EARA European Alliance for Regenerative Agriculture

2024
Policy Paper

Towards a farmer-centric CAP rooted in agroecosystem health

Facilitating the transformation of EU agrifood ecosystems

About the European Alliance for Regenerative Agriculture

The European Alliance for Regenerative Agriculture (EARA) is an independent, farmer-led coordination and political advocacy organisation of the movement of regenerative agriculture at the European level. EARA is striving to enable the transformation of our agrifood ecosystems through accountable ecologic, economic and social regeneration.

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Disclaimer

The work underpinning this Policy Paper was commissioned and stewarded by the Founding Farmers of the European Alliance for Regenerative Agriculture, to bring the voices of regeneration practitioners and pioneers into the heart of the political discourses on the transformation of Europe's agrifood ecosystems. The work was executed by EARA's Operations Team (Alliance Builder Natascha Schwarzkopf, Community Care and Facilitator Ana Digón, Student Intern Virginia Tarditi and Policy Steward Simon Kraemer) together with the strong support and experienced input of a number of experts and pioneering farmers.

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Our deep gratitude and hope lie with the great evolving, adaptive and resilient land steward movement around the world that already has a reflexive focus and has invested its efforts in the regeneration of the health of ecosystems and rural communities - the fundamental conditions of the health of our planet and all its inhabitants.

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Executive summary

In this policy paper, EARA presents a proposal for reshaping the EU Common Agricultural Policy (CAP) post 2027 towards a farmer-centric and performance-based approach that is rooted in the health of our agroecosystems.
The paper particularly develops integrative and inclusive perspectives and arguments that are seldomly pointed out in other policy documents, but are present in all farmer and industry discourses across Europe. This is done not because we underappreciate the successes of past CAP governance or the work of the people involved, but because we want to build a better mutual and pragmatic understanding of the tasks and potentials ahead.

In Part I, we reflect on the CAP's importance to Europe's social, economic and environmental development, as well as its current legal basis. The current social and scientific evidence on agricultural, environmental, health, food system and security governance in Europe is appalling. Key trends continue to go in the wrong direction and show no sign of turnaround. A structural reform of the CAP is urgently necessary to face the polycrises in agrifood systems in Europe.

In Part II, we set out premises for a successful agrifood system transformation in the form of agro-economic, -sociological and -ecological working theses. New understandings in the sciences of ecology and agronomy, such as the critical importance of the (evapo)transpiration of water by living plants, go hand in hand with a farmer-led revolution of agricultural praxis that lifts the productivity of 'farming with nature' on a new level. This opens the way for an exciting and promising leap in agricultural and governance innovation at a time when it is critically needed.

In Part III, we sketch the ***design of simple, fair and performance-based payments*** **as the core of a structural reform of the CAP post 2027**. Context-specific photosynthesis and soil protection performance are the key indicators of agricultural land use management. Such payments allow for a long-term governance perspective that is centred around farmer and agroecosystem health. We describe in detail the technological, financial, governance and political aspects of a future CAP design anchored in such payments.

With a switch to fair and simple hectare-based direct payments coupled to agro-ecological performance, the CAP can decrease farmer dependency on external inputs and increase on-farm climate change resiliency. Anchored in result-based payments for agroecosystem health, such a farmer-empowering CAP design aims to foster simplification and planning security with a long-term perspective in the agricultural sector.

A fair and simple performance-based CAP can deliver:

- structural simplification & fairness
- rapid spreading of context-specific innovation
- farm labour attractiveness
- synergistic integration of productivity & ecology
- an immense co-financing opportunity of Member States for climate change adaptation
- meaningful public reengagement with rural livelihoods, farmer wellbeing, local regions, landscapes and communities
- healthy and sustainable food security in Europe and beyond
- the strengthening of social cohesion and European sovereignty
- a rerooting of the European project in the health of our European continent and its inhabitants

Only with farmer and agroecosystem health at its centre, a CAP reform holds significant potentials for facilitating the necessary leap in transformational governance - to enable the urgently needed regeneration of our agrifood ecosystems and create a chance to positively re-engage with our communities, our regions, our nations and our European continent for peace and economic stability, on a planet supporting life.

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Introduction

With this policy paper, EARA lays out a detailed and systematic policy proposal for a structural reform of the EU's Common Agricultural Policy (CAP). **Drawing upon views and experiences from across the agrifood system, the proposed reform holds critical potential to disrupt current political and economic path dependencies**, in order to incubate[1] the socio-economic and -ecological regeneration of EU agrifood ecosystems[2].

This paper has been developed in careful awareness of many policy papers and opinions on the next CAP or its context, such as for example those of OECD, FAO, IEEP, IDDRI, IIED, SAPEA, EEB, FAIRR, ECA, EEA, CEJA, IFOAM/EFA & COPA-COGECA and many others[3]. In essence, the goal of the paper is to describe the hereto **undescribed synergistic and coalescing discourse-space between them**.

The overall aim of the policy paper is a holistic yet practical discussion of the next evolutionary step of the CAP towards being performance-based.

While 'performance-, result- or outcome-based'[4] has become a new catchword in the agricultural policy discourse[5], little work has gone into actually doing the nitty-gritty work of programming such policy (or their proposals) in **a holistic yet farmer-centric and simple way that is cost-efficient, fair and effective**. Questions about indicators to be measured, the structure of payments design, the monitoring, reporting and verification (MRV) process to be used, etc. remain open. EARA, led by pioneering farmers, is taking on exactly this work.

The core argument

By switching to fair and simple hectare-based direct payments coupled to agro-ecological performance, the CAP can decrease farmer dependency on external inputs. It can also increase on-farm climate change resilience in a positive engagement with farmer livelihoods and food security.
In this context, we discuss related questions on the CAP in general, such as the challenges and benefits of smallholder farms, generational succession on farms, sustainable total factor productivity[6] of the agrifood system, trade and legal aspects.

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[1] Current policy discourses use 'catalyse' instead of 'incubate'. But to catalyse stems from a mechanical metaphor and is hence unfit for purpose to describe interference in a living system. In science, incubation is a process of development. The word is derived from the Latin incubate, 'to hatch'. A hen sits on her eggs, warming them beneath her so they will be able to hatch, meaning maintaining something at the most favourable conditions for its development - that is understood as the process of incubation.
[2] By differentially using 'agrifood ecosystem' and 'agrifood system' we want to signify where and when ecology, especially also from an economic perspective, is or is not properly taken into account.
[3] OECD. Policies for the Future of Farming and Food in the European Union. (LINK);
IEEP (2023). Transforming EU land use and the CAP: a post-2024 vision. (LINK); IDDRI. (2023). Should we (already) be thinking about the next reform of the Common Agricultural Policy?. (LINK); IIED. (2023). Tackling environmental challenges through food systems governance. (LINK);
SAPEA. (2021). A sustainable food system for the European Union. (LINK);
EEB. (2023). A brighter future for EU food and farming. (LINK);
FAIRR. (2023). G20 Agricultural Subsidies Investor Statement. (LINK);
ECA. (2023). Special report 23/2023: Restructuring and planting vineyards in the EU. (LINK);
EEA. (2022). Rethinking agriculture. (LINK);
CEJA. (2023). INI Report on generational renewal: a positive vote to open a wider reflection on young farmers in the EU. (LINK);
Häusling, M. (2023). Standpunkt zur EU-Agrarpolitik (GAP) ab 2028 Martin Häusling, MdEP. (LINK); COPA-COGECA. (2023). Brochure : Initial reflections on the post-2027 CAP. (LINK)
[4] We understand 'performance-based' as the broader term incorporating both results and outcomes as well as absolute and relative performance. Results and outcomes are differentiated by the time and conclusiveness of the underlying observation (i.e. result = YOY development of NPP; outcome = several year development of soil health)(absolute = X amount in X time; relative = X % change in YOY).
[5] OECD. Policies for the Future of Farming and Food in the European Union. (LINK); FAIRR. (2023). G20 Agricultural Subsidies Investor Statement. (LINK);
[6] We want to caution about the undifferentiated goal of sustainable total factor productivity, as many social and ecological factors are not accounted for. For example, high-value rural and farmer livelihoods, rather than just an undifferentiated assessment of farm income, needs to be a core goal of the CAP.

We outline a structural yet politically feasible CAP reform that leverages the experience of diverse pioneering farmers from across varying European agroecosystems and economic contexts. These farmers act as guiding stewards for advancing the economic, social and ecological trajectory of all farmers and their land. The proposed reform has the **potential to bring the youth back to farming, and leverages fairness and innovation in the agricultural sector for a future-proof food security**, as well as **value-based and vibrant rural livelihoods in Europe and beyond**. It lies at the heart of any attempts towards a genuine EU Common Food Policy or the like. It is embedded in a **policy narrative designed to foster systemic cohesion** between the stakeholders in the policy arena influencing and deciding the next CAP reform.

Structure of the document

The document sets out to build consensus and confidence in a pragmatic analysis of the converging challenges we all face. More importantly, it aims to build a shared understanding of the synergies and agencies we have at hand to overcome these challenges. It outlines how synergies and agencies can be fostered by a structural, farmer- and agroecosystem health-centred CAP reform.

Thereto, the document particularly develops integrative and inclusive perspectives and arguments that are seldom pointed out in other policy documents, but are present in all farmer and industry discourses across Europe. This is done, not because we underappreciate the successes of past CAP governance or the work of the people involved, but because we want to build a better mutual and pragmatic understanding of the tasks and potentials ahead.

Part I is a reflection of the CAP's importance to Europe's social, economic and environmental development as well as its current legal basis. The current scientific evidence on agricultural, environmental, health, food system and security governance in Europe, including the social factors of agricultural transformation, are reflected in this context.

In Part II, the document presents premises for a successful agrifood system transformation in the form of agro-economic, -sociological and -ecological working theses deduced from the evidence presented in Part I. In Part III we sketch the ***design of simple, just, transparent and long-term farmer and agroecosystem health centred performance-based payments as the basis of the next CAP***. This sketch is contextualised in the technological, financial, governance and political aspects of a future CAP design anchored in such payments.

We close by outlining why a **structural CAP reform with farmer and agroecosystem health at its centre, holds significant and urgently needed potentials for facilitating the necessary leap in transformational governance**. A leap necessary for reversing the plurality of devastating trends locking each other-in and accelerating in the EU's agrifood system and abroad, today.

This paper is not exhaustive. The developed arguments are designed to facilitate more cohesion among the narratives of the stakeholders in the policy discourse. The arguments welcome critical reflections and are open for improvements. The paper is envisioned as a fertile soil from which to grow support and refinement.

Part I: Reflections on the status quo of Europe's agrifood system and the role of the CAP

Before laying out in detail what interventions we propose to effectively leverage the agencies and synergies we have at hand, a reflection on the current dynamics and trends in Europe's agrifood ecosystems serves to frame and build a shared understanding of the difficult task ahead. Thereon we reflect on the role and relevance of the CAP in that task.

1.1 The dynamics of our current agrifood system

In order to derive a comprehensive policy design for a structural CAP reform that enables the CAP to live up to its objectives in the 21st century, a holistic analysis of the current global and EU agrifood system dynamics is needed.

The EU agrifood system has evolved over the last decades as an intrinsic part of a global agrifood system that is governed along core agro-economic indicators, such as standard output, total factor productivity, comparative advantage and gross value added. Maximising these indicators, whose conceptual assumptions have very **limited whole-system scope, has come at a high price of hidden costs and invaluable losses.**

The interests of key stakeholders have been neglected by funding and financial streams in the current system, springing from and reinforced by reductionist research efforts driven by ill-guided market influences. Examples range all the way from conventional agronomic theories and models to soil monitoring systems that i.e. measure few chemical and sometimes physical parameters but disregard a wide range of biological parameters that are essential to soil and crop health. **The dominance of short-term profit orientation in the current market environment fosters predatory and unfair competition**, driven by ego-centric worldviews as well as rapid vertical and horizontal market and power concentration. **Current market structures are thus contributing massively to ecosystem degradation[7] and social fragmentation**[8].

Scientific research states that our current global agrifood system

- is the greatest cause of the degradation of our planetary health by economic sector[9].
- is the primary driver of biodiversity loss[10].
- is the greatest emitter of greenhouse gases by economic sector[11].
- has severely impacted on freshwater resources and their availability[12].
- fails to give access to sufficient and healthy food for all[13].

[7] Mighty Earth. Cargill: The Worst Company In the World. (LINK)
[8] Wikipedia. Dutch farmers' protests. (LINK)
[9] Campbell, B. M., Beare, D. J., Bennett, E. M., Hall-Spencer, J. M., Ingram, J. S., Jaramillo, F., ... & Shindell, D. (2017). Agriculture production as a major driver of the Earth system exceeding planetary boundaries. Ecology and society, 22(4). (LINK)
[10] UNEP. (2021). Our global food system is the primary driver of biodiversity loss. (LINK)
[11] Crippa, M., Solazzo, E., Guizzardi, D., Monforti-Ferrario, F., Tubiello, F. N., & Leip, A. J. N. F. (2021). Food systems are responsible for a third of global anthropogenic GHG emissions. Nature Food, 2(3), 198-209. (LINK)
[12] Wang-Erlandsson, L., Tobian, A., van der Ent, R. J., Fetzer, I., te Wierik, S., Porkka, M., ... & Rockström, J. (2022). A planetary boundary for green water. Nature Reviews Earth & Environment, 3(6), 380-392. (LINK)
[13] FAO. (2023). The State of Food Security and Nutrition in the World. (LINK)

1.1.1 Fragile Ecological Resilience

It is estimated that one species goes extinct every seven minutes globally. At the same time, most of the biodiversity that lives in soil ecosystems and enables them to function has not yet been described[14]. Similarly, the **functionality of the largest biogeochemical cycle, the cycle of water as most important nutrient of life on earth, has only recently been ecologically comprehended**[15]. This novel understanding of water cycles was translated into a planetary boundary last year – Green Water. Green Water describes terrestrial precipitation, evaporation and soil moisture, and is fundamental to the planet's climate and our agricultural production. Research found that we have **significantly overstepped the planetary boundary of water**[16]. This is largely due to degradative soil use and land use changes. Likewise, the disruptions of the second and third largest biogeochemical cycles, carbon and nitrogen[17], are largely **due to conventional ways of agricultural production, and contribute to climate change and weather extremes in stronger ways than previously estimated**[18].

1.1.2 Volatile agronomic performance

From 2021 to 2022, **all of European agricultural production dropped significantly**. For example, vegetables and horticultural products dropped 6.5% in produced volume 2021-2022[19]. The core reasons identified by the European Commission are crop diseases and droughts. Crop diseases and droughts are largely caused by the ecological impact of the agrifood system itself[20]. Drought is also a main reason why the compound annual growth rate of per hectare production of the main crops in major EU agricultural sectors has come to a standstill in the last 20 years[21]. The impacts of droughts on EU agricultural production continue to intensify[22]. Water-related soil functions, such as water infiltration, storage and percolation, are decisive variables for agricultural production in times when droughts and torrential rains alternate.

Such developments in agricultural performance are **expressed in the deterioration of the EU's primary agricultural trade balance**. Further, the positive value-added trade balance of the EU might be set to fade in the near future under any of the following circumstances:

- EU civil society proceeds with demands for reductions in industrial livestock production as i.e. recently in Denmark
- further EU specific agricultural input price increases appear (e.g. on gasoline, fertiliser, feedstock)
- EU consumption of fruits, nuts and vegetables accelerate to substitute animal products, without a significant increase of EU production of these products[23].

[14] Geisen, S., Wall, D. H., & van der Putten, W. H. (2019). Challenges and opportunities for soil biodiversity in the anthropocene. Current Biology, 29(19), R1036-R1044. (LINK)
[15] Kravčík, M., Pokorný, J., Kohutiar, J., Kováč, M., & Tóth, E. (2009). Water for the recovery of the climate - A new water paradigm. Water Policy 2009, Water as a Vulnerable and Exhaustible Resource. (LINK);
Duncan, D., & Dryden, H. (2022). Climate disruption caused by a decline in marine biodiversity and pollution. International Journal of Environment and Climate Change, 12(11), 3414-3436. (LINK)
[16] Wang-Erlandsson, L., Tobian, A., van der Ent, R. J., Fetzer, I., te Wierik, S., Porkka, M., ... & Rockström, J. (2022). A planetary boundary for green water. Nature Reviews Earth & Environment, 3(6), 380-392. (LINK)
[17] Fowler et al. (2013). The global nitrogen cycle in the twenty-first century. (LINK)
[18] I.e. "Research has revealed that the current methods used to estimate nitrous oxide emissions from nitrogen fertiliser usage may underestimate actual emissions by up to five-fold and fail to identify hotspots." (CGIAR. (2022). IMPROVING ESTIMATION OF NITROUS OXIDE EMISSIONS FROM AGRICULTURE. (LINK))
[19] EUROSTAT. (2023). Economic accounts for agriculture - indices: volume, price, values. (LINK)
[20] Zhang, Y., Yu, G., Yang, J., Wimberly, M. C., Zhang, X., Tao, J., ... & Zhu, J. (2014). Climate-driven global changes in carbon use efficiency. Global Ecology and Biogeography, 23(2), 144-155. (LINK)
[21] NABU. (2023). The Case for Regenerative Agriculture in Germany and Beyond. (LINK)
[22] Kapsambelis, D., Moncoulon, D., Veysseire, M., Soubeyroux, J. M., & Cordier, J. (2022). Modelling the Impact of Extreme Droughts on Agriculture under Current and Future Climate Conditions Using a Spatialized Climatic Index. Applied Sciences, 12(5), 2481. (LINK)
[23] Eurostat. (2023). Extra-EU trade in agricultural goods. (LINK)

1.1.3 Food and health crises

The right to food should serve as the solid and clear framework for the transition to sustainable agrifood systems[24]. **Globally, acute food insecurity has been spiralling since 2015**. Still, the EU remains a net-importer of calories, while over 3 billion people globally cannot afford a healthy diet to date. Additionally, through rising emphasis on 'Food Is Medicine'[25] and the associated costs and health implications of the existing food system[26], the topic of **soil health tied to nutritional outcomes** has only begun to unfold. One of every five deaths across the globe is attributable to a suboptimal diet, more than any other risk factor, including tobacco[27]. Irresponsibly, the EU's main agricultural and food exports are not fit to support healthy diets anywhere[28].

Similarly, more than 8.6% (an increasing figure) of the EU population is unable to afford an adequate meal every second day[29]. Overweight, obesity and diet-related non-communicable diseases (NCDs) are a major public health challenge in Europe[30] - historically co-facilitated by the CAP[31]. It is estimated that the major NCDs cost each EU citizen more than 411€ annually - while the costs of all NCDs together are considered to be much higher and are predicted to continue to rise rapidly[32]. Emerging medical science that associates the **epidemic of NCDs with the destruction of soil microbiomes,** as these feed the microbiomes of plants which in turn feed the microbiomes of animals and of ourselves. In other words, **the destruction of the health of living soil ecosystems has a boomerang effect on our health** of considerable proportions, which are so far seldomly recognized[33].

The recent food price inflation helps to illuminate often unrecognised realities: our food is a 'commodity' very dependent on fossil energy. Further, its **production is largely concentrated in the hands of big corporations and associated interests** - some of which use their market power to the benefit of increasing their exorbitant profits but to the detriment of the CAP's objectives, as well as the detriment of farmers and people in Europe and abroad.[34]

Another, ever more important reason for food price inflation and the affordability of food is given by the European Central Bank:

> *"[…] we estimate that the 2022 summer heat extreme increased food inflation in Europe by 0.67 (0.43-0.93) percentage-points and that future warming projected for 2035 would amplify the impacts of such extremes by 50%."*[35]

The EU Commission reflected on the recent developments, stating that "the current crisis lays bare the dependency of the EU food system on imported inputs, such as fossil fuels, fertiliser, feed and raw

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[24] A. Magalí et al. (2023). The Right to Food for a Just Transition Towards Sustainable Food Systems: How the right to food can underpin and guide the European Commission's work on a legislative Framework for Sustainable Food Systems (FSFS). (LINK).
[25] Food as medicine: translating the evidence. (2023). Nat Med 29, 753–754. (LINK)
[26] FAO. (2023). The State of Food and Agriculture 2023. (LINK); World Economic Forum. (2021). Achieving Societal Resilience: The Nutrition Opportunity. (LINK)
[27] Downer et al. (2020). Food is medicine: actions to integrate food and nutrition into healthcare. (LINK)
[28] Willet et al. (2019). Food in the Anthropocene: the EAT–Lancet Commission on healthy diets from sustainable food systems. (LINK)
[29] Eurostat. (2022). 8.6% of people in the EU are unable to afford a proper meal. (LINK)
[30] JPI-HDHL Policy Evaluation Network. (2021). The Healthy Food Environment Policy Index (Food-EPI): European Union. An assessment of EU-level policies influencing food environments and priority actions to create healthy food environments in the EU. (LINK)
[31] James McEldowney. (2020). EU agricultural policy and health EPRS | European Parliamentary Research Service. (LINK)
[32] European Commission. (2021). Cost of Non-Communicable Diseases in the EU. (LINK);
European Commission. (2022). Healthier Together EU Non-Communicable Diseases Initiative. (LINK)
[33] Banerjee, S., & van der Heijden, M. G. (2023). Soil microbiomes and one health. Nature Reviews Microbiology, 21(1), 6-20. (LINK); Plaza-Diaz, J. (2020). Nutrition, microbiota and noncommunicable diseases. Nutrients, 12(7), 1971. (LINK)
[34] Lighthouse Reports. (2022). The Hunger Profiteershttps. (LINK);
Allianz. (2023). European food inflation – hungry for profits? (LINK);
MATTHEWS, A. (2023). Food price situation in Europe. Studies in Agricultural Economics, 125(2). (LINK);
ZEF. (2022). Speculation risks in food commodity markets in the context of the 2022 price spikes - Implications for policy. (LINK)
[35] ECB. (2023). The impact of global warming on inflation: averages, seasonality and extremes. (LINK)

materials, **confirming the necessity of a fundamental reorientation of EU agriculture and EU food systems toward sustainability**, in line with the Green Deal and the reformed CAP [...]"[36].

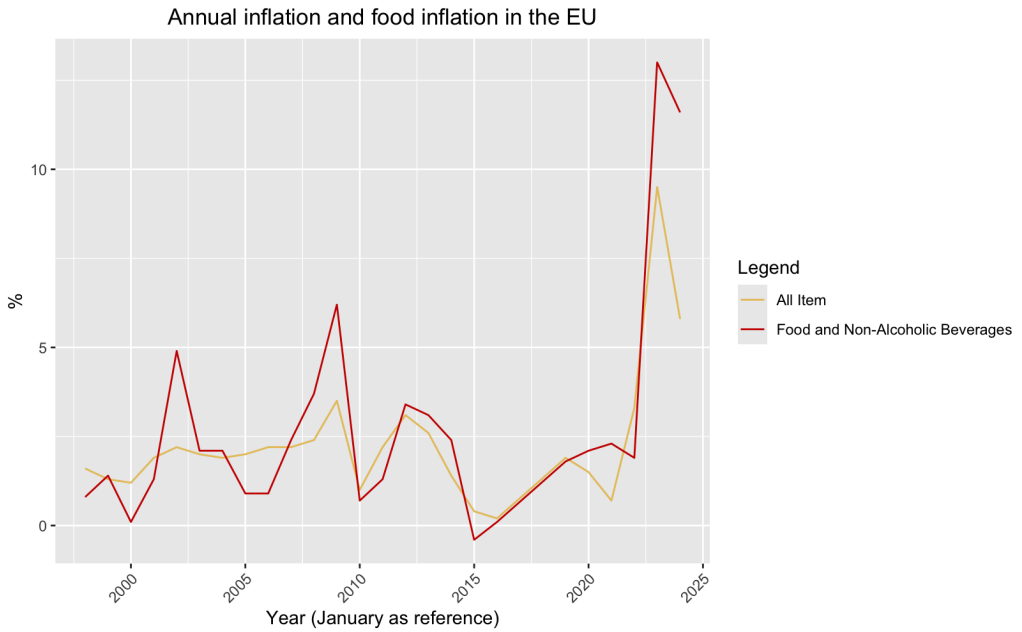

Figure 1: Annual inflation and food inflation in the EU (January 1997 - September 2023)[37]

1.1.4 Governance in disarray

Scientists concluded the **current CAP neither to be in line with the Green Deal nor to be sufficient to enable a genuine and urgently needed holistic sustainability transformation**[38]. Recent analyses on the uptake and impact of CAP eco-schemes strongly support that judgement from an ecological perspective[39]. This judgement weighs even stronger from a social and economic perspective, as expressed by the recent farmer protests.

Matthew et al. (2023)[40] give an overview of the dynamics involved in "[t]he political economy of food system transformation in the European Union". They summarise the governance dilemma as follows:

> *"The biggest obstacle to change is the tension between the economic and environmental dimensions of sustainability, reflected both in the concerns of the farming community over the potential negative impact on their income, and the concerns of consumers and governments around higher food prices".*

[36] EUR-LEX. (2022). COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE EUROPEAN COUNCIL, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Safeguarding food security and reinforcing the resilience of food systems. (LINK)
[37] Eurostat. (2024). (LINK)
[38] Candel, J. J., Lakner, S., & Pe'er, G. (2021). Europe's reformed agricultural policy disappoints. Nature, 595(7869), 650-650. (LINK)
[39] Meister, NABU. (2023). Analysis on eco-schemes across the EU. (LINK)
[40] Matthews, A., Candel, J., de Mûelenaere, N., & Scheelbeek, P. (2023). The Political Economy of Food System Transformation in the European Union. In The Political Economy of Food System Transformation: Pathways to Progress in a Polarised World (p. 311). Oxford University Press. (LINK)

The prevailing policy-making narratives employed over the last years to address the deeply interlinked crises have **resulted in a political stalemate, that is hindering the transformative shift towards sustainability and resilience**[41]. Those competing narratives are:

- in agriculture: Sustainable Intensification, Organic Agriculture, Agroecology, Conservation Agriculture and Nature Conservation
- in market & trade: Productivist, Globalist, One Health[42] and Food Sovereignty

The existing agrifood system governance can be understood as a **result of these competing narratives producing an incoherent governance mosaic**, in trying to do due diligence on the different demands brought forward by the stakeholders.

Path dependencies and minimum-position-compromises between these narratives produced a **largely practice-based, complicated, non-systematic, overly bureaucratic, unjust and mostly short-term focused CAP policy design**. It is a design concealing within itself a long history of prioritising the interests of stakeholders owning land, market and power asymmetries, over the interests of farming communities, the resilience and health of the EU's agrifood ecosystems, and - in short - **the actual objectives of the CAP**.

Worse still, this governance system is **producing negative agri-sociological feedback loops**, in which farmers are held devoid of planning security and are prescribed 'practices' for monetary gain. Society's stewards of local agro-ecological contexts are thus deprived of their agency and capacity for consequence capture. We will elaborate on these aspects of motivation for systematic learning, planning and enacting in Part II.

In its recent report, the OECD summarises its assessment of the EU agricultural sector as follows:

> *"[…], in recent years, agricultural productivity has increased at a slower pace than in other OECD countries, while the environmental sustainability performance of the sector has not improved in line with expectations. **This stalled progress is** not **due** to insufficient ambition or lack of resources, but rather **to policy design and implementation**."*[43]

The current Strategic Dialogue on the Future of EU Agriculture is attempting to resolve this. While it provides a starting point to answer these questions, it needs to be complemented by discussions at Member State level. **More importantly, a shared understanding of the advanced scientific assumptions which are underlying agricultural and food system debates must be achieved**, to bring about holistic ameliorations. (The German version of this Strategic Dialogue failed due to a lack of such a shared understanding of underlying assumptions.)

In agreement with the findings of Matthew et al. outlined above, INRAE and IDDRI (2024) write about the EU food system's governance challenge:

> *"The equation for ensuring equal treatment between its economic and environmental terms is so complex that it is never tackled head-on in public discussions. The result is a mismatch between some of the stated objectives and the measures actually implemented, and ultimately, the disorientation we see today. In other words, constructing medium- or long-term policy instruments in the absence of any serious points of agreement between stakeholders amounts to a delicate balancing, but above all detrimental to all stakeholders in the long term."*[44]

[41] Bless, A., Davila, F., & Plant, R. (2023). A genealogy of sustainable agriculture narratives: implications for the transformative potential of regenerative agriculture. Agriculture and Human Values, 1-19. (LINK)
[42] One Health is an integrated, unifying approach that aims to sustainably balance and optimise the health of people, animals and ecosystems. It recognizes that the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and interdependent. (LINK)
[43] OECD. (2023). Policies for the Future of Farming and Food in the European Union. (LINK)
[44] P.-M. Aubert et al. (2024). Getting out of business as usual: four conditions for building a new agreement on the European and French food system. (LINK)

In Part II we will tackle head-on the **missing cohesion of assumptions underwriting the different narratives currently driving stakeholders alienation and polarisation**, that are leading to a prevention of any constructive and structural agreements between those stakeholders. **The key lies in the paradigm shift of understanding economic and environmental dimensions not in zero-sum relationships**, in which the dimensions' equal treatment can lead to an 'optimal trade-off', but understanding them in a dialectical relationship, **that either leads to degradation or, when utilised in synergy, to regeneration**.

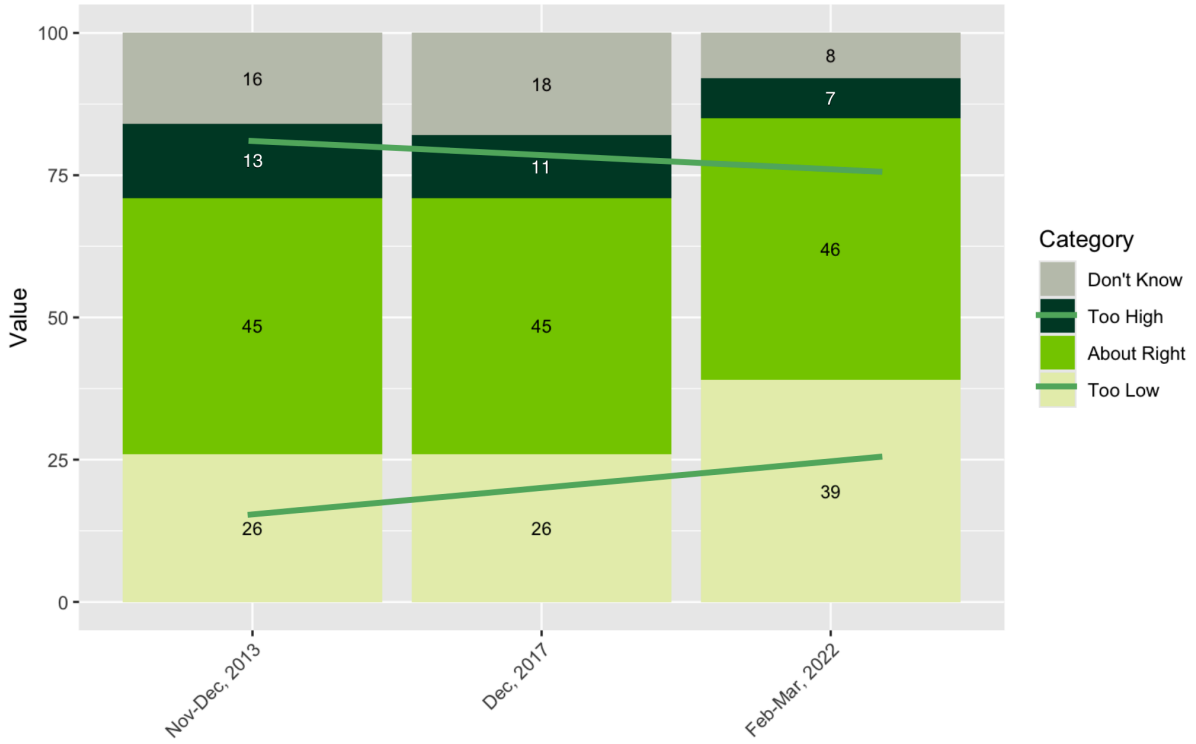

Figure 2: Citizens answer the question: Do you think financial support to farmers is too low, about right or too high? Citizens want better support for farmers: European citizens increasingly perceive the financial aid to farmers as too low (most probably strengthened by recent protests)[45].

1.2 The CAP's relevance for Europeans in the 21st century

The most fundamental conditions to sustain peaceful and healthy human lives are a stable biosphere, water, food and shelter. The availability and quality of a stable biosphere[46], water[47] and food depends primarily on ocean and land use management. In a circular bioeconomy, many of the resources for the fulfilment of the subsequent need of shelter also depend largely on land use management.

Building on this understanding as a baseline requirement for functioning ecosystems, and therefore the European society and economy, this paragraph reflects on the importance of the CAP for land use management in Europe. In the light of pressing challenges in the agrifood system regarding trade and food security, the current legal basis of the CAP will be reviewed. A thorough examination of the Treaty of the Functioning of the European Union shows that a **structural reform of the CAP is possible without having to rewrite its legal base**. Even more strongly, this examination highlights the actual **necessity of a structural reform to meet the aim expressed in the Treaty**.

[45] EU Commission. (2022). Special Eurobarometer 520 (Europeans, Agriculture and the CAP). (LINK)
[46] Dryden, H., & Duncan, D. (2021). Climate regulating ocean plants and animals are being destroyed by toxic chemicals and plastics, accelerating our path towards ocean pH 7.95 in 25 years, which will devastate humanity. Available at SSRN 3860950. (LINK)
[47] Lerner, D. N., & Harris, B. (2009). The relationship between land use and groundwater resources and quality. Land use policy, 26, S265-S273. (LINK)

1.2.1 The importance of land use management

A holistic outcome indicator for the performance of land use management is soil health. Soil health development can show if land use management is causing degradation or regeneration.

As an illustration, over the past 10 years large parts of Europe experienced increased total annual precipitation[48] but decreasing groundwater tables [49]. Those are the regions in which yields plummeted in drought years over the last decades. This led to stagnation and decreasing resilience of yields of major crops like wheat and maize in Europe[50].

The greatest common explanatory variable is land use management's impact on soil health. Soil health determines the functionality of soil ecosystems to infiltrate, store and percolate water, as well as manage surface cooling/heating through reradiation, evapotranspiration and albedo effects. In conventional land use systems, all these water-related soil functions are severely impaired[51].

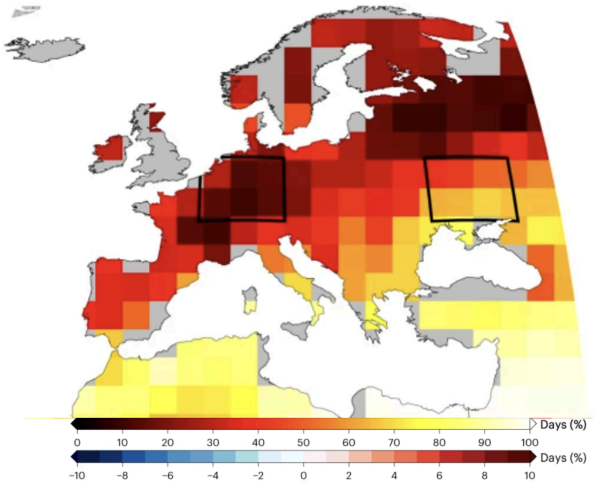

Figure 3: Percentage of days with maximum soil temperatures higher than maximum air temperatures, during air hot extremes under 1.5 °C warming level[52]

1.2.2 The CAP's influence on land use management

To date, about 40% of Europe's land surface and the majority of land used for food production is subsidised with around 33% of the total budget of the European Union – the CAP[53]. 30 years ago, the governance of CAP started to increasingly include sustainability objectives. However, to date, **the CAP has failed to tip the ecological** (and hence to a large extent economic) **balance of agricultural land use management from degradation to regeneration**[54]. To reverse these trends as the outcomes of land use management is of highest relevance to all Europeans, to ensure prosperous livelihoods.

Apart from political-economic reasons such as those outlined above, we see **two main reasons why the CAP failed to facilitate the trend reversals**.

Both are related to its mode of governance :

[48] Unwelt Bundesamthttps. (LINK)
[49] TU Graz. (2023). Satellite Data Shows Sustained Severe Drought in Europe. (LINK)
[50] NabU (2023). The Case for Regenerative Agriculture in Germany and Beyond. (LINK)
[51] European Soil Observatory, Soil Health Dashboard. (LINK)
[52] García-García et al. (2023). Soil heat extremes can outpace air temperature extremes. (LINK)
[53] European Parliament. (2023). FINANCING OF THE CAP. (LINK)
[54] European Soil Observatory, Soil Health Dashboard. (LINK); EUROSTAT. (2023). Economic accounts for agriculture - indices: volume, price, values. (LINK)

- the CAP design has to date adopted a measure- and/or practice-based[55] approach to facilitate the sustainability transformation of European agriculture.
- the CAP design has understood sustainability not as a central agricultural production factor, but as a trade-off to productivity (intensive vs. extensive).

We argue that, for a governance design fit to achieve the CAP's objectives in the 21st century, the two fundamental 'production factors' are a **result- and outcome-orientation, as well as a focus on sustainable total factor productivity**[56].

In Part II we will explain how paying farmers for results rather than solely practices and measures compares from agri-sociological, -economical and -ecological perspectives, and why we imply an orientation towards performance-based remuneration when we speak of farmer-centric policy design.

We will further explain how mitigating negative 'externalities' on the environment by land use management does not come by default as a trade-off with productivity (less pesticides = less yields). It rather comes with positive effects on productivity, if it is operationalised in synergy with optimising positive 'externalities' of land use management on the environment (better soil health <-> less pesticides = better yields).

1.2.3 EU food security and agrifood trade-balance

To maintain food security and a positive agrifood trade balance in monetary terms, the EU agrifood system must be stewarded with foresight. From an economic perspective, this positive trade balance does not only come at huge hidden costs of food competition, offshored deforestation or land grabbing[57], but appears increasingly fragile.

The EU is currently a net importer of both calories and proteins, relying on imports for the equivalent of 11% of the calories consumed and 26% of proteins[58].

Wine and pig meat make up a lion share of the EU's top agrifood exports by monetary value. However, the EU's capacity to produce both wine and pig meat competitively is decreasing. Its production of wine has been steadily decreasing over the past years despite the agricultural land use for wine remaining relatively stable (figure 4)[59].

Pig meat exports rely on soybean imports. According to a simulation by top EU officials and policy experts in February 2024, those will be drastically reduced by the effects of climate change in combination with El Niño[60] in 2024 and 2025. Additionally, greater global competition and decreasing relative purchasing power means that the core feedstock supply of the EU pig sector at competitive prices is increasingly at risk[61]. Quickly decreasing EU export trends of pigs seem to show that this risk is materialising already (figure 5).

To counteract such economic trends and ensure future food security in the EU, we need regenerative land use management and restructured market and consumption patterns.

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[55] A measure- and/or practice-based approach to incentivizing and stewarding the agricultural transition focuses on providing stronger incentives for specific climate-and environment-friendly farming practices and approaches. Policy measures aimed at supporting climate, biodiversity, environment and animal welfare so far were mainly programmed in a 'do' or 'do not do' non-context-specific way.
[56] Henderson, B. and J. Lankoski. (2023). Integrated approaches for agricultural sustainability and productivity assessments. OECD Food, Agriculture and Fisheries Papers, No. 204, OECD. (LINK)
[57] Ruiz Mirazo. (2022). Europe Eats the World. WWF. (LINK)
[58] Schiavo, M. et al. (2021). An agro-ecological Europe by 2050: What impact on land use, trade and global food security? IDDRI. (LINK)
[59] Eurostat. (LINK)
[60] El Niño is a natural climate phenomenon marked by warmer-than-average sea surface temperatures in the central and eastern Pacific Ocean near the equator, which occurs on average every 2-7 years.
[61] Hegadorn et al. (2024). Stress Testing the EU's Food System. (LINK)

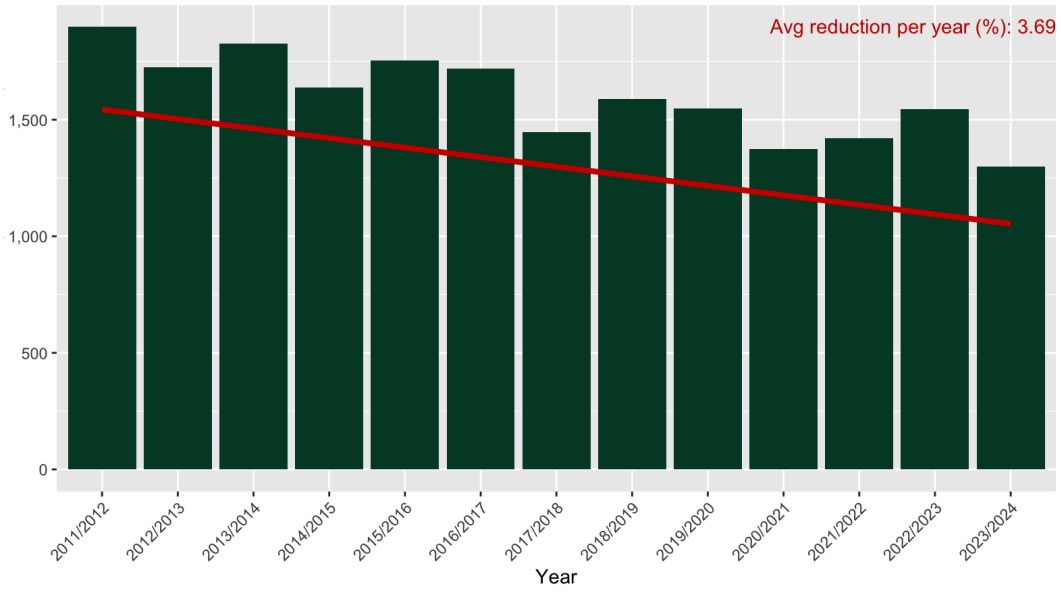

Figure 4: Production volume of grapes in the European Union (in thousand tonnes) (area under production relatively stable over the same time period)

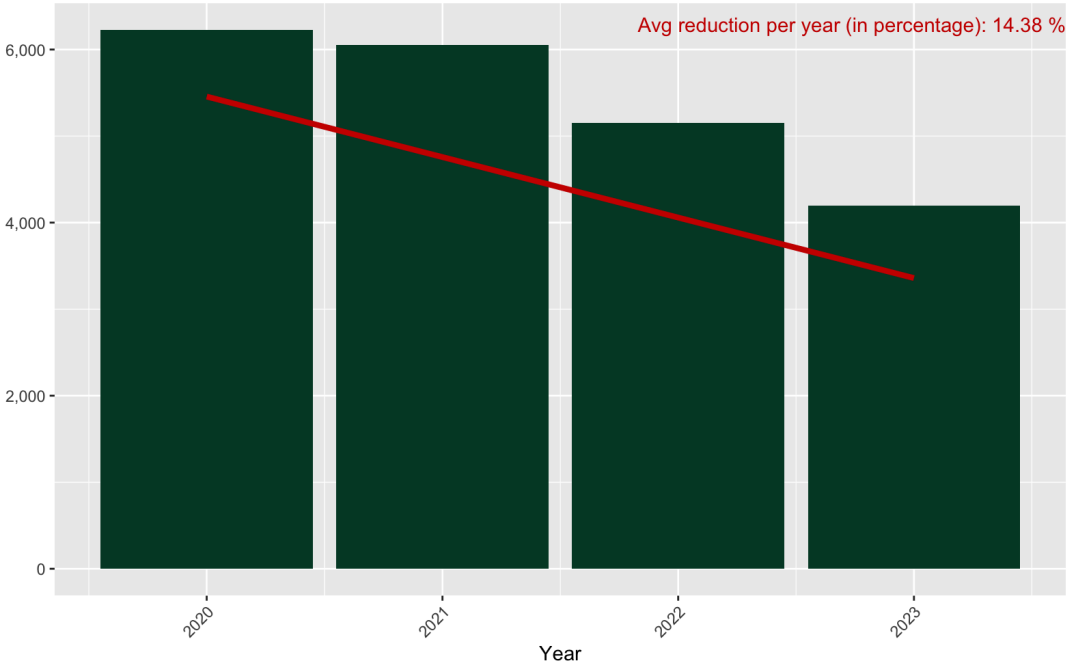

Figure 5: EU trade of pork meat (in thousand tonnes)

Ultimately, a future EU agrifood system that is sustainably competitive, with a net-positive trade balance in terms of calories, proteins and monetary value, requires a different approach than unsubstantiated hopes in novel technologies and free trade. It can only be the outcome of **markets and sectors that are properly managed by democratic public governance bodies committed to the well-being of citizens, planetary health and farmers**.

1.2.4 The CAP's legal basis from a farmer- and food-centric sustainability lens

A fundamental rewriting of the legal basis of the CAP in the coming years is politically highly improbable. Consequently, in reflection of the arguments above, this paper is **reinterpreting the existing legal basis of the CAP from a performance-based sustainability perspective**. As such, **rewriting the legal foundation of the CAP is not necessary** in order to redesign it into a decisive lever in the sustainability transformation of Europe's land use management, and thus agrifood ecosystems.

In the following, we are reviewing Article 39 of the Treaty of the Functioning of the European Union, with **a focus on farmer-centricity & sustainable total factor productivity**:

> *1. "The objectives of the common agricultural policy shall be:*
>
> *(a) to increase agricultural productivity by promoting technical progress and by ensuring the rational development of agricultural production and the optimum utilisation of the factors of production, in particular labour;*

Scientific and technical progress is constantly co-created and put in practice all over Europe by the most innovative farmers to adapt agricultural production to climate change, as well as reverse the balance of agricultural land use management from degradation to regeneration[62]. The **most innovative farmers from all EU farming contexts achieve this by designing their production systems using an up-to-date scientific understanding of agro-ecological processes**, to improve agricultural productivity with degressive fossil and synthetic inputs, traditionally seen as the main means of technological progress for productivity. These innovative farmers comprehend a fit-for-purpose outcome indicator of the 'optimum utilisation of the factors of agricultural production' in their agricultural labour as: **their yields and their lands'** (and particularly soils') **ecosystem services show a positive development in their respective context**[63]. **An understanding of the relevant result indicators (plant vitality or photosynthesis performance) and outcome indicators (soil health) is central for the CAP's ability to deliver on its objective (a) in the 21st century**.

> *(b) thus to ensure a fair standard of living for the agricultural community, in particular by increasing the individual earnings of persons engaged in agriculture;*

89% of EU farmers are aged over 40[64]. On average, farm households in the lowest quartile are worse off than non-farm households in the same quartile[65]. Overall, an estimated 800 000 to 1 million seasonal workers are hired each year in the EU, mainly in agriculture, often with poor working conditions.[66] In this time of converging crises and a thorough restructuring of the overall labor market in EU countries, due to automatisation and digitalisation[67], **labour in agriculture needs a substantial re-evaluation in terms of its bureaucratic burden, financial compensation, public opinion and general appreciation. The CAP is of central importance[68] to this.**

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[62] European Commission. (2023). What is regenerative agriculture? (LINK);
EASAC. (2022). Regenerative agriculture in Europe. (LINK);
Leu, A. (2023). Maximizing Photosynthesis and Root Exudates through Regenerative Agriculture to Increase Soil Organic Carbon to Mitigate Climate Change. (LINK) ;
ECAF. (2023). Conservation Agriculture: Moving towards the preservation and improvement of biodiversity in agricultural ecosystems. (LINK)

[63] This will be further elaborated in the agro-economic and -sociological working theses.

[64] Sutherland, L. A. (2023). Who do we want our 'new generation' of farmers to be? The need for demographic reform in European agriculture. Agricultural and Food Economics, 11(1), 1-9. (LINK)

[65] Marino, M., Rocchi, B., & Severini, S. (2023). Assessing the Farm–Nonfarm Households' Income Gap along the Income Distribution in the European Union. JCMS: Journal of Common Market Studies. (LINK)

[66] European Parliament. (2021). Migrant seasonal workers in the European agricultural sector. (LINK)

[67] In mid-2021, estimates of job loss likely to be caused by automation ranged from 10% to 15%. (Eurofound. Employment impact of digitalization. (LINK)

[68] Bojnec, Š., & Fertő, I. (2022). Do different types of Common Agricultural Policy subsidies promote farm employment?. Land Use Policy, 112, 105823. (LINK)

(c) to stabilise markets;

The core levers to stabilise agricultural and food markets in Europe are greater fossil input independence in the context of the volatility of geopolitics and energy markets, extreme weather resilience and fair competition. Resilience of food security and positive trade balances can be achieved without great yield dips only when in marching step with a **rapid increase of agroecosystem, soil and crop health through increased planning security for farmers, their education and transition support, as well as fair competition.**

(d) to assure the availability of supplies;

Apart from political variables, in agricultural and food markets **the availability of supplies in the face of extreme weather or diseases is determined by agroecosystem, soil and crop health.** Food security is determined by **farmer capacity of agro-ecological performance, in combination with the local to regional and continental resilience of the farmer downstream food value chain and food environments**.

(e) to ensure that supplies reach consumers at reasonable prices.

Recent inflation in EU food prices has demonstrated how yield and supply chain fragility, in combination with accelerating market concentrations, can prevent reasonable prices for consumers. **In combination with (a), (b), (c) and antitrust regulation, action seems urgently necessary to protect SMEs and consumers**[69] and to work towards resilient reasonable prices of food in Europe.

2. In working out the common agricultural policy and the special methods for its application, account shall be taken of:

(a) the particular nature of agricultural activity, which results from the social structure of agriculture and from structural and natural disparities between the various agricultural regions;

This points to the context-specificity of agriculture as well as the sector's specific dependence on environmental stability. Technological progress today enables **result- and outcome-based payments that can be fair and context-specific** (geographic, economic, etc.).

(b) the need to effect the appropriate adjustments by degrees;

We need an approach to transformational **governance that is fostering social cohesion, agency and synergy**. It needs to be able to pick up every farmer and every plot at its current agro-economic and -ecological state, by contributing to the journey of regenerating or conserving that state. Result- and outcome-based payments can be paid for the context-specific year-over-year (YOY) or e.g. 7 year performance. As such, the **appropriate adjustments tailored to each farmer's context can be remunerated and incentivised**.

(c) the fact that in the Member States agriculture constitutes a sector closely linked with the economy as a whole.

After having faded from policy discourse over the late 20th and early 21st century, this close link is now quickly and intensively brought to everyone's attention with the challenges of geopolitical instability, related supply shocks, the need for a circular bioeconomy, climate adaptation and mitigation, as well as a shifting labour market and food price inflation. Earlier crises of high food prices such as 2007/08, but also more recently the war in Ukraine, as well as unexpected supply chain disruptions and ultimately the farmers' protests, have shown that agriculture and food production is not only relevant for national economies, but it can quickly become an issue of national security. Additionally, hidden costs and costs of inaction, such as health issues related to dietary habits and food quality, are increasing rapidly.

[69] Lademann & Kleczka. (2023). Marktbeherrschung im Lebensmitteleinzelhandel?. (LINK); Howard, P. (2022). Concentration and Power in the Food System: Who Controls What We Eat?, Revised Edition (Contemporary Food Studies: Economy, Culture and Politics). (LINK)

The objectives of the CAP are of highest relevance to the functioning of the European Union and even more importantly to the well-being of Europeans and their fellow citizens abroad. The CAP's objectives include the most important objectives of a common food policy, with a mandate of acting on food security, availability, quality and affordability.

Many of the CAP's objectives seem increasingly difficult to achieve. We argue this is mainly due to the current CAP design's failure to enable farmers to tip the net-balance of Europe's agricultural land use management from degradation to regeneration over the last decades. This will be explained in more detail in the next subchapter.

Additionally, as the still highly relevant IPES report 'Towards a Common Food Policy for the European Union' states:

> *"there exists a crisis of confidence in the European project, yet a bold new initiative on food can rebuild trust and reconnect European citizens to "Brussels"."*[70]

An immense window of opportunity exists today for the CAP to become, once again, a positive integrator and thus facilitator of the European project. Its relevance, if anything, has only increased for Europeans.

The CAP is, if not the only, certainly the most decisive governance-lever for system change in Europe regarding political, social, economic and ecological reasons.

[70] IPES. (2019). Towards a Common Food Policy for the European Union. (LINK)

Part II: New Paradigms for Agronomy and Governance

This section of the paper shares perspectives on the revised assumptions fit-for-purpose to achieve the CAP's objectives and a regenerative agriculture in the 21st century.

It will outline the different assumptions that are underlying a farmer and soil health centred CAP design from agro-ecological, agronomic and agri-sociological perspectives.

Despite the current deadlock in the policy discourse, there is a growing consensus among farmers, industry and science. Interestingly, those farmers are actually stemming from the different sustainability narratives in the agricultural sector. They are coalescing in their **understanding of a new agronomic paradigm** (elaborated below.) This coalescing of pioneering farmers, industry and science opens a crucial window of opportunity for structural reform of the CAP.

Highly advanced agronomic praxes and scientific assumptions break the ground for an exciting and promising leap in agricultural innovation, at a time when it is critically needed. **Leverage, agencies and potentials in the transition must be clearly identified**, in order to optimally diffuse these innovations in **farmer-empowering narratives and policy designs that enhance uptake in land use management.**

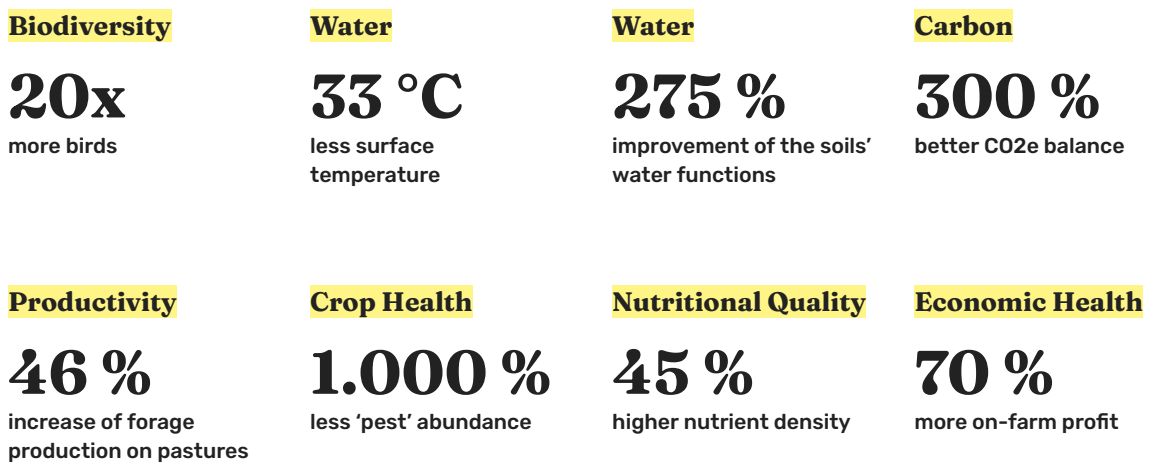

Figure 6: Evidence of the comparative agro-economic and -ecological performance of conventional vs. regenerating farms. Own illustration, for details see eara.farm

2.1 New scientific paradigms for ecology and agriculture

Two decisive factors in nature, climate and agrifood system governance have so far been largely left out of the reasoning that informs political decision-making. These factors are arguably the most critically important parts of biodiversity and the earth system's biogeochemical cycles: **soil biodiversity and water** (vapour). Both are simultaneously the most important means of agricultural production when practising regenerative agriculture and forestry – the eco-effective land use management strategy fit for purpose in the 21st century (elaborated on in the next subchapter).

With the earth system's collapse approaching[71], it is due time to take a deep look at the planet's ecological history and to disseminate the latest scientific insights that shed light on the earth system's functional processes.

> *Early Earth, like other planets such as Venus and Mars, had very little free oxygen in the atmosphere.[72] Before the evolution of land plants and animals more than 540 million years ago, soils were similar to those of desert and alpine regions today, and like them supported only microbial earth communities, but no complex life in the form of plants or animals. These microbial earth communities henceforth worked in symbioses with plants and animals (known as the Proserpina Principle or the plant-animal-bacteria-fungi-cycle [added by author]), building richer soils that could support more complex plants and animals, ecosystems, free oxygen in the atmosphere and ultimately us humans.[73]*

Intact biogeochemical cycles of the earth (water, carbon, nitrogen, phosphor, etc.) are coupled and closed, recycled and upcycled by the oceans' and soils' (micro)biodiversity, in symbiosis with the sun's energy, which is harvested via photosynthesis by plants. Their biomass feeds microbial and complex animal life on earth (humans included). As scientists have validated, this concept is likewise at the core of the production-integrated regeneration strategies that have been developed by indigenous peoples, peasants and farmers around the world[74].

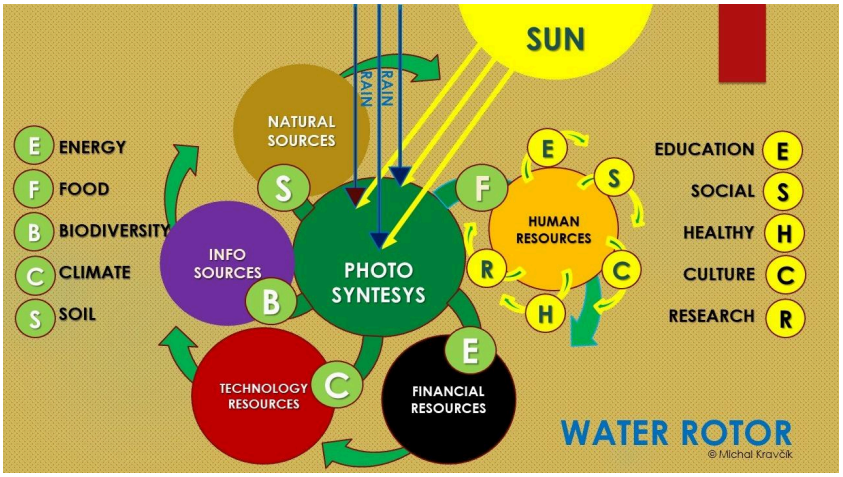

Figure 7: The concept of the WATER ROTOR by Prof Dr. Michal Kravčík (distinguished hydrologist, environmentalist and Goldman Environmental Prize winner, co-author of the New Water Paradigm) visualises how the sun, photosynthesis and water are connected to human societies, their land use management, economies, ecologies and planetary health[75].

Net primary production (NPP) describes the net carbon gain by plants through photosynthesis. NPP includes the new biomass produced by plants and the soluble organic compounds that living plants share with their environment.

Therefore, **NPP serves as an indicator for the carbon assimilation through photosynthesis on an area of land, typically measured over one year**. Moreover, it indicates how well the area of land was cooled and moisturised by plants through (evapo)transpiration, which enables habitats for vital biodiversity and stabilisation of the biosphere. **NPP can thus indicate the effects of land use management on water cycles** (water management performance).

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[71] Richardson, K., Steffen, W., Lucht, W., Bendtsen, J., Cornell, S. E., Donges, J. F., ... & Rockström, J. (2023). Earth beyond six of nine planetary boundaries. Science Advances, 9(37), eadh2458. (LINK)
[72] The timing and extent of transformation to the oxygenic atmosphere of today is revealed by color and chemical changes in paleosols.
[73] Retallack, G. J. (2022). Soil Grown Tall. Springer International Publishing. (LINK)
[74] Al-Kaisi, M. M., & Lal, R. (2020). Aligning science and policy of regenerative agriculture. Soil Science Society of America Journal, 84(6), 1808-1820. (LINK)
[75] Kováč and Kravčík. (2023). Water for Climate Healing - A New Water Paradigm White Paper. UN Water Conference. (LINK).

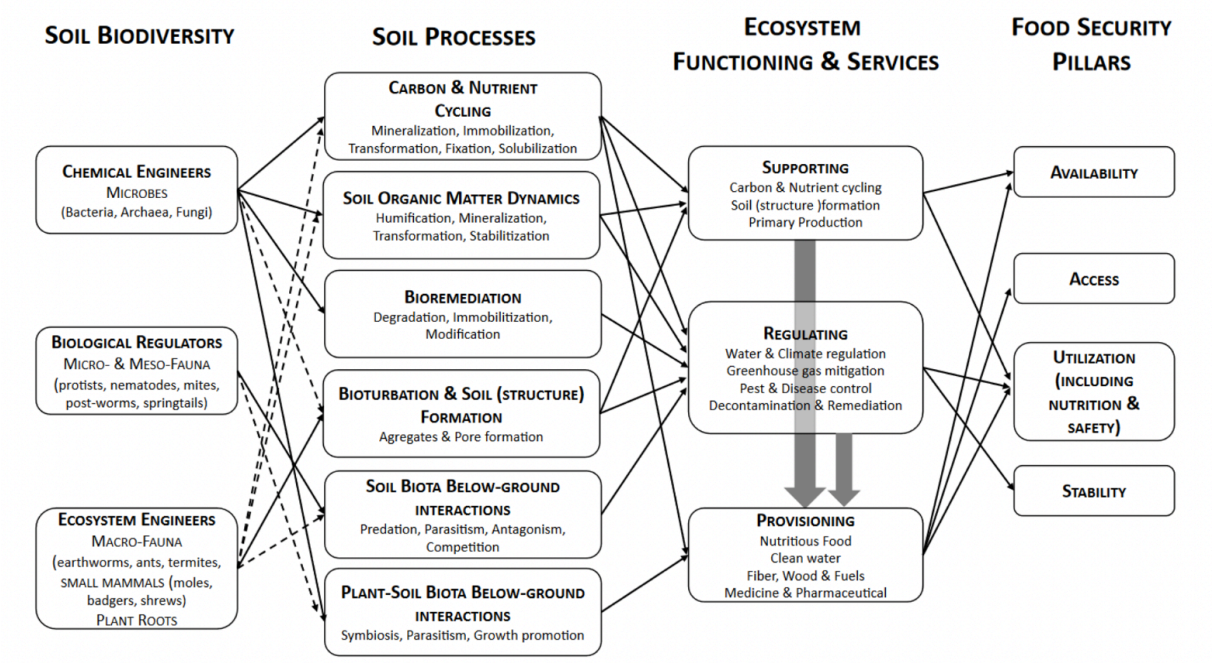

Figure 8: Relationships between soil biodiversity and food security pillars through soil processes and ecosystem functioning and services[76].

The efficiency of carbon assimilation through NPP on an area of land over a certain time largely depends on the vitality and functional diversity of the soil biology that is present. Soil biodiversity and abundance have a strong influence on the carbon cycle, by affecting whether biogenic greenhouse gases (GHG) are emitted to the atmosphere or sequestered in the soil. As such, they influence the year-over-year GHG-balance on that land being positive or negative, which is fundamental for the land's capacity to gain higher NPP in the future with less external inputs. Consequently, both in agriculture and forestry this largely depends on the soil, crop and animal management practices and systems.

In ecological sciences, agriculture has been long understood through NPP, and the human appropriated net primary productivity (HANPP) as the food, feed and fibre of the overall NPP of an area[77]. Yet the above-displayed newer ecological science in relation to NPP has so far only been comprehended and integrated in agronomic models as the amount of biomass left on the field as crop residues. However, all the other (much more decisive) **elements of the overall NPP beyond HANPP, which do not end up in food, feed and fibre production, are so far not fully incorporated**. Those encompass the photosynthetic capacity of the land in between main crops and during main crops (vertically and horizontally), as well as root biomass and root exudates (the soluble organic compounds that living plants share with their environment) throughout the entire year.

Those exudates feed the biodiversity of soil. Fungi and bacteria make up a primary core layer of the multi-trophic soil food web. This layer receives large parts of the soluble organic compounds that are passed on via living plants or through the processing of the organic matter of dead plants.

The soil food web is the first layer of all multi-layered food webs of our terrestrial ecosystems. It is the most underlying condition for all terrestrial biodiversity, including humans[78]. **A key agronomic variable in this context is the mechanical soil disturbance by regular tillage activities in most agricultural operations.**

[76] Mujtar et al. (2019). Role and management of soil biodiversity for food security and nutrition; where do we stand?. (LINK)
[77] Mayer et al. (2021). Applying the Human Appropriation of Net Primary Production framework to map provisioning ecosystem services and their relation to ecosystem functioning across the European Union. (LINK)
[78] Anthony, M. A., Bender, S. F., & van der Heijden, M. G. (2023). Enumerating soil biodiversity. Proceedings of the National Academy of Sciences, 120(33), e2304663120. (LINK)

This destroys the habitat for essential soil biology, like earthworms and fungi. Despite such knowledge, this part of biodiversity is painstakingly orphaned in environmental policy until now. **Without addressing soil biodiversity regeneration holistically** (soil protection, health and NPP optimization), **it will be impossible to achieve the goals of the EU Green Deal**, the EU Soil Mission and strategy, the Farm to Fork and Biodiversity Strategy, the goals agreed to by the European Commission and its Member States in COP15 of the UN Convention on Biodiversity (CBD)[79] and in UN Climate Change Conferences. Likewise, SDG 2 - a world without hunger - just as much as healthy nutrition, and hence a world of peace, will be unachievable without **reframing and re-understanding food security and biodiversity, not as a trade-off, but as a synergy**.

Rapidly changing scientific paradigms

For too long it has been assumed, as within the classic argument for extensive grasslands, that productivity and biodiversity in grasslands are in trade-off with each other. New scientific paradigms take a broader whole-system perspective that highlights synergies in areas where formerly dead-ends of supposed trade-offs and target-conflicts between human needs and biodiversity have been established. Based on new scientific paradigms, agricultural praxes and historical analysis of indigenous land use management, it can be explained how the standard agricultural policy measure of regulating animal density per hectare can have negative ecosystem service effects. **Result-based policy, in turn, can steward for holistically optimising grazing systems and avoid the pitfalls of incentivising single variable animal density.**

A practical example in the following photo from Mundos Nuevos farm in Southern Spain: on the left, a conventional cereal crop with chemical inputs and free grazing for parts of the year vs, on the right side of the fence, 10 years of no inputs at all, only regenerative holistic planned grazing to maximise photosynthesis, in both cases with sheep, in an environment with 250 mm of average annual rainfall, even less lately.

Production in comparable terms is now 3500 kgs of oats on the left vs 5000 rations of sheep forage (1000 sheep/Ha. for one single day, 5 times over the year), which is equivalent to 5000 kgs of oats, ie. 40% higher, with zero input costs. Rainwater capture and storage, biodiversity (plants, insects, birds, etc.) and thus ecosystem functions at Mundos Nuevos are visibly increasing exponentially[80], all of which in turn will continue to increase the land's carrying capacity.

[79] ENCA. (2023). Integrating Soil Biodiversity Conservation into Sustainable Land Use. (LINK)
[80] Source: Spanish Association of Regenerative Agriculture and Alejab Savory Institute Hub.

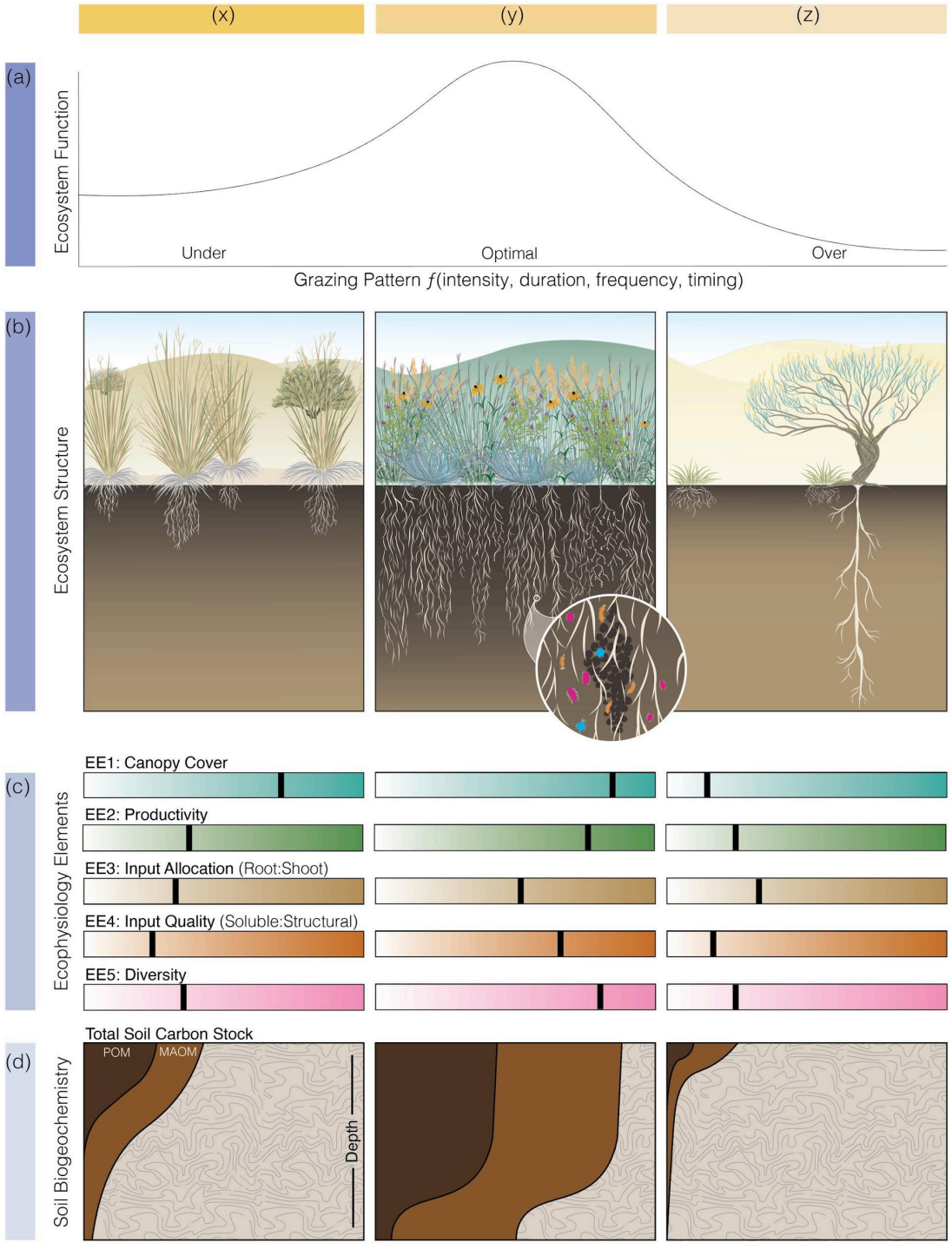

Figure Box: Conceptual illustration of how grazing patterns (x, y, z) affect ecosystem function (a) and structure (b) by modulating plant ecophysiological elements (c), which together give rise to soil biogeochemical outcomes (d) in terms of total soil organic carbon stock and distribution into particulate (POM) and mineral associated organic matter (MAOM)[81].

[81] Stanley et al. (2024). Ruminating on soil carbon: Applying current understanding to inform grazing management. (LINK)

2.2 The 4th agricultural revolution

In the following paragraphs, we outline the central agricultural advances that make up the true 4th agricultural revolution: regenerative agriculture. We touch upon the agronomy of the new agricultural praxes[82] and the economics of the transition, as well as the **key performance indicators (KPIs) of its management and governance**.

2.2.1 A new generation of agronomic assumptions

Today, most fundamentally, water, as the element of the largest biogeochemical cycle and a highly important greenhouse gas (water vapour), is the **main limiting production factor of our agro-economic and -ecological systems**. It is also a decisive variable in society's climate change mitigation and adaptation capacities[83].

Most prominently, yields are being increasingly limited by water impacts in Europe over the last 20 years: either there is too much water caused by torrential rains; or too little water caused by droughts; or too high temperatures leading to too much evapotranspiration, plant stress and greater irrigation need; or cold temperatures leading to frozen water at unexpected times – all with negative impacts on yields[84,85]. As even in "good" water years the yields are not increasing, soil productivity-related causes must be addressed quickly[86].

Apart from the water and soil variables, animal and plant diseases lead to serious negative impacts on European yields[87]. Diseases can be mitigated and adapted to sustainably only through increasing the health of microbiomes by improving below- and above-ground biodiversity[88]. For land use management to achieve this in times of accelerating climate change, **the first condition to grow the food and habitat for soil biodiversity is better water and soil management**[89].

Hence, for resilient and nutritionally rich food security in the 21st century, **we need farming for biodiversity, water and carbon**. According to an up-to-date understanding of agronomic and ecological sciences, **carbon farming works through farming for net primary productivity[90] (NPP) and soil health[91]**. More living plants in an area that are doing photosynthesis lead to more protection of cash crops against extreme weather conditions and richer crop nutrition by more vital soil microbiomes. **In scientific, practical and political debates, these advanced agronomic insights are meant when the term regenerative agriculture is used in its full meaning[92]**.

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[82] Praxes describe the practical application of theory. The application of practices
[83] NCCS. Warming Makes Droughts, Extreme Wet Events More Frequent, Intense. (LINK);
United Nations. White paper: Water for Climate Healing - A New Water Paradigm. (LINK)
[84] BR24. (2023). Zu viel Regen: Weizen droht auf Feldern zu verderben. (LINK);
Brookshire, E. N. J., & Weaver, T. (2015). Long-term decline in grassland productivity driven by increasing dryness. Nature communications, 6(1), 7148. (LINK)
[85] It ought to be noted though, that impact is driven also by management. Crops can be relatively resilient to higher or lower temperatures, drought etc. through improved soil and agroecosystem health. However, almonds and olives, as examples, are lost in southern Europe currently with only a degree less or more in temperature.
[86] BCG & NABU. (2023). The Case for Regenerative Agriculture in Germany—and Beyond. (LINK)
[87] Matthews, A. (2023). 2022: a record year for farm income. (LINK)
[88] Jayaraman, S., Naorem, A. K., Lal, R., Dalal, R. C., Sinha, N. K., Patra, A. K., & Chaudhari, S. K. (2021). Disease-suppressive soils—beyond food production: a critical review. Journal of Soil Science and Plant Nutrition, 21, 1437-1465. (LINK) ;
Hirt, H. (2020). Healthy soils for healthy plants for healthy humans: How beneficial microbes in the soil, food and gut are interconnected and how agriculture can contribute to human health. EMBO reports, 21(8), e51069. (LINK)
[89] UNEP. (2021). Working with plants, soils and water to cool the climate and rehydrate Earth's landscapes. (LINK)
[90] NPP is the net carbon gain by plants through photosynthesis.
[91] Leu, A. (2023). Maximizing Photosynthesis and Root Exudates through Regenerative Agriculture to Increase Soil Organic Carbon to Mitigate Climate Change. (LINK)
[92] Manshanden, M., Jellema, A., Sukkel, W., Jongeneel, R., Alho, C. B. V., de Miguel Garcia, A., ... & Geerling-Eiff, F. (2023). Regenerative agriculture in Europe: An overview paper on the state of knowledge and innovation in Europe.

*"The emphasis must be based on **living soil and plant sciences to maximize photosynthesis** to capture CO2 [...] and **maximize root exudations to feed** [...] **the soil microbiome** [...]."*[93]

– André Leu, Adjunct Professor South Seas University, International Director Regeneration International, Ambassador IFOAM Organics International, Farmer in Australia

We manage more than 300 hectares of farmland in conservation agriculture with highest cash crop yields using no-till, cover, undersown and a diversity of plants and crops to produce liquid carbon through photosynthesis, to feed and protect soil biology 365 days a year.

Geraud Dumont du Chassard, Farmer in Belgium

At Smelyne Farm, we seek to understand each pasture's context to apply different grazing management techniques. Our goal is to increase the leaf-to-stem ratio of plants, which boosts their photosynthetic potential. We also prioritise long recovery periods on winter stockpile pastures, allowing plants to complete their life cycles and build soil aggregates.

Justina Kaučikas, Farmer in Lithuania

2.2.2 Towards a recalibrated agrifood system compass

In order to scale-out this agronomic praxis fit-for-purpose in the 21st century, mainstream farming needs a new socio-economic compass. The guiding narratives of governance for the agricultural sector and farmers must switch from solely setting the course of classic 'standard output' (single cash crop yield per hectare per year) to aiming at yield resilience and quality. **Yield resilience should be understood as multiple crop standard output predictively modelled (not extrapolated)**.

Ecological guidance is fully integrated into such economic guidance if understood with the newest scientific insights on microbiology, biogeochemistry, earth sciences etc.[94]. NPP and soil health are both the foundations of ecosystem health and biodiversity, as well as of the sustainable total factor productivity of the agricultural sector and of individual farms.

The new socio-economic compass as an agronomic praxis aims at optimising overall NPP of farmed land over the entire year, thus regenerating soil health YOY as the capital to produce the critically important agricultural production factors of the agronomic praxis of regenerative agriculture: water and a vital soil microbiome, which can nourish the biome of the crops[95]. This is decisive for their capacity to grow under stress (i.e. droughts or pests), as well as nourish the regeneration of biodiversity and of biogeochemical

[93] Leu, A. (2023). Maximizing Photosynthesis and Root Exudates through Regenerative Agriculture to Increase Soil Organic Carbon to Mitigate Climate Change. (LINK)
[94] Yang, Y., Sun, H., Zhu, M., Wang, J., & Zhang, W. (2022). An R package of maximum entropy production model to estimate 41 years of global evapotranspiration. Journal of Hydrology, 614, 128639.;
Erlwein, A. (2022). Exploring Ecosystem Health: Effects of Increments of Biodiversity and Trophic Complexity on the Stability of a Simple Gaian Ecosystem Model. Agro sur, 50(2), 13-24. ;
Muñoz, E., & Carneiro, J. (2022). Plant–microbe symbiosis widens the habitability range of the Daisyworld. Journal of Theoretical Biology, 554, 111275.
[95] Hirt, H. (2020). Healthy soils for healthy plants for healthy humans: How beneficial microbes in the soil, food and gut are interconnected and how agriculture can contribute to human health. EMBO reports, 21(8), e51069. (LINK)

cycles, while detoxifying the environment and decarbonizing the agricultural sector without yield implosions[96].

Instead of only focusing on the part of NPP that is appropriated by humans, understood in science as HANPP[97], advancing **from standard output to yield resilience and quality means moving the agronomic compass of solely HANPP to NPP & HANPP.**

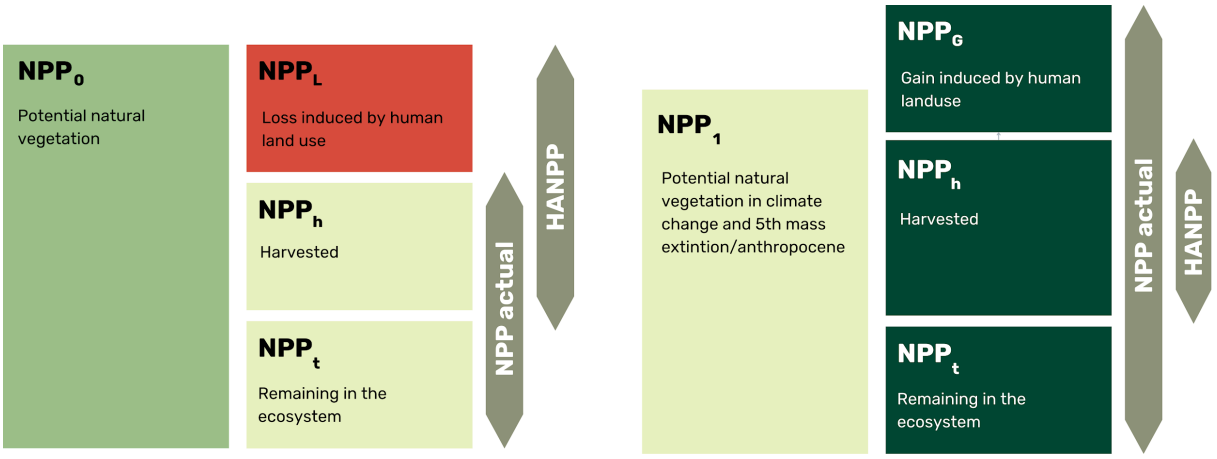

Figure 9: Instead of assuming human land use as necessarily in trade-off with the health of ecosystems (left), updated scientific knowledge of indigenous land use, higher temperatures, more water vapour and CO2-fertilisation attests that the most advanced forms of regenerative human land use are able to 'outperform' the NPP of ecosystems without human intervention (right). Because of the state of earth- and ecosystem degradation as well as the speed of climate change and biodiversity loss, **land left to itself will have much higher difficulty to recover and regenerate (because of missing wild grazing regimes or shade and wind protection, broken water cycles, etc.) than when active productive regeneration is executed by farming with nature to increase the life holding capacity of the place and people in question.**

We try to keep the soil covered all the time. We use multiple species when we are seeding, so that cover crops and cash crops can maximise leaf shapes and heights, as well as the root system depth and shapes, to feed into everywhere and cover everything with life.

Zoltan Lengyel, Farmer in Hungary

I'm always trying to be at the right place, at the right time, with the right behaviour of my animals, so that the photosynthesis of the plants is stimulated and the soil is protected optimally. This is massively fostering both biodiversity and agronomic production."

Christina Bajohr, Farmer in Germany

[96] El Mujtar, V., Muñoz, N., Mc Cormick, B. P., Pulleman, M., & Tittonell, P. (2019). Role and management of soil biodiversity for food security and nutrition; where do we stand? Global food security, 20, 132-144. (LINK)
[97] Krausmann, F., Erb, K. H., Gingrich, S., Haberl, H., Bondeau, A., Gaube, V., ... & Searchinger, T. D. (2013). Global human appropriation of net primary production doubled in the 20th century. Proceedings of the national academy of sciences, 110(25), 10324-10329. (LINK)

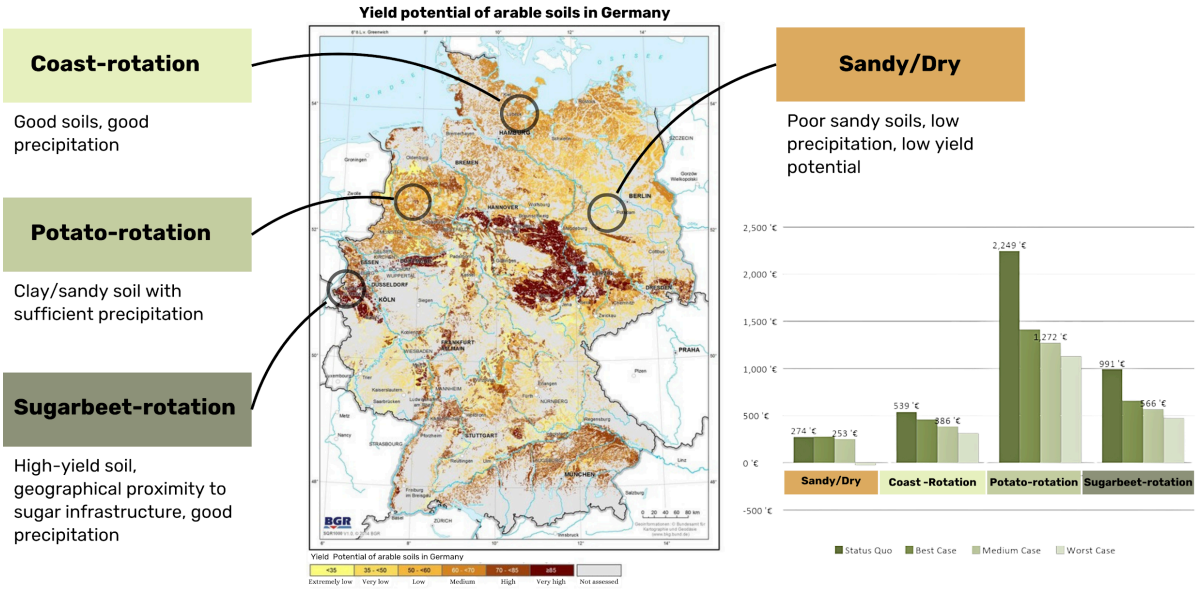

Figure 10: Overview of context-specific transition costs of mainstream agricultural production systems in Germany[98]

2.2.3 The context-specific economics of changing the agronomic compass of mainstream agricultural praxis in Europe

Several calculations are being produced regarding the transition (transfer and opportunity) costs for farmers in Europe to change the course of their agronomic praxis, from standard output optimization to yield resilience and quality optimization ('NPP & HANPP')[99]. **An understanding of the entailed transfer and opportunity costs is decisive to design a better CAP that can truly bridge the supposed trade-off of productivity and socio-ecological outcomes with a revised scientific understanding.**

The specific costs depend largely on the farm's context (existing machinery, crop rotation, pedoclimatic conditions, debt, etc.). The regulatory and incentive environment of the agricultural sector must enable farm businesses and farmers to agronomically prioritise a significant YOY soil health and yield resilience (and quality) optimisation, over and above the risk of short term yield and profit reductions. The governance must further enable the capacities of farmers for the agronomic execution of that management prioritisation in order to implement the agronomic praxes of a truly regenerative agriculture.

Understanding the context-specificity of the transition variables and costs is critical for a differentiated discussion of the leverage and agencies in the transition. Opportunity and transfer costs are especially high where European farmers had record income in 2021-2022, because farmers in those contexts had only relatively mild impacts of climate change (in global comparison) due to being in optimal pedoclimatic conditions and mechanisation rates, at times when global food commodity prices increased faster than their fossil input and labour costs. Further, these sections of the European agricultural sector are destined to continue to profit from their competitive advantage[100] in the international comparison, due to their climate change specific pedoclimatic conditions and capitalization rates. **More and more of this prime EU farmland has come under the ownership of ever few[101]. The specific overlap of concentrated farmland ownership and those farms particularly benefitting monetarily from the status quo in their agricultural context (the CAP included), remains a question for further study.**

[98] Expert & farmer analysis based on 2021/22 economic data by NABU and Kiebitz unpublished.
[99] Lal, R. (2020). Regenerative Agriculture for Food and Climate. (LINK); Leu, A. F. (2023). Maximising Photosynthesis and Root Exudates through Regenerative Agriculture to Increase Soil Organic Carbon to Mitigate Climate Change. (LINK); Petry et al. (2023). Cultivating farmer prosperity: Investing in Regenerative Agriculture. OP2B, BCG. (LINK);
[100] If EU specific energy, fertiliser, etc. prices do not get too high or a significant reduction in the EU's agricultural production dependence on their use for yields would have been achieved.
[101] TNI. (2016). Land grabbing and land concentration in Europe. (LINK)

To visualise the context-specificity of transition costs, one can model the optimal transition speed of a holistic and genuine application of the new agronomic praxis / regenerative agricultural journey[102] in the first 6 years for 4 arable pedoclimatic and crop rotation types in conventional agriculture in Germany. Here the annual difference in the absolute contribution margin per hectare (investment, inputs, labour, on farm-consulting, yield developments, crop rotations, etc. – full CAPEX & OPEX) was calculated[103]. It is estimated that in Germany, annual transfer and opportunity costs for arable farm operations range from about 0-1000€ per annum in the first 6 years. About 40% of German agricultural land is estimated at around 100€ of costs per ha/a, 30% below that and maybe 15% of arable land around 1000€ ha/a.[104]

2.2.4 The key KPIs for measuring and managing the transition

Key performance indicators (KPIs) to measure and manage the transition towards regenerative agronomic praxes provide practical information for agricultural land use management, while measuring both agronomic and ecological performance. This is of highest importance to enable and incentivise broad uptake and support land stewards in their transition.

Photosynthesis and net primary productivity

At the foundation of land use management lies the NPP performance of an area. The NPP performance indicates if the agriculturally used land is aggravating or alleviating climate change, and how the agricultural productivity potential of the land and habitat for biodiversity is developing over time.

Furthermore, it can indirectly indicate how well the microbial engines, which are driving the earth's biogeochemical cycles, are fed over time. Thus, it can **indicate the development of the land's functions for biodiversity, water purification and detoxification, as well as the development of the nutritional value of the food produced on that land**.

So writes the EU's Joint Research Center:

> *"In fact, many ecosystem services are positively correlated with net primary production (NPP), including food production, climate regulation, purification of water, maintenance of nutrients, healthy soils, carbon sinks, biodiversity, and aesthetic landscape function."*[105]

Soil health and cover

The performance of the soil's microbial engines, and therefore their capability of efficiently and effectively feeding crops, biodiversity and natural cycles, can be derived from information indicating how well the soil is protected by cover throughout the year.

Soil health, as an outcome of agronomic performance, can give a more robust and holistic indication of performance over a longer time span. Measuring the **land use management's outcome in soil health can validate more robustly the yearly result-based performance of NPP and soil protection through land use management along longer time intervals**, and also provides crucial information for agronomic and ecological management (i.e. micronutrient needs of the soil).

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[102] The transformation modelled 10% reduction of synth fertiliser, pesticides and gasoline per annum as well as an adaptation of the crop rotation without immediate yield implosion while building yield resilience at a high productivity level.
[103] Ceteris paribus contemporary general agrifood system's meta governance structure (fossil fuel subsidies, geopolitics, monetary policy etc.).
[104] In a much rougher ecological than economic assessment, we estimate mean carbon sequestration around 0,9T C y/ha and mean carbon mitigation around 0,6T y/ha. This is just the CO2e balance, while water as well as biodiversity, health and other positive impacts are not quantified in this assessment.
[105] Joint Research Center, WORLD ATLAS OF DESERTIFICATION. (2019). Net primary production. (LINK)

Resource efficiency

Ultimately, the land use management's performance on NPP, soil cover and soil health in a specific farm's management context, ought to be **compared against the efficiency with which external resources such as fertilisers, feed, diesel and pesticides are used to achieve this performance**. When comparing the land use management's performance on a plot basis in its pedoclimatic context, this is arguably not necessary because of equally distributed market incentives for efficiency in comparable pedoclimatic and regulatory contexts (Annex II will explain how we are preparing to test this claim in practice). In Part III we will discuss how such KPIs can be used for farmer-centric performance-based payments for agroecosystem health in the next CAP.

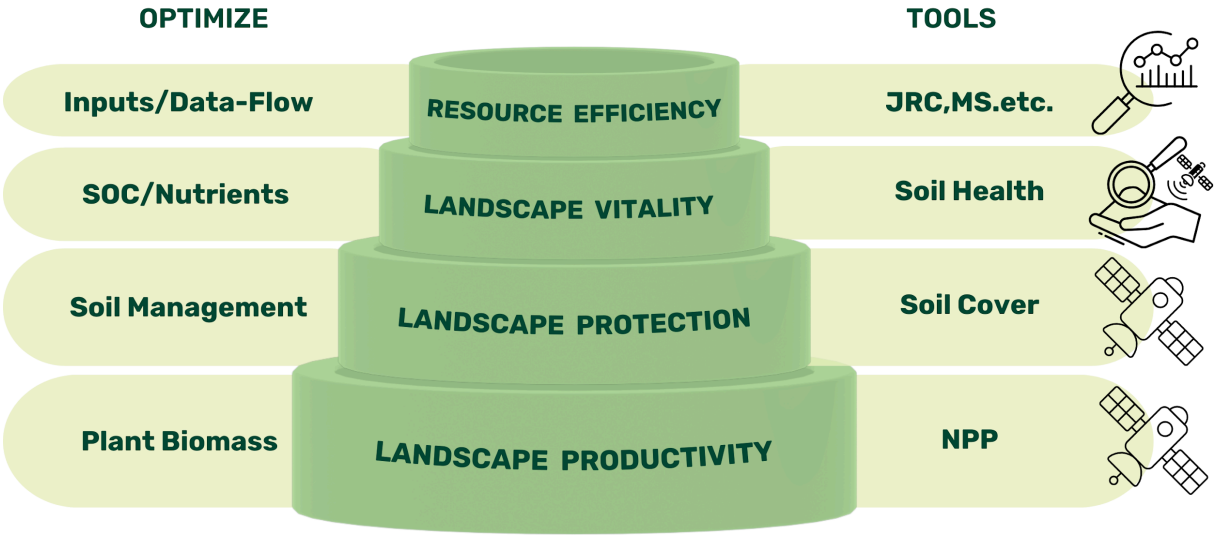

Figure 11: Pyramid of key performance-indicators of agricultural land use management and agricultural policy[106]

At Curly Creek Ranch, we use holistic planned grazing in our pastures to augment biomass production and nutrient cycling through increased photosynthesis, soil protection and microbiome activity.

Meghan Sapp, Farmer in Spain

Rieckens Eichhof is growing multi-species ecosystems with upper layer woody perennials over annual crops, pastures and even edible mushrooms. With that strategy, we seek to build productivity and resilience to extreme weather through photosynthesis maximisation and soil protection, to nurture the social, economic and ecologic health in our farm and region.

Felix Riecken, Farmer in Germany

[106] Own graphic adapted from AgriCircle

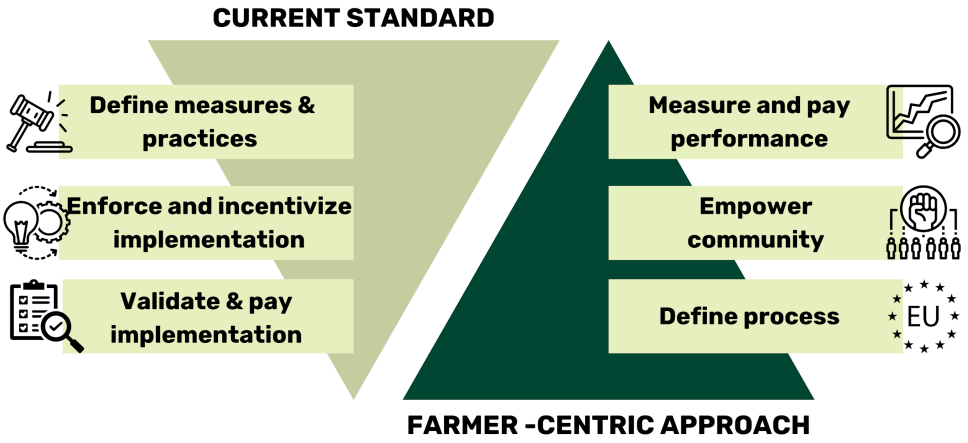

Figure 12: Approaches to agricultural policy[107]

2.3 Critical Perspectives on Food System Governance

For any governance to successfully transform the system it governs, it first must transform its mode of governance. In the face of rapid change, in alignment with Ashby's Law of Requisite Variety[108] and with plentiful research on the mode of governance for transformations (including the JRC)[109], governance ought to refrain from attempting to exhaustively respond to change in each context with specifically targeted policies from policy making centres. Instead, **governance should face the complexity of accelerating and converging challenges**, whenever possible, **by synergies and agency-enhancing multi-benefit policy strategies** (reflexive governance[110]). Those strategies ought to be designed to foster adaptation and mitigation capacities within places and people. This insight is particularly important for governing the agricultural sector, where the impact of any change of circumstances is on productivity. **Therefore, the current standard of prescribing measures and practices from policy making centres must switch towards a farmer-centric approach.**

This will lead to policy based on the understanding of the core processes involved, to empowering community through context-specificity and to incentivizing simply and fairly performances in that context.

2.3.1 Short-comings of measure and practice-based agricultural policy

The number, severity and complexity of problems in agrifood ecosystems are increasing. The existing measure-based approach for incubating the socio-ecological transformation of agriculture at a speed and scope that match the converging challenges, has failed - and continues to fail[111].

That is because the most important components of a systems-approach to scaling (ie. a focus on context, awareness of unintended consequences, and the facilitation of collective understanding and action[112]) are

[107] Own graphic adapted from AgriCircle
[108] Klir, G. J., & Ashby, W. R. (1991). Requisite variety and its implications for the control of complex systems. Facets of systems science, 405-417. (LINK)
[109] Leeuwis et al. (2021). How food systems change (or not): governance implications for system transformation processes. (LINK); Metabolic. (2018). Using Systems Thinking to Transform Society: The European Food System as a Case Study. (LINK); Rancati et a. (2021). Managing complexity (and chaos) in times of crisis – A field guide for decision makers inspired by the Cynefin framework. European Commission, Joint Research Centre. (LINK)
[110] Feindt, P. H., & Weiland, S. (2018). Reflexive governance: Exploring the concept and assessing its critical potential for sustainable development. Introduction to the special issue. Journal of Environmental Policy & Planning, 20(6), 661-674. (LINK)
[111] ECA. (2023). Common Agricultural Policy and climate: Half of EU climate spending but farm emissions are not decreasing (LINK); OECD. Policies for the Future of Farming and Food in the European Union. (LINK)
[112] Woltering ett al. (2024). Supporting a systems approach to scaling for all; insights from using the Scaling Scan tool. (LINK)

omitted in a measure and practice-based approach to disseminating agro-ecological innovations of the kind described in Part II.

Two of many similar examples in contemporary EU agricultural policy, serve as an illustration of this

Example 1: Paying for practices that are designed to only produce ecosystem services or biodiversity but not food (like a flower strip) alienate farmers' ordinal utility. At the same time, they are mostly not bringing structural, long-lasting, self-reinforcing change in agronomic praxes towards strategically farming with nature. Instead, payments for context-specific NPP results, respecting the reality of farmers, will incubate their climate change adaptation capacities. This will lead to improvements of the food web for all birds, in this example, as well as a number of other ecosystem services, like recharging groundwater aquifers, growing flood resilience and cooling ecosystems[113].

Example 2: Paying for measures that function with key-date regulations that prescribe when soil has to be covered or grasslands mowed, can lead to non-optimal or even negative outcomes. Such measures quite simply cannot be responsive to the pedoclimatic nor economic conditions of the farmer or plot. At the same time, such policy design degrades farmer agency and capacity building, as well as climate change adaptation. Especially with weather patterns getting more volatile and unpredictable, setting preset deadlines is even more unfit for purpose. Instead, policies ought to focus on paying for absolute and relative results over the whole year. Additionally, measuring outcomes over longer time horizons which reflect the farmer's agro-ecological performance in a fair context, will enable farmers to manage their land use in a more context-specific and agile way. Such an outcome-focused policy will contribute to the objectives of the farmer, just as much as those of the governance as a whole (we will elaborate on such designs further down).

Measure and practice-based subsidies have a high risk of negative unintended consequences and second-order effects that can impede transformation in the long run. Measure and practice-based subsidies:

- reduce the agency of farmers, their motivation and ability for consequence capture (learn from observation and mistakes) and thus for capacity building;
- alienate farmers and contribute to the rural/urban divide. Farmers often do not feel acknowledged, praised or even rewarded with the financial reimbursement for the measures they implement, because of the bureaucratic efforts involved in obtaining the subsidy, accompanied by the impediment of their own motivation and sense of utility;
- are necessarily innovation laggers. If a farmer invents a measure, the impact must be scientifically validated and afterwards be picked up by policy-making. Such processes can take ten years or more;
- are usually not context-specific, as contexts can be very different between two fields even only a few hundred metres apart;
- are not universal and will produce different outcomes depending on time, place and farmer. Therefore, they are inaccurate to fulfil their own objectives;
- open the door for the lobbying of special interests seeking to financially profit from the measures;
- decrease planning security of farmers;
- offer no prospect of significant governance simplification;
- disadvantage family farms by the bureaucratic hurdles to receive exhaustive payments,as only economies of scale can reach cost-effectiveness of office staff on farms;
- fail to foster the kind of land use integration, innovation and context-responsiveness necessary for regenerative land use management and climate adaptation in the agricultural sector.

[113] Joint Research Center, WORLD ATLAS OF DESERTIFICATION. (2019). Net primary production. (LINK)

Prescribing measures and practices from afar, without the possibility of quick, constant, context-specific and systematic adaptation, does not work in environmentally ever-more volatile conditions. In fact, as argued above, it even harms. The necessary agricultural transformation, the 'regenerative innovation', can only, and so far has only, come from farmers themselves. It is for farmers to set the bar. It is for policy makers to guide and inoculate the innovation, not to develop, impede nor to prescribe it measure by measure.

In regards to current alternatives and improvements being discussed, it ought to be noted that measure and practice-based point models (as alternatives for a post-2027 CAP and already enacted in the Netherlands and Hungary) by themselves propose no functional progress from the ineffectiveness, inefficiency and sociologically degrading impact of the measure and practice-based approach to agricultural governance. Likewise, the largest parts of the Sustainable Farming Incentive Scheme in England and Wales failed to simplify the incentivisation, structurally increase the planning security of 'farming with nature' or overcome the negative unintended consequences of measure and practice-based incentives[114].

The next CAP reform must be structural by shifting its mode of governance from being predominantly measure and practice-based, non-context-specific and overly bureaucratic, to being performance-based.

On our farm, we aim to maximise photosynthesis and soil health by maximising crop/plant cover in a place and time. This means thriving multi-species grasslands, winter crops and undersown cover crops with spring crops.

Juuso Joona, Farmer in Finland

2.3.2 Agrisociology's importance in agricultural governance success

Performance-based payments and other means to facilitate the spreading and uptake of nature-based innovations, must be fair to the pioneering leaders and their trials, errors and inspiring results in agro-ecological performance. At the same time, arguably even more ambitiously, the regeneration of degraded farmland needs to be incentivised in a socio-economically just manner (the specific payment design will be further elaborated in Part III). Farmer-centric governance must root the agency for regeneration in the farmer, reducing bureaucratic burden while increasing planning security.

The human capacities of farmers in the agricultural sector are crucial, and require impartial practical **consultation as well as peer-to-peer exchange** to enable positive feedback loops regarding resilience, autonomy and profitability, as well as agroecosystem regeneration.

Studies of farm transitions to agro-ecological farming systems and new agronomic praxes have shown that the key drivers for robust transitions are, that farmers[115]:

- use a variety of external sources of information beyond those provided by their input suppliers;
- learn from their own experiments, using controls and documenting results. This often requires external support as it is time-demanding (e.g., to design the experiment and collect results) and requires specific methodological knowledge;

[114] PoliticsJoe. (2024). Is this the end of British Farming? (LINK)
[115] Catalogna et al. (2022). Multi-annual experimental itinerary : An analytical framework to better understand how farmers experiment agro-ecological practices. (LINK); Chantre & Cardona (2014). Trajectories of French Field Crop Farmers Moving Toward Sustainable Farming Practices : Change, Learning, and Links with the Advisory Services. (LINK); Mawois et al. (2019). Transition to legume-based farming systems requires stable outlets, learning, and peer-networking. (LINK); Revoyron et al. (2022). Diversity and drivers of crop diversification pathways of European farms. (LINK)

- participate in collective experiments;
- learn from peers and multipliers;
- change their evaluation criteria from simple crop-level criteria (e.g., yield and field "cleanliness") to multiple system-level criteria (e.g., rotation-level gross margin, quality of work, health, environment and personal satisfaction). For example, a large part of the benefits of legumes are only visible when looking at the gross margin of subsequent crops;
- expect clear and stable benefits from the practice change in the medium term. In particular, they are more likely to change practices if the market and regulatory context ensures the benefits of the change in the long term. This is critical when an investment is needed, e.g. in machinery (e.g. direct drilling) or perennial plants (e.g. agroforestry);
- implement changes step-by-step, monitoring results and generalising successes.

We need a farmer-centric governance approach for all farmers – big or small, with any agronomic farm type or ecological context. We need the governance NOT to overload farmers with bureaucracy, but to empower capacities in the agricultural sector through reflexive governance that assures and enhances agency, planning security and socio-ecological diversity for high-value rural livelihoods.

Only with a fundamental switch - from top down to bottom up - in the understanding of the CAP and its according operationalisation in governance, will European farmers be able to act as net-calorie and -protein exporters, to aid communities around the globe in the long-run. As such, they will **leverage the EU's competitive advantage in climate change pro-socially**. This will support Europe's journey to food security and sovereignty while coalescing in reasonable and fair trade, that is fostering communities and the environment[116].

Additionally, in the future, **Europe could help governments everywhere to put in practice a new generation of land use governance** that protects farmers' data, rights and futures, while enabling them to achieve the optimal agro-economic and -ecological performance that all of humanity and all other species depend upon.

A diversity-uniting policy narrative could enable wide buy-in of European farmers to embark on the immediate journey towards a resilient and regenerative agriculture. In other words: enable the wide and self-managed commitment of European farmers to accelerate their on-farm investments into context-specific applications of the 'new' generation of means of agricultural production (cover crop seeds, on-farm biostimulant production, direct seeding machinery, fences, human capacities, etc.). We will elaborate on that narrative further down.

2.4. The great potential of agrifood system transformation for reversing polarisation and rebuilding social cohesion

Given the latest Green Deal and Farm-to-Fork setbacks, the deteriorating terms of trade and increasingly burdening regulation for farmers, serious supply risks due to insufficient climate change adaptation and geopolitical tensions, the mode and narrative of the sustainability transition of Europe's agrifood system must change.

For more detailed practical insights into this transition, further differentiation is decisive, as well as an understanding of the bell curve of Roger's theory of innovation[117].

The new agronomic praxes are being co-developed and implemented by about 2.5 % of all European farmers, which are, according to Roger's theory, **the 'innovators'**. They stem from all farm types and

[116] US Right to know. (2023). Gates Foundation agriculture project in Africa flunks review. (LINK); Binswanger, M. (2020). Mehr Wohlstand durch weniger Agrarfreihandel. (LINK)
[117] Diffusion of Innovation (DOI) Theory, developed by E.M. Rogers in 1962, is a widely recognized theory of social science. It originated in communication to explain how, over time, an idea or product gains momentum and spreads through a specific population or social system.

contexts (geographically, demographically, economically) and from different genealogies of sustainability: Conservation Agriculture, Organic, Agroecology, Community-supported Agriculture, Holistic Management, etc. They usually self-identify as practising some form of regenerative agriculture.

The early adopters (13.5%) of the EU agricultural sector have begun their journey, but the innovative agronomic praxis and its thorough implementation in the whole of the agricultural sector are currently spreading much too slow[118].

Additionally, we can comprehend the latest farmer outbursts and current political deadlock as "The Chasm" (see figure 13). This widening chasm is likewise a widening chasm in the polarisation of many groups in the whole of European society (rural/urban, left/right, etc.). **While the chasm grows, so do society's immense hidden costs: the costs of inaction and lock-ins.**

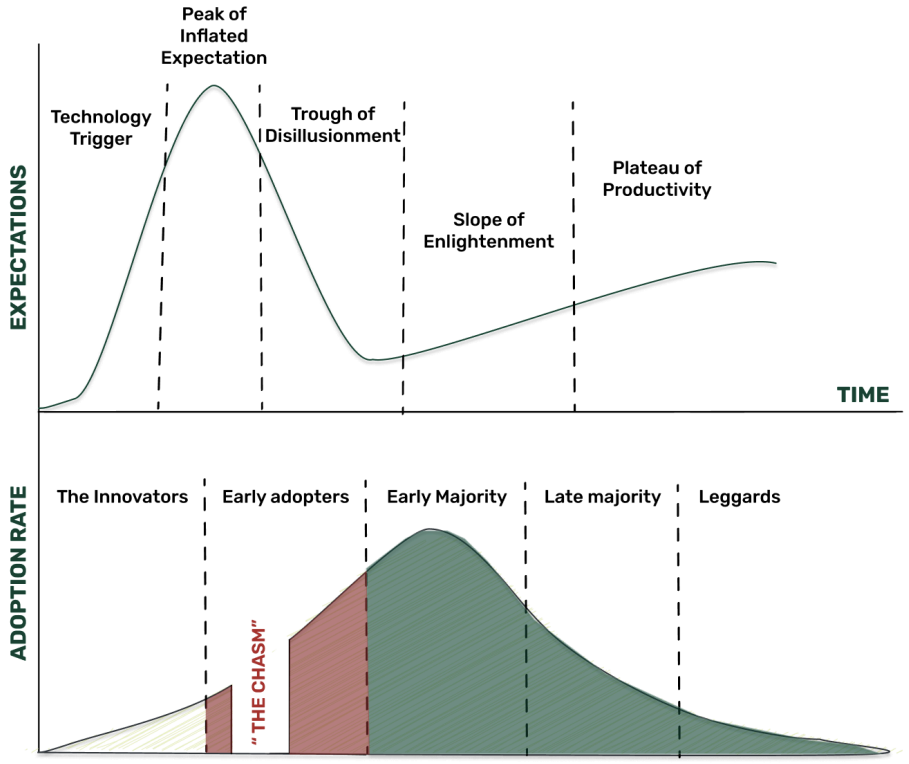

Figure 13: Gartner's 'Hype Cycle' and Roger's Innovation Adoption Curve plotted together expressing the "chasm" in innovation diffusion[119].

As a European society, we can no longer afford impacts of governance and policies that are degrading social cohesion or the environment. We need socio-ecological regeneration to grow, not degrade, social cohesion and ecosystem health. **We need to work towards a shared consensus and action plan of farmers, industry, citizens, policy makers, science etc. that holistically, synergistically and inclusively addresses our converging challenges.**

As the farmer outrage in the Netherlands in 2019 or current farmer protest across Europe are proving (especially with the demands of French farmers related to agri-environment-climate measures)[120], policy uptake and social cohesion development are not primarily a question of the size of funding that is allocated through governance, but a question of the **mode, purpose and narrative of governance.**

[118] This can be deduced from proxies such as soil disturbance intensities (tillage, etc.), cover crop application, integration rate of agroforestry, or of grazed livestock - or from more standard proxies such as pesticide and synthetic fertiliser use intensities. (LINK); (LINK); (LINK)
[119] Moore. (1991). Crossing the Chasm. (LINK)
[120] Westhoek & Boezeman. (2024). No deal on farming: lessons from the Netherlands. (LINK)

The default willingness of most farmers for adaptation and transformation increases daily, due to the increased number and severity of torrential rains, droughts, rising input costs etc. **We need coalescing narratives and action plans that synergistically steward our agrifood ecosystems by empowering farmers to cross the "chasm" towards the track of socio-ecological regeneration.**

The "chasm" can be bridged only by a production-integrated transformational narrative. Farmers want to produce, and society needs produce. Only with a production-integrated narrative, farmer-centric governance design and action plans for agro-economic and -ecological transformation, resilience and nature restoration, governance can nurture the necessary farmer motivation and capacity-building. This, in synergy with a facilitated public re-evaluation and appreciation of agricultural labour, are bedrocks of a successful future CAP governance - and imperative for a positive role of the CAP in the European project.

To bridge the "chasm" we need to move away from either/or outlooks. We do not need political narratives and policy approaches that contribute to binary oppositions, path-dependent deadlocks and mutual alienation. We need all. We need everything and everyone. We need Organic, we need Agroecology, we need Market Gardening, we need Community Supported Agriculture, we need Conservation Agriculture, we need Biodynamics, Syntropic Agroforestry and Holistic Management. Ultimately, from a governance perspective, we must understand them not as alternatives but synergistically, as moving towards regenerating agrifood ecosystems (leading to positive trends on key sustainability indicators). We need a policy and governance approach that is inclusive, non-dogmatic and transformation-enabling. An approach that can pick up every farmer and every plot at its current agro-economic and -ecological state and contribute to them regenerating that state. We need to root the agency for this regenerative transformation firmly within the farmers.

At our regenerative farm, Pangaio Manufaktur, we optimise agronomy by 'simply' maximising the plant surface available to us and farming beneficial microorganisms. What that means is farming a very diverse mix of plants with different functions and different housing/food types for all of the beneficial (micro)organisms above and underneath the surface. This way we also capture and integrate the maximum amount of sun energy possible into living roots that feed the constantly covered soil.

Beate Samaras, Farmer in Greece

At Iside Farm we develop different approaches to reach the enhancement of ecological processes, while maintaining, increasing and diversifying production. Our aim is to redefine the relation between management resources, space and outcomes within the photosynthesis processes adapted to our specific context, through the stratification of species, the maximisation of light use and the protection and integration of processes, thus increasing system performances linked to production, quality, resilience and adaptation.

Matteo Mazzola, Farmer in Italy

Part III: Towards a renewed CAP governance

The updated CAP until 2027 has been assessed from various angles, both by scientists and farmers[121]. It does not deliver in terms of establishing planning security and debureaucratization from a farmer's point of view. Nor does it deliver on the environment, nor on national economic, health and security issues from a political or scientific point of view. It has failed in its narrative and framing to sustainably and practically bridge 'the chasm' between productivity and socio-ecological outcomes, or between policy-making centres and the rural world.

At the Member State level, examples have been evolving of a new generation of farmer- and agroecosystem health-centred policy measures, largely in the form of result-based and/or soil health focused eco-schemes. These eco-schemes (around 20 across all of the EU) focus largely on reduced mechanical soil disturbance and increased soil cover, programmed in coordination with remote sensing technologies[122]. The next CAP reform ought to be about using the learnings of these schemes and farmer- and outcome-centric 'public-private' sector initiatives to evolve them into a systematic design of farmer-centric CAP payments for agroecosystem health performance.

We propose for the next CAP to start remunerating farmers for NPP and soil protection results, per year and per hectare, and per absolute and year-over-year results, benchmarked to the results of other plots from the same pedoclimatic region and land use category.

As such, a CAP can facilitate the long-awaited and necessary leap in agricultural governance and agronomic adaptation.

3.1 Designing performance-based payments for agroecosystem health

We propose a systematic design that aims at subsidising each agricultural plot according to its agro-ecological performance. **The performance can be monitored, reported and verified by the contextualised and holistic result- and outcome-based indicators of agroecosystem health development: NPP and soil health.**

Results of annual performance per plot can be derived from context-specific NPP and soil protection developments. Those results could optimally be verified by the longer-term outcome of land use management indicated by soil health developments.

The measurement and remuneration of the performance, and thus the annual payments per hectare, ought to be context-specific and of value to agronomic management - hence farmer-centric.

Consequently, the performance-based MRV-design should be responsive to:

- the soil and climatic (pedoclimatic) region of the plot
- the land use category of the plot
- the performance of the other plots in that pedoclimatic region and land use category
- two kinds of results/outcomes: absolute performance and year-over-year development

The context-specific benchmarking of performance allows for payments to be structured in order to be both fair to pioneers of European farming and, arguably even more importantly, be a powerful incentive that pulls all farmers towards the performance of the pioneers. Payments for the absolute performance (amount of NPP produced per hectare in one year) **assure fairness to the pioneers of land management methods**

[121] Candel, J. J., Lakner, S., & Pe'er, G. (2021). Europe's reformed agricultural policy disappoints. Nature, 595(7869), 650-650. (LINK)
[122] Meister, NABU. (2023). Analysis on eco-schemes across the EU. (LINK)

that produce the most public goods, have internalised the most externalities and produce the healthiest food. Year-over-year (YOY) results show how much NPP & soil cover performance have improved per hectare in one year. Payments based on YOY results ensure that every farmer working towards improving their yield resilience and quality, environmental impact and nature-based profitability, is supported in their transition in a way that allows for constant on-farm learning, context-specific adaptation and long-term guidance. This **reduces transfer costs and increases planning security for optimising on-farm sustainable total factor productivity.** Additionally, the proportion of funds going towards either absolute or YOY performance can be easily adapted.

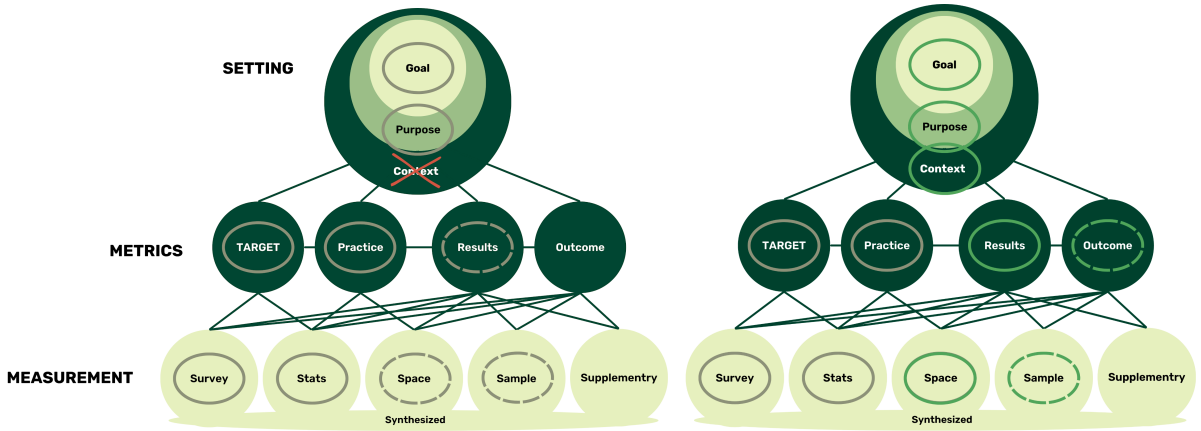

Figure 14: Schematic overview of holistic and context-specific governance design tools for agricultural policy. On the left is indicated what CAP governance has mainly been utilised so far. On the right is indicated where a farmer-centric and performance-based CAP post-2027 should be anchored[123].

3.1.1 Technological feasibility of MRV-Design

The technological feasibility of such a core MRV design anchored in NPP and soil protection already exists today[124]. With the Copernicus Land Monitoring Service (CLMS), the EU is particularly well prepared to become a global leader and set an example in performance-based land use governance, informed by remote sensing.

NPP can be remotely sensed using i.e. the Cloudless Biomass Index (CBI), which is optimised for photosynthesis performance with the **fraction of absorbed photosynthetically active radiation** (FAPAR). Soil protection can be remotely sensed using a Bare Soil Index (BSI). Drafts for pedoclimatic regions by the JRC exist[125]. Land use category data exists and can be improved with remote sensing data. With the EU's Earth Observation Copernicus Global Land Surface program, the EU Commission is constantly developing its own capacities for NPP and soil protection monitoring. European remote sensing experts deem the current **Copernicus capacities sufficient for making relative NPP and soil protection judgements at plot level**. The remaining uncertainties are equally distributed and therefore not significantly harming the fairness or the impact potential of the proposed payment design[126].

Apart from the public operational capabilities of the EU, Europe already has pioneering public-private data tools and operationalisation that are successfully proving the cost-efficient feasibility of the proposed remote sensing MRV-design (as well as for *in situ* soil health testing for outcome-based remuneration). The

[123] Adapted from Schreefel et al. (2023). How to Monitor the 'Success' of (Regenerative) Agriculture: A Perspective. (LINK)
[124] Sinergise. (2020). (LINK); AgriCircle (LINK)
[125] G. Tóth. et al. (2016). Hierarchical and multi-scale pedoclimatic zonation. iSQAPER Project Deliverable. (LINK)
[126] Experts consulted from Vito, Sinergise, Thuenen Institute and INRAE.

Field Observatory of Carbon Action[127] is a unique and long-term collaboration of farmers, researchers and companies who are promoting regenerative farming to benefit food production and the environment around the Baltic Sea. Another example is AgriCircle[128], who, on behalf of the European Space Agency, was one of the first companies using the Copernicus satellites for producing affordable agronomic management tools in combination with ecological monitoring.

The EU's Soil Monitoring and Resilience Law accelerates the EU's capacities for plot- and context-specific soil health measuring. Capacities are further enhanced by EU Horizon projects such as BENCHMARKS[129]. The latter is a project coordinating 24 European case studies to develop a multi-scale and multi-user focused monitoring framework that is contextualised, transparent, harmonised and cost-effective. Underpinned by the best scientific knowledge and technologies, **this framework will provide a clear soil health index for benchmarking**, using indicators that are pertinent to the objective of assessment and the context of land use, as well as being logistically feasible.

Annex II of this paper will explain how we set out to test the proposed MRV-design in 2024.

3.1.2 The enormous leverage the CAP could mobilise with performance-based payments

To understand from where and in what scope funds could underwrite fair and simple agroecosystem health performance-based payments, we now briefly reflect upon the finances of the current CAP.

CAP financial capacity and effectiveness of current spending

€387 billion in funding will be allocated to the CAP for the 2021-27 period.

This comes from two different funds and is structured in two different pillars: the European agricultural guarantee fund (EAGF), which has been set at €291.1 billion and fully covers Pillar I (market measures and direct payments); and the European agricultural fund for rural development (EAFRD), which will amount to €95.5 billion for pillar II (rural development) and is co-financed by Member States (varying from 25% to 75% depending on the measures and region).

Since the new reform in 2021/22, a financial reserve has been added - €450 million every year that can be directed towards measures such as emergency buying and private storage aid. Two years in a row, the full crisis reserve budget of €450 million per year was spent in the first half of the year.

The recent use of that reserve enabled Member States to co-finance with 200%. However, this emergency funding is relatively small in comparison to the amount which Member States mobilise themselves: for example, Spain issued a farmer support package of 1.8 billion in 2023, Germany of 1 billion in 2020. In response to the war in Ukraine only, Member States have provided more than €7 billion in aid to farmers[130].

It can be argued that, apart from the few attempts of redesigned eco-schemes mentioned above, **none of the financial incentives just described are currently aimed at supporting the new generation of agricultural innovation nor at building yield resilience and quality** - as the new 'standard output' understanding fit-for-purpose in the 21st century. On the contrary, most payments provide no incentive to structurally change or adapt agronomic praxes but support business as usual.

In comparison to how inefficiently public funds are spent currently, it is crucial to understand that performance-based payment design is agile and adaptive. Objective data can be analysed, allowing full cash outflow and payment adaptation to happen in retrospect, as well as to be prepared with data from the previous years. It can be assured that no one is left behind who invests in sustainability. and that all public

[127] (LINK)
[128] (LINK)
[129] (LINK)
[130] According to Farm-Europe, these numbers only give a partial view of the real aid granted by the Member States.

money is spent for optimal incentivisation of 'sustainable total factor productivity'. It should be discussed how the payment design could further be opened to co-financing. Member States might want to move from paying crisis relief without structural impact, towards paying for investments in building agricultural resilience, as well as LULUCF mitigation and removals.

The CAP's financial capacity to pay farmers' transition costs

To compare the financial resources of the CAP with the transition costs of the majority of conventional farms that decide over the majority of the land use management in Europe (exemplarily sketched in Part II), we will break the total current CAP PIIlar I funding capacity down, on a per hectare basis.

If we do a simple calculation of spreading the €291.1 billion over 5 years over the approx. 157 million hectares of EU farmland, that makes about 370€ per hectare and year.

It is reasonable to assume that those with the highest transfer and opportunity costs have also the lowest performance in NPP and soil health (eg. conventional vegetable, sugar beet and potato focused arable farms)[131]. However, those are likewise the farms with the least necessity for farm income support. In Roger's theory of the diffusion of innovation introduced in Part II, the last 16% of the population to adopt an innovation are the 'laggards'. Let's assume that, in the first iteration with a new CAP design, the laggards will not be able to qualify for performance-based payments because they do not perform adequately. To qualify they would need to significantly improve performance YOY or not be among the poorest of absolute results.

The share of funding that would be going to underperforming 'laggards' can then be distributed to drive a farmer- and agroecosystem health-centred sustainability transformation of the EU agrifood system, on the remaining approximately 84% of EU farmland where management is performing to qualify for public remuneration. On those lands, agro-economic opportunity and transfer costs do not outperform CAP funding capacities, and farm income support is more likely to be reasonable. It is of course also possible, and a matter of political discussion and decision-making, to set the lower threshold for subsidy recipients i.e. to all agricultural plots who do not show a degradative development[132].

Advancing the livestock transformation

Key to the EU agrifood system transformation is the structural change of EU livestock production. For governing the livestock sectors' transformation, it is essential to center the theory of change around an understanding of livestock's essential role in agroecosystem regeneration and function[133], as for example for closing nitrogen cycles regionally and improving drought resilience.

When livestock is disconnected from the land into concentrated animal feeding operations, they require allocation of arable land to produce livestock feed that is in competition to human food and, in turn, at least in the European context, forces imports of protein to feed these animals[134]. The feed situation is then compounded by management challenges, including animal health and well-being, in addition to environmental and human health impacts, due to the concentration and management of animals and waste.

A sustainable transformation of EU livestock production should be understood primarily through the lens of agroecosystem, animal and personal health. **Animal husbandry should support the health of animals and agroecosystems**. **Animal feed ought not to be in competition with human food and should be sourced from the bioregion**.

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[131] Garland et al. (2021). Crop cover is more important than rotational diversity for soil multifunctionality and cereal yields in European cropping systems. (LINK).

[132] Degradative development could be understood as having poorer context-specific NPP and soil protection results than in preceding years after normalization for precipitation, while being in the lowest bracket of performers.

[133] Thompson et al. (2023). Ecosystem management using livestock: embracing diversity and respecting ecological principles. (LINK).

[134] EU self-sufficiency for all protein sources has been stable at around 77% this decade, yet the EU imports approximately 28 million tonnes of soybean meal annually. (LINK)

The transformation of EU livestock production to one where livestock is used as a key lever of land use management for achieving healthy soils, could be incentivized by the here proposed performance-based direct payments design.

Decades of planned grazing in Europe and around the world demonstrate how planned, high density grazing combined with long recovery periods, increase soil and plant diversity, enhance soil function and nutrient cycling through photosynthesis-driven relationships between plants and the soil microbiome, increase organic carbon in soils that in turn improve water infiltration and retention, and reduce bare ground[135] (see our Box in Part II). By connecting animals back with the land, livestock help to cycle nutrients from the soil and then back into the soil through forage – thanks to photosynthesis. In the current system, feed is primarily an externalised cost of production, and waste management is a cost of doing business. On the contrary, getting livestock back onto the land en masse reduces the true costs of production significantly, by integrating livestock production with primary feed sources, while waste is converted into beneficial nutrient cycling for soils, with the added benefit of more nutrient dense foods for humans, animals and plants, in addition to water resiliency and drought resistance[136].

Planned grazing methods can greatly improve NPP as well as soil and animal health in grasslands and arable lands. Additionally, feed from arable farming performing high on the here proposed indicators can lead to healthier animals and healthier food[137].

Whereas today the majority of CAP funding goes to concentrated animal feeding operations and connected stranded assets in the downstream supply chain[138], the proposed design would aid the construction of the political power necessary to assure the ending of coupled and indirect support by the CAP to socio-ecologically degradative livestock production[139]. Of course, for a successful transformation of EU livestock production, many other factors such as education to help citizens to adapt dietary choices (including making informed decisions about the personal health and environmental aspect of meat and dairy products depending on their production systems), food environments[140] and/or other policy levers will be needed.

Sufficient leverage and immense impact potential for the sustainability transformation of the agricultural sector

Member States co-financing for YOY performance would be wise to rapidly scale out the new agricultural innovations for food security, as well as agroecosystem and citizen health. If the current Pillar I and II structure remains, that could be envisioned for example as an additional AECM, using the same MRV working with bonuses. Many other possibilities exist and ought to be taken into account as the discussion on CAP post 2027 architecture advances.

Ultimately, the scenario discussed above regarding the mature agricultural sector in Germany, shows that **the CAP clearly has the financial resources to supply the transition costs for facilitating agro-economic and ecological trend reversals on the largest parts of agricultural land in Europe. This holds the potential to reverse negative trends in those largest parts of the biodiversity, and consequently in the natural cycles and the food consumed in the EU.**

[135] Rowntree et al (2020). Ecosystem Impacts and Productive Capacity of a Multi-Species Pastured Livestock System. (LINK)
[136] Pérez-Gutiérrez et al (2019). Impacts of soil carbon sequestration on life cycle greenhouse gas emissions in Midwestern USA beef finishing systems (LINK)
[137] Montgomery et al. (2022). Soil health and nutrient density: preliminary comparison of regenerative and conventional farming. (LINK)
[138] Kortleve, A., Mogollón, J., Harwatt, H., Behrens, P., (2024), Over 80% of the EU's CAP supports emission-intensive animal-products, Nature Food, in publication
[139] Greenpeace. (2021). Marketing meat: HOW EU PROMOTIONAL FUNDS FAVOUR MEAT AND DAIRY. (LINK)
[140] Food environments describe the context in which consumers engage with the food system to make decisions on acquiring, preparing and consuming food.

3.1.3. Structure, amount and fairness of performance-based payments

The following example outlines the specific monetary structures of the payment design, based on current Pillar I financial capabilities, for one plot of one farm in one pedoclimatic region.

Let us consider a hypothetical pedoclimatic region that has 10.000 hectares in a particular land use category.

The best performing bracket of plots, with the highest absolute NPP and soil protection results, gets 325€ per hectare and year. The top 10% of plots, which increased their Y0Y NPP and soil protection results the most, are also receiving 325€ per hectare and year.

The second best bracket could get 300€ per hectare. This continues until the last population segment (see details in figure 15) which would be excluded from receiving payments due to underperformance (again, this is a political decision to be discussed)[141]. Not paying the lowest brackets of results can be comprehended as a new option for performance-based conditionality.

To further increase the fairness and impact of the public money being spent, the already well-known idea of capping the amount of payments that a single farmer/landowner can receive is imperative.

Hence, we introduce an additional idea of bonuses and discounts on the performance-based payments, in respect of the farm size of the recipient:

If a farm is:

- smaller than 5 hectares: Their per hectare performance-based payment could get a bonus by multiplying by a factor of 10
- smaller than 15 hectares: factor 8
- smaller than 30 hectares: factor 5
- smaller than 50 hectares: factor 1,.5.

On the contrary, if a farm is:

- larger than 500 hectares, their per hectare performance-based payment could be discounted by a division factor of 3
- larger than 400 hectares: division factor 2
- larger than 300 hectares: division factor 1.5
- larger than 200: division factor 1.25[142].

Such bonus and discount mechanisms could not only preventively abate undesirable consequences (land grabbing, land price speculation, concentration of public fundings, etc.), but could also help to proactively counteract already entrenched problems, like land ownership concentrations, unattractiveness of agricultural labour and demographic problems of the agricultural sector.

[141] Of course many different variables would ultimately come into play to determine the actual programming of funding sizes and distributions. In the long-term, one could spare some financial capacities to remunerate context-specifically the soil health performance in a similar mode every 7 years.
[142] This discount and bonus distribution is roughly approximated from the distribution of the size of current farm holdings.

Basic Information

Farmer	Farm Size (ha)	Plot Name	Plot size (ha)	Farm Size Bonus/Discount	Land Use Category	Size Context-Region (ha)
Ms XY	85	A	10	Does not apply	Arable	10,000

Performance & Payment Overview of Plot A

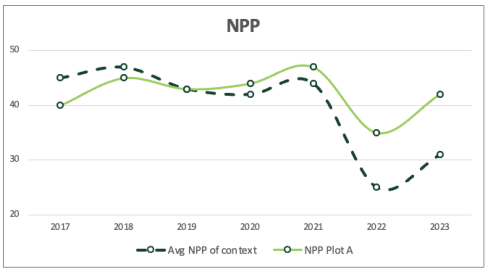
	Regionally Benchmarked Peformance Rating (NPP & SC)		Performance Payment (NPP & SC)		Combined Payment	
Year	Plot A	YOY Plot A	Plot A	YOY Plot A	Single Payment	Total payment (total ha)
2017	6900	0	€ -	-	€ -	€ -
2018	5950	2643	€ 175	€ 225	€ 400	€ 4,000
2019	5000	3266	€ 225	€ 225	€ 450	€ 4,500
2020	4400	3827	€ 225	€ 225	€ 450	€ 4,500
2021	4200	4604	€ 225	€ 300	€ 525	€ 5,250
2022	2100	1016	€ 225	€ 175	€ 400	€ 4,000
2023	1850	5578				

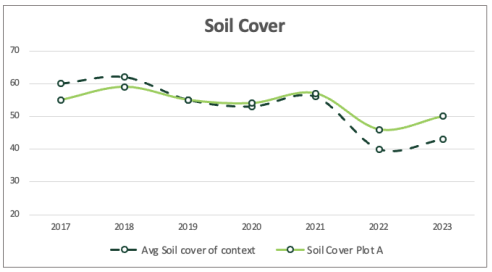
* Hectares are pre-aggregated and benchmarked as average result per plot

NPP

Results and performance

	Average		Plot A		Plot Ranking NPP	
Year	Avg NPP of context	YOY Avg NPP of context	NPP Plot A	YOY NPP Plot A	Plot A	YOY Plot A
2017	45		40		6900	
2018	47	4%	45	13%	5800	1841
2019	43	-9%	43	-4%	5000	3085
2020	42	-2%	44	2%	4200	3446
2021	44	5%	47	7%	3800	4207
2022	25	-43%	35	-26%	1500	446
2023	31	24%	42	20%	1300	6554





Soil Cover

Results and Performance

	Average		Plot A		Plot Ranking Soil Cover	
Year	Avg Soil cover of context	YOY Avg Soil cover of context	Soil Cover Plot A	YOY Soil Cover Plot A	Plot A	YOY Plot A
2017	60		55		6900	
2018	62	3%	59	7%	6100	3446
2019	55	-11%	55	-7%	5000	3446
2020	53	-4%	54	-2%	4600	4207
2021	56	6%	57	6%	4600	5000
2022	40	-29%	46	-19%	2700	1587
2023	43	8%	50	9%	2400	4602

Distribution Key of Pedoclimatic Context

Range	Payment distribution key	Ranking Threeshold of ha in region	Range Minimum	Range Maximum	Payment Plot	Payment YOY
A	2.5%	250	1	250	325 €	325 €
B	13.5%	1,350	250	1,600	300 €	300 €
C	34.0%	3,400	1,600	5,000	225 €	225 €
D	34.0%	3,400	5,000	8,400	175 €	175 €
E	16.0%	1,600	8,400	10,000	- €	- €

Figure 15: Exemplary farmer- and plot-specific performance and payment information for NPP and soil cover in a pedoclimatic region over one year.

We want to highlight that these numbers are hypothetical. In particular, the structure and budget of the distribution key should ultimately be developed in the EU trilogue negotiations. The operationalisation at Member State and pedoclimatic context level ought to be implemented with agility, by using empirical data of preceding years and trend developments, as well as predictive modelling. In Annex II, we describe how we plan to pilot the proposed system underlying the payments and test for different scenarios, unintended consequences and impact potential, thus producing the technological 'proof of concept'.

3.2 Reflexive CAP Governance

Since the last reform, the CAP is allowed to reimburse farmers for costs of measures and forgone opportunities, and also to make income-effective payments for ecosystem services, and hence for the delivery of the objectives of the TFEU and CAP from a perspective as described in Part I[143]. Eco-scheme 1 in Finland (vegetation cover in winter, also for permanent grassland) is one example of the application of those new governance abilities for incentivizing both agro-ecological and economical performance in an income-effective manner.

The CAP design we propose is a **multi-benefit, fair and performance-based policy, as discussed by the OECD**. It is designed to deliver on objectives in agricultural, climate, environment, food and health governance. It is modelled after and co-developed with the most innovative European farmers. Creation and spreading of innovation starts with the first group of 2.5% of adoptees who are themselves the innovators, followed by 13.5% of people being early adopters. **The approach is designed as a policy strategy for spreading the new generation of agricultural innovations amongst the majority of EU farmers** - a majority which so far was unable and is expected to remain unable to fully commit their agronomic praxis to these new innovations in due time.

Contrary to recent developments, in which Eco-schemes can change annually, such a structural redesign would allow more planning security in the subsidy (and prospectively regulatory) environment of farmers. In comparison to measure-based policies and decoupled direct payments, the goals of agroecosystem health and yield resilience, as well as the proposed indicators, can be committed to over much longer time horizons.

Arguments which focus on possible adverse effects[144] of the proposed payment design must be weighted against the possibility and thus the impacts of continuing to NOT reach the majority of EU farms with a new compass that structurally integrates agronomy and agro-ecology, significant simplification and positive reengagement.

3.2.1 Towards a hybrid CAP scheme

Transitioning to a farmer- and agroecosystem health-focused CAP design post-2027 could take the form of a **hybrid scheme anchored in payments for result-based performance per hectare, alongside payments for specific measures and practices**.

Assuming that the current basic CAP infrastructure would remain, a farmer- and agroecosystem health-centred CAP design should commit its full Pillar I funding to a type of performance-based payments as described above.

These could be complemented with various programs of Pillar II. The fairness and levelness of the playing field, regarding external costs in the EU agricultural sector, could be greatly improved with socio-economically and ecologically performance-based payments, instead of decoupled direct payments[145]. Farmers that produce the most ecosystem services and resilience of agriculture production would be supported most. These would be likewise the farmers who have internalised the most environmental externalities (eg. you cannot use a lot of synthetic nitrogen fertiliser and at the same time have and care for the vital nitrogen-fixing bacteria communities in your soil).

Such a transition above all requires upfront and carefully narrated, farmer-led communication with farmers.

[143] The new paragraph 7a) of Article 31 of the Regulation on the last reform of the CAP "Basic income support for sustainability" allows this. This paragraph is closely related to Article 4 of the CAP SP Regulation, which had extended agricultural activity to the production of public goods.
[144] A discussion must be opened and continuously held about possible perverse incentives through NPP and soil protection performance-based payments. In the evaluation of possible adverse off-target effects, different variables must inform the reasoning. We must consider political success chances of different strategies- that is to say, consider the net-adverse off-target effects (in comparison i.e. to continuing decoupled direct payments).
[145] Sometimes also referred to as untargeted and targeted direct payments.

It is crucial to **provide timely, clear and inclusive communication, promoting a narrative that gives primacy to short- and long-term production aspects and transparent methodologies**, thus ensuring optimal uptake and educational effectiveness. Data should be shared with farmers that shows their NPP and soil cover performance of preceding years, as well as that of regional pioneers in agroecosystem regeneration (and their land use management strategies) so as to build understanding and inform future land use management decisions.

Expected benefits of a farmer- and agroecosystem health-centred CAP design[146]:

- Long-term planning security for farmers (drastic reduction of transfer costs);
- New societal appreciation of the positive agency of farmers in our climate and biodiversity crises (contributing to alleviate demographic problem in the agricultural sector);
- Very little to no bureaucratic work for farmers;
- More level playing field for farmers;
- Context and journey responsive subsidies;
- Production-integrated payments for public goods and agricultural productivity (we pay mainly for NPP/HANPP ecological and economic 'yield');
- Fairness to Pioneers in the farming sector;
- Transformation and innovation inoculation of agricultural sector (farmers are incentivized to go further / 'have something to negotiate with');
- Fostering of farmer motivation and ability for consequence capture and capacity building;
- Possible positive feedback loops through regional peer to peer synergies:
- Assured cash outflow for performed production of public goods (those which are not remunerated by the private market).

Additionally, to facilitate transition we believe that the **CAP, in combination with a payments design anchored in agroecosystem health,** should:

- **Support the animation of peer-exchange networks** such as the "GIEE" initiative[147] in France or the association Greenotec in Belgium, both financed through public money of the Member States. Support for these networks could be provided in several ways:

  Funding a network facilitator to organise meetings, manage collective experiments, collect, synthesise and disseminate knowledge from technical and basic research institutions and from farmers themselves[148].
- **Support on-farm experimental networks**, which are best suited to analyse the performance of farm health that requires the collection of large data sets and cannot be handled by reductionist approaches [149].
- **Support the dissemination of pioneer knowledge**:

  Set-up re-training workshops of extension services with pioneering farmers, consultants and scientists.

[146] European Network for Rural Development. (2017). Result-based approaches to AECM. (LINK)
[147] Economic and Environmental Interest Group (LINK)
[148] Catalogna, M. (2018). Expérimentations de pratiques agroécologiques réalisées par des agriculteurs : Proposition d'un cadre d'analyse à partir du cas des grandes cultures et du maraîchage diversifié dans le département de la Drôme; Salembiere et al. (2018). Genealogy of design reasoning in agronomy: Lessons for supporting the design of agricultural systems. (LINK).
[149] Lacoste et al. (2021). On-Farm Experimentation to transform global agriculture. (LINK)

Initiate projects to collect and disseminate pioneering knowledge, e.g. by tracking innovation approaches. [150]

Provide incentives to pioneers to share their knowledge with their peers in the same pedoclimatic context.

Support coupled innovation projects across food system actors to mitigate lock-in effects[151], e.g. product specifications not adapted to regenerative systems, while alternative specifications are achievable, e.g. protein requirements for bread, purity of grain coming from mixed crops.

3.2.2 Political context of CAP reforms

The proposed governance approach sketches a **way to end the negative impacts that the CAP's decoupled direct payments have, such as locking into path dependency and violating global trade rules**. The approach does so without undermining farm income or productivity, but by inoculating farm input autonomy, on-farm climate change adaptation and the resilience of a **future-proof and nature-positive EU agrifood system**. It further seeks to facilitate a positive and meaningful public reengagement with rural livelihoods, ecosystems and farmer well-being.

CAP reforms are driven by external and internal pressures. The last structural reform, in the years 2006 and 2007. from price support to decoupled direct payments, is believed to have been ultimately triggered by new WTO agreements. Back then, the idea of income support in the form of direct payments, rather than price support, had for a long time neither been deemed practical from an administrative point of view, nor desirable from a financial point of view by the Commission. OECD and WTO pressure on price support contributed to changing that.

OECD and WTO now demand performance-based payments and increase the pressure on decoupled direct payments[152]. Coupled direct payments can be measure/practice-, result- or outcome-based. Since 2013 the CAP has been shifting funds from decoupled direct payments to measure- and practice-based payments. Sadly, this was with very little socio-ecological or -economic success from a sustainability, fairness and resilience perspective[153]. The success for the now running period is likewise expected to be insufficient for EU Green Deal goals. In many cases, other governance objectives such as cash outflow, transparency or social cohesion are not achieved either.

Internal pressures on the CAP are rising as well. Farmers demand debureaucratization. Science, civil society and agrifood industry actors are calling for justice, health, resilience and sustainability.

In order to successfully steer the necessary socio-economic and ecological regeneration of EU agrifood ecosystems, we believe it is fundamental for policy makers to embrace farmers as the most important agents for regenerating ecosystems, and as utterly important agents for Europe's existential adaptation to climate change.

This must come with the acknowledgement that changes in and pressures on the agricultural sector are accelerating. Constant adaptation in the sector must be as responsive to local contexts as possible. The agency, motivation and capacity for meeting context-specific agro-ecological challenges must be rooted in farmers.

[150] Adelhart Toorop et al. (2020). Using a positive deviance approach to inform farming systems redesign : A case study from Bihar, India. (LINK); Périnelle et al. (2021). Combining on-farm innovation tracking and participatory prototyping trials to develop legume-based cropping systems in West Africa. (LINK); Salembier et al. (2021). A theoretical framework for tracking farmers' innovations to support farming system design. (LINK)
[151] Meynard et al (2017). Designing coupled innovations for the sustainability transition of agrifood systems. (LINK); Puech et al. (2021). Collective design of innovative agro-ecological cropping systems for the industrial vegetable sector. (LINK)
[152] Euractiv. (2022). OECD-Chef fordert weltweite Abschaffung„ wettbewerbsverzerrender" Agrarsubventionen. (LINK)
[153] European Commission. (2023). The Environmental Dimension of the EU's Common Agricultural Policy (CAP). (LINK)

3.2.3 Benefits for the public and private sector

The benefits of a redesigned CAP could be plentiful, not only to farmers and citizens, but also to the public and private sector.

Opting for a farmer- and agroecosystem health-centred CAP design as outlined above could achieve **transparency, cash outflow and optimal incentivisation of changes in agricultural production systems**, as well as a basis for a wide coalition for the proposal's support. Additionally, an indirect penalising effect would be achieved by increasing the political chances for eliminating decoupled direct payments in 2027.

The European public sector, integrating learnings of historical, recent and ongoing agricultural governance redesign processes, i.e. in England and Wales or the United States[154], could be setting a new benchmark for agricultural and ecosystem governance globally.

For the private sector, immense supply chain de-risking as well as a significant push for its own programs could be expected. The design **does not compromise the private sectors' own programs related to SBTi FLAG, CRCF or price premiums**, but rather **sets private and public engagement into a synergistic path for structural change.**

3.2.4 Political feasibility and opportunity

In political terms, the design opens up the **urgently needed opportunity for a policy discourse that fosters cohesiveness among the narratives currently competing in the policy arena**.

In the current debate, NGOs, science and smallholder farmers want to terminate hectare-based direct payments in the CAP. Contrarily, big landowners and powerful farmer associations want to continue decoupled hectare-based direct payments in collaboration with other stakeholders with a vested interest in the status quo.

Our proposed CAP design can mediate a synergistic middle way.

Rather than agreeing to a minimum reform without sufficient ambition and agonising alienating consequences, **this design creates a synergistic middle way by opening an achievable systemic shift led by innovative farmers from all European regions and farm types**. It aims at building the practical bridge between the stakeholders, by mobilising a critical mass behind the **proposal of hectare-based, simple, direct payments that are specifically designed to fairly remunerate and incentivize agroecosystem health performance, sustainable factor productivity and farmer livelihoods**.

Towards a prosperous future - a structurally reformed CAP to reroot the European Union

From a perspective of currently competing policy narratives in the agrifood system transformation discourse, the outlined understanding of the innovative leap in agricultural practice - regenerative agriculture - roots itself in pioneering farmers in Europe and beyond. **Farmers are producing the innovations for a fit-for-purpose agriculture in the context of the 21st century**. They are integrated by their 'unity in diversity' representing the full diversity of farming contexts from Europe. **This holds the unique potential to integrate all progressive farming positions, climate, environmental, gender and social justice movements, to accelerate and unify their voice and political agency**. Such a coalescence is

[154] The Guardian. (2022). 'We're only seeing the negative': UK farmers on Brexit and losing the common agricultural policy. (LINK); AHDB. Background to the Sustainable Farming Incentive. (LINK); IATP. (2024). Farm Bill extension leaves behind farmers eaters. (LINK)

imperative to build the political power necessary to sufficiently enable policy makers towards a differentiated regulation and incentivisation of agrifood system agents – farm to fork.

An inclusive umbrella perspective of **'regenerative agriculture' aims at bridging not only the "chasm" in the agricultural sector, but also of the rural/urban, young/old etc. dichotomies, through organising at the farmer-citizen level** - thus forging new alliances along comprehensive policy programs tailored to specific regions, but based on shared principles and processes. In this way, regional agitation and change, as well as coordinated private and public support, can advance coherently with a developing vision of a reflexive agrifood system governance for regeneration that can be integrated, defended and pushed for at a global level as well[155].

A farmer- and agroecosystem health-centred CAP ought to be embedded in such a wider governance programme.

The keystones of such a wider governance programme should put emphasis on:

- **results & outcomes instead of measures/practices**
  Farmer- and agroecosystem health-centred performance-based payments as a core public incentivization lever in the transformation
- **yield resilience, quality and diversity instead of classic standard output**
  All economic relations in the agrifood system must be designed to enable farmers to farm for NPP & HANPP[156]
- **animal husbandry instead of concentrated animal feeding operations, and**
  We need a differentiated policy on livestock, basically along two principles: (1) animal feed ought not to be in competition with human food and should be sourced from the bioregion; (2) animals ought to be raised in support of biodiversity, natural cycles and animal health
- **degressive trade, fair competition and international law, instead of free trade in a rules-based order**
  Theory and terms of trade[157], monetary, market and property structures currently drive degradation, but must be utilised to drive regeneration [commodity speculation, retail oligopolies, etc.]

We propose a narrative that can be shared widely in the policy and public discourse for the next CAP:

The European Union's and each Member State's most fundamental survival depends on social stability, of which the first conditions are a stable biosphere, as well as water and food security. At this point, arguably **all actors' most important lever in a constant and accelerating climate crisis is water resilience** (heat, drought, storm and flood resilience). This can be achieved **primarily through increasing net primary production (NPP) in synergy with soil health and the detoxification of our environment** (biodiversity and biogeochemical cycle regeneration).

It is common sense that agriculture should provide family farmers with a secured income and value-based livelihoods, provide citizens with a secured, affordable and healthy nutrition, and provide ecosystems with nature-positive stewardship. The agricultural sector should not be a refuge or frontier of capital investment in the search for ever-higher profits and rents. The largest deficiency of the regulatory, subsidy and market status quo is not the lack of markets where farmers can sell the public goods they produce. The structural problems lie much deeper. Many underlying assumptions in the agricultural sector - from the theory of comparative advantage to the economies of scale over productivist and globalist biases - need thorough reassessment and a revision in coherence with the challenging context of the 21st century.

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[155] Gordon et al. (2023). Regenerative agriculture: a potentially transformative storyline shared by nine discourses. (LINK)
[156] Human appropriated net primary productivity (HANPP) is a standard concept in science to refer to yields such as food and fiber.
[157] Binswanger, M. (2020). Mehr Wohlstand durch weniger Agrarfreihandel (More prosperity through less agricultural free trade). (LINK)

To achieve this, the power of large landowners, concentrated agricultural input and livestock industries, food commodity speculation, FMCGs and retail[158] **needs a differentiated assessment and guiding regulation regarding market power and CO_2e emissions, as well as social and environmental impacts**[159].

The CAP cannot achieve all this by itself. However, it remains the largest leverage in the European system to date (and to come). The political window of opportunity to use this leverage as a European community has already opened and must be seized.

For the current European context, **a reformed, farmer-centric CAP anchored in simple and fair payments for agroecosystem health performance holds unique potential to facilitate the necessary change in the agricultural sector**. Embedded in a **wider reassessment of agrifood ecosystem governance**, all stakeholders (farmers, public servants, food councils, science, civil society, the future-oriented business community, activists and citizens) can make large gains towards food agency, security and sovereignty in the EU and globally, as well as the largest possible gains to counteract our societies' and planet's demise.

Therewith, we as Europeans, farmers, public servants and citizens alike, will have a policy project worth fighting for, and a chance to positively re-engage with our communities, our regions, our nations and our European continent, for peace and economic stability, on a planet supporting life.

[158] Unite. (2023). Unite Investigates: Profiteering across the economy—it's systemic. (LINK); Lademann & Kleczka. (2023). Marktbeherrschung im Lebensmitteleinzelhandel? (Market domination in food retail?). (LINK); Howard, P. (2022). Concentration and Power in the Food System: Who Controls What We Eat?, Revised Edition (Contemporary Food Studies: Economy, Culture and Politics). (LINK)

[159] For which many historical examples exist, such as that of the A&P supermarket chain, which accounted for 16% of U.S. grocery sales at its peak in 1933, a considerably smaller share than Walmart, and today controls about one-quarter of the national market. Concerned that the company was using its size to pressure suppliers for discounts not available to other grocers, the US Congress in 1936 added a new law to the government's antitrust arsenal. Aimed squarely at checking the power of big retailers, the Robinson-Patman Act barred chains from using their leverage as major buyers of goods to coerce suppliers into charging them less and their competitors more. We need to enforce the antitrust laws in accordance with their purpose, which was not to chase the idea of maximum efficiency, but rather to structure markets to promote competition. Many examples exist in the history of European economic thoughts, which has a tradition of strengthening anti-trust action and fair competition - starting with French physiocrats or classical political economists towards ordoliberalists and modern money theorists,

Appendix I: On the CAP's objectives b,c,d,e – Alleviating market and power asymmetries in the EU agrifood system for future-proof rural and urban livelihoods

To incentivize the necessary speed and scale of the transformation, especially of farms with high transfer- and opportunity costs, private and public compass-setting and financial support needs to be coordinated and pushing in the same direction.

Many executives in the big corporations of the agrifood system are fully aware that the common misinterpretation[160] of the term 'sustainable intensification' is a disastrous path. They know that only true farming for regeneration, the new agronomic praxis described above, holds sufficient potential to successfully overcome the challenges ahead[161].

Further, a wide and novel coalition of stakeholders expressed in 2023 the insight on the leap in agricultural innovation[162]: the Soil Health Law Coalition brought together more than €215 billion in annual agrifood system turnover, to voice their support for an ambitious and progressive environmental soil law (total food sales in EU approx. €1,790 billion p.a.; of which 16% as the combined two most innovative segments of the population according to Rogers theory of innovation are approx. €286 billion, showing significant correlation).

While some of the big Fast-Moving Consumer Good companies (FMCGs) (driven by the insight on the agricultural innovation, by yield fragility and by the need to de-risk supply chains) are giving some serious financial commitments to the socio-ecological regeneration of their upstream value chains, food retail in Europe has not caught up yet[163]. A comparative look at their scope 3 emission reduction targets, as well as their regenerative agriculture commitments, is telling - that is although retailers have high targets on increasing the share of their inhouse brands in overall sales (increasing their direct responsibility for their supply chains).

For example, a recent study sponsored by the state, finds that none of the big German retail chains had positive proactive supply chain engagement with more than 5% of their suppliers[164]. While some of the big FMCGs now have targets and goals on the ecological standards of their supply[165], retail so far either does not have any, has rare or much less systematic implementation, or offloads the responsibility to the upstream supply chain.

The FMCG engagement for ecological transformation is motivated mainly by supply chain resilience, and to the largest part entails some kind of social betterment within the supply chain as well. That is because generally, as the resilience of the supply chain is revalued by those bearing the costs of the latest shocks, longer relationships are perceived to be more cost-efficient and necessary to build sales through a comparative advantage in supply access and marketing, which leads to the betterment of the terms of trade for suppliers (at best of singular farmers).

Currently, this reevaluation of cooperation over competition along food supply chains and/or the growing sensibility for the fragility of agricultural yields, is either not happening at a sufficient scale, with the

[160] Actually, the original meaning of "sustainable intensification" when the term was coined by the United Nations Food and Agriculture Organization was to produce as much as possible without leaving a lasting negative footprint in the environment, but instead regenerating ecosystems and their services at the same time.
[161] The Guardian. (2023). Healing nature will help us all. So why are MEPs fighting a key new restoration law? (LINK)
[162] EEB. (2023). Joint open letter to the European Commission on the urgent need for an ambitious and progressive EU Soil Health Law. (LINK)
[163] FAIRR. (2023). The Four Labours of Regenerative Agriculture. (LINK)
[164] Unwelt Bundesamt. (2022). Nachhaltigkeit im Supermarkt: Handel schöpft Potenzial nicht aus Politik muss Rahmenbedingungen für Umweltschutz als Wettbewerbsvorteil schaffen. (LINK)
[165] FAIRR. (2023). Food Sector Making "More Promises Than Progress" On Regenerative Agriculture. (LINK)

necessary priority in management's decision-making - or, is not happening at all among those actors whose profit developments give no impetus for any structural supply management reassessments (yet) and/or whose core business can simply not be existent in a sustainable agrifood system.

More precisely, large parts of ag-input, commodity trading and factory farming that are deteriorating our economy, ecosystems and society in their current form, have to be met with market conditions that drive their current mode of business out of business as quickly as possible. Also, big food, retail and gastronomy must quickly acquire the insights of the more sustainably ambitious FMCGs and be met with market conditions making them accountable for their fair and extensive contribution to the regeneration of ecosystems and livelihoods[166]. Such contributions ought to be prioritised by the executive management when allocating financial resources i.e. over rewarding shareholders and executive management through stock buy-back schemes. Of course, it is the shareholders' but particularly the shareholders' regulators' responsibility, to create conditions in the financial markets that enable the executive management to make such prioritisations.

Diversity in unity, through valuing cooperation over competition, must be enhanced throughout the whole agrifood system and beyond – from the microbiomes in our soils to the global affairs of our geopolitics.

As an example, research in Germany (representative for mature agrifood systems) has now affirmed that there is an oligopoly in food retail[167]. This is faced by about 4000 processing (food industry / FMCG) companies of all sizes (quickly reducing) in Germany. It is believed that, in the three years from 2022 until the end of 2024, about 2000 of the small and medium size processing enterprises will have disappeared as 'independent' businesses. A large share of their production capacity is being taken over by the retailers themselves. The take-over of other SME food industry production capacities assist further horizontal concentration among FMCGs.

This is only one national example from the many concentrated food retail models that have been growing and restructuring upstream value chains worldwide. The agrifood system is thus increasingly vertically integrated by actors from below (i.e. Cargill) and above (i.e. Schwarz Group, P&E, etc.) who heavily influence their own governance environment (from land use[168] to waste[169]). As experienced in the last years, this concentration does not only undermine farmers' terms of trade. In conjunction with productivity and supply chain issues, it also drives inflation throughout the chain. In times of market turmoil, when everyone takes the largest cut feasible to them, the result is that the least concentrated actors in the system, with the worst terms of trade - farmers and consumers - are left to pick up the tab[170].

No matter who - may that be the big commodity and livestock giants, the aforementioned retailers or others – those who do not show a serious strategy to drastically reduce into nonexistence those parts of their businesses that continue to cause agonising harm to people and ecologies across the globe, need to be met with penalties and be eradicated.

This is very different with farmers. Society cannot afford to lose another farmer. Instead, we have to re-engage the youth in farming, give the land back into the hands of farmers, and work ceaselessly to regenerate the hearts, capacities and lands of all farmers.

Just as in our soils, "unity in diversity for health" can be achieved if we learn to differentiate between elements that cause either unhealthily competitive or positive cooperative system-functionalities, and steward accordingly for efficiency, productivity and health.

As stakeholders in agrifood system practice and policy discourses are coming closer to a shared understanding of what farming for regeneration entails ecologically and agronomically, it is now more

[166] News as such can only be the mild beginning of rapid redesign of value cycles in the corporate agri-food system. (ESG Today. (2023). Walmart, General Mills Launch 600,000 Acre Regenerative Agriculture Partnership. (LINK))
[167] Lademann & Kleczka. (2023). Marktbeherrschung im Lebensmitteleinzelhandel?. (LINK);
[168] Sustainability Beat. (2023). Cargill accused of blocking deal to end soy-linked deforestation. (LINK)
[169] EU Observer. (2023). McDonald's at centre of lobbying blitz against EU packaging waste laws. (LINK)
[170] Amores et al. (2023). Inflation, fiscal policy and inequality. JRC Working Papers on Taxation and Structural Reforms No 10. European Commission, Seville, Spain. (LINK); Jung, C., & Hayes, C. (2023). Inflation, profits and market power: Towards a new research and policy agenda. IPPR and Common Wealth. (LINK)

decisive than ever to build a shared understanding of what it means to farm for regeneration economically and socially in a global, European, regional and local context.

We urge that the democratic political legitimacy of real people underwrites stakeholders', especially policy makers', perspectives and narratives in the policy discourses for the next CAP. We have the immense potential to grow a shared understanding and a critical mass to transform the EU's agrifood system's governance, to rapidly facilitate the divest from extractive farming for standard output to the rapid and scaled-out investments in farming for holistic regeneration.

Appendix II: Pilot program and study proof of context

We are currently in the process of setting up a pilot program & proof-of-concept study for building the economic, ecological and social empirical evidence of the payment design laid out above. The project aims at the comparison of the agro-ecological performance of least 150 pioneering farmers from diverse EU contexts to their regional average.

"Pioneering" refers to farmers from all EU contexts, that includes ages, genders, ecosystems and farm types (like i.e. big arable farms practising Conservation Agriculture, small community-supported no-dig market gardening farms, mixed medium farms practising regenerative organic and/or agro-ecology, livestock farms and pastoralists managing holistically, and many others).

The study will compare the data of pioneering agricultural plots with that of random plots over the last 3 years. It will compare three plots per farm, with randomised plots of the same pedoclimatic and land use category context.

Pioneers of EU farming are expected to outperform their regional peers in both agronomic and ecological performance of agricultural land use management. This is measured as yield-to-input ratio, as well as absolute and relative NPP and soil cover results.

We will also test the technological operationality of the payment design, consisting of the satellite data, AI-informed context demarcations (pedoclimatic and land use category) and performance demographics (which are the common brackets within the farmer population), as well as other factors. It further aims to understand better and possibly test against unintended consequences. The project aims at close collaboration with EU Horizon projects such as LAMASUS, BrighSpace, BENCHMARKS, as well as to contribute to the further improvement of the EU's Farm Sustainability Data Network and Agricultural Knowledge and Innovation Systems.