UNIVERSITAT DE BARCELONA

Facultat de Biologia

Fòrum Ambiental 2024

21 Març 13h - Aula Magna

Els reptes de la Restauració Ecològica en una Biosfera Canviant

Santi Sabaté (Departament BEECA UB-CREAF)

Life Terra

UNIVERSITAT DE BARCELONA

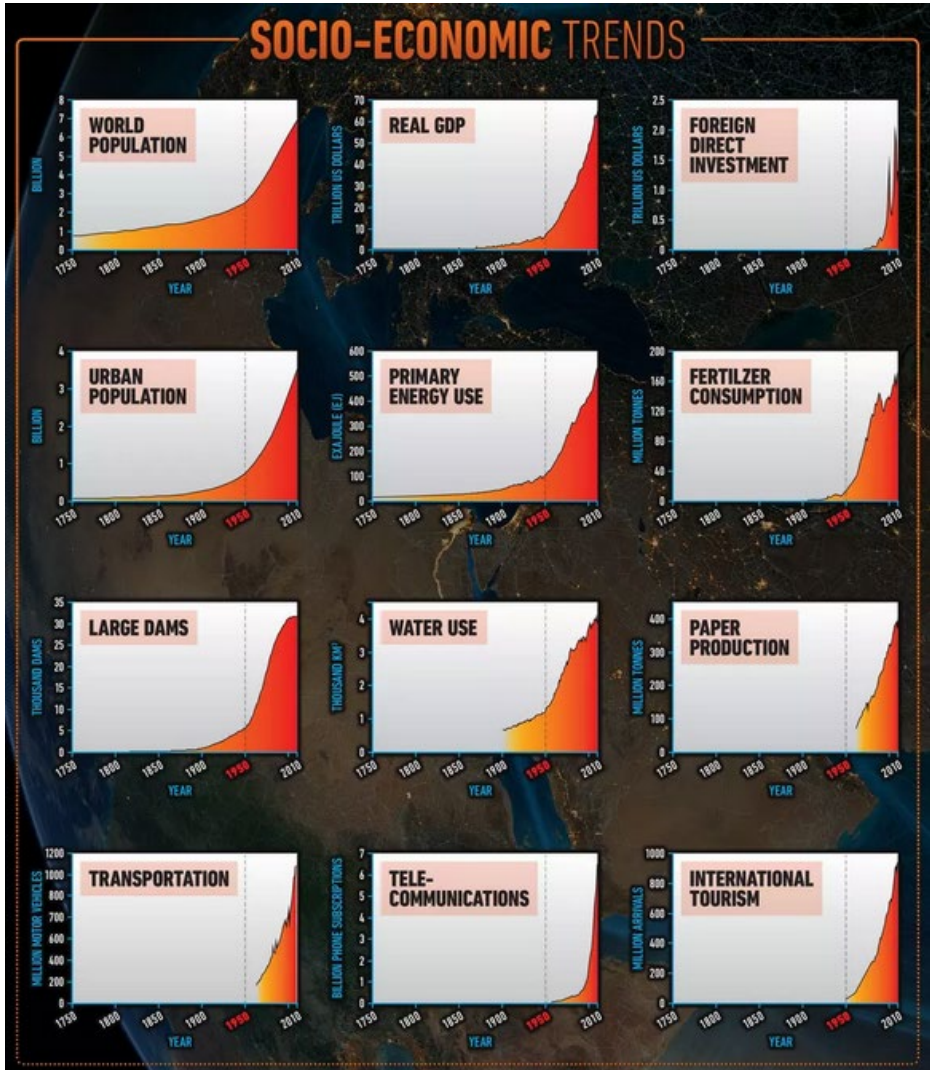
CREAF SEVERO OCHOA EXCELLENCE

"Els reptes de la Restauració Ecològica en una Biosfera Canviant"

Parlarem de:

- Frenar un Canvi Global que degrada
- Restaurar preparant-nos pels canvis
- Connectar coneixement i societat.
- Eines i projectes per explorar opcions front els reptes, dificultats i riscos de la restauració ecològica.

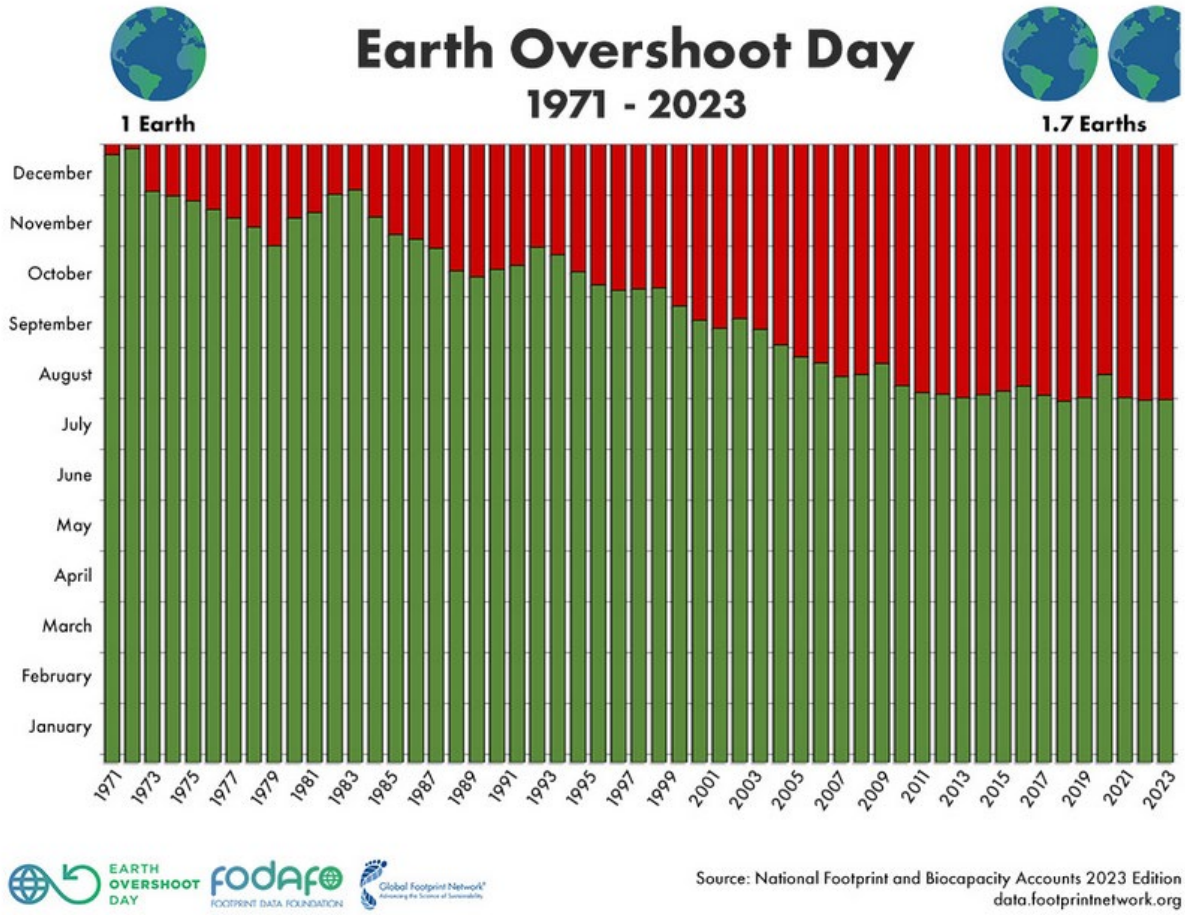
Ens trobem en condicions inestables amb un Canvi Global que no para i sobre el que costa construir els possibles futurs



Font: Will Steffen, Wendy Broadgate, Lisa Deutsch, Owen Gaffney and Cornelia Ludwig. 2015 The trajectory of the Anthropocene: The Great Acceleration. The Anthropocene Review. 1:18

El nostre comportment, any rere any, no és sostenible

Global Footprint Network
Advancing the Science of Sustainability



L'Energia exosomàtica i el Canvi Global van junts

Energia fòssil

Energia fòssil

(PPN biosfera antiga)

Població humana (>8098 milions)

Ús d'Energia Exosomàtica (~20 mW/m^2)

Artefactes exosomàtics (eines, maquinària, ciutats, vies de comunicació)

fertilitzants, pesticides, irrigació

aigua, ciment, minerals metalls

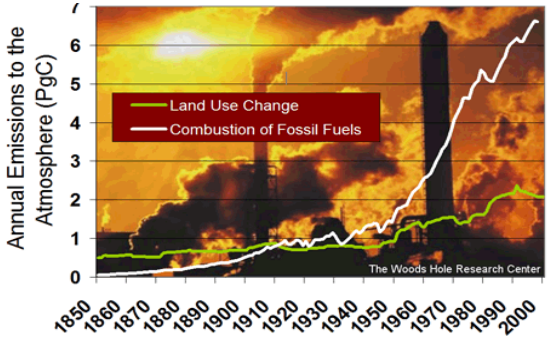
Producció agrícola (revolució verda)

Ocupació del territori
Fragmentació del paisatge (desforestació, crema,..)

Increment taxes de consum = creixement econòmic

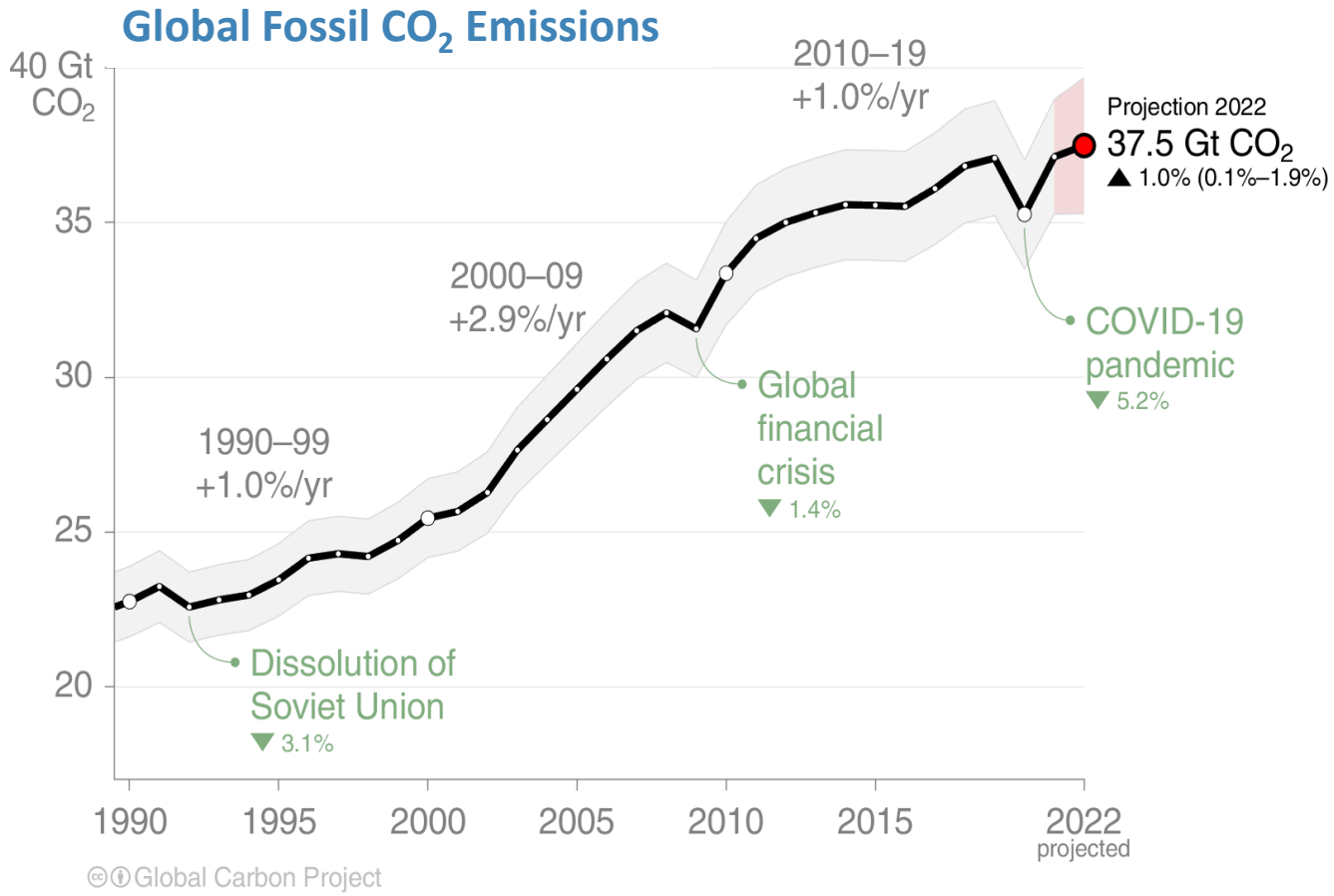
Símptoma:

Increment de gasos hivernacle (CO_2, NOx, SOx, CH_4, NH3, CFCs)	Contaminació (insuficient ús d'energ. exosomàtica per reciclar)	Destrucció dels sòls Erosió Desertització (territori antropitzat)	Escassetat aigua potable i pitjor qualitat	Destrucció dels hàbitats: pèrdua biodiversitat (extincions d'espècies)



Primer, frenar els canvis!

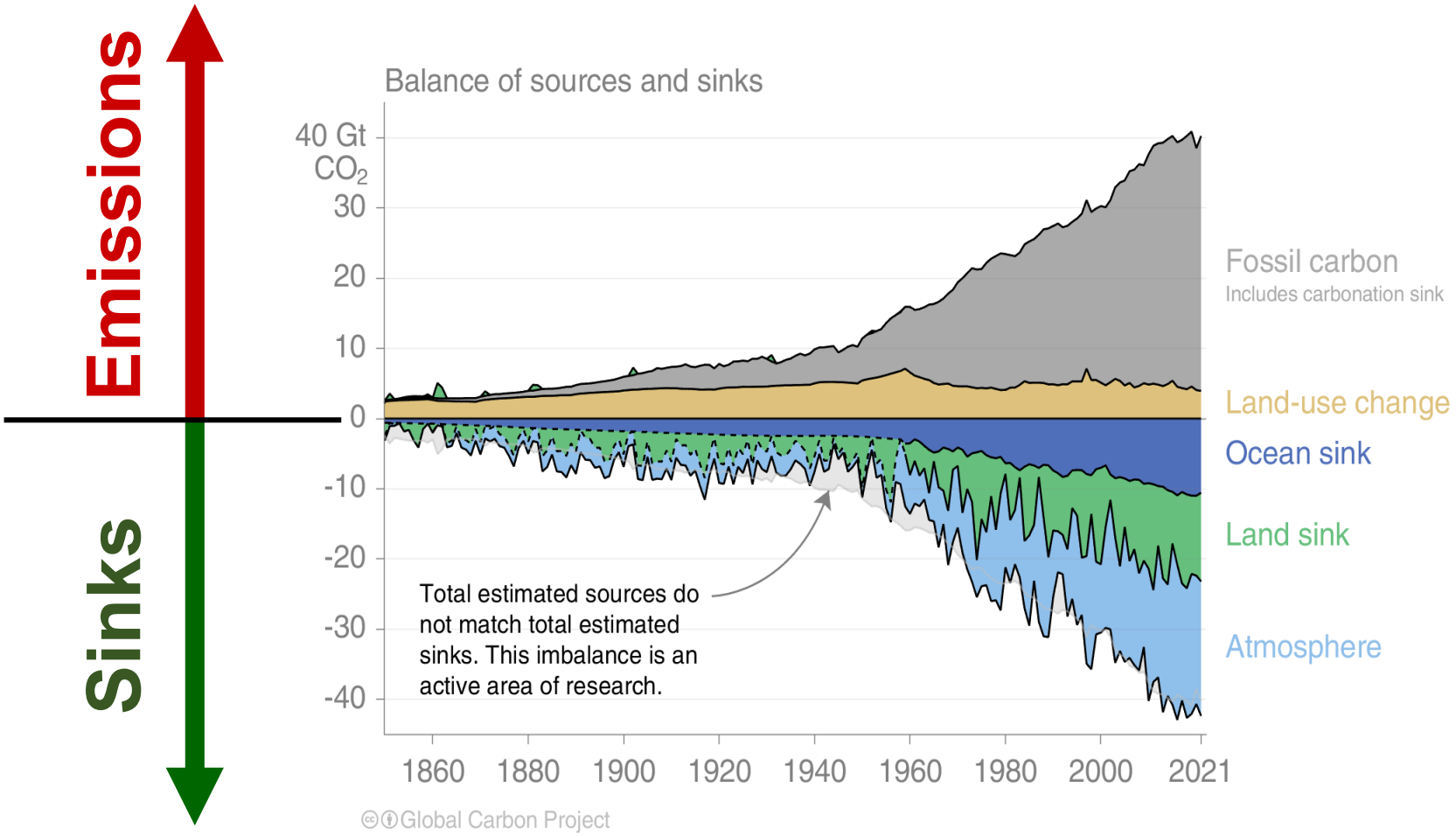
Reduir les emissions per estabilitzar l'estat de canvi a la Biosfera



When including cement carbonation, the 2021 and 2022 estimates amount to 36.3 ± 2 $GtCO_2$ and 36.6 ± 2 $GtCO_2$ respectively
The 2022 projection is based on preliminary data and modelling.
Source: Friedlingstein et al 2022; Global Carbon Project 2022

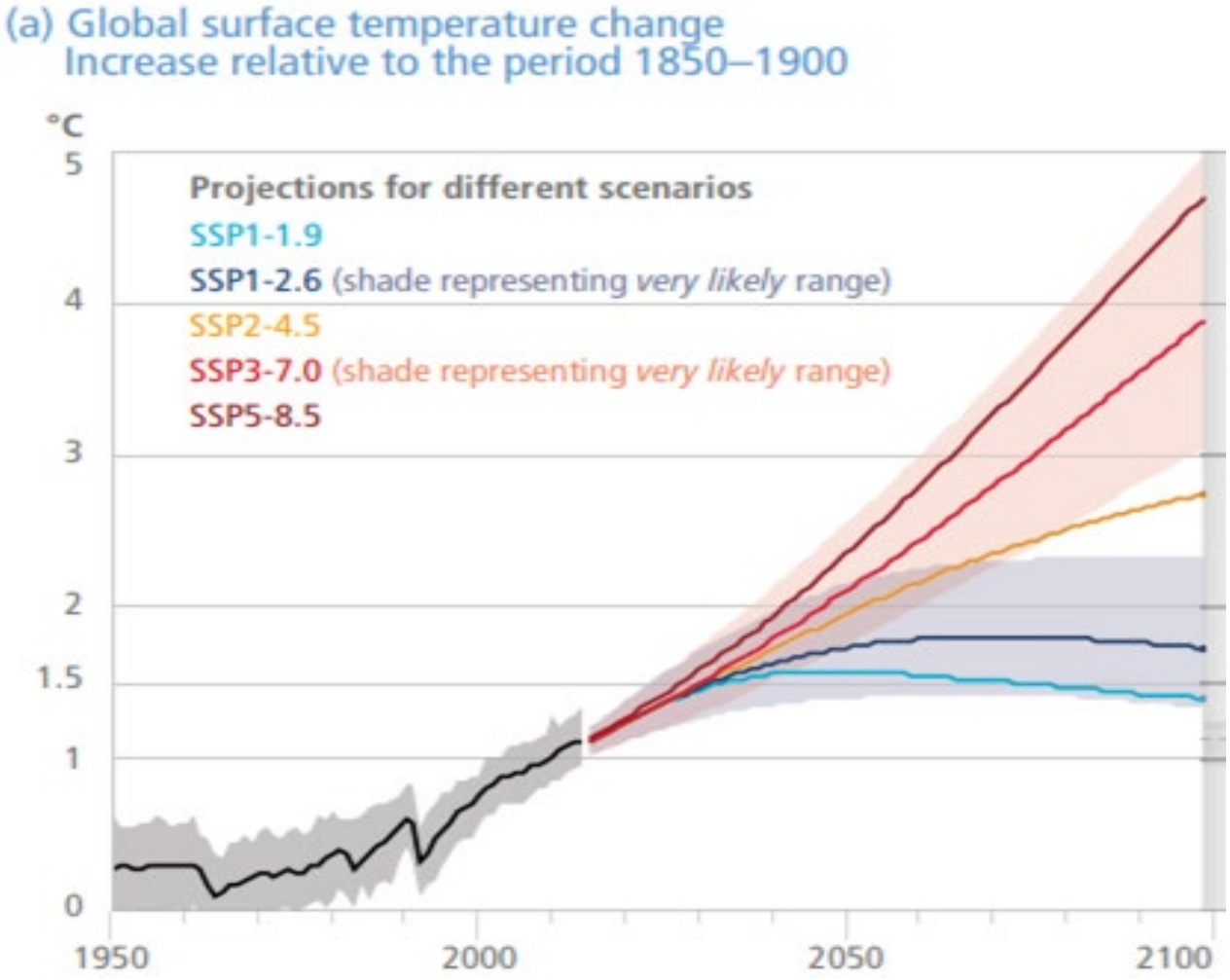
GLOBAL CARBON PROJECT

On van a parar les emissions?



Global carbon budget Report 2022

L’escalfament global futur depèn dels escenari d'emissions de gasos d’efecte hivernacle

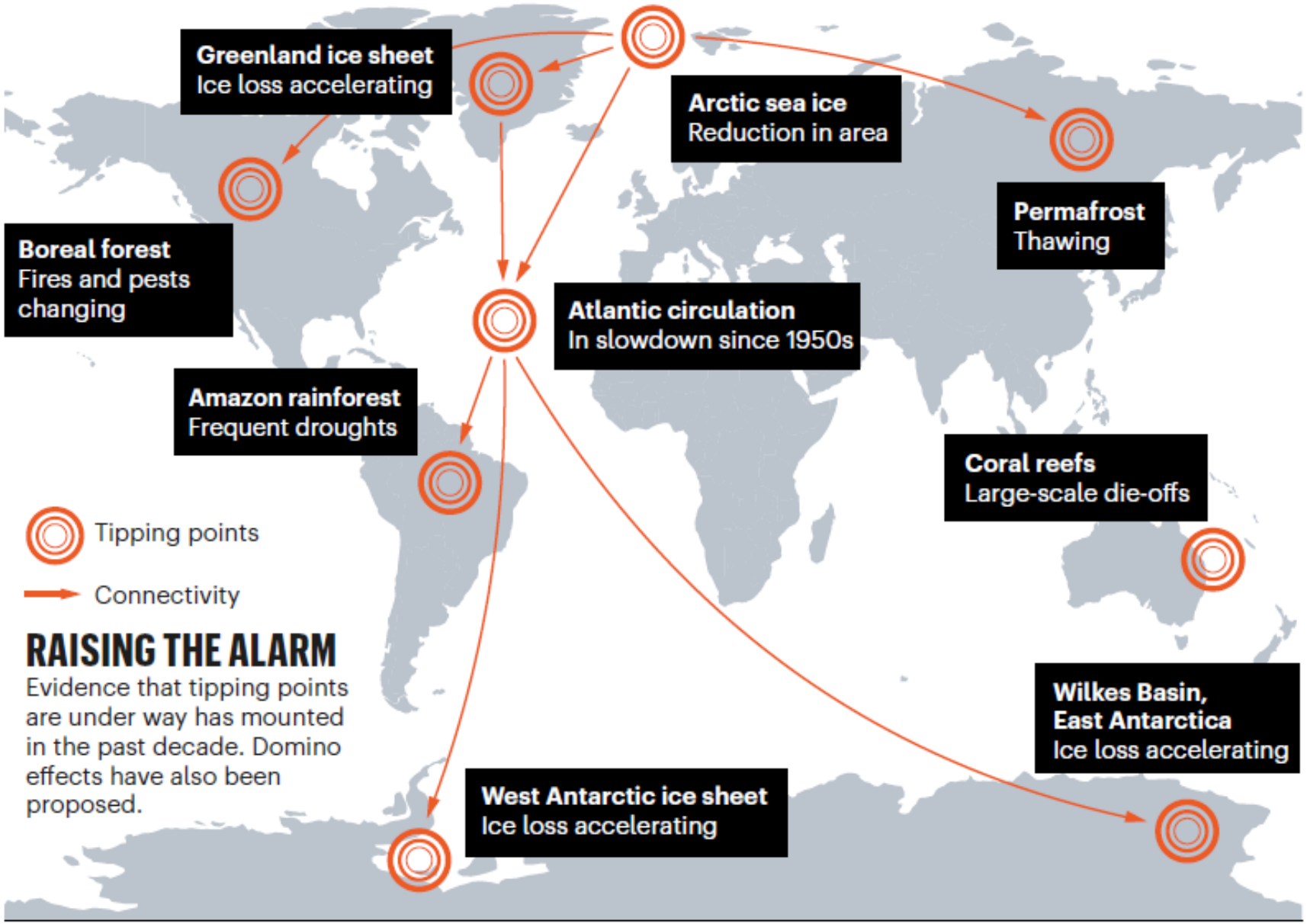


Consequences of increasing **radiative forcing from 1.9 to 8.5 w/m²** with respect to preindustrial radiative forcing values.

IPCC (2022)

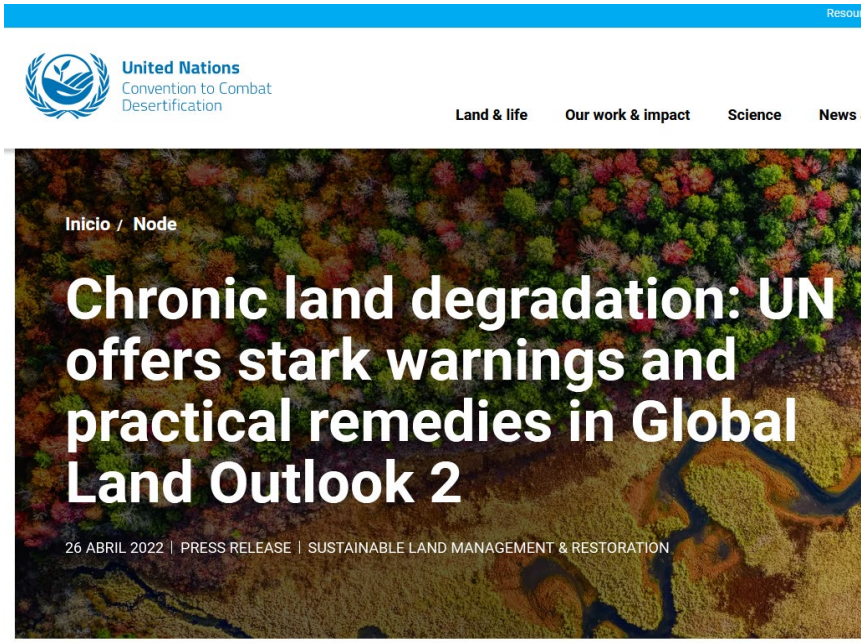
Tot està connectat a la Biosfera

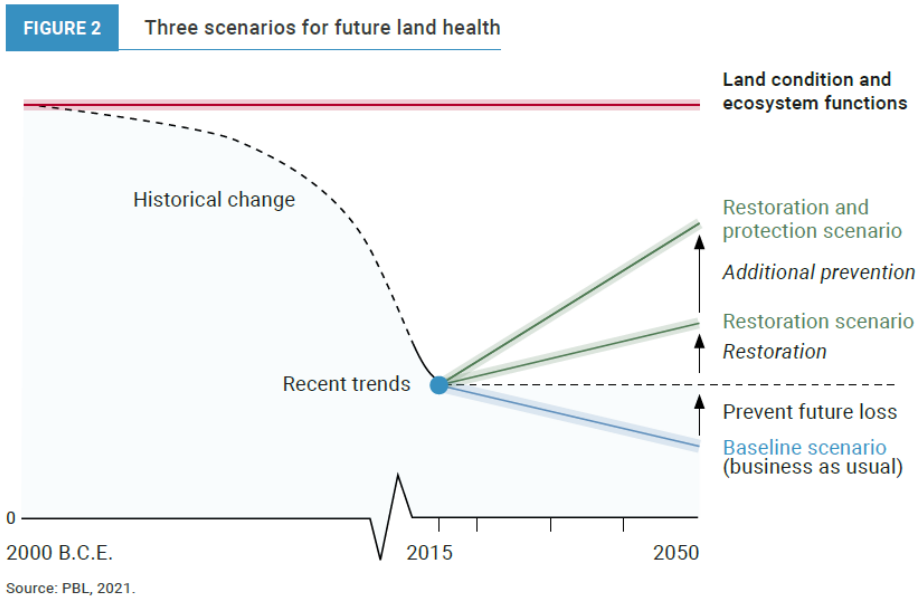
Conseqüències des de les escales locals a les globals



Totes les accions que canviïn i evitin la tendència actual de degradació són necessàries

… The way land resources – soil, water and biodiversity – are currently mismanaged and misused threatens the health and continued survival of many species on Earth, including our own …

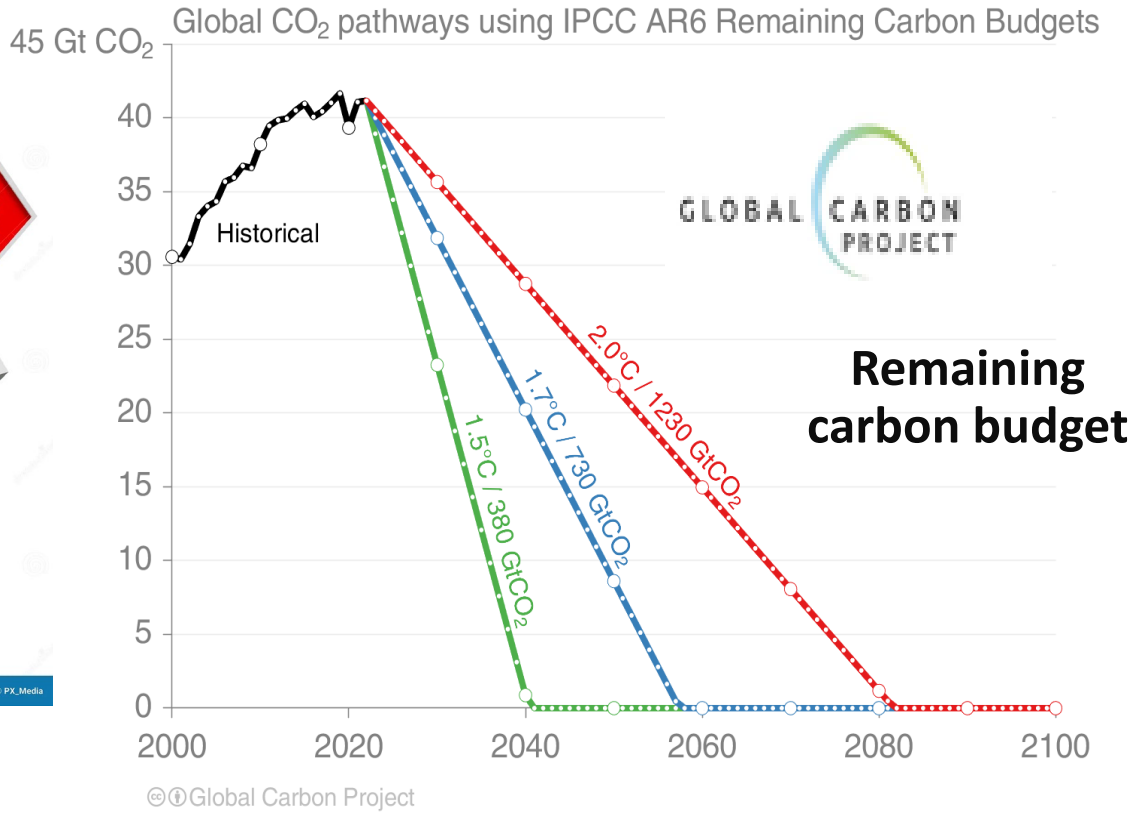




Up to 40 % of the planet's land is degraded, directly affects half of humanity, threatens roughly half of global GDP (US$44 trillion)

Primer: frenar els canvis! Reduir les emissions per estabilitzar l'escalfament i l'estat de tensió a la Biosfera

- Global CO_2 emissions must reach zero to limit global warming



- Source: Friedlingstein et al 2022; Global Carbon Project 2022

UN Biodiversity Conference (COP 15)

7-19 December 2022 in Montreal, Canada

New set of goals to guide global action through 2030 to halt and reverse nature loss.

- Effective **conservation and management of at least 30%** of the **world's land, coastal areas and oceans.** Currently, 17 percent of land and *8 per cent of marine areas are under protection
- **Restoration of 30% of terrestrial and marine ecosystems**
- **Reduce to near zero the loss of areas of high biodiversity importance and high ecological integrity**
- Halving global **food waste**
- Phasing out **or reforming subsidies that harm biodiversity** by at least $500 billion per year, while scaling up **positive incentives for biodiversity conservation** and sustainable use
- Mobilizing at least **$200 billion per year from public and private sources** for biodiversity-related funding
- **Raising international financial flows from developed to developing countries** to at least US$ 30 billion per year
- Requiring transnational companies and financial institutions **to monitor, assess, and transparently disclose risks and impacts on biodiversity** through their operations, portfolios, supply and value chains

Under the EU Biodiversity Strategy for 2030, part of the **European Green Deal**, the **European Commission committed to put forward a proposal for legally binding EU nature restoration targets to restore degraded ecosystems.**

European Nature Restauration Law

News
European Parliament

Homepage | Press room | Agenda | FAQ | Election Press Kit

Press room / Nature restoration: Parliament adopts law to restore 20% of EU's land and sea

Nature restoration: Parliament adopts law to restore 20% of EU's land and sea

Press Releases PLENARY SESSION ENVI 27-02-2024 - 12:32

- EU countries must restore at least 30% of habitats in poor condition by 2030, 60% by 2040, and 90% by 2050
- Provisions for agricultural ecosystems can be temporarily suspended under exceptional circumstances
- Over 80% of European habitats are in poor shape

2030

European Nature Restauration Law

To restore at least 20 % of the EU's land and 20 % of sea areas by 2030, and **all ecosystems in need of restoration by 2050.**

On Land, Member States should give **priority until 2030 to areas of habitat types not in good condition that are located in Natura 2000 sites.**

Parliament's proposed **provisions related to pollinators, planting additional trees and coherence with fisheries policy are retained, with amendments.**

Derogations from the targets are foreseen, notably for very common and widespread habitat types. Further **flexibilities are added to the ecosystem-specific targets**.

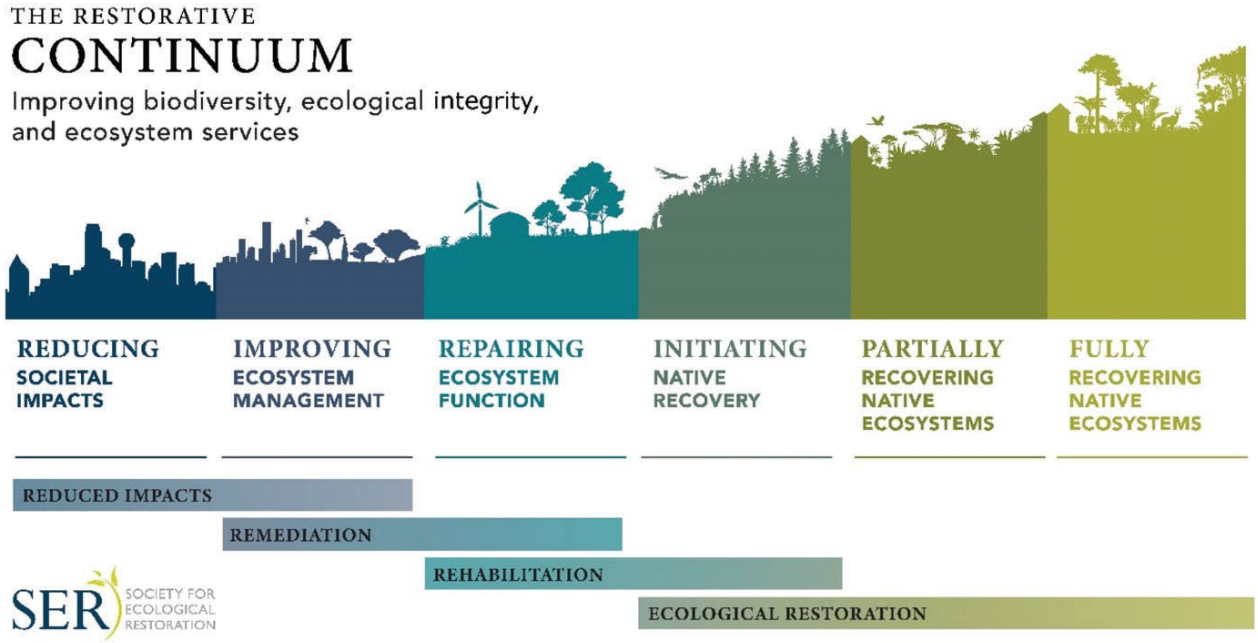
Under the deal, relevant provisions on the **restoration of agroecosystems could be temporarily suspended** in the case of an exceptional event outside EU control with severe impacts on the **availability of land necessary to secure sufficient agricultural production for EU food consumption**.

Key messages from SER-E about the Nature Restoration Law (NRL)

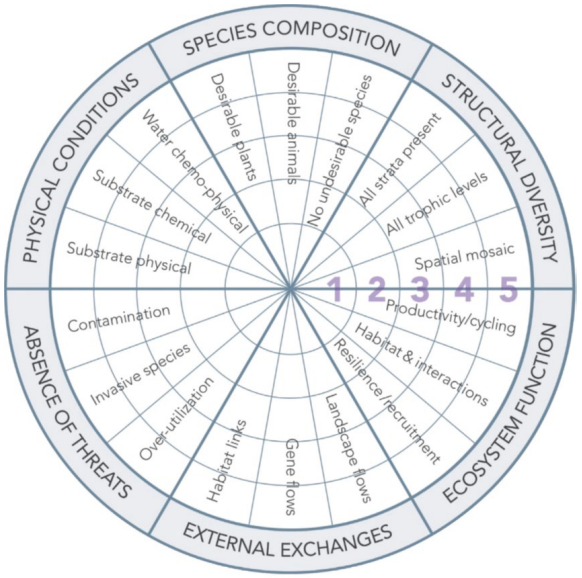
The strengths of the EU Nature Restoration Regulation include:

1. **Legally binding** and **measurable targets** to **restore 20%** of land and marine ecosystems in the EU **by 2030** and to **restore all ecosystems in need of restoration by 2050.**
2. A **holistic approach** emphasizing the importance of **nature-based solutions** to climate challenges, environmental degradation, and environmental risks (drought, extreme temperatures, wildfires, flooding), in an integrated way.
3. Active **involvement and collaboration among societal actors** who manage land and seas, including farmers, forest owners, local authorities, businesses, NGOs, and local communities. This inclusive approach is **vital for the successful implementation** of nature restoration initiatives that benefits both nature and people.
4. **Financial support from public and private sources** to facilitate the transition to more sustainable practices and achievement of restoration goals.
5. **National Nature Restoration Plans** will be adopted by **the Member States** within **two years** to start delivering systematically the required measures on their territory. SER-E calls for these plans both to be grounded on a participatory process for societal engagement, and to be **standards- and evidence- based to improve the likelihood of success.**

La restauració en un sentit ampli, des del més artificial al més natural



Indicadors

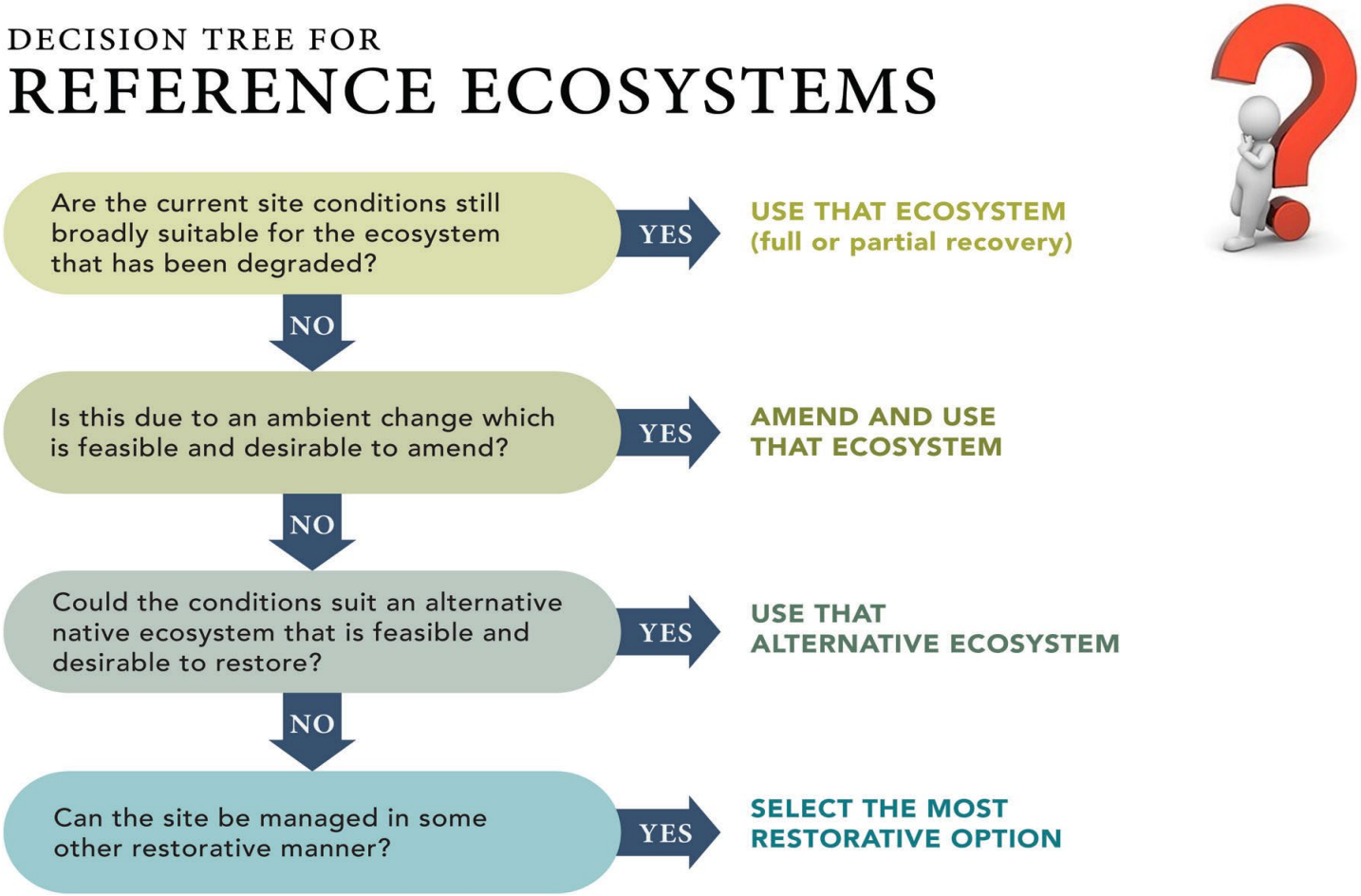


Ecological recovery wheel

Gann, G.D. et al. 2019. International principles and standards for the practice of ecological restoration. Second edition. Restoration Ecology. 27: pp. S1-S46.

Les decisions a seguir a les restauracions

Cap a on tirar? Quina és la referència?

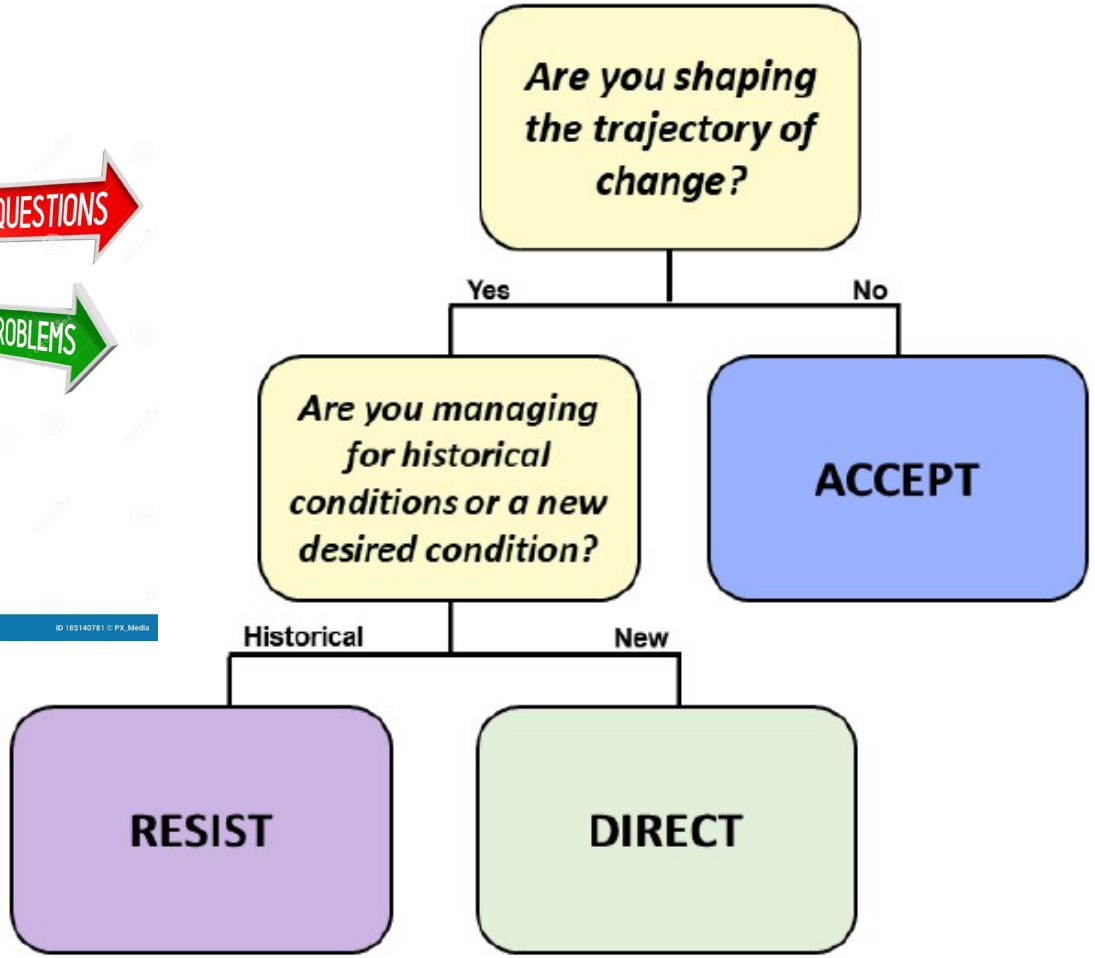


Gann, G.D. et al. 2019. International principles and standards for the practice of ecological restoration. Second edition. Restoration Ecology. 27: pp. S1-S46.

Cap a on tirar? Quina és la referència?...
En un Món en transició, en canvi continu

Image by robinsonk26 at Pixabay

La restauració i la conservació ha de moure's sortejant els canvis



Gregor W. Schuurman et al 2020. Natural Resource Report NPS/NRSS/CCRP/NRR—2020/2213

Alteració dels serveis ecosistèmics en el temps i en l'espai

Hem de canviar d'hàbits i maneres de fer...

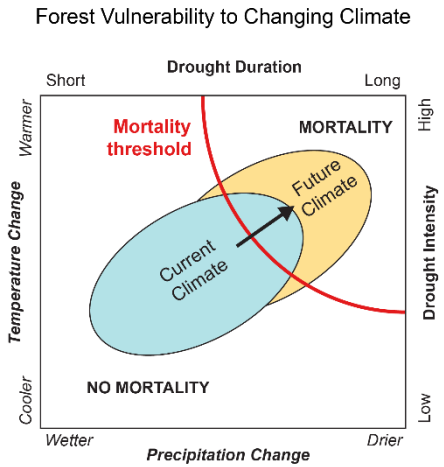
Què proposem als gestors?

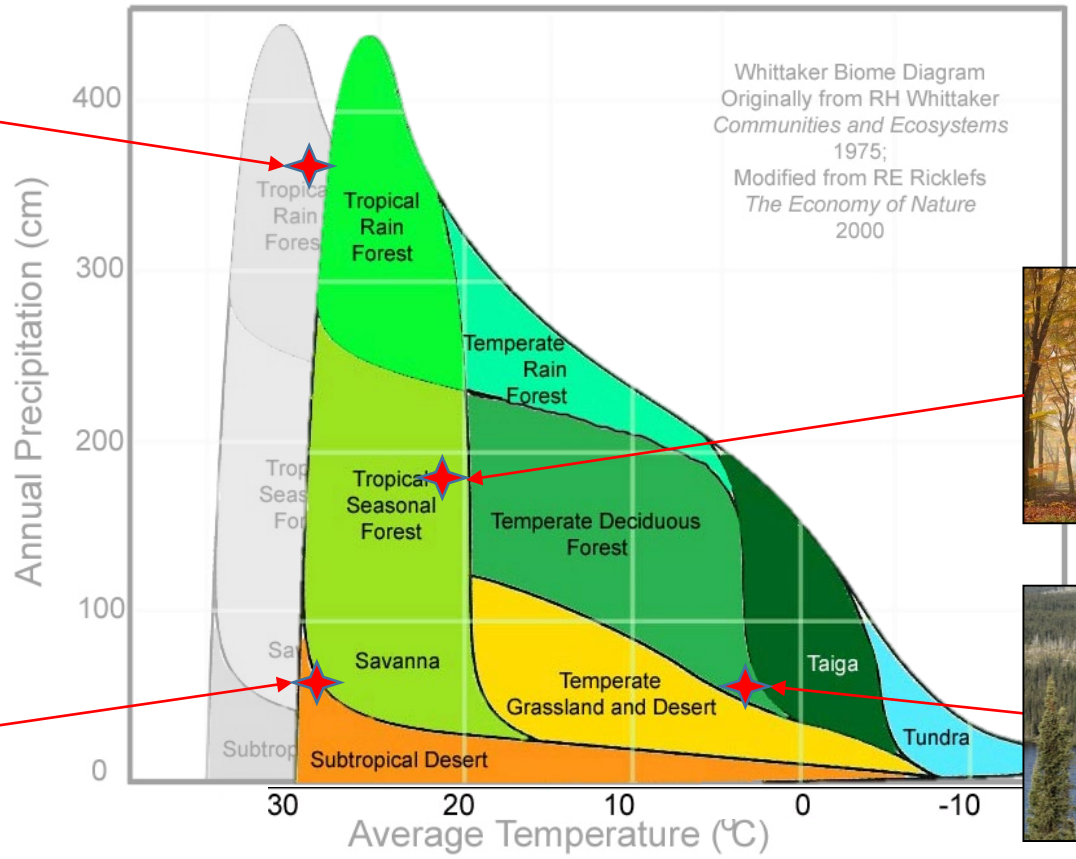
Provisió de fusta

Sumitomo Forestry Corporation

La distribució dels Ecosistemes està modulada pel clima

Un clima que està canviant ràpidament





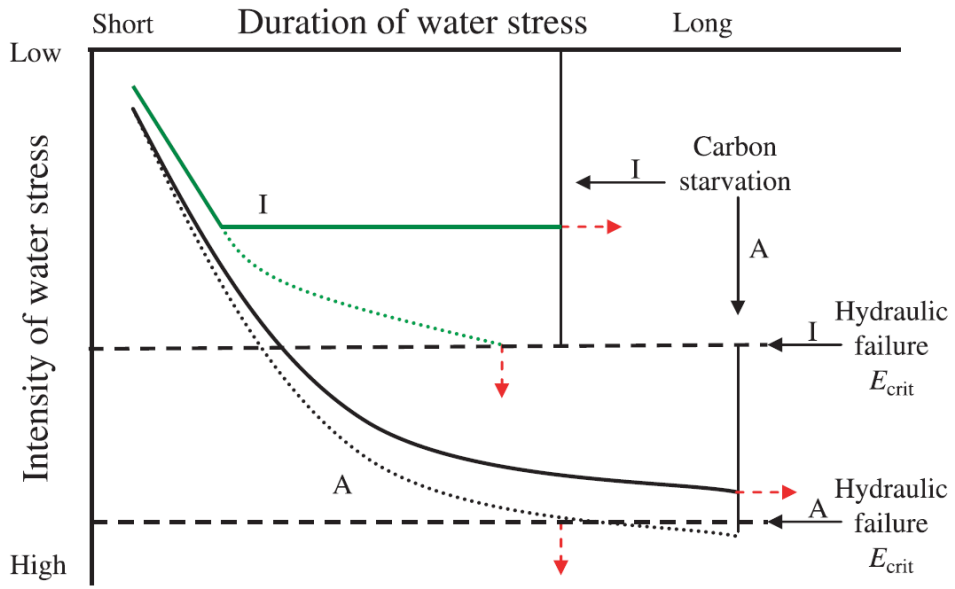
Forest Vulnerability to Changing Climate. (Repport of Climate Change Impact in the United States. 2014 National Climate Assessment, produced in collaboration with the U.S. Global Change Research Program).

Les plantes han de transpirar per fixar carboni i sobreviure... No totes funcionen igual.

Entre la sed i la fam

- Duració de l'estrès hídric +

+ Intensitat de l'estrès hídric -



McDowell *et al.* (*New Phyt*, 2008)

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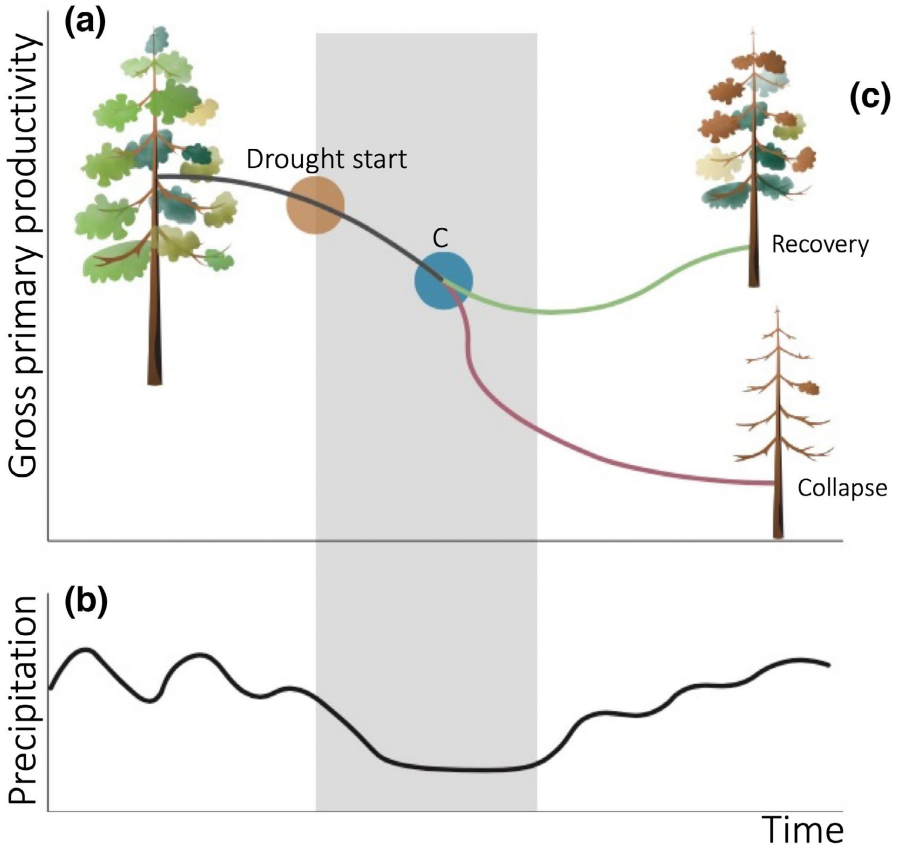
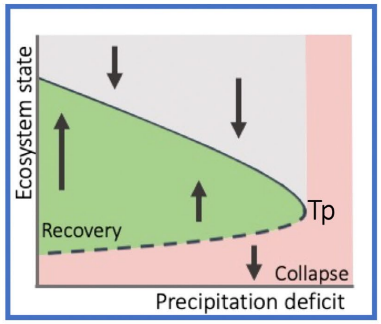




Annual-GPP- constrained models can detect drought-induced GPP collapse

Potential consequences of drought on the state of a forest ecosystem. (a) GPP decreases in a healthy forest ecosystem (black line) during (b) sustained drought. Depending on the resilience of the ecosystem, ecosystem GPP recovers under pre-drought Precipitation levels (green line) or ecosystem GPP falls below the point of recovery and the ecosystem collapses despite precipitation conditions improving (red line).

J. Au et al. 2023 Glob Change Biol. 2023;00:1–14.

Identificar les **condicions favorables** i **desfavorables**, i com van canviant per **optimitzar la captura de CO_2** però sobretot **l'èxit de la restauració**

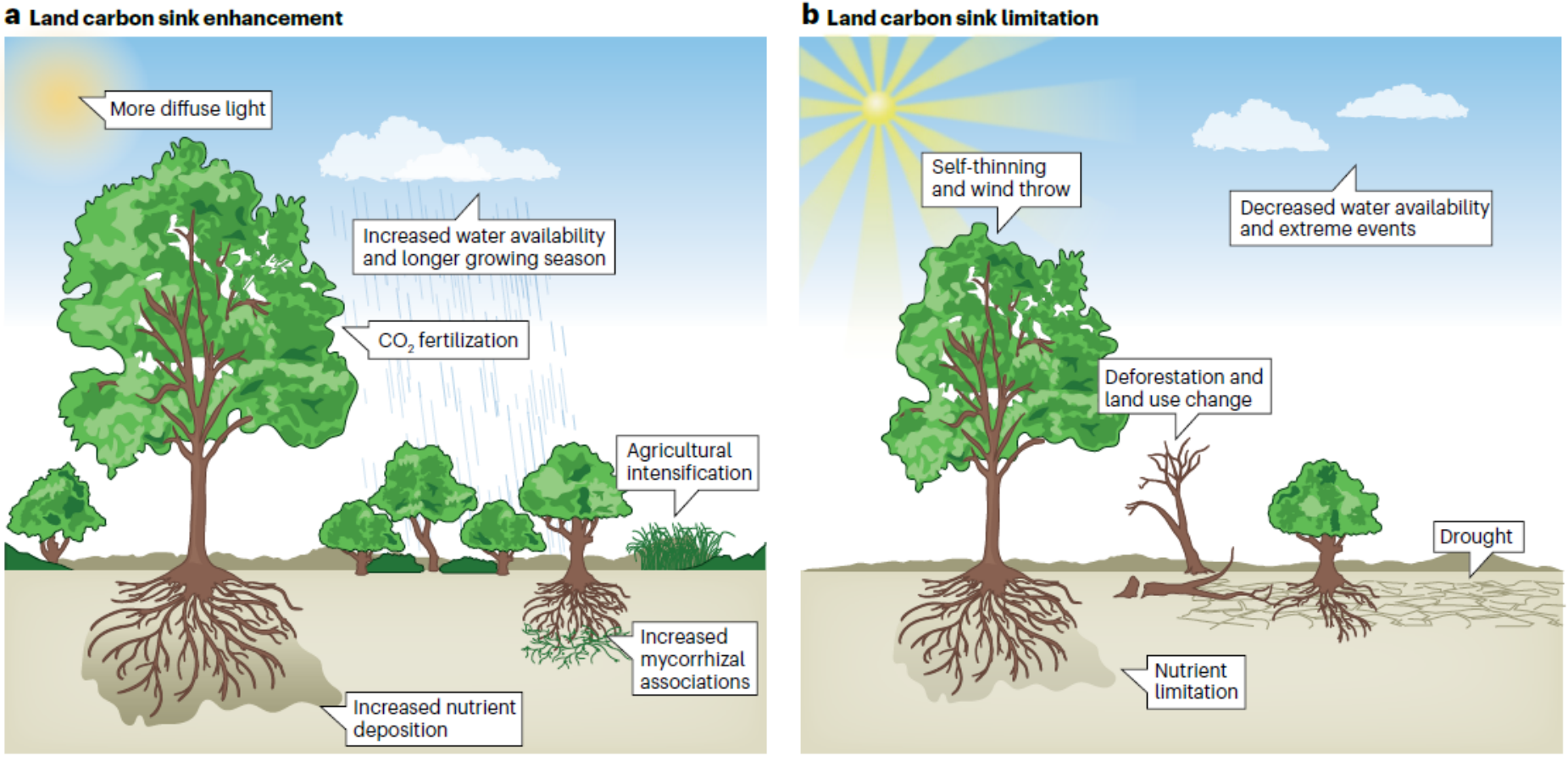
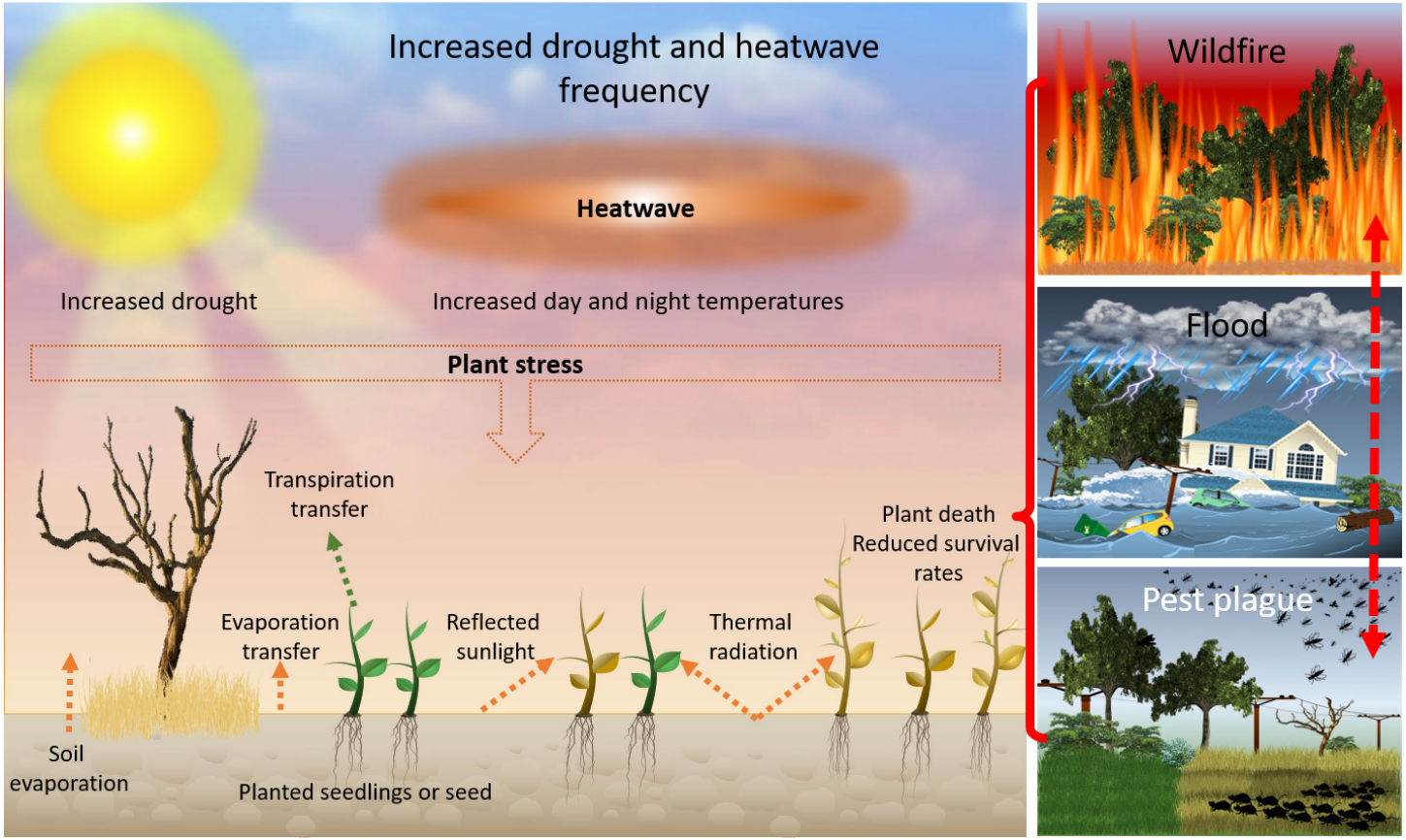


Fig. 3 | Changes to the land carbon sink. a, Schematic representation of the processes enhancing the land carbon sink by stimulating biomass growth and supporting either larger trees or more individuals. **b**, The processes limiting the net land carbon sink by supporting fewer, smaller individuals. The past, present and future of the sink are determined by the combined result of enhancing and limiting processes.

Sophie Ruehr et al. 2023 *Nature Reviews Earth & Environment* **volume 4**, pages 518–534

El repte de les múltiples pertorbacions que compliquen la restauració ecològica, i amb el que hem de conviure

Planificació i disseny!

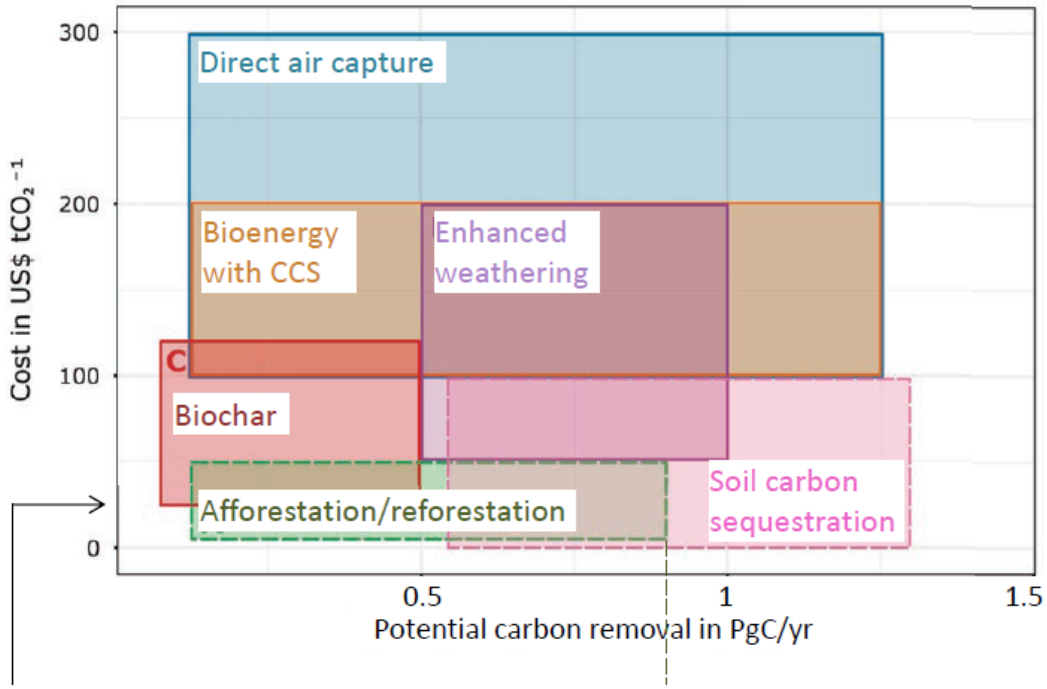


Multi-hazard resilience, with the heightened likelihood of extreme events such as **droughts, heatwaves, wildfires, floods, and pest plagues**, which drive ecosystem stress, creates an increasing **need for adaptable restoration planning and design**.

Lauren N. Svejcar et al. 2023 Glob Change Biol. 2023;00:1–5.

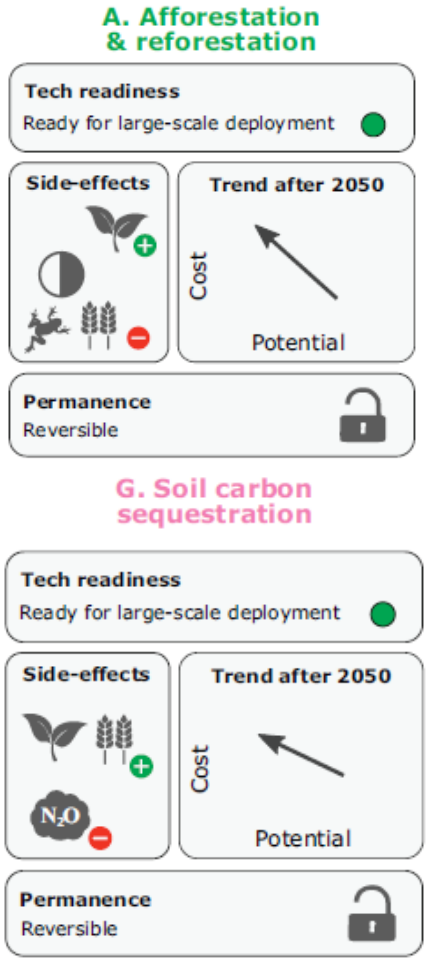
Com retirar CO_2 atmosfèric per mitigar les emissions?

TOPICAL REVIEW: **Minx_2018_Environ._Res._Lett._13_063001**
Negative emissions—Part 1: Research landscape and synthesis



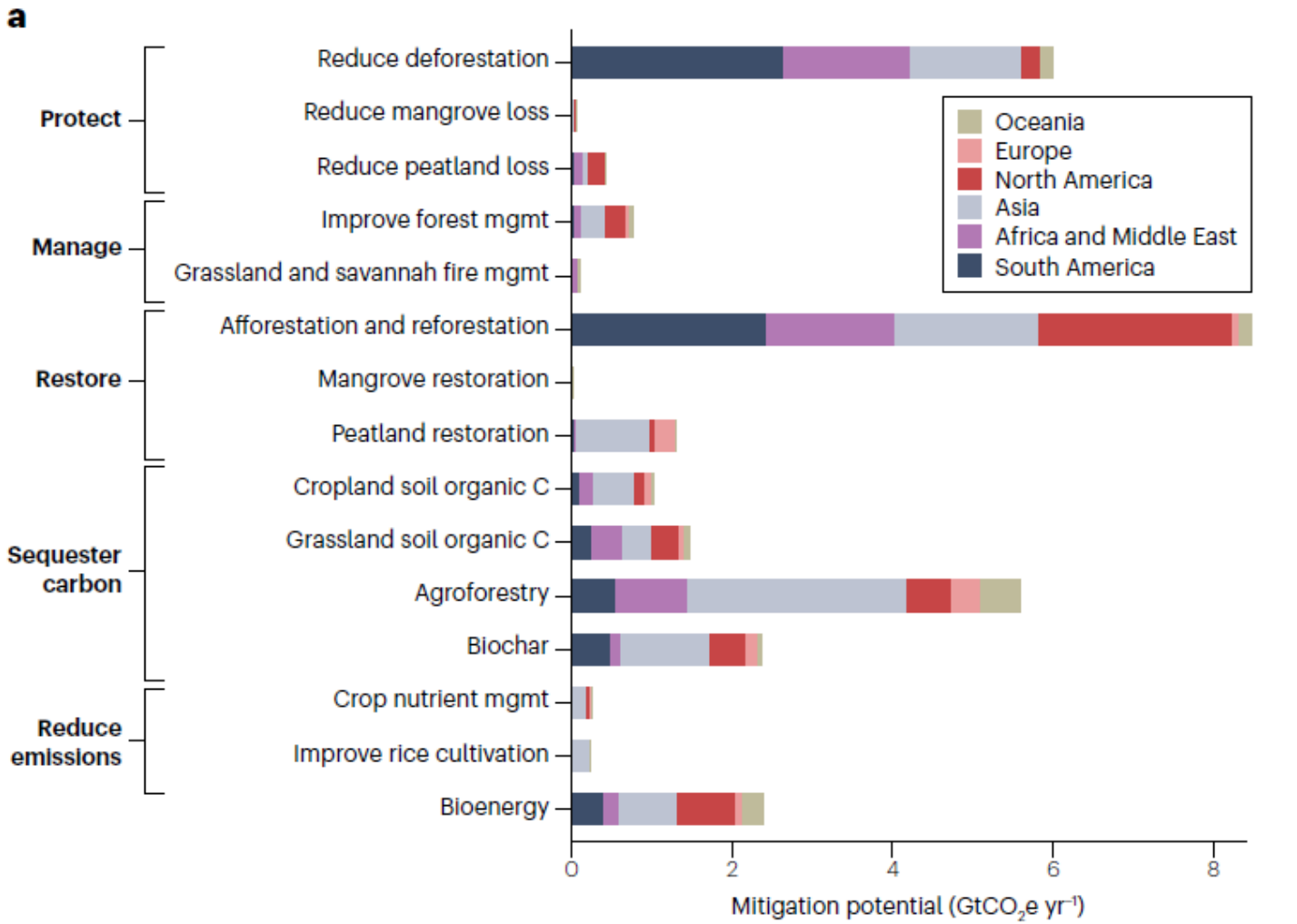
current price for compensation:
~$25 / tCO_2

Until 2100: ~80 PgC
(<10a current emissions)



Nature-Based-Solutions!

Diferents opcions potencials per la mitigació de les emissions de CO_2



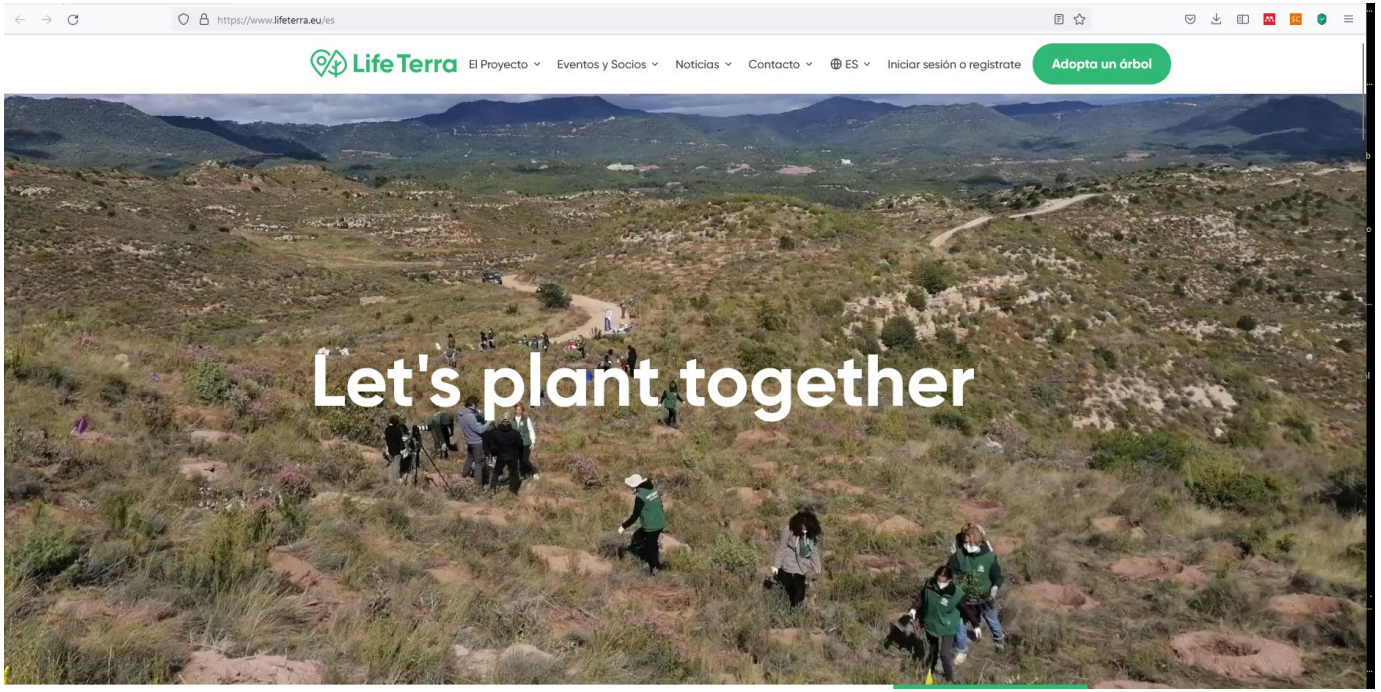
Carbon emission mitigation potential on land. a, Carbon mitigation potential of nature based climate solutions (NbCSs) by geographical area. Labels on the *y* axis denote various strategies, grouped into broader categories (for example, protecting existing carbon resources vs. restoring previously degraded resources)

Sophie Ruehr et al. 2023 *Nature Reviews Earth & Environment* **volume 4**, pages 518–534

Què estem fent de recerca per entendre i proposar solucions als reptes del Canvi Global?

5 exemples propis

- **Life Terra.** Europe's single biggest citizen-driven initiative to plant an monitor 500 million trees to mitigate climate Change. https://www.lifeterra.eu/es



Context per projectes de restauració com Life Terra

- La **necessitat urgent d'actuar** front del Canvi Climàtic i en general Canvi Global
- **La captura de CO_2** pot ajudar a mitigar les emissions però **no és suficient**
- **La restauració** de terres degradades promou la recuperació i el manteniment de **serveis ecosistèmics**
- **Ciència i tecnologia** han de treballar per proporcionar solucions però **per ser efectives han d'involucrar a la ciutadania.**
- Hi ha una relació **ineludible** entre el **benestar de la Societat** i la salut de la **Natura. Una sola Salut.**
- 2021-2030 La dècada de la **restauració dels Ecosistemes**

- Es necessiten **accions extensives**, **però ULL! Actuar apropiadament** es clau para obtenir **resultats positius**.
- **Life Terra** es un Projecte de **restauració a escala Europea** que planteja la plantació de **500 milions d'arbres fins el 2025**.

Ten golden rules for reforestation to optimize carbon sequestration, biodiversity recovery and livelihood benefits

Sacco et al *Glob Change Biol.* 2021;27:1328–1348.

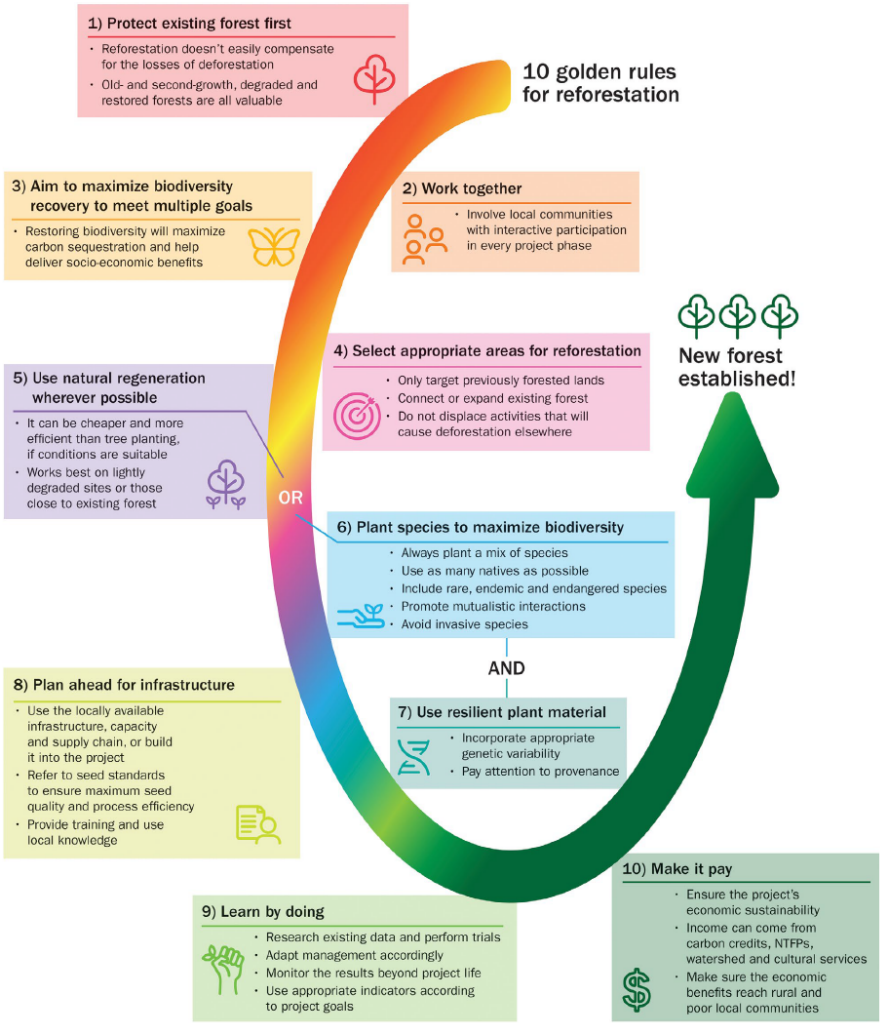


FIGURE 2 Ten golden rules for a successful reforestation project. The order of the rules matches the order in which tasks should be considered during project planning and implementation, although some are interdependent and should be considered in parallel. See text for details

1) Protect existing forest first

- Reforestation doesn't easily compensate for the losses of deforestation
- Old- and second-growth, degraded and restored forests are all valuable

2) Work together

- Involve local communities with interactive participation in every project phase

3) Aim to maximize biodiversity recovery to meet multiple goals

- Restoring biodiversity will maximize carbon sequestration and help deliver socio-economic benefits

4) Select appropriate areas for reforestation

- Only target previously forested lands
- Connect or expand existing forest
- Do not displace activities that will cause deforestation elsewhere

Ten golden rules for reforestation to optimize carbon sequestration, biodiversity recovery and livelihood benefits

Sacco et al *Glob Change Biol.* 2021;27:1328–1348.

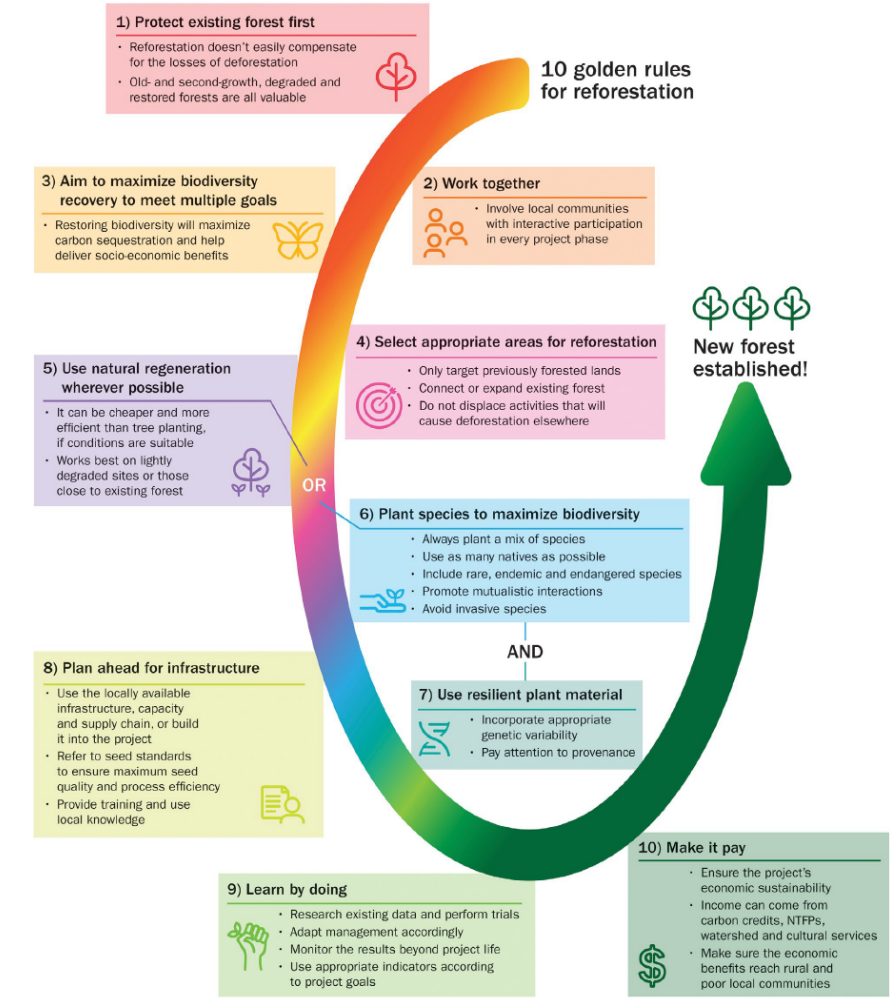


FIGURE 2 Ten golden rules for a successful reforestation project. The order of the rules matches the order in which tasks should be considered during project planning and implementation, although some are interdependent and should be considered in parallel. See text for details

5) Use natural regeneration wherever possible

- It can be cheaper and more efficient than tree planting, if conditions are suitable
- Works best on lightly degraded sites or those close to existing forest

OR

6) Plant species to maximize biodiversity

- Always plant a mix of species
- Use as many natives as possible
- Include rare, endemic and endangered species
- Promote mutualistic interactions
- Avoid invasive species

AND

7) Use resilient plant material

- Incorporate appropriate genetic variability
- Pay attention to provenance

Ten golden rules for reforestation to optimize carbon sequestration, biodiversity recovery and livelihood benefits

Sacco et al *Glob Change Biol.* 2021;27:1328–1348.

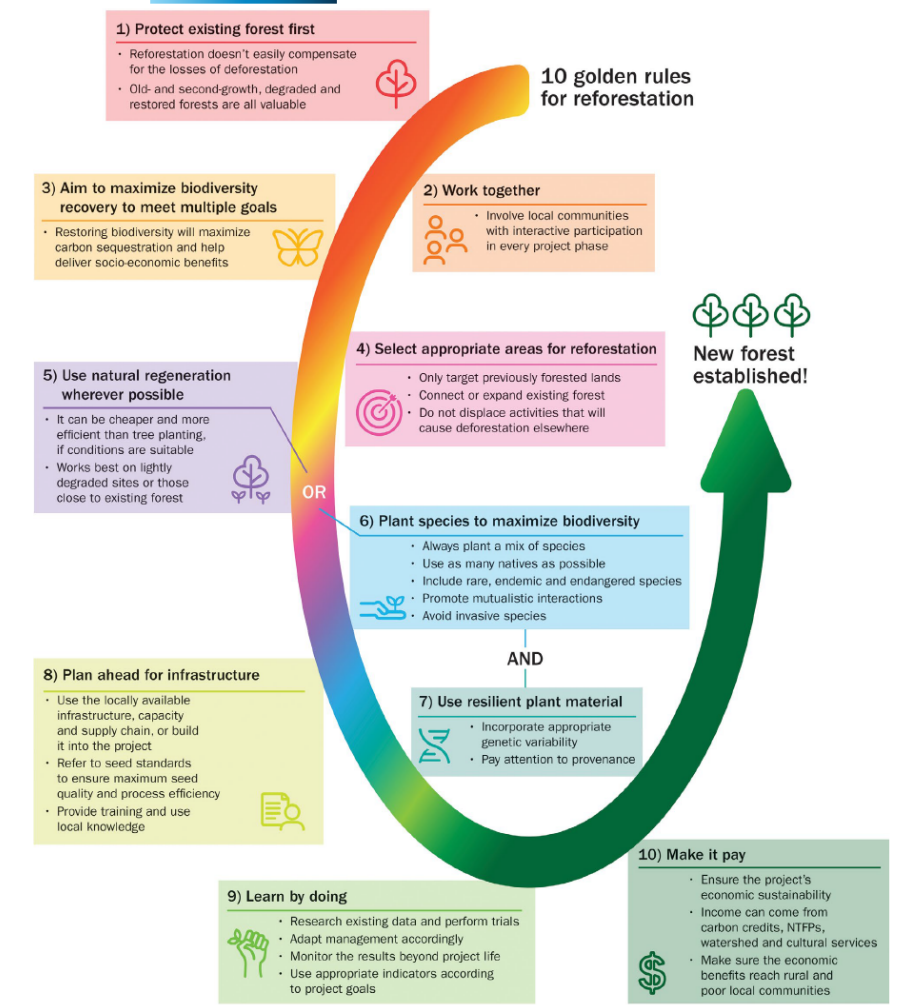


FIGURE 2 Ten golden rules for a successful reforestation project. The order of the rules matches the order in which tasks should be considered during project planning and implementation, although some are interdependent and should be considered in parallel. See text for details

8) Plan ahead for infrastructure

- Use the locally available infrastructure, capacity and supply chain, or build it into the project
- Refer to seed standards to ensure maximum seed quality and process efficiency
- Provide training and use local knowledge

9) Learn by doing

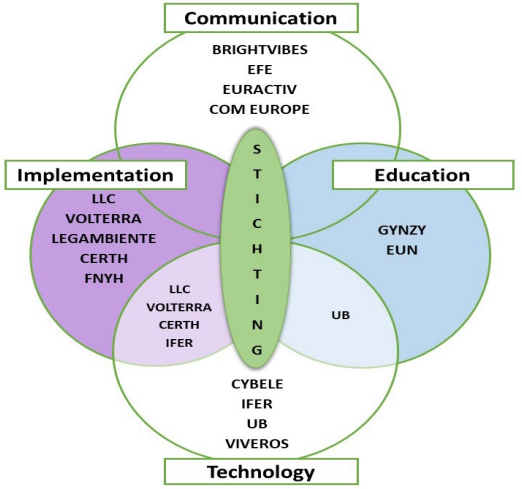
- Research existing data and perform trials
- Adapt management accordingly
- Monitor the results beyond project life
- Use appropriate indicators according to project goals

10) Make it pay

- Ensure the project's economic sustainability
- Income can come from carbon credits, NTFPs, watershed and cultural services
- Make sure the economic benefits reach rural and poor local communities

Principis i reptes de Life Terra

- **Transparència** – Eines per mesurar, quantificar i visibilitzar les iniciatives de plantació realitzades.
- **Biodiversitat** – Plantacions multi-específiques. Combinar las especies apropiades a cada de plantació.
- **L'arbre apropiat al lloc correcte** – Aproximació ecosistémica. No plantar a qualsevol lloc.
- **Els arbres no son suficients** – Influir para canviar les maneres de viure i de consum. Reduir emissions.
- **Coneixement** – Entendre para actuar. Eines i coneixement per les noves generacions.
- **Sostenibilitat** – compromís dels propietaris a llarg termini per mantenir en el tiemps el potencial de captura de $CO_{2.}$
- **Contractació amb criteris ecològics** – Proveïdors: organitzacions amb objetius ambientals i socials a més dels financers.



Els detalls són importants. Vestits a mida!

Allasia S. 2023. Implementation and monitoring of a reforestation project tin semi-arid northeastern Spain. Master thesis. Univ. Barcelona.

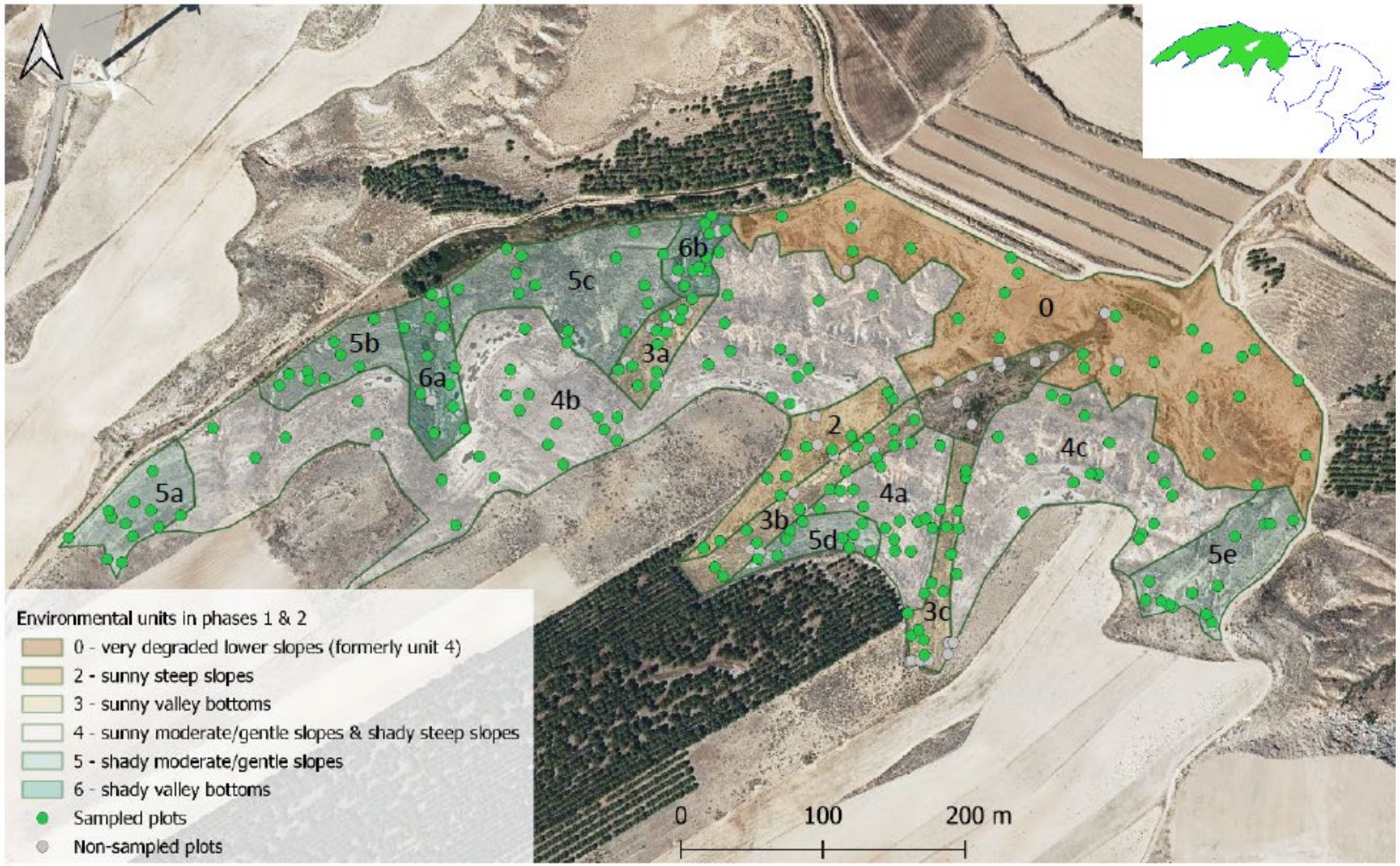


Figure 2. Map showing the environmental units and subunits in phases 1 and 2. The total planted area is around 14 hectares. The spared wetland area is not identical to the one in Figure 1 because it was redrawn according to field observations.

Què fem de recerca per entendre i proposar solucions als reptes del Canvi Global?

- **RiparianEcoRest** Developing Nature-Based-Solutions for Riparian Ecosystems restauration. From knowledge to practice set 2023-2027

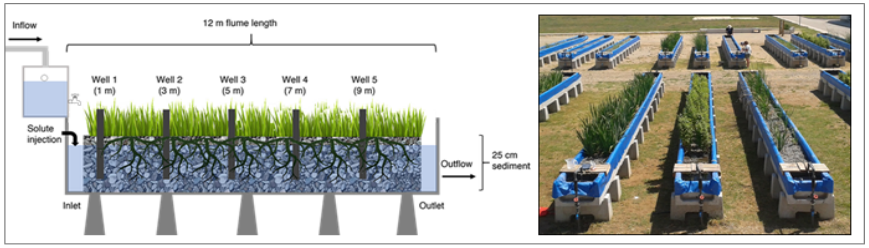


Figure 4. On the left, a scheme of a vegetated flume at the **Urban River Lab experimental platform**. This drawing shows the five PVC wells to collect the subsurface water through the substrate along the flume. On the right, panoramic picture of the flumes, which are fed with WWTP effluent of Montornès del Vallès (NE Barcelona)

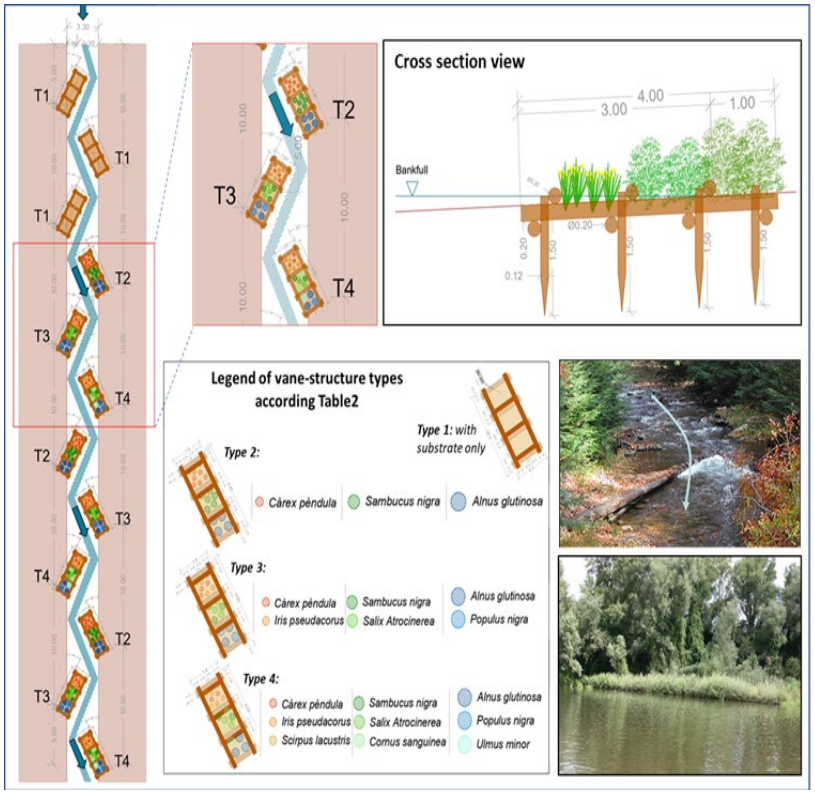
WP1: Experimental Essays in Urban River Lab (URL).

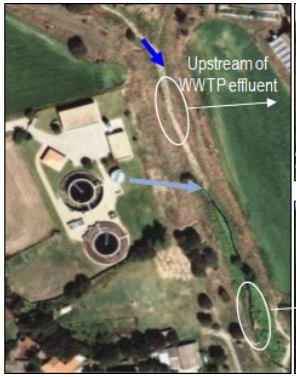
Què fem de recerca per entendre i proposar solucions als reptes del Canvi Global?

- **RiparianEcoRest** Developing Nature-Based-Solutions for Riparian Ecosystems restauration. From knowledge to practice set 2023-2027

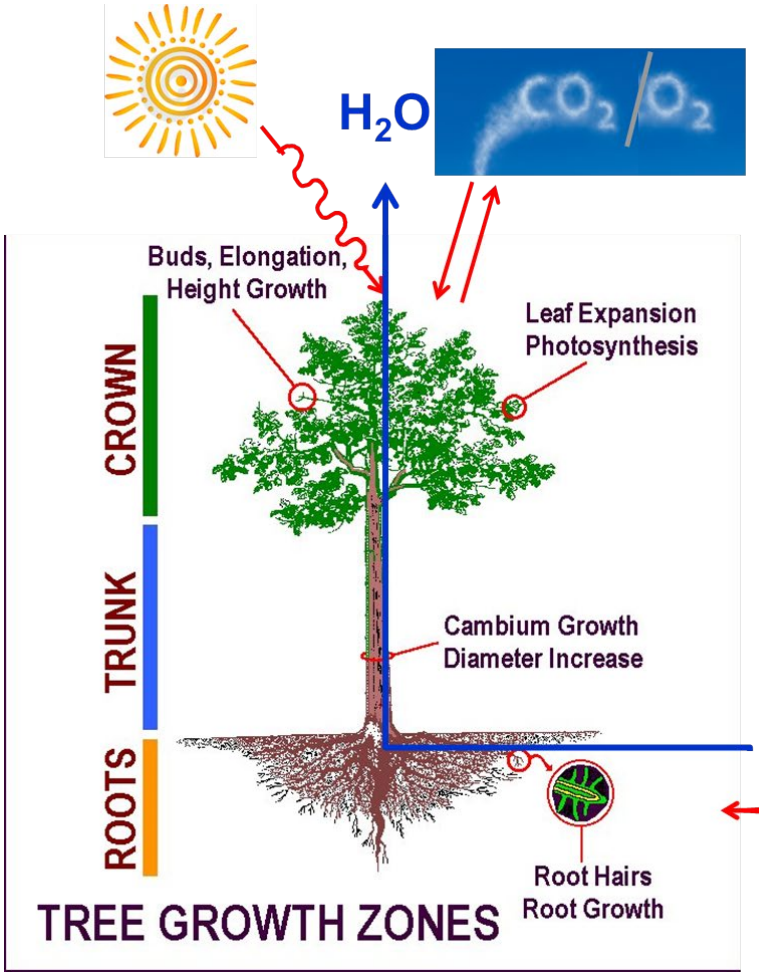
WP2. Pilot Restoration implementation applying Nature-Based Solutions.

Riera de Vallserena (St Antoni de Vilamajor)





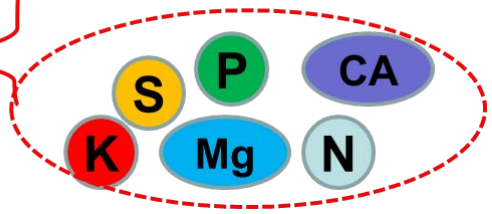
Treballem amb models per explorar processos i descriure com la natura respon a les condicions ambientals



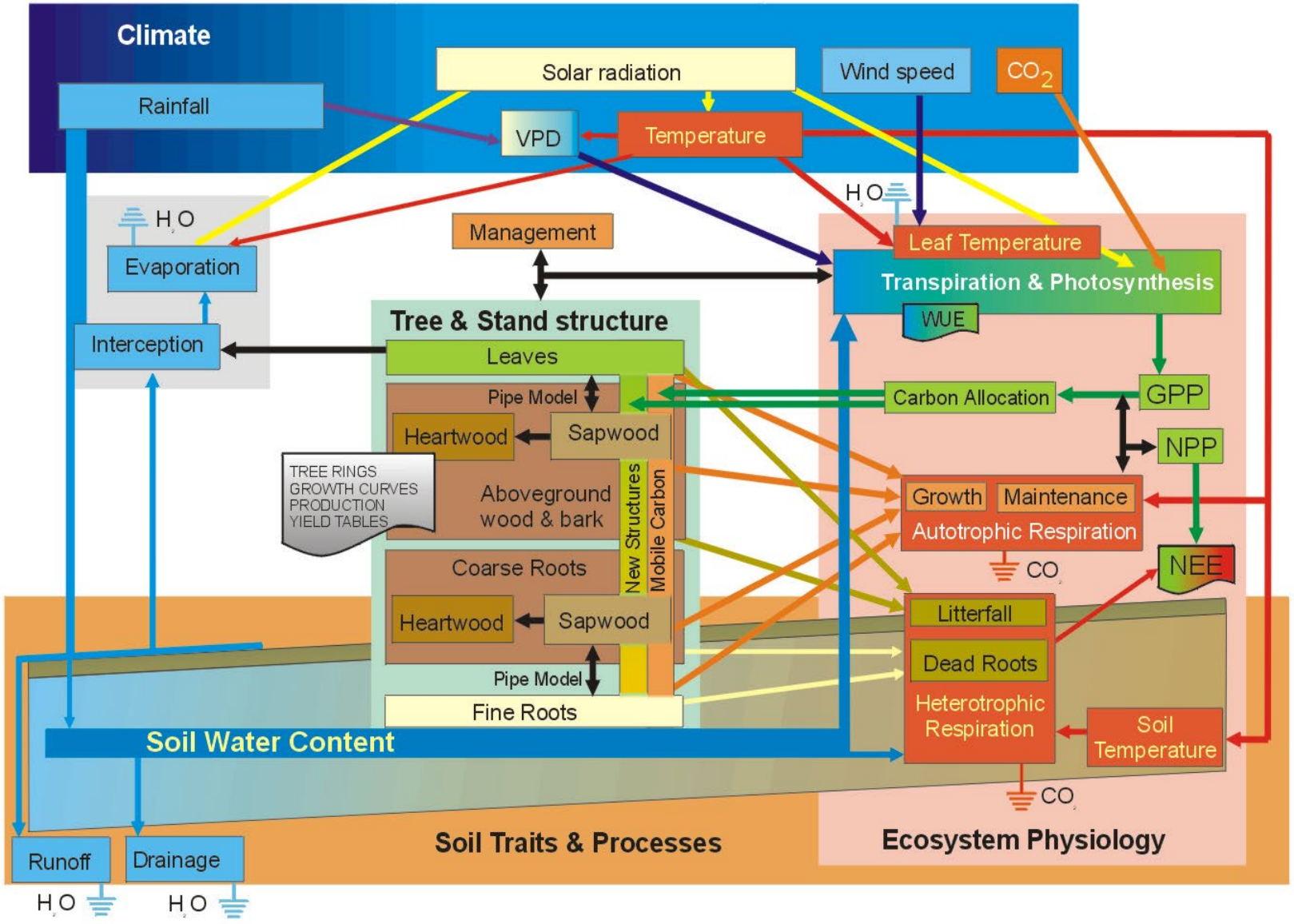
Fotosíntesis

Transpiració

Respiració



Treballem amb models per explorar processos i descriure com la natura respon a les condicions ambientals. **Ex. GOTILWA+**



Eines per planificar i optimitzar les actuacions de restauració amb criteris i objectius múltiples (conservació de la biodiversitat, mitigació del canvi climàtic, minimitzar costos, ...)

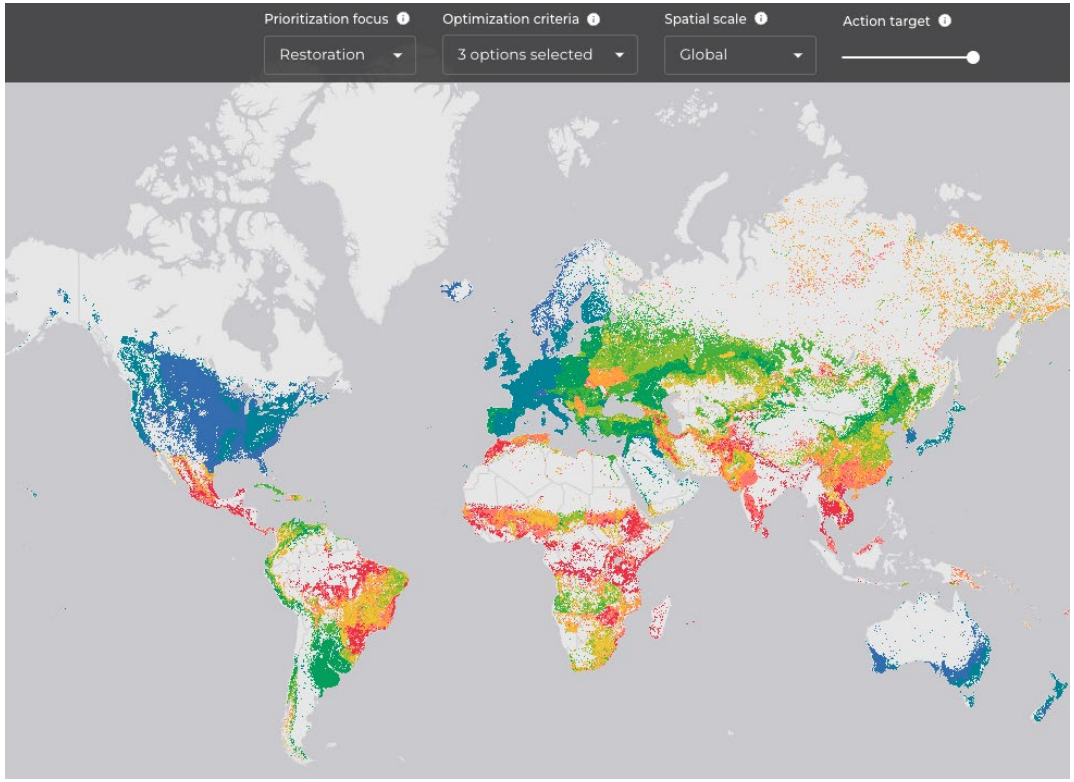
PLANGEA: Strategic Land Use Planning

PLANGEA

multi-criteria approach to optimize the spatial planning of ecosystem restoration, conservation and conversion actions

PLANGEA

https://map.plangea.earth/



Ep! Però també cal deixar espais on els humans no en siguem els protagonistes.

No cal que siguem a tot arreu!

"Els reptes de la Restauració Ecològica en una Biosfera Canviant"

Deures ineludibles:

- Frenar un Canvi Global que degrada
- Restaurar preparant-nos pels canvis
- Connectar coneixement i societat.
- Desenvolupar eines i projectes per explorar opcions front els reptes, dificultats i riscos de la restauració ecològica.

Moltes gràcies!