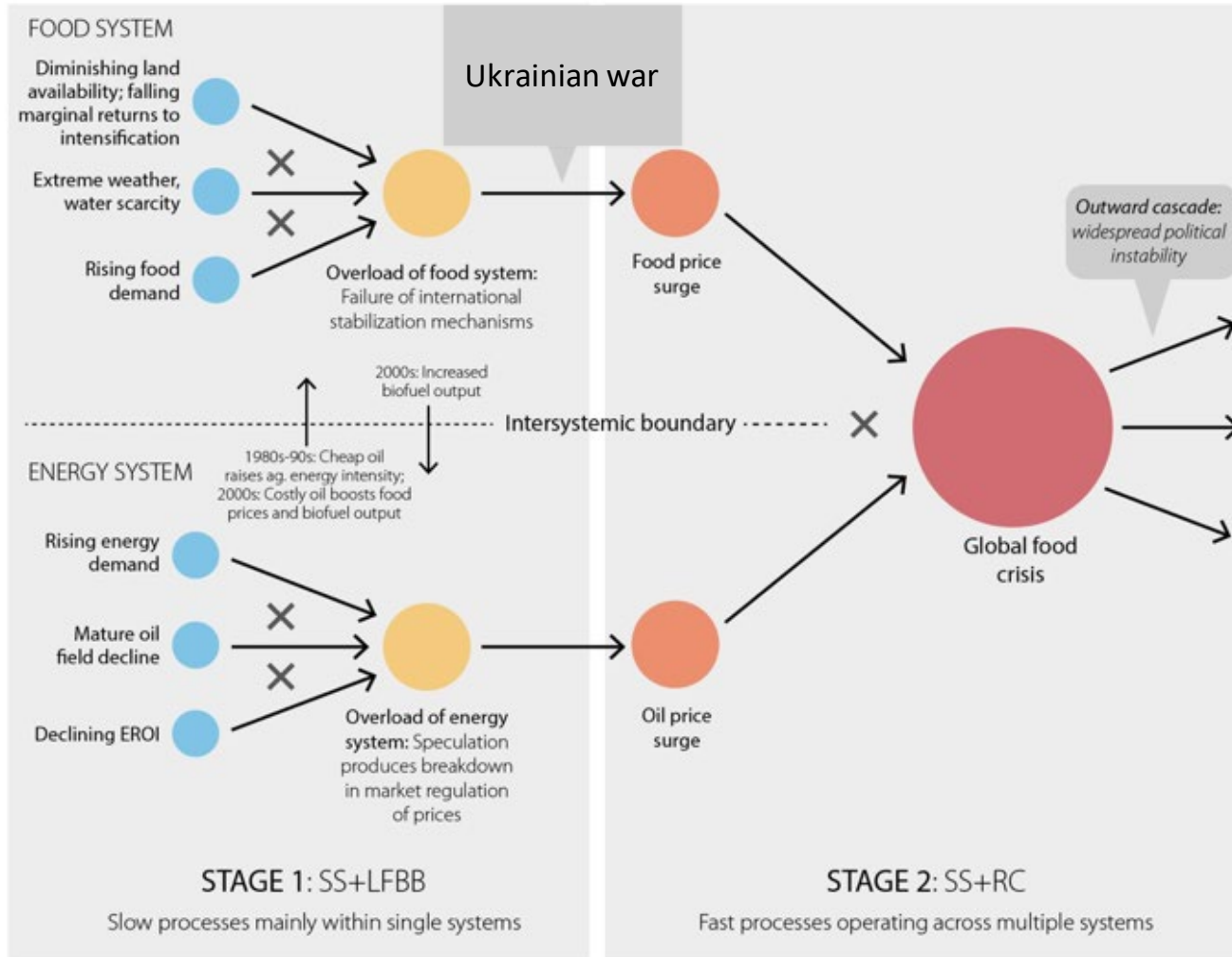


Regenerative agriculture in Europe



A critical analysis of contributions to European Union
Farm to Fork and Biodiversity Strategies

The world in a state of Polycrisis?



food security

inflation

social, political
instability

Alternatives to
mineral fertilizers
(nutrient cycling,
legumes, etc)

Alternatives to
fossil fuel
(biogas, EVs, etc)

(modified after Homer-Dixon et al. 2015)

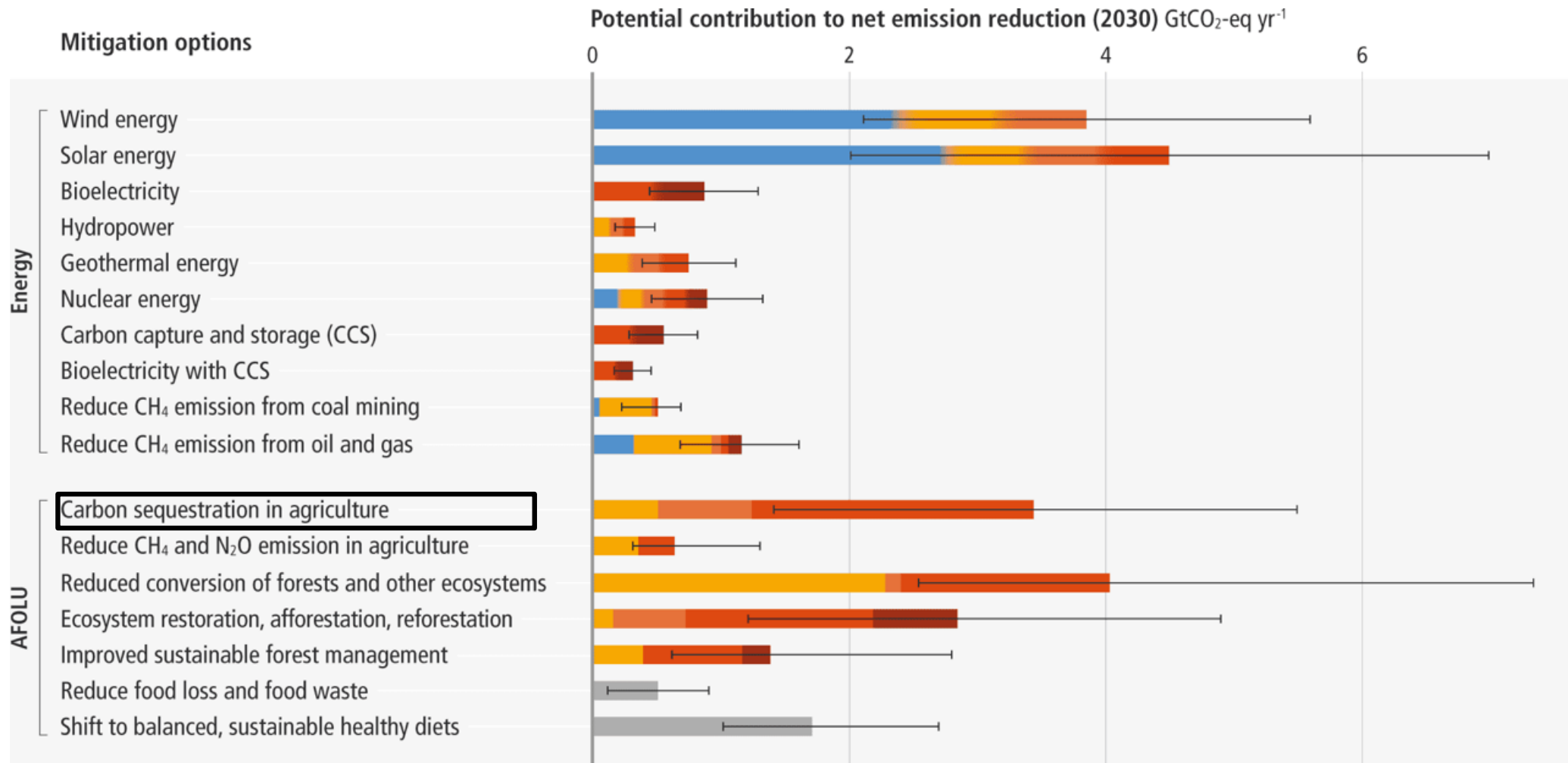
What is Regenerative Agriculture?

Aims to **maintain agricultural productivity**, **increase biodiversity**, in particular restore and maintain soil biodiversity, and enhance ecosystem services including **carbon capture and storage**.

Despite gaining increasing international interest - a critical scientific evaluation of objectives and assumptions had yet to be made

Source: Oberč and Arroyo Schnell 2020

The role of the agricultural landscape in carbon capture and storage



Source: IPCC April 2022

Practices associated with Regenerative agriculture

Farming practice	Suggested for carbon capture and storage	Suggested for biodiversity
Conversion of arable land to grassland	X	X
Grassland management (to capture carbon)	X	X
Woodland (wood pastures; silvo-pasture)	X	X
Native tree plantations on arable land	X	(X)
Agroforestry	X	X
Hedgerows, woody buffer strips, farmland trees	X	X
Improved crop rotations	X	
Crop diversity in rotations	X	X
Crop diversity - intercropping	X	(X)
Crop diversity - in sown/relay cropping	X	(X)
Minimise tillage: reduced, minimum or no tillage	X	X
Cover crops	X	
Retaining crop residues/Leaving crop residues on soil surface	X	
Organic amendments	X	(X)
Biochar	X	
Perennial crops	X	
Avoid insecticides, fungicides and herbicides	(X)	X
Field borders, etc. for beneficial insects (mainly pollinators and natural enemies to pests)	(X)	X
Flower strips (pollinators)		X
Buffer strips (often mandated for environmental/erosion reason)	(X)	(X)
Herbal keys and summer fallows in crop rotations		X
Natural and semi-natural habitats		X
Landscape mosaics in space and time	(X)	X
Switch from large- to small-scale landscape patterns, e.g. decreased field size	(X)	X
Supporting transitional habitats, reducing sharp boundary structures		X

36 meta-analyses and systematic reviews

250 empirical studies

EASAC Recommendations

Policy environment

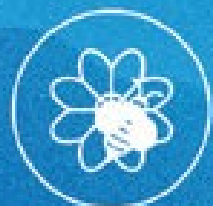
- Biodiversity Strategy
- Farm to Fork Strategy
- Common Agricultural Policy



Maintain agricultural productivity

Evolving toolbox

- Sustainable innovations e.g. nutrient cycling, pest control
- Diversification of agricultural practices in space and time



Restore biodiversity and soil health

Enhance carbon capture and storage



Farm scale

- < Diversification within and among crops
- < Introduction of permanent and perennial crops
- < Expanded agroforestry and intercropping
- < Keeping green plant cover on farm fields during all seasons
- < Reduced tillage

Synergies

Landscape scale

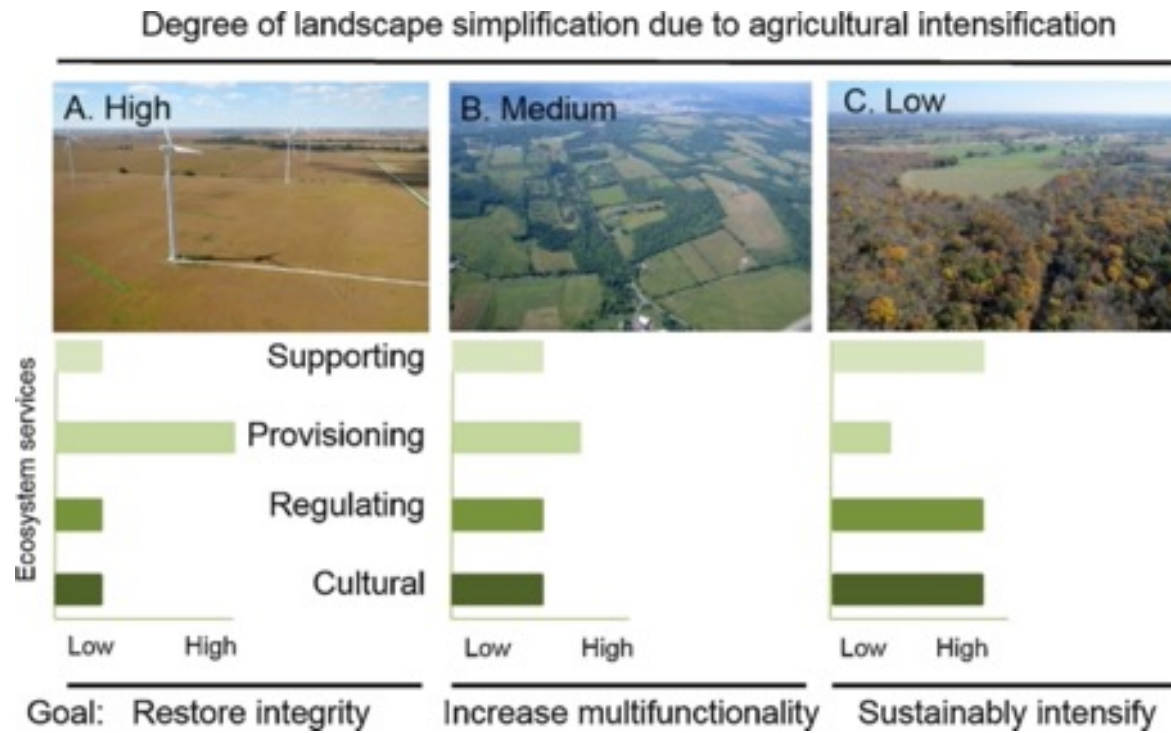


- > Restoration in the agricultural landscape
- > Maintenance of existing semi-natural habitats
- > Connecting high-diversity landscape features
- > Development of green infrastructure
- > Increasing landscape and management heterogeneity

The Importance of the Landscape Scale

- Multifunctional agricultural landscape: several non-provisioning ecosystem services and functions
- Site-scale benefits of diversification: upscaled at the landscape scale
- Scientific basis of landscape-scale diversification in landscape ecology, restoration ecology
- Global restoration ambitions of the UN Decade on Ecosystem Restoration

The Importance of the Landscape Scale



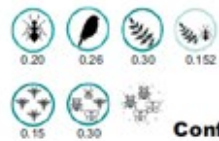
Source: Landis 2017 BAAE

The Importance of the Landscape Scale

Diversifying cropland



Reducing field sizes



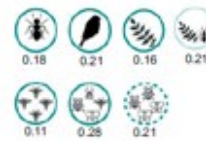
Configuration***



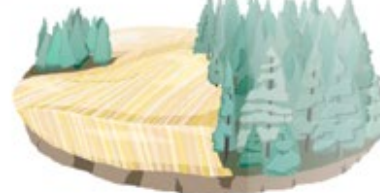
Heterogeneity*



Maintaining and restoring non-crop habitats



Composition***



Landscape complexity dimensions

Heterogeneity

Provides high quality, year-round resources in dynamic landscapes (e.g. diverse land-uses with varied flowering seasons)



LU/Crop diversity (5 metrics)
LU/Crop evenness (5 metrics)

Composition

Maintains biodiversity-species pool (e.g. landscapes with remnant patches of forest)



Non-crop areas (25 metrics)
Seminatural areas (15 metrics)

Configuration

Sustains populations and recolonization. (e.g. fields separated by multispecies live-fences)



Aggregation (2 metrics)
Proximity (8 metrics)
Connectivity (15 metrics)

The Importance of the Landscape Scale

- Develop schemes that support **better coordination of management practices** that simultaneously enhance biodiversity and carbon capture and reduce net GHG emissions at the landscape/regional scales
- Stimulate schemes that benefit not only individual farmers but also **cooperation within communities and groups of farmers**, for example within the framework of National Rural Development Programmes
- Promote **sustainable innovations** for rural–urban - rural cycles of nutrients
- Adapt and develop **meaningful indicators** that can be easily measurable over large spatial scales, such as field size or the extent of high-diversity landscape features
- **Result-based indicators** instead of activity-based ones, **adaptive management**

The Biodiversity Strategy

10% of agriculturally utilized area covered by high-diversity landscape features by 2030

- Importance of maintaining the existing ones and restoring new HDLFs as **part of an existing habitat network**
- Spatial prioritization and zoning: AES are the most effective in landscapes with existing semi-natural habitats; support for diversification in **simple landscapes**



The Biodiversity Strategy

25% of all croplands under organic farming cultivation by 2030

- Important to **critically evaluate** whether organic farming or conventional farming with landscape diversification is more effective and cost-effective from the viewpoint of crop production and the maintenance of biodiversity
- It is evident that **organic intensification** diminishes the positive effects of organic management of arable land
- Our literature review suggests that allocating resource to the **diversification and restoration of semi-natural habitats in conventionally farmed agricultural landscapes** would be at least equally important for biodiversity as prioritising organic agriculture.

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Science Advice for the Benefit of Europe

Thank you for your attention!

The Report is available at:

<https://easac.eu/publications/details/regenerative-agriculture-in-europe/>