Il contributo di agricoltura e foreste alla mitigazione della crisi climatica

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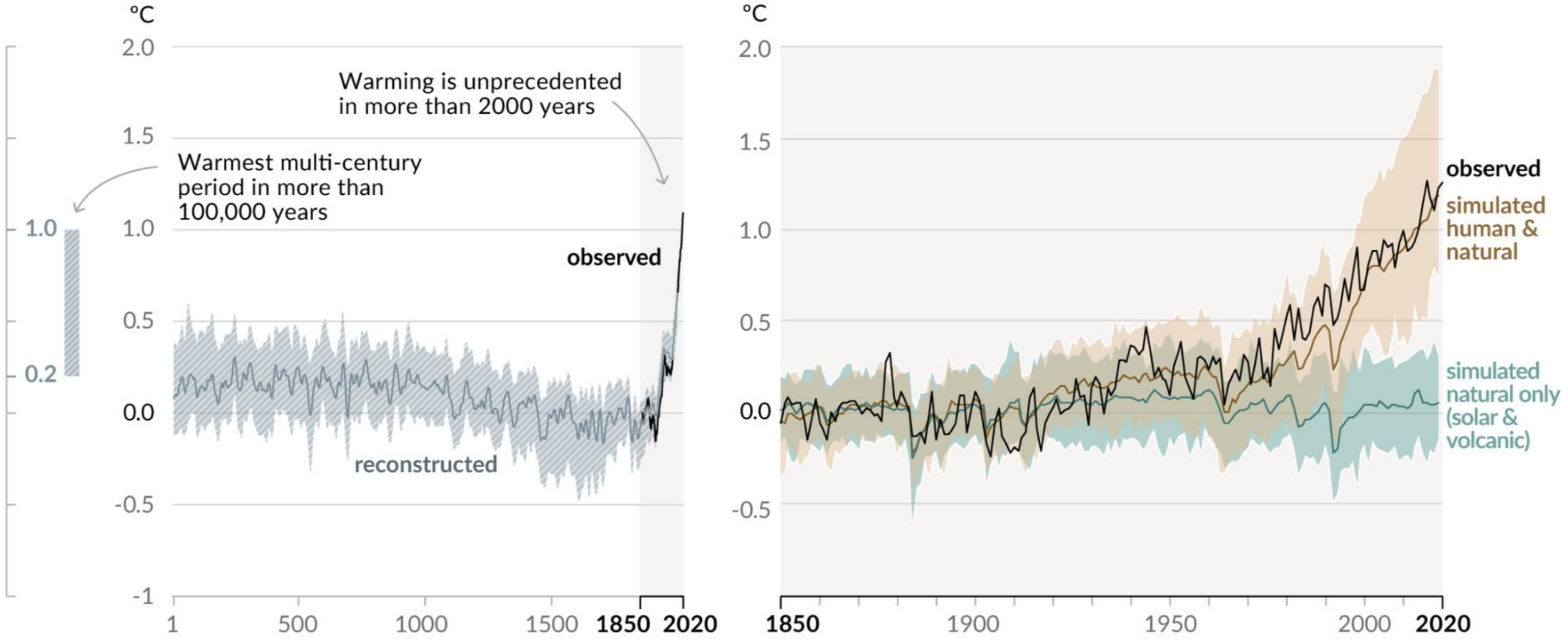
Human influence has warmed the climate at a rate that is unprecedented in at least the last 2000 years

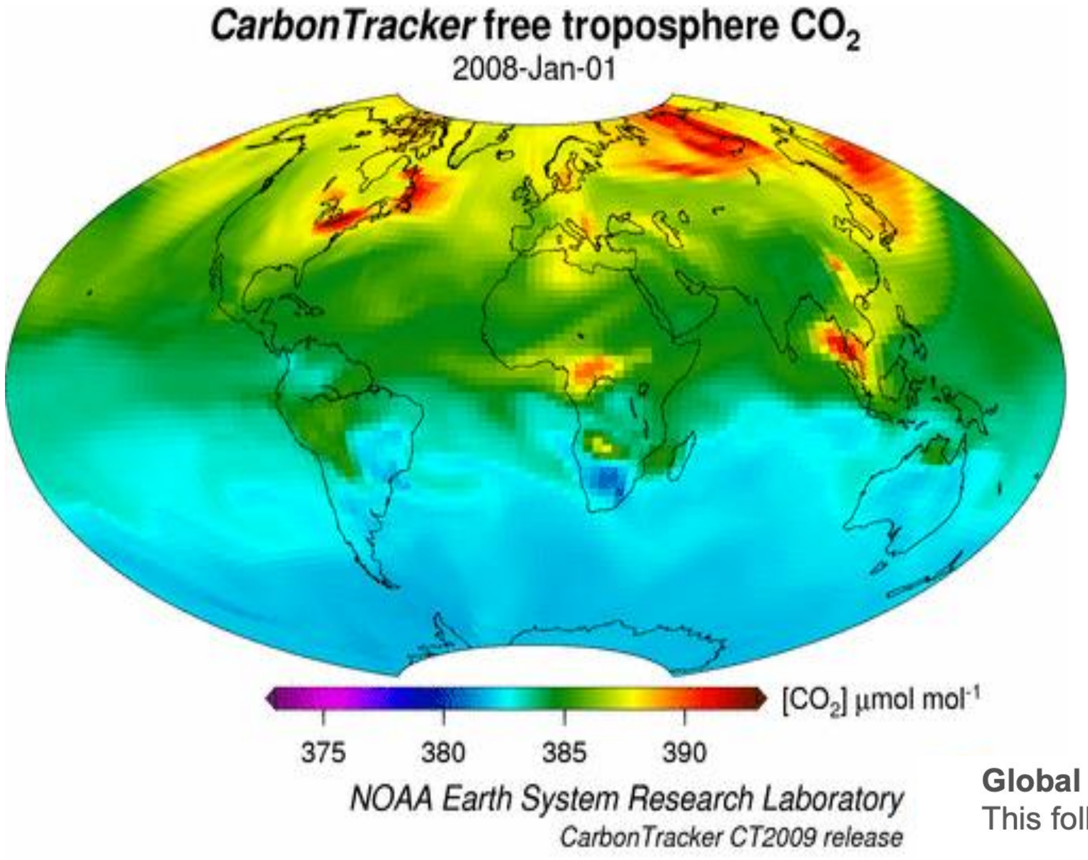
Figure SPM.1

Changes in global surface temperature relative to 1850-1900

a) Change in global surface temperature (decadal average) as reconstructed (1-2000) and **observed** (1850-2020)

b) Change in global surface temperature (annual average) as **observed** and simulated using human & natural and only natural factors (both 1850-2020)

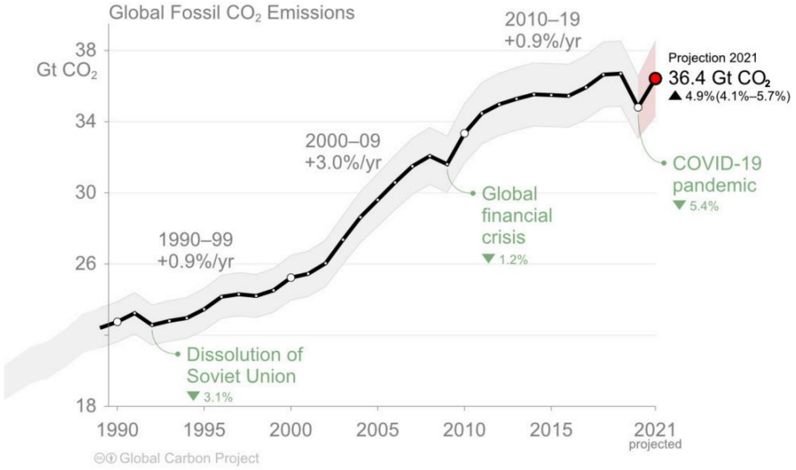




Oct. 4, 2022 = 415.16 ppm
Oct. 4, 2021 = 413.46 ppm

CO2 emissions do not stop !

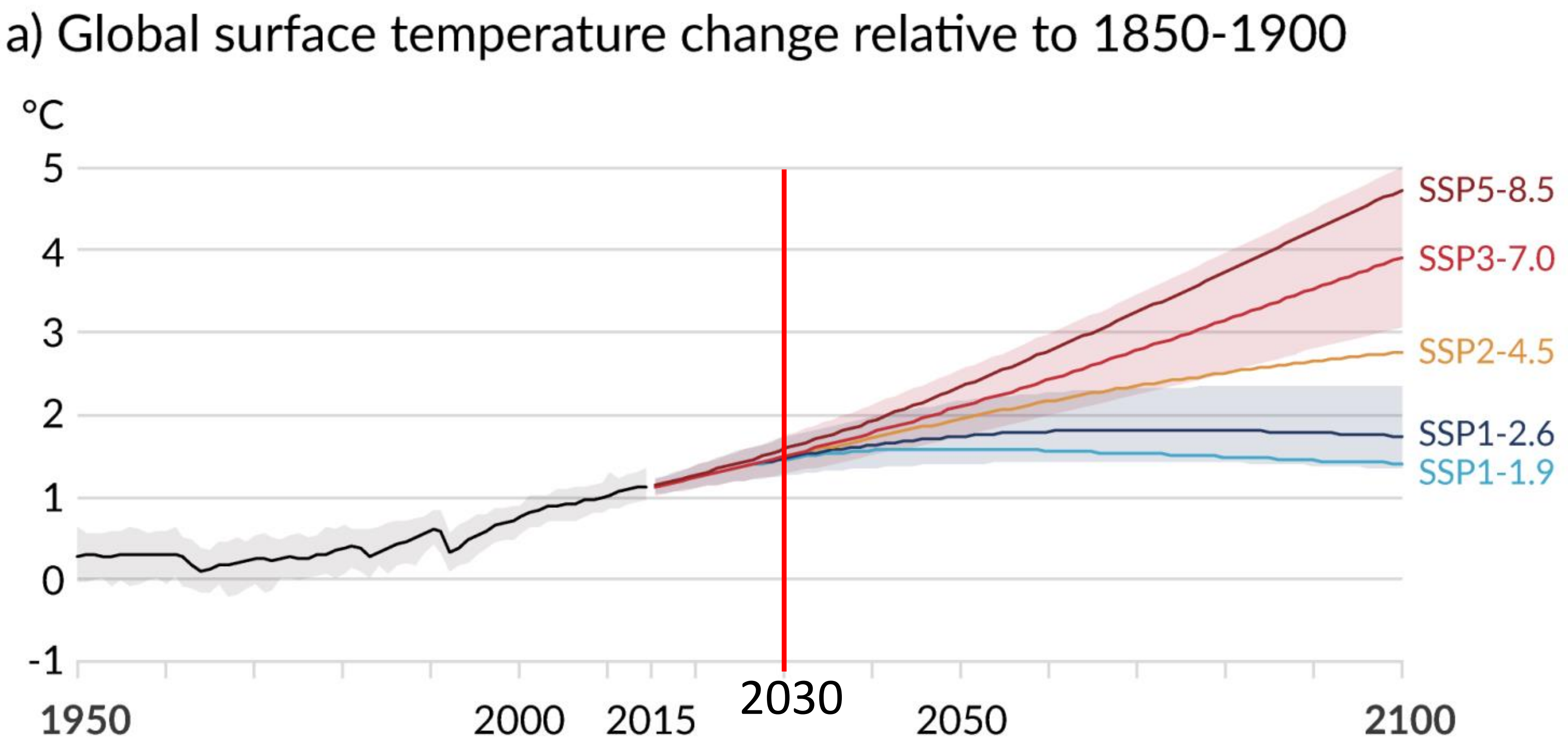
Global fossil CO_2 emissions in 2021 are set to rebound 4.9% after a record 5.4% drop in 2020.
This follows a decade of strong and growing energy decarbonisation which reduced the growth of emissions.



CO_2 emissions cuts of 1.4 billion tonnes are needed each year on average to reach net zero by 2050

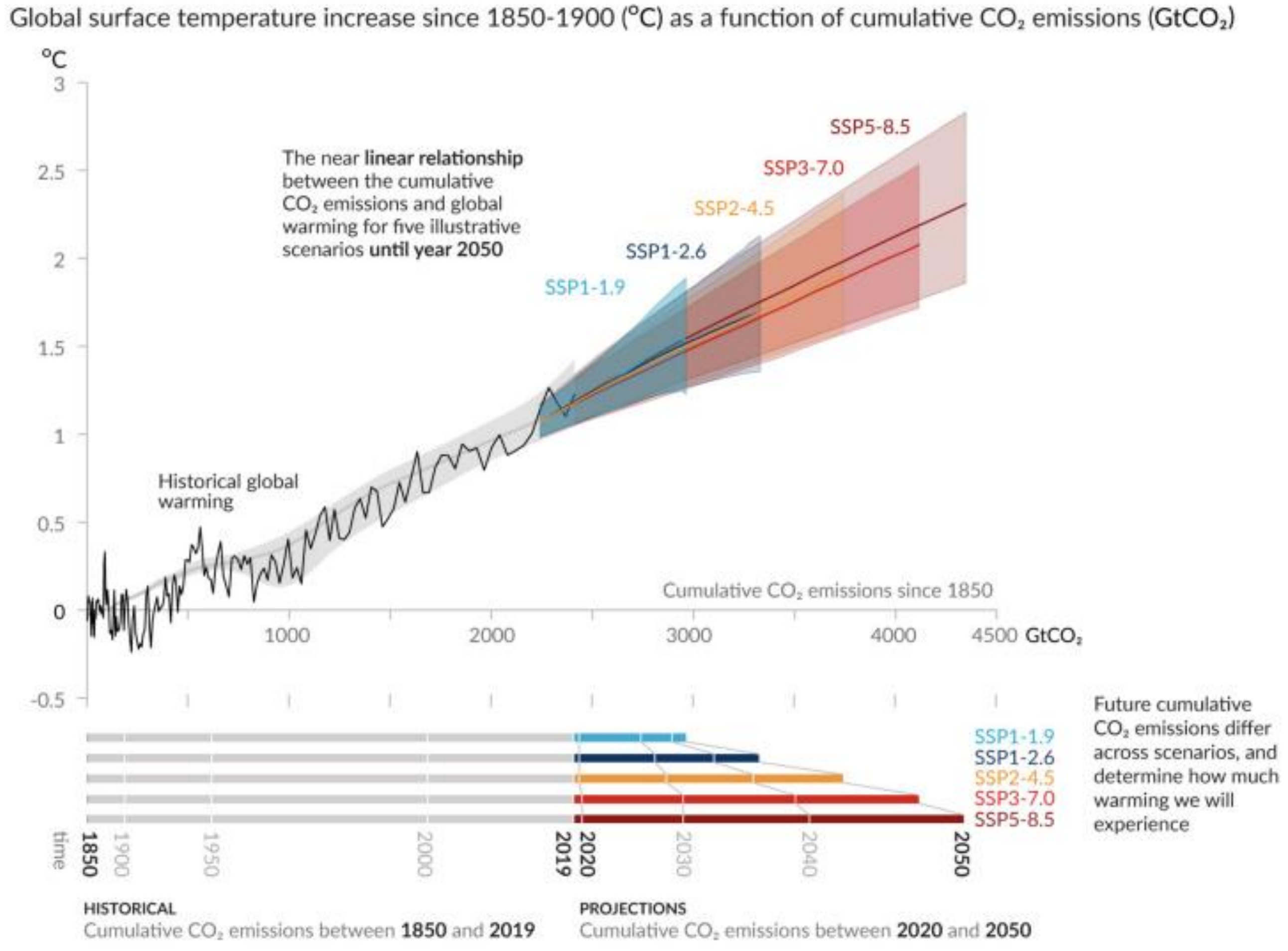
Human activities affect all the major climate system components, with some responding over decades and others over centuries

Figure SPM.8



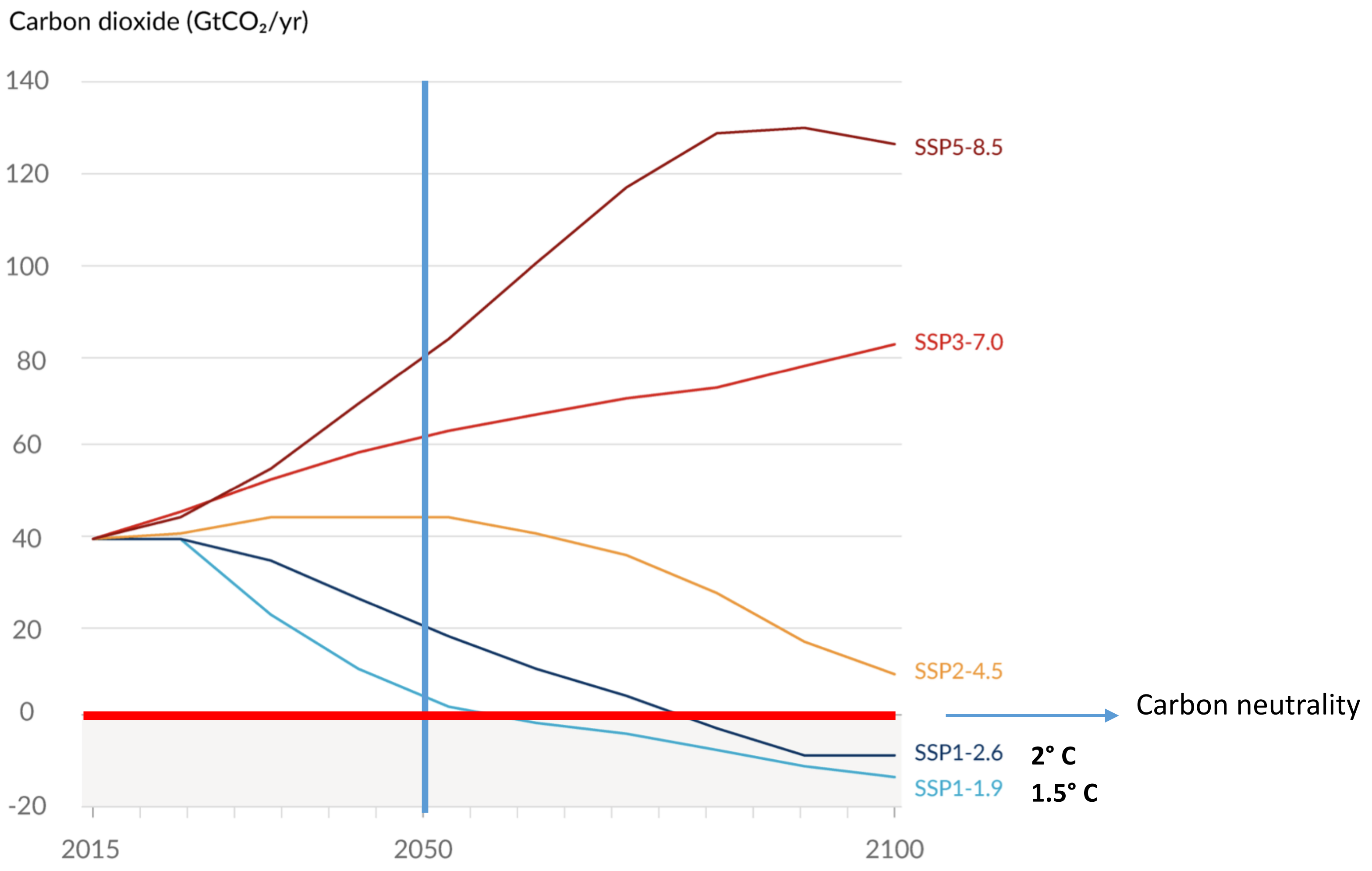
Every tonne of CO_2 emissions adds to global warming

Figure SPM.10



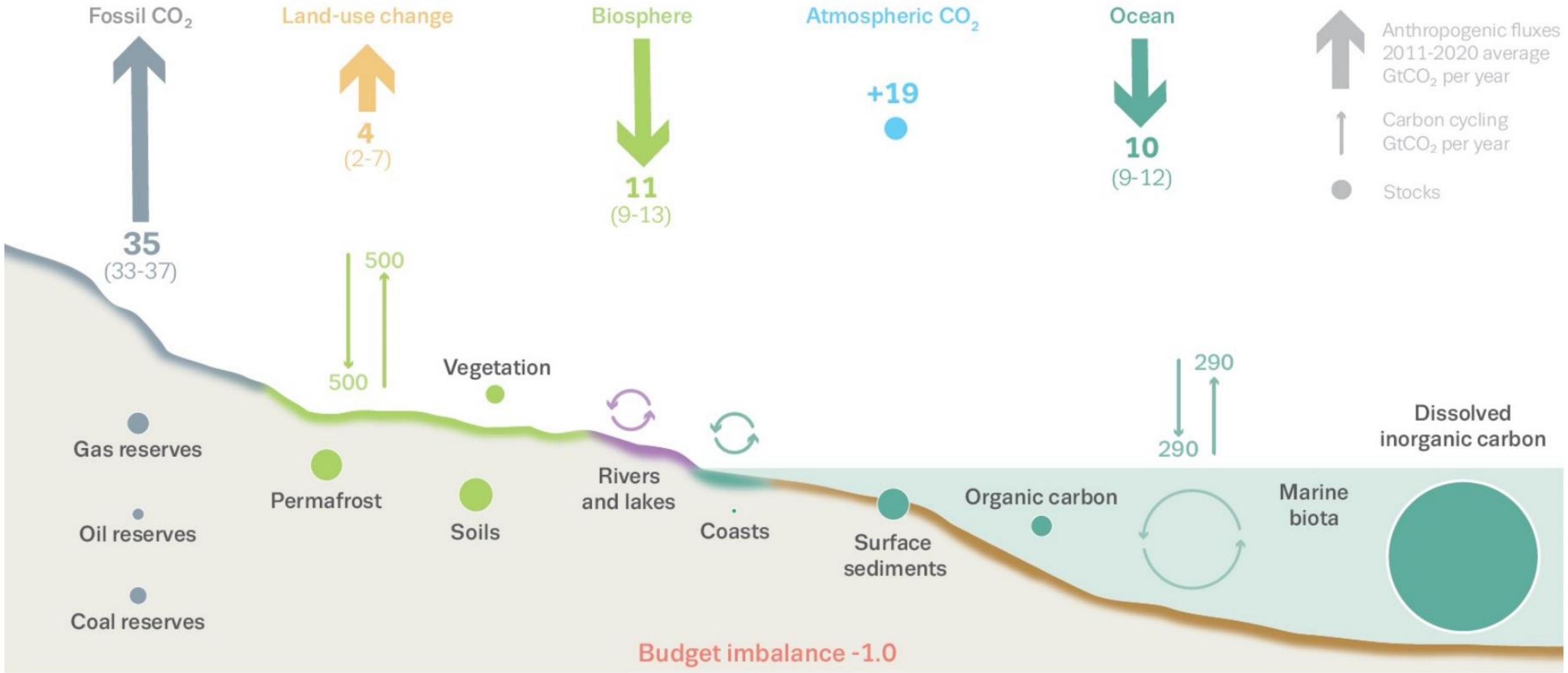
Future emissions cause future additional warming, with total warming dominated by past and future CO_2 emissions

Figure SPM.4



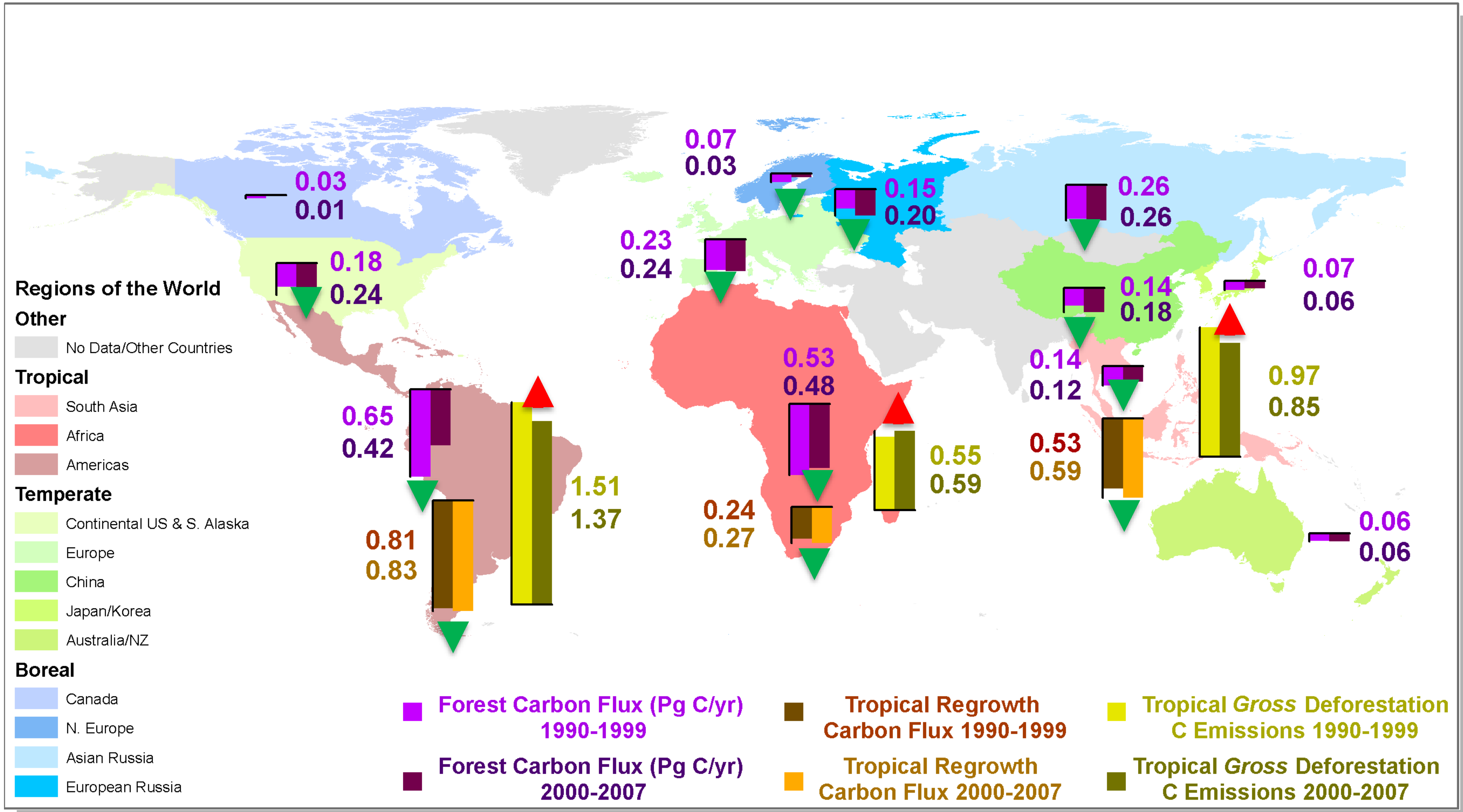
2021 Global Carbon Budget

The level of CO_2 continues to increase in the atmosphere, causing climate change.
Emissions from deforestation and other land-use change remain high, partly offset by removals from regrowth of forest and soil recovery.



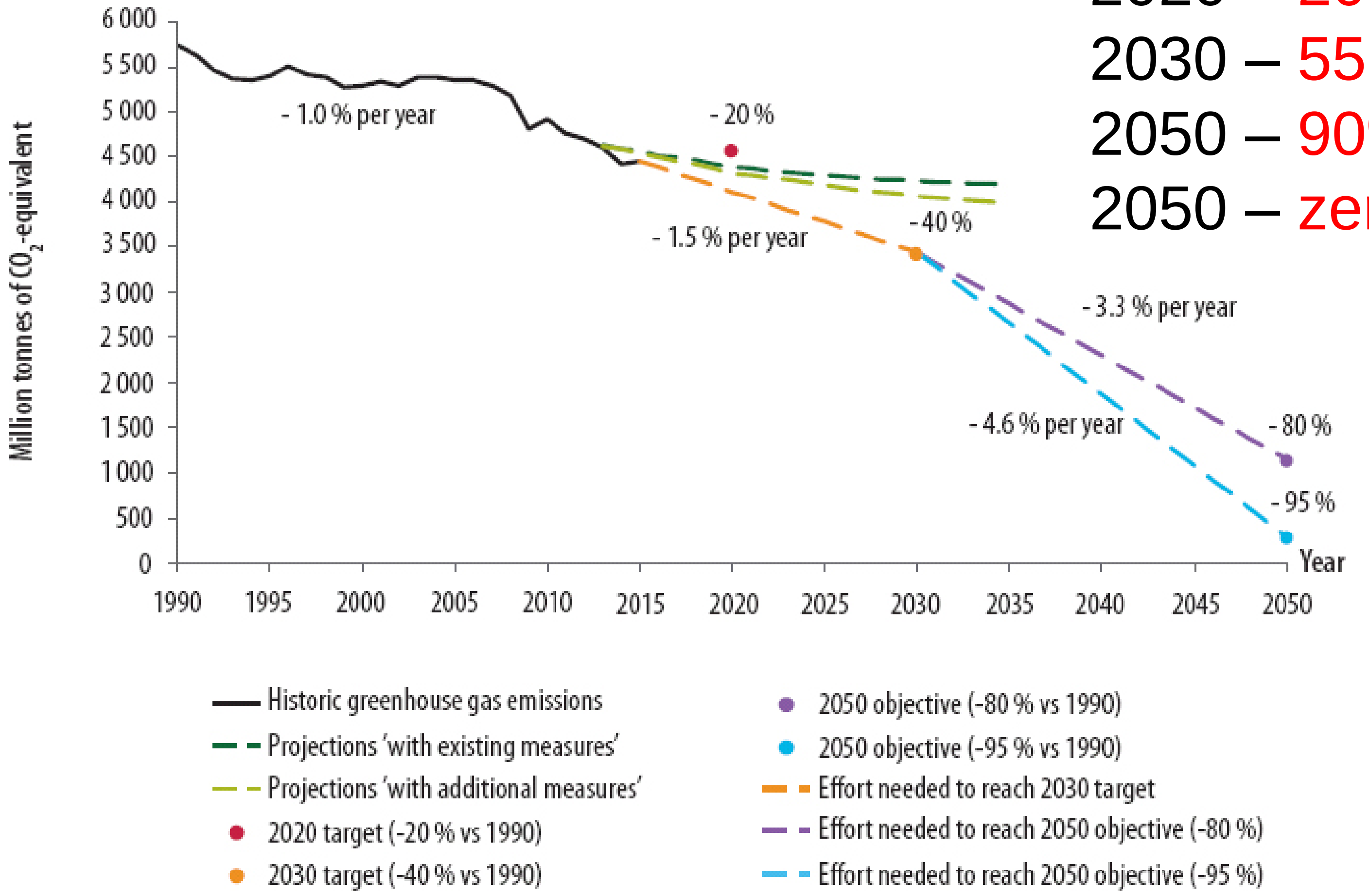
Produced by the Global Carbon Project based on Friedlingstein et al. Earth System Science Data (2021). Written and edited by Corinne Le Quéré (UEA) and Pierre Friedlingstein (Exeter University) with the Global Carbon Budget team. Emissions figures by Robbie Andrew (CICERO), bottom figure by Nigel Hawtin. Infographics design adapted from a previous version by Nigel Hawtin. Poster created by Natalie Porter (ClimateUEA).

Large and Consistent Global Forest Carbon Sink



Pan et al. 2011, Science

Il cammino EU verso la neutralità



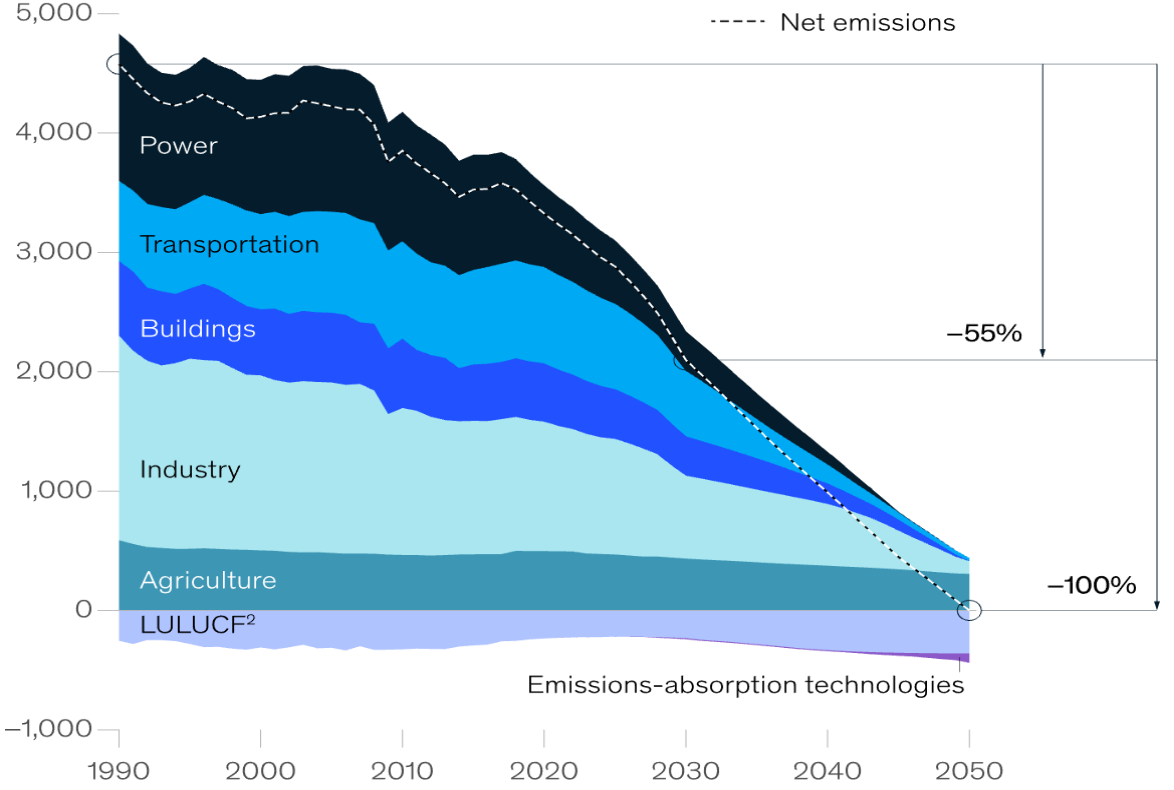
2020 – 20% since 1990 -→ 23%
2030 – 55 % since 1990 → Paris agreement
2050 – 90% since 1990 (for some sectors)
2050 – zero net emission

Exhibit 3

The «resistent» Agricultural sector

The power sector would reach net-zero emissions before the others.

Total emissions per sector in cost-optimal pathway for EU-27,[1] megatons of carbon dioxide equivalent



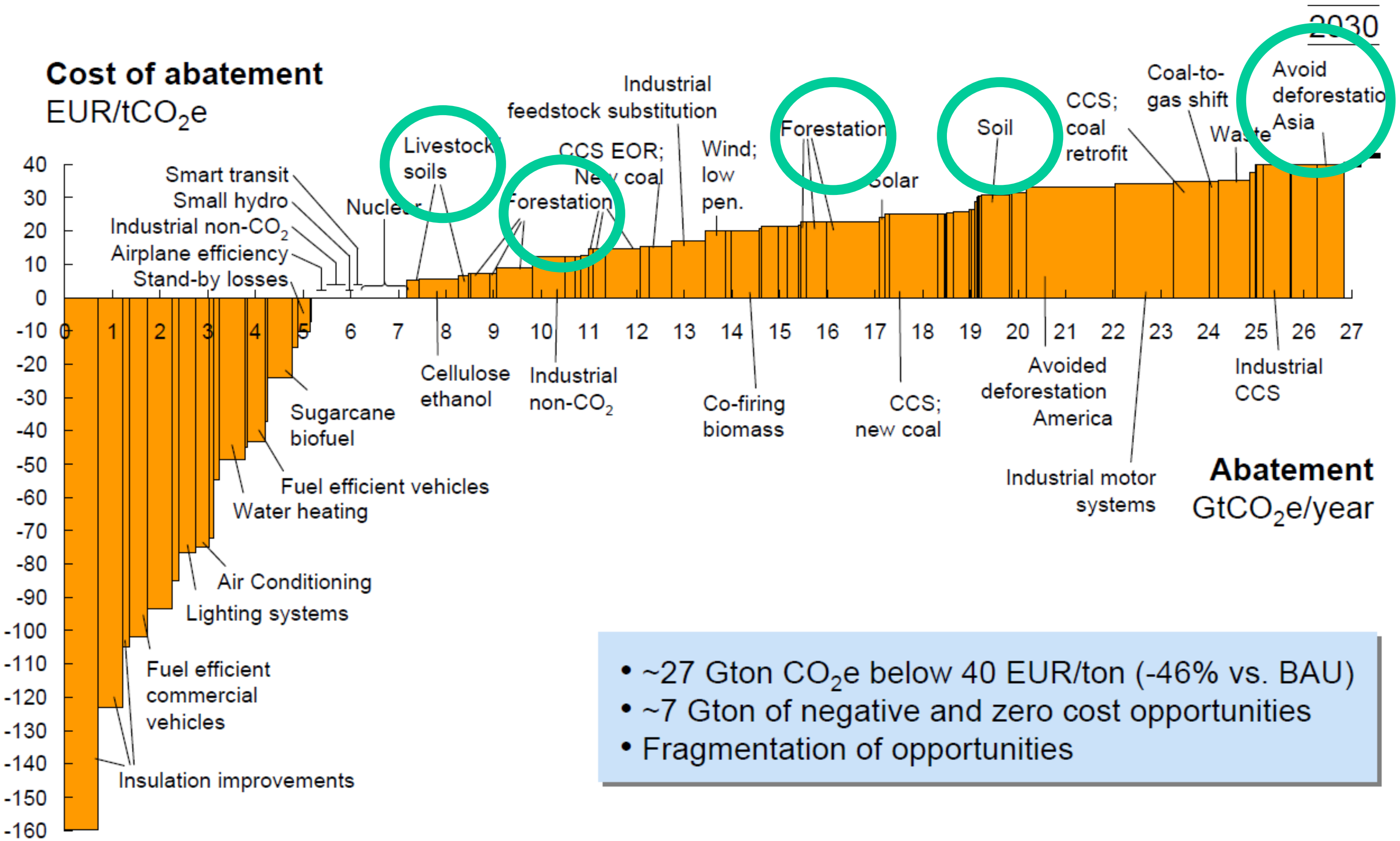
Residuo: 65-85 MtCO2eq

[1]Excluding international aviation and shipping.
[2]Land use, land-use change, and forestry entails all forms in which atmospheric CO_2 can be captured or released as carbon in vegetation and soils in terrestrial ecosystems.
Source: UNFCCC; McKinsey analysis

McKinsey & Company

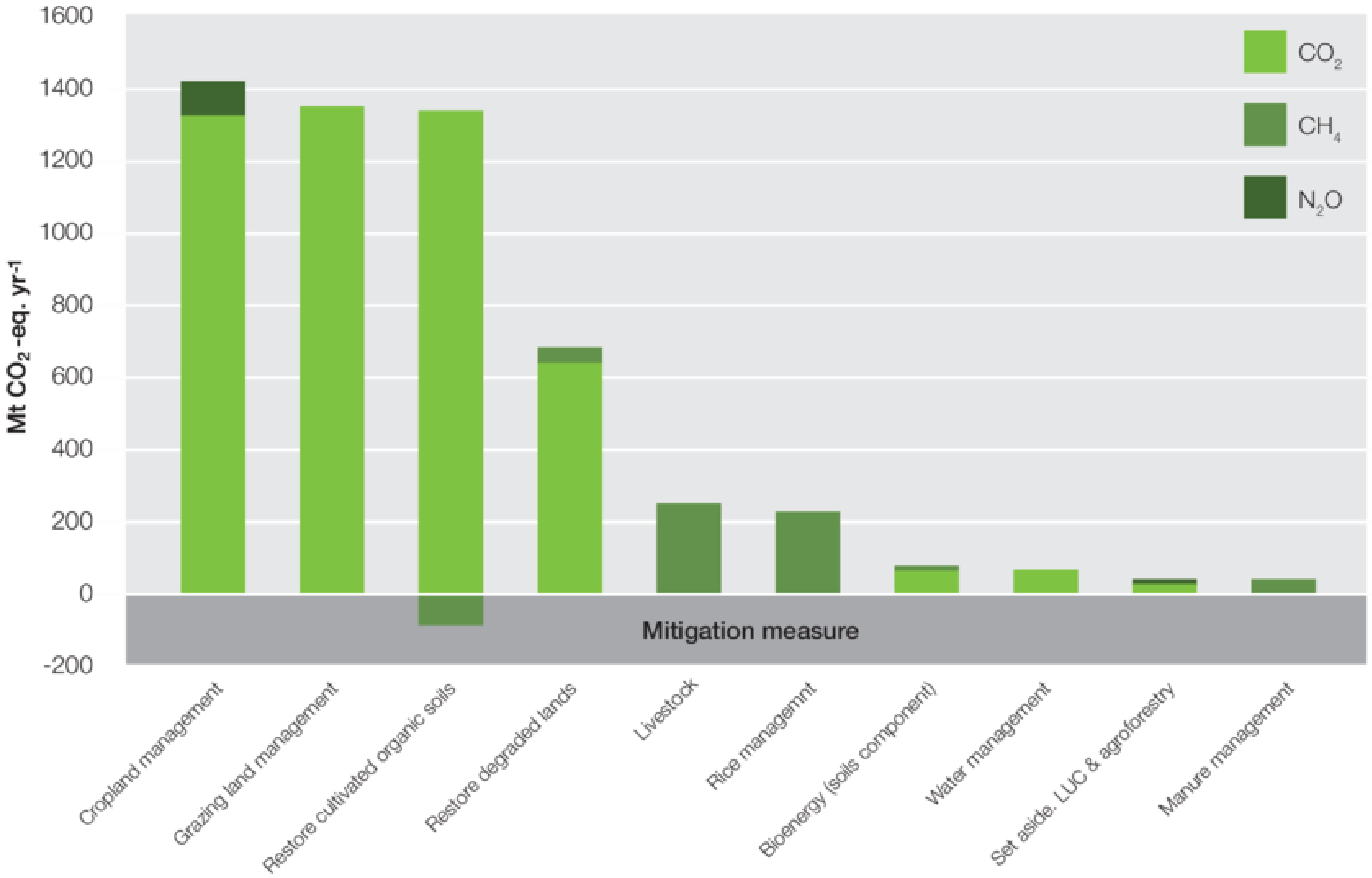
Mitigation

Most future benefits of decarbonizing the economy depend on the agriculture, forestry and land use sector (AFOLU)

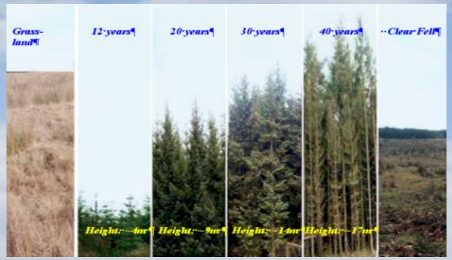


- ~27 Gton CO_2e below 40 EUR/ton (-46% vs. BAU)
- ~7 Gton of negative and zero cost opportunities
- Fragmentation of opportunities

Climate mitigation potential of agriculture



Soil greening

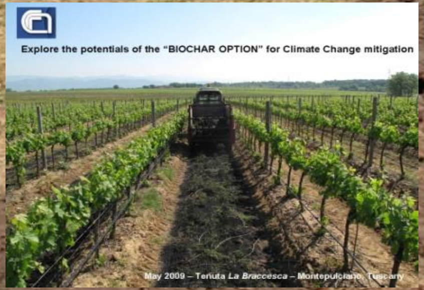


Reforestation

Pasture management

Organic farming

Minimum tillage



Biochar

Bioenergy

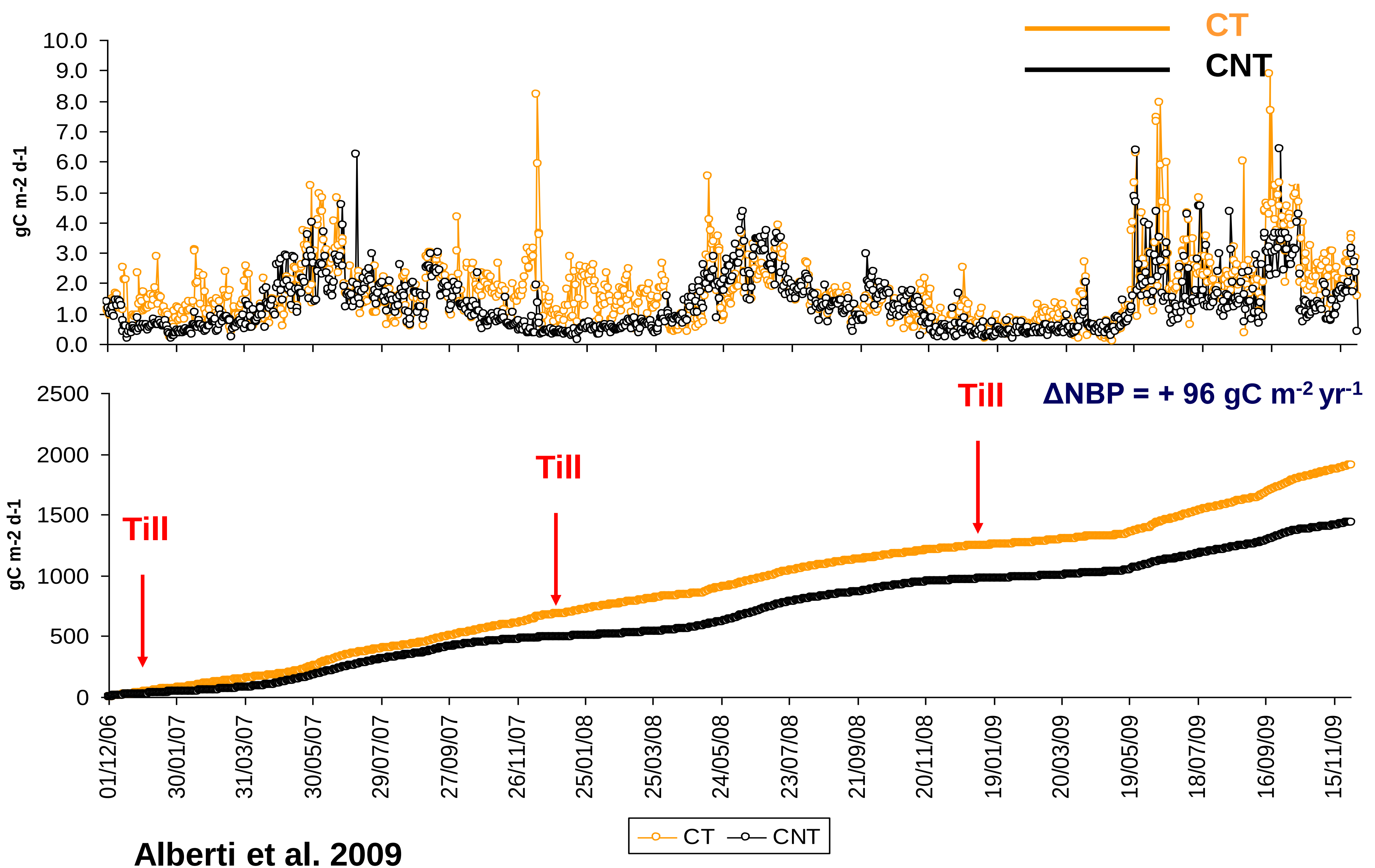
CARBON FARMING

Increased carbon sequestration by land use management in Mediterranean forest

(Ruiz-Peinado et al. 2017)
(Munoz-Rojas et al. 2016)

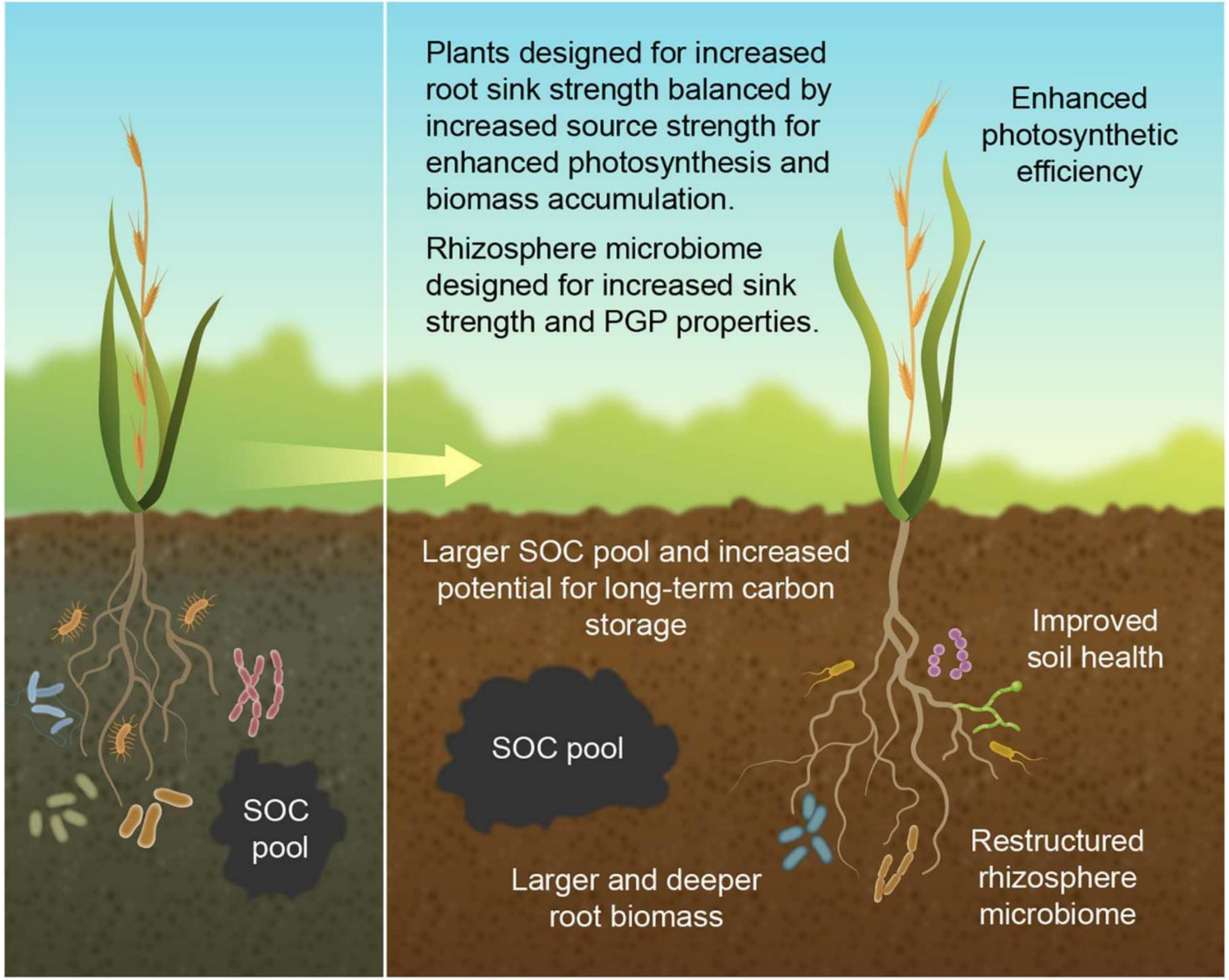
Thinning (light versus unthinned/heavily thinned)	5-10% C ha-1
Extending rotation period (20-30 y)	6-37% C ha-1
Soil carbon changes (reforestation/afforestation)	-10 + 45% C ha-1

Rh: corn no-till (CNT) vs corn till (CT)



Alberti et al. 2009

Plants Carbon Engeneering



The EU current carbon sink

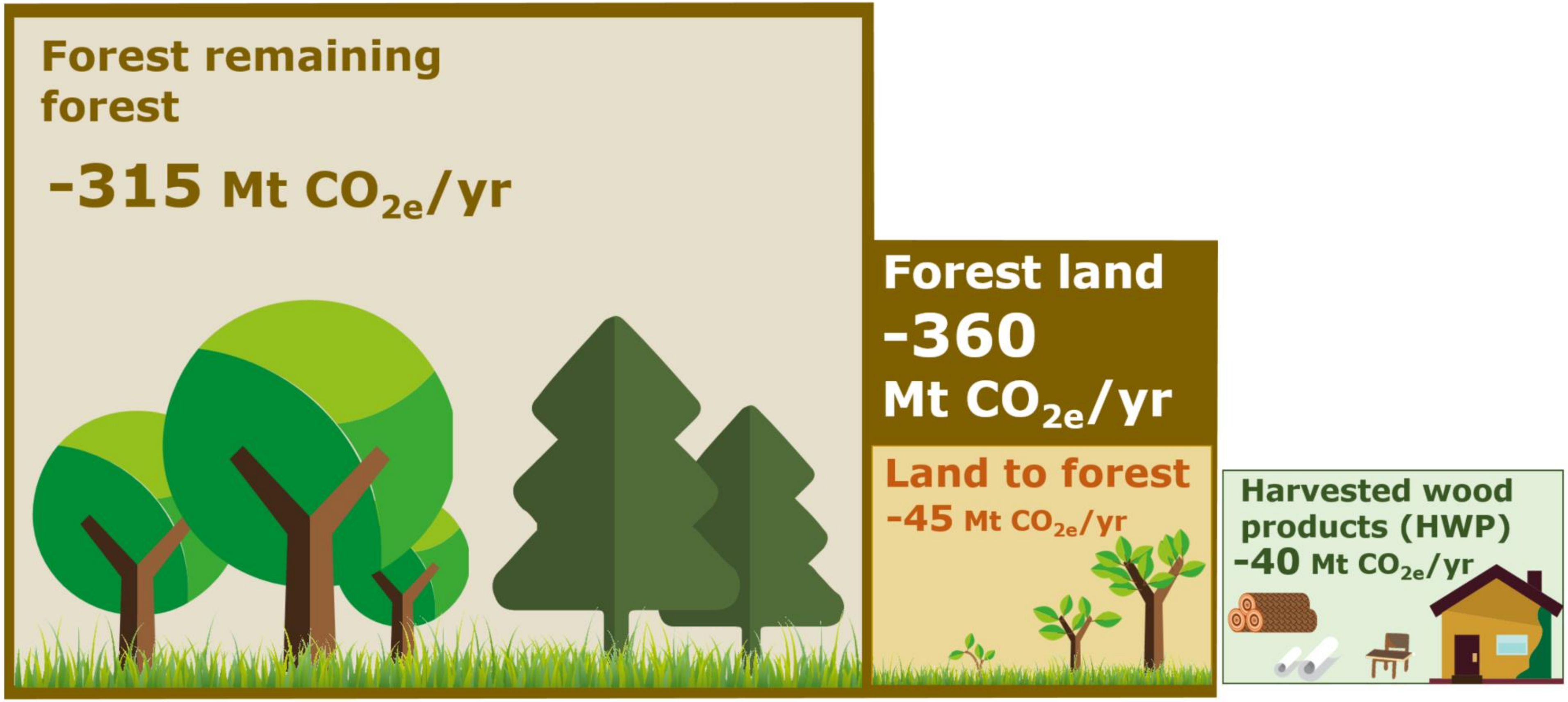


Figure 1. Approximate average net carbon sinks in the EU[3] during the period 2016-2018: forest land (-360 MtCO_{2e}/yr) and HWPs (-40 Mt CO_{2e}/yr), together offsetting -400 Mt CO_{2e}/yr, i.e. about 10% of total EU GHG emissions. The net sink from 'forest land' results from the 'forest land remaining forest land' (about -315 MtCO_{2e}/yr) and the 'land converted to forest land' over the past 20 years (about -45 Mt CO_{2e}/yr) and include changes in carbon stock in living biomass, dead organic matter and soil organic carbon.

The EU future carbon sink scenario

- Decarbonization scenario (zero net emission@2050)

360 Mt CO_2 eq/anno ---------»» 450 Mt CO_2 eq/anno

- Wood products scenarios
- Bioenergy

Settori di reporting/accounting

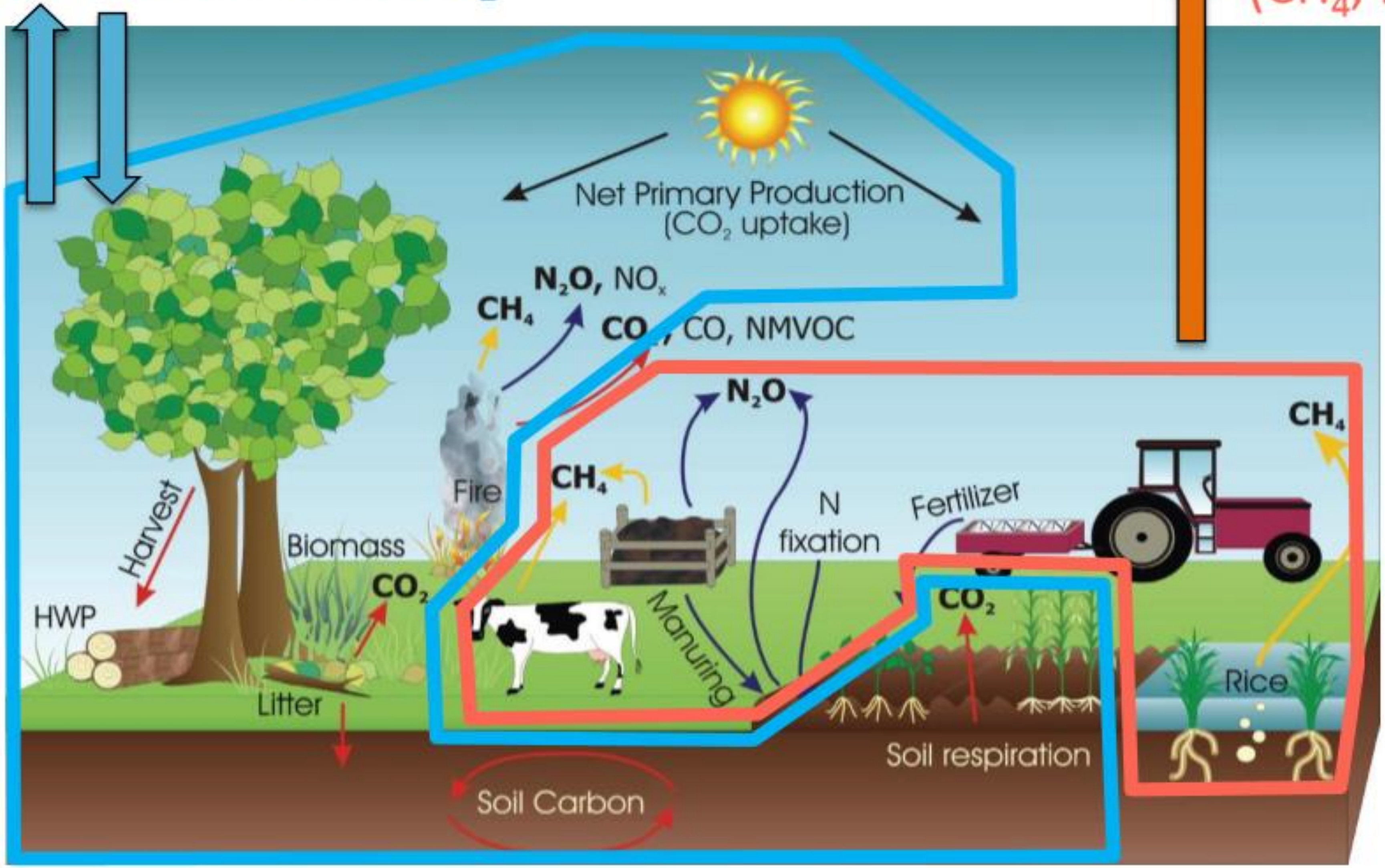
Land Use, Land use Change and Forestry

(LULUCF): mainly CO_2

Agricoltura

(CH_4, N_2O)

All human-induced



Land base accounting ?

Are pest and diseases a threat to carbon mitigation potential ?

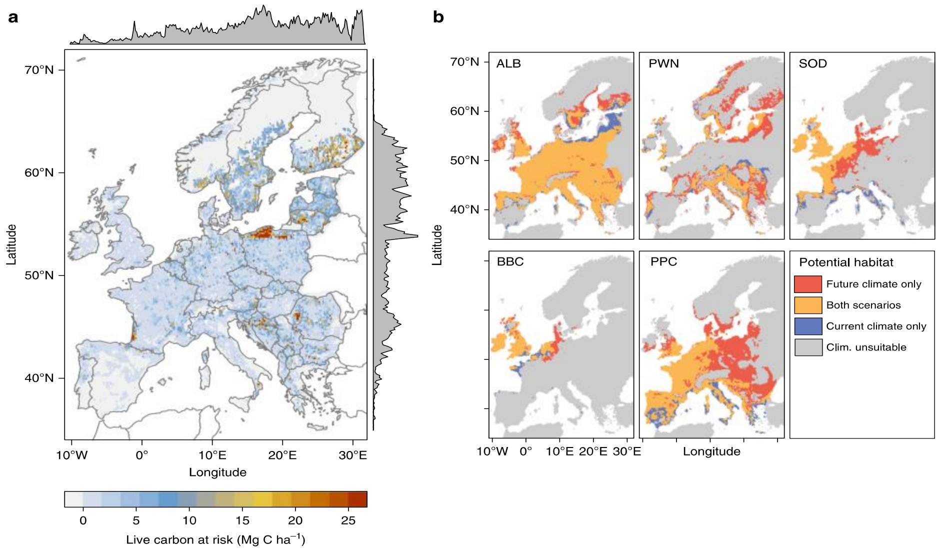


Fig. 1 Live tree carbon at risk from an invasion of five alien pest species into their climatically suitable areas in Europe. **a** The total amount of live tree carbon at risk (in Megagrams carbon per hectare) from a complete invasion of all five pest species into their climatically suitable areas under intermediate climate change (2030–2080, scenario RCP 4.5). **b** Climatically suitable ranges for each pest species under current climate (1950–2000) and intermediate climate change (2030–2080, scenario RCP 4.5). ALB: Asian Long-horned Beetle (*Anoplophora glabripennis*), PWN: Pine Wood Nematode (*Bursaphelenchus xylophilus*), SOD: Sudden Oak Death (*Phytophthora ramorum*), BBC: Beech Bleeding Canker (*Phytophthora kernoviae*), PPC: Pitch Pine Cancer (*Fusarium circinatum*)

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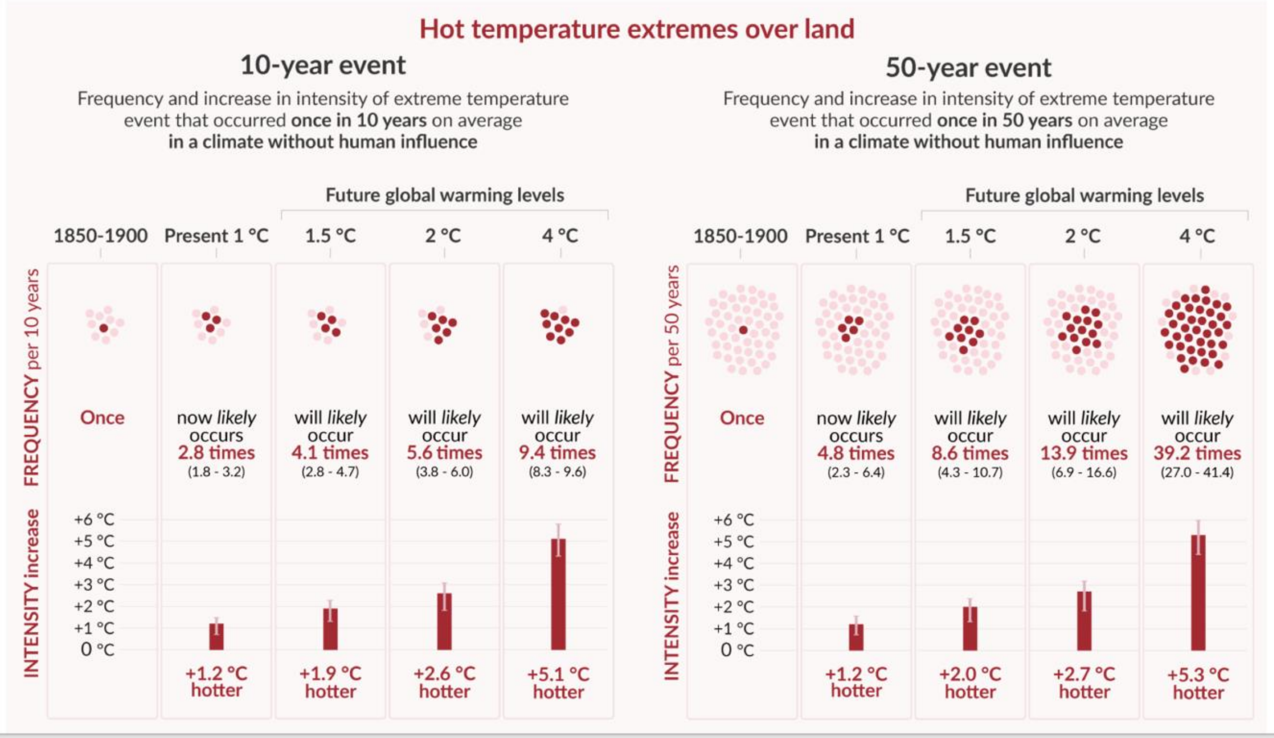
ARTICLE

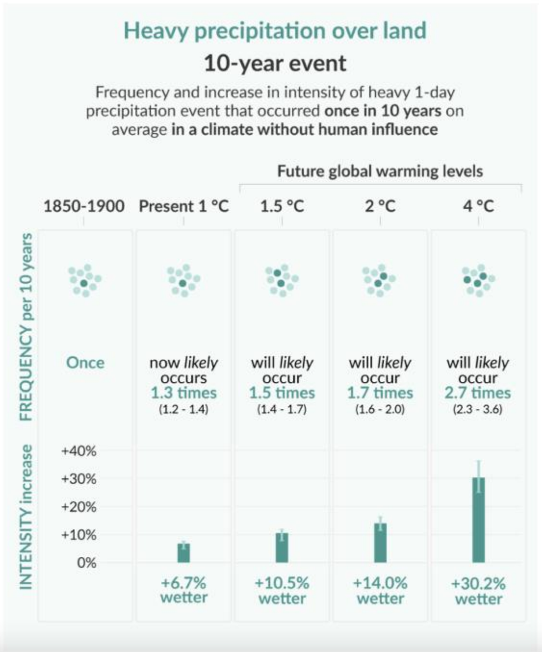
Table 3 Equilibrium C cycle effects of a potential invasive alien disturbance regime compared to the natural disturbance regime in Europe

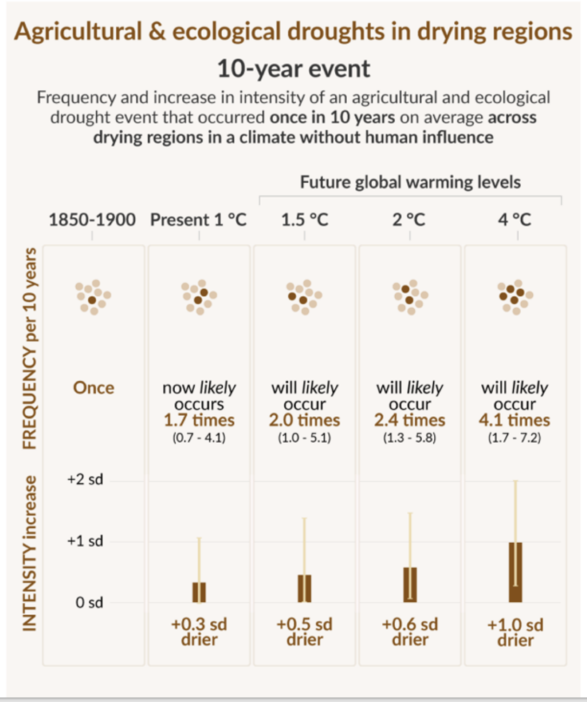
		Current climate (Tg C)	Future climate (Tg C)
Invasive alien disturbance regime	ALB—Asian Long-horned Beetle	246.0	252.0
	PWN—Pine Wood Nematode	188.4	291.2
	SOD—Sudden Oak Death	9.0	32.7
	BBC—Beech Bleeding Canker	5.7	11.7
	PPC—Pitch Pine Canker	10.4	46.5
	All	308.7	392.6
Natural disturbance regime	Wind, native bark beetles, and wildfires	319.8	503.4

Values indicate the long-term reduction of total ecosystem C storage capacity in Europe's forests due to disturbance (Tg C). For invasive alien pests, the implementation of effective pest management measures is considered under both current climate (1950–2000) and future climate (RCP 4.5, 2030–2080), as also natural disturbance risk is commonly managed in Europe's forests. Values for the natural disturbance regime of Europe are taken from Seidl et al.[6] and refer to observations for 1971–2010 (current climate) and the median projection for an ensemble of 12 climate change scenarios for 2021–2030. Please note that, while methodologically similar, the reference periods and climate scenarios differ between the assessments of invasive alien and natural disturbance regimes. All: upper bound of the equilibrium C cycle effect from all five invasive alien pests jointly

AR6 Extreme events future scenarios



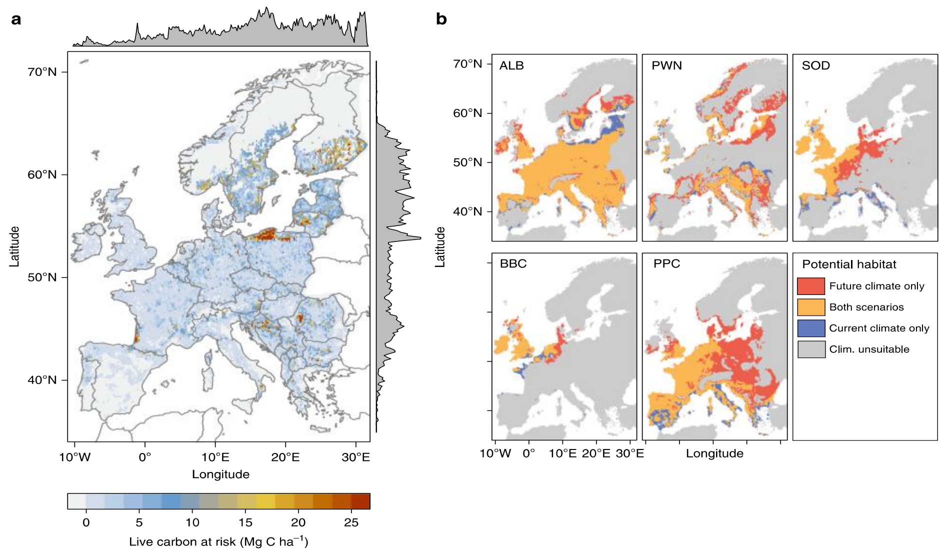




The biggest uncertainties

Are pest and diseases a threat to carbon mitigation potential ?

Alien species +27%
Disturbances +57%



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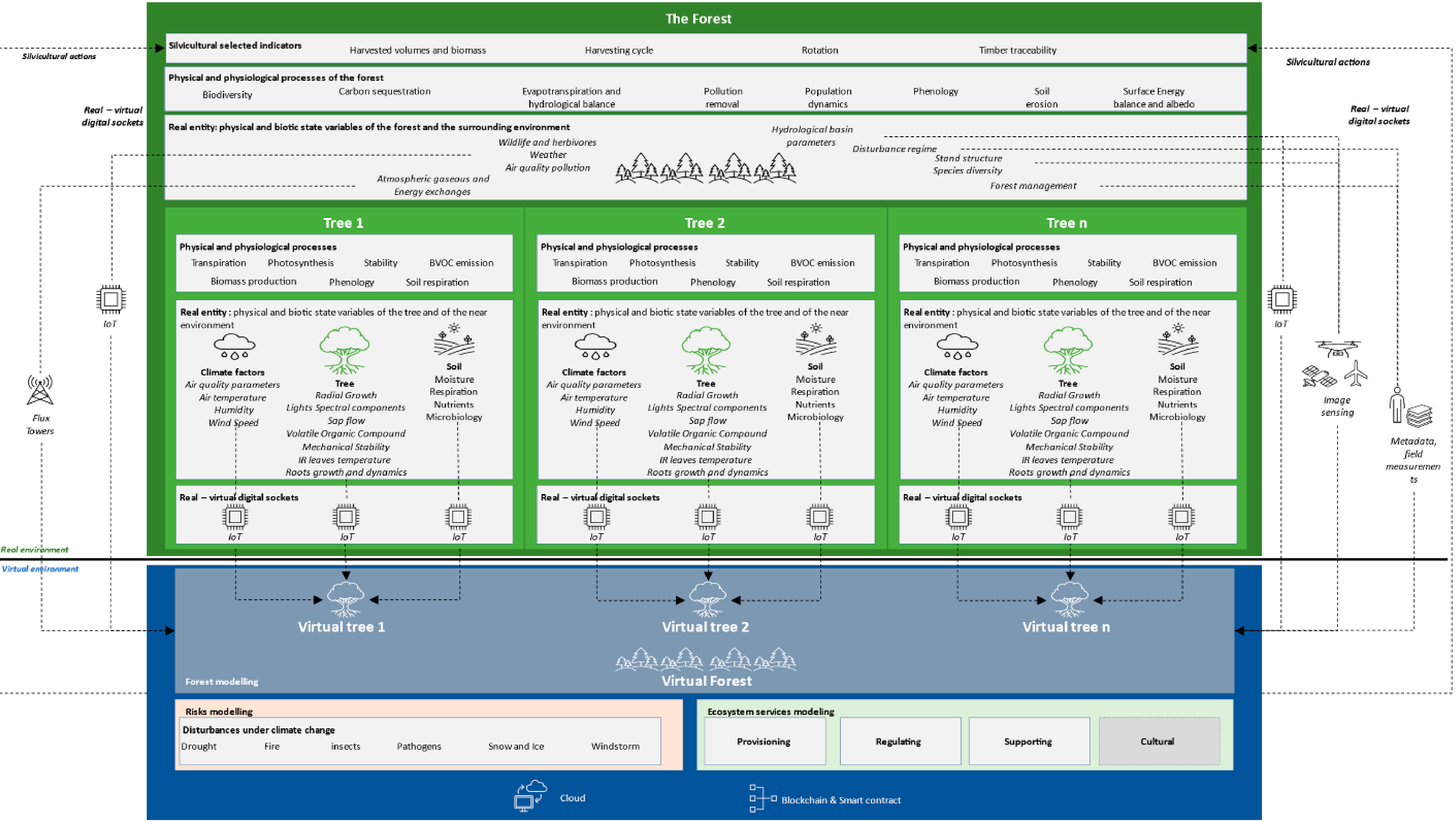
THE PARADOX OF THE CICADA AND THE ANT AND FOREST CARBON SEQUESTRATION

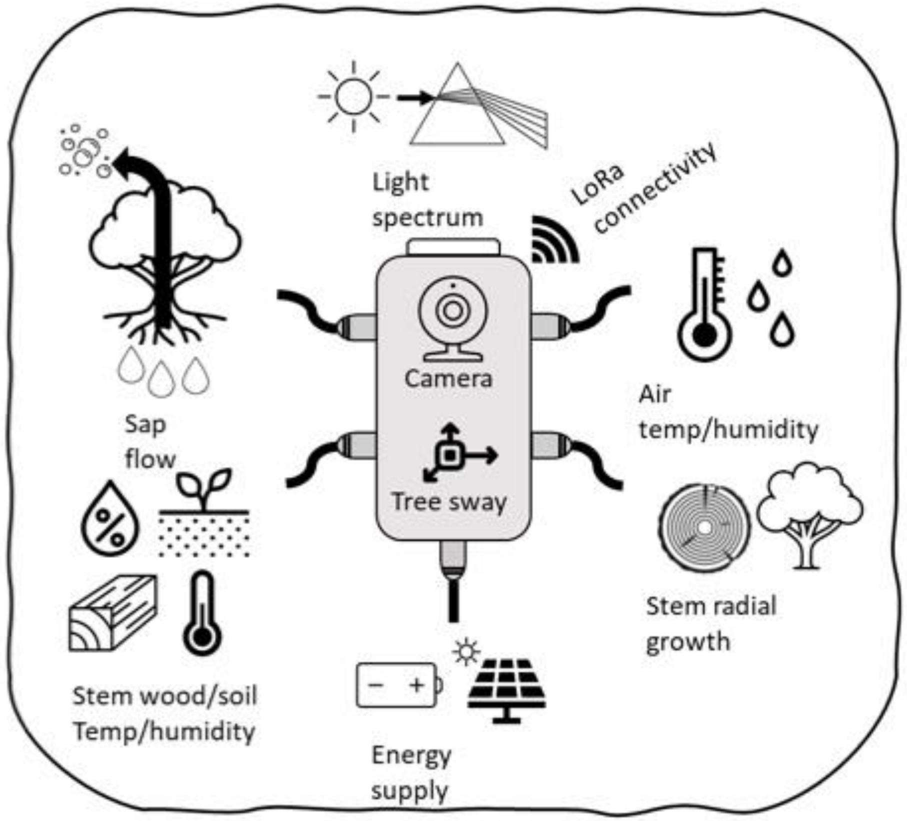
- Is it more convenient to take a small amount of biomass continuously over time or to let it accumulate indefinitely?

REAL TIME FOREST MONITORING - The FOREST DIGITAL TWIN



Tree-Talker

a multifunctional device for monitoring trees biological and physical features based on the Internet of Things (IoT) technology



TreeTalker®

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Fondazione Edmund Mach

Philipps Universität Marburg

Nature4.0
Inspire to invent change

Università degli Studi del Molise

Real time carbon Blockchain

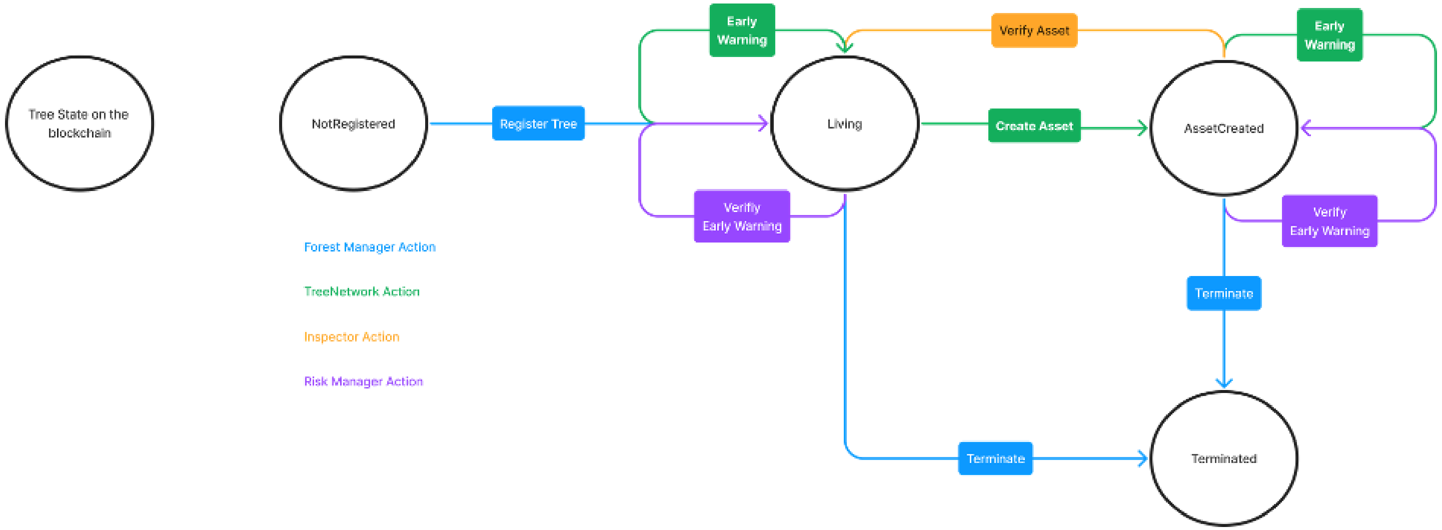

Figure 6: Tree lifecycle on the blockchain enforced in the smart contract

- **Forest Manager:** responsible to register the tree on the blockchain network and emit tokens
- **TreeNetwork:** the network of IoT devices sharing information on state variables at tree levels
- **Inspector:** role responsible to confirm the creation of the asset (e.g. Kg Carbon sequestered)
- **Risk Manager:** role responsible to force the creation of asset buffer (not available for tokenization) in case of early warnings from the Tree Network

```
ID,doy,air_temp,air_hum,vbat,cum_sum
5C200000,255.0,15.85,93.0,3.8138646145721724,37.56527791335943
5C200001,255.0,16.0,93.0,3.7598116892810123,48.24669231114562
5C200002,255.0,15.8,93.0,3.3585064683554107,32.27654672674196
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5C200005,255.0,16.0,96.5,3.7618942783419738,17.43427537747356
5C200006,255.0,16.05,99.0,3.540987911600816,29.97910833353048
5C200007,255.0,15.7,104.5,3.539669769109094,20.8570630707713
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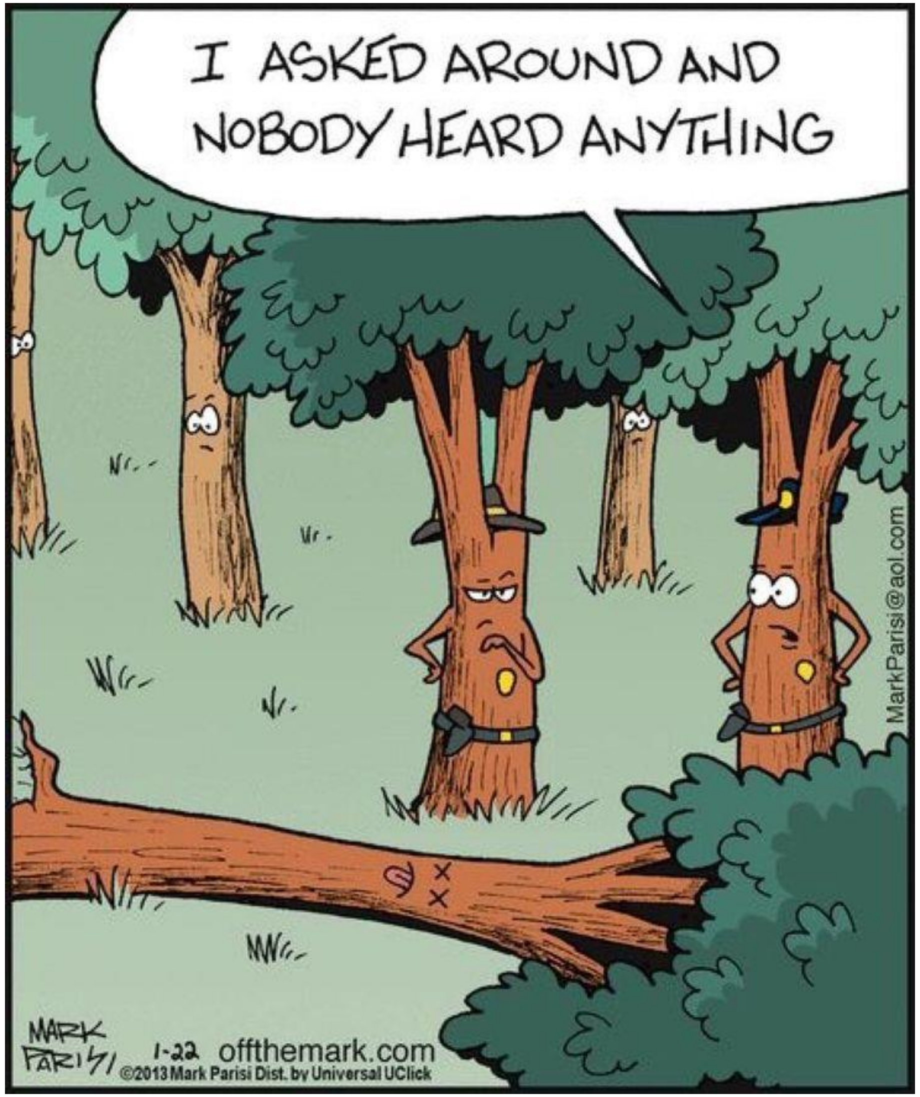
Figure 5: example of data captured for a stand per single day


I ASKED AROUND AND NOBODY HEARD ANYTHING
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Grazie !!