



European
Commission

THE VITAL ROLE OF **NATURE-BASED SOLUTIONS** IN A NATURE POSITIVE ECONOMY

Independent
Expert
Report



Research and
Innovation

The vital role of Nature-Based Solutions in a Nature Positive Economy

European Commission
Directorate-General for Research and Innovation
Directorate B — Healthy Planet
Unit B.3 — Climate and Planetary Boundaries

Contact Julie DELCROIX
Email Julie.DELCROIX@ec.europa.eu
RTD-ENV-NATURE-BASED-SOLUTIONS@ec.europa.eu
RTD-PUBLICATIONS@ec.europa.eu

European Commission
B-1049 Brussels

Manuscript completed in April 2022.

First edition.

This document has been prepared for the European Commission, however it reflects the views only of the authors, and the European Commission is not liable for any consequence stemming from the reuse of this publication.

More information on the European Union is available on the internet (<http://europa.eu>).

PDF ISBN 978-92-76-40679-2 doi:10.2777/307761 KI-08-21-223-EN-N

Luxembourg: Publications Office of the European Union, 2021

© European Union, 2022



The reuse policy of European Commission documents is implemented based on Commission Decision 2011/833/EU of 12 December 2011 on the reuse of Commission documents (OJ L 330, 14.12.2011, p. 39). Except otherwise noted, the reuse of this document is authorised under a Creative Commons Attribution 4.0 International (CC-BY 4.0) licence (<https://creativecommons.org/licenses/by/4.0/>). This means that reuse is allowed provided appropriate credit is given and any changes are indicated. For any use or reproduction of elements that are not owned by the European Union, permission may need to be sought directly from the respective rightholders.

Image credits:

cover: © MicroOne # 305386384, 2019. Source: stock.adobe.com

EUROPEAN COMMISSION

THE VITAL ROLE OF
NATURE-BASED SOLUTIONS
IN A NATURE POSITIVE ECONOMY

Siobhan MCQUAID and Esmee KOOIJMAN, [Centre for Social Innovation, Trinity College Dublin](#)

Daniela RIZZI, [ICLEI – Local Governments for Sustainability](#)

Thomas ANDERSSON, [International Organisation for Knowledge Economy and Enterprise Development \(IKED\)](#)

Joanne SCHANTÉ, [LGI Sustainable Innovation](#)

Table of Contents

CHAPTER 1 INTRODUCTION	18
1.1 Context and objectives.....	18
1.2 Key concepts	19
1.3 Methodology.....	21
1.4 Structure.....	23
CHAPTER 2 NBS MARKET.....	25
2.1 Market Trends.....	25
2.1.1 Demand for NBS	25
2.1.2 Investment in NBS	26
2.1.3 Supply of NBS	30
2.1.4 Key actors in NBS value chains	34
2.2 Specific market sectors.....	36
2.2.1 Ecosystem creation, restoration and management: Marine ecosystem restoration	40
2.2.2 NBS for green buildings	42
2.2.3 NBS for public and urban spaces	45
2.2.4 NBS for water management and treatment	47
2.2.5 Sustainable forestry and biomaterials	50
2.2.6 Sustainable agriculture & food production	52
2.2.7 Sustainable Tourism	56
2.2.8 NBS for Health & Wellbeing	60
2.2.9 Community Engagement for NBS	63
2.2.10 Smart technology, monitoring and assessment of NBS	64
2.3 Recommendations to address sector specific challenges and enablers.....	67
CHAPTER 3 TECHNOLOGY & NATURE-BASED SOLUTIONS	70
3.1 Introduction.....	70
3.2 Case studies	71
3.3 Outstanding system issues.....	74
3.4 Conclusions and recommendations	76
CHAPTER 4 INTERNATIONAL PERSPECTIVES ON HOW NBS CAN CONTRIBUTE TO A NATURE POSITIVE ECONOMY	80
4.1 Natural Environment	80
4.2 Economic Context	84
4.3 Cultural Context	91
CHAPTER 5 KEY ISSUES AND RECOMMENDATIONS	93
5.1 Standards.....	93
5.2 Measurement and Valuation	96
5.3 Public Policy.....	101
5.3.1 Multi-level, cross-sectoral policy development	101
5.3.2 Investment / financing frameworks and instruments	105
5.3.3 NBS in economic development policy	112
5.3.4 Potential in developing economies	114
5.4 Awareness and Capacity Building	115
5.4.1 Awareness	115
5.4.2 Capacity building	117
5.5 Economic opportunities and challenges	123
5.6 Key issues and recommendations: summary tables.....	125
REFERENCES	134

APPENDIX I: LIST OF H2020 PROJECT MEMBERS OF NATURE-BASED ECONOMY WORKING GROUP 142

FOREWORD

Our livelihoods, well-being, and our chance to meet the challenge of global warming all depend on nature. Nature provides all sorts of essential services to humanity: clean air and water, food, and pollination, it sustains tourism and leisure activities, it contributes to mental and physical health and delivers many other functions.

Nature, in many instances, is also the most effective insurance policy – protecting us from floods, landslides, fires or extreme heat. The tragic natural disasters that have hit Europe and the world in the summer of 2021 have all been a stark reminder of how much we need this protection. Natural capital stocks per capita have declined by nearly 40% between 1992 and 2014 and one million plant and animal species now face extinction. All this while roughly half of the world's GDP is moderately or highly dependent on nature and societies and economies depend on healthy ecosystems.

This is a serious threat to our present and future welfare and calls for development away from a fossil-fuel based economy towards a regenerative economy based on biological resources that is more respectful of nature. At the centre of this paradigm shift are Nature-Based Solutions (NBS). They are increasingly recognised internationally as a fundamental part of action for climate and biodiversity.

A growing number of businesses are making the case for NBS already, but it is time to move from a niche to a broader movement. Hence, while NBS are already being delivered, are visible and credible, we need a greater uptake, including through the supportive policy framework offered by the European Green Deal and its initiatives.

The recovery from the COVID-19 pandemic is another chance to bring back nature to the core of our societies. National Recovery and Resilience Plans, which aim to build a more sustainable and resilient economy across Europe are a once in a life-time opportunity for a nature-based recovery.

The potential for local job creation is tremendous, comprising both highly technical green jobs and jobs that are low-skilled, offering a chance to reach those who have been hit hardest by the pandemic.

We need to move towards:

- An Economy that puts Nature and People at its heart;
- An Economy that is aligned with Nature and Climate goals, including through incentive structures, fiscal and budgetary policies;
- An Economy with more holistic objectives and measures of progress that look beyond economic growth/GDP.

Such an Economy would create opportunities for viable, large-scale NBS across various sectors, while creating a win-win for nature, climate, and the people.

The EC have mobilised research and innovation to support policy investing more than €350 million in projects demonstrating how to deploy NBS and on large-scale ecosystem restoration. NBS also feature prominently in Horizon Europe's Work programmes, in the EU's Biodiversity Partnership, Biodiversa+, as well as in Horizon Europe Missions, notably on Adaptation to Climate Change and Ocean and Waters.

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

In a nutshell – we are not short of ideas. Science is clear on what needs to be done, but it is time to scale up and step up the implementation of NBS and deliver innovation and demonstration of NBS – across policy, business, and civil society.

Opportunities are plentiful and it is entirely in our hands to move to a greener, safer, and more equitable economy that leaves no one behind, now that the world grapples with unprecedented climate and biodiversity emergencies. The question is: will we do it in the limited time available? The recent IPCC AR6 WG II report made it very clear that we are getting dangerously close to irreversible and possibly cascading tipping points and hence time is our biggest challenge.



John Bell, "Healthy Planet" Director, DG Research & Innovation, European Commission.

Kindly reproduced and adapted from [TNOG Roundtable on the Nature-based Economy](#)

EXECUTIVE SUMMARY

1. Introduction

Business as usual is destroying and degrading ecosystems which are the basis for our societies and economies. But alternatives require a fundamental shift away from current practices, which do not adequately account for the impact of business on nature, to new approaches where the value of nature and its contribution to society and the economy are recognised and form the basis of future economic development strategies. A paradigm shift is needed towards a nature-positive¹, carbon neutral and equitable economy.

The objective of this report is to highlight the vital role of Nature-Based Solutions (NBS) in this shift towards a nature-positive economy and to raise awareness of the increasingly important role of Nature-Based Enterprises (NBE) in delivering NBS. The UNEA Resolution on Nature-Based Solutions² for supporting sustainable development defines NBS as *actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits*. The resolution further states that *nature-based solutions respect social and environmental safeguards*.

Nature-Based Enterprises (NBEs) are private or third sector organisations that place nature at the core of their business. Driven by environmental and societal goals, the success of such enterprises is of high importance to realise the potential of NBS and contribute to addressing the twin climate change and biodiversity crises we face. Urgent action is needed to support the start-up and scaling of NBEs to increase their environmental and societal impact, in parallel with a significant increase in investment in NBS.

A nature-based economic approach is complementary to concepts such as the Circular Economy³ and the Bioeconomy⁴ which propose viable pathways towards sustainable development. However, while the economic relevance of the circular economy and food and bio-based industries have been extensively debated and researched, much less work has gone into examining the potential economic benefits of Nature-Based Solutions⁵ or the challenges facing Nature-Based Enterprises in delivering such solutions.

¹ A nature positive economy is one in which businesses, governments and others, take action at scale to reduce and remove the drivers and pressures fuelling the degradation of nature, and work to actively improve the state of nature and the ecosystem services it provides. Source: [CISL](#)

² [UNEP/EA.5/L9/REV1](#)

³ [The Circular Economy Action Plan](#) was adopted by the EC in March 2020. It is a model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible.

⁴ The bioeconomy encompasses all sectors and associated services and investments that produce, use, process, distribute or consume biological resources, including ecosystem services. Bioeconomy policies take a cross-sectoral perspective to improve policy coherence and identify and resolve trade-offs, for example on land and biomass demands. Bioeconomy policies contribute to build a bioeconomy addressing all three dimensions of sustainability. (Source: [EU Bioeconomy Strategy Progress Report](#): European Bioeconomy policy: stocktaking and future developments, to be adopted May 2022)

⁵ The Commission defines nature-based solutions as "Solutions that are 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

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

This report is a first step in addressing some of these knowledge gaps. Based on extensive consultations with 170 diverse stakeholders over a 6-month period from June to November 2021, we profile some of the economic activities where nature-based enterprises are engaged in the delivery of NBS - generating new jobs, innovations, skills, and wider economic impacts, achieved through a nature-based approach respecting the needs of the environment and communities. We examine some of the key issues confronting stakeholders in the development of a nature-based approach, including 'greenwashing' and abuse of the NBS concept by vested interests. Such challenges are addressed head-on, informing guidelines and recommendations on how to realise the transition to a nature-positive economy with NBS and NBE at the core.

This report is aimed specifically at economic policy makers but is of high relevance for policy makers across multiple domains, public sector institutions and agencies, researchers, civil society and NGO representatives, investors and financial institutions, industry and NBE delivering NBS.

This publication is not intended to be read from start to finish. It is designed as a reference guide to accompany policy makers and practitioners at different stages of their NBS journey towards a nature-positive economy.

2. The NBS market

Demand and Investment

Demand for NBS is increasing globally, due largely to the mainstreaming of NBS in international policy but also due to the initiatives of citizens and other actors who recognise the multiple benefits they offer.

Investment however remains a key challenge. The UNEP State of Finance for Nature report (2021) estimates that current investment in NBS globally is approximately \$133 billion annually. However, to meet climate change, biodiversity and land degradation targets, the UNEP calls for a tripling of investment by 2030 and a quadrupling of investment in NBS by 2050. Economic justification for increased investment in nature is provided by the World Economic Forum (2020) which quantifies that over half of the global GDP, \$44 trillion, is potentially threatened by nature loss while the transition to a nature-positive economy could create 395 million jobs by 2030.

In order to achieve these ambitious investment targets, a change in the ratio of public to private investment in NBS is needed. The draft White Paper on the Nature-Based Economy (2021) called for a significant increase in private sector investment from 14% in 2021 to 40% by 2030. Hybrid or joint public-private financing presents an attractive alternative to public or private sector financing alone.

While there is much focus on large-scale NBS projects, this publication notes the high level of demand for small scale community-led projects which generate significant social impacts in fields such as health and wellbeing. It is essential that community and indigenous stakeholder voices are well represented in public and private sector investment approaches and that equal attention is given to financing and sustainability strategies for smaller scale, community-led initiatives.

Beyond public sector and community investment in NBS, this report finds significant scope for increased corporate investment in NBS and calls for measures to further support, and

systemic interventions."Nature-based solutions must therefore benefit biodiversity and support the delivery of a range of ecosystem services.

indeed go beyond, current Natural Capital and Circular Economy approaches. There is an urgent need however to raise awareness of 'greenwashing' among the corporate sector such as for example the mislabelling of monoculture plantations for carbon offsetting as NBS.

Barriers to NBS investment are well known and synthesised in this report. Emerging innovative financial vehicles such as green bonds and the development of European equivalents of Natural Asset Companies (NAC) (being launched in the US), along with the growing weight of Environment, Social and Governance (ESG) investment in private capital markets, carry the potential to scale support to the nature-positive economy. Cross sectoral and interdisciplinary collaboration will be needed to establish standards, reduce risk and provide confidence to investors.

Value Chains in the Supply of NBS

Many actors are involved across complex value chains in the demand and supply of nature-based solutions. Citizens and local communities are essential, their role interlinked with inclusive governance as a key principle of nature-based quality standards⁶. Open innovation processes involving the wider ecosystem are essential for nature-based economic development.

While public sector institutions have historically been responsible for the planning, delivery, and stewardship of many NBS, growing demand for NBS opens up significant market opportunities for private sector and third sector organisations. The concept of nature-based enterprises (NBE) has emerged from research. NBE are defined as enterprises that *use nature either directly or indirectly. Nature may be used directly by growing, harnessing, harvesting, or restoring natural resources in a sustainable way and/or indirectly by contributing to the planning, delivery or stewardship of NBS. NBEs contribute to biodiversity net gain.*⁷

Research identifies 11 categories of economic activity where private or third sector actors are delivering NBS (Table 1).

Table 1 Categories of economic activity where private sector actors are delivering NBS (Kooijman et al., 2021)

Economic category
Ecosystem creation, restoration and management
NBS for green buildings
NBS for public and urban spaces
NBS for water management and treatment
Sustainable agriculture & food production
Sustainable forestry and biomaterials
Sustainable tourism and health & wellbeing
Advisory services

⁶ Inclusive governance is one of the eight key criteria of the [IUCN Global Standard for NBS](#)

⁷ Kooijman et al., 2021, pp 2

Education, research & innovation activities
Financial services
Smart technology, monitoring and assessment of NBS

The market for some sectors, such as green buildings, is well developed in a small number of European countries, such as Germany and Austria, but under-developed in most countries. In other sectors, such as smart technologies for NBS or nature therapies for health and well-being, markets are at a nascent stage of development in all countries. Despite the variation across sectors and countries, overall market maturity for NBS is at an 'early adopter' development stage, presenting significant potential for future growth.

Increased investment in NBS therefore presents economic policy makers with the opportunity to support new types of job creation. Research shows that nature-based enterprises for example, are a source of both high-tech and low-skilled jobs and are well aligned with the goal of the European Green Deal of a just transition to a nature-positive, carbon neutral and equitable economy in all regions of Europe.

However, the remaining presence of institutional and market issues, along with a lack of awareness and specific support measures for nature-based enterprises, has led to a shortage of skilled and experienced suppliers in the private sector. This in turn creates bottlenecks in the upscaling of high quality NBS. Recent studies show that the majority of nature-based enterprises are small in size with many new start-ups in this sector. Nature-based enterprises face specific challenges to development including political, legal and regulatory barriers, lack of specific economic support policies, fragmented networks hampering knowledge exchange and learning and varying levels of awareness across Europe and globally. Nonetheless NBE are highly motivated to scale in order to achieve greater societal and environmental impact. Some measures to address these challenges were identified such as accelerator support programmes and platforms such as the Connecting Nature Enterprise Platform⁸.

3. Technology as an enabler

The role of technology in realising the economic potential of Nature-Based Solutions is often overlooked. In the urban context of today, the potential of technology to engage citizens in sustainability efforts at individual and community level offers radically improved avenues to achieving societal transformation. It is not that technology is without risk, and issues associated with data misuse and manipulation, privacy and cyber-security pose high risks especially to vulnerable groups. Digital tools in support of citizen participation, for instance, must be carefully calibrated to the particular purposes for which they are used, as well as appropriate methodology and content. On this basis, however, technologies based on computation, information and communication technology, artificial intelligence, and robotics, including multi-modal sensing systems as well as blockchain and tokenisation, provide cities with new means to unlock their regenerative potential.

With the use of technology, more consistent, reliable, and precise data on NBS can be created, making decision-makers across municipal departments, practitioners and researchers better equipped to recognise their value for the environment, economy, and

⁸ <https://www.naturebasedenterprise.eu/> The Connecting Nature Enterprise Platforms connects 2000+ practitioners across NBS sectors to exchange knowledge, improve best practice and support business development

society. More importantly, technology opens for far-reaching changes in governance with the opportunity for much enhanced contributions by citizens and relevant stakeholders across the entire NBS value-chain.

4. International Perspectives

Feedback from the consultation process across Europe combined with insights from UrbanByNature Hubs⁹ in China, Korea, Brazil and the Caucuses highlighted three specific contextual factors influencing the potential for a nature-positive economy:

- Natural environments;
- Economic contexts;
- Cultural contexts.

Natural environment

The natural environment is the basis for the development of a nature-positive economy. The abundance of natural resources, and unspoiled environments evident in many countries in South America for example can support ecologically-friendly tourism and wellness tourism. On the other hand, care needs to be taken to make sure that such economic activity does not undermine the natural asset it depends on. Further research is needed to understand interrelations between environmental pressures, sustainable responses and the future of sustainable tourism development within protected natural areas will provide further insight.

Recognising the vital role of nature-based solutions in the nature-positive economy, public policies and procurement processes should consider the local/regional environmental context instead of the country scale. Educational initiatives and awareness raising strategies around NBS at citizen and community level are needed in most parts of the world in order to increase the understanding of the nexus among environmental health parameters, ecosystem vitality and sound natural resource management.

Economic context

It was evident from consultation responses that the economic situation of different countries and the conditions for NBS investment can foster or hinder the development of a nature-positive economy. While some private sector-focused nature conservation and NBS accelerator funds are being created to provide measurable conservation and social benefits and to deliver financial returns for investors, greenwashing poses a real challenge for a nature-positive economy.

Furthermore, the continued path dependency of many national economic policies on sustained growth trajectories has not been sufficiently challenged. The current economic paradigm of 'making money and consuming products and services as fast as possible' is a barrier for investing in NBS.

⁹ <https://urbanbynature.eu/>: UrbanByNature is a facilitated capacity-building programme promoting exchange among cities, researchers, SMEs and NGOs to build bridges with the Nature-Based Solutions communities across Europe, Asia, Latin America, and other interested regions. The programme is powered by ICLEI - Local Governments for Sustainability, and the EU-funded projects Connecting Nature and CLEVER Cities.

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

The importance of cities in the deployment of nature-based solutions is being increasingly recognised, but issues of land use competition and congestion continue to present roadblocks to scaling. Various incentives, such as specific inducements directed towards government bodies, businesses, non-governmental organisations, or local people, can be applied to conserve biological diversity or make more sustainable use of its components. Additionally, people or particular stakeholders can be propelled to support nature-based value chains through mechanisms ranging from awareness creation, trusted information systems or other enabling conditions spurring adjustments in consumer and investment behaviours to protect ecosystems.

Cultural context

The importance of cultural contexts in the take-up of concepts such as nature-based solutions and the nature-positive economy has been under-researched. Local traditions and ancestral knowledge are mentioned in this consultation process as having applied sound approaches to conservation and water management well suited to local contexts, given that in many parts of the world, people have lived for centuries or are still living in harmony with nature. Indigenous people's values need to be preserved, and they need to (economically) benefit from NBS interventions. This is embedded in the recent UNEA resolution, which states that NBS need to respect social and environmental safeguards.

The 2050 vision of a world 'living in harmony with nature' requires a fast and radical paradigm shift in value systems. Culture can be a high determinant in terms of people's willingness to engage and invest in NBS. Citizen's acceptance of NBS and related collaborative governance models are essential to creating demand for NBS, given that people need to understand why NBS are important to be able to truly engage.

5. Key issues and recommendations

Synthesising the extensive feedback from this consultation process, the following factors emerged as major roadblocks in achieving the full potential of NBS as a driver of the nature-positive economy:

1. Standards: As the concept of NBS matures, increasing concerns have been raised about misuse of terminology, greenwashing, and the quality of NBS. There have been calls for transparent and widely accepted standards and codes of practice which can provide greater clarity around what is and what is not a NBS and guidance on how NBS should be implemented at planning, delivery, and maintenance phases. Monitoring and reporting are essential elements to avoid greenwashing and loss of biodiversity and to ensure additionality and permanency of the impact of NBS investments.

Summary of Recommendations: International and European standards for different types of NBS are urgently needed. Standards should address all stages of NBS planning, delivery, management, monitoring, and sustainability and be incorporated into procurement processes. Standards should be developed with end-users and industry representatives and accompanied by appropriate accreditation schemes. Governments can also encourage compliance to standards by liaising with standardisation bodies for training and capacity-building. Simplified accreditation processes for smaller market players and accompanying measures to support uptake should be put in place. Awareness raising actions and capacity building for NBS sectors are also needed - and incentives can increase buy-in such as industry awards and recognition for excellence. Reports on the uptake of standards and

accreditation processes by NBS typology should be made publicly available through an international and European observatory.

2. Measurement and valuation: The general consensus from the consultation was that more data and larger data sets were needed to better inform decision-makers and investors about NBS. Some respondents called for the introduction of mandatory valuation of ecosystem services, in particular by public sector organisations. However, the question of how to value NBS and the pricing of ecosystem services is still the subject of much discussion. Proposals on valuation put forward by MAES¹⁰ and UNEP amongst others have yet to be transferred into a policy format suitable for uptake.

Summary of Recommendations: Decisive action and leadership is needed. In the immediate short term, reporting of natural capital should be mandatory for public organisations and large industry players across their entire value chains with appropriate incentives and penalties put in place to ensure compliance. In the short-medium term, a more holistic approach to include non-monetary ecosystem service valuation should be introduced alongside measures for smaller organisations including those in the third sector. An independent NBS open-source observatory is required to demonstrate progress on a range of valuation metrics across different sectors and geographies, generating comparable data to facilitate decision-making. Further research and demonstrations are needed on a carbon credit equivalent to capture the value of NBS for biodiversity and ecosystem restoration.

3. Public policy: Supportive, integrating public policy is of paramount importance in effecting the paradigm shift required to embed NBS as the bedrock of a nature-positive economy. NBS can only contribute to a nature-positive economy if NBS concepts and approaches are embedded in multi-level, cross-sectoral policy frameworks developed through participatory processes and accompanied by a range of policy instruments and related awareness raising. Many policy frameworks and processes in the EU (e.g. European Green Deal, EU Biodiversity Strategy 2030, EU Adaptation Strategy 2020, EU Nature Directives) and globally (e.g., forthcoming CBD Post-2020 Global Biodiversity Framework, Edinburgh Declaration, UN Decade of Ecosystem Restoration) call for multi-level, whole-of government policy frameworks. The potential for alignment of NBS with other policy fields is vast. Policy areas of high priority for NBS integration next to Environment include Climate, Economy, Energy, Planning, Digital Europe, Health and Social Policy.

Summary of Recommendations: Billions are being invested into economic policies such as the Circular Economy, the Bioeconomy, the EU Green Deal Investment, Smart Specialisation and InvestEU strategies. Immediate action is needed at local, national and international level to better integrate NBS into such economic policy approaches. In doing so this will ensure the embedding of participatory planning and co-creation decision-making approaches in such policies. Similar measures are needed to better integrate NBS into other policy fields including climate change; soil, land use and planning; energy and building; social and health policies; smart technologies and digitalisation. Specifically, the Urban Greening Plans¹¹, mentioned in the EU Biodiversity Strategy 2030, as well as

¹⁰ Mapping and Assessment of Ecosystems and their Services, see

https://ec.europa.eu/environment/nature/knowledge/ecosystem_assessment/index_en.htm

¹¹ <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52020DC0380&from=EN>

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

initiatives and projects supporting the implementation of at least 4¹² of the 5 EU Mission provide a great opportunity for the deployment of NBS in urban, rural and coastal environments to mobilise policy, regulatory and financial tools to give a push towards a nature-positive economy and achieve climate and biodiversity goals while addressing societal challenges, such as public health, quality of life, and social justice.

4. Investment in NBS: Recent initiatives, such as the EU Taxonomy on Sustainable Finance and the Taskforce on Nature-related Financial Disclosures (TNFD), hold much potential to channel increased financing towards nature-positive investments. More could be done, however, to ensure that investment is channelled towards cost effective and efficient NBS, complying with all the necessary social and environmental safeguards as set out in the UNEA resolution on NBS. Increased recognition is needed of the importance of collaborative approaches to project development to ensure the voice of communities is adequately represented in investment decisions. Further research and support actions are needed to address the financing and sustainability of small scale, often community led NBS projects.

Summary of Recommendations: Policy makers need to enable accelerated investment in NBS by both the public and private sector. In the immediate short-term, public-sector investment in NBS should double at all policy levels in response to the unequivocal evidence of climate and biodiversity emergencies as indicated in the latest IPCC reports. The potential of NBS for job creation provides an impetus for public and private investment. Simultaneously wide ranging policy measures are needed to stimulate a massive increase in private sector investment in NBS including strengthening of NBS in the EU Taxonomy, alignment with the TNFD and measures to increase financing in community led, small-scale projects as well as large-scale NBS projects (see detailed table of recommendations). The approach to governance should place high priority on citizen engagement and leadership of NBS initiatives with the goal that investment is not undertaken “for” people, but “with” and “by” people.

5. Development of specific market sectors: The term ‘nature-based enterprise’ is an umbrella concept covering a subset of 11 existing economic activities (see Table 1). While specific needs emerged from industry consultation in each sector, many common challenges and enablers were identified including low levels of awareness and support for NBS among the general public, business sector and in the wider political and public sector environment; a lack of practical, cost-effective methodologies and tools for small businesses to measure the effectiveness of NBS; variation in quality standards and codes of good practice across sectors increasing risk for investors; lack of market research data and support from business innovation ecosystems for market development; skills gaps both technical and related to ‘soft skills’ such as business development.

Summary of Recommendations: Immediate investment in research on market data on each economic category of activity identified in Table 1 and on research and demonstration of practical, cost-effective methodologies and tools for small businesses to measure the effectiveness of NBS. Involvement of industry bodies and practitioners in developing codes of practice and standards for different NBS activities. Investment in awareness raising in

¹² The potential to integrate and thus streamline the financing and implementation of NBS is huge across these four EU Horizon Europe Missions “Adaptation to Climate Change”, “A Soil Deal for Europe”, “100 Climate-Neutral and Smart Cities by 2030” and “Restore our Ocean and Waters by 2030”.

the public sector to increase technical understanding of the need to adapt processes and practices, e.g., public procurement for NBS. Increased awareness of economic policy makers of the environmental and societal mission orientation of nature-based enterprises leading to recognition of such KPIs in economic policies and the development of support and capacity-building measures for financing and scaling aligned with this mission.

6. NBS awareness and capacity building: Measures to increase awareness and build capacity were identified as critically important for all stakeholders - economic policy makers in particular, but policy makers across the board, public sector professionals, businesses across the value chain, innovation ecosystems including investors, third sector organisations and most important above all, communities and citizens. The potential of technology and platforms to connect complex NBS value chains and to provide information for decision making was clearly recognised.

Summary of Recommendations: Investment in awareness raising measures is needed prioritising two levels (i) a broad-based multimedia Europe-wide information campaign raising awareness and support among the general public for increased investment in NBS (ii) specific awareness-raising measures targeted to the information needs of different stakeholders in relation to previous recommendations e.g., benefits of valuation approaches. Building on increased awareness of investment in capacity building measures is also needed at two levels: (i) to empower citizens and communities to engage in decision-making and governance of NBS (ii) to build the capacities of different stakeholders to take-up the previous recommendations, e.g., small business take up of training and accreditation processes on standards.

6. Conclusion

In conclusion this report identifies that large scale investment in NBS presents significant but largely unexplored potential to deliver a viable route to a nature-positive economy. A key differentiating feature of NBS is their potential to simultaneously generate a multitude of benefits, while promoting and safeguarding biodiversity remains at the centre of a nature-based approach. The large-scale investment in NBS needed for transitioning to a nature-positive economy must carefully balance the vast potential to harness nature for economic development and job creation with equal respect for the voice of communities, culture, and traditions and above all, lead to the restoration of natural resources and biodiversity.

ACKNOWLEDGEMENTS

We would like to acknowledge the valuable contributions from the following 15 Horizon 2020 funded projects (Connecting Nature, URBiNAT, Just Nature, Regreen, NetworkNature, UNaLab, GrowGreen, INTERLACE, Clearing House, Clever Cities, Conexus, GoGreenRoutes, FutureMares, Naturvation and URBAN GreenUP) and the LIFE funded project ARTISAN to this publication.

LEAD AUTHORS

Name	Organisation	EU Project Support
Siobhan MCQUAID Esmee KOOIJMAN	Centre for Social Innovation, Trinity College Dublin https://www.tcd.ie/business/research/social-innovation-centre.php	 https://connectingnature.eu/  https://gogreenroutes.eu/
Daniela RIZZI	ICLEI – Local Governments for Sustainability https://iclei.org/	 https://connectingnature.eu/  https://clevercities.eu/  CONEXUS https://www.conexusnbs.com/  https://www.regreen-project.eu
Thomas ANDERSSON	International Organisation for Knowledge Economy and Enterprise Development (IKED) http://www.iked.org/	 https://urbinat.eu/
Joanne SCHANTÉ	LGI Sustainable Innovation http://lgi-consulting.com/	 Le climat change, adaptons-nous avec la nature https://webgate.ec.europa.eu/life/publicWebsite/index.cfm?fuseaction=search.dspPage&n_proj_id=7406

		 <p>CLEARINGHOUSE 中欧城市森林应对方案 https://clearinghouseproject.eu/</p>
--	--	---

EXPERT REVIEWERS

Name	Organisation	EU Project Support
Mark Bennett	Inlecom https://inlecom.eu/group/	JUST NATURE https://cordis.europa.eu/project/id/101003757
Michael Kernitzky Hans-Peter Elmer Andreas Tuerk	JOANNEUM RESEARCH https://www.joanneum.at/en/	 REGREEN NATURE-BASED SOLUTIONS https://www.regreen-project.eu/
Laura Wendling	VTT https://www.vttresearch.com/en	 UNaLab URBAN NATURE LABS https://unalab.eu/en
Matthieu Grosjean	Steinbeis Europa https://www.steinbeis-europa.de/en/home	 Network Nature https://networknature.eu/
Mary Lee Rhodes Dharm Kapletia Alice Reil	Centre for Social Innovation, Trinity College Dublin https://www.tcd.ie/business/research/so Horizon Nua https://horizonnua.eu/cial-innovation-centre.php ICLEI https://iclei.org/	 Connecting Nature https://connectingnature.eu/

Contribution to Case studies / Toolbox of best practice:

 REGREEN NATURE-BASED SOLUTIONS https://www.regreen-project.eu/	 CLEVER Cities Clever Cities https://clevercities.eu/	 Grow Green https://growgreenproject.eu/
 CONEXUS https://www.conexusnbs.com/	 Future MARES https://www.futuremares.eu/	 Connecting Nature https://connectingnature.eu/

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

 <p>INTERLACE HUB</p> <p>https://interlace-hub.com/</p>	 <p>GO GREEN ROUTES</p> <p>https://gogreenroutes.eu/</p>	 <p>URBiNAT</p> <p>https://urbinat.eu/</p>
 <p>URBAN GREEN UP</p> <p>https://www.urbangreenup.eu/</p>	 <p>merces restoring marine ecosystems</p> <p>http://www.merces-project.eu/</p>	 <p>NATURVATION cities - nature - innovation</p> <p>https://naturvation.eu/</p>
 <p>artisan Le climat change, adaptons-nous avec la nature</p> <p>https://webgate.ec.europa.eu/life/publicWebsite/index.cfm?fuseaction=search.dspPage&n_proj_id=7406</p>		

CHAPTER 1 INTRODUCTION

1.1 Context and objectives

"We are on a pathway to global warming of more than double the 1.5-degree limit agreed in Paris. Some government and business leaders are saying one thing – but doing another. Simply put, they are lying. And the results will be catastrophic."

António Guterres, UN Secretary-General speaking on the launch of the third IPCC report¹³, April 4th, 2022.

It is well established that business as usual is destroying and degrading the ecosystems which are the basis for our societies and economies. But alternatives to business as usual require a fundamental shift from current practices which do not adequately account for the impact of business on nature to new approaches where the value of nature and its contribution to the economy are recognised and form the basis of future economic development strategies. A paradigm shift is needed to transition to a nature-positive¹⁴, carbon neutral and equitable economy. All three elements are equally important. Nature-positive can only be achieved if we also achieve carbon neutrality and vice versa. And both achieving zero carbon and biodiversity-positive means that equity must be addressed. This report, however, focusses on the nature-positive aspect.

More precisely, this report aims to increase recognition of the vital role of Nature-Based Solutions in a nature-positive economy and identify the increasingly important role of Nature-Based Enterprises (NBE) in delivering NBS.

A nature-based approach is complementary to concepts such as the circular economy¹⁵, or bioeconomy¹⁶, which propose viable pathways towards sustainable economic development. In contrast with such concepts however where potential economic contributions have been well researched and demonstrated, little is known about the potential economic benefits of Nature-Based Solutions or how to achieve them.

This report is a first step in addressing these knowledge gaps. Based on extensive consultations with diverse stakeholders, we analyse the potential of NBS in contributing to the nature positive economy. Insights are drawn from a range of industry practitioners, representing more established sectors such as sustainable agriculture and green infrastructure but also new emerging sectors such as smart technologies for Nature-Based Solutions. We reveal the key issues stakeholders see in the embedding of NBS as a key driver of the nature-positive economy including increasing evidence of 'greenwashing' and cynical abuse of the NBS concept by a small minority of organisations. These criticisms are

¹³ Secretary-General's video message on the launch of the third IPCC report. Available here: <https://www.ipcc.ch/2022/04/04/ipcc-remarks-wgiii-ar6-press-conference/> . Summary of IPCC WG3 AR6 report available here <https://www.ipcc.ch/report/ar6/wg3/>

¹⁴ A nature positive economy is one in which businesses, governments and others, take action at scale to reduce and remove the drivers and pressures fuelling the degradation of nature, and work to actively improve the state of nature and the ecosystem services it provides. Source: CISL <https://www.cisl.cam.ac.uk/resources/nature-positive>

¹⁵ [The Circular Economy Action Plan](#) was adopted by the EC in March 2020. The circular economy is a model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible. In this way, the life cycle of products is extended.

¹⁶ [COM\(2018\)673 and SWD\(2018\)431](#). A sustainable Bioeconomy for Europe: Strengthening the connection between economy, society and the environment.

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

addressed head-on in this report and inform guidelines and recommendations on how to realise the potential of Nature-Based Solutions which are grounded in good practices and stakeholder consultation.

Target audiences: How to use this publication?

While economic policy makers are a key target audience for this publication, specific recommendations are developed for policy makers at multiple levels, public sector institutions and agencies, researchers, civil society and NGO representatives, investors and financial institutions, industry and corporates and nature-based enterprises delivering NBS.

This publication is not intended to be read from start to finish. It is intended as a reference guide for different target audiences to consult at different stages of their NBS journey. We aim for a practical approach based on case studies and realistic recommendations. Industry practitioners may only be interested in the outlook for specific market segments. Economic policy makers may be interested in case studies and specific policy recommendations on how to stimulate market development. International policy makers may be interested in overarching knowledge gaps which need to be addressed.

We hope this publication will lead to further dialogue but given the urgency of the challenges faced, we call for immediate actions to forge a new economic partnership between nature and people.

1.2 Key concepts

Nature-Based Solutions (NBS)

NBS is an umbrella concept encompassing multiple dimensions (strategic, spatial planning, soft engineering and performance) and building on a vast knowledge-base of approaches including ecosystem services, ecosystem-based adaptation, ecosystem-based disaster risk reduction, ecological engineering, blue infrastructure, green infrastructure, blue-green infrastructure, Urban Forestry, Sustainable Urban Drainage Systems, Low-Impact design and other concepts (European Commission, 2022). The concepts the most used at EU level for ecosystem-based initiatives have been regrouped in an online glossary on the Resources Hub OPPLA¹⁷.

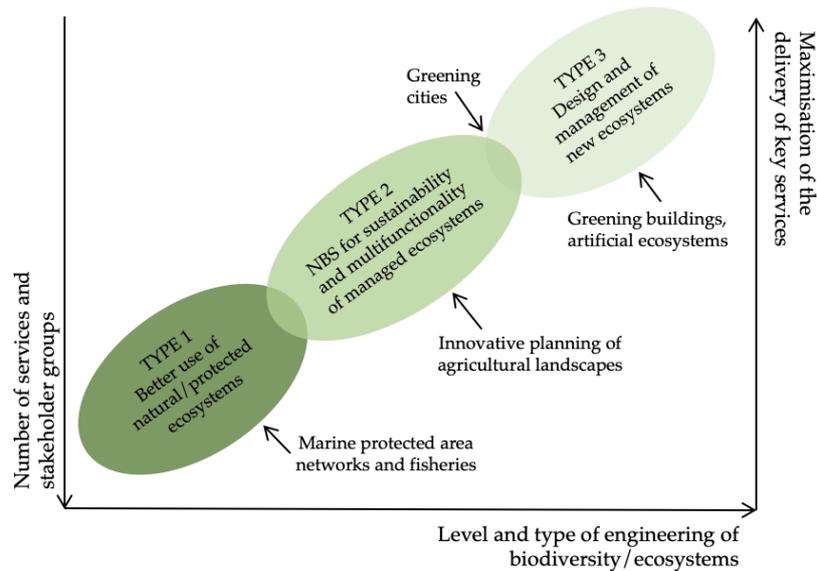
The International Union for Conservation of Nature (IUCN) was first to use the NBS term in the early 2000s, identifying that actions to protect, manage and restore nature could simultaneously generate wider benefits for human well-being and biodiversity (Eggermont et al. 2015; Cohen-Shacham et al., 2016; IUCN, 2020). Over the last decade increasing evidence has emerged of the potential of Nature-Based Solutions (NBS) to tackle some of our most urgent environmental and societal challenges such as emission reduction, climate adaptation and mitigation, air and water quality pollution, biodiversity loss, but also providing cost-effective solutions for public health, food security and even social cohesion. In their definition of NBS, the EC also recognise the potential economic benefits of NBS such as new economic opportunities and green jobs (Raymond et al., 2017; Wendling & Dumitru, 2021). In this publication we use the definition of NBS from the UNEA Resolution on Nature-Based Solutions¹⁸ for supporting sustainable development which defines NBS as *actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing*

¹⁷ Oppla is the EU Knowledge Repository on Nature-Based Solutions <https://oppla.eu/case-studies/existing-ecosystem-based-initiatives-eu-level>

¹⁸ UNEP/EA.5/L9/REV1 <https://www.unep.org/environmentassembly/proceedings-report-ministerial-declaration-resolutions-and-decisions-unea-5.2>

human well-being, ecosystem services and resilience and biodiversity benefits. The resolution further states that *nature-based solutions respect social and environmental safeguards*.

Eggermont et al. (2015) identifies 3 types of Nature-Based Solutions, based on the level and type of engineering of biodiversity and ecosystems, and as a function of both the number of services and stakeholder groups involved and the maximisation of the delivery of key services (Figure 1).



**Figure 1 Typology of Nature-Based Solutions
(Adapted from Eggermont et al., 2015)**

The multiple benefits NBS deliver have been highlighted in European and international frameworks such as the EU Biodiversity Strategy for 2030 (European Commission, 2021), the EU Green Deal (European Commission, 2019), the Urban Agenda 2030 (UN, 2016), the UN Climate Action Summit 2019¹⁹ and the Convention of Biological Diversity’s Biodiversity Framework (CBD, 2021).

The Vital Role of Nature-Based Solutions in the Nature-Positive Economy

The paradigm shift required to rapidly transform current economic policies and practices to slow and reverse the accelerating climate crisis is comprehensive and immensely challenging. Complementing the work of other international bodies on the nature-positive economy, an EC working group was established and prepared a draft White Paper on the Nature-Based Economy²⁰ which explored the role of nature-based solutions in a nature-positive economy.

The rationale for a nature-based economic approach was based on the identification of four major limitations in current economic approaches. These are (1) current inadequacies in approaches to the pricing and valuation of nature; (2) a failure to take into account the diversity and interaction of actors in production and consumption; (3) a sustained lack of emphasis on resource inefficiencies; (4) the exclusion of decision-making processes in the formation of rules governing production and consumption. A paradigm shift towards a

¹⁹ <https://www.un.org/en/climatechange/2019-climate-action-summit>

²⁰ Draft White Paper on the Nature-Based Economy available here <https://doi.org/10.5281/zenodo.5055605>

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

nature-based economic perspective means the explicit recognition of nature as both providing a critical input to production and generating valued output in the economy. Such a paradigm shift recognises the vital role of NBS in 'super-charging' the transition to sustainable development decoupled from resource exploitation, biodiversity loss and carbon emission growth.

For further information on the conceptual basis for such a nature-based economic approach and more details on its features please consult the draft [White Paper](#).

The concept of nature-based enterprises (NBE) has also recently emerged from research. NBE are defined as enterprises that *use nature either directly or indirectly. Nature may be used directly by growing, harnessing, harvesting or restoring natural resources in a sustainable way and/or indirectly by contributing to the planning, delivery or stewardship of NBS. NBE contribute to biodiversity net-gain.*²¹

Research underway by the same authors shows important differentiating characteristics between nature-based enterprises and other types of social or profit-oriented enterprise. Nature-based enterprises are driven first and foremost by environmental and societal challenges and are highly motivated to scale in order to address the magnitude of the climate change and biodiversity crises we face. Urgent action is needed to support the start-up and impact of such enterprises in parallel with a significant increase in investment in NBS. This investment in NBS leads to increased demand for NBE that in turn generates economic benefits such as new 'green' jobs in both high-tech and low-tech fields.

1.3 Methodology

This publication is informed by the **Consultation process on the draft White Paper on the Nature-Based Economy**. The consultation process was launched on NetworkNature²², the EU-funded platform on NBS, in June 2021 with the publication of a draft White Paper on the Nature-Based Economy (McQuaid et al, 2021a). The consultation closed in November 2021. In total 170 responses were gathered through a structured online questionnaire (107), which included unstructured online responses (75) and from stakeholder feedback (63) gathered at organised roundtable discussions and events. In the online process, respondents had the option to add detailed comments and submit relevant documents related to the topic. A collaborative working group approach to coding the responses into categories was carried out for the analysis of the unstructured results of the consultation process. For an overview of the number of respondents per stakeholder group and geographic area see Figure 2. A comprehensive report on the consultation process is available online²³

²¹ Kooijman et al., 2021, pp 2

²² More information on the NetworkNature consultation process is available here: <https://networknature.eu/Nature-Based-Economy-White-Paper-Consultation>

²³ Consultation Report on the draft White Paper on the Nature-Based Economy is available here: <https://doi.org/10.5281/zenodo.6424796>

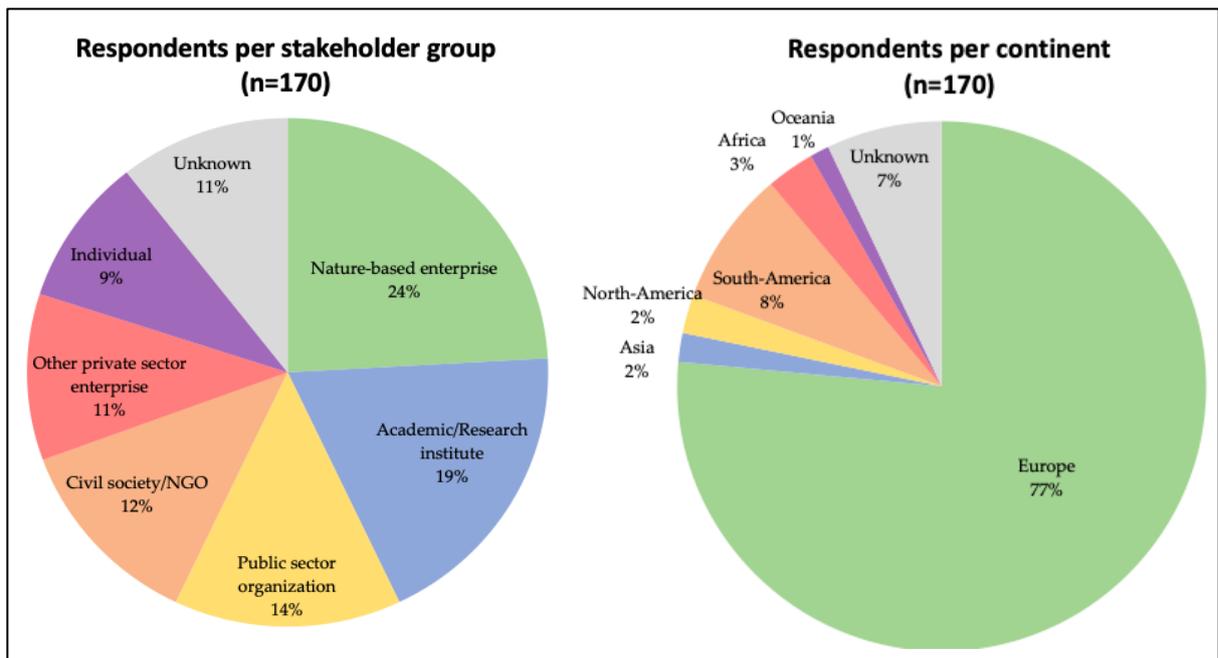


Figure 2 Overview of respondents to the consultation on the Draft White Paper on the Nature-Based Economy

The Nature of Cities Global Roundtable on the Nature-based Economy²⁴

Parallel to the consultation process, a global virtual roundtable was launched in the fall of 2021 on The Nature of Cities' website (TNOC). The effort with the global roundtable was to get perspectives on the nature-based economy beyond Europe, making the whole discussion around nature and its benefits across the sectors of business, planning, engineering, science, conservation, and community more inclusive. The roundtable attracted inspiring inputs from around the globe: South America, North America, Africa, Western Asia and others, which are analysed in Section 4 under the categories of: a) natural environment, b) economic context and c) cultural context.

Limitations

One of the key recommendations of this report is the need to address significant gaps in the availability of European-wide market data across nature-based economic sectors. This lack of reliable economic data is a significant limitation of this report. An extensive stakeholder consultation was undertaken to address this shortcoming including insights from communities of industry practitioners. While this consultation provides a deep and valuable understanding of key issues, challenges, and opportunities, it does not provide an adequate substitution for quantifiable, verifiable economic data.

Another limitation is the lack of available input from experts in sectors where there is potential for significant nature-based entrepreneurial activities – this includes for example NBS and the blue economy, or NBS and Insurance activities²⁵.

This publication and the preceding White Paper were prepared by the Nature-based Economy Working Group of Task Force III "Governance, Business Models and Financial

²⁴ The full list of contributions to this virtual roundtable is available here:

<https://www.thenatureofcities.com/2021/09/07/how-can-nature-based-solutions-nbs-provide-the-basis-for-a-nature-based-economy/>

²⁵ For example and illustrations of business cases for NBS, see EC Publication "Nature-based Solutions State of the Art in EU-funded Project" Pp 210 Available here:

<https://op.europa.eu/en/publication-detail/-/publication/8bb07125-4518-11eb-b59f-01aa75ed71a1>

Mechanisms” of the European Commission. The members of this group contributed their expert opinions based on a review of relevant literature and from various reports and case studies collected across EU funded NBS demonstration action. See Appendix 1 for a list of members of this working group and the Acknowledgement section for details of their respective contributions. More information on the Research and Innovation projects on NBS funded under Horizon 2020 Work Programme is available on the NetworkNature²⁶ and Research and Executive Agency²⁷ websites.

1.4 Structure

Following this brief introduction to context and concepts, the remaining chapters are structured as follows:

Chapter 2 looks first at the key factors influencing demand, investment and supply of Nature-Based Solutions. We provide an overview of different sectors of economic activity and identify the complexity of value-chains across sectors. Then we drill down into the characteristics of some market sectors to highlight opportunities and knowledge gaps.

Chapter 3 addresses the role of technology in realising the potential of NBS in the transition to a nature-positive economy.

Chapter 4 presents different perspectives on opportunities and challenges for nature-based economic development globally.

Chapter 5 concludes this publication with a summary of the key issues influencing the contribution of nature-based solutions to of a nature-positive economy and calls for action to address these issues. For each issue, we identify good practices, guidelines and recommendations for action.

Throughout this report we use case studies firstly, as a source of inspiration and good practice and secondly, to inform the guidelines and recommendations.

Expert opinion ‘Let’s invest in human incredible capacity and imagination to regenerate planet Earth’

We need a radical shift in the indicators we measure value and wealth, and switch to an ecological economy. [Georgescu-Roegen](#), [Daly](#), [Elkington](#), [Klein](#), [McKibben](#), [Piketty](#), [Raworth](#), [Mazzucato](#), among so many others have been proposing and advocating for this essential transformation during the last century, especially in the last decades. The collapse we are now seeing was foreseeable a long time ago. The present trigger is a climate emergency showing that our environmental, social, and cultural predatory economy has led us in a wrong direction. Countless concomitant climate impacts worldwide are happening. It is undeniable that time urges to transition to a new nature-based economy that fits in the



Cecilia Herzog, Urban Landscape Planner and professor at Pontifical Catholic University of Rio de Janeiro.

²⁶ <https://networknature.eu/networknature/nature-based-solutions-task-forces>

²⁷ https://rea.ec.europa.eu/system/files/2021-08/NBS_online_002.pdf

planetary boundaries and reverses the abyssal social disparities, besides respecting social-cultural, ethnic, and gender distinctiveness of all people.

Climate is global and is affecting rich and poor countries, real people in the real world, destroying our biosphere on an unthinkable speed. New green deals emerging in wealthy countries must take a tangible turn when NATURE and PEOPLE must be THE PRIORITY! Brazil has a huge role to play in this scenario, where the AMAZON and other precious biomes collapse must be taken extremely seriously. At city level, Brazilian cities are still introducing Nature-Based Solutions as demonstration projects at a slow pace. The landscape transformation must gain scale urgently, bringing nature to all possible places. Taking out cars, planting trees and opening spaces for people close to regenerated urban nature, creating new and sustainable businesses and jobs.

Multilateral banks are already focusing on NBS, inducing their investments to projects that are environmentally and socially oriented (e.g. [World Bank](#), [IDB](#)), as well as the [World Economic Forum](#). The concentration of wealth in the hands of very few people²⁸ while the vast majority of humanity tries to survive until the next meal, has to be addressed. In my view, there is no way we will overcome the disaster unless the economy, politics, and decision makers find a way to redistribute capital in a fair way, so every person on earth will be able to be concerned with our collective good and invest in Nature-Based Solutions.

We must innovate, educate, and create new jobs that restores ecosystems; produce healthy foods; build and prepare cities to be resilient to climate impacts; shift to clean and active mobility in comfortable and safe ways; adopt (incentivize) renewable energy (and divest on fossil fuel); value and invest in local production; besides developing technologies that enables recover ecological functions that are desperately needed.

Source: Kindly reproduced from [TNOC Roundtable on the Nature-based Economy as part of consultation process](#).

²⁸ https://oi-files-d8-prod.s3.eu-west-2.amazonaws.com/s3fs-public/2019-12/191219_Oxfam_Annual_Report_2018-19.pdf

CHAPTER 2 NBS MARKET

2.1 Market Trends

At the most simplistic level, the market for NBS consists of those organisations with demand for NBS (buyers) and those supplying NBS products and services to the market (suppliers) (Wild et al., 2020). In reality, the situation is somewhat more complicated with multiple stakeholders interacting across value chains which vary in complexity from sector to sector. In this section, we first look at the 'buyers' driving market demand for NBS, then at the 'suppliers' in both the public and private sector, and finally we look at key stakeholders in NBS value chains.

2.1.1 Demand for NBS

Demand for NBS is increasing globally due largely to the mainstreaming of NBS in international policy but also due to the initiatives of citizens and other actors who recognise the multiple benefits they offer. The basic demand for NBS emerges from several directions:

- Policymakers, public managers and experts observe their potential benefits, for the urban environment, health and social wellbeing, economically and socially, as well as for the environment and ecology.
- Private firms, developers, entrepreneurs and financiers who discern economic gains and development opportunities.
- Citizens and representatives of the "third sector" (non-profits, community groups, charities) that perceive opportunities to address local problems and opportunities for new initiatives and the realisation of new assets, such as public space and engagement in meaningful activities.

The European Union considers NBS as an opportunity to foster innovation and competitiveness, both in domestic and international markets (European Commission, 2015). In its Biodiversity Strategy for 2030, the European Commission (2021) states that industry and business have an impact on nature, but are also key in developing innovations, partnerships, and expertise for tackling biodiversity loss and restoring ecosystems. The European Union has called on cities with over 20,000 inhabitants to develop Urban Greening Plans for example. NBS are key to innovation for economic or societal needs that rely on nature, and the uptake of NBS leads to business and employment opportunities in a wide variety of sectors.

Thanks to these efforts, government stakeholders, academia, the business community, citizens, and other actors are increasingly recognizing and embracing NBS (Wild et al., 2020). The Urban Nature Atlas compiled by the H2020 project Naturvation²⁹ includes 1000+ examples of NBS from 100+ EU cities, and the number of projects added have been steadily increasing from 1990 – 2016 (Figure 3). A PESTLE analysis of market demand³⁰ was undertaken by the H2020 project Clever Cities which proposed market strategies for green roofs, vegetated noise barriers and urban gardening.

²⁹ Naturvation H2020 Funded Project, Urban Nature Atlas <https://naturvation.eu/explore>

³⁰ Market Analysis. Clever Cities H2020 Funded Project.

https://clevercities.eu/fileadmin/user_upload/Resources/D5.1_Market_analysis.pdf

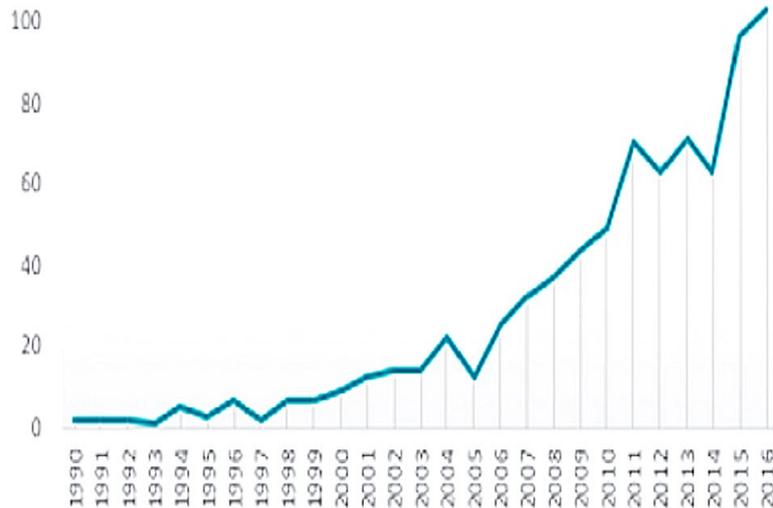


Figure 3 Number of NBS per starting year in the Urban Nature Atlas (1990-2016)

In terms of growth of market demand, while there are variations across different types of NBS, most NBS market sectors (see section 2.2) are in the early stages of market development and product diffusion and therefore are likely to have significant room to expand demand. Figure 4 shows the stages of adoption and demand development in the diffusion of innovations. Nature-based solutions are generally new approaches to societal challenges, and products and services related to NBS are still in the early stages of adoption and demand development.

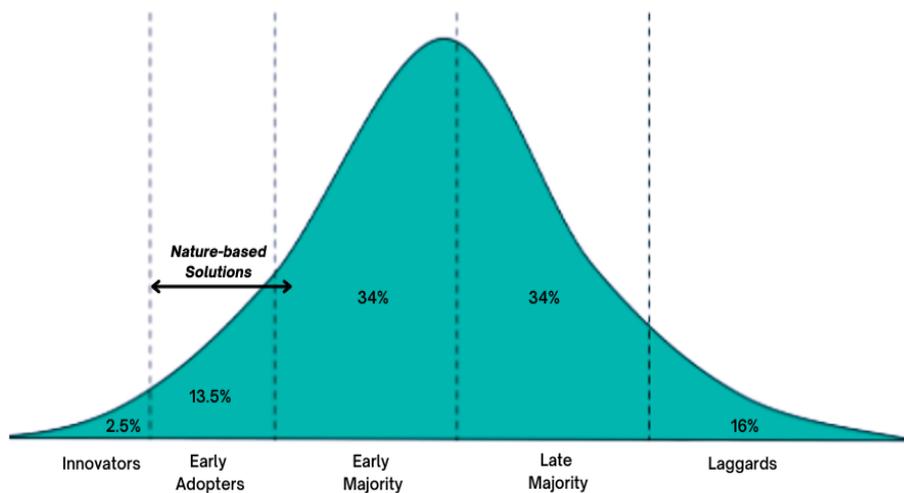


Figure 4 Stages of adoption and demand development in the diffusion of innovations (Adapted from Rogers, 1962) and Nature-Based Solutions

2.1.2 Investment in NBS

While demand for NBS is clearly increasing, investment remains a key challenge in responding to demand. The UN State of Finance for Nature report 2021 estimates that current investment in NBS globally is approximately \$133 billion. However, in order to meet climate change, biodiversity and land degradation targets, this report calls for a tripling of investment by 2030 and a quadrupling of investment in Nature-Based Solutions by 2050. The economic justification for such investment is made in “The World Economic

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

Forum’s (WEF) second report of the New Nature Economy Report (NNE) series “The Future of Nature and Business”, which puts forward a series of strategies to transition to a nature-positive economy. The report quantifies that such transitions could create 395 million jobs by 2030, representing around one fifth of the total projected increase in the global labour force between now and 2030. To reach this scale, investments of around USD \$2.7 trillion annually are needed through 2030.” To put this level of investment in perspective, it is estimated that \$USD 17 trillion has been lost due to the pandemic alone in the last two years (Polman & Winston, 2021).

The UN State of Finance for Nature report (UNEP, 2021) called for closing a USD 4.1 trillion financing gap in Nature-Based Solutions. It estimates that the public sector currently accounts for 86% of current investment in NBS. In order to achieve the ambitious targets of tripling NBS investment by 2030 it is clear that a substantial increase in both public and private sector financing is needed. The recently published ‘The State of Finance for Nature in the G20’ report (UNEP, 2022) builds on this report, and states that the current G20 investment gap for Nature-Based Solutions is USD 120 billion/year. Further, the indication is that the G20 Official Development Assistance and private sector investments are too small when compared with domestic government spending. Within this context, G20 leadership is pointed out as key to catalyse private capital inflow for Nature-Based Solutions from now on. The report presents a wake-up call for G20 countries to scale-up annual Nature-Based Solutions spending to USD 285 billion by 2050 to tackle the interrelated nature, climate, and land degradation crises on which much of our economies are dependent. Finally, it provides recommendations to align development and economic recovery with nature goals through setting quantifiable monetary objectives, governance and policy options, and devices to facilitate systemic changes to meet this investment gap. Building on this, the Nature-Based Economy working group of the EC called for an increase in private sector investment from 14% in 2021 to 40% by 2030 (Figure 5). Hybrid or joint public-private financing is often proposed as an attractive option, but this raises questions about the exclusion of community or indigenous stakeholders and how to ensure their voice is equally represented.

The involvement of community stakeholders is particularly relevant in the case of small-scale NBS such as community gardens. While much attention is focused on the financing requirements of large-scale NBS projects which hold the most potential for transformative environmental change at landscape-level, less attention is often given to the financing of small-scale NBS projects which hold significant potential for generating social benefits such as health and wellbeing. Research has shown that in Europe a large number of urban NBS projects are small-scale, requiring investment of less than €2m (Dushkova & Haase, 2020).

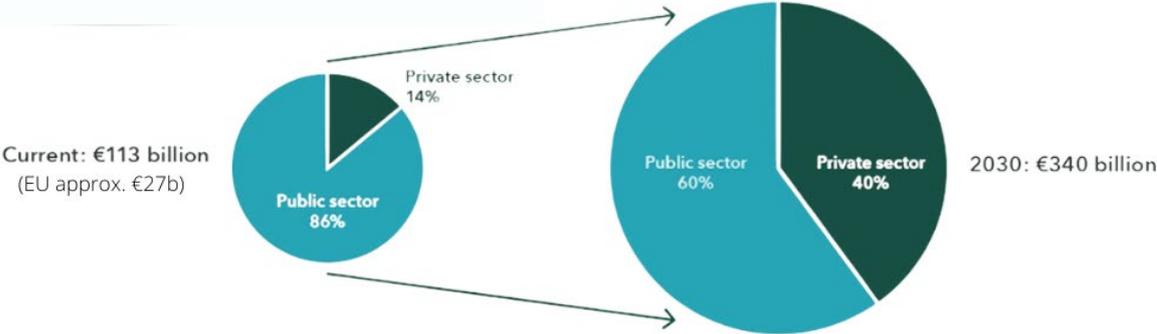


Figure 5 Investment in nature (adapted from UNEP State of Finance for Nature, 2021)

The dependency of businesses on nature is sometimes not clear due to many factors including the complexity of value chains which may distance some manufacturing sectors from the raw materials on which they depend. In the service and digital economy, this connection is even less obvious. However according to the first New Nature Economy report from the World Economic Forum, businesses are highly dependent on nature and biodiversity, “with approximately \$44 trillion of economic value generation - over half the

world's total GDP - moderately or highly dependent on nature and its services, and, as a result, exposed to risks from nature loss". The Natural Capital and Circular Economy movements are increasingly raising awareness among the business community of the need to understand the importance of valuing natural capital and reducing resource usage. Nature-based solutions complement these approaches by regenerating and restoring natural resources.

Barriers to NBS investment

In order to increase investment in NBS to meet demand we need to understand limitations to current levels of investment. A myriad of reasons has been well explored in literature which can be summarised as follows (Seddon et al., 2020; Toxopeus and Polzin, 2021; Mayor et al., 2021):

- Valuation of NBS: Many NBS are considered as 'public goods' or 'common pool resources' (Ostrom, 1990). Consider for example the value created by urban parks, it is difficult to charge for such NBS and difficult to exclude anyone who doesn't pay to benefit from some of the value generated e.g., the National Trust in the UK may charge an entry fee to some parks but wider society still benefits from diverse benefits such as increased air quality and biodiversity, carbon capture etc. An increasing body of research is responding to this dilemma proposing diverse methods of ecosystem valuation and measures to address market failures (Crocchi and Lucchitta, 2022). Another key challenge is the difficulty in valuing social or health benefits or even some environmental benefits that are less easy to measure. The difficulty in capturing value is one of the reasons why investing in NBS is less attractive to the private sector (for more details see McQuaid et al., 2021a)
- Knowledge gap on implementation, finance, and effectiveness of NBS
 - Effectiveness of NBS depends greatly on local climatic conditions which are also changing due to climate change,
 - Tried and tested grey infrastructure which can offer a more well-established cost-benefit analysis and routes for financing,
 - Knowledge and data gaps regarding appropriate and effective monitoring of NBS projects to evidence their proposed benefits.
- Sustained pressure on public sector funding of NBS:
 - Lack of investment in climate mitigation / preventive measures (vs post-disaster spending),
 - NBS compete for public funding with other projects. Lack of NBS indicators to secure support.
- Mismatch between NBS investment needs and institutional investor demands
 - Lack of scale, convincing cash flows and return on investment potential (for example 'public good' NBS projects); standardised NBS impact indicators missing
- Large-scale NBS infrastructure projects are typically more expensive up-front than grey infrastructure equivalents, but they become cost-effective in the long-term and also when the multiple benefits generated are considered. Measuring benefits and co-funding across multiple beneficiaries is challenging
 - Investment is often focused on one benefit; coordination requires complex co-governance (and shared indicators for decision-making)
- Maintenance and monitoring of NBS more complex than grey infrastructure
 - Stakeholders hesitate to take long-term costs into budget, although NBS appreciate rather than depreciate over time
- Urban NBS competing for increasingly expensive urban space with building development
 - Financial markets / low interest rates; high demand for living in cities

Many of these historic challenges are now being addressed with the results of pilots and demonstration projects providing an increasing evidence base on the effectiveness of NBS. Guidelines and tools to support impact measurement, cost-benefit analysis, business model development and financing are increasingly available (Mayor et al., 2021).

Emerging innovative financial vehicles such as green bonds and the development of European equivalents of Natural Asset Companies (NAC) (being launched in the US), along with the growing weight of Environment, Social and Governance (ESG) investment in private capital markets, carry the potential to scale support to the nature-positive economy. Cross sectoral and interdisciplinary collaboration will be needed to establish standards, reduce risk, and provide confidence to investors.

Case study: Green buildings market sector and value chain in Austria

The environmental and social benefits of NBS are already being recognised as effective measures to combat climate change in urban regions. However, the value in terms of jobs, innovations, and the economic contribution is not so well known, even by the industry itself.

Based on our GREEN MARKET REPORT for Austria we know today that the direct value chain of greening buildings includes 550 companies and 1200 jobs. The sector is quite young and has great potential to grow. 38% of companies were founded in the past 10 years. If every other newly constructed building is fitted with a green roof we would generate 33.000 new green jobs in Austria. Currently, mainly small and medium-sized companies are active in this country along the entire value chain, from technology

development and planning to the manufacture of components, execution and maintenance. The industry is also characterised by a high degree of innovation.

The NBS sector provides value as well as innovations for other sectors of construction, circular economy, additive manufacturing, digitalisation etc, for example, solar green roofs in which the cooling effect of the plants boosts the performance of photovoltaics, or the use and purification of grey and service water on roofs. Our innovation lab GRÜNSTATTTGRAU is a holistic competence centre for greening buildings.

The multiple benefits of this nature-based asset can only be realised when a long-term strategy is put in place. High quality execution of green infrastructure is very important. For this reason, we have developed standards and a new qualifications program in Austria, which include maintenance concepts. Our Biodiversity Strategy Austria 2020+ aims to conserve biodiversity, to stem the loss of species, genetic diversity and habitats and to minimise the causes of threats based on the international objectives set out in the Convention on Biological Diversity and on those of the European Union. A different financial approach or perspective is needed for climate change measures such as greening buildings. Our program



Susanne Formanek is managing director of the innovation laboratory GRÜNSTATTTGRAU (Austria), and president of IBO, the Austrian Institute for Building Biology and Ecology.

Green Finance 2021 by the “Klima und Energiefonds” supports companies and municipalities/cities in carrying out a profitability calculation for planned projects. Innovative solutions and technologies from Austria thus quickly find their way into the domestic and often also international market.

Source: Kindly reproduced from [TNO Roundtable on the Nature-based Economy](#) as part of the consultation process.

2.1.3 Supply of NBS

Much of the research on NBS to date has focused on the public sector as a lead stakeholder - from the perspective of demand and from the perspective of supply. In comparison, significantly less research has looked at the role of the private sector in the implementation of NBS. In this section, we provide a contextual overview of supply side issues in the public sector before presenting findings from recent studies of organisations in the private sector who play an important role in the supply of NBS.

Public sector

Historically public sector organisations have played a lead role in the direct financing and implementation of NBS (Sekulova and Anguelovski, 2017) and they continue to play a crucial role today (UNEP, 2021). Collaborative governance approaches, where public sector organisations play an initiating role in bringing other actors together, have been identified as a key success factor for NBS (Frantzeskaki, 2019). The **challenges of public sector organisations in implementing NBS** are well known (Kabisch et al., 2016, Seddon et al., 2020) and are summarised as follows:

- **Skills and knowledge gaps:** as the public sector have historically been responsible for management of natural resources and urban spaces, they have built up large public sector staff resources with expertise in this field. However, NBS are complex, and constructive processes for their design as well as uptake tend to require transformative change guided by multidisciplinary skill sets. In the presence of established corporatist structures, such processes are regularly resisted by incumbent actors and competencies (Andersson et al., 2009). Meanwhile, public sector budget shortages and recruitment freezes have limited the opportunity for many public sector organisations to recruit NBS specialists. When the lack of inhouse capacity is combined with public procurement challenges inhibiting the engagement of external expertise, this knowledge block leads to an increased risk of a negative outcomes cycle. Sub-optimal implementation of NBS will lead to limited effectiveness of NBS which in turn will lead to lack of support for further investment.
- **Measuring effectiveness:** to date a lack of knowledge and skills on how to measure the effectiveness of NBS has been a major challenge increasing the perception of higher risks related to NBS and hampering larger scale implementation. The recent publication of an EC Handbook on Indicators (Wending and Dumitru, 2021) will help to address this issue but will need to be accompanied by technical support tools, on the ground training and skills development measures.
- **Long term sustainability and governance models:** much of the focus of public sector attention to date has been on securing financing for up-front investment in NBS and not on the development of long-term business models for NBS built on principles of co-governance. Inclusive governance is enshrined as one of the fundamental criteria

of the IUCN Global Standard for NBS, but Connecting Nature resources³¹ shows considerable knowledge gaps remain in cities as regards the development of inclusive governance models engaging citizens and local businesses in the planning and stewardship of NBS.

- **Poorly suited processes:** many processes in the public sector have been designed for conventional 'grey' infrastructure solutions and are not well suited to the implementation of NBS. This is particularly evident in reports on the inadequacy of public procurement processes which are not well suited to the complexity of NBS.
- **Market failures - difficulty finding external suppliers:** while inadequate public procurement processes are often cited as a reason for the difficulty in finding external suppliers, the reality may be more complex. NBS is a new area experiencing rapidly growing demand. Little effort has been invested to date in understanding or cultivating the supply of solutions from the private sector and networks of investors are missing. As a result, there is a shortage of supply in general with many nature-based enterprises reporting significant increases in demand. As NBS are context specific i.e., they need to be designed taking into account local needs and maintained, usually by local suppliers, urgent measures are required at local government level to stimulate the emergence of skilled suppliers to meet future increases in demand. Coordination of skill and capacity development support policies and programmes is needed at national and EU level.

Private sector and third sector suppliers: Nature-based enterprises

Research by Kooijman et al. (2021)³² found that NBS are delivered by different types of organisations, including enterprises. Nature-based enterprises are for-profit or non-profit companies, organisations or initiatives engaged in economic activity that contribute to the development and delivery of NBS. Nature-based enterprises may use nature either directly, or indirectly. Nature may be used directly by growing, harnessing, harvesting, or restoring natural resources in a sustainable way and/or indirectly by contributing to the planning, delivery, or stewardship of sustainable NBS.

Characteristics of nature-based enterprises

- **Size:** Most nature-based enterprises fit the EC classification of a micro-enterprise³³. In comparison with the EU average where 93% of SMEs are micro and 5% are small, research findings show that 76% of these types of enterprises fall into the category of micro and 21% into the category of small enterprises.
- **Age and stage of development:** Nature-based enterprises are not a new phenomenon with research indicating that a number of nature-based enterprises have been active for more than 20 years. It is evident however that the number of new enterprises starting up in this sector is increasing significantly in recent years. Most

³¹ Governance Guidebook for NBS <https://connectingnature.eu/innovations/governance>

³² The aim of the study by Kooijman et al. (2021) was to identify private sector agents involved in the delivery of NBS. Based on the evaluation of 174 data points from a systematic review of academic literature (26) and an enterprise survey (148), a typology of organisations delivering NBS and a categorisation of their economic activities was proposed. A follow up study (McQuaid et al, 2021b) aimed at better understanding characteristics, barriers and enablers drew on additional survey data (148 enterprises) and follow up interviews with 22 founders of nature-based enterprises.

³³ According to the definition of the European Commission (2015): micro enterprises have < 10 full-time employees and an annual turnover of < 2 million Euro, small enterprises have <50 full-time employees and an annual turnover of <10 million Euro, medium enterprises have <250 full-time employees and an annual turnover of <50 million Euro.

nature-based enterprises identify themselves as in a growth stage of development indicating potential for further development.

- **For Profit / Not-for-profit status:** Most enterprises indicated to be either for profit (40%) or hybrid (44%) as opposed to non-profit (16%).
- **Mission orientation:** most nature-based enterprises are strongly motivated by environmental or societal goals. Economic objectives are recognised as important in order to increase greater environmental or social impact.

11 categories of economic activities were identified, ranging from ecosystem restoration, living green roofs, and eco-tourism to smart technologies and community engagement for NBS (Table 2). In these activities, nature is used directly or indirectly. These specific sectors of activities are discussed in section 2.2.

Challenges and enablers faced by nature-based enterprises

Nature-based enterprises identify political and regulatory factors as the most significant external factors influencing demand for NBS. These, and other factors, are summarised below and in Figure 6 (McQuaid et al., 2021b)³⁴:

- **Political, Legal / Regulatory factors**
 - Consistent policies: The lack of consistency in public policies towards Nature-Based Solutions. For example, while Nature-Based Solutions may be endorsed in climate policy, in other policy areas such as planning, building regulations or public procurement, regulations and processes often hindered implementation. In general there is a lack of tailored strategies towards NBS take-up.
 - Public procurement: Another common barrier was that public procurement processes for NBS were not well suited to smaller nature-based enterprises.
 - Standards: Nature-based enterprises identify that in the absence of standards, the quality of NBS implementation may sometimes be variable. Given the early stage of development of NBS, poor quality implementation may lead to wider reputational damage and inhibit future uptake. Nature-based enterprises recognised the need to raise awareness of best practice and introduce regulations and/or standards related to the delivery of Nature-Based Solutions. Such measures need to be supported by capacity building to address knowledge deficits.
- **Economic factors**
 - Policies to stimulate demand: Nature-based enterprises considered that in the public sector there was a lack of funding/support for NBS and in the private sector a lack of regulation/incentive to stimulate take-up of NBS.
 - Economic instruments: Subsidies or fees were found to have an important positive impact on market development and private sector investment in NBS.
 - Strong partnerships or networks: Networking was seen as important to get in contact with stakeholders and potential new clients (business networks), but also to find partners for projects and funding, to pool competences and share experience (innovation networks). Many nature-based enterprises co-operate with research

³⁴ Drawing on the review of literature, data from the enterprise survey (182 respondents, 148 included), and interviews with founders/CEOs of nature-based enterprises (22 respondents), McQuaid et al., 2021b categorise the resulting data using 'PESTEL' (i.e., political, economic, social, technological, environmental, legal). This framework is a widely accepted framework for analysing external factors affecting firms in the business strategy literature.

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

institutions. Universities and other research and development actors are seen as a knowledge base for innovation.

- Awareness and detailed understanding: nature-based enterprises noted an increased general awareness of NBS concept among potential buyers in the public and private sector but pointed to a lack of detailed understanding, in particular as regards the cost structure of NBS and the need to budget for long term maintenance costs.
- **Social**
 - General awareness: Increased levels of public awareness of environmental issues and the availability of education, skills, and training for nature-based enterprises.
- **Technical / Technological**
 - Lack of evidence of the effectiveness of NBS: This remains a major stumbling block which is compounded by a lack of knowledge on how to measure the multiple impacts of NBS.
 - Access to platforms: Access to independent platforms in order to organise knowledge and join forces was rated as very valuable to nature-based enterprises. Some companies are already part of accelerator programs. The [Connecting Nature Enterprise Platform](#)³⁵ was mentioned as a useful awareness raising platform by those enterprises involved.

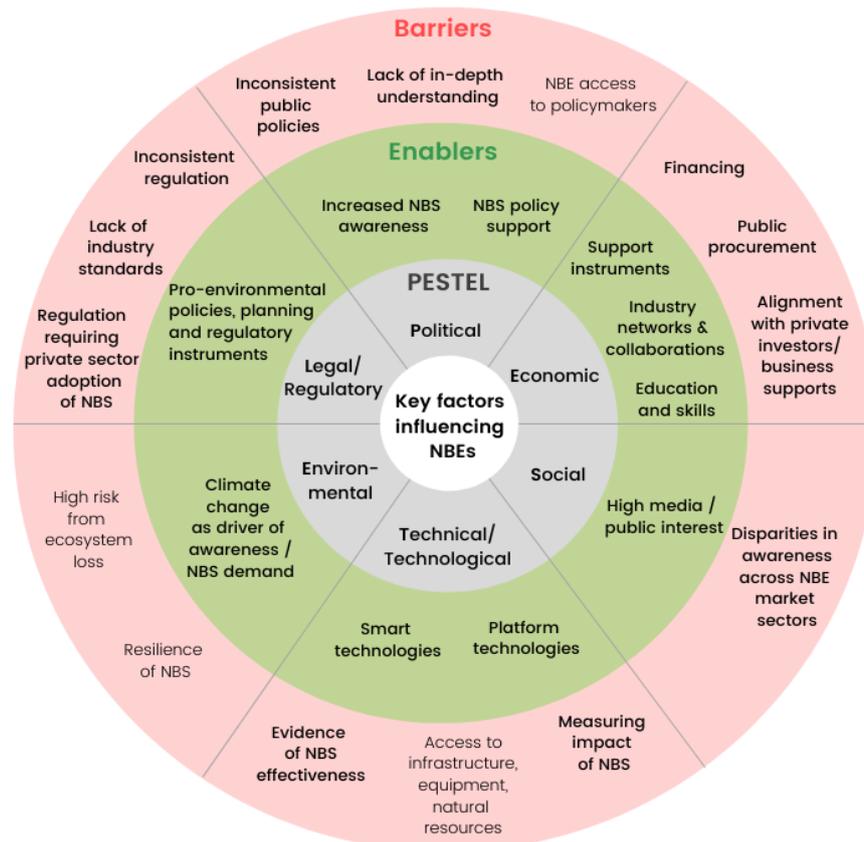


Figure 6 Key factors influencing Nature-Based Enterprises. Influencing factors highlighted in bold were identified in the literature, surveys, and interviews. (McQuaid et al., 2021b)

Next to external factors, nature-based enterprises are also faced by organisational challenges. The main challenges (Kooijman & McQuaid, *forthcoming*) are:

³⁵ <https://www.naturebasedenterprise.eu/> The Connecting Nature Enterprise Platforms connects 2000+ practitioners across NBS sectors to exchange knowledge, improve best practice and support business development

- **Financing:** High working capital requirements were identified as a challenge in some industry sectors (e.g., forestry) where capital could be tied up for years. In other industry sectors, the funding needs of nature-based enterprises could be considered as volatile based on the project-by-project nature of many NBS contracts. A lack of trust in financial institutions and impact investors was found. Nature-based enterprises refer to the concerns about the compatibility of their environmental mission with the economic growth criteria required for existing grant financing and for conventional investors.
- **Knowledge and skills:** Nature-based enterprises identify that local suppliers play a vital role in the delivery of NBS given the spatial and context-specific nature of NBS. They point to widespread knowledge gaps and skill shortages at a local level. Other skills gaps found were the lack of multidisciplinary skill sets, business development, financing and scaling knowledge, technology skills and skills in measuring impact. In general, nature-based enterprises expressed a strong interest in, and need for, continual professional development. They recognised rapid advances in knowledge in some cases linked to increased investment in NBS research. Overall, nature-based enterprises rated access to education, training and skills development as highly important.

2.1.4 *Key actors in NBS value chains*

Generally, NBS are complex, and relationships cannot be only defined in terms of 'buyer-supplier' relationships between the public and private sector or between the private sector and consumers. The implementation of NBS involves an interconnected web of value-chain actors. The actors involved may differ depending on the type of NBS, level of maturity and phase of development. The boundaries between demand and supply may also overlap. End-users such as communities and businesses may also be suppliers of services (e.g., volunteers supplying maintenance or monitoring services) and suppliers of financing (e.g., through crowd-funding or corporate sponsorship). In understanding demand, NBS suppliers need to involve end-users at early planning stages to establish user needs. This co-production process involving multiple stakeholders may be compared to an open innovation process involving the wider innovation ecosystem and opening up potential for new innovations.

The ARTISAN Project funded by the EU LIFE programme and coordinated by the French Agency for Biodiversity (OFB) undertook a study of the value chains involved in NBS implementation in five different NBS fields: NBS for urban planning (buildings, neighbourhoods, natural parks, and water management), water management, sustainable agriculture, forestry (sustainable management, afforestation and existing ecosystems conservation) and sustainable tourism.

This study led by l'ADEME with LGI Sustainable Innovation and EcoAct, identified a broad range of stakeholders involved across the different phases of design, implementation and operation or stewardship of NBS. Value chains were invariably complex showing different stakeholders involved in different types of NBS and multiple interactions between stakeholders across all value chains.

The ARTISAN study identified a key role for communities/consumers in the design phase of many of the NBS exemplars and there is evidence that private producers can play a key role in NBS implementation – particularly in agriculture and forestry. The complexity of NBS in comparison to conventional economic models depicting linear flows between firms and households is demonstrated across all value chains and illustrated in the case study below supported by Figure 7 and 8.

Case study of NBS value chain in the sustainable agriculture sector: Fermes de Figeac

Fermes de Figeac is a cooperative in the Ségala Limargue area in central France. The cooperative works on creating a high environmental value for farmers in the area, by developing initiatives for and with farmers and providing them with financial support, networking, and transfer of knowledge. Activities ranges from practical adaptation to climate change, reduction of greenhouse gas emissions, preservation of resources, biodiversity, and landscapes, as well as the creation of local value chains

Founded in 1985, Fermes de Figeac’s economic model has changed throughout the years. It is now a SAS, a French simplified joint-stock company. The model is based on the contribution and funding of various stakeholders (See Figure 7 and 8). The projects they support are mostly endorsed and co-financed by multiple partners, mainly public bodies.

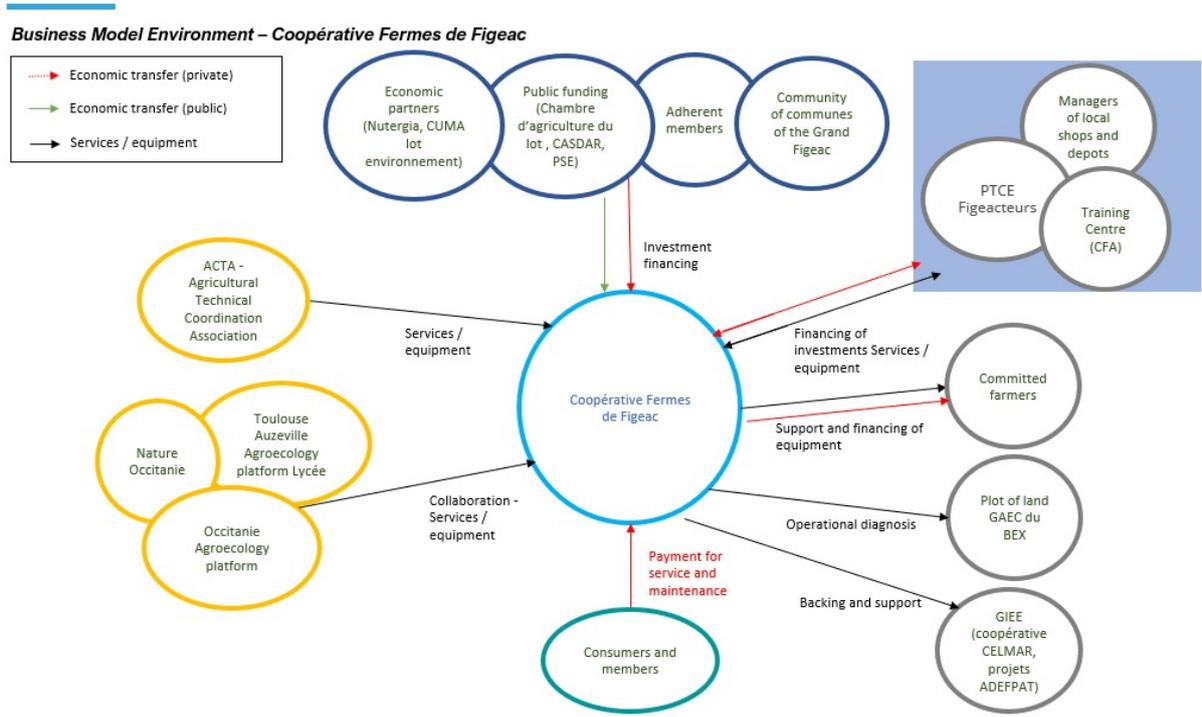
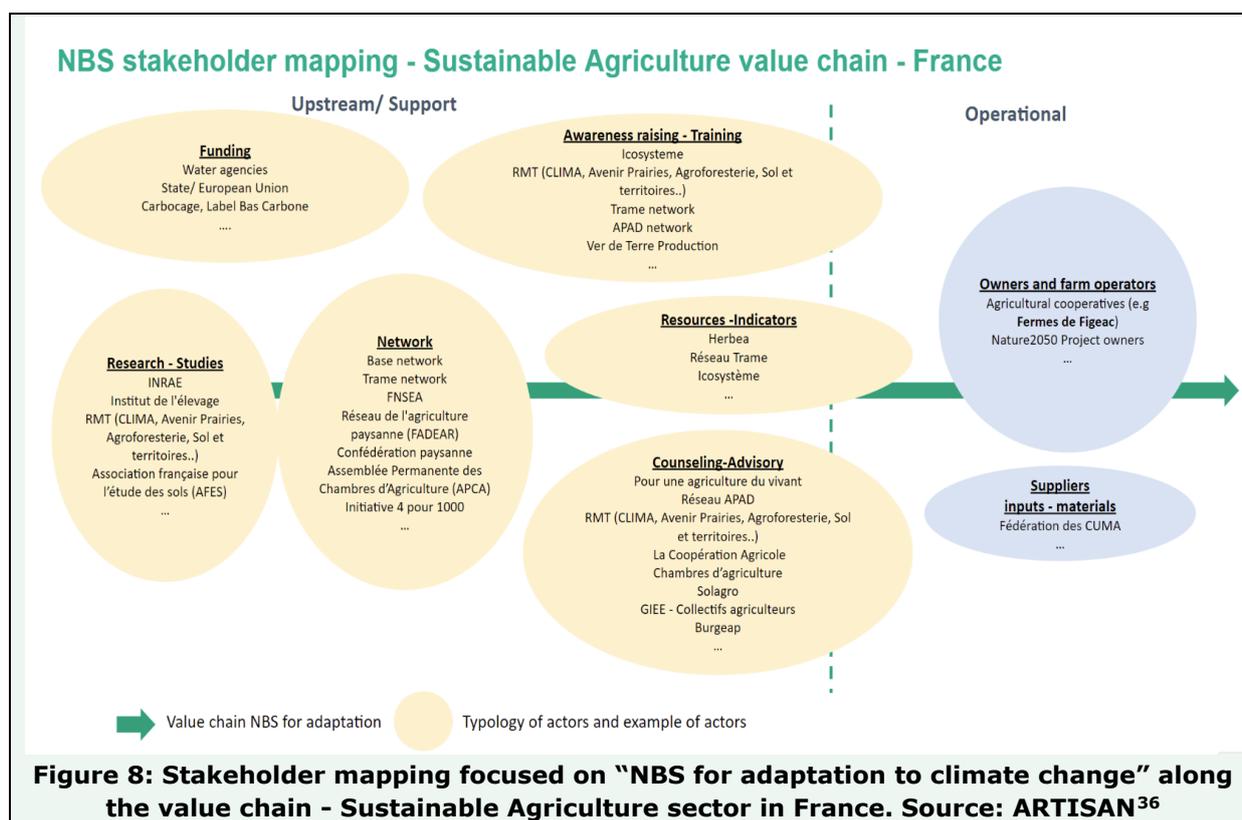


Figure 7: Business model environment for Fermes de Figeac, with economic interactions among actors. Source: ARTISAN³⁶



2.2 Specific market sectors

Some NBS-market sectors have been present in the market for many years. These established NBS-market sectors include green buildings, water management, landscape architecture, urban and environmental planning, sustainable forestry, and sustainable agriculture. Research has identified 11 economic sectors where the private sector are key actors in the supply of NBS (Table 2 and section 2.2.1-10). These sectors are either directly ‘using’ nature sustainably as part of their product/service offering, for example living green roofs, or indirectly, for example by contributing to the design or monitoring of a green roof. In NACE³⁷, the European classification for industry activities, the essential aspect of environmental sustainability of these nature-based economic activities is not addressed (Kooijman et al., 2021).

The EU Sustainable Finance Taxonomy is “a tool to help investors, companies, issuers and project promoters navigate the transition to a low-carbon, resilient and resource-efficient economy” (EU TEG on Sustainable Finance, 2020a, p.2). The taxonomy sets performance thresholds for economic activities within the NACE classification which 1) make a substantial contribution to one or more of the six environmental objectives (climate change mitigation (CCM) and adaptation (CCA), sustainable and protection of water and marine resources (W), transition to a circular economy (CE), pollution prevention and control (P), protection and restoration of biodiversity and ecosystems (ES), 2) do no significant harm to the other five, where relevant, and 3) meet minimum safeguards (e.g., OECD Guidelines on Multinational Enterprises and the UN Guiding Principles on Business and Human Rights).

This 1st Delegated Act of the EU Sustainable Finance Taxonomy (European Commission, 2021)³⁸ concentrated at economic activities under NACE that potentially have substantial

³⁶ ARTISAN LIFE funded project. Link :

https://webgate.ec.europa.eu/life/publicWebsite/index.cfm?fuseaction=search.dspPage&n_proj_id=7406

³⁷ Statistical Classification of Economic Activities in the European Community (NACE) by the European Commission (2008)

³⁸ [EUR-Lex - 32021R2139 - EN - EUR-Lex \(europa.eu\)](#)

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

contributions to climate change mitigation and adaptation, and therefore focused on sectors with the highest contribution to CO2 emissions (energy, manufacturing, transport, buildings), as well as activities enabling their transformation. It covers roughly 40% of listed companies, in sectors which are responsible for almost 80% of direct greenhouse gas emissions in Europe. Although Nature-Based Solutions can contribute to climate change mitigation and adaptation, goals are often broader than this and it can make a significant contribution in the protection and restoration of biodiversity of ecosystems. For this, additional NACE codes to cover activities related to 'natural capital preservation, restoration and creation and related services' additional NACE codes will need to be added (EU TEG on Sustainable Finance, 2020a;b). Furthermore, the Taxonomy did not yet consider the contributions of activities to the other four environmental objectives: sustainable and protection of water and marine resources, transition to a circular economy, pollution prevention and control, or protection and restoration of biodiversity and ecosystems. The EU Sustainable Finance Taxonomy will develop over time, and further delegated acts, or revisions of existing ones, will likely include other economic activities from different sectors and sub-sectors of the economy. In the 2nd Delegated Act - to be published in 2022 - the contributions of activities to the other four environmental objectives will be included. For this, the Platform on Sustainable Finance has issued recommendations on technical screening criteria for these four remaining environmental objectives of the Taxonomy (European Union Platform on Sustainable Finance, 2022a;b).

In Table 2, the categories of economic activity where private sector actors are delivering NBS (Kooijman et al., 2021), mapped against the 1st Delegated Act of the EU Sustainable Finance Taxonomy (European Commission, 2021) that includes NACE macro sectors and their contribution to climate change mitigation (CCM) and adaptation (CCA), and 'do not significantly harm' sustainable use and protection of water and marine resources (W), transition to a circular economy (CE), pollution prevention and control (P), protection and restoration of biodiversity and ecosystems (ES).

Table 2 categories of economic activity where private sector actors are delivering NBS (Kooijman et al., 2021), mapped against the 1st Delegated Act of the EU Sustainable Finance Taxonomy (European Commission, 2021).

NBS Economic Activities		EU Sustainable Finance Taxonomy						
Economic category	Sub-categories	Closest NACE macro sectors	Contribution to:		'Do not significantly harm':			
			CCM	CCA	W	CE	P	ES
			Ecosystem creation, restoration and management	Ecological & landscape restoration Ecosystem conservation and management Biodiversity conservation Reforestation Marine and freshwater ecosystem conservation and management	<i>No dedicated NACE code, but 'Environmental protection and restoration activities (Restoration of wetlands)' is included in the Taxonomy</i>	X	X	X
NBS for green buildings	Living green roofs and façades Living green wall indoor Living green walls outdoor	Construction and real estate activities (Construction of new buildings, Renovation of existing buildings)	X	X	X	X	X	X

NBS Economic Activities		EU Sustainable Finance Taxonomy						
Economic category	Sub-categories	Closest NACE macro sectors	Contribution to:		'Do not significantly harm':			
			CCM	CCA	W	CE	P	ES
			NBS for public and urban spaces	Green areas, parks and gardens Green infrastructure Green space management Urban forestry Urban regeneration projects	Professional, scientific and technical activities (Engineering activities and related technical consultancy dedicated to adaptation to climate change)		X	X
NBS for water management and treatment	Natural flood & surface water management Urban green and blue infrastructure Urban water management Wastewater management	Water supply; sewerage; waste management and remediation activities	X	X	X		X	X
Sustainable agriculture & food production	Agroforestry Beekeeping Horticulture Plant and soil improvement Regenerative farming	<i>Not included in the Taxonomy. The EU TEG on Sustainable Finance (2020 a;b) did include activities on 'Agriculture, forestry and fishing (Growing of perennial crops, Growing of non-perennial crops, Livestock production)', but these do not reflect the activities mentioned on the left.</i>						
Sustainable forestry and biomaterials	Sustainable forestry Biomaterials for construction Biomaterials for food preservation	Forestry (Afforestation, Rehabilitation & Restoration, Forest management, Conservation forestry)	X	X	X	X	X	X
Sustainable tourism and health & wellbeing	NBS for health & wellbeing Agritourism Eco-tourism and nature-based tourism Forestry tourism	Human health and social work (Residential care activities)		X				
Advisory services	Biodiversity and ecosystems Urban greening design & planning Landscape architecture Water management Community engagement for NBS	Professional, scientific and technical activities (Engineering activities and related technical consultancy dedicated to adaptation to climate change)		X	X			
Education, research & innovation activities	Ecological research Environmental awareness & education Research & innovation projects Vocational & skills training	Education Professional, scientific and technical activities (Close to market research, development and innovation, Research, development and innovation for direct air capture of CO2)	X	X	X	X	X	X
Financial services	Carbon offsetting ³⁹ Investment for biodiversity and conservation Natural capital accounting	Financial and insurance activities (Non-life insurance: underwriting of climate-related perils, Reinsurance)		X				

³⁹ Nature-Based Solutions (NBS) credits and similar should not be used to offset activities resulting in high GHGs emissions which would be written down or balanced through NBS credits. It should be

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

NBS Economic Activities		EU Sustainable Finance Taxonomy							
Economic category	Sub-categories	Closest NACE macro sectors	Contribution to:		'Do not significantly harm':				
			CCM	CCA	W	CE	P	ES	
			Smart technology, monitoring and assessment of NBS	Smart technology solutions for NBS Environmental monitoring Spatial tools for environment	Information and communication (Data-driven solutions for GHG emission reductions, Computer programming, consultancy and related activities)	X	X		

Connecting fragmented market sectors

Given the novelty of the nature-based enterprise concept, research (McQuaid et al., 2021) indicated the need to connect actors within and across NBS economic activities to raise awareness, support the sharing of good practice and stimulate inter-sectoral exchange and innovation. The [Connecting Nature Enterprise Platform](#) was set up in 2020 to connect different stakeholders across complex NBS value chains. At the core of the platform are communities of practice led by industry ambassadors who are innovation leaders in different market sectors. These market sectors were taken from the research by Kooijman et al. (2021).

Case study: 'Connecting Nature Enterprise Platform'

The Connecting Nature Enterprise Platform (CNEP) was launched in October 2020 as a direct response to addressing a significant bottleneck where cities and developers seeking to implement NBS voiced their difficulty in finding and sourcing skilled suppliers of NBS. Developed as a marketplace to match buyers and suppliers of NBS, the Platform has developed into ten communities of practice where nature-based enterprises and other organisations operating in the same sectors meet informally, network, exchange best practice and collaborate.

Another goal of the platform is to share knowledge and relevant research outcomes on nature-based economic activities. CNEP provides a communication channel to address practitioners implementing NBS in the public, third and especially the private sector, and policymakers. These audiences are mainly addressed through the organisation of online events.

clear that NBS are an additional tool, and the use of it should be beneficial to both climate and the environment, while the bulk of GHG reduction shall continue to come from dedicated climate, energy, and transport measures.



"Thanks to the Platform we connected with another NBE, BIOTONOMY, and together with them, we will be designing and building the first hydroponic vertical garden system in Malaga, Spain. This system will reuse and treat the greywater of a hotel in the city centre." (Gerardo Gonzalez, Bioazul NBE)

Source: [Connecting Nature](#), Horizon 2020 project

In the following section we present an update from the industry ambassadors of the Connecting Nature Enterprise Platform on the status of market development in their sectors. The sectors 'Financial services' and 'Education, research & innovation activities' are not yet represented on this platform and not included in the section below. For the sector on 'Ecosystem creation, restoration and management', which is also not represented on the platform, a description of marine ecosystem restoration prepared by H2020 projects FutureMARES and MERCES is included.

2.2.1 Ecosystem creation, restoration and management: Marine ecosystem restoration

Lead contributor: Wenting Chen ([NIVA](#)), H2020 projects FutureMARES and MERCES

UN Decade on Ecosystem Restoration (2021-2030) calls for actions to accelerate the global restoration of degraded ecosystems and coincides with the UN Decade of Ocean Science for Sustainable Development (Chen et al., 2020). Ecosystem restoration practices are regarded as an important nature-based solution to combat hazards induced by climate change (European Commission, 2020), to improve marine ecosystem and natural capital assets (Gordon et al., 2020) and associated ecosystem services and values (Aronson et al., 2020).

Impact of nature-based enterprises/NBS on the market

Marine ecosystem restoration experiments have been carried out across the European seas, for example in the H2020 projects FutureMARES and MERCES. This type of restoration is still at the experimental stage, and upscaling of marine ecosystem restoration activities is needed to achieve broad and long-term environmental and social benefits. Restoration costs are generally high. However, recent studies have shown that the socioeconomic benefits could outweigh the restoration costs for coastal and marine ecosystem restoration, such as deep-sea ecosystem restoration (Chen et al., 2020,

Bayraktarov et al., 2020), kelp forest ecosystem restoration (Hynes et al., 2021, Gregr et al., 2020) and oyster reef restoration (Hynes et al., 2022). A pan European study carried out by the H2020 MERCES project showed generally high social acceptance for marine ecosystem restoration activities. In the ongoing H2020 FutureMARES project, socially and economically viable marine ecosystem restoration are explored for climate change adaptation and mitigation. As these activities generate both market and non-market benefits, it is important to identify and support the mechanisms that facilitate integration of non-market benefits in the decision making and spatial planning for both the public and private sector.

Case study “Kelp forest restoration in Norway”

Kelp forest habitats have deteriorated along the Norwegian coasts since the 1970s (Chen et al., 2020). Urchin barrens - caused by sea urchin overgrazing - now dominate the Northern coast. In contrast to urchin barrens, kelp forests provide rich ecosystem services (Hynes et al. 2021, Krumhansl and Scheibling, 2012). Kelp forests are underwater habitats that contribute to coastal ecosystem production, biodiversity, and functioning (Filbee-Dexter and Wernberg, 2018). They provide food and shelter for various marine species, and generate direct value through kelp harvesting, commercial and recreational fishing, and tourism activities. They also provide supporting and regulating ecosystem services such as carbon sinks and taking up extra nutrients in the water.



Figure 9 Kelp forest in Norway (Photo: Hartvig Christie NIVA)

Kelp forests are underwater habitats that contribute to coastal ecosystem production, biodiversity, and functioning (Filbee-Dexter and Wernberg, 2018). They provide food and shelter for various marine species, and generate direct value through kelp harvesting, commercial and recreational fishing, and tourism activities. They also provide supporting and regulating ecosystem services such as carbon sinks and taking up extra nutrients in the water.

Restoring coastal habitats such as kelp forest can bring social and environmental benefits and contribute to the long-term sustainability of coastal areas. Three restoration methods are proposed: transplantation of kelp from donor sites to restoration sites; removal of sea urchins (e.g., by harvesting, or culling using lime treatments); and using artificial reefs to restore the kelp population.

As part of the H2020 MERCES project, willingness to pay for effective restoration of Norwegian kelp habitats is estimated. The willingness to pay (WTP) for a full restoration with 40,000 m² amounted to €70.7 per capita. WTP for a medium restoration with 20,000 m² amounted to €59.1 per capita (Hynes et al., 2021). Local research institutes have been collaborating with local businesses who are interested in harvesting wild sea urchins, and NGOs who are interested in alternative funding models for kelp

restoration. Multiple kelp restoration experiments have been funded by local business and NGOs.

Source: MERCES⁴⁰ and FutureMARES⁴¹ Horizon 2020 projects

Sector specific challenges/enablers

The challenges and enablers are summarised based on H2020 MERCES Deliverable 7.5 (Chen et al., 2021). The main barriers for the sustainable marine ecosystem restoration investments are:

- Fragmented and short-term funding are the main challenges facing marine restoration activities. Public funding is the main funding source. Involvement of private and institutional investors are still limited.
- Initial investment costs are high and the areas requiring restoration are large. Poorly defined property rights, large uncertainties associated with restoration success, and long timescales for ecosystem improvements have hindered cashing out the returns from marine restoration investments by private investors.

The main enablers / supporting factors for the sustainable marine ecosystem restoration investments are:

- High social acceptance and broad support for marine restoration activities.
- Marine ecosystem restoration activities have been regarded as having high environmental and social benefits, and worth investing in.

2.2.2 NBS for green buildings

Lead contributor: Jonathan Müller ([Helix Pflanzensysteme](#)), Ambassador for Green Buildings community on Connecting Nature Enterprise Platform (531 members)

In dense urban areas there is often a lack of open space and green areas, leading to pollution, temperature increase (i.e., the urban heat island effect), and poor biodiversity. This is a threat to the health and wellbeing of citizens. Nature-based solutions in the urban environment, including on buildings, tackle this through using the ecosystem services provided by vegetation.

The NBS sector for Green Buildings consists of living green roofs, façades and walls and interior greening. All aspects of a building and vegetation are covered by this sector. Actors are mostly SMEs in the landscaping industry although there are some large players too. Other actors in the value chain include planners (public and private) and supporting industry players such as architects. Highly specialised gardeners and horticultural experts are needed to maintain and cultivate living walls, roofs, or green infrastructure solutions and to define and plan requirements for indoor and outdoor spaces.

Impact of nature-based enterprises/NBS on the market

The green building sector is one of the more mature NBS sectors in some European countries. The European Federation of Green Roofs and Walls consist of national associations from 14 countries. Already in 2014, in six European countries, 11.25 million

⁴⁰For more information on MERCES visit <http://www.merces-project.eu/>

⁴¹ For more information on Future MARES visit <https://www.futuremares.eu/>

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

m2 of green roofs were built with an estimated value of about €382 million. This growth has led to job opportunities in the industry, as well as in supporting activities such as education and training, research and development, and consulting (BuGG, 2021). In some countries, such as Germany and Austria, extensive market research has been undertaken and a business support ecosystem has been put in place. For example, in Germany, the market for green roofs grew by 100% between 2008-2019. About 84% of these green roofs were categorised as extensively greened (large areas with little substrate and lower biodiversity impact) in contrast to intensively greened (smaller areas with more substrate and higher biodiversity impact). While intensive green roofs in most cases are better for biodiversity, they are less popular as they are more expensive to maintain and can present structural challenges. There is more demand for biodiversity on visible facades than on green roofs which are often extensively greened as a 'quick fix' to meet council regulations. In 2019, approximately 20,000 - 55,000 m² of wall-bound and ground-bound façade greening (with climbing aids) was installed in Germany (BuGG, 2021). In the Czech Republic, the area of green roofs increased by more than 25% in 2018 with a parallel increase in industry turnover (European Federation of Green Roofs and Walls, 2019). In Austria, significant market growth is also foreseen - the current green roofs and walls industry consists of 550 companies with 1.200 employees in the direct value chain with a turnover of €90,5 million in 2018. The compound annual growth rate for the green roof sector in Austria between 2014 and 2018 was 9% (GRÜNSTATTGRAU, 2020).

On the Connecting Nature Enterprise Platform, the activities of organisations active in this sector include living green roofs and façades, living green walls, interior greening, and green buildings management. There is an overlap with other NBS sectors 'NBS for public and urban spaces', 'Smart Technologies', and 'Water Management'.



Figure 10 Green façade at a parking garage in Köln Mülheim

Case study "Development of the green façades market in Germany"

From 2019, architects in Germany have increasingly planned for green façades on new buildings. Two to three years later, the demand for green façades in Germany is still growing rapidly. This growth is observed especially in the public

sector, but also in the private sector.

An example of a green façade is shown in Figure 10 at a newly built parking garage in Köln Mülheim installed in 2020. Three years after installation it is expected to have a coverage of 2.000 m² in total. Five different climbers such as Clematis m. Rubens, Lonicera henry, Parthenocissus quin., Hedera helix and Actinidia arguta are grown in 290 metres of wall-bounded planters and in 75 metres of planters in the ground. The selected plants assure different leaf and flower colours over the year and are winter green. The rainwater from the parking garage roof is collected, stored in reservoirs, and used for the watering of the plants. Sensors monitor soil moisture and plant needs to ensure long term sustainability.

While demand has increased in recent years, it is not totally clear what drives this demand for green façades in Germany. There is a common perception that “green” on buildings is good, but there is a lack of knowledge on how to maximise the impact of green façades (for example, in terms of rainwater use, plant selection and biodiversity). It seems that the aesthetic value of a green façade is currently the main driver of demand and is an important factor in decision making processes. In the coming years, the green building sector has to move towards impact-based arguments. As shown in the example above, highly specialised nature-based enterprise can deliver the design, installation, and maintenance of green façades. We need to measure and value the impact of such projects, so that the driver of demand becomes the contribution to biodiversity and the aesthetics of green buildings becomes the add-on.

Source: Connecting Nature Enterprise Platform⁴², supported by H2020

Sector specific challenges/enablers

Even though green roofs are perceived as eco-friendly, there is still a lack of knowledge about their impact in terms of ecosystem services. To maximise the value of green buildings, more specific knowledge about plants and biodiversity aspects is needed. Lack of knowledge on how to maintain green roofs, façades and interior greening is also evident. There are, for example, only a handful of companies in the green façade market in Germany that are able to maximise the ecosystem services of NBS on buildings by effectively maintaining the structure and plants. Specific training and education is therefore needed on NBS for green buildings design, implementation, maintenance, monitoring and measurement. To develop the sector, standards need to be better defined for green buildings, particularly for façades and walls (for roofs these are well-established in some countries). To increase greening on buildings in urban areas, funding and policy incentives were found to be very important. For example, in Germany, the following supporting factors for NBS for Green Buildings were identified: façade and roof greening in municipal development plans, financial subsidies for both green façades and green roofs, and reduced fees for wastewater treatment (European Federation of Green Roofs and Walls, 2021).

As part of the ARTISAN LIFE project, an analysis was undertaken of the strengths, weaknesses, opportunities, and threats (SWOT) for nature-based enterprises in France in a number of sectors. Figure 11 presents the SWOT analysis for urban planning and buildings which shows some commonalities with the experience of the green buildings sector in other European countries such as Germany and Austria e.g., more developed sector but lack of tools and methodologies for measuring impact. However, some of the issues related to water resource management and governance are more related to urban planning than green buildings.

⁴² <https://www.naturebasedenterprise.eu/> The Connecting Nature Enterprise Platforms connects 2000+ practitioners across NBS sectors to exchange knowledge, improve best practice and support business development

NBE SWOT in France (ARTISAN study) - Urban planning and Buildings

 <p>Strengths</p> <ul style="list-style-type: none"> - Initiatives already in place and structured actors - Strong potential synergies with the adaptation of cities - Knowledge being developed in training courses - Multiplier effect of co-benefits produced - Feedback from national and international projects - Awareness raising of communities in progress - Certain competitive advantages (e.g.: alternative stormwater management costs) 	 <p>Weaknesses</p> <ul style="list-style-type: none"> - Tools and methodologies for monitoring/evaluating the impact and effectiveness of solutions - Demonstration of the profitability of the solutions and communication of the co-benefits produced - Skills and internal technical expertise - Limited scale in the deployment of solutions - Lack of consensus and cooperation between actors and stakeholders upstream of projects - Long-term visible benefits and impact difficult to measure
 <p>Opportunities</p> <ul style="list-style-type: none"> - Development of labelling schemes or exchange spaces between developers, real estate sector and sustainable development - Alternative financing via local partnerships or EU projects - Opening up to innovation and experimentation through pilot projects - Strong exposure of "green city" projects 	 <p>Threats</p> <ul style="list-style-type: none"> - Lack of water resources management policies considering the possibilities offered by NBS for adaptation - Scattered and complex water governance, a political landscape that is still sometimes very fragmented - Unequal relationships and many competing and conflicting interests between actors (land use issues) - Under-funding of NbS compared to grey infrastructure - Regulatory complexities

Figure 11 NBE SWOT in France (ARTISAN study) Urban Planning and Buildings

2.2.3 NBS for public and urban spaces

Lead contributors: Roisin Byrne, [RBLA](#) (Ireland); Barbara Golicnik Marusic & Manca Dremel, [UIRS](#) (Slovenia), Ambassadors for NBS for public and urban spaces community on Connecting Nature Enterprise Platform (778 members)

Nature-based solutions for urban landscapes include green infrastructure, urban forests, parks and gardens. Urban greening creates multiple benefits for nature and people - helping to reduce the urban heat island effect, making outdoor areas more attractive thus adding value to local businesses, and contributing to enhanced well-being and mental health of local citizens. Activities in this sector include landscape planning and design, co-creation of green areas, designing location specific NBS, e.g. permeable systems for rainwater management, green roofs, restoration of degraded environments, supporting local governments in implementing NBS, etc. Nature-based enterprises in this sector are either direct or indirect providers of NBS. Direct providers contribute to implementation of NBS by supplying or building the elements of solutions. Indirect providers include enterprises that design solutions in relation to place management and development, such as planners, landscape architects, engineers, and ecologists.

Case study

In county Wicklow, Ireland, local actors identified a derelict site running alongside the river Slaney and approached local government councillors to identify what could be done. The councillors then ran a competition for a design for the park. This design enabled early visualisation of 'What Could Be' (Figure 12).

A possible funding stream from the local authority was identified by the local actors to begin the process of creating 'a place to play' in the locality. The committee then worked with the landscape architect who created a co-design process to design a park with nature play and planting schemes using native tree, hedging and wildflower species, which would 'Give Back to Nature' (net benefit on biodiversity) thus multiple co-benefits were established from the outset. Armed with visualisations around the project, the community leaders were able to communicate with the wider community and corporate organisations about their goal. As a result, the community was able to leverage LEADER + funding (European regional development funding) to secure sponsorship and matched funding for the project.



Figure 12 The project before (left) and after (right)

Source: Connecting Nature, Horizon 2020 project

Sector specific challenges / enablers

While the potential for NBS for urban landscapes is high and has been highlighted in numerous policy agendas, there is little market data on the levels of take-up at scale. The sector is fragmented with a lack of awareness and knowledge among non-specialist industry bodies compounded by a lack of evidence on effectiveness of NBS, lack of regulations and standards. Consequently, there is little evidence to date of specific financial support for this sector including lack of funding for experimenting with new approaches. Given the lack of market studies, the challenges and enablers identified in this section are drawn from interactions with the 778 members of the NBS for public and urban spaces community on the Connecting Nature Enterprise Platform.

NBS are place-based and require a high level of time and skilled resources to co-create with the community. Training for local authority staff, breaking down of silos between departments and additional resources to manage the co-creation, implementation, and stewardship of NBS at scale is needed. Moreover, the lack of standards and the inclusion of NBS principles to current approaches should be addressed.

2.2.4 NBS for water management and treatment

Lead contributor: Gerardo Gonzalez ([BIOAZUL SL](#)) Ambassador for NBS for Water Management and Treatment community on the Connecting Nature Enterprise Platform (543 members)

Nature-based solutions for water management involve the use of ecosystem services to improve water quantity and quality, and to increase resilience to climate change (UNEP & IUCN, 2018). These include natural solutions for the management of flood and surface water in rural, peri-urban, and urban contexts, wastewater management and treatment, and resource recovery. Certain sub-categories such as natural flood and surface water management, or urban green and blue infrastructure, are also included in this sector (Kooijman et al., 2021). Using Eggermont et al. (2015) categorization of Nature-Based Solutions, water managers and related nature-based enterprises implement NBS for:

- 1) Protecting natural ecosystems. Here, existing ecosystem services are sustainably utilised and protected (e.g., establishment of marine protected areas to conserve biodiversity in mangroves).
- 2) Restoring ecosystems. Degraded ecosystems are rehabilitated to restore or enhance ecosystem services (e.g., forest landscape restoration to reduce flood impacts, stabilise slopes and provide clean water).
- 3) Creating new ecosystems. Nature-based solutions are used to reproduce ecosystem services where there are cost-effective benefits for sustainable water resources management. Here, NBS could be adopted in conjunction with conventional water infrastructure and grey infrastructure, forming so-called "hybrid" solutions (e.g., use of constructed wetlands to treat domestic wastewater and effectively complement conventional wastewater treatment systems).

From surveys carried out with the members of the Connecting Nature Enterprise Platform NBS for Water Management community, it was found that most companies and organisations are involved in 1) urban water management, including green and blue solutions such as sustainable urban drainage systems (SUDS) and rain gardens; 2) wastewater treatment, including green zone creation, constructed wetlands, reed beds and willow structures; 3) surface water treatment. Rainwater harvesting systems and river and wetland restoration are also mentioned as activities. These enterprises offer services such as consulting, monitoring, feasibility, and impact assessment of Nature-Based Solutions, as well as NBS planning and design services.

Impact of nature-based enterprises/NBS on the market

The world water market is growing rapidly and there is a high potential for the creation of green jobs. In Europe, it is estimated that 1% market growth could create up to 20,000 green jobs in the water-related industry (European Commission, 2022). Traditionally, "grey" or "hard" infrastructure have dominated efforts to reduce and manage impacts from natural disasters and to manage water resources. But the focus is now shifting towards NBS for water management, disaster risk reduction, and climate change adaptation. Despite the increasing uptake of NBS, direct investments in NBS are globally still less than 1% of the total investments in water resources infrastructure and management (UN-Water, 2018). Little is known about the specific barriers hampering greater take up of NBS water resources infrastructure or the impact of greater take up on market opportunities.

Case study "Green - Blue: Sustainable Urban Drainage Project"

Málaga (Spain) suffers episodes of heavy rain and flooding every year, causing severe damages in the city and surroundings. As an adaptation

measure, a project on Sustainable Urban Drainage was launched in 2018 by a local university in collaboration with local nature-based enterprises specialised in sustainable design and architecture, as well as landscape and gardening.

As part of the project, a range of Sustainable Urban Drainage Systems (SUDS) techniques, specifically an infiltration trench and a rain garden with a surface area of 870m², were implemented by the students of the “Universidad Laboral” in order to solve specific flood problems at a local playground (Figure 13). This pilot project helped local stakeholders to visualise the potential of Green Urban Design (GUD) in the field of integrated management of water at an urban scale. For the development of the project, a multidisciplinary team of professionals, nature-based enterprises and institutions were involved which shows that the planning and management of green areas requires an integrated vision while emphasising the capacity of specialised nature-based enterprises to provide such solutions.



Figure 13 Playground at “CEIP Luis Buñuel Center” for Early and Primary Education before (left) and after (right) implementation of SUDS. Source: Paisajes Resilientes

Source: Connecting Nature, Horizon 2020 project

Sector specific challenges/enablers

One of the obstacles for the growth of nature-based enterprises in the sector is the lack of networking and cooperation opportunities. Moreover, there is a need for greater evidence of the effectiveness of NBS products and services in water management and there is little knowledge on market opportunities and business cases. The lack of funding and financial support, for example to carry out R&D activities was also identified. Enablers identified were policy support, showcasing and sharing evidence of success stories (including cost-benefit analysis, designs, photos, etc.), training and transfer of knowhow among practitioners, and raising awareness about NBS for policymakers, water utilities, the public, etc. Generally, meeting the requirements of regulations and legal standards was not perceived as a challenge.

On the demand side of NBS, city authorities and private developers experience a knowledge gap in the type of NBS available on the market (although various policy papers and

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

platforms have been developed on Natural Water Retention Measures (NWRM)⁴³ since 2014 and on Ecosystem based adaptation⁴⁴). This gap includes lack of evidence and effectiveness of such solutions. There is also a lack of experience when it comes to public and private procurement of NBS. Here, sharing detailed designs and technical solutions available in the market was seen as an enabler, as well as training of municipal authorities and technicians, regulations to promote NBS application (including the promotion of a closed-the-loop approach in water management), and evidence of the economic, environmental, and social impact of NBS.

Figure 14 from the ARTISAN LIFE project, shows an analysis of the strengths, weaknesses, opportunities, and threats (SWOT) for nature-based enterprises in France in the water management sector. In common with members of the water management community in Connecting Nature, skills deficits and challenges measuring long term benefits were identified as weaknesses. However, in France it appears that short term monitoring is undertaken and there is a high level of technical and scientific knowledge. Large scale experiments were recognised as an effective mechanism to build evidence of effectiveness. The importance of collaborating with communities in water management was recognised across the board but the complexity of multi-actor governance was also highlighted as a threat. In France, it appears there is much room for improvement in terms of policy and funding support for alternatives to grey infrastructure solutions. Funding for long term maintenance was identified as both an opportunity and a threat.

NBE SWOT in France (ARTISAN study) - Water management

<p> Strengths</p> <ul style="list-style-type: none"> - Large-scale experiments supported by the Water Agencies - Efficient alternatives to grey infrastructure - Monitoring of projects developed: biodiversity, hydro-biological, technical - Synergies of solutions with CC mitigation, with existing networks and programs (e.g. wetlands) - Collaboration with local residents to facilitate the implementation of projects - Multiplicity of solutions and co-benefits - State of technical and scientific knowledge 	<p> Weaknesses</p> <ul style="list-style-type: none"> - Long-term benefits are difficult to measure - Limited availability of skills
<p> Opportunities</p> <ul style="list-style-type: none"> - Launching of calls for projects from public and private NBS, EU financial instruments - Funds for long-term maintenance of solutions - Harmonization of legislation and public policies in terms of water resource management - Official recognition of the benefits of NBS 	<p> Threats</p> <ul style="list-style-type: none"> - Lack of funding compared to "grey" solutions - Regulatory complexities - NBS poorly integrated into policy assessment and natural resource planning and management - Scattered and complex water governance, a political landscape that is still sometimes very fragmented - Uneven relationships and many competing and conflicting interests between stakeholders (land use issues) - Differences in perception of the concept and issues of adaptation and responses between public and private actors

Figure 14 NBE SWOT in France (ARTISAN study) Water Management

⁴³ Natural Water Retention Measures (NWRM) measures were the topic of a 2014 policy paper for Common Implementation Strategy (CIS) developed with EU Member States so as to achieve the goals of the Water Framework Directive, the Flood Directive, as well as the Habitats and Birds Directive. The [NWRM platform](#) that was then developed with the industry sector gathers information on NWRM at EU level, providing further insight on the NWRM definition and individual NWRMs grouped by sectors and/or benefits. See also [Nature-based solutions for flood mitigation and coastal resilience - Publications Office of the EU \(europa.eu\)](#)

⁴⁴ The [EU Platform Climate Adapt](#) is centralising guidance and experience on Ecosystem based adaptation, to which NBS constitute an umbrella term.

2.2.5 Sustainable forestry and biomaterials

Lead contributors: Ilaria Doimo, Jacopo Giacomoni and Ilaria Doimo (ETIFOR), Ambassador for Sustainable Forestry and Biomaterials community on the Connecting Nature Enterprise Platform (351 members)

Sustainable forestry refers to using the forest in a way that its services and its environmental, social, and economic functions are preserved for future generations (Resolution H1 of the Helsinki Ministerial Conference on the Protection of Forests in Europe, 1993). Sustainable forestry is thus fully aligned with the concept of NBS and enterprises implementing sustainable forestry can be categorised as nature-based enterprises. Europe has almost one-third of its surface covered by forest, and the area has increased by 9% since 1990 (Forest Europe, 2020). Sustainable management of forests is essential to maintain and increase the delivery of ecosystem services that are vital for humans and the preservation of European forests. Forests provide a multitude of ecosystem services, such as the provision of raw materials and food, regulation of the environment (e.g., purification of water and air, uptake of carbon, etc.) and cultural services (e.g., recreation, tourism, education, therapy etc.).

Impact of nature-based enterprises/NBS on the Sustainable Forestry market

Degradation of forests is an important driver of biodiversity decline and highlights the potential for Nature-Based Solutions (IPCC, 2019; IPBES, 2019). Nature-based solutions are still a relatively new concept in the Sustainable Forestry sector. A global survey on forestry by CDP (2020) found that only 15% of companies are implementing some form of NBS. These companies are generally dependent on forest ecosystem services, and engage in forest conservation, reforestation, and habitat restoration.

In Europe, the largest forestry sectors are still the paper industry (42%), the wood industry (36%) and forestry, such as management and non-wood forest products (22%). The forest sector provided jobs to more than 2,6 million employees in 2015, of which most work in the traditional forest-based sector (forest management, logging, sawmilling, wood-based products, cork, pulp, and paper) (European Commission, 2021). From the Connecting Nature Enterprise Platform, we see that nature-based enterprises in Sustainable Forestry are broader than traditional forestry companies. Most are active in forest management and urban forestry, mainly dealing with forest planning, forest inventory, tree planting initiatives, and Data Science (e.g., AI, IoT) and geospatial mapping services for improving forest management. Nevertheless, there is also an overlap with activities in other sectors, namely: agroforestry (discussed under 'Sustainable Agriculture'), and forestry tourism (discussed under 'Sustainable Tourism'), and forest-based care (discussed under 'Health and Wellbeing').

Case study "Il Fungo di Borgotaro": the first P.G.I. (Protected Geographic Indication) labelled wild mushroom

In Borgotaro, a valley in the Italian Apennines, the interest of the local community and forest managers toward the traditional products of the forest, such as firewood and roundwood, faced a big decline in the last decades. The abandonment of the forest led to unexpected results: the production of one of the most appreciated Non-Wood Forest Products of the area, the Boletus mushroom, decreased.

The boletus mushroom, labelled as Protected Geographical Indication product in the late 90s and protected by the legal entity called “Consorzio per la Tutela dell’Indicazione Geografica Protetta Fungo di Borgotaro”, was crucial for the tourism of the area and the local enterprises. To reactivate and stimulate the active management of the forest and



Figure 15 The forest in Borgotaro

consequently stimulate the production of mushrooms, the local public enterprise managing the forest decided to heavily invest in the promotion of mushroom and in sustaining responsible and sustainable forest management in line with NBS principles. The Consorzio Comunalie Parmensi is the name of the facility that manages the forest of both the Comunalie (mainly public land) and the association of private owners with the following main objectives: apply and promote sustainable forest management, enhance local tourism linked to mushroom, promote the use of renewable energy such as biomass. This decision of sustainably managing the forest for producing mushrooms paid-off economically (€0,5-1,2 mln depending on the year), and to increase wild mushroom productivity, and helped create a positive loop in which revenues from mushroom are re-invested in forest management.

Source: Connecting Nature, Horizon 2020 project

Sector specific challenges/enablers

The main barriers for the sustainable forestry sector are:

- Lack of awareness of the linkages between sustainable forestry and NBS among decision-makers. For some European countries there is very poor data concerning the forest sector and the relevance of NBS to this sector. This creates gaps in knowledge when defining future strategies and policies and leads to a lack of alignment with NBS approaches in other policy areas.
- Lack of networking and cooperation between organisations in the sector. Sometimes there are big differences among countries and even within the same country. When the sector is fragmented and several actors do not communicate, it’s almost impossible to define a common path toward sustainable forest management and uptake of new concepts such as NBS.
- Public/private sector lack of funding/support for experimenting new NBS approaches. Best practices and success cases in the field of sustainable forest management can be found, but what is lacking is the commitment of the private/public sector to support innovative and experimental NBS approaches.

The main enablers / supporting factors for the sustainable forestry sector are:

- Availability of funding instruments (such as grants and subsidies). Having funds to support research and experimentation in the application of NBS approaches in

sustainable forest management and forestry is indeed essential to create and spread best cases and success stories

- Good mechanisms to share NBS knowledge and technologies in the sector. The creation of knowledge repositories and databases is crucial to share the knowledge and share best cases.
- Openness to NBS innovation and experimentation in the public sector. As described in the case study, openness to innovation can boost experimental approaches and provide value that exceeds traditional forestry activities.

Figure 16 from the ARTISAN LIFE project, shows an analysis of the strengths, weaknesses, opportunities, and threats (SWOT) for nature-based enterprises in France in the forestry sector. The importance of building multi-actor stakeholder networks and increasing awareness among the general public were highlighted as strengths which helps to combat the threat of low technical knowledge (apart from in ecological engineering), lack of consensus and ownership of the NBS concept in the public and private sectors. Similar to other sectors, challenges in measuring impact hinder decision making. Inclusion of sustainable forestry in public policies is seen as an opportunity but this needs to be accompanied by appropriate regulation and incentives for the private sector to offset higher costs and longer development cycles.

NBE SWOT in France (ARTISAN study) - Forestry

 <p>Strengths</p> <ul style="list-style-type: none"> - Participation of stakeholders (owners, managers, citizens...) - Diversity and development of partnerships and networks - Awareness raising of the general public in progress - Expertise in particular in ecological engineering - Research work on NBS for adaptation - Implementation of evaluation and monitoring systems - Ecological engineering tools for forest managers 	 <p>Weaknesses</p> <ul style="list-style-type: none"> - Lack of performance indicators, tools and methodologies to help decision making in terms of climate risks - Training of forestry actors in scientific, educational and civic issues - Technical knowledge on impacts in terms of adaptation and biodiversity - Duration of project validation
 <p>Opportunities</p> <ul style="list-style-type: none"> - Incentives for private foresters to adopt sustainable management - Public policy instruments and state funding, in particular via the Low Carbon Label and France Relance for experimenting with new management and organizational practices - European and alternative financing - Financial valuation of positive externalities 	 <p>Threats</p> <ul style="list-style-type: none"> - Lack of consensus between the actors of the sectors - Low ownership of the NBS concept (public and private) - Costs of certain species - Forest management documents not always adapted to climate issues - Evolution of legislation to support forestry companies - Lack of understanding of social demand by regional actors

Figure 16 NBE SWOT in France (ARTISAN study) in Forestry sector

2.2.6 Sustainable agriculture & food production

Lead contributor: Valeria Stacchini (Metropolitan City of Bologna) Ambassador for Sustainable Agriculture and Food Production community on the Connecting Nature Enterprise Platform (484 members)

Sustainable agriculture provides food and non-food crops while managing natural resources in a way that maintains ecosystem functions to support current, as well as future human needs. It includes five key principles: 1) to increase productivity, employment, and value addition in food systems, 2) to protect and enhance natural resources, 3) to improve livelihoods and foster inclusive economic growth, 4) to enhance the resilience of people,

communities, and ecosystems, and 5) to adapt governance to new challenges (FAO, 2014). Nature-Based Solutions can provide a pathway to transition towards sustainable agriculture⁴⁵ (Oberč & Arroyo Schnell, 2020) as NBS can shift agricultural land from being a driver of negative environmental impact to being a solution. These types of solutions could contribute to an increase in agricultural production, climate change mitigation and adaptation, nature and biodiversity conservation, socio-economic benefits, such as increased resilience (Miralles-Wilhelm, 2021).

'Sustainable urban and peri-urban agriculture at both micro and commercial smallholder scales has substantial development potential in many regions, providing livelihoods to poor and low-income people and contributing to reducing food miles and greater city-regional food supply resilience. Replacing exotic vegetation in urban parks, roadside beds and embankments with native/indigenous species that are more climate resilient and have greater urban biodiversity value is an increasingly urgent nature-based economic activity in its own right not least through commercial scale plant/tree nurseries.

Agroforestry is another promising field that pushes to integrate agriculture with local landscapes and biodiversity profiles. It is based on the principle of ecological succession, which aims to recreate the same relationships among plants, trees and grasses that persist in a vital forest with the added value of inserting indigenous food species."

- David Simon, input to the TNOC global roundtable on the nature-based economy

Impact of nature-based enterprises/NBS on the market

NBS in agriculture are part of managed or restored ecosystems (type 2, Eggermont et al. 2015) and include solutions for agricultural landscapes and for agricultural production. Nature-based enterprises can contribute to many activities in agricultural landscapes and production. In agricultural landscapes, examples of NBS are focused on nature and biodiversity conservation: wetland and peatland restoration, etc. NBS for production are focused on increasing production and ecosystem health, and examples of practices include trees in cropland, grazing optimization, nutrient management, etc. Besides agriculture, there are examples of NBS also in aquaculture and fisheries (Iseman & Miralles-Wilhelm, 2021). On the Connecting Nature Enterprise Platform, enterprises are active in food production/allotments, regenerative farming, horticulture, beekeeping. There is some overlap with nature-based economic activities under ecosystem creation, restoration and management, tourism, forestry and NBS for public and urban spaces.

Investments in Nature-Based Solutions in the agricultural sector is increasing and investors see future growth opportunities. The potential is considerable as sustainable practices are currently associated with just 0.04% of agricultural land worldwide. NBS in agriculture generate private and public benefits: they are implemented by farmers on agricultural lands (Hallstein & Iseman, 2021) creating direct economic benefit for the producer in terms of increased yields or reduced costs, in addition to broader social and environmental benefits (Iseman & Miralles-Wilhelm, 2021)

⁴⁵ Approaches to sustainable agriculture that positively contribute to nature and biodiversity include: agroecology, nature-inclusive agriculture, regenerative agriculture, permaculture, biodynamic agriculture, organic farming, conservation agriculture, carbon farming, climate-smart agriculture, high nature value farming, low external input agriculture, circular agriculture, ecological intensification, sustainable intensification.

Case study: "Smart City Rooftop Farming in Graz, Austria"

The Smart City Rooftop Farming is an integrative solution for city roofs regarding climate change adaptation. The main objective of the project is to develop and establish a food production in close vicinity to consumers. Four additional functions are symbiotically combined here: food production, city cooling, renewable energy generation and social integration.



Figure 17 Rooftop farm in Graz

The Rooftop Farming is located 60 metres high at the top of an office building, which is used as a research building for urban and green technologies. The project includes 19 raised beds, arranged in a ring. The cultivable area of about 100m² is surrounded by special energy glass. On the one hand, the glass cover generates renewable energy and on the other hand it protects the plants from harsh weather but allows necessary sunlight to pass.

The approach of growing food on urban rooftops provides from an agricultural angle ecologically and locally produced food with short transport routes. From a climate-oriented perspective such green roofs offer not only better resilience against heat, it is also helpful to retain water during heavy rainfall. Fostering biodiversity and reducing emissions are positive environmental effects. At societal level there are the employees from the building who benefit as well as young people in work training programs, responsible for the ongoing maintenance of the beds. Also, for local gastronomes it is an opportunity to get fresh organic herbs or vegetables directly in the neighbourhood.

The Smart City Rooftop Farming is coordinated and scientifically accompanied by an interdisciplinary team of experts from Joanneum Research – Life. Together with partners from economy, science and the educational sector the project should help to develop a best practice example for the sustainable use of rooftops for a professionalised food production.

Source: REGREEN⁴⁶ H2020 project

⁴⁶ <https://www.regreen-project.eu/>

Sector specific challenges/enablers

For farmers and enterprises working in this field, adoption, and market penetration of NBS may be slow due to many factors such as lack of training, awareness, the uncertainty of the financial return on investment, and non-economic factors such as cultural barriers and ease of implementation. For investors and corporations, barriers to investing in NBS in agriculture include investment costs, short-term risks, mismatch between the timing of investments and returns, and uncertainty associated with NBS in the sustainable agriculture transition (Miralles-Wilhelm, 2021). In addition, scaling up agricultural NBS at landscape scale can introduce challenges relating to the coordination of multiple stakeholders (Hallstein & Iseman, 2021). Effective policies are required to enable NBS uptake, to reduce risk and liquidity constraints (Miralles-Wilhelm, 2021). Policies could be top-down approaches: global agreements (such as the Biological Diversity Convention or Sustainable Development Goals) or policies and regulations at national and regional levels. Bottom-up approaches include successful pilots, networking and sharing knowledge (Iseman & Miralles-Wilhelm, 2021).

Figure 18 from the ARTISAN LIFE project, shows an analysis of the strengths, weaknesses, opportunities, and threats (SWOT) for nature-based enterprises in France in the agriculture sector. On the positive side the momentum for such approaches appears to be growing with multi-actor collaborations emerging resulting in new R&D innovations and strategies for differentiation. There are strong synergies with other sectors and some incentives exist such as payment for ecosystem services (PES). On the negative side, this multiplicity of actors and indeed concepts in sustainable agriculture creates confusion. Cultural challenges related to changing centuries old farming practices should not be underestimated and should be approached with sensitivity. There is a strong need for skills development related to alternative practices and incentives for pilot projects to demonstrate the multiple benefits of NBS across the value chain. From a financial perspective, subsidies and incentives are needed to offset the costs of transition, longer term development cycles and higher risks. Conflicting policies supporting more intensive practices need to be tackled.

NBE SWOT in France (ARTISAN study) - Agriculture

 <p>Strengths</p> <ul style="list-style-type: none"> - Collaboration between associations, public services and agri-food industry players; joint technological networks (RMT) and synergies between players - Construction of R&D partnerships on new crops - Differentiation strategy for agri-food products - Synergies of solutions with mitigation issues and other sectors (forestry, water, urban development, tourism) - Strong proximity to the services provided by nature and capacity to raise awareness through practical methods - Traceability and evaluation of external audits 	 <p>Weaknesses</p> <ul style="list-style-type: none"> - Multiplicity of actors - Structuring of value chains and cooperation between organizations in the sector - Development of skills and training on alternative agroecological practices - Advice, training and promotion of agroforestry - Demonstration of the environmental benefits of solutions - Difficulty in measuring the costs & benefits of solutions
 <p>Opportunities</p> <ul style="list-style-type: none"> - Financial instruments and European programs linked to the Green Pact - Existence of incentive mechanisms (ex. payment for ecosystem services) - Creation of technical and economic reference systems - Creation of standards and labels for agroforestry 	 <p>Threats</p> <ul style="list-style-type: none"> - Research disinvestment in crop diversification - Risk aversion related to the conversion to an agroecological system, perception associated with too alternative farming methods - Perception of associated costs/ profitability and acceptability by farmers - Competition with dominant crops and mass distribution - Low constraint and level of incentive through regulation

Figure 18 NBE SWOT in France (ARTISAN study) in Agriculture sector

Case study Agri-Tourism: Bolognese Apennines Biodistrict

The Bolognese Apennines Biodistrict in Italy is an innovative system that boosts organic farming and circular economy practices, while supporting the local economy. Led by the Metropolitan City of Bologna and in collaboration with 20 municipalities and 150 companies, farmers, citizens, tour operators, institutions, associations, and public administrations work together for the sustainable management of local resources. By developing a sustainable agri-food supply chain, combined with an eco-tourism strategy, the most unique aspects of the region are leveraged: its natural environment, landscape, and quality food and wine. At the same time, tourism operators and creatives are involved to develop new forms of tourism in close relationship with nature.

The "Sementerie Artistiche" (Artistic seedbed) is a good example of an innovative enterprise supported (Figure 16). It is a theatre company that manages the homonymous agri-cultural space for artistic creation, training, and residency in

Bologna's countryside. Thanks to the funds allocated for the reconstruction of the buildings damaged by the 2012 earthquake, the creative startup comes to life and profitably interacts with the farm production. The social aspects are important in this - the theatre is a tool for inclusion that offers cultural and social opportunities for inhabitants and tourists. The performances take place in a straw arena, redesigned every summer and dismantled in



Figure 19 Sementerie Artistiche

September (when the bales return to their original function: they are sold or given away to feed the animals). The initiative generated job opportunities, as well as social and environmental benefits.

Source: Connecting Nature, Horizon 2020 project

2.2.7 Sustainable Tourism

Lead contributors: Aleksandra Dragozet, Melissa Novotny, Indy Schumacher and Angelika Vartmann ([Sea Going Green](#)) - Ambassador for Sustainable Tourism community on the Connecting Nature Enterprise Platform (338 members)

The sustainable tourism market aims to cater to those who desire travel that entails minimum negative impacts on the environment and local residents, while providing benefits for people, planet, and profit. Nature-based solutions (NBS) are inherent to the core values and principles of sustainable tourism, as it promotes the conservation of nature and the integration of the natural world into tourism offerings (e.g. in tourist accommodation, operational practices, conservation of natural tourism assets and engagement of communities). On the other hand, Chapter 4 warns against greenwashing and the need for further research to understand trade-offs between environmental

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

benefits, sustainable responses and the future of sustainable tourism development.

The empowerment of stakeholders is pivotal for the success of preservation and maintenance of natural resources and therefore a central component of NBS in tourism. It involves capacity building and training of local communities to enable them to act towards sustainable development and to develop a positive attitude to nature conservation. Another important dimension involves monitoring the state of the natural environment. Negative impacts of tourism on the environment, such as plastic and other waste, can decrease visitor satisfaction. Monitoring is crucial to identify adverse impacts on the environment before they are irreversibly harmful. The application or leveraging of NBS can contribute to greater benefits from tourism for local populations. For instance, by inducing more locally produced food or greater appreciation for experience nurtured by nature, employment opportunities and new venture development tend to go together with societal cohesion and higher quality of life. To reduce negative impacts of tourism such as pollution and overconsumption of resources, the adoption of environment-friendly solutions is another important dimension of NBS in tourism. A long-term success of NBS can be guaranteed by changing stakeholders' mindset towards the adoption of nature-friendly practices. A long-term success also requires the implementation of legislation and policy development (Padma et al., 2019, Figure 20).

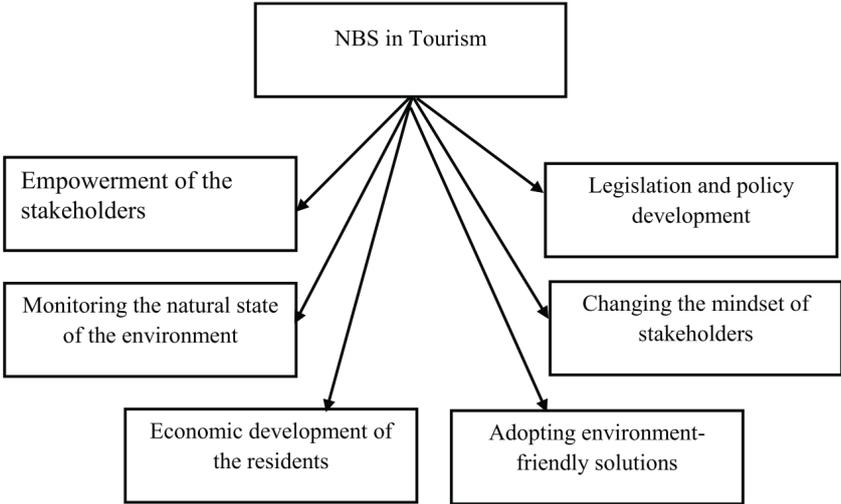


Figure 20 The different dimensions of NBS in Tourism (Padma et al., 2019)

Impact of nature-based enterprises/NBS on the market

Since the 1970s and 1980s when ecotourism first took off, the pushback against mass tourism and its natural consequences, sowed the seeds of a generation who wished for a form of tourism that was kind to the planet. Fast forward to the turn of the century. The newly branded tourism niche, "sustainable tourism" once again presented a new way of thinking about incorporating nature and communities into the picture. Within the global tourism industry, the sustainable tourism niche market in particular shows strong potential for sustainable development and is even expected to experience a compound annual growth rate (CAGR) of approximately 5% between 2019-2024 along with 130.12 Billion USD incremental growth (Technavio, 2021). In 2019, the global ecotourism market size was estimated at \$181.1 Billion and is expected to reach \$333.8 Billion by 2027 (Allied Market Research, 2021).

Measuring the market size of nature-based tourism offerings capacity is limited as NBS in tourism is still novel. Nevertheless, Nature-Based Solutions in and around hotels improves guests' satisfaction, well-being and builds customer loyalty (Han & Hyun, 2019; Han et al., 2020). On the Connecting Nature Enterprise Platform, activities in the sustainable tourism community include ecotourism, recreation, agritourism, and community engagement activities for tourism – for example community-based tourism.

Case study "Una National Park"

The Una National Park is situated in the north-western part of Bosnia and Herzegovina with important natural resources, diverse and preserved natural landscapes of outstanding beauty, rich cultural and historical heritage. Due to the lack of a strategic approach and bodies targeting the issue of sustainable tourism development in the context of the protected area, an initiative for the establishment of a tourist cluster was established in 2017. Tourist Cluster Una is the result of several years of cooperation between the local community, tourist services providers, civil society organisations, sports associations and other stakeholders in the Bihać area, and it is designed to help local businesses and tourist entities to use economic opportunities offered by increasing tourism in the Una National Park. The Cluster was established within the framework of WWF's program "Protected Areas for Nature and People", field project Una funded by the Swedish Development Agency.

Members of the Cluster work on building the identity of the destination, standardising and strengthening the quality of services, promoting the overall tourist offers and their expansion, as well as joint planning of activities related to the strengthening of the sustainable development sector and nature conservation in the Una NP. With the support of WWF, the Cluster organises education for its members on various topics with an aim to promote existing and create new tourism products. It works on branding and labelling of the cluster members' products, standardisation of members' businesses and products and supporting cooperation between cluster members.

Within the "Eco-aware" programme work is done on raising awareness of the local community regarding the importance of protecting nature. Some of specific actions are: Before the proclamation of the Park, sports activities such as rafting and kayaking on the Una River were performed with no restrictions, thus threatening highly sensitive tufa deposits (potentially NATURA 2000 habitat). Today, zones where those activities can be performed, as well as conditions for their performance, are regulated by the Public Company Una National Park which provides permits and concessions for specialised local agencies, therefore minimising the impact on the river and tufa beds. With the proclamation of the Park, on certain parts of the Una, Unac and Krka fishing districts, a new regulation of the fishing regime has been organised, there is development of beekeeping, presentation (and education) to visitors and promotion of products and local fauna and flora.

Source: [Handbook of successful and innovative practices for sustainable tourism inside Protected Areas](#) (InterReg Central Europe CEETO, 2018, pp 50)

Sector specific challenges/enablers

Considering the potential that could be achieved by integrating Nature-Based Solutions into tourism practices, obstacles, and barriers to the growth of this sector in Europe and beyond exist and must be addressed. The most recent obstacle was the COVID-19 pandemic, which has impacted the global tourism sector in the face of lockdowns and restrictions on movement. Not only did vast numbers of those employed in the tourism industry lose their livelihoods, but it also put tourism stakeholders' concerns for sustainability on the back burner as tourism businesses scrambled to preserve their bottom lines and cut "extra" costs, including sustainable investments. Another long-term challenge to achieving real sustainable growth in the industry is the practice of greenwashing. Many organisations and businesses make eco-friendly claims that they are conscious of their impacts on the environment. This is where some may "greenwash" using green branding to lure in customers and guests with a demand for eco-products and ethical experiences, without reducing or neutralising their impacts or developing products that are considerate of communities and the environment. Institutions - as well as conditions in the marketplace - must help consumers to become more critical of the products and services they purchase and demand transparency of supply chains. Tangible mechanisms need to take shape ensuring that businesses are incentivised to measure and report on issues of sustainability, underpinning the merit of genuine branding. To underpin nature-based tourism accommodations and offerings, sector-wide champions need to arise and increase their presence and reputation. This will show the potential of NBS in sustainable tourism as something desirable for all price points and in different tourism segments.

Figure 21 from the ARTISAN LIFE project, shows an analysis of the strengths, weaknesses, opportunities and threats (SWOT) for nature-based enterprises in France in the tourism sector. In contrast with other sectors such as sustainable agriculture, one of the strengths of sustainable tourism is that it doesn't require a major change in existing practices but rather celebrates divergences in local culture and traditions which leads to higher support from local citizens. However, this divergence in offerings also presents challenges in terms of industry fragmentation leading to poor visibility of solutions. From a policy perspective, while there are increased policies and legislation in support of sustainable tourism, there is a lack of cross-policy alignment with climate change issues, emerging confusion with different concepts and measures to support the costs of adaptation and promotion.

NBE SWOT in France (ARTISAN study) - Tourism

<p> Strengths</p> <ul style="list-style-type: none"> - Potential to share the socio-economic benefits of NBS with the local community - Diversification of tourism activities (not only seasonal opening, awareness raising activities) - Citizen engagement through awareness campaigns - Understanding of local culture - adaptation to cultural and social context 	<p> Weaknesses</p> <ul style="list-style-type: none"> - Few NBS actors directly involved in the tourism sector - Lack of knowledge of the challenges of adapting to climate change among tourism stakeholders - Lack of visibility of solutions, difficulty for the demand to access the NBS offer - Limited evaluation of the environmental impact and the effects of human activity on natural resources - Lack of involvement of communities (e.g. ski areas)
<p> Opportunities</p> <ul style="list-style-type: none"> - Increased national and European public funding for ecotourism - Policies that encourage responsible tourism: increase in protected areas, charters and historical labels at the local and regional level/ Urban planning code/ Agreements to protect the most vulnerable ecosystems - Legislation around a territorial climate-air-energy plan territorial plans ("PCAET") - Changing societal expectations 	<p> Threats</p> <ul style="list-style-type: none"> - Few regulations taking into account climate issues, fragility of existing legal instruments ("Montagne II" law), non obligation of the intercommunities mentioned (Alpine region) to adopt a territorial climate-air-energy plan - Lack of cooperation due to conflicts of space/interest in the sector - Acceptance of the concept, use of other terms for NbS in the tourism sector literature - Consideration of short-term economic issues

Figure 21 NBE SWOT in France (ARTISAN study) in Tourism sector

2.2.8 NBS for Health & Wellbeing

Lead contributor: Shirley Gleeson ([Ecowellness Consulting](#)) Ambassador for the NBS for Health & Wellbeing community on the Connecting Nature Enterprise Platform (558 members)

NBS for health and wellbeing is an emerging area and includes a broad range of services and practices globally. NBS promotes positive health and wellbeing through health promotion, disease prevention, treatment, and rehabilitation. Nature-based enterprises deliver green care activities such as nature therapy, forest bathing, forest therapy, green exercise, ecotherapy, adventure therapy, wilderness therapy, social and therapeutic horticulture, care farming, and animal assisted therapy. NBS for health and wellbeing can be implemented in many locations including healing gardens, curative and healing forests, urban parks, forests, hospital grounds, clinics, residential and care homes, and prisons.

NBS can involve activities taking place in both blue and green spaces (as well as indoors by bringing natural elements inside for therapeutic gain/ interaction). These nature-based activities have many health benefits. These include physical (reduced cortisol levels and blood pressure, enhanced immune system functioning), social (enhanced social cohesion and reduced loneliness), psychological (improved mood and reduced anxiety), spiritual (heightened sense of meaning and purpose), and environmental (increased conservation behaviour as they also focus on enhancing nature connectedness and by promoting pro-environmental behaviours).

Impact of nature-based enterprises/NBS on the market

Even though NBS for Health and Wellbeing is still at an early stage of development, there is a growing need for NBS for health and wellbeing compliant with the life stage model (from cradle to grave). As a result of the COVID-19 pandemic, health and social care services and their employees are overstretched with high rates of burnout and compassion

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

fatigue. NBS can support the traditional health services by offering a range of innovative green prescriptions through the process of social prescribing. Poor mental health is estimated to cost Europe over €600 bn/year or over 4% of GDP (of which a third is in direct health care spending). Access to nature can help reduce anxiety, depression, and loneliness (Gascon et al., 2018). Protected areas, for example, can deliver important mental health benefits to visitors, which have been valued at €5.5 trillion per year globally (Buckley et al., 2019). Another growing area is Nature-Based Workplace Wellbeing. While statistics vary by country, recent systematic review evidence suggests that the yearly cost of occupational stress at a UK and European level, can range from \$221.13 million to \$187 billion (Hassard et al., 2017).

Another area of interest and growth is that of green care tourism. Green care tourism (GCT) is defined as “a wide range of organised tourism experiences and products that rely on nature and wild spaces for tourists in search of health, well-being and regeneration” (Mammadova et al. 2021). Health and wellbeing are top priorities for eco conscious travels post pandemic. Research carried out by Green4C on forest-based care initiatives showed that all ten forest-based care initiatives expected their customer base to increase in the coming five years. Forest based care practitioners reported average revenue of € 57, 412 per year in the EU, excluding the highest revenue of € 1,680,000 (Fraccaroli et al., 2021).

Case study: Wellbeing at Whistlewood, UK

Wellbeing at Whistlewood is an inclusive nature-based wellbeing enterprise, based within a beautiful, community owned 10 acres of woodland in South Derbyshire (Figure 19). All their nature-based interventions are delivered by highly trained professionals within the National Forest. They offer a range of services including Forest Bathing, Forest Therapies, and complementary therapies. They offer “Calm and Restore Retreat Days” to social and corporate teams that include gardening-based activities, conservation activities and nature-based arts and crafts. Their “Green Connections Ecotherapy Project”

is run in partnership with Derbyshire Mind and supports local residents who experience mental health difficulties. They are also involved in a major UK Green social prescriptions initiative “Green Spring” which is a pilot project to test nature-based interventions to roll out nationally. They take part in awareness campaigns at wellness festivals to highlight the health benefits of nature connection.



Figure 22 Wellbeing at Whistlewood

Sector specific challenges/enablers

The current challenges identified for this sector include a lack of quality assurance European and international certification and accreditation standards across the sector. It

is vital for credibility and professionalism that work is done in this area to ensure safeguards are in place for best practice when working with vulnerable populations. Further research is needed (qualitative studies and RCT's) to investigate the acceptability and efficacy of specific nature-based interventions for their integration and acceptance within the health and social care sectors. Further longitudinal studies are required to examine whether the effects of such interventions endure over the long term. A broad research programme utilising different natural environments, diverse populations, and varied intervention types will enable a determination of what interventions work, for who, and in which contexts. There is also a real need for financial sustainability of micro enterprises as there is a lack of awareness of the health and wellbeing benefits of services.

In terms of enablers, there is a growing interest in this sector across many disciplines from health, social care, environment, and wellness sectors. There is an acknowledgement that in order to address some of the chronic and complex health, social and environmental issues that we have to work across silos and create new, innovative green jobs for the younger generation. There are currently strong international networks of highly skilled nature-based practitioners working in various sectors. In the past five years there has been growth in EU funded projects in this sector such as Forests for Health, Green4C, GoGreenRoutes, Youth Action for Nature and Wellbeing and Dr. Forest.

Case study: GoGreenRoutes

GoGreenRoutes is a €10.5m EU-funded project sowing the seeds for increased nature-connectedness across Europe, Latin America and China.



Its multidisciplinary consortium of 40 organisations is pairing participatory approaches and citizen science with Big Data analyses and digital innovation to co-create "Urban Well-being Labs" in six "Cultivating Cities": Burgas (Bulgaria), Lahti (Finland), Limerick (Ireland), Tallinn (Estonia), Umeå (Sweden) and Versailles (France).

These pioneering cities are implementing "nature-based solutions" such as green corridors, linear parks, pocket parks and shared walkways to enhance the physical and mental health of their urban residents. By maximising the available public space people can move around the city more actively, enjoy their free time and interact with others, whilst there is also room for restoring ecologically valuable spaces.

GoGreenRoutes will contribute to the sustainability and growth of the NBS for Health and Well-being community on the Connecting Nature Enterprise Platform. This community of practitioners supports and encourages the exchange of best practice in this industry sector and supports the start-up of new nature-based enterprises in the health and wellbeing space.

Source: [GoGreenRoutes](#), Horizon 2020 project

2.2.9 Community Engagement for NBS

Lead contributor: Paula Vandergert, [EM|Path](#), Ambassador for Community Engagement on the Connecting Nature Enterprise Platform (586 members)

Communities play an important role in delivering sustainable Nature-Based Solutions and inclusive governance is one of the eight key criteria of the IUCN Global Standard for NBS. As such, enterprises specialising in community engagement processes are invaluable partners who can work alongside other enterprises and organisations with the aim to embed multiple partners in the planning, delivery, and stewardship of Nature-Based Solutions, and to create good governance frameworks.

These could include charities, social enterprises, local groups working on environmental and social issues, and design companies specialising in collaborative planning who use co-production processes for creating a shared vision and help democratise the planning process. Not all these enterprises and organisations will consider nature as their core business, but the services they offer contribute to societal goals – in particular social goals – of Nature-Based Solutions⁴⁷.

Impact of nature-based enterprises/NBS on the market

As Nature-Based Solutions are a relatively new concept, community engagement activities for their implementation is nascent and limited market data is available. On the Connecting Nature Enterprise Platform, 66 enterprises are active in community engagement, mainly as part of the sector 'NBS for public and urban spaces'. Other activities of these enterprises include 'Research, Education, and Innovation activities'. Examples of enterprise engaging communities in the planning, delivery and stewardship of Nature-Based Solutions include:

- Planning – inclusive community engagement in the planning process helps co-create a shared vision that has legitimacy and broader societal approval. Co-creation is widely accepted in literature as pivotal to the success of NBS. Design companies or social enterprises who offer co-creation processes can assist with this.
- Delivery – inclusive community engagement in delivery of a Nature-Based Solution provides opportunities for developing skills and local enterprise, environmental education and community activities that foster physical and mental wellbeing. Social enterprises, local educational organisations and local charities who work with engaging residents and the wider community in nature conservation, environmental education and organic gardening can assist with this.
- Stewardship – enabling local communities to be involved in the ongoing management and maintenance of a Nature-Based Solution creates economic opportunities, skills development, opportunities for social interactions and improved health and wellbeing. Existing or new social enterprises, local educational and health organisations, charities and friend groups can assist with this.

Case Study: Ecos do Sur – embedding community gardening

Ecos do Sur is a non-governmental organisation based in A Coruna, Spain. It was set up in 1991 and operates in Galicia and Madrid reaching over 8,000 people each year. They work with vulnerable members of society, including migrants, the long-term unemployed, recipients of social assistance and survivors of gender-based violence, providing a wide range

⁴⁷ Such as the UN global goals and the societal goals identified by the EU taskforce on the impact of Nature-Based Solutions (Wendling & Dumutru, 2021)

of services such as legal aid, social work, language training, intercultural mediation, and skills-based training.

From 2017, Ecos dos Sur started using community gardens as a tool of social integration because they recognise that community gardens promote mental and physical health, provide spaces for social gathering, and can help develop soft skills (work routines, long-term planning, etc.). Since starting, more than 200 people have participated in structured garden activities with the innovative approach of using 'gardenisers' – professionals who combine the roles of a professional gardener and social organiser. They can provide a key catalyst to help and find synergies among the different existing community gardens within a neighbourhood (school ones, occupational, therapeutic, etc.), help start new ones, attracting all ages, and even engaging the necessary volunteers and the local trade.



Figure 23 Ecos do Sur

Source: Connecting Nature, H2020 project

Sector specific challenges/enablers

Despite widespread recognition of the critical importance of co-creation and inclusive governance in NBS, all too often, community engagement is either not factored into Nature-Based Solutions or is merely done as a nice gesture to the public. To engage communities in a meaningful and inclusive way takes time, expertise in working with people, multiple skills, and resources to ensure that the invaluable local knowledge and experiences in a community benefit the project and its outcomes in a lasting and sustainable way. These skills are currently underappreciated and more needs to be done to support their contribution to the growing understanding of what makes effective multi-benefit NBS. Moreover, many of the required skills are lacking in current NBS engagement processes. Policy makers and project managers need to take this into account and consider who is best placed to deliver effective and skilled community engagement and ensure that budgets and resources are available for this.

2.2.10 Smart technology, monitoring and assessment of NBS

Lead contributor: [Nadina Galle](#), Ambassador for Smart technology, monitoring and assessment of NBS on the Connecting Nature Enterprise Platform (453 members)

Activities under smart technology, monitoring, and assessment of NBS use satellite imagery, environmental sensors, spatial tools, and data analytics, e.g., for creating an inventory of tree species, analysing tree and soil health, contributing to decision making on investment priorities and to monitoring of NBS effectiveness. These types of applications are applied in all three types of NBS, with the highest representation in type 2, semi-natural ecosystems. In an urban context, smart solutions are combined with small green areas such as green roofs, and data analytics is used to provide insights for increasing

effectiveness. The NACE classifications for these activities and financial services do not account for the level of detail of these activities, nor acknowledge the business models used.

Now that the climate is changing, nature can play an important role in keeping cities liveable. However, nature in many of the world's growing cities is increasingly threatened by development, and by a lack of proper maintenance and understanding on how to optimally manage NBS. Smart technologies can help better understand, monitor, and manage urban nature, in addition to reconnecting citizens to these open spaces critical to their health and wellbeing. The framework, Internet of Nature (IoN) was conceptualised by Galle et al. (2019) to support urban planners in developing an urban nature intelligence system that will improve the understanding of urban ecosystem dynamics while promoting self-sufficiency and resilience across the city. Some examples of smart technologies for NBS offered by enterprises include:

- Soil moisture sensors, which, thanks to machine learning, can predict how much water a tree will need the day after tomorrow.
- LiDAR scanners on cars to map (street) trees, calculate leaf area and collect better input data for iTree 2.0 models.
- Assigning email addresses to trees so that people can better report issues and connect with urban nature.
- Virtual reality and other immersive technologies to help design biophilic spaces, get investors and developers on board, and increase people's empathy to the natural world
- Online platforms to engage both the public and practitioners about the potential of NBS and its opportunities

Impact of nature-based enterprises/NBS on the market

The following section is a synthesis of findings of Galle et al. (2019), Nitoslowski et al. (2019, 2021) and Prebble et al. (2021). Applying smart technologies to design, monitoring, and management of NBS is still relatively novel. As such, little is known about the growth and/or market trends in this field. However, we can draw on parallel movements such as "green tech" (i.e., technology whose use is intended to mitigate or reverse the effects of human activity on the environment), "precision agriculture" (i.e., technology whose use is intended to optimise and increase soil quality and productivity for farmers) or "precision forestry" (i.e., technology whose use is intended to collect data that is analysed by artificial intelligence and machine learning software to provide insights, which people then use to make decisions for site-specific management).

We can also look at trends in "arboriculture" in general, which may provide insight about where the future of the tree sector is going. Arboriculture is defined as the study, cultivation, and management of trees, shrubs, vines, and other woody plants. One such trend is that arboriculture favours small-to-medium enterprises, as even though the four largest firms are widely known, they account for just 4% of total industry receipts that are generated. As SMEs are leaner and more adaptive to innovation, this may mean a larger uptake in technology use in the field.

Another trend is the fear of labour shortages. Nearly 50% of industry professionals fear a quality labour shortage will appear within the next 3 years. This is a critical challenge to overcome as skilled workers will be key to nature-based city transformation. However, technology can play a role in alleviating this shortage by digitising processes and knowledge, but also by optimising workflows, so workers' time can be used most efficiently.

Lastly, even though millennials are often seen as the generation that favours technology

over nature, a recent study found 74% of millennials feel it is important to spend time outside, specifically in their gardens. Arboriculture and landscaping firms have felt this by seeing a shift from short-term to long-term service orders, meaning millennials are wanting to preserve overall tree health. Many new technologies, from soil sensors to remote sensing monitoring to LiDAR scans are working to optimise tree health scans, which will become an important tool to support this trend.

Case study: How can we ensure newly planted NBS not only survive—but *thrive*—in urban environments?

TreeMania’s Internet of Things-connected soil sensors (see photos) can play an essential role in a sustainable approach to the management of NBS, specifically shrubs, trees, forests, and agriculture. A sensor is placed in the soil during planting or maintenance of a plant or tree and constantly monitors the moisture, temperature, electrical conductivity, pH, and oxygen content of the soil. The collected data from the sensor is translated into a clear dashboard, with which you can see exactly where and when a tree needs resources. If, after a number of years, the monitored plant is thriving and no longer requires special care, the sensor can be transferred to a new location.

In the Netherlands, where a severe drought caused significant tree loss from June to September 2018, TreeMania’s sensors collect data on soil moisture content in real-time and send emails or SMS-updates to tree managers and workers. The sensors have been deployed across 5500 trees in the southern Netherlands, and when those updates are acted upon, have a 99% success rate in keeping newly planted trees alive. In the Dutch village of Geijsteren, the sensors were installed for trees located in the town square. Instead of tree managers, neighbouring residents receive the watering updates, promoting citizen engagement and participation in tree maintenance. In the future, machine learning-based moisture prediction algorithms, combining real-time moisture data with weather forecasts, location factors, and historical data, will be developed to add further nuance to tree watering strategies.



Figure 24 Soil mania sensors

Podcast episode: <https://www.nadinagalle.com/podcasts/8-marcel-steegh-soilmania>

Source: Connecting Nature H2020 project

Sector specific challenges/enablers

Key challenges to applying various technologies to urban ecology management include: data reliability (can I trust the data?), data quality and accuracy (is the data reflecting what's in the field?), assumptions or bias in data models, regulation, and legal protection, a general fear of tech adoption (will this take over my job?), and lastly, a lack of successful use cases (beyond pilot projects) that can prove the technology's worth.

Enablers could include funding availability for pilots of new technology so innovators can demonstrate effectiveness in real-life settings; increased communication amongst practitioners as regards the usefulness of technology, alleviating fears that technology will replace jobs.

2.3 Recommendations to address sector specific challenges and enablers

Common recommendations across all sectors

Investment in research to address common knowledge gaps: Two overarching research gaps were identified across all sectors. Firstly, knowledge gaps on impact measurement were identified in particular in relation to indicators for measuring impact of NBS on biodiversity and in comparison, with grey infrastructure solutions. Given the SME status of most NBE, a clear need was identified for simple, cost-effective, and widely accepted measurement approaches. Secondly, a lack of data on market trends and market development potential at EU/international level was identified as another critically important knowledge gap hindering investment and the development of specific support measures.

Urgent action on development of industry standards and codes of practice: while some evidence emerged of national standards in more mature industry sectors, urgent action is needed to develop codes of practice and sector specific standards at European/international level. Standards are needed to cover not just the design and delivery phase but equally importantly monitoring of maintenance and effectiveness in the long term. Industry players, including SMEs, need to be involved in the development of standards.

Adapt support policies and instruments:

(i) Better integration of NBS into public policy: increased use of NBS terminology and definitions in policy development leading to increased integration of NBS approaches such as NBS for water management, sustainable forestry, green buildings in relevant policy fields. Conflicting policy messages and instruments need to be urgently addressed (in particular in agriculture). Significantly higher incentives are needed to offset the costs of transition, longer term development cycles and higher risks (accompanied by awareness raising campaigns) in industry sectors such as forestry and agriculture.

(ii) Enterprise policy: Motivated by intertwined environmental and societal goals, NBE differ in mission orientation from most commercial enterprises and social enterprises. Specific support policies and instruments are required oriented towards helping NBE achieve environmental and societal KPIs first and traditional economic KPIs second. The business and innovation ecosystem were identified as key actors in addressing this recommendation.

(iii) Public procurement: Many NBE also identified the need for a change in current public procurement practices to prioritise criteria aligned with carbon reduction and biodiversity

net-gain and to recognise the critical importance of NBS approaches such as co-creation to build community consensus and engagement.

Targeted actions to increase awareness across the value chain: while knowledge of NBS is high among specialised audiences, general knowledge of NBS is still low across the wider value chain. Customised campaigns are needed targeting different audiences to raise awareness of the multiple benefits but also the complexity of NBS implementation. Success stories and pilot demonstrators were identified as highly effective in raising awareness and support. Important audiences include the general public, economic policy makers, impact investors, existing industry bodies and public authorities. Sensitivities towards existing traditions, cultures and practices need to be taken into account in awareness raising actions.

Networks: support is needed for existing and new multi-actor collaborative NBS networks to address industry fragmentation at local, national and international scale. A recommendation was made for support to build networks of practitioners adhering to codes of good practice or industry standards in each field. Networking actions are also needed to build collaboration between sectors.

Address skills gaps through capacity building, training and education: Reflecting the two major knowledge gaps identified above, two important skills gaps need to be addressed. Firstly, enhanced collaboration is needed between the research sector and educational, vocational, and training bodies to build awareness and support take-up of new knowledge in this rapidly developing field. Training on NBS approaches are needed from a scientific, educational, and civic perspective. Secondly, 'soft' skills gaps need to be addressed such as business models and financing strategies and methodologies to sustain multi-actor collaboration and governance. Peer-to-peer learning networks and platforms were identified as an effective mechanism for building knowledge and skills across both skills gaps.

Sector-specific recommendations

Investment in research to address sector specific knowledge gaps: in addition to the overarching research gaps identified in the previous section, sector specific research gaps also emerged including:

- Ecosystem restoration (marine ecosystems): further research and evidence on ecosystem service value for marine ecosystem restoration, and integration of this in the design of financing mechanisms for restoration.
- Green buildings: further research on how to increase impact on biodiversity through better design, cost-effective intensive greening techniques, and maintenance practices.
- Water management: R&D and large-scale pilot projects to provide evidence of effectiveness.
- Sustainable Forestry: clarify synergies and conflicts between NBS approaches to sustainable forestry and other concepts and policy approaches.
- Sustainable Agriculture: behavioural research is needed to understand and test solutions to overcome cultural barriers to take up of sustainable agricultural practices across the value chain. To achieve systemic change, more research is also needed on the impacts of changes in diet and to establish an evidence base that food security can be ensured through for example, modelling of land use competition between food, fibres and feed when addressing biodiversity and climate crises.
- Sustainable Tourism: interrelations between environmental pressures, sustainable responses and the future of tourism development within protected natural areas
- NBS for Health and Wellbeing: address research gaps relating to specific nature-based interventions and randomised control trials to measure impact leading to improved integration and acceptance within the health sectors.
- Community Engagement: the role and effectiveness of different community engagement methodologies and impact of such approaches on NBS processes.

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

- Smart technologies for NBS: research gaps related to data reliability, data quality and accuracy, data models, regulation, and legal protection.

Sector specific support policies and instruments:

- Green buildings: wider inclusion of green building measures in city development plans supported by policy instruments such as financial subsidies and reduced fees.
- NBS for water management needs to be more clearly integrated into policy and planning in particular as regards climate change policy but also other cross-policy linkages should be explored such as circular economy closed-the-loop approach in water.
- Specific incentives for nature-based enterprises starting up in forestry, agriculture and tourism to offset set-up costs and long development cycles.

CHAPTER 3 TECHNOLOGY & NATURE-BASED SOLUTIONS

3.1 Introduction

The present chapter addresses the role of technology in realising the potential of NBS for establishing a Nature-Positive Economy (NBE). Partly due to the broad scope of the term “technology”, this is a multifaceted subject, making it challenging to include all aspects.

Technology is widely understood as fundamental to the rise of human civilisation, complex societal relations and modern economies. The role of technology in relation to nature is highly equivocal and subject to change. In many cases, technical progress has been driven by a need to control nature, for instance, to protect against extreme weather events. As societies evolved, particularly with the Industrial Revolution in the 18th century onward, technology became a source of more effective resource use and higher productivity. Nature was widely exploited as a source of low-cost input, with limited efforts to limit pollution or waste generation. In the centuries since the onset of the Industrial Revolution, our perception of nature has shifted from an abundant source of raw materials to a vulnerable bundle of vital assets and services. Today, the ongoing degradation of nature not only puts up serious limits to human development and well-being but poses risks for the very existence of civilization as we know it and even life itself.

On the other side of the coin, technology is increasingly mobilised to prevent and/or mitigate damage caused to the environment by human activities. Broadly speaking, technology has gone through three phases in this respect. In the early 20th century, technological advances primarily offered “end-of-pipe” solutions to reduce pollution from specific industrial activities. From the 1960s onward, technology was mobilised to alter products or the blend of economic output and consumption patterns in ways that caused less environmental damage. More recently, technology has been applied at the overarching systems level to collect and diffuse information, increase awareness and transparency, and to support improved governance and sound long-term management of the environment, society, and the economy.

Digitalisation and technological innovation are providing new opportunities for the way cities operate. This ultimately enables more rapid data collection, communication and devising decentralised solutions, which is of high relevance for NBS and the fostering of a nature-positive economy. Technologies can support cities’ urgent need to reinvent the means through which communities assume responsibility for sustainability efforts, honouring the multitude of benefits that emanate from NBS and facilitating for citizens to engage meaningfully in the enhancement of their own urban environment. The implementation of NBS at the neighbourhood level combined with the deployment of decentralised co-creation solutions offers a promising terrain for societal transformation. In this sense, applying technologies for digitally supported self-organisation, connecting urgent sustainability demands with democratic participation can be a powerful approach. Over the past decade, many cities have mobilised digitalisation for the purpose of creating virtual space conducive to participation, in effect empowering a wide range of stakeholders and citizens to take active part in solving complex societal problems, including by engaging in NBS design, implementation, and management. However, participation dynamics remain challenged by potential drawbacks and pitfalls.

The smart cities’ discourse built around connected devices and services that include smart buildings, grids, energy utilities, mobility, health, etc. typically does not consider, or fully consider, the relevance of NBS. The very natural and social capital upon which the urban environment is built, is frequently not part of the narrative by digital revolution proponents

and local governments. There are, however, multiple opportunities for the use of technologies to restore, protect, and reconnect people with nature. Technologies based on computation, information and communication technology, artificial intelligence, and robotics, including multi-modal sensing systems as well as blockchain and tokenisation solutions, can enable cities to unlock their regenerative potential via NBS and provide citizens with knowledge and guidance for a regenerative transition towards a nature-positive economy.

Here, our focus is on the role of technology in shaping the approach to and implications of NBS and, more broadly, underpinning the scale-up of nature-based solutions in a nature-positive economy. While these aspects are not new, such considerations have assumed new dimensions with the arrival of digitalisation, and with the third phase of technical impacts, which is the focus of this chapter.

The chapter is organised as follows. First, we introduce three case studies to illustrate the role of technology in NBS, taking note of various ways in which technology may be central to functionality, value-generation, and sustainability. We then review the wider context of economy, technology, and sustainability, including the role of policy vs. markets and corporate strategy in advancing technology for sustainability. This leads to the converging technological landscape associated with digitalisation, and associated developments related to big data, IoT, platforms, AI, block-chain, etc (see Figure 20). Finally, we make the case for applying technologies to unlock the role of nature-based solutions in the nature-positive economy with implications for smart solutions, citizen engagement, capacity building, and governance.

3.2 Case studies

Each of the case studies presented in this section were examined in some detail by the URBiNAT project (Andersson et al., 2020a). The case studies are associated with different categories of NBS - technological, territorial, social, and participatory - yet, the success of each draws strongly on technology, albeit embedded in a wider context.

The first case, FinBIF, links directly to NBS powered by technology, here for the purpose of increasing the awareness of biodiversity. The second, Sensoterra, is classified as a territorial NBS, devised to facilitate water management. The third, Womenability, represents a social NBS, serving to enhance inclusivity in cities. All these cases demonstrate different ways that technology combines with other elements in realising the potential value of NBS.

While various technologies are applicable to NBS, the selected cases all apply digital tools, facilitating the wider reach and more rapid diffusion of information. Additionally, digitalisation supports interactivity and tailors communications to meet the needs and interests of specific users. A potent instrument here is the Community of Practice (CoP), which brings people together in continuous exchanges and learning processes. If properly structured, such networks may become action-oriented and serve as an instrument to overcome barriers and facilitate the implementation of effective solutions. In URBiNAT, an appropriately structured CoP has been designed for the purpose of instigating collaborative experimentation and joint learning from relevant experience, such as the cases below (Andersson, 2020b).

In the case of **FinBIF**, GIS mapping and digital photos services are applied to enable participation while also building a data bank. A highly diverse community of citizens is engaged to support data collection as well as the conservation of biodiversity. In the case

of **Sensoterra**, devised with a view to territorial issues, wireless sensors connect to cloud-based networks and IoT platforms to avoid wasting of water, mitigate flooding and improve irrigation. In **Womenability**, PCs and mobile surveys are accessed by targeted users to map out exploratory walks, conduct training and produce reports, contributing to the effective and meaningful inclusion of gender in urban planning.

The success and sustainability of each case hinges on the application of a specific business model and its ability to cater the respective value proposition to specific target audiences. The sustainability of each case essentially depends on continuously demonstrating value generation, considering social, environmental, and economic impacts and, in so doing, attracting public and/or public paying clients. FinBF and Sensoterra achieve environmental benefits that, in part, can be internalised and sustain the responsible business organisation. Womenability generates social value by providing safe walking paths for women along with indirect economic returns. This is done by creating user-driven terms for mobility under conditions that are free from risk of assaults and violence, reducing human suffering and health related costs while supporting active participation by vulnerable citizens and increasing their sense of well-being.

Irrespective of the NBS, the three cases illustrate how the application of technology can be key to achieving or leveraging particular functionality, with significant implications for the results achieved and the sustainability of the business cases and organisations involved. Technological innovations can be used synergistically with NBS to improve success of upscaling efforts, and to enhance NBS benefits and co-benefits. These cases show that with the use of technology, more consistent, reliable, and precise data on NBS performance and impact can be generated, helping decision-makers across municipal departments, practitioners, and researchers to recognise the value of NBS for the environment, the economy and society.

Table 3 Three cases of NBS exemplifying technology as enabler. Source: [URBiNAT](#), H2020 project

Case Name and type of NBS	Value proposition	Business Model	Financing Seed & Continuation	Technology as enabler	Value-creation Social, Environmental and Economic Impact
FinBIE <i>Technological NBS</i>	Increase awareness about biodiversity Engage citizens in support of data collection and conservation of biodiversity	Service and platform usage is free of charge	Gov't and EU funding; extensive support by experts on a voluntary basis	GIS mapping and digital photo services increase participation and build data bank	<i>Social impact</i> - community of users <i>Environmental</i> - data creation & conservation <i>Economic</i> -secondary impacts linked to the environmental impacts
Sensoterra <i>Territorial NBS</i>	Facilitate water management, improve irrigation, avoid wasting water, mitigate flooding, manage stormwater	The product is sold to paying clients such as municipalities, farmers, and regional authorities. Partnering with complementary services and technologies IoT	Financing via paying clients and traditional funding mechanisms	Wireless sensors that are connected to cloud-based networks and IoT platforms	<i>Social Impact</i> -awareness on water usage; <i>Environmental</i> -improved water use efficiency and risk mitigation <i>Economic</i> - water savings and damage control in regard to flooding, etc.

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

<p><u>Womenability</u> Social and Participatory NBS</p>	<p>Improve inclusivity at all levels in cities. Work for the inclusion of gender in urban planning.</p>	<p>NGO that offers training; studies using participatory tools; organises exploratory walks; generates inputs for inclusive urban development.</p>	<p>Cities and municipalities as key clients.</p>	<p>PC and mobile survey tool.</p>	<p><i>Social impact</i>-Shaping cities that are gender inclusive and thus also inclusive for migrants.</p>
---	---	--	--	-----------------------------------	--

The social, environmental and economic impacts of the case study enabling technologies associated with NBS are outlined in Table 3: formation of a community of users; increased quantity of available, relevant environmental data; catalyzation of awareness raising; increase of water use efficiency and risk mitigation, resulting in water savings and more effective damage control in the face of flooding, etc. The identified impacts were achieved through the application of ICT and digitalisation, which stand at the core of an evolving creativity and innovation landscape of NBS. ICT can foster scientific advances in the many interlinked areas, including policymaking, governance, planning, delivery, management and upscaling as related to NBS. The links to innovation also draw on digitalisation as a means of enhanced diffusion of information, awareness raising, and a revamping of organisational strategies and relations that are in the process of altering the way in which policies and markets interact in relation to sustainability and the rise of an NBE. A related key impetus has to do with the greatly enhanced potential for constructive engagement of citizens in policy processes, which has been most apparent in urban planning. Smart sensors powered by deep-learning algorithms and AI managed through smart brains, or “orchestrators” collecting, processing and distributing Big Data widen the scope for engaging citizens on a continuous basis (Ahad, 2020). A number of cities have pursued far-reaching initiatives spanning the identification of outstanding issues, the implementation and monitoring of solutions (Brabham, 2009; Gabrys, 2014; Brorström et al., 2018).

The mechanisms for technology to influence markets, to operate more effectively from various ends, applying to both supply, demand, and by lowering transaction costs connecting the two sides, receive new impetus with the development of platforms. For example, the [Connecting Nature Enterprise Platform](#) connects a range of stakeholders across complex NBS value chains. At the level of individual market sectors, smart technology applications to nature are an emerging market sector.

Platforms arise due to the collapse in the cost of collecting and diffusing data made possible by ICT. A specific category of digital enablers takes advantage of platform economy functionality to link supply and demand more effectively, resulting in reduced transaction costs as traditional middlemen are bypassed or done away with. Other benefits may result from using AI, machine learning (ML) and/or Big Data analytics to effectively synthesise, assess and display these data (for example through Digital Twins). On this basis, data management and modelling platforms may serve to strengthen: i) valuation of the benefits of NBS, and ii) measuring the effectiveness of NBS (referred to in Section 2.2.1). In turn, this may then mobilise new sources of NBS project finance, such as carbon or biodiversity credits, where there is a critical need for extensive data in both planning and operations.

The outcome of the platform economy, which is powered by novel applications of digitalisation, ultimately depends on whether there will be better functioning markets, how

they are structured, and how social values are protected (Kenney and Zysman, 2016).

3.3 Outstanding system issues

In urban areas, despite the potential contributions of digitalisation as reflected in the flourishing of “smart” cities, conditions on the ground continue to demonstrate mixed results (Albino et al., 2015). Extensive literature reviews and assessments of developments point to the presence of multiple obstacles and distortions. Entrenched perspectives and relations risk fostering a culture of unheralded acceptance of influences by narrow expertise with excessive focus on commercial interests and technological advances (Swyngedouw 2007; Vanolo, 2014).

Meanwhile, digitalisation in itself gives rise to specific issues, including a real or perceived lack of security, privacy and control of personal data, which are particularly detrimental to vulnerable groups (Kitchin and Dodge, 2019; Ismagilova et al., 2020). The increased dependency on digital communication during recent years as a result of COVID-19 related limitations to physical meetings, although driven by and sustaining major benefits of continued connectivity, also gave rise to issues. Examples include a sense of fatigue, conformity, and mismatch between technical requirements and user skills, (Picazo-Vela et al., 2012; Gordon and Mihailidis, 2016).

In addition, it is widely recognised that ICT does not in itself resolve issues of social fragmentation. On the contrary, ICT may well propel a widening “digital” divide (Norris, 2001; van Dijk and Hacker, 2003; van Dijk, 2005). The term captures lingering inequalities in the distribution of benefits from digitalisation, caused by differences in literacy, awareness, culture, and so forth. A related phenomenon is the emergence of a “mobile underclass” (Napoli and Obar, 2014). Whilst mobile phones have been credited with alleviating socioeconomic disparities, referring to affordability, safety, and service provision of particular relevance to the economically disadvantaged (Rice and Katz, 2003; Castells et al., 2007), the idea that improving access to ICT for disadvantaged groups by itself could serve as an equaliser fell more or less flat many years ago (Azari and Pick, 2005).

The insight has grown that addressing the digital divide hinges on a fundamentally changed approach (Kvasny and Keil, 2006; Bertot et al., 2012; Kummitha and Crutzen, 2017). More needs to be done for ICT and digitalisation to be accompanied by strengthened education and training – professional working life relations (Hayden and Ball-Rokeach, 2007; Edwards and Fenwick, 2016; European Commission, 2016; Patrinos, 2020). Basically, ICT needs to be part of a broader strategy, where a range of policies and measures are taken in tandem to address the root causes of downsides, by way of environmental impacts as well as income inequality and digital divide.

Addressing such issues requires the means to embark on transformative systems change, including governance. The H2020 UNaLab project has produced a set of online tools to support municipal authorities and other stakeholders in decision making concerning NBS implementation.

“The [Open Nature Innovation Arena](#) for city authorities lists relevant NBS challenges and offers participating stakeholders like citizens the opportunity to share ideas in resolving these challenges. The [City Performance Monitor](#) used by the cities increases stakeholder and citizen awareness of urban conditions through a representation of the effectiveness of NBS implemented in a given city using social, environmental and economic performance

indicators. The [NBS Simulation Visualisation Tool](#) makes it possible to evaluate and discuss how much NBS could impact urban change adaptation, simulating the effects on social, economic and environmental domains⁴⁸

Infrastructure4.0: Achieving Better Outcomes with Technology and Systems Thinking. Infrastructure 4.0 is defined in this report as "Forward-looking infrastructure that leverages technology and information to provide high-quality environmental, economic and social outcomes, and functions as a system within broader human and natural systems."

Digital tools can be deployed in support of citizen participation in order to promote the more widespread inclusion of citizens in defining, implementing and managing NBS to resolve issues that are relevant to citizens. Spatial tools, smart monitoring and assessment, and the cases highlighted in Section 4.2, offer examples. Building on Communities of Interest (CoI) in deprived neighbourhoods, the URBiNAT project extends these considerations to gain new ground in how to secure greater inclusion, mobilise social and solidarity economy dynamics, and thus counter issues of fragmentation and polarisation that promote a host of cultural and social problems, undermining trust, security and wellness in cities around the world. Examples of bonding counter-measures include applications of participatory geographical information systems (PGIS) in support of awareness creation and inspiration by targeted citizens in urban farming, locally produced food and enhanced wellbeing (Andersson, 2021).

Effective solutions in this respect cannot draw on technology alone. *Digital enablers* are defined in Andersson (2020a) as a bundle of building blocks adequately packaged and matched in support of co-creation by citizens of NBS, and also their aggregated construct of Healthy Corridors (Gonçalves et al., 2021). Digital enablers consist of four building blocks, namely purpose, methods, content and tools. *Purpose* is, in essence, what co-creation, or participation, aims to achieve. *Methods* comprise the means of encouraging a process of meaningful participation. *Content* is the substance that is devised, codified, and packaged, relating to the purpose, and tailored to the target audience (with the help of methods and tools). *Tools* encompass apps, websites, GIS, sensors, blogs, interactive boards and IoT platforms.

Digitalisation/the fourth revolution holds the promise of better embracing complexity, breaking silos in planning, coordinating public and private investments, considering the role of ecosystems as critical infrastructure and a source of supporting services. Other evolving elements, such as blockchain (smart contracting and monitoring systems that cannot be altered/corrupted) can contribute to strengthening NBS and NBE, realising sustainable supply chains, improving energy efficiency, and promoting the creation of secure and reliable smart cities. This may ultimately contribute to crafting new arrangements for changing the economic nature of common resources and public goods, and thus help overcome the problem of underinvestment and mismanagement of natural resources.

Artificial Intelligence and Machine Learning applications are ever-present in modern society and have de facto taken over a multitude of processes embracing both human and technical applications. AI and ML applications can help crafting timely managed content and rewards,

⁴⁸ See: <https://cordis.europa.eu/article/id/421778-ict-tools-methodologies-and-models-to-improve-cities-climate-and-water-resilience>

achieve inherently adaptive incentive schemes that draw on inputs from citizens and incorporate optimised reward structures. However, the terms within which AI and ML applications are to be utilised remain in flux, reflecting the absence of established orderly governance mechanisms for the advancement of these technologies (Kaspersen and Wallach, 2022). Resolving the limits and directions of AI and ML, governance will require consideration of both efficiency and ethics. The concept of human capability may be pointed to as a guiding framework. This implies adopting a distributed approach to AI/ML governance aiming for resolution of issues at the level where they can be practically dealt with most effectively. At the same time, coordinated capacity building is required to counter risks of data misuse, violation of privacy and exploitation of AI/ML applications for destructive purposes, such as corruption or war.

The merger between biological functions and AI is a case in point. Currently, the downsides of this merger are beginning to emerge. Legitimate purposes such as allowing for orderly authentication and authorisation of human beings to access buildings, drive cars or vote in an election may be hijacked and controlled for other purposes, entailing fraud, loss of privacy, psychological manipulation, addictive use, social anxiety and distraction, misinformation, and mass narcissism. In some respects, AI has already crossed beyond a point of return, where continued lack of oversight and effective demarcation lines puts up new threats to sustainability.

3.4 Conclusions and recommendations

The previous sections have outlined several channels and mechanisms through which technology influences the planning, delivery, and stewardship of NBS. and thus, the prerequisites for an NBE. Technology has served as a major contributor to economic growth. However, conventional economic growth has often increased resource consumption and pollution, leading to the loss of ecosystems and biodiversity. In this chapter, we underline the importance of putting technology to use as a catalyst for shifting from a conventional focus on limited commercial gains to an economic model aligned with nature.

Technology forms an inherent component of the toolbox required in this respect, having brought powerful means of assessment and communication, and instilling awareness and a greatly enhanced demand for environmental protection and sustainability. Technology continues to play a central role in developing suitable responses to critical societal issues. The present chapter has focused particularly on digitalisation, whose advance has brought a convergence in data infrastructure, processing, and use that spans disciplinary, sectoral and geographical barriers. Contrary to the past rise of “end-of-pipe solutions”, or merely improved product or process properties, digitalisation is now a force for systemic change at the aggregate level, instilling a broad-based impetus for increased transparency, citizen and stakeholder engagement and enhanced dynamics by markets as well institutions and policies to consider in the effort to clearly identify and articulate the requirements for an NBE.

The present assessment has highlighted the potential of technology to:

- Support decision making (public, private, investors) - for example in planning, design, valuation, and developing the NBS performance and impact evidence base through data monitoring and evaluation;
- Develop the market – for example by connecting key stakeholders;

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

- Increase participation - for example by raising awareness and citizen engagement, and underpinning reflexive governance;
- Enable new finance models - for example cryptocurrency and shared benefit modes;
- Propel infrastructure improvements.

There is a need for a governance approach aiming at long-term success in achieving a strong standing and constructive contribution of technology to NBS in all phases (planning, delivery, maintenance, monitoring, upscaling) and ultimately towards an economy based in nature, i.e., an economy whose interrelated system of human labour, exchange, and consumption is not only aligned with nature, but also provides numerous co-benefits for people and nature.

Recommendations

Data: There is a clear need for more and better-quality data on NBS, their impacts, and value-chains. Ways forward include harnessing the advancements of sensors, drones, Internet of Things (IoT) devices and Geographic Information Systems (GIS) to better understand where NBS should be prioritised, positioned and scaled to derive maximum benefit.

As data alone do not solve problems, advances in analysis and actionable knowledge are required. Technologies can vastly accelerate data analyses by automating processes. Multiple, heterogeneous streams of real-time data can be analysed, and abnormal data can be more easily detected.

Decision-support tools and stakeholder platforms: Through technology, tools can be developed to facilitate the work of decision-makers, simplifying recognition of win-win scenarios and synergistic scenarios. Technology can be deployed in support of better decision-making, integrating a robust scientific evidence base with citizen engagement (see Greenopolis case study). This includes staging consultation processes in ways that facilitate addressing potential trade-offs and meaningful compromise. In addition, policy-makers can widely benefit from tools and software, accelerating the process of designing better policies that consider biodiversity and ecosystem integrity in the context of the food, water, energy and climate nexus. Further progress is required, however, to create and mainstream adaptable decision-support environments for key stakeholders involved in NBS value chains such as farmers, urban gardeners, CEOs of nature-based enterprises, indigenous communities, foresters, government officials, citizen groups, environmental engineers, academia, and others.



Case Study: Greenopolis, interactive platform for citizen engagement with NBS

Greenopolis is a digital educational platform with exercises and activities that bring nature into the classroom and bring the pupils out into

nature. The digital content is structured into different themes. The first theme introduces the pupils to the concepts of biodiversity, ecosystems and ecosystem services, climate change and sustainable urban development. Through Greenopolis, the pupils get a basic understanding of how NBS can help create resilient cities. The digital learning platform is designed and developed with the aim of making the learning and exploring of NBS simple, inspiring, and motivating. The material is divided into five themes that all treat one climate challenge and introduce relevant examples of NBS to deal with this specific challenge. The Greenopolis platform was developed by Stine Kondrup's nature-based enterprise Intugreen within the H2020-funded REGREEN project.

Source: <https://greenopolis.intugreen.dk/>, Intugreen, REGREEN H2020 Project

Measurement tools: understanding the impacts of NBS-related decisions is essential, from the local levels to the wider implications for human and planetary health. Satellite imagery, real-time information, sensor data, AI and/or ML applications, market based digital incentives that provide a pathway for greater adoption of NBS, digital platforms, tool sets to automate NBS data aggregation, visualisation, and advanced analytics, all have a role to play in optimising personnel and financial resource use as well as fuelling widely diffused benefits of NBS across wide spectrum of stakeholders. For all this to propel an NBE, constructive interfaces are required between technologists, digital entrepreneurs, and a spectrum of other competences and perspectives.

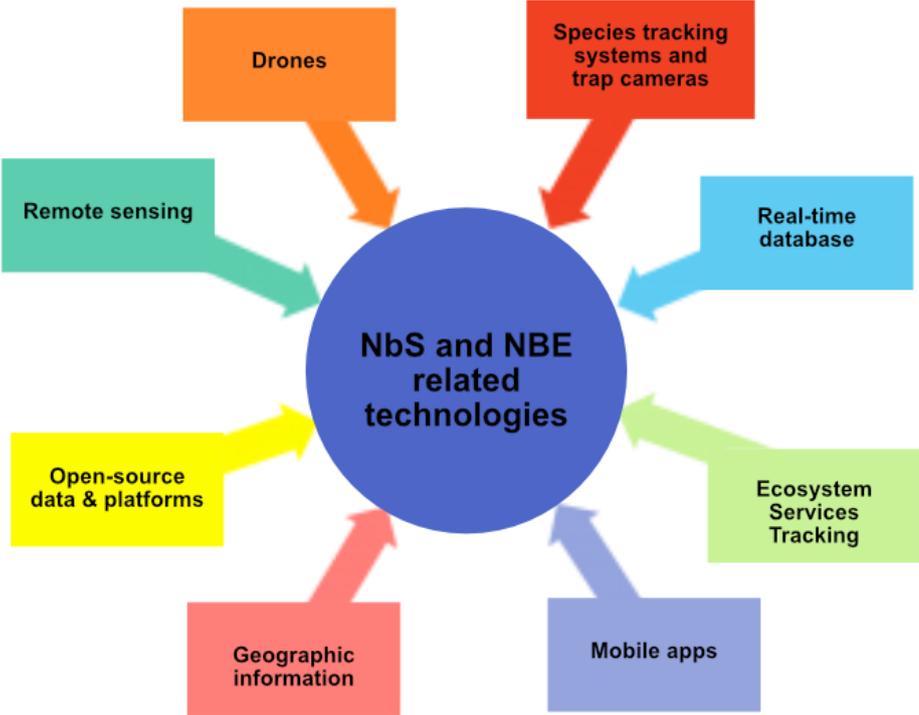


Figure 25 Overview of technological influences on NBS and NBE

CHAPTER 4 INTERNATIONAL PERSPECTIVES ON HOW NBS CAN CONTRIBUTE TO A NATURE POSITIVE ECONOMY

This chapter looks at perspectives from around the world on how NBS can be the backbone of a nature positive economy. The idea is to unveil the factors influencing how different countries, or cultures, are facilitating or hindering elements of a nature positive economy, aiming at answering questions such as: how are NBS reflected in global trends, including policies impacting public and private investment in NBS? What are the encountered challenges and opportunities? Are there specific networking, awareness raising and capacity-building activities related to NBS⁴⁹, which can help to spread the word about an economy based on NBS?

Naturally, there is no such thing as a single international perspective on how NBS can be the driver of a nature positive economy, given the multitude of players involved in the planning, implementation and stewardship of NBS and their differing interests (urban planners, community leaders, city administrators, decision makers, policy makers, landscape architects, entrepreneurs, students, researchers, etc.), as well as the different fields of inquiry (e.g., environmental, sociological, economical, ethical lens) as well as differing philosophical values or political orientations (e.g., liberal and conservative, moderate and radical, socialist and capitalist, optimistic and pessimistic points of view). As covered in Chapter 2, NBS value chains are formed by a complex setting of different stakeholders involved in different types of NBS. NBS value chains are complex - not only in terms of multi-stakeholder involvement, but also because of the interdependence across different regions or even across different continents.

The feedback from the consultation highlighted three specific contextual factors influencing the potential for a nature-based economy in different parts of the world:

- Natural environments;
- Economic contexts;
- Cultural contexts.

4.1 Natural Environment

Drawing on the mentioned consultation process, the relationship to the natural environment was identified as the first key factor influencing the potential for development of a nature positive economy. The opportunities generated by NBS and sustainable tourism were highlighted multiple times in consultation responses. **Ecologically friendly tourism** has been pointed out as a vector to promote pro-biodiversity actions and to contribute to nature restoration and nature conservation activities. A response from South America points to areas with an abundance of natural resources and biodiversity such as the Caribbean, Andean, Pacific, Amazon and Orinoquia regions and suggests these regions have the opportunity to engage in sustainable tourism as a means to help preserve the natural environment. The respondent also mentioned that there are manifold economic opportunities for local communities linked to the exceptional biodiversity of many areas in South America.

As identified in Section 2.2.6 on Sustainable Tourism, several journal publications have covered research on the links between NBS and sustainable tourism development (Mandić et al., 2019; Padma et al., 2019), analysing the potential of NBS in face of challenges such

⁴⁹ See the activities of the [UrbanByNature](#) Brazilian hub, for example, via the European-funded H2020 Connecting Nature project

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

as overtourism, climate change, conflict between stakeholders, loss of integrity of tourism sites, pollution, and refugee crises. However, further research is needed on topics such as the interrelations between environmental pressures, sustainable responses, and the future of tourism development within protected natural areas. The potential of sustainable tourism in the process of restoration of ecological integrity and enhancement of local and indigenous community wellbeing should be further explored. Likewise, there is a need for further research on the governance structures, management and planning related to sustainable tourism to foster the resilience of natural protected areas and safeguarding of sensitive ecosystems through NBS.

Taking into account the character and potential of a country in terms of availability of biomass and attractiveness of natural resources, as well as changes in consumer behaviour towards nature-friendly solutions, many regions can become proponents and safeguards of NBS.

"The UN recognises "wellness tourism" as the top reason people will travel internationally & Ireland is in a unique place to harness this welcoming small groups to a relatively unspoilt environment not saturated with visitors centres & the like." - Consultation response

On the other hand, the overuse of natural resources, the displacement of native plant and animal species by invasive non-native ones, the expansion of agricultural areas and the industrialisation of farming, as well as environmental pollution pose huge challenges, but can also become opportunities.

In terms of the relationship between humans and the natural environment, many countries identify "**Ancestral NBS**", mirroring a respectful handling of the soils and natural features. Pastoral activities run by families or small to medium enterprises used low-tech approaches, without posing a threat in terms of biodiversity loss. However, large-scale agriculture and herding coupled with poor environmental awareness has caused huge degradation through high amounts of fertilisers and chemicals, resulting in depleted soil along with the demise of traditional knowledge.

"Italy is one of the most biodiverse countries in Europe. Italians long-lived agro pastoral activities run by families or small to medium enterprises. Similarly to France, we still use many low-tech high-impact solutions and if seen from a NBS perspective, historically, we were amongst the most resilient societies. Recently intensive agriculture and herding (pushed by our beheaded capitalistic system) and a poor awareness of environmental damage done by fertilisers and chemicals, is depleting our soils and traditional NBS." - Consultation response

Responses to the consultation process indicate that economic opportunities for NBS are manifold in light of the **climate change** crisis. In some countries and regions that deal with droughts, desertification, temperature increase, urban heat island effect and floodings, NBS are key solutions for mitigation and adaptation processes to help to cope with climate change. NBS for water management is specifically mentioned in these contexts. Further, NBS can improve environmental conditions while generating new businesses and job opportunities in countries that are characterised by a high level of

unemployment; and lack of social cohesion and pollution is also an economic opportunity for NBS.

The potential for NBS has direct relations to the local context and the natural environment. Within a country, this potential can differ from region to region as a result of geography, land use (including urban and rural areas), climate change impacts and related vulnerabilities, as well as biodiversity, be it for hotspots or by risk of nature degradation. In countries with islands, mountains, and rural areas there is a huge opportunity for decentralised solutions such as NBS for water and wastewater management.

"My country is Syria and NBS is the best solution to handle the environment problem in such an arid climate. So important."

"Greece is already suffering from climate change impacts; desertification is already noticed in the southern islands, extreme weather events are becoming more frequent and intense (e.g. heat waves) and many areas (e.g. islands) are already suffering from limited availability of freshwater resources."

"The south of Spain will burn in the next 50 years due to climate change, with a high risk of becoming like the Sahara. Actually, already now in summer, the temperatures that Sevilla, Granada etc. reach are unbearable. NBS will be indispensable for climate adaptation-mitigation measures if we do not want to live underground."

- Consultation responses

Biodiversity hotspots with a richness of different taxonomic classes and the necessity to preserve them can generate manifold opportunities for ecological engineering solutions. Balancing biodiversity conservation with food security seems to be the key to global [sustainable development](#). Pressure on biodiversity by land use is a global issue, especially in Latin America, the United States, Sub-Saharan Africa, Central Europe, Southern Europe, Belarus, Ukraine, South Asia, China, Japan, South Korea, North Korea and Southeast Asia (Zhao et al., 2022). In this sense, international cooperation and mechanisms of assistance are required, as well as elaborating policies at global, national and regional levels. Considering that most of the hotspots are located in developing countries, NBS and related biodiversity conservation can be key to avoid repeating the mistakes of already developed countries. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES et al., 2019) stated that joint goals and targets need to be reviewed and scientific knowledge exchange paired with innovative technologies need to be updated to ease transboundary cooperation for environmental conservation. To enable cooperation mechanisms, international financial support for developing countries is crucial (Secretariat of the Convention on Biological Diversity, 2021).

NBS can foster the shift away from large-scale predatory agricultural settings, which are a leading source of emissions, deforestation and biodiversity loss, towards **chemical-free and sustainable food systems** with diversified crops. International organisations and initiatives can play a major role in providing science-based research for such a transition, which can itself unlock a whole range of new nature-based economic activities.

Similarly, given that **infrastructure** investments are one of the main pillars of stimulus plans globally for a green, fair, inclusive and resilient recovery, if designed as nature-based infrastructure packages, these can relevantly promote sustainability and quality in

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

sufficient quantity worldwide to make a shift towards ecosystem restoration and reposition of an economy rooted in and aligned with nature.

However, unfortunately a large proportion of fiscal spending in response to the **COVID-19** crisis will aggravate environmental problems by investing in non-sustainable sectors with a heavy biodiversity and carbon footprint. For countries to better deal with the aftermath of the pandemic by shifting towards a nature positive economy, there is a need for streamlined global guidance and greater international policy coordination. By synchronising and consolidating NBS-related frameworks, standards and indicators, global task forces can make an orchestrated call for larger commitments across NBS value chains.

"The stimulus to focus on nature usage for making and saving money from the family level (in ecological agriculture, controlled extractivism, art, tourism, etc) to the industrial level (by saving money from solid waste and wastewater management, monitoring a product life cycle, energy and light sources, better working conditions, etc) and the public sector (being able to invest less money in environmental sanitation, environmental health, fixing damaged infrastructure due to extreme climate events and build expensive short-to-mid longevity ones, etc, and investing it in other sectors) in Brazil would solve many socio economic issues that the country faces, like socioeconomic inequalities, loss of environmental quality and forest area, stimulate environmental consciousness by a large range of the society, promote more resources like fresh water and, since it is a hydropower energy-based country, more electricity capacity, bring more financial investment from abroad and many other benefits."

- Consultation response

NBS-related **public policies and procurement processes** should take into account local/regional scales instead of country scales, given that the adoption of the same NBS strategies can lead to different responses, even negative ones, depending on the particularities of the regional ecosystems in which they are located. Therefore, the local context is important to be considered in policy - NBS strategies need to be specific for their local environmental context to ensure effectiveness.

The relevance of **educational initiatives and awareness raising** strategies around NBS is also key to enlighten urbanites and people from rural areas about the value of nature (biodiversity, ecosystems, clean water bodies, oceans...) and to create new jobs to restore ecosystems, produce healthy foods, prepare cities to be resilient to climate impacts, shift to clean and active mobility in comfortable and safe ways, incentivise renewables, value and invest in local production, besides developing technologies that ease the rehabilitation of ecological functions. These activities altogether will form the basis for the development of a nature positive economy.

Since the pandemic crisis erupted, many relevant global reports were published ([IPBES 2019](#), [IPCC 2022](#), [WWF 2021](#), [WEF 2022](#), and others) highlighting the relevance of NBS. Together these open precedents for a nature positive economy to be developed. In some countries such as Peru, NBS interventions have been empowering communities to work with nature to safeguard it through conservation and restoration activities, whilst also heating up small economies in rural areas. In Kampala, for example, which has a highly relevant environmental context for many regions beyond Uganda, an economy rooted in and aligned with nature could offer answers to address the challenges of an aggressive urbanisation. For the development of nature-based economic indicators (e.g. urban forestry cover, air quality, blue infrastructure, green technology), governments, policy

makers, experts and the private sector need to collaborate in order to set the scene for balanced ecosystems amidst the threat of climate change, driving economic and political decisions as opposed to the norm. Governments should be encouraged to closely monitor indicators related to how NBS can contribute to the flourishing of a nature positive economy, getting the support from global task forces and enabling financial resources.

"Peru is one of the most biodiverse countries in the world, which makes it one of the most vulnerable areas regarding climate change impacts. Besides that, it faces political and socio economic challenges that increase environmental hazards and their consequences. During the past decade the country has been closely involved on global and regional pacts for climate, assuming it has an important role to play. Environmental policies in the country are a novelty once the Ministry of Environment was only created in 2008 focused on nature conservancy. Nature and economy had traditionally taken different paths, as well as social inclusion, but a possible shift of the business-as-usual model is being recently proposed here. (...) Yet, the design of business models to support and scale up NBS in Peru is challenging once it encompasses a range of actors and sectors that usually are not used to collaborating."

- Taícia H. N. Marques, Peru, input to the TNOC global roundtable on the nature-based economy

"Kampala has two population figures, that is a night population (residents) of 1.65 million people and day-time population of 4.0 million people (UBOS, 2019). This large disparity in the two population figures shows the urbanisation pressures this city faces. However, if the city fails to protect the ecosystem around Lake Victoria, then this will have devastating effects not only on the economies of countries within the Lake Victoria basin but also the countries served by the River Nile all the way up to Egypt in Northern Africa.."

- Isaac Mugumbule and Rhoda Gwayinga, Uganda, input to the TNOC global roundtable on the nature-based economy

4.2 Economic Context

It was evident from consultation responses that the economic situation of different countries and the conditions for NBS investment, can foster or hinder the development of a nature positive economy. Many recent publications make the case to increase green finance and investment in NBS, for example the UN reports (see section 2.2.2 on investment). In the latest report from the IPCC, investment in NBS has also been highlighted as crucial to tackle the ongoing interlinked crises of biodiversity and climate change and for meeting targets on biodiversity, climate, and land restoration. In fact, more than 40 reports were published in the last few years on "investing in nature", many of which directly refer to investment in and financing for NBS. Some private sector-focused nature conservation and NBS accelerator funds are being created to provide measurable conservation and social benefits while delivering financial returns for investors (e.g. [Nature+ Accelerator Fund](#), [Global EbA Fund](#), [Global Environment Facility Trust Fund](#), etc.). It is critical to examine what the many 'funds for nature' are really prioritising to make sure they are not flowing into environmentally harmful initiatives. Some funds are controversial, as many groups have been using the NBS term to include offsetting of emissions, which might be detrimental for nature (mining, infrastructure, etc.). The legitimacy of nature-based carbon offsets has been questioned during COP26 as experts grow sceptical of corporate "net zero" pledges. Some problems related to offsetting

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

emissions against NBS elsewhere are the postponing of the real reductions in emissions, which would be needed as of now. There is also the issue of transferring responsibility for reducing emissions from wealthy countries to poor countries, so that the wealthy countries are spared from performing significant behavioural change, because they can buy their way out by “offsetting”. Carbon dioxide removals do not offset fossil fuel emissions. So NBS should by no means be misused to greenwash the oil and gas industries.

In different economic contexts, greenwashing poses a challenge for NBS to catalyse the unfolding of a nature positive economy, as fundamental changes cannot take place as long as institutions, enterprises, industries and interest groups are able to make use of the NBS concept to cover up unsustainable activities, cementing predatory economic flows.

Another challenge for a nature positive economy lies on the ‘path dependency’ related to ‘demand for growth’, which hardly gets challenged.

“Our — meaning the world’s — issues of sustainability, resilience, livability, and social justice are so vast that the answers cannot be found in corporations donating to green causes, thus providing political cover. This is greenwashing. A cover up that simply happens to look green. Buried deep in our problem is that we are better at appearing to be green-virtuous than making fundamental changes that often are inconvenient or seem to “cost more”. This is for regular people too, not just businesses. Recycling comes to mind, when we recycle at higher rates, but consume even faster. We get a bigger car that has marginally better gas efficiency, but we drive more and don’t use public transportation. We buy organic food without worrying that it was grown halfway around the world. (...) For me, several imperatives are clear, although I am not sure people are ready for the political battles they would require. (...) We need to abandon economic growth as a de-facto good; We need to root out greenwashing; We need to accept the idea that sustainability will cost all of us something; We need to understand and act on (i.e., be responsible for) the true environmental costs and “footprint” of our actions. (...) We need everyone — all businesses and all people — to be part of the movement.”

- David Maddox, The Nature of Cities, input to the TNOC global roundtable on the nature-based economy

Investing in countries with high biodiversity to enable the implementation of NBS has been mentioned in various entries of the consultation process. However, willingness to invest in NBS depends on the level of awareness and political commitment of the region and country. The current economic system of ‘making money as fast as possible’ is a barrier for investing in NBS. The development of a nature positive economy, in which NBS play a central role, is seen as opening a range of possibilities and new career paths, also in developing countries.

“Access to funding is one of the most common barriers to NBS implementation. Governments can attract such investments and increase the market demand by modifying and re-orienting their policies, subsidies, and public investments and provide better incentives for private investors to finance adaptation projects. Procurement, financing conditions, industry standards, and other policies should be improved to ensure that NBS are included and evaluated among the various adaptation solutions and their benefits are assessed for all options under consideration.”

“The nature-based economy presents major opportunities for developing countries where

nature-based economic activities and primary industry sectors are often more important than in developing countries.”

- Consultation responses

Cities attain a critical role for the transition towards an economy aligned with nature, considering that urban centres are the home of a good part of productive activities and where the largest population of consumers reside. Key ecosystem services are being delivered in cities and clearly public investment remains essential for sustained financial support for conservation, restoration, and stewardship within and beyond urban and peri-urban landscapes. However, considering that the scale of investment required is not likely to be fulfilled by public investment alone, there is increasing interest to attract private investment in nature. Another argument to attract the private sector and stimulate broader engagement of urban actors. Realising an economy based on nature hinges on reducing multiple drivers of ecosystem degradation (large-scale conventional agriculture, biodiverse habitat loss, deforestation, pollution, etc.) while simultaneously closing part of the financing gap. Finally, a favourable policy environment is key to supporting the upscaling of on-the-ground impact and nature-based investments. However, policy frameworks should not allow the continuation of business as usual in return for investments in NBS. Risks in this respect have caused controversy around the concept, which has been criticised for sometimes distracting attention from what matters most, as well as for meaning different things to different interest groups.

“In a city evolving towards sustainability, nature should be an integral part of the urban planning, so that infrastructure, buildings, and mobility corridors are articulated with ecological networks, which are the natural support base for economic production cycles. Economy and ecology find an opportunity for synergy in urban areas, inspired by the common benefit and pointing to integrated goals of environmental sustainability, economic competitiveness, and social inclusion.”

- Eduardo Guerrero, Colombia input to the TNOG global roundtable on the nature-based economy

Direct incentives, as specific inducements designed to influence government bodies, businesses, non-governmental organisations, or local people to conserve biological diversity or to use its components in a sustainable manner, as well as indirect incentives are recommended, being the indirect ones those mechanisms which encourage people to support nature-based value chains by setting in place enabling conditions that will cause them to change their consumer and economic behaviour to protect ecosystems. Effective economic incentives should ideally be specified in overall planning guidelines and nature and conservation plans, aligned with regulatory frameworks as well as coordinated with monitoring systems upon indicators.

Financing and entrepreneurship in four regional UrbanByNature hubs considering their economic contexts

In a deliverable of the [Connecting Nature project](#), the [UrbanByNature programme](#) reflects on the state of nature-based financing and entrepreneurship in four hubs to unlock the implementation of NBS. The report gives recommendations for the four regional hubs based on the experiences that were made whilst implementing the UrbanByNature (UbN) Programme in Brazil, China, Korea, and the Caucasus. The report outlines the gap between

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

NBS products and services on offer by nature-based enterprises (NBE) and the demand for NBS by local governments. It also identifies opportunities for overcoming them (e.g., integration of NBS in policy initiatives, funding for nature-based enterprises, resolving procurement barriers).

A set of questions was sent out by Connecting Nature's Work Package 5 to the four active UbN regional hubs of Korea, China, the Caucasus and Brazil. The questions submitted to the UbN hubs were clustered into 4 groups considering:

- The NBS financing landscape in your city/region/country;
- Funding/support initiatives for SMEs and Start-Ups (in particular those oriented towards sustainable 'green' activities such as nature-based enterprises) in your city/region/country;
- The existence of nature-based enterprises in your city/region/country and the sectors of their action;
- The atmosphere for entrepreneurship and innovation for NBS in your city/region/country.

UrbanByNature Brazil

Encountered barriers in Brazil:

- Awareness of NBS needs to be spread: the number of enterprises that see themselves as NBE and recognise the potential of directly working with NBS could be raised through improved and targeted NBS awareness campaigns.
- NBE are usually receptive to engage in dialogues with municipal public actors.
- Lack of tailored accessible funding/ financing initiatives for NBS projects, specifically for projects at an early stage of development, as well as lack of results-based NBS financing schemes.
- Lack of public-private sector dialogue (e.g. lack of clear NBS-incentivising procurement processes).
- Small and medium-sized cities usually lack NBS capacity and knowledge of NBE who work with NBS.

Encountered enablers in Brazil:

- NBE are interested in capacity-building and strengthening relationships between each other, raising the relevance of the NBS agenda in Brazil and discussing common issues.
- PES supports the implementation of NBS in the territory - one of the few examples of blended finance that includes NBS as part of a consolidated strategy
- Large Brazilian cities usually have administrative staff with the technical capacity and projects.
- The existing national and regional legislation can be helpful to foster more NBS.

Key recommendations to unlock NBS Financing and Entrepreneurship in Brazil according information raised by UrbanByNature:

- The launching of associations such as the "[Aliança Bioconexão Urbana](#)" and of NBS clusters such as the [NBS Cluster of Malaga](#), which focus on reaching financial opportunities for implementing NBS in Brazilian cities and on lobbying for the NBS agenda in the country, is highly recommended.

- Building better conditions for partnerships between public authorities and enterprises is vital to promote the NBS agenda and subsequent implementation. Considering the current dialogue between the European Union and Brazil on NBS between government institutions as well as projects, there remains a lot of capacity-building work to be done within public institutions to create suitable conditions. Mentoring for public sector actors could be a suitable next step for the Brazilian UbN hub, using the UbN Programme as a starting point and delving deeper into relevant topics or challenges together with Brazilian experts.

UrbanByNature Caucasus

Encountered barriers in the Caucasus:

- NBS is a relatively new concept in the Caucasian region.
- No funding strategies or sources in the region with the goal of leveraging NBS implementation.
- Difficulties for scaling up NBS interventions due to delays when it comes to decision-making.

Encountered enablers in the Caucasus:

- Timely integration of NBS concept into EBRD requirements and possibility to work further with partners due to the countries being Associate Countries to the EU's Horizon 2020 and Horizon Europe funding programmes.
- Interest in [Connecting Nature's guidebooks and tools](#), especially on [NBS Impact Assessment \(Co-Impact app\)](#).
- Several NBS related initiatives were implemented as successful demos funded by public charity organisations and environmental conservation NGOs in Armenia, as well as through private and non-governmental initiatives, and by public funding through municipal budgets in Georgia.

Key recommendations to unlock NBS Financing and Entrepreneurship in the Caucasus according information raised by UrbanByNature:

- Tapping into the full potential of NBS in the region by providing small-scale funding for pilots to increase awareness and engagement of NBE would incentivise local action.
- The provision of small and medium-sized grants for communities, NGOs and other local actors would enhance NBS piloting in the region and disseminate adoption efforts as well as raise the interest of local companies to raise their skills to implement NBS.
- Making it mandatory to include NBS in public land use planning and developing voluntary guidelines for the private sector to follow/take on and ensure quality standards.

UrbanByNature Korea

Encountered barriers in Korea:

- Lack of clear political vision and a supporting policy framework for NBS as well as limited co-production activities with the local community and/or private sector, which could drive NBS implementation.
- Lack of consensus on the concept of NBS in Korea.
- Korea has a high number of development projects ongoing, but compensation schemes with NBS are still quite limited, so the sums still do not compensate for the losses and degradation caused by development projects.
- Insufficient resources to cover NBS maintenance and regular running costs.

Encountered enablers in Korea:

- Legislation from 2001 has been backing up funding lines for ecosystem conservation and restoration. There are requirements for urban developers to pay into an ecosystem conservation fund, which is then used for restoration projects such as NBS.
- The public sector has been the main funder of NBS in South Korea.
- The UbN Programme brought local governments together to learn about NBS for the first time in the Korean context and contributed to establishing the concept of NBS and having direct contact with national government policy-makers via events and dedicated sessions: a momentum has been created to influence policies.
- Public Korean research institutions established by national and local governments have been major supporters of NBS.

Key recommendations to unlock NBS Financing and Entrepreneurship in Korea according to information raised by UrbanByNature:

- It is highly recommended that greater attention and investments go into collaborative actions. Cooperative dynamics and shared practices among organisation members interested in NBS implementation can leverage moving towards a more sustainable nature positive and low-carbon economy.
- Actions to raise public awareness towards NBS in Korea would raise awareness and pave the way also for more local action and stewardship considering that the wider community is seen as a key player.
- Create new environmental compensation schemes with NBS to have developers at least partly compensate for the natural degradation caused by new development projects, which are popping up at a rapid rate in the country.

UrbanByNature China

Encountered barriers in China:

- Mainstreaming the concept of NBS and green infrastructure in landscape planning in urban settings still has a long way to go for Chinese cities.
- Challenges of stewardship: long-term financing mechanisms for the maintenance of NBS is seen as key, however ongoing mechanisms do not foresee it.
- Narrow motivation from stakeholders to engage in NBS implementation processes / relatively small interest in co-production due to top-down policy-making.
- Knowledge on and openness for blended financing schemes are still limited in China

Encountered enablers in China:

- Experience with sponge city programme: there has been a shift from grey infrastructure to green, defying conventional design practises technically, aesthetically and ethically.
- Strong political support: top-down political system with mandatory guidelines regarding the sponge city programme for government officials has been pushing the NBS agenda forward in China.
- Emphasis on ESG reporting among corporates
- Momentum generated on the topic of biodiversity (and NBS) by the Convention of Biological Diversity's COP 15, to take place in 2022 in Kunming, China.

Key recommendations to unlock NBS Financing and Entrepreneurship in China according information raised by UrbanByNature:

- Build on the growing momentum shift in the Chinese finance sector towards incorporating ESG criteria in investment processes, aligning projects with national goals, rather than only from the perspective of corporate social responsibility (CSR).
- Address the issue of inconsistency of policies by promoting greater policy synergies and NBS mainstreaming.
- Provide more NBS financing to leverage NBS implementation.
- Strengthen awareness on NBS effectiveness by using smart technologies, which can help to grow NBS demand.

Case study: UrbanByNature supporting nature-based enterprises



The [UrbanByNature programme](#) consists of training and capacity-building among local authorities, nature-based enterprises and the general public interested in NBS planning, delivery and maintenance. Online webinars can be watched on the Connecting Nature CitiesWithNature YouTube channels (70+ videos, more than 8,000 views). Prior to the pandemic, face-to-face knowledge-sharing events took place. Registrants receive a monthly Digest with updates related to NBS and invitations to take part in regional events and exchanges. Initiated hubs include Brazil, Caucasus, China, Korea, Spain, Flanders, Scotland (funded under the H2020 project Connecting Nature), Latin America and South Eastern Europe (funded under the H2020 project Clever Cities). Other ongoing H2020-funded projects (e.g. REGREEN, Clearing House, Go Green, CONEXUS) have manifested interest to use the programme's registrant base to share project findings and outputs with a broader audience (1,000 registrants from more than 120 countries). The programme has contributed to include the NBS term in relevant planning documents of Brazilian cities.

OSMOS, a nature-based enterprise of Connecting Nature, delivered a Mentoring and Exchange Module on Design Thinking for Enterprises of the

Brazilian and the Caucasian hubs. Participants from a diverse range of NBS-related fields (e.g. landscape architects; urban planners; engineers; GIS experts; advocacy and education organisations) joined. A Brazilian co-created local hub has become active as a result.

"The Mentoring Programme delivered by UrbanByNature and Osmos in Brazil was very well structured, organised and flexible. It used practical experiences from competent European counterparts to illustrate sound approaches to the implementation of private, governmental and community-based NBS initiatives. It keeps inspiring us all months after the completion of the programme!"

Guilherme Castagna, Founding Partner - Fluxus Design Ecológico



Testimonial from a Brazilian nature-based enterprise, Fluxus Design Ecológico:

UrbanByNature is supported by Connecting Nature and Clever Cities, H2020 projects, and hosted by the [CitiesWithNature platform](#), which has 200+ affiliated cities worldwide.

4.3 Cultural Context

According to the [Local Biodiversity Outlooks 2](#): "Worldviews that separate nature and culture are an underlying cause of biodiversity loss, as cultures condition behaviours and frame people's relationships with other people and with the natural world. The holistic and diverse value systems and ways of life of indigenous peoples and local communities (IPLCs) across the world offer culturally distinctive visions of alternative sustainable futures which need to be understood, respected and protected across the whole of government, economy and society. Yet, the cultures of IPLCs and the associated rich biodiversity on their lands continue to be eroded and displaced by dominant unsustainable production and consumption systems that are destroying the planet's biodiversity."

The outlook highlights that nature is intricately linked with the social and cultural systems that sustain and are sustained by nature. Some entries of the consultation process on the draft paper on the nature-based economy align with this perspective. Local traditions and ancestral knowledge are mentioned as having applied sound approaches to conservation and water management well suited to local contexts, given that in many parts of the world people have lived for centuries or are still living in harmony with nature. Indigenous people's values need to be preserved, and they need to (economically) benefit from NBS interventions. Among the recommendations for the post-2020 Global Biodiversity Framework of the [Forest Peoples Programme](#), one highlights the importance of alignment with IPLCs: "Any proposed 'Nature-Based Solution' of any type that may be situated on or impact on indigenous peoples' lands and territories must not proceed without full recognition of their rights and with their free, prior and informed consent." In this respect, more needs to be done in research, policy and practice to catalyse recognition of ancient

nature-friendly techniques and traditional knowledge as NBS, given that “Indigenous Peoples’ knowledge systems are nature-based and honour the complex interdependence of all life forms. This is the root of success for the sustainable management of their resources, including waters, rivers, oceans, peatlands, forests, deserts, prairies and savannas, developing effective solutions and practices for biodiversity conservation and climate change adaptation and mitigation. Securing the rights of Indigenous Peoples to their lands, territories and resources can conserve and restore our most vulnerable ecosystems”, as stated at the [2019 Climate Summit](#).

The 2050 vision of a world ‘living in harmony with nature’ requires a radical paradigm shift in value systems. Culture can be quite determinant in terms of people’s willingness to engage and invest in NBS. The more so in terms of behavioural change. Stakeholders, politicians, and civil society in general will only take NBS seriously depending on their level of awareness towards the challenges within their realities and how NBS could provide win-win alternatives. Besides this, not every person is aware of an earth-first perspective, therefore awareness raising, and educational activities are key to fostering an economy truly harmonious and rooted in nature.

“Ecological education is key to everyone. (...) The transformation of the way the economy functions must lead to innovative and creative ways to regenerate nature wherever possible, using our incredible capacity and imagination here on our planet Earth. For this to be achievable, it is also urgent to enlighten people to value nature (biodiversity, ecosystems, clean water bodies, oceans...) more than exploring other planets and buying superfluous consumer goods. (...) I believe we will see a shift in the way we relate to nature so we can remain living on this wonderful planet that is our only home. This has been said so many times that all humans should be eager to contribute to enhance all forms of life, protect existent ecosystems (terrestrial and aquatic) and be trained to live and work on this new regenerative paradigm of the nature-based economy.”

- Cecília Herzog, input to the TNOG global roundtable on the nature-based economy

Citizen’s acceptance of NBS and related collaborative governance models are essential to creating demand for NBS, given that people need to understand why NBS are important to be able to truly engage. It is easier to spread the word and inspire behavioural change if individuals feel they are part of the process, which can be strengthened by collective efforts and collaborative settings. The upscaling of good practices on NBS can be catalysed with co-creation by combining knowledge from local people with that of scientific institutions and public agencies. The context and stakeholders need to be taken into account - information and decision making need to be as transparent as possible and there needs to be a space for civic engagement.

“Many of us believe that raising living standards for the world’s underserved is moral, just, and right. Will we in the global north be prepared to sacrifice for this just cause? Maybe. Maybe not. For their part, all these new cities in the south are an opportunity to not repeat the same planning mistakes of current cities. We’ll need imagination and resist the temptation of the easy solution that has a big development company (often from the north) get paid to recreate an old-fashioned solution.”

- David Maddox, input to the TNOG global roundtable on the nature-based economy

CHAPTER 5 KEY ISSUES AND RECOMMENDATIONS

In this final chapter, we present key issues influencing the shift to a nature positive economy with NBS at its core. The following key issues were identified from open responses to the consultation and insights from working group experts (Table 4). A full report on the consultation process is available online⁵⁰.

Table 4 Consultation responses per category

Issue	No of open stakeholder responses
Standards	23
Measurement & Valuation	29
Public policy	49
Capacity building & Awareness raising among: <ul style="list-style-type: none"> • Financial institutions (7) • Public sector (26) • Private sector (29) • Citizens / Third sector (19) 	81
Economic opportunities	71

Following a synthesis of feedback, we illustrate key issues with case studies and identify some examples of existing resources and good practices before concluding with recommendations for different stakeholder groups.

5.1 Standards

As the concept of NBS matures, increasing concerns have been raised about misuse of the term and greenwashing. There have been increasing calls for transparent and widely accepted standards which can provide greater clarity around what is and what isn't an NBS and how NBS should be implemented at planning, delivery, and maintenance phases. European projects have identified that grassroots concerns over quality standards and long-term maintenance have even led to community opposition to NBS e.g., experience of Liverpool in the Urban Green Up H2020-funded project. The NetworkNature project also recognises the relevance of the topic by launching a semester theme⁵¹ on NBS and quality standards (April. 2022-Sept. 2022), stating that "It is important to understand what NBS are and what they are not, to adhere to principles which should guide the selection and implementation of NBS at any scale to ensure there is minimal room for critique and it doesn't support monoculture, greenwashing or results in strong, negative implications, e.g., avoiding gentrification as a result of greening neighbourhoods by ensuring socially inclusive planning processes". Clear standards can not only help to provide reassurance about NBS quality to multiple stakeholders, but also decrease risk leading to greater investment and increase community confidence in the maintenance of NBS in the long term. On the other hand, not all NBS can be standardised in order to realise the full range

⁵⁰ [Consultation Report on the draft White Paper on the Nature-Based Economy](#)
⁵¹ <https://networknature.eu/sites/default/files/uploads/nn-s3-concept-report.pdf>

of benefits possible and the trade-off between replicability enabled by standards and reaping the full range of local and systemic benefits should be carefully considered.

The introduction of standards was considered vitally important by industry professionals to raise awareness about good and ethical practices. Industry input from both small and large players into the development of standards was identified as an essential part of the process in developing standards and accreditation.

Some standards are already in place at a national level in more mature NBS industry sectors such as green roofs and forestry e.g., standards for vertical green roofs in Germany. In other emerging sectors such as NBS for health and wellbeing, the lack of standards and accreditation has been flagged as a concern by industry professionals with potential negative consequences from malpractice. There appears to be a disparity in the use of standards across Europe and globally, possibly linked to the different maturity of industry sectors across countries and regions.

International organisations such as the IUCN have published general NBS standards based on a set of principles about how NBS should be developed. A weakness of such standards is that they are voluntary, and adherence is measured by self-assessment. The development of training and accreditation programmes for independent experts to validate adherence to standards is a crucial step. Once international standards and technical regulations for NBS are defined, a mechanism should be put in place to enable conformity assessment, i.e., compliance with the specified requirements. There is the need to set up an internationally recognised institutional structure to facilitate assessment by internationally recognised auditors.

Significant work has already started on international standards among existing standardisation bodies. CEN/TC 465 has included NBS in its Scope and Business Plan.

The lack of standards is related to challenges faced in monitoring and measurement of NBS impacts e.g., a lack of standardised approaches and integrated assessments to measuring biodiversity net-gain, an approach to development, land and marine management that leaves biodiversity in a measurably better state than before the development took place.

Toolbox: Standards	
Example of global standard	IUCN Global Standard for Nature-Based Solutions - self assessment platform for those applying standard (Link)
Example of global standard	UN standard on ecosystem accounting standards (Link)
Example of national industry standard	Three new standards in 2022 (Arable and Horticultural Soils, Improved Grasslands Soils, Moorland and Rough Grazing) underpinning Sustainable Farming Incentive in UK. (Link) National Standards for Sustainable Drainage Systems in England and Wales (Link)
Introduction to Biodiversity net-gain	Introduction to biodiversity net-gain concept from Natural England (Link)

Building with Nature Standards

The BwN Standards support cross-disciplinary decision making about green infrastructure design and delivery, from both a planner's point of view (e.g., for use in both policy making and development management), and a developer's point of view in their application to the master-planning and detailed design, implementation and construction, or management and maintenance of green infrastructure. ([Link](#))

Recommendations by stakeholder type:

S1 Standards bodies: A consistent set of international standards is needed to guide and assess NBS planning, delivery, monitoring, and sustainability. As NBS vary in size and typology from small-scale urban projects to large-scale cross border landscape-scale initiatives, standards need to be adaptable to different scales. The IUCN Global standard for NBS⁵² and the European Committee for Standardization (CEN) work in Technical Committee such as TC 465 in the field of Sustainable Cities and Communities⁵³ represents a good starting point. However specific technical standards at international levels need to be developed for different NBS sectors and considering different climate and geographic conditions. NBS industry players, suppliers and end users need to be involved in the development of standards. As many small enterprises are involved in the delivery of NBS, standards should be designed to avoid market distortion in favour of larger entities. As such, it is necessary to develop standards backed up by an NBS policy-friendly environment, as well as legal and regulatory frameworks, in order to reduce risks and raise the opportunity for enterprises to compete effectively.

S2 Accreditation bodies: NBS standards should be accompanied by appropriate accreditation schemes which may be voluntary or mandatory depending on the potential impact on human safety and health e.g., mandatory standards needed for green building infrastructure and NBS for health and wellbeing. In order to overcome barriers related to legal frameworks differing from country to country and consequent NBS-related information asymmetries, international accreditation schemes can help to build trust and signal credibility. Reports on uptake of standards and accreditation by industry type, scale and location should be made publicly available and effectively communicated to policy makers and other stakeholders. Simplified accreditation processes should be considered for smaller market players.

S3 Policy makers: The importance of standards and accreditation in NBS upscaling should be recognised and actions to prioritise international standards and accreditation development should be supported at international policy level. Policy makers at national and regional levels need to put in place policy instruments to support the uptake of international standards and accreditation in local contexts.

S4 Public sector bodies: Uptake of existing and new standards should be accompanied by appropriate awareness raising actions across NBS value chains, including specific actions targeting investors. Capacity building measures to support uptake of standards and accreditation by NBS providers should be put in place, in association with industry associations where applicable. To avoid market distortion in favour of larger players,

⁵² <https://portals.iucn.org/library/node/49070> accessed 6/4/2022

⁵³ [cen-cenelec-green-deal-position-paper.pdf](https://cencenelec.eu/cen-cenelec-green-deal-position-paper.pdf) (cencenelec.eu)

specific measures should be put in place to support uptake of standards among smaller enterprises e.g., discounted access to capacity building actions and accreditation fees. If a conformity assessment service provider is a government body, trust can be higher, however, it does not automatically lead to acceptance of certificates. Governments can also encourage compliance to standards by offering training and capacity-building.

S5 Public sector procurement offices: Public procurement can require compliance to NBS standards and thus encourage firms and entrepreneurs to adopt national, international, or private NBS standards. For example, NBS enterprises might be required to comply with relevant standards to be eligible to bid on public contracts. Specific efforts should be made towards informing public sector procurers about standards development and accreditation. Adherence to standards should be incorporated into public procurement measures taking care not to lead to discrimination against smaller players.

S6 Industry (buyers of NBS): The NBS value chains are complex with many actors influencing purchasing decisions around NBS e.g., architects, developers, local communities, etc. Appropriate awareness raising and capacity building measures should be put in place to support the incorporation of standards into purchasing procedures that “do no harm” to environmental and sustainable objectives, i.e., not perpetuating environmental degradation and human rights abuses, whilst also avoiding discrimination against smaller NBS industry providers.

S7 Citizens, Community groups and NGOs: Community groups and NGOs can play an important role in increasing citizen and political awareness about NBS industry standards and demanding adherence to such standards in planning, delivery, and long-term maintenance.

S8 Industry (providers of NBS) and industry associations: Industry associations have an important role to play in contributing to the development of standards, supporting uptake of existing and new NBS standards and accreditation. Awareness raising actions and capacity building measures are needed e.g., industry awards and recognition for excellence.

S9 Investors: Investors should be made aware of developments in NBS industry standards and accreditation and take such factors into account in investment decisions that ‘do no significant harm’ (DNSH), in alignment with the six environmental objectives covered by the Taxonomy Regulation. Risk assessment models using benchmarks based on standards accreditation could then be developed for broad dissemination and accelerating investor interest.

S10 Researchers: Further research is needed on the value, and optimal approaches, to standards and accreditation for different scales and typologies of NBS and the impact of such approaches on different actors and the uptake of NBS as a whole.

5.2 Measurement and Valuation

The topic of measurement and valuation of NBS has divided opinions. On one hand arguments were put forward against valuation stating that nature’s intrinsic values shouldn’t be reduced “to utilitarian economic value... privileging those services that can be quantified” (consultation response).

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

Questions were raised about how adequately economic valuations can capture nature's contributions to human and planetary health. Others argued that more data and larger data sets were needed to inform decision-makers and investors about the urgency of the challenges faced. Some stated that mandatory valuation of ecosystem services is needed.

"In this capitalistic and increasingly monetised world, attaching tangible values to ecosystems and the services they perform is the most likely way to conserve them"

- David Simon, input to the TNOC global roundtable on the nature-based economy

The use of consolidated metrics, such as Return on Investment (ROI), was recognised as being of limited benefit with a clear demand emerging for a new approach that goes beyond financial metric to consider wider contributions to human and natural capitals. The importance of including non-monetary valuation methodologies using qualitative as well as quantitative indicators was highlighted.

Two contrasting approaches to NBS measurement and valuation were identified. On one hand, scientific approaches to measuring the benefits of NBS in terms of carbon capture and sequestration are well advanced and linked to monetary reward mechanisms thus incentivising investment in carbon related NBS. However, these market incentives have in some cases led to negative environmental and social consequences. In contrast with well-established methods of capturing the carbon value of NBS, biodiversity net-gain schemes are far less developed. Scientifically based approaches to measuring impact of biodiversity for nature recovery by enhancement of existing or creation of new habitats networks exist but are far from perfect and not widely used. This creates challenges in establishing baselines and measuring progress on achieving goals such as biodiversity net-gain. Strong arguments were made for valuation following bottom up as well as top-down approaches. Such approaches consider citizen and community perspectives, and the added-value of involving communities directly in climate related adaptation projects, including tree planting and maintenance, enhancing the capacity of decision-makers to confront critical trade-offs in support of sustainability.

For the private sector, the resources required to put in place specific accounting or valuation processes for NBS were seen as a huge challenge due to the complexity and costs involved. This is particularly the case for small companies where requirements for such practices in tendering processes could be construed as anti-competitive. These factors create a significant disincentive for investment. Natural capital accounting was identified as one of the better-known approaches to valuation of nature – but was criticised for not taking into account all the benefits of nature (*'piecemeal analysis of marginal impacts' - consultation response*). Notwithstanding the many challenges, it was argued that requirements for valuation should not delay the investment in nature that is critically needed. Existing valuation approaches need to be built on and expanded to reorient public as well as private investment towards nature.

The role of the public sector in taking a holistic and independent approach to NBS valuation and measurement was also highlighted. Procurers/procurement agencies need to understand the importance of using performance/outcome-based procurement for NBS taking into account a range of indicators and using a combination of monetary and non-monetary approaches.

Finally, the question of how to value NBS and the pricing of ecosystem services is still the subject of much discussion. Proposals on valuation put forward by MAES and UNEP amongst others have yet to be transferred into a policy format suitable for uptake.

Case study: Warsaw - valuing ecosystems services from trees to raise funds

"Warsaw takes good care of nature, and through our projects, we have demonstrated that nature too cares about us, bringing us benefits, including economic ones. This year we have implemented a pilot project involving the appraisal of tree ecosystem services. We learned that the air-cleaning, oxygen production and carbon dioxide storage services provided by trees in Warsaw alone are worth a whopping PLN 170 million a year (about EUR 37.69 million). This led us to launch a Green Fund, allowing the private sector to contribute to green projects across the city. The Fund aims to encourage businesses to support Warsaw's development, and to build a sense of community and co-responsibility for the city's space".

- Rafał Trzaskowski, Mayor of Warsaw (Speaking at the Connecting Nature Enterprise Summit, 29-30 June 2021)

Source: Connecting Nature, H2020 project

Toolbox: Measurement and Valuation	
Handbook	Evaluating the impact of nature-based solutions A handbook for practitioners Link
Project	<p>Transparent is an EU LIFE funded project developing standardized natural capital accounting and valuation principles for business. Link</p> <p>In the frame of the Urban Innovative Action IGNITION, Greater Manchester has compiled Capital Expenditure and Operational Expenditure for different types of NBS. Link The metropolis has also developed guidance for Net Biodiversity Gain urban development as well as a Natural Capital Investment Plan. Link</p> <p>Supported by Horizon 2020 funding, We Value Nature is a campaign supporting businesses and the natural capital community to make valuing nature the new normal for businesses across Europe. Natural capital stories, training resources and a media library are available to support businesses on this transition. Link</p>
Good practice in Financing Instruments	BankersWithoutBorders (BwB) TNOC contribution on the importance of Monitoring, Reporting and Verification (MRV) in financial instruments KPI bonds with a robust MRV mechanism and centralised mechanism named Green Neighbourhoods as a Service .
Accounting practice	Value based accounting (VBA) reporting on integrated profit and loss (P&L) shows how much positive and negative value is created for society. (Example)

Recommendations for different stakeholders:

V1 Policy makers at multiple levels: Policies to support the valuation of nature across all pillars of society (government, industry, and civil society) are urgently required. Such policies are underpinned by circular economy principles requiring a reduction in resource usage in line with planetary boundaries. Unless our usage of natural capital is measured and valued, there is no incentive to reduce current levels of overuse and wastage or invest in conservation and restoration measures. Piecemeal approaches to valuation of nature must be replaced with holistic monetary and non-monetary approaches that capture the multiple ecosystem benefits nature provides. Policy makers are urged to take action to:

- Put in place concrete measures to incorporate the valuation of nature in both public and private practices in line with the UN SDGs (part. Goal 8, Goal 11 and 15 and their targets), the future global post-2020 biodiversity framework as well as the UN NBS for Climate Manifesto (2019)⁵⁴. For example, measures (and international standards) to encourage a shift or expansion of the focus from global reporting of GDP to reporting of natural capitals-aligned indicator(s).
- Prioritise the creation of international multi-stakeholder databases to increase data availability and improve decision-making related to greater investment in NBS as part of a transition to the nature positive economy at a global level. This in turn will require significant advancements in the widespread acceptance of operationally useful Key Performance Indicators (KPIs) and SMART targets measuring impact across different valuation criteria (including non-economic). This will help to reduce risk and uncertainty about NBS performance and an enhanced understanding of non-monetary value creation leading to increased investment interest in the public and private sectors.
- Raise awareness and build capacities to value nature in the public sector, industry (large and small) and civil society tailored appropriately to different levels of knowledge and expertise. Particular attention should be focused on the value of nature to indigenous communities, vulnerable and marginalised groups as they may have a higher level of dependency but less access to the full range of ecosystem service benefits nature provides, which resonates with the UNEA NBS definition.
- Reporting of natural capital should be mandatory for public organisations and large industry players across their entire value chains with appropriate incentives and penalties put in place for non-compliance following a transition period. Baseline valuations should be accompanied by annual progress updates reporting on progress to reduce exploitation and support restoration. Valuation of the full range of ecosystem services and wider societal impacts and trade-offs should be taken into account.
- Measures to simplify valuation processes for smaller businesses and NGOs should be developed. Capacity building measures and a higher level of incentives should be put in place to support uptake followed by appropriate penalties after a longer transition period. It is essential that smaller players are fully involved in developing these processes and advising on suitable policy and capacity building measures.
- At an international level, an independent observatory should be supported to measure progress against policy development, capacity building and report on a range of valuation metrics across different sectors and geographies. Such an observatory would play a vital role in generating decision making data.

V2 Public sector institutions and agencies and their representative organisations at

⁵⁴ [First draft of the post-2020 global biodiversity framework \(cbd.int\)](#)

international level: In the absence of mandatory reporting requirements, public sector institutions and agencies should lead by example in following a voluntary code of practice for valuation of nature. To avoid a multiplicity of approaches emerging, international organisations representing public sector institutions and agencies such as IUCN, Climate Alliance, ICLEI, CitiesWithNature, Covenant of Mayors, C40 Cities, Natural Capital Coalition, etc., should play a leadership role collaborating on a widely accepted voluntary code of practice adaptable to multiple contexts. Such an approach should be supported by capacity building measures to encourage broad uptake.

V3 Researchers: While NBS is a relatively novel umbrella concept, a multiplicity of valuation approaches have already been developed quantifying ecosystem services benefits. This field is expected to continue to evolve and would benefit from a specific focus on this topic in existing fora for researchers such as Future Earth⁵⁵ where latest advances in this field could be shared. Advances need to be shared in a suitable format for policymakers, practitioners, and investors. Many opportunities exist to build on current programmes such as Horizon Europe, Creative Europe, the New European Bauhaus, InvestEU, Digital Europe, Erasmus+, etc.

The research community plays an important role as independent experts in the international observatory proposed under V1 to measure progress against policy development, capacity building and report on a range of valuation metrics.

Further investment is needed in research and development exploring the conceptual and operational opportunities and trade-offs of developing a carbon credit equivalent to capture the value of NBS for biodiversity, health and other benefits.

"Further work is urgently needed to test the effects of employing equity, risk-sharing arrangements rather than debt finance for NbS, such as by conducting randomized control trials to examine the effects of moving from traditional to more innovative forms of financing." Seddon et al. (2020)

V4 Civil society and NGO representatives: Similar to circular economy approaches, the valuation of nature requires a 'whole of society' approach. Awareness raising and capacity building measures should be adapted appropriately to encourage citizens and society as a whole to understand our collective dependency on nature and the importance not just of reducing waste but of different ways to contribute to nature conservation and restoration of planetary health through NBS. Many opportunities exist to build on current programmes such as Horizon Europe, Creative Europe, the New European Bauhaus, InvestEU, Digital Europe, Erasmus+, etc.

V5 Investors and financial institutions: Investors and financial institutions are often leading the field in the valuation of nature but primarily from a monetary valuation perspective using traditional cost-benefit approaches. Investors and financial institutions would benefit from capacity building on monetary and non-monetary valuation approaches and consideration of trade-offs (see recommendation V3). A voluntary code of practice should be established for investors. However, following such a code of practice should be mandatory for public sector investments in NBS and for hybrid investments involving public resources.

⁵⁵ <https://futureearth.org/> Future Earth is a global network of scientists, researchers and innovators for sustainability

V6 Industry and corporates and their representative organisations: As per recommendation V1, industry and corporates and their representative organisations should collaborate with policy makers on planning and delivery of a range of awareness raising, capacity building measures, incentives, penalties, and reporting mechanisms to support uptake of holistic valuation approaches i.e., going beyond current natural capital accounting approaches to consider wider ecosystem and societal benefits. The work of the global Task Force on Nature-related Financial Disclosures (TNFD) to develop a nature-related risk management and disclosure framework by late 2023 is tremendously important with the potential to lead to increased awareness and uptake of natural capital valuation approaches among industry, corporates, and government bodies.

Nature-based enterprises: By definition, nature-based enterprises involved in the delivery of NBS are highly dependent on nature and perform activities to increase biodiversity net-gain. However, due to their small size, many NBE are not able to accurately measure or value their impact on nature. Specific measures should be put in place to support these types of enterprises in measuring environmental impact e.g., specific support for investment through EU Taxonomy on Sustainable Finance (2021)⁵⁶. Such measures would facilitate greater investment and scaling, further increasing impact on biodiversity net-gain.

5.3 Public Policy

5.3.1 Multi-level, cross-sectoral policy development

NBS can only contribute to nature-based economic development if NBS concepts and approaches are embedded in multi-level, cross-sectoral policy frameworks developed through participatory processes and accompanied by a range of policy instruments. Stronger regulation combined with incentives for change and awareness raising are needed to drive market demand for NBS.

NBS and Biodiversity Policy: As the definition postulates, biodiversity is at the centre of NBS. The EU Biodiversity Strategy 2030, the UN Decade of Ecosystem Restoration, and the forthcoming CBD Post-2020 Global Biodiversity Framework all set out ambitious goals for biodiversity conservation and biodiversity net-gain. These frameworks, also with the EU Adaptation Strategy 2020 and the European Green Deal call for multi-level policy frameworks and endorse the recognition of a combined climate and biodiversity crises, which must be tackled in conjunction.

The EU Biodiversity Strategy 2030 calls European cities with over 20,000 inhabitants to develop Urban Greening Plans in order to systematically bring nature back to urban and peri-urban environments. NBS play a vital role for biodiversity enhancement to achieve the target of planting 3 billion trees by 2030. It is clear such plans will also mobilise policy, regulatory and financial tools to give a push towards a nature positive economy (Wilk et al., 2021).

NBS and Climate Policy: The potential for alignment of NBS with other mainstream policy fields is vast. In climate change policy there is clear evidence of the contribution of NBS to reducing carbon emissions, climate adaptation and mitigation. Yet policy dialogues on

⁵⁶ Information on EU taxonomy, establishing a list of environmentally sustainable economic activities https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/eu-taxonomy-sustainable-activities_en

climate change and NBS often happen separately. A good example of alignment is the Climate Change Initiative of the 17 countries in the climate change “hotspot” of the Eastern Mediterranean & Middle East (EMME) region. This initiative recognises NBS as a strategic tool for addressing climate change in a region with limited and declining bio-capacities.

Local and regional climate action plans, including Urban Greening Plans, now mandatory in many parts of Europe, can serve as an ideal legal framework to mainstream NBS for climate action and biodiversity loss when they are co-created across multiple policy areas and with multiple stakeholders. The co-creation of such frameworks with multiple stakeholders contributes to better governance of measures, including NBS initiatives. End-users should be involved in bottom-up policy processes “to create a much faster change (a transformative change) than the usual top-down policy processes.”

NBS and Economic Policy: In economic policy, there is a need for increased recognition of shared goals with environmental policy makers. There have been many dialogues around NBS and climate change and the impacts of climate change on national economies, but these dialogues rarely take place on the same platform. There are multiple opportunities for synergies through inclusion of NBS in Covid-19 recovery plans, regional development policies such as smart specialisation, sectoral policies such as circular economy and bioeconomy strategies.

“Economic and ecological cycles are closely interlinked, so dichotomies that confront economy and environment are more than ever unwise. Akin to related concepts such as bioeconomy, biotrade, climate economy, green growth, and green business, the circular economy model is generating a new paradigm pointing to a sustainable economy aligned with a global energy transition and biodiversity conservation urgency. (...) Sustainable cities require a strong development of circular economy schemes, since they are home to a good part of the productive activity and, in addition, the largest population of consumers. In a city evolving towards sustainability, nature should be an integral part of urban planning, so that infrastructure, buildings, and mobility corridors are articulated with ecological networks, which are the natural support base for economic production cycles.”
- Eduardo Guerrero, input to the TNOC global roundtable on the nature-based economy

NBS and Circular Economy and Bioeconomy: There is a need for greater research on how NBS fits with circular and bioeconomy approaches. Some examples are evident, for example connecting greening buildings to wastewater reuse or connecting the bioeconomy to decentralised and connected green infrastructure and organic waste management. At the EU level, the Strategy for the Bioeconomy⁵⁷ encompasses all sectors and associated services and investments that produce, use, process, distribute or consume biological resources, including ecosystem services. One of the key actions of the EU Bioeconomy Strategy is to “Understand the ecological boundaries of the bioeconomy”. It considers at the level of the whole economy the spatial dimension of a change in land management practices – for example how less intensive practices in one place can lead to a spill-over effect with more intensive land management practice in another place. This means

⁵⁷ EU Strategy for the Bioeconomy https://ec.europa.eu/info/research-and-innovation/research-area/environment/bioeconomy/bioeconomy-strategy_en#:~:text=The%20bioeconomy%20strategy%20will%20accelerate%20the%20deployment%20of,climate%20change%20strengthen%20European%20competitiveness%20and%20create%20jobs (accessed 6/4/2022)

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

stressing the importance of considering the trade-off that a nature positive activity can have on another location.

"Green entrepreneurship articulated with a culture of sustainability, circularity, innovation, and competitiveness: There are multiple opportunities for the development of enterprises based on the bioeconomy with circularity criteria that articulate existing capacities in urban centers with the comparative advantages of the biodiversity of each city-region. Businesses based on technologies for water reuse, biotechnology, urban agriculture, nature tourism on an urban-regional scale, bio-commerce with an emphasis on local products (with a low carbon footprint), improved production and marketing of natural medicines and nutraceuticals. These and other green business can be integrated into circular economy models with a greater efficiency in the use of resources inspired on ecological cycles." – Consultation response

NBS & Energy policy: In energy policy, synergies and trade-offs need to be explored with renewable energy production, particularly bioenergy but also hydropower. Opportunities for reduction of energy consumption through green building infrastructure also holds much potential.

NBS & Planning policy: NBS should be considered as an integral element of land use, landscape, and green building policies at different spatial scales. Some respondents to the consultation called for the creation of a master plan of land use at sub-national level underpinned by clear regulatory frameworks which would oversee the governance of green infrastructure and NBS on a statutory mandated basis, placing obligations on regional and local government bodies as regards integration of NBS into planning, design, and management processes. The Open Space Strategy of Glasgow is a good example of embedding NBS into planning policy at city-wide scale.

NBS & Health and Social policy: Increasing evidence is emerging of the potential of NBS to contribute to health and social policy. Scientific evidence linked the emergence of the Covid 19 pandemic with the destruction of natural habitats globally while the importance of access to nature for mental health and wellbeing as a pandemic response was equally well documented. Even before the pandemic highlighted this link the importance of nature in planning resilient and liveable cities was well established. NBS form an integral element of disaster risk reduction measures from the Sponge Cities of China to the Risk Resilience strategy of Kampala. However not all NBS developments have positive social impacts. Research has highlighted widespread social inequities in terms of access to nature and the importance of planning for, and putting in place, measures to mitigate against unintended consequences such as gentrification arising from increased NBS investment in an area.

The potential contribution of NBS to social policy in fields such as social cohesion is an emerging area of knowledge but knowledge about contribution to cultural policy is less well known.

"A nature-based economy is operating within our planetary boundaries, working mutually towards net-zero and resilience efforts. It is an economy in which the production and consumption of nature-based goods and services are used to meet the needs of the communities they serve, whilst regenerating and building resilience in the (eco)systems they rely on. For example, timber sustainably harvested from local mixed-species forest is used to substitute carbon intensive materials like cement or steel in construction efforts;

meeting housing needs, whilst supporting local labour markets via the new jobs needed to process and build with wood. **This example, however, sets out the fragility of the nature-based economy as it is an economy that must be deliberate and purposeful.** The forests, for example, if not planted and managed to regenerate soils, promote biodiversity, and build resilience to future climate scenarios, can further lock-in vulnerabilities to our systems. As a result, the increased use of timber in construction, though it would realise quantifiable carbon benefits via carbon storage in wood-based products in addition to providing new local economic opportunities, could jeopardise the ecological system in which it lives. Nature-based economies must therefore be designed deliberately.”

- Ellie Tonks, EIT Climate-KIC, input to the TNO global roundtable on the nature-based economy

Policy development and implementation related to NBS is closely linked to standards, certification, and valuation approaches as identified in the previous sections.

Case study Peru “Embedding NBS in policy frameworks”

Peru is one of the most biodiverse countries in the world, which makes it one of the most vulnerable areas regarding climate change impacts. Yet environmental policies remain a novelty as the Ministry of Environment was only created in 2008 with a focus on nature conservancy. Nature and economy had traditionally taken different paths, as well as social inclusion, but a possible shift of the business-as-usual model is being recently proposed here. The National Policy of Competitiveness and Productivity, approved in 2018 by the Ministry of Economics and Finance, incorporates strategies of circular economy to achieve sustainability. It is being complemented by specific roadmaps designed by the Ministry of Environment (MINAM), to guide each one of the most representative economic sectors of the country (industry, agriculture, fishing, and aquaculture), on closing the loop. In parallel, very fresh policies and regulations focused on Climate Change mitigation and adaptation are being launched by MINAM. From that, 154 National Determined Contributions are planned, among them Ecosystem based Adaptation (EbA), Natural Infrastructure (IN) actions and different approaches to mitigate greenhouse gas emissions to target 2050 neutrality. Together the two groups of policies provide the bases for NBS in the country and open precedents for a Nature-based economy to be developed. Even though this terminology is very new here, NBS is already cited on official documents referencing the planned NDC.

Toolbox: Public Policy ‘Multi-level, cross-sectoral policy development’

Factsheet	<p>EC Factsheet: Applying polluter pays principle in practice. (Link)</p> <p>Example from Poland of the Environmental Liability Directive (Client Earth, Link)</p>
Tool	<p>The Austrian Green Finance 2021 programme by the “Klima und Energiefond” supports companies and municipalities/cities in carrying out a profitability calculation for planned projects. Link</p>

Integrating NBS into planning policy	Glasgow’s Open Space Strategy (Link)
--------------------------------------	--

Recommendations for policy makers:

P1 Launch an immediate consultation on how to increase recognition of the vital role of “Nature-based Solutions” and related terms such as “nature-based enterprises” in relation to other strategies such as “circular bioeconomy”, “bioeconomy”, “nature positive economy” inter alia. This needs to be supported by renewed efforts to arrive at a simple NBS typology within the wider socio-economic context which is widely accepted. This in turn would facilitate the development of a ‘common language’ across policy sectors and monitoring schemes at all levels.

P2 Embedding of NBS terminology in sub-national, national, and international policy frameworks based on the development of clear standards, practices, measurement, and valuation of NBS impacts (see S3-S5 for specific recommendations for policymakers relating to standards and V1-V2 for specific recommendations relating to valuation and measurement).

P3 Alignment of NBS with wider policy development: consideration of NBS concepts and terminology as complementary and mutually reinforcing elements of other policy approaches including inter alia climate change and resilience strategies; land use and planning policies; energy and building policies; economic policies including bioeconomy, circular economy, and smart specialisation policies; social and health policies.

P4 Embedding of participatory decision-making processes in policy making: Leadership is required to embed participatory processes as an essential part of policy making and planning processes related to an equitable nature positive economy. While significant advances have been made on community engagement in NBS, increased engagement between local government and local business in exploring the potential of NBS as part of the nature positive economy are needed.

5.3.2 Investment / financing frameworks and instruments

At present, despite calls for massive investment in NBS (tripling of investment in NBS by 2030 and quadrupling by 2050 in line with the recommendations of the UN Report on the State of Finance for Nature (UNEP, 2021), the policy framework required to support such investment is lagging behind. In addition to the embedding of NBS in multi-level policy frameworks, significant investment is needed in long term strategies and policy instruments to bolster investor confidence leading to increased industry investment and development and ultimately scaling of NBS sectors. The EU Taxonomy on Sustainable Finance (2021) provides clarity on which economic activities contribute to climate adaptation and mitigation. When major companies and investors are required to disclose how their investments align with this taxonomy, a significant increase in the direction of private sector finance towards such activities is expected. While this taxonomy represents a significant milestone in sustainable finance, the contribution of economic activities to factors such as biodiversity remain underdeveloped. Table 2 shows that not all areas of NBS economic activity are included in this Taxonomy thus reducing opportunities for investment and market development.

The launch of the TNFD Framework on nature-related risk disclosure and management in the second half of 2023 may be another important milestone leading to increased investment in NBS. Policy measures are needed to raise awareness about such initiatives and increase usage among smaller industry players.

Many policy instruments already exist to disincentive negative environmental practices including applying 'polluter pays principle' through environmental taxes on air or water pollution or charges for waste and use of natural resources. Such charges however do not always address hidden costs such as the longer-term impact of pollution on public health expenditure or price in risks from missing trees or green infrastructure in urban areas. The extent to which public sector revenues from such 'polluter pays' levies are ring-fenced for investment in climate adaptation and mitigation measures such as NBS have been criticised, including by many in the public sector.

'Cap and trade' mechanisms setting limits for carbon emissions and facilitating carbon trading is another common policy measure. While carbon credits could be an important incentive for NBS - on the voluntary market and/or linked to EU Emissions Trading Systems (ETS), there is a need for a standard framework for carbon accounting and monitoring. Investment in NBS for carbon trading has come under fire recently for leading to intensive mono-culture plantations without adequate consideration of community rights and wider trade-offs. Such practices highlight again the importance of standards and certification throughout the NBS co-creation and planning, delivery, and stewardship phases to guide both public procurement and private investment. Equally some large corporations have been accused of 'green-washing' - investing in NBS to offset carbon emissions while maintaining 'business as usual' approaches to fossil fuel exploitation.

Given the 'public goods' nature of many NBS, securing private sector interest and investment requires consideration of a range of innovative financing approaches including for examples blended financing through public-private-people partnerships (see case study), environmental impact bonds, inclusion of NBS in tax-increment financing (TIF) measures, support for crowdfunding mechanisms for smaller scale projects or platform technologies to aggregate small-scale projects to attract larger investment interest.

Case Study: How an insurance firm stimulates green roof uptake in the Netherlands⁵⁸

When Interpolis, a damage insurance firm located in the Netherlands, studied their long-term roof damage cost data they came to the conclusion that these costs were steadily increasing. To counter this trend, they came up with the idea that increased green roof coverage among their clients might lower their expenditures on roof repairs, by protecting the roof from ultraviolet light, which damages the bitumen surface. In line with their 'prevention-oriented' market positioning, a business development manager at Interpolis developed a programme aimed at supporting and growing the green roof market in the Netherlands. They started a pilot in the city where they are headquartered, Tilburg, where together with the municipality and a green roof firm they organized a discounted offer for green roofs to all citizens in the city. After this successful pilot, Interpolis, together with the green roof firm, agreed to roll out their discounted green roofs through a national marketing campaign. Their offer was open to all citizens – not just current clients – also strengthened their positioning as prevention-oriented insurance firm. While the money that Interpolis invested was aimed at lowering the firm's costs and strengthened their positioning, their effort at coordinating collective buying power and thus upscaling the green roof market, was a directed intervention supporting the mainstreaming of a specific type of urban NBS. Their offering remains ongoing and has recently diversified to different types of green roofs (e.g., including more biodiversity).



Figure 26 Marketing campaign promoting green roofs (Photo credit: Helen Toxopeus)

Source: NATURVATION project

Crowdfunding as a tool can bring multiple benefits to NBS projects. In its essence crowdfunding is an online call to the public to fund NBS projects through many small investments. As NBS projects often fall into the domain of public goods, quantifying the direct economic benefits of NBS can be challenging. Two models of fundraising via crowdfunding two models stand out – donation-based and reward-based crowdfunding. Examples of such investments include: tree or forest planting, NBS in the school yards, NBS in kindergartens, building a pocket park or maintaining existing parks, starting or maintaining public gardens, and similar small investments. For such projects, ideal protagonists are community associations (with access to the skills needed to start a local campaign) and the municipality or city representatives (who can generate media coverage).

The crucial elements of crowdfunding are careful planning and timing, outreach and marketing strategy, storytelling skills, preparation of communication materials including videos, and building a community around the project. A strong marketing and community building strategy is needed around the crowdfunding goal, project, or initiative. By raising awareness of an NBS project via a public campaign, the developer of the project can increase public knowledge about city climate challenges, test levels of acceptance of

⁵⁸ More information: <https://www.interpolis.nl/slimme-oplossingen/groene-daken>

existing NBS as a solution to resolve urban challenges, or they can use crowdfunding to promote new nature-based solutions to citizens. The H2020 funded project REGREEN is investigating crowdfunding as a tool for financing NBS projects. They developed a website⁵⁹ to offer knowledge exchange and support on the financing of innovative green projects.

Beyond large-scale public and private investment at institutional level, policy instruments can play an important role in incentivising landowners, building owners and developers, farmers, and citizens to invest in NBS. In the building sector, similar incentives to those in existing energy/retrofitting schemes would help to offset the increased cost of private investment in green building infrastructure leading to increased market demand. Indeed, given increased evidence of the insulation values of green infrastructure, closer collaboration with those responsible for energy reduction in the building sector, could be mutually beneficial. In the agricultural sector conflicting policy approaches and incentives are well known and need to be urgently addressed e.g., support for intensive agriculture and draining of wetlands to increase land productivity exceeding incentives for biodiversity measures such as the 'Set Aside' scheme. On the positive side, alternative business models for sustainable rural development are increasingly gaining traction from rural afforestation schemes to regional eco-tourism initiatives.

"Sustainable urban and peri-urban agriculture in cities - at both micro and commercial smallholder scales - has substantial development potential in many regions: providing livelihoods to poor and low-income people and contributing to reducing food miles and greater city-regional food supply resilience."

- David Simon, input to the TNOC global roundtable on the nature-based economy

Case study: Example of public policy instrument to stimulate uptake

Scheme for the purchase of rainwater management installations, Bratislava – As part of the 'Bratislava Turns Green' project, the municipality encourages households to contribute to protecting the city from pluvial flooding through a subsidy scheme for the purchase of stormwater management systems. Since 2016, private organisations and households are eligible to apply for a subsidy covering 50% of total costs of the installation, for small-scale projects with a maximum cost of €1000. The scheme also offers consultancy to applicants on their project's implementation and disseminates information about the projects to raise awareness. Subsidy applicants are assessed by the Steering Committee of the subsidy scheme (consisting of the Vice Mayor, Office of the Chief Architect, the Department of Strategies and Projects and the Department of the Environment). The majority of successful applicants installed rainwater catchment tanks, created rain gardens, replaced impermeable surfaces with permeable materials or installed green roofs.

Source: GrowGreen H2020 project⁶⁰

⁵⁹ Information on innovative financing of NBS from H2020 project REGREEN www.nature-solutions.eu

⁶⁰ Source: <http://growgreenproject.eu/approaches-financing-nature-based-solutions-cities/>

Toolbox: Investment / financing frameworks and instruments	
EU taxonomy for sustainable activities	The EU taxonomy is a classification system, establishing a list of environmentally sustainable economic activities. It could play an important role helping the EU scale up sustainable investment Link
Taskforce on Nature-related Financial Disclosures (TNFD)	The TNFD is delivering a risk management and disclosure framework for organisations to report and act on nature-related risks. Link
OECD Guide 'Biodiversity, Natural Capital and the Economy'	Biodiversity, Natural Capital and the Economy: A Policy Guide for Finance, Economic and Environment Ministers Link
World Economic Forum White Paper on Private Sector Investment	Scaling Investments in Nature The Next Critical Frontier for Private Sector Leadership Link
Global Canopy Handbook on Investment in Nature	The Little Book of Investing in Nature Link
EIB e-learning resource on Investing in Nature	Online toolkit to help identify the cost-saving and revenue-generating opportunities of nature and think about optimal financial structure and financing options Link
Catalogue of financing approaches for NBS	An overview of financing approaches that can be used to deliver green infrastructure and Nature-Based Solutions including public policy (prepared by GrowGreen H2020 project, Link)

Recommendations on Investment/Financing Frameworks and instruments:

Policy makers at international level

Recognising the economic, environmental, and social benefits that accrue from investment in NBS, significantly increase public sector investment in NBS in line with UNEP calls. Leverage public-sector investment to stimulate a massive increase in private sector investment through blended financing mechanisms, resulting in a rebalancing of current investment ratios between public and private investment in NBS.

Accelerate the activities of international networks, working groups and taskforces towards increasing and incentivising positive financial flows towards investment in nature across all governance levels, accompanied by measures to reduce financial flows towards activities harmful to nature.

P3.1 EU Taxonomy on Sustainable Finance: inclusion of specific references to potential of NBS in Taxonomy as an activity contributing to climate change adaptation and mitigation. Acceleration of plans to identify economic activities contributing to biodiversity net-gain with clear references to NBS where relevant. Inclusion and publication of data on increased financing of NBS from corporate disclosures of related investment. Requirement

for public sector disclosure of investments in NBS in line with EU Taxonomy.

P3.2 Task Force on Nature-related Financial Disclosures (TNFD): higher level of engagement of EC policymakers in TNFD activities to ensure alignment of disclosures with EU Taxonomy on Sustainable Finance and other policies.

P3.3 Increased monitoring of 'cap and trade' mechanisms to include the use of NBS standards, certification and monitoring in carbon trading investments ensuring biodiversity net-gain, community engagement and inclusive governance.

P3.4 Significant increase in investment in research and pilot experimentation of biodiversity credit mechanisms modelled on successful carbon trading mechanisms.

P3.5 Develop a comprehensive international framework for labelling, tracking, reporting, and verifying capital flows and outcomes in NBS contributing to the nature positive economy. This could be developed either through existing international frameworks and bodies (e.g., UN conventions) or through international standards applied at local level.

P3.6 Agree a formalised strategic plan at the global level to introduce a cross-cutting modality of investment for NBS across policy sectors and initiatives, effectively creating an asset class for NBS

P3.7 Increase investor understanding of NBS: Measures are needed to increase investor understanding of NBS cost structure and business models, including long term maintenance requirements and the benefits of inclusive decision-making processes relating to NBS.

For policy makers at National / Local government level:

P3.8 Ring-fencing of environmental tax revenue for increased investment in climate and biodiversity actions such as NBS.

P3.9 Portfolio approach - rating NBS attractiveness for investors: We recommend immediate measures to build a portfolio of NBS projects for public and private sector investment at local/national government level. We recommend the potential impacts of NBS projects are valued (monetary/non-monetary) and based on this valuation projects are rated in terms of attractiveness for private sector investors, for public investment and for hybrid investment.

P3.10 Development of new policy instruments to support increased private sector investment: Experimentation of a range of innovative financing approaches including for example blended financing through public-private-people partnerships, environmental impact bonds, support for crowdfunding mechanisms for smaller scale projects, inclusion of NBS in tax-increment financing (TIF).

P3.11 Increase local business investment in NBS: Measures should be put in place to increase awareness and engagement of local businesses with communities and other actors in decision making processes around NBS. Local Green Deals or local biodiversity contracts could be strengthened as potential vehicles for such collaboration. Studies show that increased engagement has led to local business investment in public NBS through for example Corporate Social Responsibility measures or through use of facilities such as office space/venue hire in public NBS.

P3.12 Increase awareness of business benefits of NBS from specific NBS such as green (building) infrastructure. Increase business understanding about cost-efficiencies but also cost structures (maintenance requirements) and standards in particular in urban development/construction sector. Put in place direct incentives to support private sector uptake. Reduce restrictions in terms of construction regulations and policy restrictions. Support market development through platforms and competence centres.

Case study: Public-private collaboration in NBS implementation



Source: Raúl Sanchez. URBAN GreenUP Green Façade implemented in the “El Corte Inglés” building.

The URBAN GreenUP project is focused on the implementation of many Nature-based Solutions to fight against climate challenges in urban areas (heat island effect, flood risks, air quality, ...). The involvement of local authorities, citizens and NBS technology providers is essential to achieve the engagement of the urban community.

Implementation of NBS on existing infrastructures or buildings is one of the most important barriers in Cities. However, public-private collaboration appears as one of the most relevant ways to solve this obstacle.

The Green Façade implemented on El Corte Ingles shopping building in Valladolid is an excellent public-private collaboration in which both entities have participated in the co-design, co-funding and co-implementation of this NBS.

In the same way, the St. John's Green Wall in Liverpool is presented as another representative public-private collaboration case study in the URBAN GreenUP project.

Source: URBAN GreenUP, H2020 project⁶¹

P3.13 Increased policy instruments to incentivise land-owners, building owners, farmers and citizens: related to P2 expansion of existing energy/retrofitting incentives to include

⁶¹For more information on URBAN Green UP <https://www.urbangreenup.eu/about/about.kl>

investment in NBS; increased incentives for farmers to invest in biodiversity measures accompanied by penalties for biodiversity loss.

P3.14 Increase consumer demand: Put in place measures to increase the level of consumer awareness of the benefits of NBS and the need and opportunities for public, private and consumer investment and engagement. Measures should encourage communal identity to overcome cultural differences, build awareness of environmental issues and offer guidelines for living in harmony with the environment e.g., vegetable gardens, compost toilets, biking, etc. Measures should be accessible and inclusive e.g., technology platforms and social media but also direct outreach, education, and engagement activities with groups such as schools, elderly or vulnerable groups.

P3.15 Citizen financing: Put in place measures to facilitate community financing of NBS as part of inclusive approaches to co-governance⁶².

P3.16 Partnerships / platforms / infrastructure: The public sector can also direct actions to stimulate private demand through for example, fostering public-private partnerships with entities that own land or buildings - enable NGOs to use these facilities for NBS; create platforms for idea exchange, and business growth and resource bundling.

5.3.3 NBS in economic development policy

"Nature-based solutions can only provide the framework and foundations of a nature-based economy if these solutions are accompanied by strong overarching policy recommendations that ensure barriers to scale are addressed, and enabling factors are enhanced."

- Rupesh Madlani and Emre Eren, Bankers Without Boundaries, input to the TNOC global roundtable on the nature-based economy

The increased involvement of private sector and community organisations in delivering NBS has the potential to contribute to long term sustainable economic development in harmony with nature. Economic benefits include increased innovation stemming from research and practice, development and deployment of new innovations including social innovations, new enterprise creation, scaling of existing enterprises, skills development, and job creation in both high-tech and low-tech fields. The potential of NBS to contribute to socio-economic development has been recognised in European policies such as the Green Deal, the 2030 Biodiversity Strategy and internationally through organisations such as IUCN, the UNEP and the WEF.

To date however specific policies to leverage the socio-economic potential of NBS have not been widely put in place at national and sub-national economic policies. Local governments have been identified as key stakeholders in nature-based economic development. However significant knowledge gaps exist which are currently hindering the development of economic policy and accompanying measures. Knowledge gaps include a lack of robust economic assessment of the potential of different market sectors in different regions of Europe and globally. Little is known about market characteristics such as integrated value

⁶² See [MyParksScotland](https://www.myparkscotland.gov.uk/) for a good practice example and REGREEN H2020 project on crowdfunding www.nature-solutions.eu

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

chains, the length of product development cycles, business models, routes to scaling, the investment landscape, and the mechanism of community engagement through co-creation and collaborative governance processes. This information is essential to support policy development and investment. Some countries such as Austria are taking the lead supporting market research at national level in sectors such as green buildings, investing in research and development, cross-policy collaboration with other sectors, putting in place market development mechanisms, capacity building measures, standards, and certification schemes. This type of holistic market development approach is needed across multiple market sectors and at an EU wide level underpinned by robust research on market potential and widely accepted standards or codes of good practice.

Public procurement policies

Given that 86% of investment in NBS currently comes from the public sector (UNEP, 2021), public procurement policies can play a highly influential role in market development. However, the rigidity of existing public procurement practices presents many challenges. NBS are complex to implement, requiring public agencies to be open to redesign of public procurement policies and monitoring and evaluation criteria in collaboration with stakeholders at a regional/ local scale. The importance of using long term performance/outcome-based procurement approaches which take into account social and environmental benefits may require a departure from short-term cost-benefit analysis approaches. While standards for good practice should also be integrated into public procurement processes, safeguards need to be put in place to ensure smaller players are not disadvantaged with some concerns raised in this consultation about standards “opening the door to big corporate overtake of the NBS market...”. Involving smaller players in policy making would help to mitigate against this risk.

Toolbox: Public Policy ‘NBS in economic development policy’	
EC Report on Public Procurement in NBS	This report provides an overview of the major challenges facing NBS procurers in the EU, along with case studies of success in addressing those barriers (Link)
Urban Governance Atlas	The H2020 project INTERLACE (Link) is developing an Urban Governance Atlas (UGA) for nature-based solutions. The UGA is the first database of its kind and will allow users to explore all different kinds of policy instruments and governance approaches being applied to foster NBS across the world, especially coming from Europe and Latin America. By focusing on policy instruments that have been proven to work well, the UGA will support cities to become greener and more inclusive and serve as a resource for civil society, the scientific community, and more audiences (Link)
EC Expert publication on NBS towards sustainable communities	This report examines how far Naturebased Solutions can contribute to transformative action for sustainable communities. It examines how such initiatives enable participation and inclusion in the design and implementation of sustainability at the local level and the extent to which the outcomes of NBSs are transformative for communities Link

Recommendations on NBS in economic development policy:

P4.1 Increased investment in research and demonstration activities at global, European, national, and sub-national level to establish the economic potential of different NBS market sectors and the specific characteristics of each sector

P4.2 Holistic approaches to economic policy development at global, European, national and sub-national level addressing research and innovation gaps, opportunities for cross-policy collaboration, market development mechanisms, capacity building measures, standards and certification schemes.

P4.3 Address well-known roadblocks in public procurement through capacity building, experimentation and upscaling of new approaches co-created with local stakeholders including smaller players.

P4.4 Embed multiple actors in decision-making processes on NBS at all policy levels. The EU needs to lead by example as regards the engagement of multiple actors including community representatives, industry players and SMEs in setting policies with regard to NBS. Similarly, industry and NBE need to be involved in NBS policy development at local and national level.

P4.5 Deliver seed funding support and capacity building measures to empower local community and third-party organisations to take on an increased role in social innovation related to NBS.

P4.6 Economic policy also needs to focus on the exploration, testing and sharing of best practices regarding robust sustainable business models both for projects and for entrepreneurs providing NBS services and support (e.g. tech entrepreneurs), as well as active incubation/acceleration mechanisms to support these businesses in starting and scaling. This should be at national, regional or pan-national levels.

5.3.4 Potential in developing economies

The potential for nature-based economic development in developing economies and countries was highlighted multiple times in the consultation. Political will was identified as either a significant barrier (in the case of Brazil for example) or an enabler (in the case of Peru) to NBS investment. The importance of regulatory frameworks coupled with penalties and incentives to stimulate NBS uptake was stated.

The need for a shift in development finance was also identified in this consultation:

‘Project appraisals by international (and national) funding institutions (IFIs) currently are based mostly on economic grounds and technical cost-benefit analysis., while nature, environment and even social factors are considered as second thoughts through so called environmental and social safeguards, such as environmental impact assessments and resettlement frameworks.’ – Consultation response

Case study: Potential for nature-based economic development in the Western Balkans "The social perspective of ecological transition is highly important: the nature-based economy allows for new jobs, often less complex and more enjoyable, which can

lead towards healthier and more just communities. In the context of the Green Agenda for the Western Balkan, there is a strong potential for various sectors of nature-based enterprises in the EU Candidate Countries. Community landscape and biodiversity restoration has become fairly popular, as well as agritourism, regenerative agriculture and beekeeping. Demand for biomaterials for construction, green roofs and walls, as well as nature-based urban regeneration for urban green commons, green space management, and natural flood & surface water management are expected to develop in the near future. Challenges to uptake the nature-based economy in this area lie in the strong traditional engineering matrices and institutional impedance towards less technically-intensive, Nature-Based Solutions. Nevertheless, integrating urban perspective and the values of nature has never been more important. Post-pandemic recovery is the perfect occasion for spatial and urban planners to spark the conversation on grey-to-green transition of the public spaces and infrastructure, and for the governments to accept Nature-Based Solutions and the accompanying economic activities, reskilling and upskilling of workers for green jobs, and adoption of policies which truly embrace nature-based economy."

- Ana Mitić-Radulović, CEUS, input to the TNOC global roundtable on the nature-based economy

Recommendations on realising the potential of NBS in developing economies:

P6 Shift in development finance to put environment and social criteria on an equally footing to economic and technical criteria for investment.

P7 Increase funding for knowledge exchange and collaboration between regions of Europe and the rest of the world, in particular the Global South. Increased funding through Horizon Europe work programmes to enable cooperation with world regions that have degraded ecosystems due to the supply of nature-based products to more developed economies. RTD outcomes should be more closely aligned with existing support and investment in NBS in developing countries through, for example, programmes such as the Global Climate Change Alliance Plus (GCCA+), an EU initiative to help vulnerable countries address climate change, largely based on NBS.

5.4 Awareness and Capacity Building

5.4.1 Awareness

"Public awareness of the climate crisis and lack of biodiversity leads to NBS. It needs to move from a niche to a broader movement. Awareness about Nature-Based Solutions among the public sector is in general still low, but interest is growing."

- Consultation response

Policy makers: There is heightened awareness among international policy makers and among political leaders about the climate and biodiversity crises. The levels of awareness about the potential of NBS to tackle these crises varies globally. Support for NBS is higher in countries where knowledge is higher. In Europe consultation feedback indicates higher knowledge levels in Northern and Western Europe and lower knowledge levels in Southern and Eastern Europe.

In general, however, even in countries with a high level of awareness of the potential socio-environmental benefits of NBS, little is known about the potential economic benefits. Similarly, while progress has been made on NBS awareness at sub-national level, except

for environmental policy makers, significant knowledge gaps remain at all policy levels about the wider benefits of NBS.

Citizens: The level of knowledge of the general public about NBS is low. It is not a commonly used term in comparison with other related concepts such as biodiversity loss/gain, ecosystem restoration and even green infrastructure. Increasing understanding and social acceptance of NBS is essential.

"Improving the educational sector to increase knowledge about NBS and NBE is a higher priority. Without education, strategic plans will not work due to lack of acceptance: if people don't know what it is and why it is important, they are not willing to pay for it."
– Consultation response

Young people have been identified as critically important in effecting systemic change. The level of awareness among young people about the need for transformative economic change was perceived as encouraging.

"Many environmental activists from these generations (Y and Z, millennials, and post-millennials) refrain from opportunistic and anthropocentric monetizing and pricing of ecosystem services and from considering nature as an asset, claiming that nature is invaluable."
– Ana Mitić-Radulović, CEUS, input to the TNOC global roundtable on the nature-based economy

Awareness is increasing about new market opportunities related to sustainable development of natural resources such as forestry and tourism. Efforts need to be made to ensure that local communities and local politicians understand and are empowered by the NBS concept leading to meaningful engagement in co-creation and co-governance processes.

Public sector: within the public sector there has been some scepticism about the effectiveness of NBS. This has led to path dependency on grey infrastructure solutions and a reluctance to change products and processes or even to embrace hybrid approaches. There is some evidence to suggest attitudes are changing in line with increased scientific evidence of multiple NBS impacts and other factors such as cost-benefit attractiveness in the long term.

Consulting/engineering companies: large companies who have historically focused on the design and delivery of grey infrastructure are increasingly exploring the potential of NBS and the opportunities for hybrid solutions. More needs to be done to build industry awareness accompanied with capacity building measures in research, training, standards, and certification to inspire industry confidence and overcome inertia.

Industry players: The concept of nature-based enterprises is even less well-known than the concept of NBS which is unsurprising given the novelty of the concept. Among industry practitioners the definition of this umbrella concept was generally accepted as it helped to differentiate between established industry practices and emerging nature-based industry practices in fields such as landscape architecture, nature-based therapies, sustainable tourism etc.

Awareness is increasing about new market opportunities related to sustainable development of natural resources such as forestry and tourism. Some specialised industry associations and networks are promoting greater uptake of NBS (e.g., landscape architecture) in education and practice. However, even where levels of NBS awareness are high (e.g., Sweden and Netherlands), industry knowledge is low and there is a lack of standards and incentives for private sector uptake. Platforms for collaboration (online and offline) where supply and demand meet, and best practices are highlighted are important.

While some sectors such as the green buildings sector, for example, are experiencing an increase in private sector demand, industry suppliers suggest this investment is 'still more about aesthetics than environmental, social and economic benefits'. Deeper awareness and long-term investment are needed.

Media: There is relatively little coverage of NBS success stories in the mainstream media which is important in raising overall citizen awareness. In contrast there has been extensive coverage of protests against NBS at COP26 for example. Constructive and open media coverage is needed to increase awareness of 'bad' practice but equally the mainstream media should be encouraged to highlight good practices.

Recommendation:

A1 An investment in a multi-media Europe-wide information campaign targeted to the information needs of different stakeholders is essential to increase knowledge on NBS and NBE.

5.4.2 *Capacity building*

Requirement for a holistic approach

Accompanying increased awareness, capacity building is important for all stakeholders across NBS value chains.

"The World Economic Forum has identified a wide range of professions of the future emerging from a greener economy and provides a list of jobs which are to some extent related to NBS, such as sustainability specialists, water resource specialists, or water/wastewater engineers. These professions will require distinctive skills and additional learning, for instance in geographic information systems (GIS), global environmental management and water resources management and policy."

– Antonio Lorenzo, Bioazul, input to the TNOC global roundtable on the nature-based economy

A holistic approach to capacity building is required encompassing training, education, research, and innovation. Capacity building measures should be tailored to different audiences and existing levels of knowledge about NBS but should also facilitate ongoing multi-stakeholder networking, for example, to facilitate businesses providing input to policymakers. In addition to training on technical aspects of NBS, capacity building should explore the potential of cross-sectoral knowledge alliances identifying opportunities for new innovations at the intersection between different knowledge domains. Potential synergies between energy and NBS are well-known but less well known for example is how NBS could contribute to cultural development and social cohesion.

Common skill gaps across stakeholder groups

(i) Co-creation and collaborative governance: Multi-stakeholder co-creation and inclusive, collaborative governance are well established as keys to the success of NBS. However, such approaches are challenging for many stakeholders. Much progress has been made in the co-creation field in recent years with a multitude of tools and approaches emerging. Knowledge gaps remain in collaborative governance with less known processes and outcomes.

(ii) NBS standards: capacity building measures (see section 5.1)

(iii) Valuation and impact measurement (see section 5.2)

(iv) Business skills for NBE

Capacity building needs of different stakeholders

General public: Raising awareness and education about NBS among the general public is essential. Increasing evidence points towards the importance of citizen 'connectedness' with nature for personal health and wellbeing. This in turn leads to an increased appreciation for nature and biodiversity and increased support for investment in measures to protect and restore natural habitats such as NBS. Respondents pointed to the importance of practical measures to change the perception of NBS as 'complicated ... out-of-reach' and 'at the discretion of high-ranked public managers' and to increase citizen understanding that 'small-scale, decentralised solutions can, and do play an important role in improving lives, and start demanding like-minded solutions in other areas.' Incentives to encourage citizen involvement in activities such as soil-de-sealing or the establishment of green corridors in residential areas were put forward as a good example.

Education of children and young people about NBS and opportunities for careers working with nature is lacking. There are also opportunities for social innovation with a diversity of programmes building horticultural skills among the unemployed, vulnerable groups and contributing to reduced recidivism.

Public sector: The public sector is currently the most important stakeholder when it comes to NBS. They are by far the largest investor and traditionally they manage many aspects of the planning, delivery, and maintenance of NBS in-house within the restraints of existing budgets and skill sets. As policy shifts in favour of NBS leading to increased funding and demand, the public sector is coming increasingly under pressure. Technical knowledge gaps are emerging in traditional engineering and landscape management departments; cross-departmental silos limit the potential of NBS co-benefits being realised; knowledge of co-creation and co-governance processes with external stakeholders is variable; impact measurement is challenging; financing for ongoing maintenance is often under-estimated and so on (see Chapter 2 for more detailed insights). Public procurement processes to bring in support from the private and community sectors to address some of these bottlenecks present further challenges in terms of internal process constraints and an external shortage of skilled suppliers. There is an urgent imperative to resolve these challenges which create many roadblocks slowing down the upscaling of NBS which is needed.

Investors: Currently, investor feedback suggests that there is an insufficient pipeline of NBS projects to meet investor interest and requirements. The EU Taxonomy for Sustainable Financing will lead to further increases in investor demand but also increase the potential for misalignment with available NBS 'dealflow'. Previous studies show that many urban

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

NBS projects are small-scale, and community led which may not be a good match with investor interests. Creative thinking is required to address this mismatch without compromising the social and environmental integrity of NBS projects or the fiduciary duties of investors. Platform technologies present much promise to aggregate smaller projects with intermediaries such as city councils playing an important role in due diligence. For larger projects such as sustainable forestry, revenue streams and return on investment models are clearer and increasing knowledge of hybrid financing, environmental impact bonds and other novel financing instruments is being accumulated. The risks of compromising on social and environmental impacts are also high. As private sector investments increase and accusations of negative impacts for indigenous communities make headlines, there is an increasingly strong case for strengthening standards and monitoring long-term impacts through an independent global observatory.

"Policies are needed to incentivise investors – 'policy amendments that address barriers such as providing more confidence in future revenue streams through greater certainty around carbon prices through for example a minimum price policy or framework for carbon."

- Rupesh Madlani and Emre Eren, BwB, input to the TNOC global roundtable on the nature-based economy

Private sector (procuring NBS): Private sector investment in NBS is low (14%). Many international initiatives (WEF, Capitals Coalition, Business@Biodiversity etc) are working towards increasing awareness of the role of NBS in sustaining the natural capital cycle of stocks, flows and value creation. The engagement of corporates in the TFND is increasing awareness of natural capital related risks and dependencies. More needs to be done at policy level to build the capacities of organisations of all sizes to measure such risks and raise awareness of the potential of NBS to mitigate against such risks.

"SMEs are being targeted from so many sides - reduce emissions, incorporate natural capital accounting....now NBS. This is leading to 'Sustainability Fatigue'. There is a need to interlink these issues - adopt one approach - explain this"

- Consultation response

Private sector (suppliers of NBS): The capacities of private sector organisations to deliver NBS must be developed to meet increased demand from the public and private sector. In summary this sector is at a nascent stage of development. Little market knowledge is available to guide decision-makers in putting in place appropriate support measures. Some market sectors are well developed, some are only emerging. There appear to be wide disparities across Europe and globally in terms of levels of technical knowledge of NBS leading to emerging concerns about industry standards and practices, in terms of long-term maintenance and stewardship. A holistic approach to capacity building is critical for this stakeholder group.

At an individual enterprise level, initial research studies suggest many enterprises are technically oriented but lack the business and financing acumen to navigate the financing and investment landscape required for scaling. A lack of alignment between the environmental mission of nature-based enterprises and the economic objectives of investors also inhibits growth. These barriers to scaling represent a significant market failure with wider potential consequences on the slowdown of NBS uptake and ultimately mitigation against climate change and biodiversity loss.

Technical skills development is potentially easier to address than business development. Professional bodies, such as landscape architects' associations, can play an important role in developing standards and skills at industry level - for example providing information on new scientific developments and industry standards, building knowledge around non-linear design thinking and creativity in NBS planning processes and ensuring community involvement in top-down, bottom-up approaches to NBS development etc. Industry leaders across all sectors can help to catalyse the transition to a greener economy as ambassadors or agents for change in this adaptation process. Existing educational and training institutes have an important role to play in understanding emerging industry needs and equipping students with up-to-date skills sets (see case study on Breathe).

"Innovation, IT and generating jobs and investment opportunities in cities and regions means incubating, accelerating, financing and empowering youth to put nature and climate resilience into every cent we spend and invest, sharing all our knowledge and helping them build the new world we need urgently – putting money and work where our mouth is."

- Consultation response

Business innovation and support ecosystems:

Corporates: The exposure of businesses to climate change risk has become increasingly well-known and business support ecosystems have worked collaboratively with businesses to develop measures to build resilience to such threats. Until recently less attention has been focused on the dependency of businesses on nature and the risks from biodiversity loss. Natural capital organisations have played an important role in raising awareness of these dependencies but beyond such approaches there are few policies or instruments penalising negative biodiversity practices or incentivising investments in resource reduction or restoration. Opportunities exist to piggy-back on existing measures focusing on energy reduction or circular economy to raise awareness and build capacities of businesses to invest in NBS as part of the natural capital cycle.

'As the city of Poznań we are well-known in Poland for our entrepreneurial business spirit especially when it comes to development of Small and Medium Enterprises. The role of our city is to create the best ecosystem for development of entrepreneurship – we are now creating such an ecosystem for nature-based enterprises. We deliver a series of trainings with the goal to upgrade the skills of entrepreneurs and increase the knowledge and skills of our city employees and designers concerning Nature-Based Solutions. This also means that we promote and implement NBS in our municipal activities. Starting with pilot initiatives, we are testing the use of Nature-Based Solutions with designers and subcontractors. By doing this, we gain the necessary experience and skills of not only working with NBS, but also with the private sector and entrepreneurs. "

- Jacek Jaśkowiak, Mayor of Poznan, Poland (Speaking at the Connecting Nature Enterprise Summit, 29-30 June 2021)

Private sector (suppliers of NBS): given the novelty of the NBS concept, knowledge is only beginning to emerge about NBS value chains and the specific skill gaps of suppliers in different NBS market sectors. There is considerable scope for existing business innovation and support ecosystems to meet these skills gaps in particular those relating to business planning and financing for scaling. Existing research suggests however a potential roadblock may arise in the lack of alignment between the environmental impact objectives of nature-based enterprises and the conventional economic indicators used by business

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

support organisations. While there is much potential for scaling in growing market sectors and private sector investment is needed, for nature-based enterprises indicators such as job creation and revenue growth are of secondary importance to environmental indicators such as carbon sequestration levels or biodiversity net-gain. Providing meaningful support to such enterprises requires therefore a shift in economic thinking about the parameters for success.

Some pioneers have emerged in this space. Cities such as Glasgow have taken the lead on establishing accelerator programmes to support new nature-based entrepreneurs addressing technical skills gaps but also building capacities in business and finance mobilisation to ensure success and business continuity. Local NBS incubators, where all key stakeholders take an active role, can act as hubs and multipliers of the nature-based economy.

Finally networking initiatives such as the Connecting Nature Enterprise Platform have supported the deployment of peer-to-peer learning and mentoring programmes for nature-based enterprises at all stages of development, organising webinars on financing and scaling for nature-based enterprises.

Research: The research community plays an important role in addressing knowledge gaps and building capacities. Some areas which were identified as key knowledge gaps were: the development of science-based targets and approaches to support industry to deliver on goals such as becoming net nature positive e.g., how to calculate the biodiversity footprint of global value chains, the development of technical and technology solutions to reduce biodiversity loss and boost restoration, measurement of the effectiveness of different approaches etc

Toolbox: Awareness and Capacity Building	
Example of financial instrument	KPI bonds (such as SDG bonds, Link) that incentivise proceeds to be used for country-specific Nature-Based Solutions that prioritise issues in each country. These KPI bonds, alongside a robust MRV (Monitoring, Reporting and Verification) mechanism allow for NBS projects to be implemented at scale given the significant coupon and principal reductions that can be achieved based on targets, hence the wider adoption of these instruments can have a more notable impact in terms of a nature positive economy.
Example of mechanism to value NBS	Green Neighbourhoods as a Service : centralised mechanism that utilises the co-benefits that arise from these projects to address the mismatch between ownership of the capital spend and of the value of benefits, tackle the fragmentation issue, overcome barriers to entry, allow aggregation of projects and matching of different types of finance that will be needed.
Glasgow Nature-Based Enterprise Accelerator	Piloted with support from the H2020 project Connecting Nature, Glasgow is now running a further 6 month fully funded programme using design thinking methodology to support the start-up of new nature-based enterprises.

	Link
Osmos training for NBE	A mentoring and exchange initiative delivered by an NBE for other NBEs built around the popular “Double Diamond” design methodology Link (also see case study on UrbanByNature in Chapter 4 of this publication)

Recommendations on Capacity Building:

P5.1 NBS capacity building in the public sector: cross-departmental capacity building (including public procurement departments) to raise awareness of the multiple benefits of NBS; challenges and enablers in planning, delivery, and stewardship; provide tools for internal and external co-creation with multiple stakeholders in order to overcome silo mentalities and reach consensus on optimal planning, investment and processes for delivery and evaluation.

P5.2 NBS capacity building across the private and third sector: Collaborate with existing initiatives and support new approaches to raise awareness of the role of NBS in the natural capital cycle; support organisations in quantifying natural capital related risks and dependencies and disclosure of same in accordance with TNFD requirements; raise awareness of potential of NBS to mitigate against nature-related risks and importance of adherence to NBS standards and certification requirements in procurement of NBS; ensure that principles of co-creation with community stakeholders are respected through the NBS implementation process; increase capacity to monitor and measure multiple impacts and report on same to relevant observatories.

P5.3 Build capacities of the private sector to meet growing demands for NBS: collaborate with education and training institutes, professional industry bodies and market leaders to develop skills and improve standards of practice in the implementation of NBS; collaborate with the wider innovation ecosystem, including incubators, accelerators and impact investors, to support the start-up of new enterprises and the scaling up of existing nature-based enterprises to meet emerging demands.

P5.4 Support networking: Support the development of existing and new platforms (such as the International Platform on Sustainable Finance, IPSF, the Connecting Nature Enterprise Platform), networks (e.g., NetworkNature) and face-to-face NBS market events to connect nature-based enterprises with other actors across the supply chain leading to increased innovation and market uptake. Support the organisation of match-making events between businesses and financiers focusing specifically on pro-biodiversity businesses or NBE. The EU has for example organised similar activities on the Blue Economy a few years ago which have led to a BlueInvest platform.

Case study: Building capacities in landscaping in Argentina



According to WHO, Buenos Aires's overall levels of air pollution exceed the air quality guidelines. The Breathe/Respirar Project (BRP) has the objective of addressing local air quality concerns in school communities. The project's implementation in Buenos Aires counted on a participatory process with several rounds of trial and error to identify and enrol stakeholders in a broadly defined green infrastructure initiative. Educational initiatives were launched such as the "Breathe Deep Experimental Training Course" to empower people to do work with

landscaping and gain practical experience to design and maintain living fences and greening schoolyards.

Within CONEXUS, several NBS will be implemented as part of a wider city-strategy, Breathe Deep / Respirar Profundo programme, to establish vegetated walls and fences around schools to reduce urban air pollution. Interventions to improve air quality and contribute to human health and well-being will take place in areas with particularly high levels of NO₂ and particulate matter from traffic. Opportunities for education and natural play will be created by the continuous involvement of children, teachers and parents.

Source: Conexus, H2020 project <https://www.conexusnbs.com/life-labs/project-four-cckhc> and <https://oppla.eu/casestudy/23347>

5.5 Economic opportunities and challenges

Many people had hoped for a nature positive recovery from COVID-19 economy and there was much policy talk about 'building back better'. National Recovery and Resilience Plans, which aimed to build a more sustainable and resilient economy across Europe were seen as a once in a life-time opportunity for a nature-based recovery. While measures such as the EU Taxonomy may over time lead to such transformative change sadly however in the short term, recent IEA analysis⁶³ showed that the rapid economic recovery from COVID meant that in 2021 global CO₂ emissions rebounded to their highest level in history. The Ukraine crisis of 2022 has exposed the enduring dependency of most countries on fossil fuels. There is much talk about speeding up transitions to renewable energy but also an awareness that systemic change takes time. This crisis has also highlighted the importance of building food security, another policy requiring large-scale systemic change but which in the short term is more likely to result in more intensive farming practices.

The most significant roadblock in transitioning to a nature positive economy with NBS at the core is the entrenchment of current economic and financial thinking and systems - which are grounded in unsustainable GDP growth; short-term and direct revenue streams; lack of monetization / integration of the value of nature, biodiversity or ecosystem services in economic planning, insufficient payment for pollution / negative externalities. A paradigm shift is needed in economic thinking and practice grounded on a clear

⁶³ See: <https://www.iea.org/reports/global-energy-review-co2-emissions-in-2021-2>

understanding of the value of nature. In a recent report by WWF & ILO⁶⁴, it was concluded that half of the world's Gross Domestic Product (GDP) is, to a greater or lesser degree, dependent on nature and around 1.2 billion jobs in sectors such as farming, fisheries, forestry, and tourism are highly dependent on the effective management and sustainability of ecosystems. Preserving and restoring nature thus makes economic sense.

Some argue that the potential to transition to a nature positive economy is higher in developing countries, where primary industry sectors are often more important than in developed countries and where economic systems and departmental silos are less embedded and more open to transformative change. Countries with high levels of biodiversity such as Brazil have the potential to become 'hotspots for ecological engineering solutions' with the capacity to generate multiple revenue streams from existing biological solutions, R&D investments, provisions for the carbon market, and many others. The risks are equally evident in terms of over-exploitation of resources for short-term economic gain.

NBS sectors, such as green buildings, green infrastructure, water management, were identified as important growth sectors in the context of the climate change and biodiversity crises, especially in urban areas. Evidence from China of the effectiveness of 'Sponge Cities' in climate change and mitigation will increase uptake of approaches such as NBS for water management. In rural and coastal areas (see case study on Future Mares), sustainable forestry, agriculture and marine ecosystems generate multiple benefits - for climate mitigation (carbon storage) and adaptation but also for food security, tourism, health and wellbeing. Emerging economic activities such as nature-based health therapies are increasingly being recognized as a 'medicine' on the back of increasing evidence of their impact on physical and mental wellbeing. Addressing some of the barriers for NBS implementation also presents new economic opportunities, for example, in data and smart tech (new innovations measuring effectiveness of NBS), in community engagement for NBS (new enterprises, often social enterprises, contributing to co-creation and inclusive governance of NBS) and in finance (e.g., advisory services on natural capital accounting, carbon offsetting).

Recommendations:

In response to sector-specific challenges and opportunities, Section 2.3 of this report summarises the recommendations for development. Table 5 below shows many common recommendations across market sectors e.g. lack of standards, market data etc. It is interesting to note that while these sector specific recommendations came from industry ambassadors representing communities of nature-based practitioners on the Connecting Nature Enterprise Platform, the recommendations broadly resonate with the findings from the consultation process which included a much wider range of stakeholders.

However, one clear need which emerged from industry practitioners, but not as clearly from the consultation process, was the need for significant further investment in research both in terms of market knowledge and to develop the evidence base demonstrating the full impacts of NBS.

⁶⁴ See: https://www.ilo.org/wcmsp5/groups/public/---ed_emp/documents/publication/wcms_757823.pdf

Table 5 Recommendations across Market Sectors

Sector	Research: Technical / Impact	Research: Market	Standards / Codes of Practice	Awareness raising	Capacity building	Policies and policy instruments	Other sector specific
Green Buildings	x	x	x	x	x	x	
NBS: public & urban spaces	x	x	x	x	x	x	
NBS: water management	x	x		x	x	x	
Sustainable Forestry and Biomaterials	x	x	x	x	x	x	Need for multi-actor collaborative networks
Sustainable agriculture and food production	x	x		x	x	x Conflicting policies	Behavioural research to address cultural issues
Sustainable Tourism	x	x	x	x	x	x	Address greenwashing
NBS for health and wellbeing	x	x	x	x	x	x	Medical trials
Community Engagement	x	x	x	x	x	x	
NBS: Smart tech for M&E	x	x		x	x	x	Intersect with other fields of smart-tech

5.6 Key issues and recommendations: summary tables

Two final tables are presented summarising the recommendations by issue for different stakeholders. Table 6 synthesises the recommendations for policy makers and Table 7 synthesises the recommendations for all other stakeholders.

Table 6 Summary of recommendations for policy makers by key issue

	Policy-makers (international)	Policymakers (national, regional, local)
Standards	<p>S3 At an international level, the importance of standards and accreditation for NBS and for their upscaling should be recognised.</p> <p>S4 Encourage the use of technology to improve the traceability and sustainability of NBS supply chains (e.g., blockchain technology, remote sensing, artificial intelligence, geographical information systems) and their monitoring according to standards.</p>	<p>S3 At a national/ regional level, uptake of NBS international standards and accreditation need to be supported with actions and supporting policies.</p>
Measurement & valuation	<p>V1 Policies to support the valuation of nature across all pillars of society (government, industry and civil society) are urgently required. Piecemeal approaches to valuation of nature must be replaced with holistic monetary and non-monetary approaches that capture the multiple ecosystem benefits nature provides. Particular attention should be focused on the value of nature to indigenous communities, vulnerable and marginalised groups.</p> <p>Reporting of natural capital should be mandatory for public organisations and large industry players across their entire value chains, and in the future also local governments, with appropriate incentives and penalties put in place for non-compliance following a transition period. Baseline valuations of different types of ecosystem services should be accompanied by annual progress updates reporting on progress to reduce usage and support restoration. Valuation of the full range of ecosystem services and wider societal impacts and trade-offs should be taken into account. Measures to simplify valuation processes for smaller businesses and NGOs should be developed. It is vital that smaller players are fully involved in developing these processes and advising on suitable policy and capacity building needs.</p> <p>An independent NBS open-source observatory should be supported to display measurement of progress against policy development, capacity building and report on a range of valuation metrics across different sectors and geographies. Such an observatory would play a vital role in generating data to support decision making processes.</p>	
Public policy: Multi-level, cross-sectoral policy development	<p>P1 Embedding of NBS terminology into all relevant sub-national, national and international policy strategies based on the development of clear standards, practices, measurement and valuation of NBS impacts.</p> <p>P2 Launch an immediate consultation on alignment of NBS with other policy areas: positioning of NBS concepts and terminology as complementary and mutually reinforcing elements of other policy approaches including inter alia climate change and resilience strategies; land use and planning policies; energy and building policies; economic policies including bioeconomy, circular economy and smart specialisation policies; social and health policies.</p> <p>P4 Embedding of participatory and co-productive decision making processes in NBS policy making: While significant advances have been made on community engagement in NBS, increased engagement between local government and local business in exploring the potential of the nature positive economy with NBS and NBE at the core.</p>	
Public policy: Investment /	<p>Recognising the economic, environmental and social benefits that accrue from investment in NBS, significantly increase public</p>	<p>P3.8 Ring-fencing of environmental tax revenue for increased investment in climate and biodiversity actions through NBS.</p>

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

<p><i>financing frameworks and instruments</i></p>	<p>sector investment in NBS in line with UNEP calls (State of Finance reports 2021, 2022). Leverage public-sector investment to stimulate a massive increase in private sector investment in NBS through blended financing mechanisms, resulting in a rebalancing of current investment ratios between public and private investment.</p> <p>Accelerate the activities of international networks, working groups and task-forces towards increasing and incentivising positive financial flows towards investment in nature across all governance levels, accompanied by measures to reduce financial flows towards activities harmful to nature and perverse incentives that encourage ecosystem degradation through policies, institutions, or markets. Particularly, we recommend attention to avoid environmentally harmful support for agriculture and fossil fuels.</p> <p>P3.1 EU Taxonomy on Sustainable Finance: inclusion of specific references to NBS in the Taxonomy as an activity contributing to climate change adaptation and mitigation. Acceleration of plans to identify economic activities contributing to biodiversity net-gain with clear references to NBS where relevant. Inclusion and publication of data on increased financing of NBS from corporate disclosures of related investment. Requirement for public sector disclosure of investments in NBS in line with EU Taxonomy.</p> <p>P3.2 Task Force on Nature-related Financial Disclosures (TNFD): higher level of engagement of EC NBS policy-makers in TNFD activities to ensure consideration of NBS and alignment of disclosures with EU Taxonomy on Sustainable Finance and related policies.</p> <p>P3.4 Increased monitoring of 'cap and trade' mechanisms to include the use of NBS standards, certification and monitoring in carbon trading investments ensuring biodiversity net-gain, community engagement and inclusive governance.</p> <p>P3.5 Significant increase in investment in research and pilot experimentation of biodiversity credit mechanisms modelled on successful carbon trading mechanisms.</p> <p>P3.5 Develop a comprehensive international framework for labelling, tracking, reporting and verifying investment in NBS as part of the transition to a nature positive economy. This could be developed either through existing international frameworks and bodies (e.g. UN conventions) or through</p>	<p>P3.9 Portfolio approach - rating NBS attractiveness for investors: We recommend immediate measures to build a portfolio of NBS projects for public and private sector investment at local/national government level. We recommend that the potential impacts of NBS projects are valued (monetary/non-monetary) and based on this valuation projects get rated in terms of attractiveness for private sector investors, for public investment and for hybrid investment.</p> <p>P3.10 Development of new policy instruments to support increased private sector investment in NBS: Experimentation of a range of innovative financing approaches including for example blended financing through public-private-people partnerships, environmental impact bonds, support for crowdfunding mechanisms for smaller scale projects, inclusion of NBS in tax-increment financing (TIF)</p> <p>P3.11 Increase local business investment in NBS: Measures should be put in place to raise awareness and engagement of local businesses with communities and other actors in decision making processes around NBS. Local Green Deals or local biodiversity contracts could be strengthened as potential vehicles for such collaboration. Studies show that increased engagement has led to local business investment in public NBS through for example Corporate Social Responsibility measures or through use of facilities such as office space/venue hire in public NBS.</p> <p>P3.12 Increase awareness of business benefits of NBS from specific NBS such as green (building) infrastructure. Increase business understanding about cost-efficiencies but also cost structures (maintenance requirements) and standards in particular in urban development/construction sector. Put in place direct and indirect incentives to support private sector uptake. Reduce restrictions in terms of construction regulations and policy restrictions to allow for increased NBS implementation. Support market development through NBS dedicated platforms and competence centres.</p> <p>P3.13 Increased policy instruments to incentivise land-owners, building owners, farmers and citizens: related to P2 expansion of existing energy/retrofitting incentives to include investment in NBS; increased incentives for farmers to invest in biodiversity measures accompanied by penalties for biodiversity loss</p> <p>P3.14 Increase consumer demand: Put in place measures to increase the level of consumer awareness of the benefits of NBS and the need and opportunities for public, private and consumer investment and engagement. Measures should encourage communal identity to overcome cultural differences, build awareness of environmental issues and offer guidelines for living in harmony with the environment e.g. vegetable gardens, compost toilets, biking, etc. Measures</p>
--	--	--

	<p>international standards applied at local level.</p> <p>P3.6 Agree a formalised strategic plan at the global level to introduce a cross-cutting modality of investment for NBS across policy sectors and initiatives, effectively creating an asset class for NBS</p> <p>P3.7 Increase investor understanding of NBS: Measures are needed to increase investor understanding of NBS cost structure and business models, including long term maintenance requirements and the benefits of inclusive decision making processes relating to NBS.</p>	<p>should be accessible and inclusive e.g. technology platforms and social media but also direct outreach, education and engagement activities with groups such as schools, elderly or vulnerable groups.</p> <p>P3.15 Citizen financing: Put in place measures to facilitate community financing of NBS as part of inclusive approaches to co-governance. See MyParksScotland for a good practice example.</p> <p>P3.16 Partnerships / platforms / infrastructure: The public sector can also direct actions to stimulate private demand through for example, fostering public-private partnerships with entities that own land or buildings - enable NGOs to use these facilities for NBS; create platforms for idea exchange, and business growth and resource bundling.</p>
<p>Public policy: <i>NBS in economic development policy</i></p>	<p>P4.1 Increased investment in research and demonstration activities at global, European, national and sub-national level to establish the economic potential of different NBS market sectors and the specific characteristics of each sector</p> <p>P4.2 Holistic approaches to economic policy development at global, European, national and sub-national level addressing research and innovation gaps, opportunities for cross-policy collaboration, market development mechanisms, capacity building measures, standards and certification schemes.</p> <p>P4.3 Address well-known roadblocks in public procurement through capacity building, experimentation and upscaling of new approaches co-created with local stakeholders including smaller players.</p> <p>P4.4. Embed multiple actors in decision-making processes on NBS at all policy levels. The EU needs to lead by example as regards the engagement of multiple actors including community representatives, industry players and SMEs in setting policies with regard to NBS. Similarly, industry and NBE need to be involved in NBS policy development at local and national level.</p> <p>P4.5 Deliver seed funding support and capacity building measures to empower local community and third party organisations to take on an increased role in social innovation related to NBS.</p> <p>P4.6 Increased focus on the exploration, testing, sharing of best practice regarding robust sustainable business models both for projects and for entrepreneurs</p>	
<p>Public policy: <i>Potential in developing economies</i></p>	<p>P6 Shift in development finance to put environment and social criteria on an equally footing to economic and technical criteria for investment.</p> <p>P7 Increase funding for knowledge exchange and collaboration between regions of Europe and the rest of the world, in particular the Global South. Increased funding through Horizon Europe work programmes to enable cooperation with world regions that have degraded ecosystems due to the supply of nature-based products to more developed economies. RTD outcomes should be more closely aligned with existing support and investment in NBS in developing countries through, for example, programmes such as the Global Climate Change Alliance Plus (GCCA+), an EU initiative to help vulnerable countries address climate change, largely based on NBS.</p>	

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

Economic opportunities and challenges	<p>Investment in research to address knowledge gaps on impact measurement and market knowledge.</p> <p>Urgent action on development of industry standards and codes of practice: Industry players, including SMEs, need to be involved in the development of standards.</p> <p>Adapt support policies and instruments: (i) Better integration of NBS into public policy: increased use of NBS terminology and definitions in policy development leading to increased integration of NBS approaches such as NBS for water management, sustainable forestry, green buildings in relevant policy fields. (ii) Enterprise policy: Specific support policies and instruments are required oriented towards helping NBE achieve environmental and societal KPIs first and traditional economic KPIs second. (iii) Public procurement: change in current public procurement practices to prioritise criteria aligned with carbon reduction and biodiversity net-gain and to recognise the critical importance of NBS approaches such as co-creation to build community consensus and engagement.</p> <p>Targeted actions to increase awareness across the value chain: Customised campaigns are needed targeting different audiences. Success stories and pilot demonstrators were identified as highly effective</p> <p>Networks: support is needed for existing and new multi-actor collaborative NBS networks to address industry fragmentation at local, national and international scale, to build networks of practitioners adhering to industry standards and to build collaboration between sectors.</p> <p>Address skills gaps through capacity building, training and education: enhanced collaboration is needed between the research sector and educational, vocational and training bodies to build awareness and support take-up of new knowledge in this rapidly developing field. 'Soft' skills gaps need to be addressed such as business models and financing strategies and methodologies to sustain multi-actor collaboration and governance. Peer-to-peer learning networks and platforms were identified as an effective mechanism for building knowledge and skills across both skills gaps.</p> <p><u>Sector-specific recommendations</u></p> <p>Investment in research to address sector specific knowledge gaps:</p> <ol style="list-style-type: none">1. Green buildings: further research on how to increase impact on biodiversity through better design, cost-effective intensive greening techniques, and maintenance practices.<ul style="list-style-type: none">• Water management: R&D and large-scale pilot projects to provide evidence of effectiveness.• Sustainable Forestry: clarify synergies and conflicts between NBS approaches to sustainable forestry and other concepts and policy approaches.• Sustainable Agriculture: behavioural research is needed to understand and test solutions to overcome cultural barriers to take up of sustainable agricultural practices across the value chain. To achieve systemic change, more research is also needed on the impacts of changes in diet and to establish an evidence base that food security can be ensured through for example, modelling of land use competition between food, fibres and feed when addressing biodiversity and climate crises.
--	--

- Sustainable Tourism: interrelations between environmental pressures, sustainable responses and the future of tourism development within protected natural areas
- NBS for Health and Wellbeing: address research gaps relating to specific nature-based interventions and randomised control trials to measure impact leading to improved integration and acceptance within the health sectors.
- Community Engagement: the role and effectiveness of different community engagement methodologies and impact of such approaches on NBS processes.
- Smart technologies for NBS: research gaps related to data reliability, data quality and accuracy, data models, regulation, and legal protection.

Sector specific support policies and instruments:

- Green buildings: wider inclusion of green building measures in city development plans supported by policy instruments such as financial subsidies and reduced fees.
- NBS for water management needs to be more clearly integrated into policy and planning in particular as regards climate change policy but also other cross-policy linkages should be explored such as circular economy closed-the-loop approach in water.
- Specific incentives for nature-based enterprises starting up in forestry, agriculture and tourism to offset set-up costs and long development cycles.

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

Table 7 Summary of recommendations for other actors by key issue

	Public sector professionals	Civil society / NGOs	Corporates, Nature-based enterprises, Industry bodies	Investors and financial institutions	Researchers	Other stakeholders
Standards	<p>S4: Awareness raising and capacity building measures to support uptake of standards and accreditation by NBS providers. Specific measures to support uptake of standards among smaller enterprises.</p> <p>S5 Public sector procurement offices should inform procurers about NBS standards development and accreditation, and these should be incorporated into public procurement processes for NBS.</p>	<p>S7: Increase citizen and political awareness about the application of NBS industry standards in planning, delivery and long term maintenance.</p>	<p>S8: Providers of NBS and industry associations have an important role to play in supporting the uptake of existing and new NBS standards and accreditation through awareness raising actions and capacity building measures.</p>	<p>S9: Aware of development in industry standards and accreditation and consider this in investment decisions.</p>	<p>S10: Further research is needed on the value, and optimal approaches, to standards and accreditation for different scales and typologies of NBS and the impact of such approaches on different actors and the uptake of NBS as a whole.</p>	<p>S1 Standards bodies: A consistent set of international standards is needed to accompany NBS planning, delivery, monitoring and sustainability developed with end-users and industry.</p> <p>S2 Accreditation bodies: Standards should be accompanied by appropriate voluntary or mandatory accreditation schemes. Reports on uptake of standards and accreditation by industry type, scale and location should be made available and communicated. Simplified accreditation processes for smaller market players.</p>
Measurement & valuation	<p>V2 Public sector institutions and agencies should put in place a voluntary</p>	<p>V4 Similar to circular economy approaches, the valuation of nature</p>	<p>V6 Collaborate with policy makers on planning and delivery of a range of</p>	<p>V5 Investors and financial institutions would benefit from a clarification of best</p>	<p>V3 The research community would play an important role</p>	-

	code of practice for valuation of nature. International NGOs should lead on developing a widely accepted voluntary code of practice adaptable to multiple contexts. Such an approach should be supported by capacity building measures to encourage broad uptake.	requires a 'whole of society' approach. Awareness raising and capacity building measures should be adapted appropriately to encourage citizens and society as a whole to understand our collective dependency on nature and the importance not just of reducing waste but of different ways to contribute to nature conservation and restoration. Many opportunities exist to build on current programmes.	awareness raising, capacity building measures, incentives, penalties and reporting mechanisms to support uptake of holistic valuation approaches i.e. going beyond current natural capital accounting approaches to consider wider ecosystem benefits. Specific measures should be put in place to support small nature-based enterprises in measuring environmental impact.	practice in valuation which considers monetary and non-monetary valuation approaches and wider trade-offs (see recommendation V3). Based on this evaluation of good practice, a voluntary code of practice should be established for investors. Following such a code should be mandatory for public sector investments in NBS which currently constitute 86% of total NBS investment and for hybrid investments involving public institutions.	as independent experts in the international observatory proposed under V1 to measure progress against policy development, capacity building and report on a range of valuation metrics. Further research and demonstrations would be valuable on a carbon credit equivalent to capture the value of NBS for biodiversity.	
	Public sector professionals	Corporates, Nature-based enterprises, Industry bodies			Other stakeholders	
Awareness raising and capacity building (see also recommendations by industry sector in Section 2.2)	P5.1 Cross-departmental capacity building (including public procurement departments) to raise awareness of the multiple benefits of NBS; challenges and enablers in planning, delivery and	P5.2 Collaborate with existing initiatives and support new approaches to raise awareness of the role of NBS in the natural capital cycle; support organisations in quantifying natural capital related risks and dependencies and disclosure of same in accordance with TNFD requirements, to avoid nature-related risks for companies, financiers and investors that largely invisible and mispriced; raise awareness of potential of NBS to mitigate against nature-related risks and importance of adherence to NBS standards and certification requirements in procurement of NBS; ensure that principles of co-creation with community stakeholders are respected through the NBS implementation process; increase capacity to monitor and measure multiple impacts and report on same to relevant observatories.			A1: An investment in a multi-media Europe-wide information campaign targeted to the information needs of different stakeholders is essential to increase knowledge on NBS and NBE.	

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

	<p>stewardship; provide tools for internal and external co-creation with multiple stakeholders in order to overcome silo mentalities and reach consensus on optimal planning, investment and processes for delivery and evaluation.</p>	<p>P5.3 Build capacities of the private sector to meet growing demands for NBS: collaborate with professional industry bodies and market leaders to improve standards of practice in the implementation of NBS; collaborate with the wider innovation ecosystem to support the start up of new enterprises and the scaling up of existing nature-based enterprises to meet emerging demands.</p>	
	<p>P5.4 Support networking: Support the development of existing and new platforms (such as the <u>International Platform on Sustainable Finance</u>, <u>IPSF</u>, the <u>Connecting Nature Enterprise Platform</u>), networks (e.g. <u>NetworkNature</u>) and face-to-face NBS market events to connect nature-based enterprises with other actors across the supply chain leading to increased innovation and market uptake. Support the organisation of match-making events between businesses and financiers focusing specifically on pro-biodiversity businesses or nature-based enterprises. The EU has for example organised similar activities on the Blue Economy a few years ago which have led to a <u>Blue Invest platform</u>.</p>		
<p>Economic opportunities and challenges</p>	<p><i>See recommendations per industry sector in Section 2.2</i></p>		

REFERENCES

- Ahad, M.A., Paiva, S., Tripathi, G, and Feroz, N. (2020). Enabling technologies and sustainable smart cities. *Sustainable Cities and Society* 61, May.
- Albino, V., Berardi, U., and Dangelico, R. M. (2015). Smart cities: Definitions, dimensions, performance, and initiatives. *Journal of urban technology* 22(1), pp. 3–21.
- Allied Market Research (2021) Ecotourism Market. Available at: <https://www.alliedmarketresearch.com/eco-tourism-market-A06364#:~:text=The%20ecotourism%20market%20size%20was,dominance%20throughout%20the%20forecast%20period.>
- Andersson, T., Formica, P., and Curley, M. G. (2009). Knowledge-driven entrepreneurship: the key to social and economic transformation. *Springer Science & Business Media*, New York.
- Andersson, I., Andersson, T., Björner, E. and Hilding-Hamann, K. E. (2020a). Portfolio of purposes, methods, tools and content: Forming digital enablers of NBS, *Deliverable 3.3 – URBiNAT, IKED, Malmö*.
- Andersson, I., Andersson, T., Björner, E. (2020b). On the Establishment of URBiNAT’s Community of Practice (CoP), *Deliverable 2.3 – URBiNAT, IKED, Malmö*.
- Andersson, I., Andersson, T., and Mackenzie, T. (2021). Portfolio of Methods, Tools and Content: Forming Digital Enablers of NBS. *Deliverable 3.4 – URBiNAT, IKED, Malmö*.
- Aronson, J., Goodwin, N., Orlando, L., Eisenberg, C., & Cross, A. T. (2020). A world of possibilities: six restoration strategies to support the United Nations Decade on Ecosystem Restoration. *Restoration Ecology*, 28(4), 730-736.
- Azari, R., and Pick, J. B. (2005). Technology and society: socioeconomic influences on technological sectors for United States counties. *International Journal of Information Management*, 25(1), 21-37.
- Bayraktarov, E., Brisbane, S., Hagger, V., Smith, C. S., Wilson, K. A., Lovelock, C. E., ... & Saunders, M. I. (2020). Priorities and motivations of marine coastal restoration research. *Frontiers in Marine Science*, 484.
- Bertot, J. C., Jaeger, P. T., and Hansen, D. (2012). The impact of policies on government social media usage: Issues, challenges, and recommendations. *Government information quarterly*, 29(1), 30-40.
- Bihouix, P. (2020). *The Age of Low Tech: Towards a Technologically Sustainable Civilization*. Policy Press.
- Brabham, D. (2009). Crowdsourcing the public participation process for planning projects, *Planning Theory* 8(3), pp. 242–62.
- Briers, S., De Vreese, R., Burlando, C., Doimo, I. and Candrea, E.P. (2021). Green care tourism Market Outlook. *Erasmus+ Green4C project Deliverable 3.4: EU Market outlooks*.
- Brorström, S., Argento, D., Grossi, G., Thomasson, A., and Almqvist, R. (2018). “Translating sustainable and smart city strategies into performance measurement systems”, *Public Policy & management* 38(3), pp. 193-202.
- BuGG (2021) Market Report on Building Greening 2020 Green Roofs, Green Facades and Interior Greening in Germany. Available at: https://www.gebaeudegruen.info/fileadmin/website/Englisch/Marketreport/BuGG_Marktreport_202106_23_UK_.pdf

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

Burkhardt, D., Nazemi, K., Zilke, J. R., Kohlhammer, J., & Kuijper, A. (2014). Fundamental aspects for E-Government. In *Handbook of research on advanced ICT integration for governance and policy modeling* (pp. 1-18). IGI Global.

Castells, M. (2007). Communication, power and counter-power in the network society. *International journal of communication*, 1(1), 29.

CDP (2020) Unlocking Nature's Potential: Forests related Nature-based Solutions to address climate change and promote sustainable development.

Chen, W., Hynes, S., Wallhead, P., Tinch, R., Gambi, C., Danovaro, R., with Fagerli, C., Groeneveld, R., Papadopoulou, N., Smith, C., O'Connor, E., Andersen, G. S., Billett, D., 2021. Social cost and benefit analysis for marine restoration and the policy relevance: case studies from Europe. Deliverable 7.5 for H2020 project: Restoring Marine Ecosystems in the Changing European Seas (MERCES).

http://www.merces-project.eu/sites/default/files/MERCES%20D7.5%20revision_Jan2021.pdf

Chen, W., Van Assche, K., Hynes, S., Bekkby, T., Christie H., Gundersen, H. 2020. Ecosystem accounting's potential to support coastal and marine governance, *Marine Policy* 112: 103758

<https://doi.org/10.1016/j.marpol.2019.103758>

Cohen-Shacham, E., Walters, G., Janzen, C. and Maginnis, S. (eds.) (2016). *Nature-based Solutions to address global societal challenges*. Gland, Switzerland: IUCN. xiii + 97pp

Croci, E. and Lucchitta, B. (2022). Climate Change and Urban Nature: impacts and policies at the urban level. In *Planning Climate Smart and Wise Cities*. Edited by Kwi-Gon, K. and Massamba T. *The Urban Book Series, Springer Nature*. DOI: 10.1007/978-3-030-80165-6

Van Dijk, J., and Hacker, K. (2003). The digital divide as a complex and dynamic phenomenon. *The information society*, 19(4), 315-326.

Van Dijk, J. A. (2005). *The deepening divide: Inequality in the information society*. Sage publications.

DiMaggio, P., Hargittai, E., Celeste, C., & Shafer, S. (2004). Digital inequality: From unequal access to differentiated use. *Social inequality*, 355-400.

Dushkova, D. and Haase, D. (2020). Connecting Nature NBS Data and Knowledge Base. Available at <https://oppla.eu/product/24718>

Edwards, R., & Fenwick, T. (2016). Digital analytics in professional work and learning. *Studies in Continuing Education*, 38(2), 213-227.

Eggermont, H., Balian, E., Azevedo, José Manuel N Beumer, V., Brodin, T., Claudet, J., Fady, B., ... and Le Roux, X. (2015). Nature-based Solutions: New Influence for Environmental Management and Research in Europe Nature-based Solutions, an Emerging Term. *Gaia*, 24(4), 243-248.

DOI:10.14512/gaia.24.4.9

European Commission (2008). NACE Rev. 2 Introductory Guidelines. Statistical Office of the European Communities. 2008. Available at:

<https://ec.europa.eu/eurostat/documents/1965800/1978839/NACEREV.2INTRODUCTORYGUIDELINESE N.pdf/f48c8a50-feb1-4227-8fe0-935b58a0a332>

European Commission (2015). Towards an EU Research and Innovation Policy Agenda for Nature-based Solutions & Re-naturing Cities. *Publications Office of the European Union*. DOI: [10.2777/479582](https://doi.org/10.2777/479582)

European Commission (2015) User Guide to the SME Definition. *Publications Office of the European Union: Luxembourg*.

European Commission (2016) ICT for work: Digital skills in the workplace. *Publications Office of the EU*. doi:10.2759/498467

European Commission (2019). The European Green Deal. COM/2019/640 final.

European Commission (2021). EU biodiversity strategy for 2030. *Publications Office of the EU*. DOI:10.2779/677548

European Commission (2021). EU forest strategy for 2030. *Publications Office of the EU*.

European Commission (2021). COMMISSION DELEGATED REGULATION (EU) 2021/2139 of 4 June 2021 supplementing Regulation (EU) 2020/852 of the European Parliament and of the Council by establishing the technical screening criteria for determining the conditions under which an economic activity qualifies as contributing substantially to climate change mitigation or climate change adaptation and for determining whether that economic activity causes no significant harm to any of the other environmental objectives. *Official Journal of the European Union*. [EUR-Lex - 32021R2139 - EN](#)

European Commission (2022) Nature-based solutions research policy. Available at: https://ec.europa.eu/info/research-and-innovation/research-area/environment/nature-based-solutions/research-policy_en

European Commission (2022). Water Reuse. Available at: <https://ec.europa.eu/environment/water/reuse.htm>

European Federation of Green Roofs and Walls (2015) White Paper. Available at: https://efb-greenroof.eu/wp-content/uploads/2016/12/efb_whitepaper_2015.pdf

European Federation of Green Roofs and Walls (2019). Green roofs – Market Report. 2018. Accessed 2021 Feb 23. <https://efb-greenroof.eu/2019/09/25/cz-green-roof-market-report/>

European Union Technical Expert Group on Sustainable Finance (2020a) Taxonomy: Final report of the Technical Expert Group on Sustainable Finance. *Publications Office of the European Union: Luxembourg*, 2020. Available online: https://ec.europa.eu/info/sites/default/files/business_economy_euro/banking_and_finance/documents/200309-sustainable-finance-teg-final-report-taxonomy_en.pdf

European Union Technical Expert Group on Sustainable Finance (2020b) Taxonomy Report: Technical Annex. *Publications Office of the European Union: Luxembourg*, 2020. Available online: https://ec.europa.eu/info/sites/default/files/business_economy_euro/banking_and_finance/documents/200309-sustainable-finance-teg-final-report-taxonomy-annexes_en.pdf

European Union Platform on Sustainable Finance (2022a). Platform on Sustainable Finance: Technical Working Group. PART A – Methodological report. Available online: https://ec.europa.eu/info/sites/default/files/business_economy_euro/banking_and_finance/documents/220330-sustainable-finance-platform-finance-report-remaining-environmental-objectives-taxonomy_en.pdf

European Union Platform on Sustainable Finance (2022b). Platform on Sustainable Finance: Technical Working Group. PART B – Annex: Technical Screening Criteria. Available online: https://ec.europa.eu/info/sites/default/files/business_economy_euro/banking_and_finance/documents/220330-sustainable-finance-platform-finance-report-remaining-environmental-objectives-taxonomy-annex_en.pdf

Faivre, N., M. Fritz, T. Freitas, B. de Boissezon, and S. Vandewoestijne. (2017). Nature-Based Solutions in the EU: Innovating with nature to address social, economic and environmental challenges. *Environmental Research* 159:509-518. doi: 10.1016/j.envres.2017.08.032

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

FAO (2014) Building a common vision for sustainable food and agriculture: Principles and approaches.

Available at: <https://www.fao.org/3/i3940e/i3940e.pdf>

Filbee-Dexter, K., & Wernberg, T. (2018). Rise of turfs: a new battlefield for globally declining kelp forests. *Bioscience*, 68(2), 64-76.

FOREST EUROPE (2020) State of Europe's Forests 2020. Available at: https://foresteurope.org/wp-content/uploads/2016/08/SoEF_2020.pdf

Fraccaroli, C., Soer, A., Doimo, I., De Vreese R., Devisscher, T., Humer, M., Öllerer, B., Mühlberger, D., Van Den Bosch, M. (2021). Forest-based care Market Outlook. Erasmus+ Green4C project, Deliverable 3.4: EU Market Outlook.

Frantzeskaki, N. (2019). Seven lessons for planning nature-based solutions in cities. *Environmental Science and Policy*, 93, 101-111. <https://doi.org/https://doi.org/10.1016/j.envsci.2018.12.033>

Gabrys, J. (2014). "Programming environments: environmentality and citizen sensing in the smart city, Environment and Planning D", *Society and Space* 32(1), 30-48.

Galle, N. J., Nitoslawski, S. A., & Pilla, F. (2019). The Internet of Nature: How taking nature online can shape urban ecosystems. *The Anthropocene Review*, 6(3), 279-287.

Gonçalves, C., Santinha, G., Marques, J., & Castro, E. A. D. (2021). Health and Spatial Planning Policies. *Ciência & Saúde Coletiva*, 26, 2412-2412.

Gordon, E., & Mihailidis, P. (Eds.). (2016). *Civic media: Technology, design, practice*. MIT Press.

Gordon, T. A., Radford, A. N., Simpson, S. D., & Meekan, M. G. (2020). Marine restoration projects are undervalued. *Science*, 367(6478), 635-636.

GRÜNSTATTGRAU (2020). Green Market Report. Bauwerksbegrünung in Österreich: Zahlen, Daten, Märkte. Available at: https://gruenstattgrau.at/wp-content/uploads/2020/09/layout-gmr_final_web.pdf

IUCN (2020). Guidance for Using the IUCN Global Standard for Nature-Based Solutions: A User-Friendly Framework for the Verification, Design and Scaling Up of NBS. *Gland, Switzerland: IUCN*.

[DOI:10.2305/IUCN.CH.2020.08.en](https://doi.org/10.2305/IUCN.CH.2020.08.en)

Hallstein, E., and Iseman, T. 2021. *Nature-based solutions in agriculture – Project design for securing investment*. Virginia. FAO and The Nature Conservancy. <https://doi.org/10.4060/cb3144en>

Han, H., & Hyun, S. S. (2019). Green indoor and outdoor environment as nature-based solution and its role in increasing customer/employee mental health, well-being, and loyalty. *Business strategy and the environment*, 28(4), 629-641.

Han, H., Jongsik, Y., & Hyun, S. S. (2020). Nature-based solutions and customer retention strategy: Eliciting customer well-being experiences and self-rated mental health. *International Journal of Hospitality Management*, 86, 102446.

Hayden, C., and Ball-Rokeach, S. J. (2007). Maintaining the digital hub: locating the community technology center in a communication infrastructure. *New Media & Society*, 9(2), 235-257.

Hynes, S., Chen, W., Vondolia, K., Armstrong, C., & O'Connor, E. (2021). Valuing the ecosystem service benefits from kelp forest restoration: A choice experiment from Norway. *Ecological Economics*, 179, 106833.

Hynes, S., Burger R., Tudella J., Norton D., Chen W. (2022). Estimating the costs and benefits of protecting a coastal amenity from climate change-related hazards: Nature-based solutions via oyster reef restoration versus grey infrastructure, *Ecological Economics*, Volume 194,107349, ISSN 0921-8009. <https://doi.org/10.1016/j.ecolecon.2022.107349>

IPBES (2019). Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. E. S. Brondizio, J. Settele, S. Díaz, and H. T. Ngo (editors). *IPBES secretariat, Bonn, Germany*.

IPCC (2019) Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems [P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.-O. Pörtner, D. C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (eds.)]

InterReg Central Europe CEETO (2018) Handbook of successful and innovative practices for sustainable tourism inside Protected Areas. D.T1.2.3, Ver. 2.0. Available at: <https://www.interreg-central.eu/Content.Node/Handbook-Sustainable-Tourism-EN-CEETO-Interreg.pdf>

Iseman, T. and Miralles-Wilhelm, F. 2021. Nature-based solutions in agriculture – The case and pathway for adoption. Virginia. FAO and The Nature Conservancy. <https://doi.org/10.4060/cb3141en>

Ismagilova, E., Hughes, L., Rana, N.P. et al. (2020). Security, Privacy and Risks Within Smart Cities: Literature Review and Development of a Smart City Interaction Framework. *Information System Frontiers*, July.

Kabisch, N., Frantzeskaki, N., Pauleit, S., Naumann, S., McKenna, D., Artmann, M., Haase, D., & Knapp, S. (2016). Nature-based solutions to climate change mitigation and adaptation in urban areas: perspectives on indicators, knowledge gaps, barriers, and opportunities for action. *Ecology and Society*, 21(2). <https://doi.org/10.5751/ES-08373-210239>

Kaspersen, A. and Wallach, W. (2022) We're failing at the ethics of AI. Here's how we make real impact. *World Economic Forum*, The Davos Agenda. Available at: <https://www.weforum.org/agenda/2022/01/we-re-failing-at-the-ethics-of-ai-here-s-why/>

Kenney, M. and Zysman, J. (2016). "The Rise of Platform Economy", *Issues in Science and Technology* 32(3), spring.

Kitchin, R., and Dodge, M. (2019). The (in) security of smart cities: Vulnerabilities, risks, mitigation, and prevention. *Journal of urban technology*, 26(2), 47-65.

Kooijman, E.D.; McQuaid, S.; Rhodes, M.-L.; Collier, M.J.; Pilla, F. Innovating with Nature: From Nature-Based Solutions to Nature-Based Enterprises. *Sustainability* 2021, 13, 1263. <https://doi.org/10.3390/su13031263>

Kooijman, E.D., and McQuaid, S. (*forthcoming*) Innovating with Nature: Entrepreneurial and Organisational Factors influencing Nature-Based Enterprises.

Krumhansl, K. A., & Scheibling, R. E. (2012). Production and fate of kelp detritus. *Marine Ecology Progress Series*, 467, 281-302.

Kummitha, R. K. R., & Crutzen, N. (2017). How do we understand smart cities? An evolutionary perspective. *Cities*, 67, 43-52.

Kvasny, L., & Keil, M. (2006). The challenges of redressing the digital divide: A tale of two US cities. *Information systems journal*, 16(1), 23-53.

Mammadova, A., O'Driscoll, C., Burlando, C., Doimo, I. and Pettenella, D. (2021). Background report EU Blueprint on Green Care. Nature for Health, Well-being and Social Inclusion: analysis factors influencing innovation in Green Care. Erasmus+ Green4C project, Deliverable 3.3: EU Blueprint on Green Care.

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

Mandić, A. (2019). Nature-based solutions for sustainable tourism development in protected natural areas: a review. *Environment Systems and Decisions*, 39(3), 249-268

Mayor, B., Toxopeus, H., McQuaid, S., Croci, E., Lucchitta, B., Reddy, S. E., ... & López Gunn, E. (2021). State of the art and latest advances in exploring business models for nature-based solutions. *Sustainability*, 13(13), 7413.

McQuaid, S., Rhodes, M.L., Andersson, T., Croci, E., Feichtinger-Hofer, M., Grosjean, M., Lueck, A. E., Kooijman, E., Lucchitta, B., Rizzi, D., Reil, A. and Schante, J. (2021a) From Nature-Based Solutions to the Nature-Based Economy. Nature-based Economy Working Group of EC Task Force III on Nature-Based Solutions. <https://doi.org/10.5281/zenodo.5055605>

McQuaid, S.; Kooijman, E.D.; Rhodes, M.L.; Cannon, S. (2021b) Innovating with Nature: Factors influencing the success of Nature-Based Enterprises. *Sustainability* **2021**, 13, 12488. <https://doi.org/10.3390/su132212488>

Miralles-Wilhelm, F. 2021. Nature-based solutions in agriculture – Sustainable management and conservation of land, water, and biodiversity. Virginia. FAO and The Nature Conservancy. <https://doi.org/10.4060/cb3140en>

Napoli, P.M. and Obar, J.A. (2014). "The emerging mobile internet underclass: a critique of mobile Internet access", *Information Society* 30(5), pp. 323–34.

NBS for Climate Coalition (2019). *The Nature-Based Solutions for Climate Manifesto*; UN Climate Action Summit: New York, NY, USA, 2019; Available at: www.unenvironment.org/nature-based-solutions-climate

Nitoslawski, S. A., Galle, N. J., Van Den Bosch, C. K., & Steenberg, J. W. (2019). Smarter ecosystems for smarter cities? A review of trends, technologies, and turning points for smart urban forestry. *Sustainable Cities and Society*, 51, 101770.

Nitoslawski, S. A., Wong-Stevens, K., Steenberg, J. W. N., Witherspoon, K., Nesbitt, L., & Konijnendijk van den Bosch, C. C. (2021). The digital forest: Mapping a decade of knowledge on technological applications for forest ecosystems. *Earth's Future*, 9(8), e2021EF002123.

Norris, P. (2001). *Digital Divide: Civic Engagement, Information Poverty, and the Internet Worldwide*, Cambridge University Press, Cambridge.

Norris, D. F. and Reddick, C. G. (2013). Local e-government in the United States: Transformation or incremental change?. *Public Administration Review*, 73(1), 165-175.

Oberč, B.P. and Arroyo Schnell, A. (2020). Approaches to sustainable agriculture. Exploring the pathways towards the future of farming. Brussels, Belgium: IUCN EURO.

Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action*. New York: Cambridge University.

Padma, P., Ramakrishna, S., & Rasoolimanesh, S. M. (2019). Nature-based solutions in tourism: a review of the literature and conceptualization. *Journal of Hospitality & Tourism Research*, 1096348019890052.

Patrinos, H. A. (2020). The Learning Challenge in the 21st Century. *World Bank Policy Research Working Paper* (9214).

Picazo-Vela, S., Gutierrez-Martinez, I., and Luna-Reyes, L. F. (2012). "Understanding risks, benefits, and strategic alternatives of social media applications in the public sector", *Government Information Quarterly* 29(4), pp. 504–11.

Polman, P. and Winston, A. (2021). Net Positive. *Harvard Business Review Press*. ISBN: 9781647821302

Prebble, S., McLean, J., & Houston, D. (2021). Smart urban forests: An overview of more-than-human and more-than-real urban forest management in Australian cities. *Digital Geography and Society*

Raymond, C. M., Frantzeskaki, N., Kabisch, N., Berry, P., Breil, M., Nita, M. R., ... & Calfapietra, C. (2017). A framework for assessing and implementing the co-benefits of nature-based solutions in urban areas. *Environmental Science & Policy*, 77, 15-24.

Rice, R. E., & Katz, J. E. (2003). Comparing internet and mobile phone usage: digital divides of usage, adoption, and dropouts. *Telecommunications policy*, 27(8-9), 597-623.

Secretariat of the Convention on Biological Diversity (CBD) (2021) First Draft of the Post-2020 Global Biodiversity Framework. *CBD/WG2020/3/3*. 5 July 2021. Available at: <https://www.cbd.int/doc/c/abb5/591f/2e46096d3f0330b08ce87a45/wg2020-03-03-en.pdf>

SECOND MINISTERIAL CONFERENCE ON THE PROTECTION OF FORESTS IN EUROPE (1993) The second Ministerial Conference on the Protection of Forests in Europe met in Helsinki, Finland, from 16-17 June 1993, Resolution H1) general guidelines for the sustainable management of forests in Europe. Available at: <https://enb.iisd.org/forestry/hel.html>

Seddon, N.; Chausson, A.; Berry, P.; Girardin, C.A.J.; Smith, A.; Turner, B. (2020) Understanding the Value and Limits of Nature-Based Solutions to Climate Change and Other Global Challenges. *Phil. Trans. R. Soc. B* 2020, 375, 20190120, doi:10.1098/rstb.2019.0120.

Sekulova, F. and Anguelovski, I. (2017). The Governance and Politics of Nature-Based Solutions. In *Naturvation Deliverable 1.3: Part VII*.

Swyngedouw, E. (2007). Impossible 'sustainability' and the postpolitical condition, in: R. Krueger and D. Gibbs (Eds), *The Sustainable Development Paradox: Urban Political Economy in the United States and Europe*, pp. 13-40, Guilford Press, New York.

Technavio (2021) Sustainable Tourism Market 2020-2024. Available at: <https://www.google.com/url?q=https://www.prnewswire.com/news-releases/sustainable-tourism-market-2020-2024--the-rising-popularity-of-organic-sustainable-tourism-to-boost-growth--technavio-301354641.html&sa=D&source=docs&ust=1647278024503809&usg=AOvVaw3sTpTMftmU1WqTgYRLi5a7>

Toxopeus, H. and Polzin, F. (2021) Reviewing financing barriers and strategies for urban nature-based solutions. *J. Environ. Manag.* 2021, 289, 112371.

UN - Habitat 3 (2016) The New Urban Agenda 2030. Available at: <https://habitat3.org/the-new-urban-agenda/>

UNEP - Convention on Biological Diversity (2021) First Draft of the Post-2020 Biodiversity Framework. *CBD/WG2020/3/3*.

UNEP - United Nations Environment Programme (2021). State of Finance for Nature 2021. *Nairobi*.

UNEP - United Nations Environment Programme (2022). The State of Finance for Nature in the G20. *Nairobi*.

UNEP - United Nations Environment Programme and IUCN (2018). Nature-Based Solutions for Water Management: A Primer. Available at: https://www.unepdhi.org/wp-content/uploads/sites/2/2020/05/WEB_UNEP-DHI_NBS-PRIMER-2018-2.pdf

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

UN-Water (2018). The United Nations World Water Development Report 2018: Nature-Based Solutions for Water. Paris, UNESCO. Available at: <https://reliefweb.int/sites/reliefweb.int/files/resources/261424e.pdf>

Vanolo, A. (2014). "Smartmentality: The Smart City as Disciplinary Strategy", *Urban Studies* 51(5), April, pp. 883–98.

Wendling, L. and Dumitru, A. (2021) Evaluating the impact of nature-based solutions. A handbook for practitioners. *Publications Office of the EU*. DOI: [10.2777/244577](https://doi.org/10.2777/244577)

Wild, T.C., Freitas, T. and Vandewoestijne, S. (2020) Eds. Nature-based Solutions: State of the Art in EU-funded Projects. *Publications Office of the European Union: Luxembourg*. DOI: [10.2777/236007](https://doi.org/10.2777/236007)

Wilk, B., Vetter, A., Schröder, A. (2021). "Tackling the climate and biodiversity crises in Europe through Urban Greening Plans, Recommendations for avoiding the implementation gap". *German Environment Agency, Dessau-Roßlau*. Available at: https://www.umweltbundesamt.de/sites/default/files/medien/380/dokumente/2021-10-18_scientific_opinion_paper_urban_greening_plans_0.pdf

World Economic Forum - WEF (2020). The Future Of Nature And Business. New Nature Economy Report II. Geneva.

Zhao, J., Cao, Y., Yu, L., Liu, X., Yang, R., & Gong, P. (2022). Future global conflict risk hotspots between biodiversity conservation and food security: 10 countries and 7 Biodiversity Hotspots. *Global Ecology and Conservation*, e02036

APPENDIX I: LIST OF H2020 PROJECT MEMBERS OF NATURE-BASED ECONOMY WORKING GROUP

	<p>Horizon 2020 Connecting Nature is a consortium of 30 partners within 16 European countries, and hubs in Brazil, China, Korea & The Caucasus (Georgia and Armenia). We are co-working with local authorities, communities, industry partners, NGOs and academics who are investing in large scale implementation of nature-based projects in urban settings. Grant Agreement number: 730222.</p>
	<p>Horizon 2020 URBiNAT focuses on the regeneration and integration of deprived social housing urban developments through an innovative and inclusive catalogue of Nature-Based Solutions (NBS), ensuring sustainability and mobilising driving forces for social cohesion. Grant Agreement number: 776783.</p>
	<p>Horizon 2020 UrbanGreenUp aims at developing, applying and validating a methodology for Renaturing Urban Plans to mitigate the effects of climate change, improve air quality and water management and increase the sustainability of cities through innovative nature-based solutions. Grant Agreement number: 730426.</p>
	<p>Horizon 2020 REGREEN promotes urban liveability, through fostering nature-based solutions in Europe and China using evidence-based tools and improved urban governance accelerating the transition towards equitable, green and healthy cities. Grant Agreement number: 821016.</p>
 <p>CLEARINGHOUSE 中欧城市森林应对方案</p>	<p>Horizon 2020 Clearing House uses trees as a means to improve urban living in both Europe and China. Together with 10 cities and urban regions, the project partners will develop an online application, a global benchmark tool, and guidelines that can aid in the design, governance and management of urban forests. Grant Agreement number: 821242.</p>
	<p>Horizon 2020 Network Nature is a resource for the nature-based solutions community, creating opportunities for local, regional and international cooperation to maximise the impact and spread of nature-based solutions. Grant Agreement number: 887396.</p>
	<p>Horizon 2020 Future Mares examines the relations between climate change, marine biodiversity and ecosystem services. Our activities are designed around three Nature-based Solutions (NBS): Effective Restoration, Effective Conservation, and Sustainable Harvesting of Marine Resources. Grant Agreement number: 869300.</p>
	<p>Horizon 2020 MERCES is focused on the restoration of different degraded marine habitats, with the aim of: 1) assessing the potential of different technologies and approaches; 2) quantifying the returns in terms of ecosystems services and their socio-economic impacts; 3) defining the legal-policy and governance frameworks needed to optimize the effectiveness of the different restoration approaches. Grant Agreement number: 689518.</p>
	<p>Horizon 2020 NAIAD aims to operationalise the insurance value of ecosystems for water-related risk mitigation, by developing and testing concepts, tools and applications on 9 demo sites across Europe, under the common concept of Nature-Based Solutions (NBS). Grant Agreement number: 730497.</p>

THE VITAL ROLE OF NATURE-BASED SOLUTIONS IN THE NATURE POSITIVE ECONOMY

	<p>Horizon 2020 WeValueNature is supporting businesses and the natural capital community to make valuing nature the new normal for businesses across Europe. Grant Agreement number: 821303.</p>
	<p>Horizon 2020 CleverCities uses nature-based solutions to address urban challenges and promote social inclusion in cities across Europe, South America and China. Grant Agreement number: 776604.</p>
	<p>Horizon 2020 Naturvation sought to develop our understanding of what nature-based solutions can achieve in cities, examine how innovation can be fostered in this domain, and contribute to realising the potential of nature-based solutions for responding to urban sustainability challenges by working with communities and stakeholders. Grant Agreement: 730243</p>
	<p>GoGreenRoutes is sowing the seeds for increased nature-connectedness across Europe, Latin America and China. Its multidisciplinary consortium o is pairing participatory approaches and citizen science with Big Data analyses and digital innovation.</p>
	<p>The PHUSICOS project will demonstrate how nature-based solutions provide robust, sustainable and cost-effective measures for reducing the risk of extreme weather events in rural mountain landscapes.</p>
<p>JUSTNature</p>	<p>Launched in September 2021 JUSTNature project will turn to nature-based solutions to ensure a just transition to low carbon cities. Considering the right of all citizens to ecological space, the project will co-design new systems which conserve natural ecosystem values and functions and will ultimately provide numerous benefits to people.</p>

Getting in touch with the EU

IN PERSON

All over the European Union there are hundreds of Europe Direct information centres.

You can find the address of the centre nearest you at: https://europa.eu/european-union/contact_en

ON THE PHONE OR BY EMAIL

Europe Direct is a service that answers your questions about the European Union.

You can contact this service:

- by freephone: **00 800 6 7 8 9 10 11** (certain operators may charge for these calls),
- at the following standard number: **+32 22999696**, or
- by email via: https://europa.eu/european-union/contact_en

Finding information about the EU

ONLINE

Information about the European Union in all the official languages of the EU is available on the Europa website at: https://europa.eu/european-union/index_en

EU PUBLICATIONS

You can download or order free and priced EU publications from: <https://op.europa.eu/en/publications>.

Multiple copies of free publications may be obtained by contacting Europe Direct or your local information centre (see https://europa.eu/european-union/contact_en)

EU LAW AND RELATED DOCUMENTS

For access to legal information from the EU, including all EU law since 1952 in all the official language versions, go to EUR-Lex at: <http://eur-lex.europa.eu>

OPEN DATA FROM THE EU

The EU Open Data Portal (<http://data.europa.eu/euodp/en>) provides access to datasets from the EU. Data can be downloaded and reused for free, for both commercial and non-commercial purposes.

This report is a first step in addressing knowledge gaps in the potential economic benefits of Nature-Based Solutions (NBS) and the challenges facing Nature-Based Enterprises (NBE). Based on extensive consultations, we profile some of the economic activities where NBE are engaged in the delivery of NBS – generating new jobs and skills, innovations, and wider economic impacts through a nature-based approach that respects the needs of the environment and communities. We examine some of the key issues confronting stakeholders, including ‘greenwashing’. Such challenges are addressed head-on, informing recommendations on how to realise the transition to a nature positive economy with NBS and NBE at the core.

This report is aimed specifically at economic policy makers but is of high relevance for policy makers across multiple domains, public sector institutions and agencies, researchers, civil society and NGO representatives, investors and financial institutions, industry and NBE delivering NBS.

Studies and reports

