitats adjacent to cities'. *One Earth, 4*(7), 1004–1015. https://doi.org/10.1016/J.ONEEAR.2021.06.010

22 Lindley, S., Pauleit, S., Yeshitela, K., Cilliers, S., & Shackleton, C. (2018). 'Rethinking urban green infrastructure and ecosystem services from the perspective of sub-Saharan African cities'. *Landscape and Urban Planning, 180, 328–338.* https://doi.org/10.1016/J.LANDURBPLAN.2018.08.016

23 Roberts, D., Boon, R., Diederichs, N., Douwes, E., Govender, N., Mcinnes, A., Mclean, C., O'Donoghue, S., & Spires, M. (2011). 'Exploring ecosystem-based adaptation in Durban, South Africa: "learning-by-doing" at the local government coal face', *Environment & Urbanization, 24*(1), 167–195. https://doi.org/10.1177/0956247811431412

Compared to the Global North, there is arguably a longer history in the Global South of nature-based jobs with an explicit link to climate change. Some of these initiatives have been driven by national or regional governments in response to an imperative to maintain the sustainability of residents' livelihoods, in cases where climate change impacts make traditional economic activities increasingly difficult. For instance, previous British Academy-funded research in Xuan Thuy National Park, Nam Dinh Province, Vietnam, has explored how local residents have been engaged in retraining and skills development for activities such as mushroom cultivation, honey production and mangrove restoration in response to declining farming and fishing returns. In this way, managing the coastal mangrove ecosystem as a nature-based solution provides both climate risk reduction and sustainable livelihood opportunities.[24] The UK's Joint Nature Conservation Committee has similarly been undertaking skills audits in the UK's overseas territories in the Caribbean, asking communities how they think their skills can support implementation and maintenance of nature-based solutions and what training is required on the islands.[25]

Other initiatives have focused on what are known as Payments for Ecosystem Services, whereby landowners or residents receive payments in order to maintain the ecological benefits that their land provides to wider society. At a country level, the Seychelles has initiated the first 'debt for nature' programme covering ocean spaces. The country was able to leverage debt restructuring in return for improved management of its marine environment and the ecosystem services it provides. This 'debt-for-nature' swap was supported by a 'blue bond' whose proceeds are ring-fenced to support marine-based activities such as sustainable fisheries and tourism.[26] At a community level, the Mikoko Pamoja project in southern Kenya is a community-led mangrove conservation and restoration project.[27] Mikoko Pamoja involves the prevention of deforestation of the local mangrove forest, as well as re-forestation of mangroves led by communities. As mangroves provide broader societal benefits in the form of coastal protection, biodiversity conservation and carbon dioxide sequestration, the community is able to attain 'payments' for maintaining these services in the form of donations and offsets brokered through a UK-based charity called The Association for Ecosystem Services. The payments, which are directly controlled by the community, can in turn be invested in development projects such as constructing schools and buying books, and providing clean drinking water.

However, it is vital to remember that the 'Global South' is not a homogenous entity. Cultures, socio-economic profiles, governance systems and indeed ecology and climate vary significantly between and within countries. For nature-based solutions to make a contribution to the green economy through jobs, skills development and resilience of environments to shocks and stresses, it is critical that initiatives and interventions are appropriate to the local context. As du Toit et al. note, however, empirical case studies for Global South contexts are still comparatively limited in the international scholarly literature.[28] This may be especially so for smaller cities, which are very much under-represented in the nature-based solutions literature despite

24 Mabon, L., Nguyen, S. T., Nguyen, T. K. D., Pham, T. T., Cao, T. T. N., Le, T. Q., Dang, T. T., Nguyen, T. H. T., Nguyen, T. B. N., Le, H. N., Tran, T. T., Bui, T. C. T., Tran, N. A., Mueller-Hirth, N., & Yuill, C. (2018). 'Bringing social and cultural considerations into environmental management for vulnerable coastal communities: Responses to environmental change in Xuan Thuy National Park, Nam Dinh Province, Vietnam'. *Ocean and Coastal Management, 158,* 32–44. https://doi.org/10.1016/j.ocecoaman.2018.03.022

25 JNCC. (2021). *Natural capital in the Overseas Territories.* https://jncc.gov.uk/our-work/natural-capital-in-the-overseas-territories/

26 Silver, J. J., & Campbell, L. M. (2018). Conservation, development and the blue frontier: the Republic of Seychelles' Debt Restructuring for Marine Conservation and Climate Adaptation Program'. *International Social Science Journal, 68*(229–230), 241–256. https://doi.org/10.1111/ISSJ.12156

27 (https://www.planvivo.org/mikoko-pamoja)

28 du Toit, M. J., Cilliers, S. S., Dallimer, M., Goddard, M., Guenat, S., & Cornelius, S. F. (2018). 'Urban green infrastructure and ecosystem services in sub-Saharan Africa'. *Landscape and Urban Planning, 180*(June), 249–261. https://doi.org/10.1016/j.landurbplan.2018.06.001

being the locations in which majority of people will experience climate change.[29] Further case-study based research will thus help to create a deeper understanding of how nature-based solutions may be deployed to support the green economy across different global contexts.

5.0 Criticisms and limitations of NbS in the green economy

Despite the significant enthusiasm towards the potential of nature-based solutions to support a green economy, a number of limitations and criticisms have been identified.

Firstly, for climate change mitigation especially, concerns have been raised over whose emissions are being stored, and whether some locations have to shoulder a disproportionate burden to offset the emissions of others. This is especially significant given the interest in Payments for Ecosystem Services and green or blue bonds outlined earlier. The issue was illustrated at a global scale through the controversy around a high-profile paper published in *Science* in 2019, which claimed that large-scale afforestation could mitigate the impacts of climate change and reduce the extent of global warming.[30] One of the key contentions against the paper was the assumption that Global South countries, particularly sub-Saharan Africa, would be expected to accept afforestation in order to offset the emissions of the Global North or that tree-planting could displace existing livelihood activities.[31] Greenpeace Southeast Asia Director Yeb Saño has argued that the Global South is not a blank space for afforestation, and that offsetting programmes exacerbate issues of land rights, food security and biodiversity in places with the least responsibility for causing climate change.[32] Such concerns are also relevant at the national and regional scale. Attempts to impose top-down land management practices in order to make use of rural lands as carbon sinks may be met with opposition or resistance if they do not respect landscapes and practices that are economically and culturally significant at a community level. These contestations can be seen, for example, in current debates over reforestation and rewilding in north and north-west Scotland, where private landowners are seeking to afforest or 'rewild' land with limited consultation with or consideration for adjacent communities.[33]

A second set of criticisms centres on whose vision of the green economy nature-based solutions serve, and whether nature-based solutions may simply repeat or widen existing socio-economic inequalities. Whilst it is true that effective implementation of nature-based solutions requires a high level of ecological knowledge and spatial planning expertise, it is important that this does not lead to technocratic governance and deployment, and that communities' experiences and knowledges are recognised within decision-making processes. Nature-based interventions aimed at supporting resilient local economies may be seen as unwanted or patronising, especially if they

29 Castán Broto, V. (2019). 'Climate change politics and the urban contexts of messy governmentalities'. *Territory, Politics, Governance,* 1–18. https://doi.org/10.1080/21622671.2019.1632220

30 Bastin, J.-F., Finegold, Y., Garcia, C., Mollicone, D., Rezende, M., Routh, D., Zohner, C. M., & Crowther, T. W. (2019). 'The global tree restoration potential'. *Science, 365*(6448), 76–79. https://doi.org/10.1126/SCIENCE.AAX0848

31 Luedeling, E., Börner, J., Amelung, W., Schiffers, K., Shepherd, K., & Rosenstock, T. (2019). 'Forest restoration: Overlooked constraints'. In *Science* (Vol. 366, Issue 6463, p. 315). American Association for the Advancement of Science. https://doi.org/10.1126/science.aay7988

32 Saño, Y. (2021, September 23). *Why I refuse to collude with polluters in the carbon offsetting lie.* Climate Home News. https://www.climatechangenews.com/2021/09/23/i-refuse-collude-polluters-carbon-offsetting-lie/

33 MacDonald, F. (2021, September 23). 'Wild Beasts'. *London Review of Books.* https://www.lrb.co.uk/the-paper/v43/n18/fraser-macdonald/diary

are forced on traditionally disempowered communities from on high. Woroniecki et al. argue that ecosystem-based approaches to climate resilience need to be deployed in a way that actually empowers and gives agency to the most vulnerable and marginalised people.[34]

Especially in the Global South. it has been argued that Payments for Ecosystem Services models, if not managed carefully, could simply re-produce existing inequalities by perpetuating a market-based system where those with more wealth can disproportionately pay to access natural resources..[35] Porter et al. , writing in the context of Australia, also illustrate the importance of attention to colonial legacies and the politics of 'greening' unceded indigenous people's lands.[36] It can similarly be argued that actions that would now be regarded as nature-based solutions were widespread in the past across the Global South, but were curtailed under colonial ideals of modernisation and technological development.

A third set of cautions relates to the extent to which nature-based solutions do in reality produce economically favourable outcomes. Keeler et al. warn that nature-based solutions may not always perform as well in direct comparison with engineered or managed alternatives.[37] China's 'sponge city' approach to nature-based urban flood management has won praise internationally.[38] Yet the severe flooding experienced in several Chinese cities in summer 2021 arguably illustrates the limitations of nature-based approaches in coping with unprecedented extreme events – and shows that adding natural- or semi-natural features to the built environment does not replace or offset natural landscapes lost to urbanisation.[39] On the other hand, the Staten Island Bluebelt in New York, USA has been demonstrated to be a cost-effective form of natural flood management. A series of over 50 created and enhanced wetlands were justified through cost-benefit analysis comparing development costs with conventional 'hard engineering' stormwater storage solutions. It is argued the Bluebelt has saved New York City more than US$80 million in comparison with a conventional stormwater drainage systems, as demonstrated by its role during Hurricane Sandy in 2012.[40] These examples illustrate the need for comprehensive and locally-appropriate methodologies that allow the effectiveness of nature-based solutions to be tracked and ideally measured.

There is also potential, especially in urban areas where people may live in proximity to interventions, for nature-based solutions to produce other social costs. These may include safety concerns due to darker parks and streets, allergies from enhanced vegetation, or trapping of pollutants under tree canopies. Moreover, introducing climate-friendly farming practices into existing agricultural lands may reduce climate change impacts for society overall, but could reduce productivity for farmers.[41] This may happen with, for instance, moving from intensive farming to agroforestry, or giving over lands to storage of runoff. It may also be the case

34 Woroniecki, S., Wamsler, C., & Boyd, E. (2019). 'The promises and pitfalls of ecosystem-based adaptation to climate change as a vehicle for social empowerment'. *Ecology and Society, 24*(2). https://www.jstor.org/stable/2679695

35 Kosoy, N., & Corbera, E. (2010). 'Payments for ecosystem services as commodity fetishism'. *Ecological Economics, 69*(6), 1228–1236. https://doi.org/10.1016/J.ECOLECON.2009.11.002

36 Porter, L., Hurst, J., & Grandinetti, T. (2020). 'The politics of greening unceded lands in the settler city'. *Https://Doi.Org/10.1080/00049182.2020.1740388, 51*(2), 221–238.

37 Keeler, B. L., Bratman, G. N., MacDonald, G. K., Hamel, P., Hamann, M. H., Neverisky, N., Donahue, M. L., Guerry, A. D., Brauman, K. A., Arkema, K. K., Wood, S. A., McDonald, R. I., McPhearson, T., Johnson, J. A., Hobbie, S. E., Meza Prado, K. A., & Finlay, J. C. (2019). 'Social-ecological and technological factors moderate the value of urban nature'. *Nature Sustainability, 2*(1), 29–38. https://doi.org/10.1038/s41893-018-0202-1

38 World Economic Forum. (2019, August 28). *This man is turning cities into giant sponges to save lives | World Economic Forum*. https://www.weforum.org/agenda/2019/08/sponge-cities-china-flood-protection-nature-wwf/

39 Bloomberg. (2021, August 23). 'Chinese Cities Aren't Ready for Climate Disasters'. *Bloomberg*. https://www.bloomberg.com/news/articles/2021-08-23/chinese-cities-aren-t-ready-for-climate-disasters

40 https://www1.nyc.gov/site/dep/water/the-bluebelt-program.page

41 Hernández-Morcillo, M., Burgess, P., Mirck, J., Pantera, A., & Plieninger, T. (2018). 'Scanning agroforestry-based solutions for climate change mitigation and adaptation in Europe.' *Environmental Science & Policy, 80,* 44–52. https://doi.org/10.1016/J.ENVSCI.2017.11.013

that the kind of environment that is most effective for, say storing carbon, is not necessarily the best for biodiversity. Mangroves and seagrass meadows, for example, have attracted much interest due to their carbon sequestration potential, yet the management of mangroves to optimise carbon capture and storage may negatively affect local biodiversity or require environmental and economic trade-offs.[42]

For these reasons, Chausson et al. caution that it may be better to avoid narrow economic comparisons between nature-based solutions and engineered or managed alternatives, and instead to understand the societal value brought by nature-based solutions holistically.[43] Such holistic assessment means incorporating values such as health, wellbeing and societal interaction alongside emissions reduction or climate risk reduction benefits. Yet in practice, the difficulties associated with reconciling different functions and benefits of nature-based solutions, and managing trade-offs and social costs, should not be underestimated.

6.0 Key points and recommendations: critical questions for Glasgow and beyond

This briefing concludes by summarising the main points in relation to four critical aspects of COP26 and subsequent implementation of global climate action: mitigation, adaptation, financing, and cooperation.

A first pillar of global cooperation on climate change is mitigation, especially reaching net-zero emissions sooner than mid-century and limiting warming to 1.5. degrees Celsius. Nature-based solutions may be well-placed to balance climate mitigation and green economy imperatives. The potential for peatlands, woodlands and coastal ecosystems to act as carbon sinks can create employment globally in afforestation, restoration and conservation. In Global South settings, the carbon sequestration potential of nature-based solutions can – if managed sensitively – also translate into carbon credits and payments for ecosystem services that can support a breadth of social and economic issues locally. However, the use of nature-based solutions for climate mitigation is not without problems. Tensions may exist between the locations that are expected to take up the bulk of sequestration, versus the locations that are the biggest emitters. Rural landscapes are not blank canvases onto which carbon sequestration can be imposed, and may be home to a breadth of economic activities as well as carrying social and cultural significance to those who live there. There is also concern that payment- or exchange-based approaches to nature-based solutions for carbon sequestration may replicate or even intensify existing inequalities between countries and regions.

A second strand of global climate change action is the ability to adapt to harmful and disruptive climate effects that we are already locked into. There has been notable enthusiasm towards nature-based solutions as a climate change adaptation strategy, especially for flood risk reduction and for reducing urban heat island effects. From a green economy perspective, a key attraction is that nature-based solutions are often portrayed as a 'no regrets' or 'win-win' option, in which damage and disruption to

42 Phelps, J., Friess, D. A., & Webb, E. L. (2012). 'Win–win REDD+ approaches belie carbon–biodiversity trade-offs.' *Biological Conservation, 154,* 53–60. https://doi.org/10.1016/J.BIOCON.2011.12.031

43 Chausson, A., Turner, B., Seddon, D., Chabaneix, N., Girardin, C. A. J., Kapos, V., Key, I., Roe, D., Smith, A., Woroniecki, S., & Seddon, N. (2020). 'Mapping the effectiveness of nature-based solutions for climate change adaptation'. *Global Change Biology, 26*(11), 6134–6155. https://doi.org/10.1111/gcb.15310

homes, businesses and livelihoods can be reduced at the same time as providing a breadth of health, wellbeing and social capital benefits that create more resilient communities. However, there is still a need for more empirical evidence, especially from smaller cities and across the Global South, to assess how nature-based solutions work in relation to local ecological, societal and built environment characteristics. Nonetheless, nature-based solutions do have the potential to create green jobs in urban areas through ecological engineering, construction and retrofitting, and hence may be able to support a just transition for workers in high-emitting industries if appropriate retraining opportunities are provided.

A third aspect of global cooperation on climate concerns financing for implementation of actions. Making an economic case for nature-based solutions in terms of their potential to reduce the impacts of climate change, and thus limit potential disruptions, may be one way to secure longer-term state and private sector financing. Yet caution ought to be exercised not to over-state the benefits of nature-based solutions at early stages of deployment, as dashed expectations or disappointing results may deter future investment. Similarly, changes in land management practices such as moving to agroforestry or combining farmland with natural flood management may lead to short-term declines in productivity, hence it is vital that farmers and landowners are given adequate payment for public good and opportunities to diversify livelihoods if they are engaged in nature-based solutions. At the same time, however, rising interest in new economic models such as wellbeing economies and Doughnut economics offer an opportunity to present nature-based solutions in terms of the multiple ways in which they create societal value over and above climate benefits, including mental and physical wellbeing, societal interaction and biodiversity conservation. New skills and jobs in areas such as ecological economics and natural capital accounting have an important role in evidencing these benefits.

A fourth element of global climate action is the collaboration necessary to realise the outcomes of international climate accords. International platforms like the UN Framework Convention on Climate Change or Convention on Biological Diversity, and their annual Conference of the Parties (COP) meetings, are spaces for learning and alliance-building as well as forming global agreements. Indeed, recent years have seen a multitude of initiatives to enable peer-to-peer learning and sharing of best practice on nature-based solutions at national, regional and local government levels. Yet social science scholarship has shown us that some cities and regions can be very effective in promoting themselves (or come to be promoted by international organisations working at the interface of science, policy and practice) as ‘exemplar’ cases of best practices in urban sustainability. Whilst there is a tendency to celebrate success in the use of nature-based solutions in support of a green economy, it should also not be forgotten that much can be learned by sharing and learning from policy and practice failures. It is hence vital that any so-called success stories are viewed in context and not adopted uncritically, and to acknowledge that ‘what works’ in one place may not necessarily work somewhere else.

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