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The 3 Billion Tree Planting Pledge For 2030

Accompanying the document

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

New EU Forest Strategy for 2030

{COM(2021) 572 final} - {SWD(2021) 652 final}

Contents

An old proverb:
"If you want to sit under a shade in your old age plant a tree now."

INTRODUCTION

The European Green Deal resets the Commission's commitment to tackling climate and environmental challenges, that is this generation's defining task and it supports a far-reaching environmental policy agenda with an overarching nature. It is our duty to think about the younger generations and the type of world they will inherit over the coming decades. We cannot continue 'business as usual': our society must live within planetary boundaries, both now and in the future. We need to take care of nature and the extremely valuable services that well-functioning ecosystems provide. Healthy forests and healthy trees can provide a very significant share of those ecosystem services[1].

Under the European Green Deal, the EU's biodiversity strategy for 2030 tackles the protection and restoration of nature by making a number of specific commitments and targets. One of the commitments is the pledge to plant **at least 3 billion additional trees in the EU by 2030,** in full respect of ecological principles. The EU forest strategy will include a roadmap for action to achieve this commitment.

This pledge will not solve the climate nor the biodiversity crisis on its own. We will also need additional global or European planting pledges going well beyond the 3 billion, and other ambitious action on forests and tree conservation, environment and biodiversity protection and very substantial greenhouse gas emissions reduction in other sectors. The effects of carbon sequestration will only materialise in the coming decades. But since trees take decades to grow, action must be taken now to achieve the additional carbon sequestration needed in the future. Planting new trees is not an alternative to preserving existing trees, but a complement to broader conservation action. This paper does not cover the additional needs and action on conservation.

This roadmap sets out a framework to equip the EU to reach its commitment on tree planting on the basis of the guiding principle: **plant and grow the right tree in the right place, for the right purpose.**

This will ensure that planting is carried out in a way that produces a tangible and positive impact on the climate, the environment, the economy and the quality of life of EU citizens. But planting 3 billion additional trees will only generate positive impacts if the majority of those trees survive, reach maturity and thrive. In some planting methods, only 10-20% of the saplings reach maturity, so this commitment means not only planting 3 billion additional trees, but also growing, nurturing and caring for the trees so that they reach maturity.

1.1. The pledge

1.1.1. Part of the biodiversity strategy to 2030

Under the European Green Deal, the biodiversity strategy to 2030 tackles the protection and restoration of nature in the EU through a number of specific commitments and targets. One of those commitments is the pledge to plant at least 3 billion additional trees in the EU by 2030. The Green Deal specifies that:

1 Ecosystems services - nature's contributions to people i.e. the contributions of 'ecosystems' to direct and indirect 'benefits' obtained in economic, social, cultural and other human activity. For more see Common International Classification of Ecosystem Services for the most updated list https://cices.eu/resources/

In addition to strictly protecting all remaining EU primary and old-growth forests, ***the EU must increase the quantity, quality and resilience of its forests […]***

To make this happen, the Commission will propose a dedicated ***EU forest strategy*** *in 2021 in line with our wider biodiversity and climate neutrality ambitions.* ***It will include a roadmap for planting at least 3 billion additional trees in the EU by 2030,*** *in full respect of ecological principles. This will create substantial job opportunities linked to the collecting and cultivating of seeds, planting seedlings, and ensuring their development. Tree planting is particularly beneficial in cities, while in rural areas it can work well with agroforestry, landscape features and increased carbon sequestration.*

The 3 billion trees target is also in synergy with other objectives of the biodiversity strategy, such as reaching the target to improve the conservation status of 30% of sites at EU level, with regional or site-level conservation objectives and with the restoration of certain habitats of particular value for wildlife or biodiversity. The Commission will propose legislation in 2021 to set legally binding EU nature restoration targets to restore degraded ecosystems. It will focus in particular on ecosystems with the highest potential to capture and store carbon and to prevent and reduce the impact of natural disasters. The Commission will promote tree planting, monitoring and conservation to help reach the objective of planting 3 billion additional trees by 2030.

1.1.2. The 3 billion figure

The Commission estimates that between 2010 and 2015, almost 300 million additional trees have grown in the EU each year (see Section 1.1.3).

This pledge aims to roughly **double** the forest expansion rate in the EU over the period 2005-2020, and have 3 billion additional trees by 2030 above the business-as-usual scenario. This includes not only expanding existing forests, but also planting additional trees in urban and peri-urban areas, and focusing on agroforestry and trees on agricultural land.

This pledge is **ambitious** but **feasible**. It supports the EU to get on the right track to climate neutrality by 2050, as proposed in the strategic long-term vision for a prosperous, modern, competitive and climate-neutral economy[2], endorsed by the European Council and the European Parliament in 2018, communicated to the UNFCCC in 2020[3] and legally binding, as enshrined in the European Climate Law. It will also help halt and revert the unprecedented loss of biodiversity across all EU Member States.

Although the pledge specifies planting at least 3 billion additional trees by 2030, it is crucial to enable the trees **to grow and mature**. Given the effects of climate change, which mean that not all planted trees may survive, monitoring and replanting will be an essential aspect of the initiative in order to achieve at least 3 billion additional living trees by 2030.

2 Communication 'A Clean Planet for All' COM(2018) 773.

3 HR-03-06-2020 EU Submission on Long term strategy.pdf (unfccc.int)

Therefore a long-term plan is required to ensure the pledge is effective. The following sections of this paper expand on these aspects in greater detail.

Tree density, i.e. the number of trees planted on an area unit or the space between tree trunks, is of key importance to estimate the total area required by the initiative.

Tree density depends on the species, local-to-regional geographic and bioclimatic conditions, land use and tree age. Older trees have a lower density than newly planted trees or saplings. Tree density may decrease artificially by thinning to create more space for growth or naturally at different growth stages, with species becoming dominant over the trees' lifetime. The planting of hedges also follows specific guidelines with several trees per metre and, depending on the purpose, possibly in parallel rows. The current spatial distribution of many forest tree species and their climatic niches are depicted in the European Atlas of Forest Tree Species[4].

Planting costs are also linked to the number of saplings and to the preparation of the land. Cost estimates vary widely and depend on site conditions such as terrain, water availability and soil preparation but also maintenance costs for the first 15-20 years of growth.

HIGHLIGHTS

Assuming an average tree density of 1 000/1 500 trees/ha, 3 billion additional trees corresponds to 2 to 3 million additional ha of forests/tree cover, or 200 000 to 300 000 additional ha per year over 10 years. This would be equal to planting the equivalent of 1.3 to 1.9% of the EU forest area over the 10 years of the pledge. This corresponds to 2% of the 10 million ha of forests that are lost in the world every year (also due to EU consumption and production patterns, i.e. EU imports)[5].

This is certainly feasible, in particular considering that:

- An additional total area of 77 million ha can be potentially covered by trees in the EU by restoring natural ecosystems[6].
- 4.8 million hectares may become available from agricultural land being abandoned between 2015 and 2030[7].
- The cost is also feasible (see data provided in Annex 1).
- EU countries are already taking action on tree planting (see Table 1).[8]

4 San-Miguel-Ayanz, J., de Rigo, D., Caudullo, G., Houston Durrant, T., Mauri, A. (Eds.), 2016. European Atlas of Forest Tree Species. Publication Office of the European Union, Luxembourg

5 https://www.europarl.europa.eu/legislative-train/theme-international-trade-inta/file-eu-driven-global-deforestation

6 Bastin, J.F., de Haulleville, T., Maniatis, D., Marchi, G., Massaccesi, E., Mollicone, D., Pregagnoli , C., 'Tree restoration potential in the European Union', 2020 p.22. In FISE, available at: https://forest.eea.europa.eu/data/connectors/eu-tree-restoration-in-european-union-en.pdf/@@download/file

7 Perpiña Castillo, C., Jacobs-Crisioni, C., Diogo, V., Lavalle, C., 'Modelling agricultural land abandonment in a fine spatial resolution multi-level land-use model: An application for the EU', *Environmental Modelling & Software*, Vol 136, 104946, 2021. https://doi.org/10.1016/j.envsoft.2020.104946.

8 https://foresteurope.org/wp-content/uploads/2016/08/SoEF_2020.pdf p.48

Table 1: the country-specific targets on the maintenance, conservation and enhancement of biological diversity in forests that are relevant for afforestation and tree planting

Country	Target
Austria	Increase in the forest area in regions with low forest cover until 2030
Bulgaria	2013-2020: Forestations of 2 000 ha bare forest lands and afforestation of 2 500 of an abandoned agricultural land and on land eroded or threatened by erosion
Denmark	Before the end of the 21st century, forested landscapes cover 20-25% of the total area
Estonia	Increase the total volume of growing stock
Ireland	The principal objective of the Forestry Programme 2014-2020 is to plant an additional 44 000 ha of forests
Lithuania	Afforestation of 30 000 ha according to the National Forestry Sector Department Programme for 2012-2020
Slovakia	Develop a methodology for setting functional types and subsequent management optimisation of other land with tree cover (288 thousand ha)
Spain	Nearly 4 million ha increase of forest area by 2032

- In France, 67.8 million forest seedlings were produced and sold between 2018 and 2019[9]. In Finland, 168 million domestic seedlings were delivered for planting in 2020[10].

1.1.3. Principle of additionality

Additionality is a crucial principle for the pledge, as it means that the pledge is to **plant 3 billion trees between 2020 and 2030 in addition to those that would be planted or grow anyway under a business-as-usual scenario.**

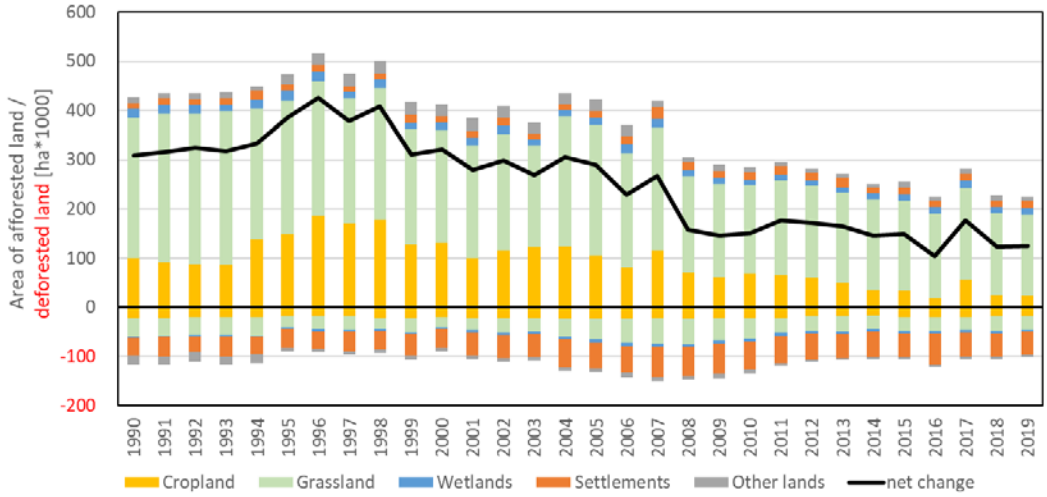
9 https://agriculture.gouv.fr/telecharger/109102?token=ccf4f3009ede3a09935181169732b6f4b0d8b9f56d8bd185495feb264989c618

10 http://statdb.luke.fi/PXWeb/pxweb/en/LUKE/LUKE__04%20Metsa__02%20Rakenne%20ja%20tuotanto__12%20Metsanhoito-%20ja%20metsanparannustyot__Siemen-%20ja%20taimitilastot/12_Istutukseen_toimitetut_kotim_taimet.px/table/tableViewLayout1/?rxid=dc711a9e-de6d-454b-82c2-74ff79a3a5e0

‘Business-as-usual’ scenario

The annual expansion of forests is on the decrease. The net area converted to forests is decreasing, therefore planting 3 billion additional trees is essential to help reverse this trend.

Figure 1: Area of afforested land / deforested land (ha*1000)[11]



Without the principle of additionality, the pledge would not achieve the desired impact. Current trends indicate that under a business-as-usual scenario, the EU would have approximately 3 billion trees more in 2030 than it had in 2020. **The purpose of the pledge is to top up that figure by another 3 billion trees.**

Only tree planting that is planned and implemented in line with the additionality principles below will be counted towards the pledge.

Part A: cumulative conditions

1. Trees planted or planting committed since adoption of the biodiversity strategy (May 2020).
2. Trees planted following the guidelines on biodiversity-friendly afforestation developed by the Commission or similar/equivalent guidelines on biodiversity-friendly afforestation existing in the Member States.
3. Trees that are not planted as a result of a legal obligation such as obligatory regeneration after harvesting or obligatory planting of trees to prevent soil erosion or landslides, or replanting after fires or other disturbances. Trees planted due to legal obligations could be reported and accounted for outside the 3 billion pledge.
4. Trees planted and not to be harvested for several decades (to be mentioned in the declaration of honour, details below in Section 2.1.3)[12].

[11] Sum of 2021 GHG inventories of EU Member States (1990-2019), CRF Table 4.1 for managed forest land conversions following forest definitions for greenhouse gas reporting as defined in National Inventory Reports. National Inventory Submissions 2021 | UNFCCC.

[12] To avoid short-rotation coppice and the counting of high numbers of young trees that will be cut in subsequent years.

Part B: in addition, the following will be counted:

1. Trees planted with the support of EU funds, provided they meet the conditions listed in Part A above. However, trees funded by the common agricultural policy must comply at least with the conditions set in Part C below. They will be counted as additional trees, when above the level of the afforested area by EU funds in the previous programming period
2. Trees that grow from natural regeneration, in compliance with the conditions in Part A above, but in areas that have been newly set aside for this purpose in response to this initiative.
3. New trees detected through remote sensing imagery, provided that they exceed the baseline number of new trees in that country.

Part C: conditions for counting trees in the framework of afforestation funded by the CAP

1. the selection of species to be planted, of areas and of methods to be used shall avoid the inappropriate afforestation of sensitive habitats such as peat lands and wetlands and negative effects on areas of high ecological value including areas under high natural value farming. On sites designated as Natura 2000 pursuant to Council Directive 92/43/EEC[13] and Directive 2009/147/EC[14] of the European Parliament and of the Council only afforestation consistent with the management objectives of the sites concerned and agreed with the Member State's authority in charge of implementing Natura 2000 shall be counted;

2. The selection of species, varieties, ecotypes and provenances of trees shall take account of the need for resilience to climate change and to natural disasters and the biotic, pedologic and hydrologic condition of the area concerned, as well as of the potential invasive character of the species under local conditions as defined by Member States.

3. The operation shall consist of either:
   (i) the exclusive planting of ecologically adapted species and/or species resilient to climate change in the bio-geographical area concerned, which have not been found, through an assessment of impacts, to threaten biodiversity and ecosystem services, or to have a negative impact on human health; or
   (ii) a mix of tree species which includes either:
   — at least 10 % of broadleaved trees by area, or
   — a minimum of three tree species or varieties, with the least abundant making up at least 10 % of the area.

4. Planting of trees for short rotation coppicing, Christmas trees or fast growing trees for energy production shall not be counted.

Not every single tree from the pledged 3 billion must literally be 'planted' by humans. Forest expansion clearly driven by forestry management decisions that enable tree growth from natural or assisted natural regeneration will also count towards the pledge (see box above, part B.2).

[13] OJ L 206, 22.7.1992, p. 7.
[14] OJ L 20, 26.1.2010, p. 7.

1. 2. The benefits

1.2.1. Benefits for the climate

To stay within the 1.5°C goal of the Paris Agreement, it will not be sufficient simply to make the global economy carbon neutral by 2050. All pathways presented in the IPCC report[15] assume that in the second half of the century, the world will need to generate negative emissions at a scale reaching even 12 Gt-CO_2/year.

Potential negative emissions technologies include afforestation and reforestation, land restoration and soil carbon sequestration. There is a widespread understanding that trees are a nature-based solution for efficient cost-effective way of absorbing CO_2 from the atmosphere, giving us some time to develop and implement innovative technological solutions for emissions reduction objectives in other sectors. So far most literature, including the IPCC reports[16], identifies afforestation and reforestation as prominent negative emissions technologies to be deployed at large scale.

HIGHLIGHTS

- Over one year, on average, a mature tree will absorb about 22 kg[17] of CO_2 from the atmosphere, and in exchange release oxygen.
- The IPCC identified the global potential of afforestation and reforestation as up to 10.1 GtCO2/year removal, although with potential trade-offs, e.g. with food security[18]
- In the EU, the total carbon stock in forests is estimated at approximately 20,000 MtC, with 9,500 MtC in aboveground living biomass[19].

Figure 2: Approximate average net carbon sinks in the EU-27 during the period 2016-2018: forest land -360 million tonnes of CO_2 equivalents per year (-Mt CO2e/yr) and HWPs (-40 Mt CO2e/yr), together offsetting -400 Mt CO2e/yr, i.e. about 10% of total EU GHG emissions[20].

15 IPCC, 2018: Summary for Policymakers. In 'Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C'.

16 https://www.ipcc.ch/sr15/ and https://www.ipcc.ch/srccl/

17 https://www.eea.europa.eu/articles/forests-health-and-climate-change/key-facts/

18 Summary for Policymakers — Special Report on Climate Change and Land (ipcc.ch)

19 https://foresteurope.org/state-europes-forests-2020-report/

20 Grassi, G., Fiorese, G., Pilli, R., Jonsson, K., Blujdea, V., Korosuo, A. and Vizzarri, M., Brief on the role of the forest-based bioeconomy in mitigating climate change through carbon storage and material substitution, Sanchez Lopez, J., Jasinevičius, G. and Avraamides, M. editor(s), European Commission, 2021, JRC124374. JRC Publications Repository - Brief on the role of the forest-based bioeconomy in mitigating climate change through carbon storage and material substitution (europa.eu)

- Assuming the 3 billion trees are distributed over about 2 million ha within the next decade, they could potentially remove from the atmosphere approximately 4 million tonnes CO_2 in 2030 and 15 million tonnes CO_2 in 2050[21]. This means that, for every ha of trees planted in the decade 2020-2030, we may expect a sink of about -4.5 t CO_2 $year^{-1}$ in the decade 2030-2040 (i.e. 10 years after planting) and about -7.8 t CO_2 $year^{-1}$ in the decade 2040-2050 (i.e. 20 years after planting).

These effects, however, largely depend on the type of forest. The EU pledge stresses that this must be made in full respect of ecological principles. Reforestation, regeneration and afforestation are therefore potentially an excellent win-win solution, provided this is carried out in 'the right way'.

To achieve the maximum benefits as above, the trees need to reach maturity, as indeed:
Net carbon uptake from the atmosphere does not follow immediately after replanting, and disturbances due to planting may release soil carbon which may take several years or even decades for the growing trees to offset. Maximum uptake will be in the middle growth period (20–60 years depending on species, location and local conditions) after which the rate of absorption starts to slow, although the amount of captured carbon (carbon stocks) continues to rise.[22]

The impact of forests and forest cover change on the climate is broader than the biogeochemical effects produced by carbon sequestration and accumulation. In addition to removing CO_2 from the atmosphere, forests also affect the climate locally and regionally with biophysical processes[23]. In particular, forests have a lower albedo than other land surfaces, meaning they absorb more incoming solar radiation, leading to a potential surface

21 These preliminary estimates are based on the average of various modelling exercises (Reference scenario from IIASA, see Annex I, and the JRC). For the JRC, the net annual increment was attributed to young forests (less then 40 years old) according to a large database of growth curves collected at European level (Somogyi et al., iForest (2008) doi: https://doi.org/10.3832/ifor0463-0010107, Pilli et al. Carbon Balance Manage (2016) doi: 10.1186/s13021-016-0047-8). The resulting total annual increment was further converted to annual carbon removals by assuming an average wood density equal to 0.50 t m^{-3}, an average biomass expansion factor equal to 1.2 and an average carbon content equal to 0.5. The resulting values do not account for carbon stock change on dead wood, litter and soil, since these pools are directly affected from the land use preceding the afforestation.

22 European Academies Science Advisory Council (2018). Negative Emission Technologies: What Role in Meeting Paris Agreement Targets? EASAC Policy Report 35.

23 Alkama, R. and Cescatti, A.: Biophysical climate impacts of recent changes in global forest cover, Science, 351(6273), 600–604, doi:10.1126/science.aac8083, 2016.

warming effect. In parallel to radiative warming triggered by albedo, forests cool the climate by sustaining high evapotranspiration rates. During the growing season, the cooling effect of evapotranspiration is typically greater than the warming effect caused by albedo[24][25]. Evapotranspiration also helps regulate local rainfall, preventing extreme weather events[26].

The combined effect of albedo and evaporation provides a net local cooling effect following afforestation in the order of 0.3-0.5°C, depending on the specific area of land converted and the climate region[27].The cooling effect of new forest cover is even greater in warmer and arid EU regions. By contrast, in cold humid climate (e.g. boreal/polar), the effect of new forest cover may lead to local warming of 0.2-0.4° C. The climate impacts of new forest cover have a clear seasonal pattern, with stronger cooling during the temperate summer and winter/spring warming in cold regions with abundant snow cover[28].

More biodiverse forests also bring benefits for climate adaptation, being more resilient to extreme weather events like droughts, pest outbreaks, storms and wildfires[29]. The recent EU climate adaptation strategy[30] recognises that climate change will trigger major shifts in forests and that adaptation considerations must be integrated in the way they are managed. In this respect reforestation is important in EU areas particularly exposed to extreme

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24 Bright, R. M., Davin, E., O'Halloran, T., Pongratz, J., Zhao, K. and Cescatti, A.: Local temperature response to land cover and management change driven by non-radiative processes, Nat. Clim. Chang., 7(4), 296–302, doi:10.1038/nclimate3250, 2017; Duveiller, G., Hooker, J. and Cescatti, A.: A dataset mapping the potential biophysical effects of vegetation cover change, Sci. Data, 5, 180014, doi:10.1038/sdata.2018.14, 2018; Duveiller, G., Hooker, J. and Cescatti, A.: The mark of vegetation change on Earth's surface energy balance, Nat. Commun., 9(1), 679, doi:10.1038/s41467-017-02810-8, 2018.

25 Bright, R. M., Davin, E., O'Halloran, T., Pongratz, J., Zhao, K. and Cescatti, A.: Local temperature response to land cover and management change driven by non-radiative processes, Nat. Clim. Chang., 7(4), 296–302, doi:10.1038/nclimate3250, 2017; Duveiller, G., Hooker, J. and Cescatti, A.: A dataset mapping the potential biophysical effects of vegetation cover change, Sci. Data, 5, 180014, doi:10.1038/sdata.2018.14, 2018; Duveiller, G., Hooker, J. and Cescatti, A.: The mark of vegetation change on Earth's surface energy balance, Nat. Commun., 9(1), 679, doi:10.1038/s41467-017-02810-8, 2018.

26 Science for Environment Policy, Soil and Water: a larger-scale perspective. Thematic Issue 52. Issue produced for the European Commission DG Environment by the Science Communication Unit, UWE, Bristol. Available at: http://ec.europa.eu/science-environment-policy, 2015, and Millán, M.: Extreme hydrometeorological events and climate change predictions in Europe, Journal of Hydrology, 518 206-224 DOI: http:// dx.doi.org/10.1016/j. jhydrol.2013.12.041, 2014.

27 Duveiller, G., Caporaso, L., Abad-Viñas, R., Perugini, L., Grassi, G., Arneth, A. and Cescatti, A.: Local biophysical effects of land use and land cover change: towards an assessment tool for policy makers, Land use policy, 91 (August 2018), 104382, doi:10.1016/j.landusepol.2019.104382, 2020.

28 Alkama, R. and Cescatti, A.: Biophysical climate impacts of recent changes in global forest cover, Science, 351(6273), 600–604, doi:10.1126/science.aac8083, 2016.

29 H. Pretzsch, G. Schütze & E. Uhl (2013) "Resistance of European tree species to drought stress in mixed versus pure forests: evidence of stress release by inter-specific facilitation". Plant Biology 15 (2013) 483–495, doi:10.1111/j.1438-8677.2012.00670.x; Da Ponte, E.; Costafreda-Aumedes, S. and Vega-García, C. (2019) "Lessons learned from arson wildfire incidence in reforestation and natural stands in Spain". Forests, *10*(3), 229; https://doi.org/10.3390/f10030229

30 Forging a climate-resilient Europe - the new EU strategy on adaptation to climate change, COM (2021) 82.

weather events, such as the EU outermost regions, given the key role biodiversity protection plays in climate adaptation.

Tree planting is not a silver bullet: it can contribute to the aim to achieve climate neutrality but it is only one way to mitigate climate change. Other measures to achieve this goal are needed too, such as forest conservation and reducing greenhouse gas emissions in other sectors. Afforestation should take place where the risk of biodiversity loss is low and where sufficient water is available to minimise possible trade- offs and prevent unintended consequences to water security[31]. The planting of trees should not lead to a land-type change of habitats listed under the Habitats Directive[32].

1.2.2. Benefits for the environment

Trees have many other advantages than carbon sequestration: they provide essential habitats for numerous species, nesting and hibernating opportunities (including for pollinators), and provide other critical ecosystem services such as water cycle regulation, soil protection and erosion control, oxygen release and air filtering. Trees provide additional benefits to water bodies (e.g. rivers, aquifers), including stabilising river banks, providing aquatic habitats and shelter, regulating surface and ground water flows, improving water quality by avoiding soil erosion, eliminating pollution by trapping or filtering water pollutants, thus resulting in better water quality, avoiding excessive water temperature, thanks to shading, which can also reduce the impacts of eutrophication. Under certain conditions, trees can also promote aquifer recharge by reducing water runoff. This also helps prevent floods and mitigate droughts[33] by retaining and storing excess rainwater[34].

Trees also have an important social value in terms of promoting recreation and wellbeing. All these advantages can in turn generate economic benefits by reducing the need for water treatment, or in soil and water bodies' restoration techniques.

Trees in forests form part of extremely complex ecosystems, where they are home to around 80% of the world's biodiversity[35]. The more biodiverse the ecosystem, the more diverse the services and benefits it can provide (i.e. higher multifunctionality)[36].

HIGHLIGHTS

- Europe is home to a great diversity of forest habitats, with 81 different habitat types identified under the Habitats Directive.
- Planting native trees, climate adapted species and varieties in full respect of ecological principles would have a positive impact on the EU's 431 threatened autochthonous tree species[37].

31 Kai Schwärzel, Lulu Zhang, Luca Montanarella, Yanhui Wang, Ge Sun (2019), Global Change Biology, Volume 26, Issue 2. https://doi.org/10.1111/gcb.14875

32 https://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm

33 https://www.eea.europa.eu/highlights/forests-can-help-prevent-floods

34 https://ec.europa.eu/environment/water/adaptation/ecosystemstorage.htm

35 http://www.fao.org/publications/highlights-detail/en/c/1267161/

36 https://besjournals.onlinelibrary.wiley.com/doi/full/10.1111/1365-2745.13378
https://www.nature.com/articles/ncomms2328
https://www.nature.com/articles/s41558-021-01062-1

37 https://portals.iucn.org/library/sites/library/files/documents/RL-4-026-En.pdf European Red List of trees (161 sp threatened and 54 sp no data)

Trees that are part of extensive silvopastoral systems[38] greatly **improve soil quality** and the capacity of soil to accumulate carbon[39]. This enables additional plant species to grow and enhances **species richness**, attracting more **pollinators and wildlife**. Such systems can also have a positive impact on cattle productivity[40].

Agroforestry systems[41] are also beneficial to **soil chemistry** and **prevent erosion** while protecting or even restoring the topsoil[42]. It is estimated that such systems provide up to 45% more benefits for biodiversity and up to 65% for the ecosystem than conventional production systems[43]. Agroforestry systems can reduce soil erosion by an order of magnitude in areas with high intensity rainfall. It can also enhance carbon sinks and potentially sequester between 0.09 and 7.29 t C ha−1 yr−1 while enhancing the environment in agricultural landscapes[44]. It is clear that the benefits of agroforestry systems are context-dependent, as certain well-researched traditional species should be used to reach the targets of this plegde. Overall, agroforestry sustains biodiversity and improves resilience at plot scale, thus it can also increase production and profitability[45].

Trees located on agricultural land (such as trees marking field margins, hedges and parts of landscape features) are very important in **reducing habitat fragmentation** (creating 'stepping stones' for species), in **facilitating gene** flow and in **reducing runoff** to **diminish soil erosion risk** and act as wind breakers thus **reducing wind erosion.** They also improve agro-ecosystem functionality. Habitats comprised of field margins are usually spared the use of pesticides, thus the invertebrate fauna is richer and acts as a food source for mammals and birds, which in turn attract larger predators. Additionally, field margins can provide excellent nesting opportunities for birds[46].

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38 Silvopastoral systems: a combination of trees and shrubs with forage and animal production. https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/651982/EPRS_BRI(2020)651982_EN.pdf

39 http://mr.crossref.org/iPage?doi=10.15446%2Facag.v67n4.70180

40 https://link.springer.com/article/10.1007/s00484-018-1638-8

41 Agroforestry is a collective name for land-use systems and technologies where woody perennials (trees, shrubs, palms, bamboos, etc.) are deliberately used on the same land-management units as agricultural crops and/or animals, in some form of spatial arrangement or temporal sequence. […] Agroforestry can also be defined as a dynamic, ecologically based, natural resource management system that, through the integration of trees on farms and in the agricultural landscape, diversifies and sustains production for increased social, economic and environmental benefits for land users at all levels. http://www.fao.org/forestry/agroforestry/80338/en/

42 https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/651982/EPRS_BRI(2020)651982_EN.pdf

43 https://www.sciencedirect.com/science/article/pii/S0167880916303097

44 Kay et al., 2019. Agroforestry creates carbon sinks whilst enhancing the environment in agricultural landscapes in Europe. https://doi.org/10.1016/j.landusepol.2019.02.025

45 https://wle.cgiar.org/project/agroforestry-biodiversity-and-other-ecosystem-services-central-america-improved-productivity

46 https://www.sciencedirect.com/science/article/pii/S0167880909001625

Trees planted on degraded, abandoned and marginal lands also yield benefits for biodiversity (preserving species that otherwise would risk extinction), water purification, soil retention and soil stabilisation.[47]

The pledge will contribute to the achievement of the target in the biodiversity strategy to achieve 10% landscape features in EU agricultural land by 2030.

Landscape features are any plant or decorative element in a landscape plan, including trees, shrubs, flowers, ditches and streams, small ponds and small wetlands, stone walls and terraces. Trees as landscape features can be planted in the form of lines, groups, in isolation or used to mark field margins.

The common agricultural policy already requires the maintenance of landscape features, and can also fund the creation of new features.

Landscape features provide habitats for beneficial insects and other arthropods, birds and plants. Landscape features bring benefits for natural resources (reducing diffuse pollution by nitrogen and phosphorous and plant protection products, preventing soil erosion and improving water quality) and they improve soil quality. They also contribute to carbon sequestration and to climate change adaptation.

HIGHLIGHTS

- According to last pan-European estimates of water erosion, over 5.2% of land in the EU suffers from severe erosion (10 tonnes per ha per year)[48].
- Planting trees can reduce soil erosion. Trees also provide shelter against the effects of rain and wind, which further protect the crops and/or the soil[49] and farmers can supplement their income with tree-sourced products.
- A specific feature of agroforestry is its synergy effect, which results in up to 40% yield increase compared to traditional agriculture, while improving biodiversity, carbon storage, soil and water quality[50].
- Crop and tree yields produced in agroforestry require 14 to 34% less land or fewer resources in terms of light, water and nutrients compared to monoculture[51].
- Agroforestry is particularly good for soil microbial diversity and improves biodiversity. A

47 Navarro, L.M., Pereira, H.M. (2012) Rewilding Abandoned Landscapes in Europe. Ecosystems 15, 900–912. https://doi.org/10.1007/s10021-012-9558-7

48 Panagos, P., Ballabio, C., Scarpa, S., Borrelli, P., Lugato, E. and Montanarella, L., Soil related indicators to support agro-environmental policies, EUR 30090 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-15645-1, doi:10.2760/889067

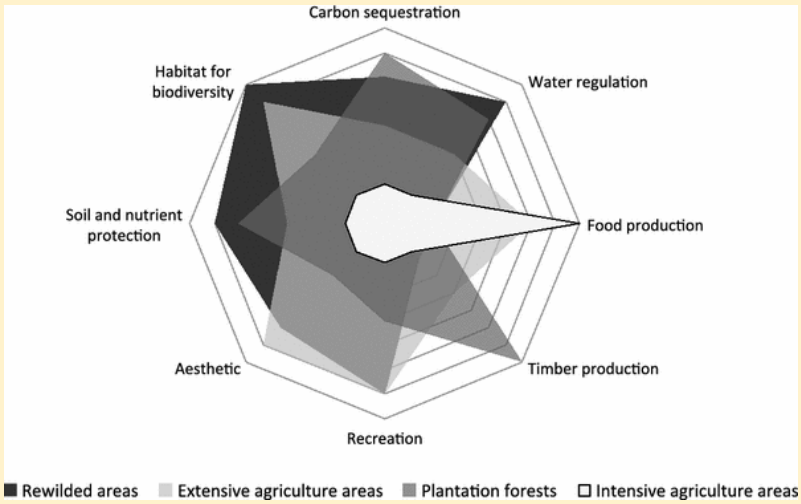
49 Víctor Hugo Durán Zuazo, Carmen Rocío Rodríguez Pleguezuelo. Soil-erosion and runoff prevention by plant covers. A review. Agronomy for Sustainable Development, Springer Verlag/EDP Sciences/INRA, 2008, 28 (1), pp.65-86. ffhal-00886458f

50 https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/651982/EPRS_BRI(2020)651982_EN.pdf p.2

51 Sollen-Norrlin, M., Bahadur Ghaley, B., Laura Jane Rintoul N. (2020) Agroforestry Benefits and Challenges for Adoption in Europe and Beyond, Sustainability, 12, 7001, p.2. doi:10.3390/su12177001.

study in Brazil found a 14.6% increase in production related to the pollination benefits of near-farm forests[52].

Figure 3: a qualitative assessment of the ecosystem services provided by rewilding, afforestation, extensive agriculture and intensive agriculture in Europe[53].



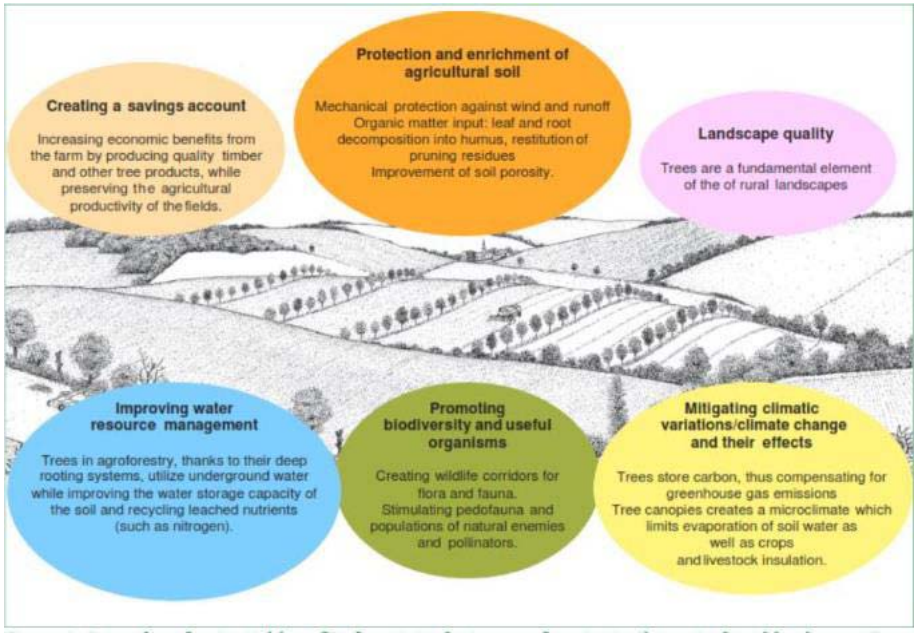
Agroforestry systems can increase resource efficiency, enhance productivity, and improve the overall resilience of agro-ecosystems. The regenerative benefits provided go from farm to global level, as shown in Figure 4[54].

52 The Economics of Biodiversity: The Dasgupta Review.

53 Navarro, L.M., Pereira, H.M. Rewilding Abandoned Landscapes in Europe. Ecosystems 15, 900–912 (2012). https://doi.org/10.1007/s10021-012-9558-7

54 https://www.researchgate.net/publication/321874299_EIP-AGRI_Focus_Group_Agroforestry_introducing_woody_vegetation_into_specialised_crop_and_livestock_systems_Final_Report

Figure 4: Examples of potential benefits from introducing agroforestry in the agricultural landscape



The benefits to the environment of planting **trees in urban areas**[55] include a lessening in urban climate change effects (e.g. urban heat[56]), mitigation of air pollution in many instances, with the potential to preserve and enable a high level of biodiversity, especially local urban bird life[57]. Urban trees play key roles in areas with a high degree of urbanisation and few natural habitats[58]. Urban trees and woodland also contribute to the attractiveness of the townscape and create the image of a positive, nature-oriented city. They are also complementary to other urban policies, such as the promotion of zero-carbon and healthy mobility, such as walking and biking, and support the goals of other EU Green Deal initiatives such as the zero pollution action plan on soil, water and air[59].

HIGHLIGHTS

- Amsterdam's 200 000 trees in open spaces are home to 140 bird species, 34 mammal species, and 6 frog and salamander species[60].
- Urban forests are a refuge for an average of 94% of native bird species found in the surrounding area and about 20% of the world's bird species are present in cities[61].
- Data demonstrating the cooling effect provided by urban trees[62] from Milan (countering the heat island effect in the framework of the ForestaMi project to plant 3 million trees by

55 C. Konijnendijk et al. Urban Forests and Trees A Reference Book, SpringerLink: 2005, p. 81.
56 https://esajournals.onlinelibrary.wiley.com/doi/10.1002/eap.2149
57 https://esajournals.onlinelibrary.wiley.com/doi/10.1002/eap.2149
58 https://www.sciencedirect.com/science/article/pii/S1618866706000732?via%3Dihub
59 https://ec.europa.eu/environment/pdf/zero-pollution-action-plan/communication_en.pdf
60 http://www.fao.org/3/i6210e/i6210e.pdf p. 63.
61 http://www.fao.org/3/i6210e/i6210e.pdf p. 63.
62 https://www.journee-internationale-des-forets.fr/comprendre-le-role-des-arbres-pour-contrer-les-ilots-de-chaleur-urbain

2030) indicate that they lower temperatures by 2-8°C in cities[63]. An increase of tree canopy cover by 10% reduces surface temperatures on average by 1.4°C[64]. Strategic placement of trees can diminish air conditioning by 30% and save 20-50% energy used for heating[65].

- A tree filters up to 450 litres of water daily.
- Every year, a tree removes about 19 kg of pollutants from the air[66].

1.2.3. Economic benefits

In addition to benefits for climate and the environment, tree planting also has benefits for our economies.

The whole chain of tree growing – planting, nurseries, etc. – provides work for many people. In 2011, forest-based industries accounted for over 2 million jobs in the EU and generated turnover in excess of EUR 300 billion for the EU economy[67]. On average, the forestry activities generate 162 euros per ha of forest[68], with most revenues coming from wood. Forests provide also numerous non-marketed services. In total, EU forests provided the equivalent of more than 512 euros per ha in 2012, considering only timber provision, carbon sequestration, flood control, water purification and nature-based recreation[69].

Studies have shown that average house prices are up to 20% higher for properties associated with mature trees[70] – conversely there is a strong correlation between poor quality environments and deprived neighbourhoods.
In urban areas, trees can be very beneficial for the economy[71], since green infrastructure developments also play an important role in enabling commercial development. In Liverpool, contribution to gross value added through increased profit, reduced costs, salary

63 From ForestaMi report: https://forestami.org/wp-content/uploads/2021/03/report_2020.pdf (but also http://www.fao.org/resources/infographics/infographics-details/en/c/411348/)

64 C. Konijnendijk et al. Urban Forests and Trees A Reference Book, Springer: 2005, p.94.

65 http://www.fao.org/resources/infographics/infographics-details/en/c/411348/

66 https://www.eea.europa.eu/articles/forests-health-and-climate-change/key-facts

67 The European Agricultural Fund for Rural Development - Examples of Forestry Projects8770.pdf (proder.pt)

68 Forest area from Forest Europe 2020; gross value added from Eurostat table NAMA_10_A64

69 Vallecillo, S., La Notte, A., Kakoulaki, G., Kamberaj, J., Robert, N., Dottori, F., Feyen, L., Rega, C. and Maes, J. (2019) Ecosystem services accounting. Part II-Pilot accounts for crop and timber provision, global climate regulation and flood control, EUR 29731 EN, Publications Office of the European Union, Luxembourg. Retrieved from http://publications.jrc.ec.europa.eu/repository/handle/JRC116334
https://ecosystem-accounts.jrc.ec.europa.eu/eu-supply-and-use-tables

70 http://www.fao.org/3/i6210e/i6210e.pdf

71 Every EUR 1 spent on planting trees yields EUR 2 of benefits according to Gregory McPherson, E., R.Simpson, J., J. Peper, P., Xiao, Q., Benefi cost analysis of Modesto's Municipal Urban Forest, Journal of Arboriculture 25(5): September 1999, 235-248.
For more: Ping Song, X., Yok Tan, P., Edwards, P. Richards, R. The economic benefits and costs of trees in urban forest stewardship: A systematic review, Urban Forestry & Urban Greening, Volume 29, 2018, 162-170. https://doi.org/10.1016/j.ufug.2017.11.017.

has reached EUR 14.3 million, and contributed EUR 19.9 million to improving public health and mitigating pollution[72].

In Barcelona, trees and shrubs were found to have filtered 305.6 tonnes of pollutants from the air, which from an economic perspective corresponded to a EUR 1 115 908 value a year. Trees were also estimated to sequester 5.422 tonnes of carbon, worth approximately EUR 412 000 a year[73]. In Torbay, the urban forest not only stores carbon worth an annual estimated value of EUR 1 584 000, but also provides EUR 1 789 900 in ecosystem services annually[74].

HIGHLIGHTS

- The value of current forests in the EU based on a set of five ecosystem services they provide is EUR 512 per ha (timber, carbon sequestration, flood control, water purification and recreation)[75].
- Gross added value in forestry in EU27 was 0.21% of total gross added value; still in EU27 2018, gross added value in the forest-based sector (forestry, manufacturing of wood and cork products as well as pulp and paper) was 0.91% of the total gross added value.[76]
- The City of Orléans, France, provides a tool (https://www.baremedelarbre.fr) for estimating the value of an urban tree based on the ecosystem services provided. This value averages between EUR 5 000 and 20 000 but can be as high as EUR 88,590 in the city centre[77].
- As shown in Figure 5 below, in cities the effective benefits become noticeable after about 50 years, and continue to increase for another 150 years[78].

72 Rogers K., Andreucci MB., Jones N., Japelj A., Vranic P. (2017) The Value of Valuing: Recognising the Benefits of the Urban Forest. In: Pearlmutter D. et al. (eds) The Urban Forest. Future City, vol 7. Springer, Cham. https://doi.org/10.1007/978-3-319-50280-9_21 p.291.

73 Ibid, p.292.

74 Ibid, p.293.

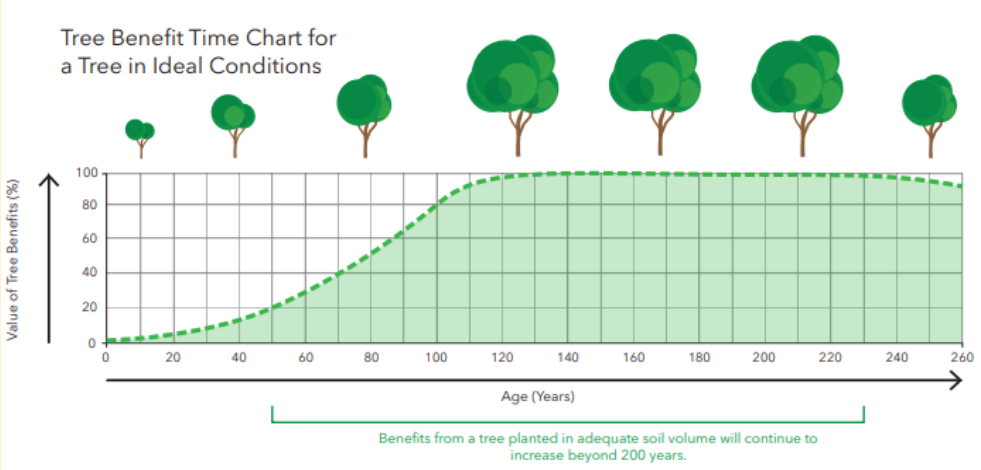
75 https://ecosystem-accounts.jrc.ec.europa.eu/eu-supply-and-use-tables; This value is the EU average, and is much higher in the proximity of cities. It does not include 'habitat and species maintenance' ecosystem services.

76 https://foresteurope.org/state-europes-forests-2020/ p.166

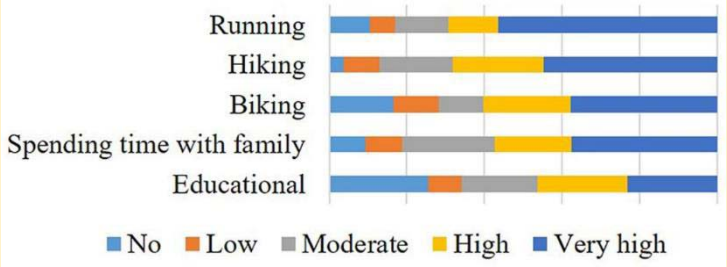
77 https://www.leparisien.fr/environnement/a-orleans-les-arbres-ont-desormais-un-prix-01-03-2021-8426685.php

78 https://www.treeconomics.co.uk/wp-content/uploads/2018/08/GBU_Street-Tree-Cost-Benefit-Analysis-2018.pd p.11

Figure 5: Tree benefit chart of a tree ideal conditions



- **Figure 6:** Ecosystem service demand for a peri-urban forest in a Member State (Romania)[79]



In addition, trees planted in landscape features can provide habitats for pollinators, which have an annual direct contribution to crop production valued at EUR 4.7 billion[80].

The actual economic benefits of forestry, trees in cities and agroforestry, however, may be underestimated because multiple public ecosystem goods and services are not reported[81].

1.2.4. Health benefits

The health of ecosystems mirrors not only the health of our planet but also human health. Soil degradation can lead to chronic micronutrient deficiency, malnutrition and food shortage (famine) while water and air pollution are responsible for numerous diseases and deaths[82]. Trees help purify water and regulate its cycle, stabilise soil and improve soil

79 Sevianu E, Maloş CV, Arghiuş V, Brişan N, Bădărău AS, Moga MC, Muntean L, Răulea A and Hartel T (2021) Mainstreaming Ecosystem Services and Biodiversity in Peri-Urban Forest Park Creation: Experience From Eastern Europe. Front. Environ. Sci. 9:618217. doi: 10.3389/fenvs.2021.618217.

80 Vysna, V., Maes, J., Petersen, J.E., La Notte, A., Vallecillo, S., Aizpurua, N., Ivits, E., Teller, A., Accounting for ecosystems and their services in the European Union (INCA). Final report from phase II of the INCA project aiming to develop a pilot for an integrated system of ecosystem accounts for the EU. Statistical report. Publications office of the European Union, Luxembourg, 2021. p.46

81 https://foresteurope.org/state-europes-forests-2020/ p.166

82 Lal, R. Soil degradation as a reason for inadequate human nutrition. Food Sec. 1, 45–57 (2009). https://doi.org/10.1007/s12571-009-0009-z ;

quality, clean the air while releasing oxygen and sequester carbon to reduce greenhouse gas concentration, thus mitigating climate change. In 2018, there were 379 000 premature deaths linked to air pollution in the EU[83]. Tree planting would contribute to the targets set under the zero pollution action plan[84].

Moreover, deforestation and forest degradation lead to encroachments that promote the spread of diseases transmitted to humans by animals. An increase in Lyme disease risk was linked to reduced forest cover[85]. Restoring habitats by growing and planting trees will help protect humans (and livestock) from deadly pathogens[86].

The vital importance of outdoor activities is evident after the worldwide lockdowns. Many studies have demonstrated how forest-based initiatives have a more beneficial impact on human health than initiatives in urban environments, by reducing stress and promoting psychological and physical rehabilitation[87]. At EU level, woodland and forest ecosystems have a high value for outdoor recreation, and they make a higher contribution to human wellbeing than other types of ecosystems[88].

Planting trees in diverse ecosystems also promotes a healthy diet (fruit of high nutritional value, prebiotics, improved bioavailability). It contributes to the accessibility of natural medicine and is beneficial for cultural, spiritual activities and mental health[89]. Effective use of our forests in promoting health has the potential to reduce public healthcare expenses[90].

THE COMMISSION'S ROLE

Tree planting initiatives are, at least so far, very bottom-up and grassroots-led initiatives. It is essential to clarify the Commission's and the EU's role in this context.

In this roadmap, the Commission sets out a number of **overall conditions and resources** that can be used to make a success of individual projects, ensuring they are in line with **EU guidelines**, and allowing them to carry the label of the **'EU 3 billion trees' initiative**.

The EU should **enable planting projects** by providing sufficient funding. In addition, the EU should provide **policy and technical support**, develop a **visual identity** for the pledge

https://www.who.int/mediacentre/news/releases/2005/pr67/en/ Human health under threat from ecosystem degradation

83 https://ec.europa.eu/commission/presscorner/detail/en/ip_20_2168

84 https://ec.europa.eu/environment/strategy/zero-pollution-action-plan_en

85 10.1046/j.1523-1739.2003.01260.x

86 https://www.nationalgeographic.com/science/article/deforestation-leading-to-more-infectious-diseases-in-humans

87 Doimo I., Masiero M., Gatto P., Forest and Wellbeing: Bridging Medical and Forest Research for Eff ective Forest-Based Initiatives, Forests 11: 791, 2020, doi:10.3390/f11080791

88 Vallecillo Rodriguez, S., La Notte, A., Polce, C., Zulian, G., Alexandris, N., Ferrini, S. and Maes, J., Ecosystem services accounting: Part I - Outdoor recreation and crop pollination , EUR 29024 EN, Publications Office of the European Union, Luxembourg, 2018, ISBN 978-92-79-77333-4, doi:10.2760/619793, JRC110321, (p.31).

89 FAO. 2020. Forests for human health and well-being – Strengthening the forest–health–nutrition nexus. Forestry Working Paper No. 18. Rome.

90 Karjalainen E, Sarjala T, Ratio H. Promoting human health through forests: overview and major challenges. Environ Health Prev Med. 2010 Jan;15(1):1-8. doi: 10.1007/s12199-008-0069-2.

and **boost communication** on the subject, help **build capacity** and foster the **exchange of best practice**.

Lastly, the Commission will set up a system to **monitor progress in reaching the target**, and create a '**EU tree counter'** to visualise progress.

2.1. Setting the framework

2.1.1. Guidelines

As announced in the biodiversity strategy for 2030, the Commission will develop, in close cooperation with Member State experts, forestry stakeholders and NGOs, **guidelines on biodiversity-friendly afforestation and reforestation** and **closer-to-nature-forestry practice**. In terms of the 3 billion trees pledge, the guidelines will promote planting that maximises the benefits for biodiversity and for the climate.

Guidelines on biodiversity-friendly afforestation and reforestation are currently under development in the Working Group Forest and Nature. They will also address **agroforestry** and **trees located in agricultural areas**, as well as for **urban trees**.

These guidelines should be followed by all tree-planting initiatives that receive EU funds.

2.1.2. Criteria

In order to **count towards the pledge**, tree-planting initiatives will need to fulfil the **following conditions**:

- **comply with the principle of additionality** (see Subsection 1.1.3).
- **benefit biodiversity and the climate** in line with the do no significant harm principle, in particular **excluding** the planting of **invasive alien species**[91]**.**
- plant only **native tree species**, unless it can be demonstrated that they are no longer adapted to projected climatic and pedo-hydrological conditions.

2.1.3. Labels and partner organisations/projects

The EU will create a label that projects and monitoring systems that meet the above criteria can use to raise awareness. It will also create a counter tracking tree planting at EU level. Projects that meet these criteria are eligible for labelling, for the mention 'contributes to the 3 billion trees EU project' and to receive a certificate.

As it is not always possible to verify on the spot, the project promoter will be invited to sign a declaration of honour attesting that they meet the requirements.

[91] Included in the List of Invasive Alien Species of Union concern. The selection of species, varieties, ecotypes and provenances of trees must take account of the need for resilience to climate change and to natural disasters and the biotic, pedologic and hydrologic condition, as well as of the potential invasive character of the species as defined by Member States, given the local conditions in the area concerned.

2.2. Enabling

2.2.1. Communication

The pledge is an initiative designed to benefit the climate, the environment, the economy and public health. The Commission will be an enabler and will help encourage people and organisations to join the initiative and encourage planting projects by developing a brand for the pledge and by publicising it.

Once the pledge brand and the guidelines are produced, the Commission will **publicise** the pledge **via selected channels,** targeting two different main stakeholder groups: (1) the EU general public and (2) tree planters/partner organisations. This will be developed in synergy with other Commission awareness-raising and communication initiatives, notably those related to the European Green Deal, the Climate Pact end the Education for Climate Coalition.

A range of tools will be used to raise awareness and promote communication, in particular press, media and social media.

The Commission will also maintain a web presence for the pledge, by creating a dedicated webpage, hosted on DG Environment's website. The purpose is to raise awareness and give users practical information and material: key policy content, an interactive map with an integrated tree planting counter, how to report planting and practical information for partners and tree planters. This could include planting guidelines, a platform to share best practice and knowledge, examples of specific planting initiatives, information on capacity building and on how to access funding.

The pledge initiative will run from 2021 to 2030. Over this period, the Commission will continue raising awareness and communicating at different key moments via selected communication channels, tools and initiatives, to help the initiative reach its objective.

2.2.2. Policy and technical support

The Commission will provide **policy support** for the pledge through communication on the biodiversity strategy and the Green Deal, and will also **integrate the tree planting initiative into existing policies and instruments** (common agricultural policy strategic plans, the Urban Greening Platform, Horizon Europe Missions, etc.). Relevant intergovernmental cooperation setups such as the Urban Agenda for the EU and its Thematic Partnerships[92] as well as the Territorial Agenda 2030[93] could also be mobilised in this process.

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92 Through its actions, the Urban Agenda for the EU Thematic Partnership on Sustainable Use of Land and Nature-based Solutions has been promoting the liveable and compact city model and the mainstreaming of nature-based solutions as a tool to build sustainable, resilient and liveable urban spaces; https://futurium.ec.europa.eu/en/urban-agenda/sustainable-land-use

93 The Territorial Agenda underlines the importance of and provides orientation for strategic spatial planning and calls for strengthening the territorial dimension of sector policies at all governance levels. It emphasises the need to respond to the increasing pressure concerning sustainable development and climate change including in the fields concerning the loss of biodiversity and land consumption. https://territorialagenda.eu/home.html

To garner the policy and technical support needed at Member State level, regular meetings are held with national representatives via the working group 'Forest and Nature'. A Community of Users liking representatives of various tree planting pledges and planting organisations will also be set up.

2.2.3. Knowledge platform

2.2.3.1. Financing

From seedlings, to workforce costs for afforestation, ground preparations and planting work to regular monitoring measures, the work involved in tree planting will require ongoing, significant investment. Some of the EU funding mechanisms available could be used to finance or co-finance this work. The list overleaf provides an overview of some of the EU funding programmes that could be used; it is not exhaustive.

Directly managed EU funding programmes	**EU funding programmes under shared management**	**Project development assistance**	**Financial institution instruments**	**Support services**	**Other**
LIFE Horizon Europe	ERDF Interreg Cohesion Fund EAFRD	Horizon Europe Project Development Assistance	Natural Capital Financing Facility	Technical Support Instrument European Investment Project Portal fi-compass EIAH	National Funds and State aids

<u>LIFE</u>

LIFE is the EU's funding programme for environmental and climate action. Tree planting has been funded under both the environment and the climate action sub-programmes, depending on the focus of the specific project. The 'Environment' part of the programme covers three priority areas: environment and resource efficiency; nature and biodiversity; and environmental governance and information. The 'Climate Action' part covers climate change mitigation; climate change adaptation; and climate governance and information. The programme is open to public bodies, businesses and NGOs. The programme is due to be renewed for the 2021-2027 period, with a total budget of EUR 5.45 billion.

Examples of ongoing LIFE projects working on tree planting are: LIFEterra, LIFE 4 oak forests, LIFE Baccata. It is also very useful to draw on previous LIFE projects as they provide experience on tree planting and on ex post monitoring of tree survival rates[94].

<u>Horizon Europe</u>

Cluster 6 (Food, Bio-economy, Natural Resources, Agriculture and Environment) under the **Horizon Europe** research and innovation funding programme will support the planting of 3

[94] Examples include LIFE07/NAT/E/000735 "Corredores para la conservación del oso pardo cantábrico" (January 2009-December 2011) and LIFE12/NAT/ES/000192 "Desfragmentación de hábitats para el oso pardo en la Cordillera Cantábrica" (August 2013- December 2016).

billion trees by improving scientific knowledge on restoration, afforestation and reforestation.

Research and innovation will contribute to the initiative and increase its impact by improving practical knowledge on forest composition and forest management practices that support the objectives on climate change mitigation, adaptation, biodiversity and bioeconomy of newly established or restored forest. The aim is to maximise synergies and minimise trade-offs. Experience and lessons learned from ongoing or previous funded research projects such as B4EST[95] or MAIL[96] could be used to build a knowledge base to underpin the initiative.

By capitalising on the results of past and ongoing EU-funded research projects under Horizon 2020 (e.g. AGFORWARD, AFINET, MIXED, AGROMIX), research and innovation will also explore the potential of agroforestry systems and their contribution to sustainable food and feed / non-food biomass production.

Cohesion policy funds

The **Cohesion Policy Funds** are funds set up to implement the EU's regional policy. They aim to reduce regional disparities in income, wealth and opportunities. Europe's poorer regions receive most of the support, but all European regions are eligible for funding under the wide range of funds and programmes available.

Member States can plan to use these funds through national partnership agreements, which are then implemented through regional programmes, including at sub-regional and city level. They can also uses the funds to finance programmes for cross-border, transnational and interregional cooperation, making use of the coordination and cooperation frameworks provided by the EU macro-regional strategies when applicable[97]. Tree planting could be covered under the natural disaster risk reduction and restoration heading.

A minimum 8% of the European Regional Development Fund resources in each Member State must be invested in priorities and projects selected by cities themselves and based on their own sustainable urban development strategies. This can include tree planting as part of a wider integrated development strategy in urban areas.

European Agricultural Fund for Rural Development (EAFRD)

Under the **rural development programme,** Member States can chose to allocate funds to support tree planting under the priority of restoring, preserving and enhancing ecosystems related to agriculture and forestry. This can include post-disaster restoration and enhancing ecosystems in agricultural lands. Afforestation and creation of woodland, as well as the establishment of agroforestry systems can also be supported.

95 https://cordis.europa.eu/project/id/773383

96 https://cordis.europa.eu/project/id/823805

97 The EU macro-regional strategies are cooperation frameworks for better coordination of actions and funds in a specific transnational geographical area (macro-region). Key features of the strategies are the cross-sectoral approach, multi-level governance and stakeholder involvement. For info: https://ec.europa.eu/regional_policy/en/policy/cooperation/macro-regional-strategies/

Carbon farming

The Farm to Fork strategy announced that, by the third quarter of 2021, the Commission will launch a new **EU carbon farming initiative** to promote carbon sequestration as a new green business model. The 2030 climate target plan identified carbon farming as a tool to create direct incentives for farmers and forest managers to take climate action and thereby to help achieve the EU's target to cut greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels. The adaptation strategy also announced that the Commission will promote carbon farming for land-based carbon removals and create financial incentives to roll out nature-based solutions.

Carbon farming incentives can cover a large range of activities, including activities that will contribute to achieve the forest strategy goals such as:

- planting new forests
- restoring degraded forests
- improving the management of existing forests
- supplying biomass for the production of long-lasting bio-based products
- planting trees in agricultural land as part of sustainable agroforestry systems.

Carbon farming could thus help create the financial incentives needed, for example to plant 3 billion additional trees in the EU by 2030.

To make carbon farming an effective business model, however, it will be necessary to improve the advisory services for land managers and to build a monitoring, reporting and verification system using the latest digital and satellite technologies.

State aid

The planting of trees can also be supported through national funding under the EU State aid rules. Under those rules, Member States may grant aid for two types measures that are particularly relevant for the planting of additional trees on areas not yet forested: aid for afforestation and creation of woodland, and aid for the establishment, regeneration or renovation of agroforestry systems. Such aid measures may also include subsidies for costs related to forest maintenance.

The EU State aid rules also allow Member States to subsidise the planting of trees in urban and peri-urban areas.

The current State aid rules for forestry are under revision. Based on the consultations carried out it seems that the new rules will maintain these funding possibilities or may even go beyond. The new rules are scheduled to take effect as from 1/1/2023.

Private-sector financing

It will be essential to **involve the private sector** to achieve the target and to leverage the funds needed for planting and monitoring.

There is a clear interest in the private sector to contribute to the pledge (banks and private fund managers, corporations, green bonds, airlines, energy infrastructure operators, etc.). Banks and fund managers are increasingly setting up dedicated branches that seek green investment opportunities, where the revenue is in the image it portrays (CSR initiatives).

In light of the significant hectares of EU land involved, operators of energy infrastructures could potentially be important partners for the 3 billion trees pledge.

It will be essential to set clear conditions/requirements to avoid greenwashing practices (i.e. planting trees in addition to other action, not instead of other action). It should also make sure that consumption that negatively affects natural resources is not labelled as sustainable (air travel, SUVs, red meat, etc.), simply by carbon offsetting through tree planting.

2.2.3.2. Best practice exchange and capacity building

To foster knowledge sharing and enable new projects to emerge, the Commission will also provide a **platform to exchange best practice**.

The Commission will also provide support and guidance to **plan and implement projects**, making use of existing instruments and initiatives (see Sections 2.2.3.1 and 2.2.3.3) for efficient long-term planning, and secure the survival and protection of the planted trees over decades.
To contribute and provide enabling conditions for **employment,** synergies with the EU Solidarity Corps will be analysed to see how that initiative could contribute to the pledge.

In addition, the pledge will foster the emergence of new digital solutions and innovative start-ups (such as drones, remote sensing, websites for tree planting and citizen science[98] in general).

2.2.3.3. Links with the Climate Pact and the Education for Climate Coalition

To avoid duplicating action on tree planting, the Commission will coordinate action taken under the 3 billion additional trees pledge with the commitments and action taken under **the Climate Pact**.

The Pact will support local communities, organisations and individuals committed to new tree-planting and caring initiatives, for instance through increased visibility and information[99].

The Pact will support (e.g. via the ambassadors) first-time pledgers and organise awards for best pledges. Both individuals and organisations will be encouraged to make a tree-related pledge through the Climate Pact website[100]. The Pact will also provide support in the form of consultancy hours to the best projects (pledges) to help them upscale or replicate.

It will link up with EU-supported agricultural plans in Member States and a range of EU funds (Cohesion Funds, LIFE programme, etc.) and platforms (the new European Urban Greening Platform announced as part of the biodiversity strategy).[101]

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98 "Citizen science is a broad term, covering that part of Open Science in which citizens can participate in the scientific research process in different possible ways: as observers, as funders, in identifying images or analysing data, or providing data themselves. This allows for the democratisation of science, and is also linked to stakeholders' engagement and public participation." Citizen science | Shaping Europe's digital future (europa.eu)

99 Communication 'European Climate Pact' COM(2020) 788 final, page11.

100 https://europa.eu/climate-pact/pledges_en

101 Ibid.

In response to the interest shown by the 'pledgers' and the questions received, a guide will be produced to direct people to relevant (EU) funding, possibly including philanthropies (that could cover the co-financing needs).
The Pact will also contribute to objectives linked to agricultural plans - the common agricultural policy strategic plans - operational programmes under the cohesion policy, LIFE programme as well as relevant platforms such as the European Urban Greening Platform.

Moreover, the **Education for Climate Coalition**[102] will play a central role in the Commission's aim to promote the education communities' contribution to the green transition by valorizing concrete cooperation and actions taken on the ground. As part of the European Education Area, the Coalition will help mobilise pupils, students, teachers and stakeholders and connecting them across local and national borders 'to make a difference' in their particular neighborhood and region.

2.2.4. Monitoring

2.2.4.1. The monitoring system

The **monitoring platform will be made available** on the **Forest Information System for Europe** website[103].

The system will also include a link to the form to submit and report planting. This form will be hosted on the EEA website via the data-reporting platform Reportnet 3.0, which will enable the EEA to collect information and to feed it into the monitoring platform. To make sure that the submitted information is reliable, it will require users to submit a declaration of honour.

2.2.4.2. The EU tree counter

The EU tree counter will provide an estimated number of additional trees planted in the EU between May 2020 (adoption of the EU biodiversity strategy for 2030) and the current day. This information will be made available on the Pledge webpage. Information provided in the counter should not duplicate existing counters. If other counters already exist, the EU counter will count the counters, avoiding double counting. Therefore, it will link up with other counter systems, also to ensure that the EU tree counter only counts the trees planted in full respect of ecological principles and the principle of additionality.

An area-based approach will complement tree counting in urban spaces and add to the total of 3 billion trees, using the equation *number of trees = area * tree density.*

The areas may be extracted from existing databases or detected by remote sensing. Such estimates varies by tree planting scheme (afforestation, landscape element, agroforestry) and species, and may also require regional or local adjustments.

For instance, afforested areas can be detected by satellite-based remote sensing. Recently, satellite-based remote sensing products have been released to map small woody features, which can be used to detect landscape features such as hedges.

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102 https://education-for-climate.ec.europa.eu/_en

103 https://forest.eea.europa.eu/

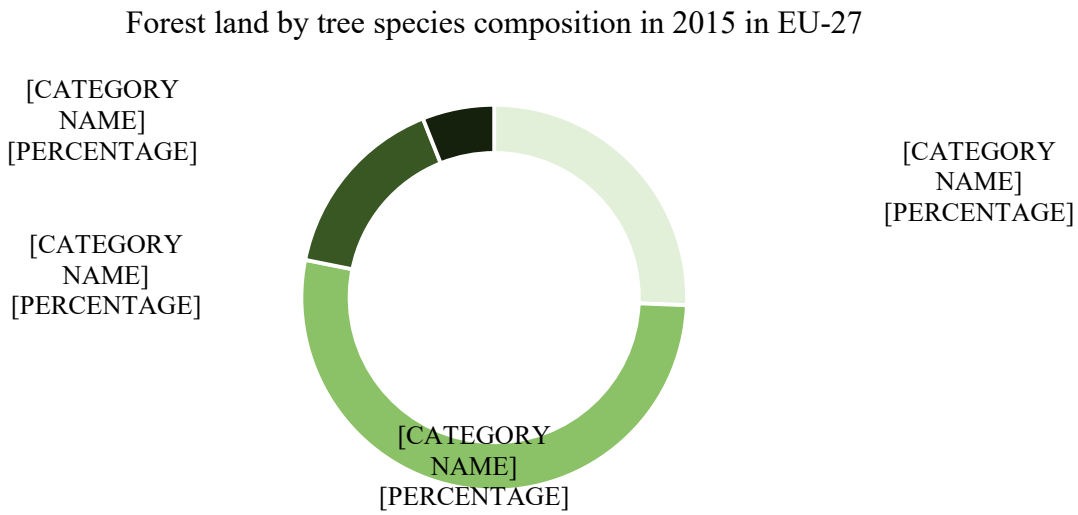
2.3. The starting point

2.3.1. Forest area

The EU accounts for approximately 5% of the world's forests. Contrary to the trends in many other parts of the world, the forested area of the EU increased at a steady pace of 0.3 million ha per year from 2010-2015[104] and 0.2 million ha per year from 2015-2020[105].

However, according to the European Environment Agency report *State of Nature in the EU*, 31% of forest habitats do not have a good conservation status. The Forest Europe Report 2020[106] explains that 'currently, less than one third of Europe′s forests are uneven-aged, 26% have only one tree species (mainly conifers), 52% have only two to three tree species, and only 6% of forests have six or more tree species (see Figure 7). (…) Forest habitats are especially affected by the removal of dead and dying trees as well as by broader land use changes, such as conversion to monocultures or other forest types'[107].

Figure 7: Forest area classified by number of tree species in the EU-27 in 2015[108].



HIGHLIGHTS

- In 2020, forests covered 159 million ha in the EU-27, some 38%[109] of total land area.
- Forest coverage varies across the EU, ranging from 66% in Finland to 1.5% in Malta.

104 Camia, A., Cazzaniga, N., Pilli, R. and Vacchiano, G., Brief on forestry biomass production, Lusser, M., Sanchez Lopez, J., Klinkenberg, M. and Avraamides, M. editor(s), Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-77232-0 (print),978-92-79-77233-7 (pdf), doi:10.2760/59347 (online),10.2760/0848 (print), JRC109352.

105 Forest Europe, 2020: State of Europe's Forests 2020.

106 Forest Europe, 2020: State of Europe's Forests 2020.

107 See Subsection 1.1.3.

108 Values for CY, DE, EL, IT, LU and MT in the forestland by number of tree species occurring are not reported.

109 https://ec.europa.eu/eurostat/statistics-explained/index.php/Forests,_forestry_and_logging

- Around 46%[110] of forest in the EU is composed of coniferous trees and 37% of broadleaved trees. Mixed stands cover 17% of the EU's forest area.
- Forest Europe reported the net forest area gain to be 0.2 million ha/year between 2015 and 2020[111].

In addition to forests, trees outside the forests have also potential to significantly enhance greenery[112] in Europe.

2.3.2. Agroforestry

8.8% of the EU's utilised agricultural area is under agroforestry. Estimates show that Europe has the potential to increase to almost 120 million ha for new and regenerated agroforestry by 2030. Nevertheless, a more conservative approach should be taken, with the main focus being on agricultural areas that have suffered most from environmental degradation and consequently have the lowest tree coverage. Given this priority, there is a potential in around 13 million ha of agroforestry that could contribute about 3.13 billion trees[113].

HIGHLIGHTS

- Table 2 shows the calculated 'priority' and 'possible' areas for agroforestry to be planted or regenerated before 2030. Planting density is based on a selective thinning rate of 3-4:1 to reach final stocking[114].

  Table 2: 'Priority' and 'possible' areas for agroforestry to be planted or regenerated before 2030

Scenario	Agroforestry System	Calculated Area (ha)	Planting Density/ha	Total trees (billion)
Priority Areas (4-5 environmental threats)	Silvoarable	9,959,142	200	1.99
	Silvopastoral	2,844,592	400	1.14
	Total			**3.13**
Possible Areas (1 environmental threat)	Silvoarable	95,890,000	200	19.18
	Silvopastoral	24,000,000	400	9.60
	Total			**28.78**

- 61% of the potential for total natural canopy restoration in the EU is found in land that is currently used for agriculture[115].

110 https://foresteurope.org/state-europes-forests-2020/ p. 31.

111 For further information on forest area and forest cover see the Commission Staff Working Document on stakeholder consultation and evidence base, accompanying the Communication on the EU Forest Strategy, SWD(2021) 652

112 By enhancing greenery, it is meant to increase the volume of vegetation, the extent of green spaces and the volume of overall tree cover.

113 http://www.europeanagroforestry.eu/news/policybriefing2 p.4.

114 http://www.europeanagroforestry.eu/news/policybriefing2 p.4.
Note that the areas exclude the UK and Croatia. An additional 100 000 trees could be included for Croatia under the 'priority' scenario.

115 Bastin, J.F., de Haulleville, T., Maniatis, D., Marchi, G., Massaccesi, E., Mollicone, D., Pregagnoli , C., 'Tree restoration potential in the European Union', 2020 p.46. In FISE,

- 58% of the total restoration potential in agricultural land is located in five Member States: France, Germany, Poland, Italy and Spain[116].

2.3.3. Urban trees

Urban forestry is commonly reported under the broader concept of green infrastructure. On average, green areas such as urban greens, private gardens and urban forests make up 40% of the land covered by Europe's cities[117]. In some cases, the estimates also provide information on urban tree coverage. For example, in Vienna, over 8 000 ha or 18% of the area is covered with forests[118], and for Copenhagen, Malmo and Oslo tree canopy cover is 16.5%, 22.3%,[119] and 28.8% respectively[120].

Over the last decade, however, urban areas have undergone significant unsustainable land use development, which have resulted in increased soil sealing (+1.46%), more dispersed settlements (+11%), an increase in mixed land use (+0.75%) and a loss of peri-urban agroecosystems (-1.5 %). As a consequence, these changes have an effect on the structure of urban green spaces and their capacity to provide ecosystem services[121], which for cities include erosion control, air purification and outdoor recreation[122].

HIGHLIGHTS

- Table 3 gives an overview of urban and peri-urban tree cover estimated using the pan-European Forest non-forest map (Pekkarinen et al., 2008) and the European Urban Morphological Zones (Milego, 2007; Simon et al., 2010). The resolution of the analysis is 100 m. UPUG: urban and peri-urban greening; UG: urban greening; PUG: peri-urban greening[123].

available at: https://forest.eea.europa.eu/data/connectors/eu-tree-restoration-in-european-union-en.pdf/@@download/file

116 Ibid, p.52

117 Maes J, Zulian G, Günther S, Thijssen M, Raynal J, Enhancing Resilience Of Urban Ecosystems through Green Infrastructure. Final Report, EUR 29630 EN; Publications Office of the European Union, Luxembourg, 2019, doi:10.2760/689989, JRC115375. p.41

118 https://efi.int/explore/city/archive

119 https://urbantreecover.org/. Also see Treepedia for more tree canopy data in cities across the world: http://senseable.mit.edu/treepedia

120 https://www.theguardian.com/cities/2019/nov/05/green-streets-which-city-has-the-most-trees

121 Maes, J., Teller, A., Erhard, M., Condé, S., Vallecillo, S., Barredo, J.I., Paracchini, M.L., Abdul Malak, D., Trombetti, M., Vigiak, O., Zulian, G., Addamo, A.M., Grizzetti, B., Somma, F., Hagyo, A., Vogt, P., Polce, C., Jones, A., Carré, A., Hauser, R., EU Ecosystem Assessment: Summary for policymakers. EUR 30599 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-30423-4, doi:10.2760/190829, JRC123783. p.54.

122 La Notte A, Vallecillo S, Polce C, Zulian G, Maes J. 2017. Implementing an EU system of accounting for ecosystems and their services. Initial proposals for the implementation of ecosystem services accounts, EUR 28681 EN; Publications Office of the European Union, Luxembourg, doi:10.2760/214137, JRC107150. p.34.

123 Casalegno, C., Urban and Peri-Urban Tree Cover in European Cities: Current Distribution and Future.
Vulnerability Under Climate Change Scenarios, 2011, p.98. Available at: https://cdn.intechopen.com/pdfs/21324/InTech-Urban_and_peri_urban_tree_cover_in_european_cities_current_distribution_and_future_vulnerability_under_climate_change_scenarios.pdf

Table 3: An overview of urban and peri-urban tree cover

	Total sq km	Urban sq km	Peri-urban sq km	% UPUG	% UG	% PUG
Amsterdam	1370	422	948	4.1	4.1	4.0
Athens	1583	454	1129	9.7	0.9	13.2
Berlin	2487	1002	1485	43.8	42.0	45.0
Bruxelles	1783	857	927	16.0	12.0	19.7
Budapest	2704	718	1986	20.8	2.5	27.3
Copenhagen	1352	547	806	21.0	28.5	16.0
Helsinki	1360	498	862	57.0	49.1	61.6
Lisbon	2063	491	1572	23.7	8.7	28.4
London	3521	1897	1623	9.9	4.9	15.8
Madrid	1903	524	1379	6.4	6.8	6.2
Paris	3549	1777	1771	20.8	10.8	30.8
Rome	1654	446	1208	8.4	3.5	10.2
Stockholm	2541	720	1820	70.5	57.3	75.7
Warsaw	3782	646	3135	32.8	36.5	32.0
Vienna	1685	457	1228	28.9	4.9	37.8

- Artificial areas[124] have the potential to supply 4 064 000 ha, which would translate into 2 197 million trees[125].
- In the EU, 55% of the restoration potential in artificial surfaces is concentrated in Germany, France, Italy and Poland. Total restoration potential represents approximately 30% of artificial areas and the first 10 countries cover more than 80% of the total amount of restoration potential[126].

2.3.4. Existing pledges

Tree planting is an excellent way to involve the general public in biodiversity and climate-friendly initiatives that help improve our living conditions and help save the planet. The EU pledge is one of a myriad pledges being made worldwide by the private sector and public authorities as a response to climate change and the biodiversity crisis.

Examples of **existing tree planting pledges** in the EU vary from projects covering different geographical areas, such as LIFE TERRA project with the aim to plant 500 million trees by 2025, to others focusing on regional aims, such as Flanders with 10 000 hectares of new forests by 2030, Wallonia with the target to reach 1 million trees, and others still shedding light on urban areas like ForestaMi (Milan), which aims to plant 3 million trees by 2030. Smaller scale grassroots initiatives are also being created in the form of green belt initiatives, such as the 1 000 trees project around the schools in Sofia, or food forest projects like the initiative in the Rijnvliet neighbourhood in Utrecht[127].

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124 Artificial areas encompass urban, industrial, commercial and transport infrastructures.

125 Bastin, J.F., de Haulleville, T., Maniatis, D., Marchi, G., Massaccesi, E., Mollicone, D., Pregagnoli , C., 'Tree restoration potential in the European Union', 2020 p.46. In FISE, available at: https://forest.eea.europa.eu/data/connectors/eu-tree-restoration-in-european-union-en.pdf/@@download/file

126 Ibid, p. 50.

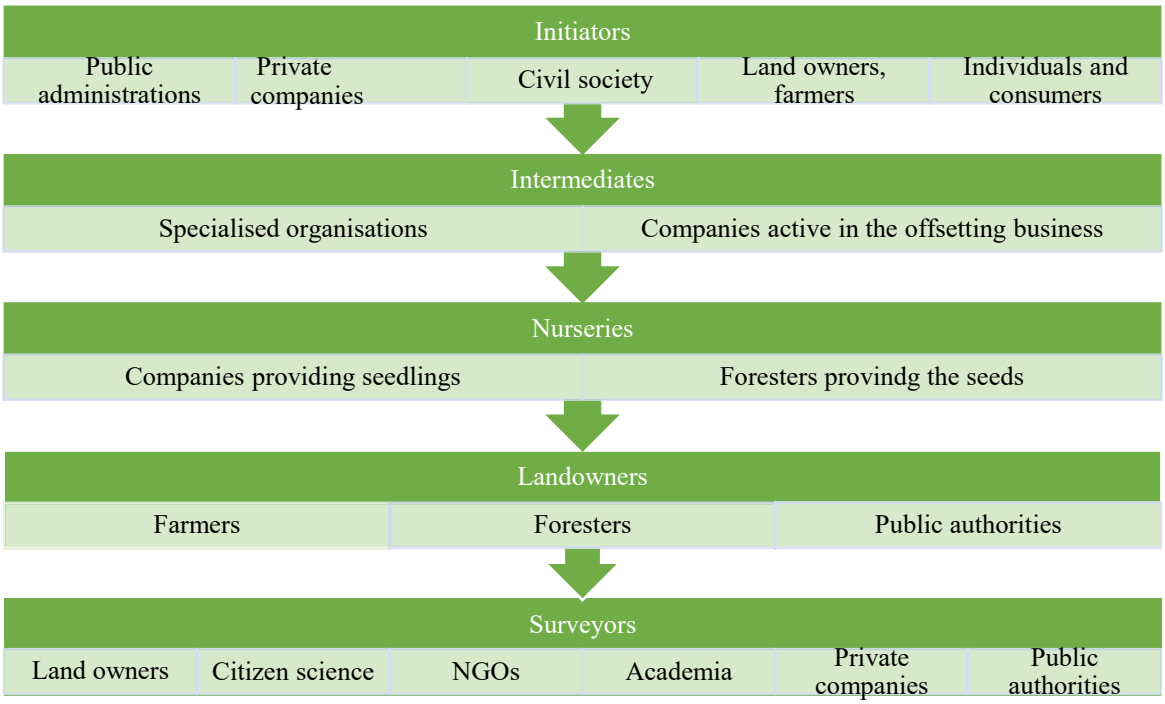
127 For more on existing pledges, ranging from ongoing specific projects to political programmes and enabling instruments, please see Annex 2.

Achieving the 3 billion additional trees by 2030 also means drawing on existing enabling mechanisms, not only from the European Commission, but also from grassroot organisations. From **communication projects** to **financial support** (e.g. EUR 8 million for tree planting in Vienna, or subsidies for individual action in Amsterdam), to **mobilising tree planters** (volunteers planted 42 000 trees in Algarve), there are many different types of enabling and supporting action to promote.

PLANTING TREES

3.1. Stakeholders in the tree planting process

Tree planting requires successful cooperation between a range of stakeholders: project initiators, intermediates, nurseries, landowners and surveyors[128].



3.1.1. Initiators

Project initiators begin the tree planting process by creating the idea or scheme. The list below gives a preliminary analysis of typical initiators and their **motivations:**

- **Public administrations**
  - Comply with legislation on nature restoration
  - Greening cities
  - Compensating greenhouse gases
  - Disaster prevention (e.g. against floods) or post-disaster repair (storms, fires)
  - Combating desertification
  - Post-COVID-19 recovery measures (new jobs)

[128] Di Sacco, A., Hardwick, K.A., Blakesley, D., Brancalion, P.H.S., Breman, E., Cecilio Rebola, L., Chomba, S., Dixon, K., Elliott, S., Ruyonga, G., Shaw, K., Smith, P., Smith, R.J. and Antonelli, A. (2021), Ten golden rules for reforestation to optimize carbon sequestration, biodiversity recovery and livelihood benefits. Glob. Change Biol., 27: 1328-1348. https://doi.org/10.1111/gcb.15498

- **Private companies and corporations**
  - Corporate responsibility
  - Compensating greenhouse gases
  - Legal obligations to restore sites after closure of activities
  - Protection of biodiversity
  - Combating climate change
  - Increasing social engagement
- **Civil society organisations**
  - Awareness raising
  - Advocacy for climate action
  - Mobilising people for climate action
  - Leading by example
- **Land owners and farmers**
  - Increasing forest areas for commercial purposes
  - Diversifying agricultural activity with agroforestry
  - Erosion and desertification control
  - Additional revenue source
- **Individuals and consumers**
  - Reducing carbon footprint and compensating for greenhouse gases (for instance in air travel)
  - Increasing the liveability of their area
  - Take tangible action for the good of the planet

Although for students, schoolchildren, politicians, companies, etc. planting trees is a great communication and civil society engagement tool, **most of the 3 billion trees will have to be planted by forest professionals**, with the **involvement of local authorities and local communities**, ensuring that the trees planted **survive and thrive**, and that there will be continuity.

3.1.2. Intermediates

In some cases, the initiators can plant the trees themselves in their own land or directly in contact with the landowners. However, very often the initiators hire the services of specialised organisations. Sometimes these intermediaries also do the planting themselves or they outsource the job of physical planting. Intermediaries run local projects or are connected to other organisations (especially at international level).

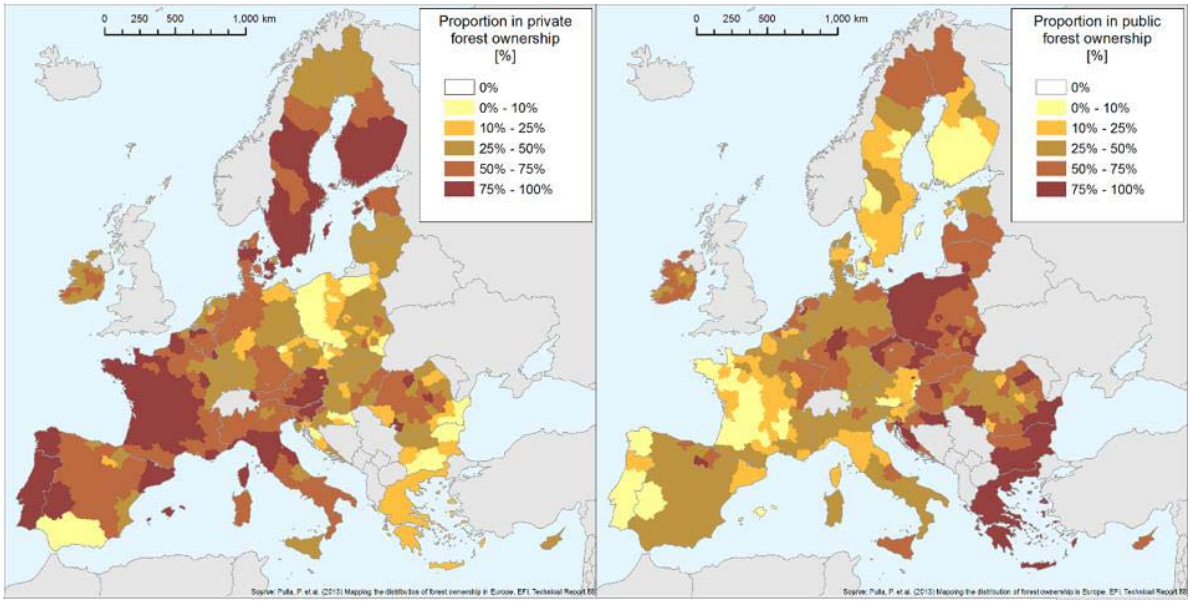
Several of these companies were active for years in the offsetting business (mainly related to the compliance market), selling CO_2 removal credits from their projects to businesses and individuals. However, not all offsetting companies commit to tree planting, due to the difficult objective of monitoring the planted trees over the long term, especially at international level. Trees must exist safely for over 50 years before the CO_2 savings can count as permanent – a timeframe that few private companies can guarantee today. The motivation of these companies stems from the business opportunities potentially linked with environmental concerns, concerns of rural development or social inclusion – as well as social responsibility and reputation.

3.1.3. Landowners

Landowners are crucial as they provide the physical space to plant the trees. They can be private or public landowners who provide the land to plant the trees, in agricultural land,

urban areas, marginal land, forest land, or along grey infrastructure (roads, railways, etc.). Therefore urban planners as well as farmers and foresters are key players.

Map 1: Proportion in private (left) and public (right) forest ownership in Europe[129]



Currently, there are around 16 million private and public forest owners in Europe. About 60% of the forest area is privately owned and 40% is publicly owned[130]. The numbers, however, differ greatly from one country to another due to different historical, legal and social circumstances that should be considered in logistics.

Good cooperation is encouraged as landowners should receive support for planting trees.

129 Pulla, P., Schuck, A., Verkerk, P. J., Lasserre, B., Marchetti, M. and Green, T. 2013. Mapping the distribution of forest ownership in Europe. EFI Technical Report 88. 92 p. Available at: https://efi.int/sites/default/files/files/publication-bank/2018/private_forest_ownership_map_of_europe_april_2013.pdf https://efi.int/sites/default/files/files/publication-bank/2018/public_forest_ownership_map_of_europe_april_2013.pdf

130 https://efi.int/sites/default/files/files/publication-bank/2021/K2A%20-%20Forest%20Question%202.pdf

Initiators, intermediaries and landowners may face the following barriers:

Initiators	Intermediates	Landowners
• Lack of funding and incentives to change • Lack of available space • Lack of knowledge • Lack of trust that the trees will be planted and grown in the long term • Lack of resources, both human and financial, to ensure continuity	• Lack of funding and lack of initiators • Lack of available space • Lack of knowledge • Lack of seedlings • Lack of available work force • Lack of coordination (e.g. challenges with distribution of seedlings)	• Cultural barriers and risk and change aversion • Opportunity costs • Lack of knowledge

3.1.4. Nurseries

Tree planting requires seedlings/saplings, and their availability very much depends on seed availability, on market demand, and on meticulous, long-term planning. Planting native species or species that are not regarded as commercially profitable but have environmental benefits will require changes on the supply side and incentives to promote and support this new approach.

National legislation on plant genetic material should be improved. The Commission is carrying out a study to look at options to update EU legislation governing the production and marketing of plant reproductive material, as requested by the Council on the basis of Article 241 TFEU. The aim is to contribute to the conservation and sustainable use of plant genetic material.

HIGHLIGHTS

- Approximately 900 million seedlings are produced every year in the EU[131].
- 30% more could be produced, provided that seed availability is not hampered[132].

Specific (and local) contracts with tree nurseries[133] are needed to provide the expected quantity of trees, especially species from dry/warm regions that depend on the availability of seeds, which in turn might be a challenge.

The sector is also crucial for the preservation of genetic diversity within and between tree species, which is a key objective. This sector, if not sufficiently developed, can become a bottleneck for this initiative, as already happened in Italy where the lack of seedlings hampered the achievement of regional pledges.

The potential of this initiative to create jobs is very high. Although automation is likely to take over the grading of plants over the coming years, it is rather a long-term vision. Currently, all plants are graded by hand and any expansion of nurseries requires significant increase in seasonal labour. Conversely, the lack of work force and full-time labour may undermine the success of the pledge.

131 Initial estimations provided by the European NurseryStock Association.
132 Ibid.
133 European associations of tree nurseries: European NurseryStock Association and European Forestry Nursery Association.

Other potential challenges include increasing pests and diseases and a lack of capital for investment to expand nurseries, especially until the planting plans are clear and confirmed[134].

3.1.5. Surveyors

Monitoring is what makes the difference between tree planting and tree growing. It also distinguishes between genuine projects and greenwashing. Monitoring is essential for the credibility of the 3 billion trees commitment.

In some cases, this can be assessed directly by the organisation in charge of planting. In cities, monitoring will be easy. However, the larger the scale, the more difficult the monitoring process.

Individual trees can be tracked by GPS coordinates, which collect information both on a large scale (and cost free) on the ground and enables (anyone) to go back and check. Several projects draw on citizen science, i.e. individual citizens using their cell phones (take a picture and transmit the position) to track tree growth.

Some of the planted trees may not survive. It will be important that the funding for planting also covers up to five/ten years of monitoring and the replanting of trees that do not survive. Monitoring over the long term should also include forested areas, since many trees will not grow due to natural competition or necessary thinning.

In any case, it will be necessary to involve a wide range of groups to make a success of surveying and monitoring.

3.2. How to plant trees

3.2.1. Long-term vision

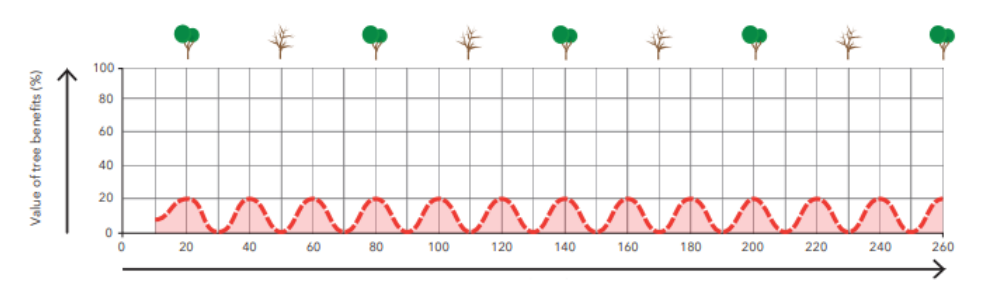
Long-term vision is necessary in order for the pledge to be meaningful. Tree planters must become tree growers, **enabling the trees to survive, thrive and reach maturity**. The pledge, implicitly, is not only about planting but also about nurturing, which requires **long-term planning and funding**. It is important for the monitoring not to be restricted to the planted species, but to extend to the whole area in order to take action where necessary to ensure the long-term development of the planted trees.

HIGHLIGHTS

- Figure 8 shows how regular replanting of urban trees before they reach 10 years of age will not provide more than 20% of their potential value – so it is better to plant one tree well than to plant 5 trees poorly[135] (y-axis represents years).

[134] There are many challenges related to the type of material recommended in different regions and biotypes, and how more seeds can be harvested and nurseries can provide the plants needed. Many of these challenges will be covered in the results of the activities carried out as part of the upcoming work in the project HORIZON-CL6-2021-BIODIV-01-15: Protection and sustainable management of forest genetic resources of high interest for biodiversity, climate change adaptation, and forest reproductive materials.

Figure 8: Value of tree benefits over the years



- The survival of planted trees[136] depends on many factors, such as the planting method, the selected species, the soil chemistry and microbial biomass, the weather, management and follow-up. The survival rate can vary from 20%-100%[137].
- For the most common species in the EU, assuming standard methods and a correct follow-up, the survival rate in forests is estimated to be 13%-55%[138].
- In urban areas, the survival rate of planted trees is on average 54%[139].
- This implies that, without the right follow-up or maintenance, more trees need to be planted in order to achieve the target of 3 billion additional trees by 2030.
- The survival rate should be assessed, especially when running planting operations on degraded land. Improved shrub and tree seedling survival was achieved even in drier climatic conditions by using the low-cost, water efficient 'cocoon' system developed as part of the LIFE09 ENV/ES/000447 (Green Deserts) and LIFE15 CCA/ES/000125 (Green Link) projects.

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135 https://www.treeconomics.co.uk/wp-content/uploads/2018/08/GBU_Street-Tree-Cost-Benefit-Analysis-2018.pdf p.8.

136 LIFE monitoring report from two projects in Spain dating back to 2007 and 2012, in particular LIFE07 NAT/E/000735 and LIFE12 NAT/ES/000192.
LIFE07 purchased 90 ha forest and planted 15 000 chestnut and cherry trees; LIFE12 23.9 ha, 17 abandoned plots and 95,000 seedlings were planted. 16 953 autochthonous fruit trees of different species were planted on 23.9 ha in 17 abandoned agricultural plots acquired within the framework of the project on the southern side of the inter-population corridor. In this project, 78 289 native trees and shrubs were also planted in public utility forests or expropriated areas. Thus in total almost 100 000 trees and shrubs were planted. The survival rate in some cases is as low as 40-50% but in most situations it reached 80%.

137 Dūmiņš, Kārlis and D. Lazdiņa, *Forest regeneration quality – factors affecting first year survival of planted trees*, Conference Research for Rural Development, 2018, p.57. doi:10.22616/rrd.24.2018.008.

138 Gary Kerr, Hamish Mackintosh, *Long-Term Survival of Saplings during the Transformation to Continuous Cover*, Forests 2012, 3, p.792. doi:10.3390/f3030787.

139 David N Skinner, *Planting Success Rates-Standard Trees,* Arboriculture Research Note 66, 1986, p.3 https://www.trees.org.uk/Trees.org.uk/files/4e/4e5f2a54-f016-408a-b520-1b965f175924.pdf

To maximise the chances of survival for a planted tree, it is crucial to involve local communities and to work with the private sector. Planting should also be in line with local management plans that specify the needs, the planting actions to take, the financing and including relevant constraints (e.g. factoring in social and environmental issues; landscape preservation and stakeholder consultation).

As a general rule, but especially for forest plantations, it is important to carry out tree care work in the early years of the trees' life to limit competition from other species. This work is indispensable and must be included (and funded) in the early stages of projects. There is also a need to strengthen and support training for public and private-sector bodies. Technical support could be provided through agricultural and forestry advisory bodies as well as by dedicated structures in urban areas e.g. city green department. This work should be in line with the Commission's role and enabling mechanisms in the pledge initiative (see Section 2).

3.2.2. Natural expansion

Natural expansion and tree regeneration are natural processes, but providing support and enhancement by creating suitable conditions for these processes to take place may be an economically attractive nature-based solution. Natural regeneration alone does not count as (active) planting, but nature can be the 'planter' if we create or enable the right conditions.

Therefore, although the pledge does take an active approach, this could be complemented by encouraging tree growth from assisted natural regeneration, when it is possible to demonstrate that seed establishment and growth are a consequence of human-mediation or facilitation[140], going beyond the business-as-usual scenario.

HIGHLIGHTS

- The SPONFOREST Project[141] assessed how spontaneous forests establish and what characteristics they show. According to the findings of this project, spontaneously established forest expansion in Europe (which has seen an increase of 17 million ha over the past 25 years) could represent a significant share of the EU's forest cover by 2100.
- In 2015[142], about 63% of the total forest area in the EU originated from natural regeneration or natural expansion, 33% from afforestation and regeneration by planting and/or seeding, and 4% from coppice sprouting.
- **Table 4:** Forest area by stand origin types, by region, 2015[143]

140 http://www.fao.org/3/ca4191en/CA4191EN.pdf
141 https://agrar.uni-hohenheim.de/organisation/projekt/era-net-biodiversa-project-sponforest
142 https://foresteurope.org/state-europes-forests-2020/ p.114.
143 Ibid.

Region	Natural regeneration and natural expansion		Afforestation and regeneration by planting and/or seeding		Coppice	
	1 000 ha	%	1 000 ha	%	1 000 ha	%
North Europe	48 765	68.5	22 434	31.5	3	0.0
Central-West Europe	23 398	60.9	13 599	35.4	1 433	3.7
Central-East Europe	21 770	48.3	19 780	43.8	3 566	7.9
South-West Europe	25 645	82.3	4 820	15.5	695	2.2
South-East Europe	23 102	78.4	1 636	5.6	4 722	16.0
EU-28	98 180	62.2	53 890	34.1	5 902	3.7
Europe	142 679	66.2	62 270	28.9	10 419	4.8

- The proportion of natural regeneration and expansion is slightly increasing in all European regions, except in north Europe, where regeneration by planting is most common[144].

The advantages of spontaneous forests are manifold. Part of the natural ecosystem dynamic, new forests can quickly and efficiently accumulate biodiversity (tree genetic diversity, insects, endophytes, small mammals, birds); they imply genetic recombination, and this can catalyse adaptation to climate change (spontaneous forests have genetic selection and adaptation built-in). At the same time, spontaneous forests might, under certain conditions, be negatively perceived or give rise to new threats (e.g. fires) that need to be assessed.

3.3. Where to plant trees

Land is a finite resource and subject to competition for use. Therefore, the land chosen for planting must be suitable. The conversion of land with a high-value for climate or biodiversity must be avoided, as should pressure on agricultural land, except in the case of agroforestry, where trees are part of the production system.

Another important issue is ensuring connectivity benefits; afforestation should be carried out at landscape level in order to strengthen connectivity with natural or semi-natural areas (forests, agricultural landscape). Land planning is also essential for the proper functioning of forest, agroforestry and urban forest ecosystems to connect habitats in space and time, in particular through green infrastructure and ecological corridors. Forest aesthetics are often neglected in policy and legislation, but this too has a high cultural and spiritual value for citizens and in passing their inheritance to future generations.

With these issues in mind, it is important to set up good governance that enables close collaboration between the public and the authorities at various levels of the administration and government (e.g. local, municipality, agglomeration, regional and national level).

HIGHLIGHTS

- A study carried out in 2020 for DG Environment[145] estimated the total potential for tree restoration in the EU (restoration denoting additional trees planted or naturally regenerated

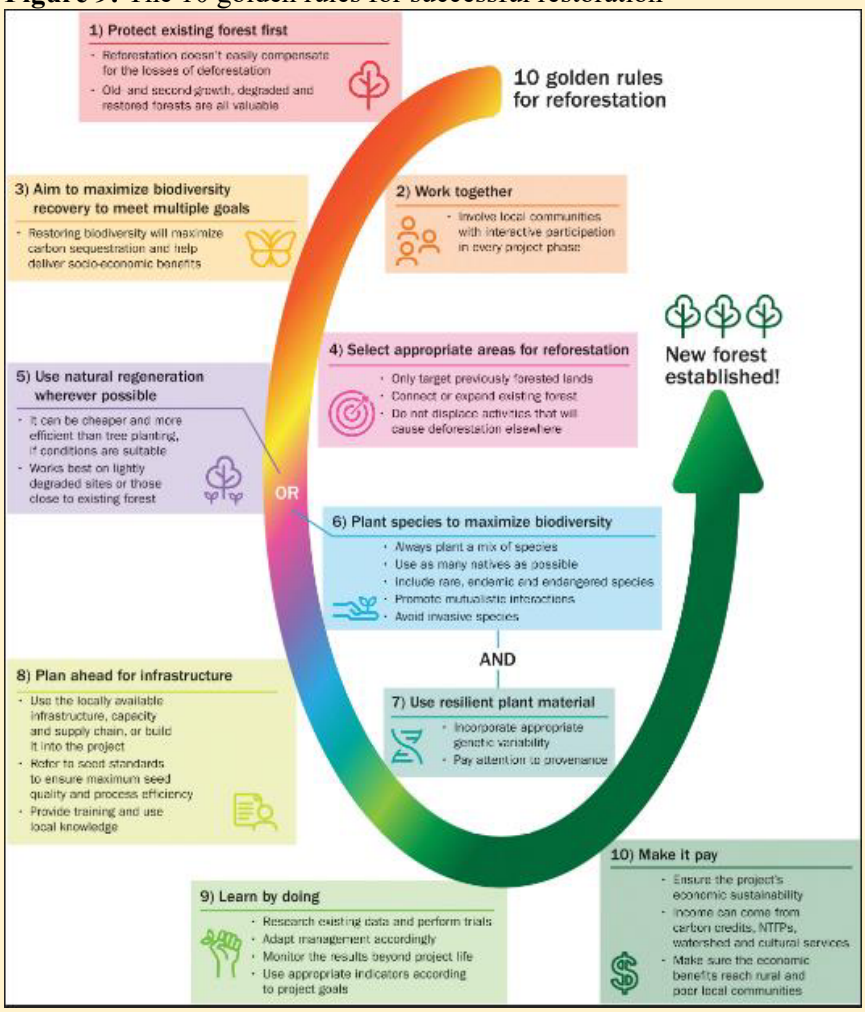
144 https://foresteurope.org/state-europes-forests-2020/ p.114.

145 Bastin, J.F., de Haulleville, T., Maniatis, D., Marchi, G., Massaccesi, E., Mollicone, D., Pregagnoli , C., 'Tree restoration potential in the European Union', 2020 p.60. In FISE, available at: https://forest.eea.europa.eu/data/connectors/eu-tree-restoration-in-european-union-en.pdf/@@download/file

and adult trees, meaning trees with a diameter at chest height of at least 10 cm) to be 59 million ha, corresponding to 36 billion trees.

- 8 million ha consist of abandoned land, corresponding to about 6 billion trees. Up to 4.8 million ha of agricultural land could effectively become abandoned over the period 2015 to 2030[146].

- **Figure 9:** The 10 golden rules for successful restoration[147]



Irrespective of these estimates (which should be further developed), and factoring in the potential of agroforestry and urban/peri-urban areas, **it can be concluded that overall the EU has sufficient land to fulfil the 3 billion trees pledge.** The main question is rather to **choose the land that is suitable to support trees and whether it is ecologically**

146 Carolina Perpiña Castillo, Chris Jacobs-Crisioni, Vasco Diogo, Carlo Lavalle (2021) Modelling agricultural land abandonment in a fine spatial resolution multi-level land-use model: An application for the EU, Environmental Modelling & Software,Volume 136,104946,https://doi.org/10.1016/j.envsoft.2020.104946.

147 Alice Di Sacco, Kate A. Hardwick, David Blakesley, Pedro H. S. Brancalion, Elinor Breman, Loic Cecilio Rebola, Susan Chomba, Kingsley Dixon, Stephen Elliott, Godfrey Ruyonga, Kirsty Shaw, Paul Smith, Rhian J. Smith, Alexandre Antonelli (2021) Ten golden rules for reforestation to optimize carbon sequestration, biodiversity recovery and livelihood benefits. Global Change Biology Volume27, Issue7. https://doi.org/10.1111/gcb.15498

meaningful. Wetlands, peatlands, permanent grassland, high carbon or biodiversity land should be avoided. Albedo effect should also be taken into consideration, where relevant.

Concerning **carbon stocks**, afforestation on former cropland leads to an increase in soil organic carbon, thus contributing to carbon sequestration. However, afforestation on pastures and natural grasslands lead to no significant changes identified in soil organic carbon, so these areas should be avoided. Furthermore, the species of tree chosen is important, with broadleaved forests generating the highest soil organic carbon increase and coniferous forests resulting in the same soil organic carbon as the former land use[148].

3.3.1. A healthy tree needs the right soil

The soil and the tree work very closely together in tandem: they feed on each other, adapt to each other and in some cases suffer together. For the tree to grow old and healthy, it needs a healthy soil. Therefore, the soil properties must be carefully analysed in order to select the tree species with the highest chances of surviving, and/or for preparing the right soil conditions for the target species.

To ensure seeds germinate and/or seedlings survive, the following soil characteristics must be assessed and/or improved according to each species' requirements: soil oxygen, nutrients, organic matter, pH, moisture capacity, available root-able soil volume and the degree of compactness. Some of the most important nutrients for tree growth are Nitrogen, Phosphorus, Potassium and Calcium. Soil organic carbon is used as an indicator of biological activity in soil. Earthworm species abundance and composition is also an indicator of soil quality[149].

Trees generally require non-compacted, well aerated and moist soil with good drainage. To thrive, tree roots need to obtain all essential elements from the soil that they require for healthy growth and for nutrient uptake and resilience, root-associated fungi inoculation is recommended. These soil conditions are often unavailable in urban areas and should be improved.

As an example of the circular economy, municipal bio-waste compost can be used to improve the soil for urban trees[150].

3.3.2. Trees as parts of forests

This category includes trees in forest restoration schemes and in the regeneration of degraded forests, rather than trees planted in new forests. The effect is the same: growing new trees. However, the trees planted in this category will only count for the 3 billion pledge if it can be shown that the trees are additional to those that would have grown anyway.

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148 Laganière, J., Angers, D.A., Paré, D., 2010. Carbon accumulation in agricultural soils after afforestation: A meta-analysis. Glob. Chang. Biol. 16, 439–453. https://doi.org/10.1111/j.1365-2486.2009.01930.x

149 https://link.springer.com/chapter/10.1007%2F978-3-642-14636-7_16

150 https://hgic.clemson.edu/factsheet/planting-trees-correctly/

3.3.3. Trees in agricultural areas

The potential in agricultural target areas is in agroforestry and silvopastures, and in landscape features. The 3 billion additional trees target is thus complementary with the target for high biodiversity landscape features. Abandoned land, estimated at 4.8 million ha by 2030 in the EU[151], also has tree planting potential, if it is not land that is already home to high levels of biodiversity.

3.3.4. Trees in cities

These are trees in urban and peri-urban areas[152]: street trees, trees in parks and open spaces, trees on private property and in green buildings. Green roofs and urban gardens together with initiatives to replace tiles with plants, bushes and trees[153] also play a growing and important role in greening the cities. Although the pledge is about trees, it could also be a stimulus to create other types of green areas, such as the smaller plant/grass species typically used in green roofs.

3.3.5. Trees along infrastructures

Mindful of the necessary safety precautions, trees can be integrated in transport and energy infrastructure such as median strips between roads and pavements, along the roads or train lines, canal banks to further sequester carbon, reduce noise and help curb the negative effects of air pollution, while also providing shade and habitat heterogeneity.

If safety concerns allow, trees can be incorporated in infrastructure projects. For example, green bridges or tunnels (eco ducts), also known as wildlife crossings, (re)connect habitats, reduce damage on habitat fragmentation and allow wildlife to move while enhancing the possibility of gene migration[154]. These crossings are important for reducing collisions between vehicles and animals, thus reducing property damage, injuries and saving lives[155] .

Overall, studies show that planting trees to create greenways along transport infrastructure edges act as a barrier for population exposure to pollutants, they have aesthetic value and play a positive role in increasing biodiversity. There are also downsides associated with roadside vegetation such as reduced visibility for drivers, increased water demand or possible debris[156].

3.3.6. Do not plant in …

Trees should not be planted in areas rich in biodiversity such as high nature value farmlands or landscapes. **Mires, bogs, fens, wetlands, peatlands, grassland** should not be transformed into forests. Planting trees in habitats that are classified as threatened on the

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151 Perpiña Castillo, C., Jacobs-Crisioni,C., Diogo, V., Lavalle, C. 2021. Modelling agricultural land abandonment in a fine spatial resolution multi-level land-use model: An application for the EU, Environmental Modelling & Software, Volume 136, 2021, 104946, ISSN 1364-8152, https://doi.org/10.1016/j.envsoft.2020.104946.

152 http://www.fao.org/zhc/detail-events/en/c/454543/

153 https://www.bloomberg.com/news/features/2021-01-05/how-dutch-cities-are-creating-more-green-space

154 https://royalsocietypublishing.org/doi/10.1098/rspb.2013.1705

155 https://www.nationalgeographic.com/animals/article/wildlife-overpasses-underpasses-make-animals-people-safer

156 https://journals.openedition.org/cybergeo/27895
https://www.fs.fed.us/psw/publications/mcpherson/psw_2013_mcpherson006_baldauf.pdf

European Red List of Habitats should be avoided unless action is taken for the purpose of habitat restoration. Planting trees in habitats that are home to relict or endemic species should be carried out with caution after a careful assessment and only with native species.

Any process that involves substantial ground disturbance could potentially damage archaeological remains buried near the surface[157]. Thus, no area identified for archaeological conservation should be ploughed, ripped or scarified to enable tree planting. Forestry and archaeology guidelines should then be developed, in consultation with a wide range of interested parties, to outline best practice for forest managers and operators[158].

Trees should not be planted in areas that are a vital component for completing the life cycle of a threatened species (e.g. migration routes, breeding grounds, hibernation quarters) if this will have a negative impact on the species. Similarly, trees should not be planted in areas where their growth could contribute to local species' extinctions.

Afforestation of **primary, ancient grassland** ecosystems have destructive effects similar to deforestation. Similarly, closed-canopy forest is not suited for **semi-natural grasslands** and **anthropogenic heathlands** whose local biodiversity is adapted to open spaces[159].

3.4. Which trees to plant

3.4.1. Right species

Although this section touches upon the principle of the right tree, at the right place with the right purpose, the information is not exhaustive and more detailed guidelines (as indicated in the sections above) are to be developed and disseminated. Each tree species has its own requirements in terms of soil type, pH, climate, water, etc. Therefore, understanding and working with the environmental specifics of each tree species is crucial in the decision-making process. The choices of tree species, location and purpose/functionality must be thoroughly considered.

Informed decisions must be made when choosing the right tree species for planting[160]. The following are examples of species that are not right (invasive, etc.) for planting schemes.

- The genus to which the Princess tree (*Paulownia tomentosa*)[161] belongs is considered invasive as it grows rapidly (in disturbed natural areas) and shades out and outcompetes native plant species for resources.

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157 https://www.forestresearch.gov.uk/tools-and-resources/fthr/historic-environment-resources/archaeological-preservation-during-woodland-expansion/archaeology-and-new-woodland-establishment/

158 https://www.forestryfocus.ie/social-environmental-aspects/cultural-heritage/archaeology/

159 https://op.europa.eu/en/publication-detail/-/publication/7120db75-6118-11eb-8146-01aa75ed71a1/language-en/format-PDF/source-188533857

160 We recommend consulting databases (such as http://www.iucngisd.org/gisd/species.php?sc=440)

161 Anjozian, Lisa-Natalie, "Nature in a Name: Paulownia tomentosa—Exotic Tree, Native Problem" (2010), JFSP Briefs. 32. http://digitalcommons.unl.edu/jfspbriefs/32
See also EASIN - European Alien Species Information Network: https://easin.jrc.ec.europa.eu/easin

- The black locust (*Robinia pseudoacacia*) is also an invasive species that expands aggressively in disturbed areas, modifying soil chemistry and outcompeting natural vegetation for resources such as pollinators[162].
- Planting eucalyptus trees in the proximity of agricultural crops will have a negative impact on crop yield due to released allelochemicals that interfere with the establishment of native plant species, also causing soil degradation and biodiversity loss[163]. Eucalyptus foliage also releases highly flammable volatile oils that may enhance fire behaviour. A 2012 study[164] shows that eucalyptus stands present the highest fire proneness followed by softwoods (i.e. pine species).

3.4.1.1. Conservation of forest genetic resources in the EU and neighbouring regions

This aspect is key to ensure that the EU has a wide-enough source of high-quality seed collection adapted to new climatic conditions.

The key to resilient ecosystems in the context of climate change is planting and growing a diverse range of trees with diverse genetic constituents that allow for natural selection of the most suitable individual. To achieve this, mixed-species forest plantations are much better suited than single-specie plantations. The right tree species requires the right seed source. It is important to ensure quality seeds are available in the quantities needed, hence the conservation of key forest areas for forest genetic resources is essential.

3.4.1.2. Projecting range of major tree species in Europe

Several studies project global warming to shift the boundaries of vegetation zones and tree ranges northwards and upwards[165]. Considering these shifts already today is important in order to select and plant tree species and ecotypes that are suited for, and will withstand, expected future climatic conditions.

Figure 10 illustrates this point by showing, based on a modelling study, the climate induced shifts in potential tree ranges which may occur under a moderate warming scenario by 2100. Under this scenario, Norway spruce would be restricted by 2100 to the higher elevations in central Europe and to areas in northern Sweden, Finland and Norway, losing its ranges to more drought-adapted species such as oaks. For broadleaves such as oak and beech, the model projected a range shift from today's ranges in Western Europe (France, Netherlands, Germany) and the lower elevations in central and Eastern Europe more to Central, Northern and North Eastern Europe.

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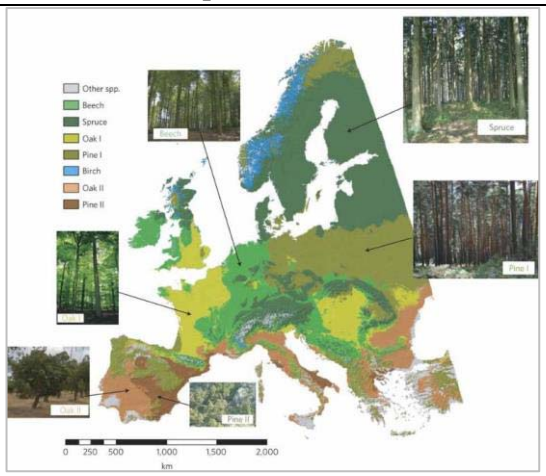
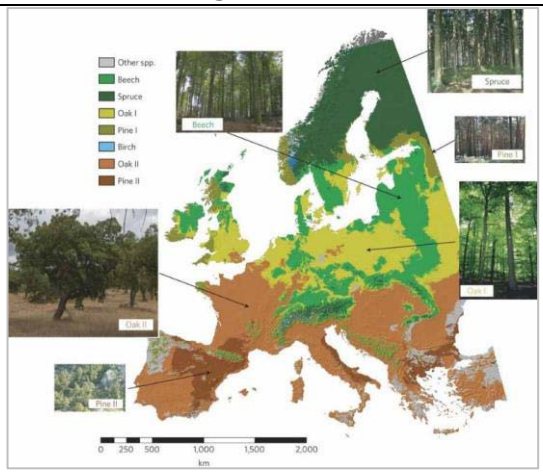
162 https://ias.biodiversity.be/species/show/15

163 https://www.sciencedirect.com/science/article/pii/S0378112714001492 https://www.researchgate.net/publication/223206745_Allelopathic_effects_of_eucalyptus_and_the_establishment_of_mixed_stands_of_eucalyptus_and_native_species

164 Garcia-Gonzalo et al, 2012, Modelling wildfire risk in pure and mixed forest stands in Portugal. Allgemeine Forst- und Jagdzeitung 2012 Vol.183 No.11/12 pp.238-248 ref.49.

165 See for instance: T. Hickler et al. (2012) Projecting the future distribution of European potential natural vegetation zones with a generalised, tree species-based dynamic vegetation model. In: Global Ecology and Biogeography, 21, 50–63 / Samuel Hoffmann, Severin D. H. Irl & Carl Beierkuhnlein (2019) Predicted climate shifts within terrestrial protected areas worldwide. Nature Communications vol 10 N° 4787

Figure 10: Potential range of major tree species in Europe under a moderate warming scenario in

Climate normal period 1950–2000	Moderate warming scenario 2070–2100
	

2070-2100 (right) compared to the 1950–2000 period (left)[166]

3.4.2. Right mix of tree species and their benefits

Multifunctionality. The right tree for the right purpose: good for climate and biodiversity. The initiative must deliver results for both policy agendas – action on climate change adaptation and mitigation and ensuring the good conservation status of habitat and species as well as the maintenance of typical habitat species. Some trees can be both very good for climate, biodiversity and provide economic benefits (e.g. agroforestry). Monocultures for commercial purposes should not count towards the pledge. The use of non-native species should also be excluded, unless it can be demonstrated that:

i. the use of the forest reproductive material leads to favourable and appropriate ecosystem conditions (such as climate, soil criteria, and vegetation zone, forest fire resilience);
ii. the native species currently present on the site are no longer adapted to projected climatic and pedo-hydrological conditions. For non-native species, preference should be given to species from the same or adjacent biogeographic region.

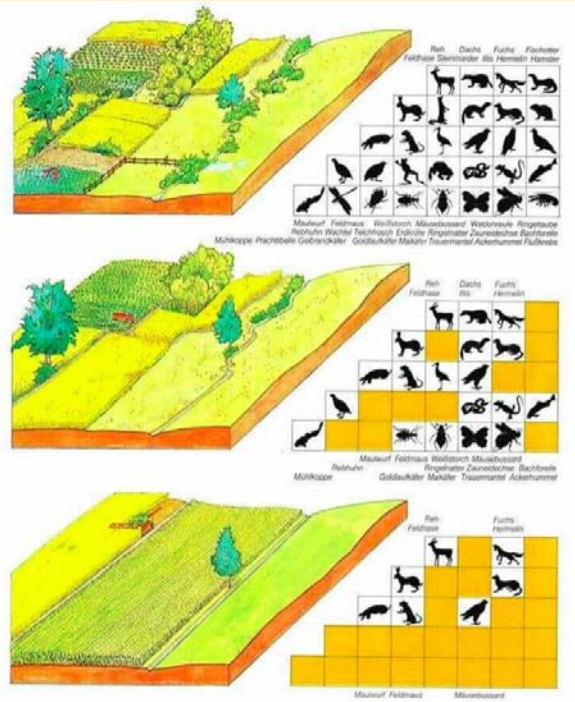
Listed invasive alien species should never be used.

HIGHLIGHTS

- Habitat heterogeneity, including trees as landscape features, supports significantly more native biodiversity than monocultures.

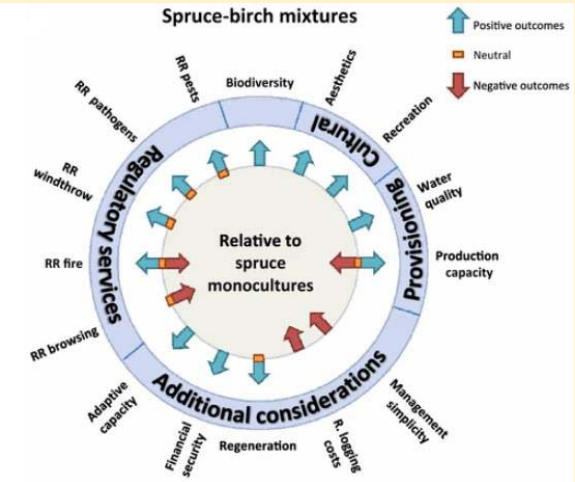
166 Source: Hanewinkel, M., Cullmann, D., Schelhaas, MJ. et al. Climate change may cause severe loss in the economic value of European forest land. Nature Clim Change3, 203–207 (2013). https://doi.org/10.1038/nclimate1687

Figure 8: Linkages between habitat heterogeneity and biodiversity[167]



- Replacing monocultures with mixed-species stands. Ecosystem service implications of two commercial forest alternatives in Sweden. RR stands for reduced risk.

Figure 12: Spruce monocultures vs. spruce-birch mixtures: positive and negative outcomes[168]



For forest restoration or large-scale abandoned-land afforestation, it is essential to establish the type of silviculture from the start. Closer-to-nature forest management should be encouraged.

167 Bundesamt, F.U., & Landschaft, W. U. Umwelt in der Schweiz 1997. Berna, Buwal.

168 Felton, A., Nilsson, U., Sonesson, J. et al. (2016). Replacing monocultures with mixed-species stands: Ecosystem service implications of two production forest alternatives in Sweden. Ambio 45, 124–139. https://doi.org/10.1007/s13280-015-0749-2

INTERNATIONAL COMMITMENTS

The EU pledge to plant 3 billion additional trees by 2030 fits in the global context, where several initiatives have been launched to afforest and/or restore several hundred million hectares of deforested and degraded land, such as:

- The Bonn Challenge, which plans to restore 350 million hectares by 2030.
- The FAO's Forest Landscape Restoration Mechanism.

Several related initiatives contribute to the Bonn Challenge:

- The New York Declaration on Forests, which aims to restore 150 million hectares of degraded landscapes and forestlands by 2020 and significantly increase the rate of global restoration thereafter.
- The African Forest Landscape Restoration Initiative (AFR 100), an effort to bring 100 million hectares of land in Africa into restoration by 2030.
- The 20x20 initiative: is a country-led effort that aims to change the dynamics of land degradation in Latin America and the Caribbean by bringing 20 million hectares of land into restoration by 2020.
- The Great Green Wall: with the ambition of restoring 100 million hectares of currently degraded land by 2030.
- The Trillion Tree Platform of the World Economic Forum (1t.org).

All these initiatives[169] are an integral part of the broader policy agenda for sustainable development, biodiversity and climate-proofing.

The Commission will continue strengthening cooperation on policies and actions as part of current initiatives underway on afforestation, forest and land restoration at international level, including with the Food and Agriculture Organisation, in order to share best practice and to participate in global action on forest and land restoration.

[169] For more international tree planting pledges and initiatives, see Annex 3.

ANNEX 1: COST ESTIMATES FOR TREE PLANTING

Calculations in this annex estimate the costs for planting 3 billion trees by artificial regeneration (afforestation). Cost estimates for soil preparation, planting and maintenance costs for the first 15-20 years are based on an existing study[170], scaled to all EU Member States. Estimations were made for a density of 1 500 trees per hectare, requiring two Mio ha of land, with a price of 0.52 EUR/seedling. Costs correspond to year 2020, and assumptions on the species or leaf type, biogeographic conditions or local circumstances were not included.

In practice, costs estimates may vary widely and depend on site conditions such as terrain and access, water availability, appropriate species selection, soil conditions and means for preparation and maintenance. The estimates shown in the following tables are approximations where conditions for planting and tree growth are good. These cost estimates are lower than EU average costs of 4 000 EUR/ha under the CAP[171]. Under specific circumstances cost can increase up to and even beyond 10 000 EUR/ha[172].

Member State	Soil preparation [173] [EUR]	Minimum for planting & thinning[174] [EUR]	Maximum for planting & thinning[175] [EUR]	Total average minimum, [Euro/ha]	Total average maximum, [Euro/ha]
Austria	650	1 016	2 084	2 446	3 514
Belgium	512	1 080	1 483	2 373	2 775
Bulgaria	455	382	537	1 618	1 773
Croatia	493	575	809	1 849	2 083
Cyprus	650	687	1 321	2 118	2 752
Czechia	447	575	809	1 802	2 036
Denmark	463	998	1 366	2 242	2 610
Estonia	400	571	782	1 752	1 962
Finland	499	1 067	1 501	2 346	2 780
France	564	1 019	2 093	2 364	3 437
Germany	526	940	1 929	2 246	3 235
Greece	612	680	1 396	2 072	2 789
Hungary	439	487	667	1 707	1 887
Ireland	536	808	1 139	2 124	2 455
Italy	659	862	1 770	2 301	3 209
Latvia	409	561	768	1 751	1 957
Lithuania	387	505	691	1 673	1 859
Luxembourg	510	1 064	1 498	2 355	2 789

170 Di Fulvio, F., Forsell, N., Lindroos, O., Korosuo, A., Gusti, M. Spatially explicit assessment of roundwood and logging residues availability and costs for the EU28 (2016) 31 (7), pp. 691-707.

171 SWD(2019) 389 final. Planned area 569,234ha for a total public expenditure of EUR 2,263 Mio for M8.1 afforestation/creation of woodland in the period 2014-2020.

172 study-forestry-measures-ruraldev_sept2017_en.pdf (europa.eu), Table 37

173 Soil preparation for afforestation: the ground ripping before planting. Di Fulvio, 2021, personal communication.

174 Planting + 1 soil fine cleaning + 1 pre-commercial thinning.

175 Planting + 2 soil fine cleanings + 2 pre-commercial thinnings.

Malta				781	781
Netherlands	463	988	1 350	2 232	2 594
Poland	421	453	637	1 654	1 838
Portugal	497	579	816	1 856	2 093
Romania	463	398	816	1 642	2 060
Slovakia	470	563	792	1 814	2 043
Slovenia	566	682	1 400	2 029	2 747
Spain	528	722	1 483	2 031	2 791
Sweden	527	1 248	1 757	2 555	3 064

The LULUCF Reference scenario[176] for the period 2020 to 2030 served as business-as-usual, on top of which an additional land conversion to forest land was modelled. The table below shows the Member States' specific potential for this land conversion to meet the EU-wide area of 2 million hectares of additional forest land by 2030. The model could not allocate additional forest land in Croatia, Cyprus, Luxembourg, Malta, Poland and Portugal. The overall cost estimates were calculated by the per hectare costs from the table above and a flat rate of 4,000 EUR/ha.

Member State	Area [ha]	Average min [EURO]	Average max [EURO]	Average for 4 000 Euro/ha [EURO]
Austria	103 253	252 571 727	362 851 488	413 012 446
Belgium	23 434	55 615 882	65 041 202	93 736 828
Bulgaria	102 583	165 935 335	181 869 385	410 330 811
Croatia	0	0	0	0
Cyprus	0	0	0	0
Czech Republic	16 166	29 127 874	32 915 123	64 663 318
Denmark	18 038	40 443 561	47 079 205	72 152 263
Estonia	13 394	23 464 337	26 282 280	53 576 019
Finland	163 720	384 121 049	455 210 583	654 878 093
France	810 194	1 915 226 193	2 784 936 780	3 240 777 437
Germany	83 884	188 428 434	271 397 754	335 537 657
Greece	5 899	12 224 916	16 449 847	23 595 049
Hungary	45 597	77 838 466	86 025 744	182 388 181
Ireland	28 711	60 996 299	70 496 988	114 843 587
Italy	99 515	229 029 134	319 383 374	398 059 741
Latvia	15 556	27 236 419	30 450 101	62 225 771
Lithuania	25 776	43 115 899	47 910 870	103 102 177
Luxembourg	0	0	0	0
Malta	0	0	0	0
Netherlands	11 532	25 736 228	29 918 222	46 128 187
Poland	0	0	0	0
Portugal	0	0	0	0
Romania	54 762	89 893 389	112 802 552	219 049 531

[176] The LULUCF Reference scenario is based on GLOBIOM and G4M. See also: EU Reference Scenario 2020 publication.

Slovakia	6 906	12 528 850	14 107 924	27 622 316
Slovenia	16 107	32 677 101	44 248 828	64 428 490
Spain	87 524	177 746 197	244 289 008	350 097 746
Sweden	267 449	683 448 081	819 572 607	1 069 794 351
EU-27	**2 000 000**	**4 527 405 372**	**6 063 239 867**	**8 000 000 000**

ANNEX 2: EXISTING PLEDGES AND ORGANISATIONS ACTIVE IN TREE PLANTING IN THE EU

Not all of the pledges and organisations listed below necessarily meet at this stage the criteria needed to qualify for the 3 billion trees pledge. They are given as examples for inspiration, but not all necessarily as practices that to be followed in the light of the pledge.

A pledge and/or organisation active in tree planting	Targeted numbers	Location
LIFE TERRA	500 million trees by 2025	Across the EU
1 tree per inhabitant project in Czechia	10 million trees within 5 years	Czechia
ForestaMI	3 million trees by 2030 – project	Milan (Italy)
Lurgaia Fundazioa Foundation	Creating a new 153 ha of mixed oak grove forest in Basque Country	Undabaso, UNESCO Biosphere Reserve of Urdaibai, Basque Country (Spain)
Bosteller	10 000 hectares of additional forest by 2030	Flanders (Belgium)
KilometroVerdeParma	200 000 trees by 2030	Parma (Italy)
Reforest'Action	No specific targets, organisation is actively involved in tree planting action	Across the EU and beyond
'Yes we plant' tree planting project	1 million trees	Wallonia Region (Belgium)
Reforest Mallorca project	40 000 trees in two years	Mallorca (Spain)
The City of Copenhagen tree policy and respective actions	100 000 trees by 2025	Copenhagen (Denmark)
"One more tree" project	60 million trees by 2030	Italy
Political target by the mayor to green the city of Paris	170 000 trees	Paris (France)
Political target by the mayor to plant trees in and around urban areas	10 000 trees	Sankt Pölten (Austria)
Political target to plant trees in Bretagne	5 million trees by 2025	Bretagne (France)
Political target to plant trees in Bavaria	30 million trees political target	Bavaria (Germany)
Political target to plant trees by French Minister of Agriculture	50 million trees	France

ANNEX 3: INTERNATIONAL INITIATIVES

International initiatives[177]:

- The Trillion Tree Campaign - Plant-for-the-Planet (NGO): target to plant 1 trillion / 13.6 billion trees to mitigate climate change and promote prosperity in the global south.
- Eden Reforestation Program - Eden Reforestation (NGO): target to plant ≥500 million trees per year by 2025 (since 2004 planted 319 million) in order to provide fair wage employment to impoverished villagers as agents of global forest restoration.
- WeForest Forest and Landscape Restoration Program - WeForest (NGO): no target stated, but aimed to plant 23 million trees from 2009-2019 to mitigate climate change, conserve and restore biodiversity, and generate income for local communities.
- OneTreePlanted (NGO): no target stated, but aimed to plant 2.5 million trees from 2014 to 2018 in order to improve the climate, protect biodiversity, watershed protection, forest management, and achieve other associated benefits.
- Team Trees – YouTuber Jimmy Donaldson in collaboration with the Arbor Day Foundation: target to plant 21.8 million trees.
- One Billion Trees Programme - New Zealand Government: 1 billion trees targeted by 2028 (already planted 149 million) to transform New Zealand's forests in a way that improves the environment, social outcomes, and economic performance in the region.
- Green Legacy Program - Ethiopia Government: target to plant 4 billion trees to increase forest cover in the country.

[177] All of the other initiatives were taken from *Supplementary Materials* for the article on *Tree planting is not a simple solution.* Link to the Supplementary Materials: https://science.sciencemag.org/content/sci/suppl/2020/05/06/368.6491.580.DC1/aba8232_Holl_SM.pdf . To the article itself:Tree planting is not a simple solution | Science (sciencemag.org)