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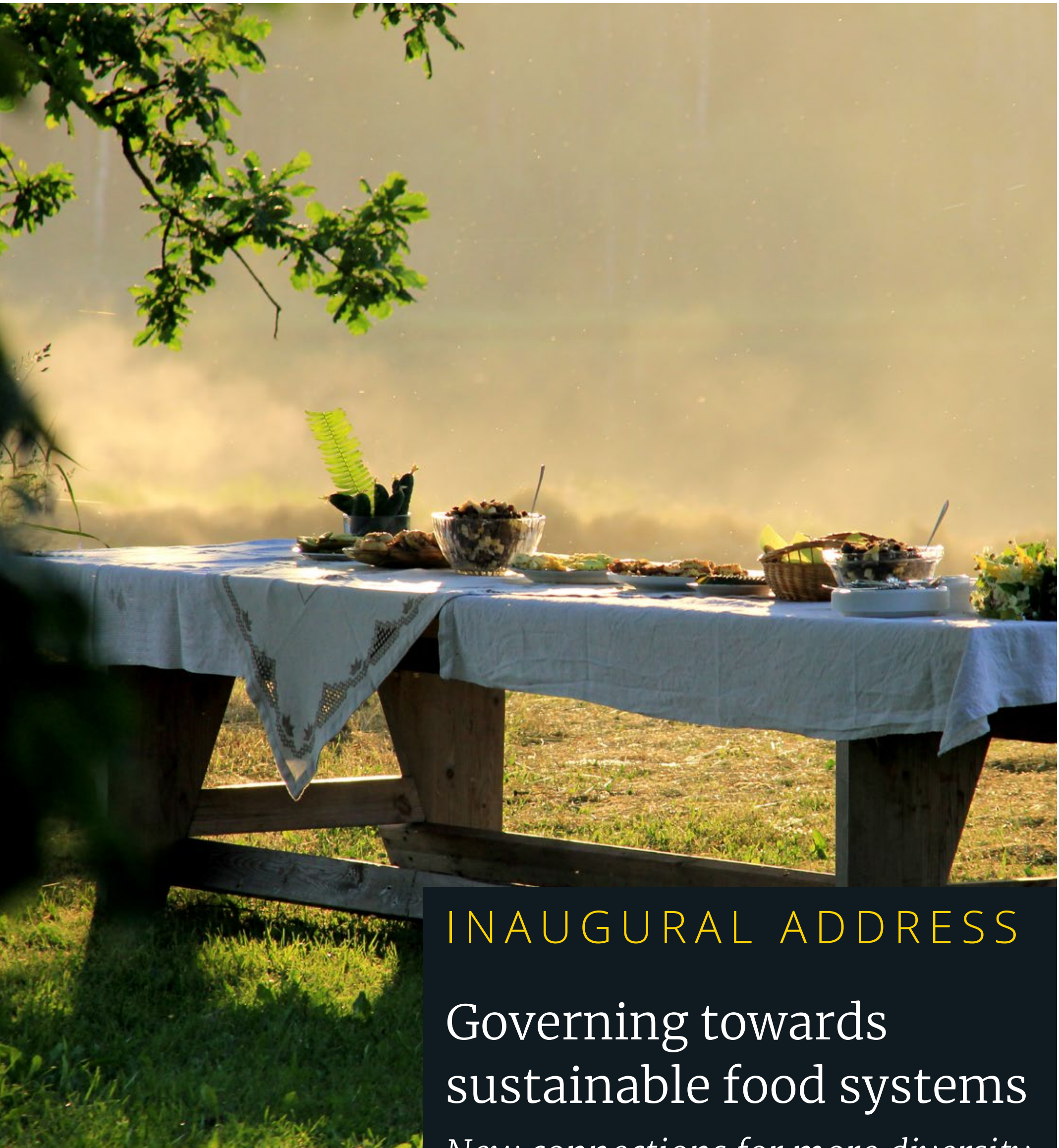

INAUGURAL ADDRESS

Governing towards sustainable food systems

New connections for more diversity

Hens Runhaar

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Governing towards sustainable food systems

New connections for more diversity

Hens Runhaar
Professor of Sustainable Food System Governance

Inaugural address as Professor at the Faculty of Geosciences of Utrecht University, January 17, 2025

Mijnheer de Rector Magnificus, thank you for your kind introduction. And dear colleagues, students, family, and friends, thank you for joining me today, in the Aula or online. It is an honour to share the ideas and plans I have for my professorship in Sustainable Food System Governance.

Setting the scene

I will start by setting the scene: what food systems are, how I define the causes of unsustainability of food systems, what governing towards more sustainable systems mean, and what I focus on.

Food is a basic need for humans, but the way in which much of it is produced, distributed, and consumed, is not sustainable. To better understand the root causes of unsustainability, we adopt a 'food systems' perspective, which means looking at components and their interconnectedness (Ingram, 2011; Resnick and Swinnen, 2024). Components include inputs for agriculture, such as land, seeds, fertiliser, and pesticides, but also functions, such as food production, trade, transport, consumption, waste, and composting. And important food system components for me are the *actors* involved, what they do and why, and how they interact.

Sustainable food systems provide sufficient, healthy, tasty, and affordable food for all; produced, distributed, and consumed in ways that have minimal environmental and ecological impacts, and that do not shift costs onto others, now or in the future (cf. Van Braun et al., 2021[1]). In my work, the sustainability challenge of *restoring biodiversity* plays an important role. Therefore, I am very interested in forms of agriculture that aim to achieve a balance between food production and biodiversity, such as agroecology, regenerative agriculture, and 'nature-inclusive' agriculture[2]. I do this particularly in the context of the European Union (EU).

I also focus on food system *governance*, which I have defined as *"how farmers, companies in agri-food chains, banks, governments, NGOs and other stakeholders interact and try to influence each other in order to achieve their objectives"* (Runhaar, 2017: 341). Some concrete examples are: farmers protesting in The Hague and in Brussels against stricter environmental legislation; banks requiring farmers to increase production as a condition for new loans; the European Commission launching the so-called Farm to Fork strategy with ambitious objectives for food system transformation; and the Dutch Minister of Agriculture deliberately not offering a solution for the manure crisis which will result in illegal dumping and extra nitrogen deposition on already polluted nature areas and in groundwater and surface water. Governing towards more sustainable food systems requires rethinking how all food system actors act and interact, which requires new rules and incentives, and, more fundamentally, it means reconsidering the basic values that underlie current food systems.

Where are we now?

Food systems worldwide have their merits but also face substantial sustainability challenges. On the positive side, productivity has been increasing by 2-3% per year globally since 1961 (FAO, 2022). Food affordability has improved (Ambikapathi et al., 2022)[3], whereas malnutrition and food insecurity have stabilised (FAO, et al., 2024). On the negative side, malnutrition still occurs, food insecurity remains consistently higher among women than among men, and there is an increased incidence of diet-related diseases such as obesity (15.8% of the world population in 2022) (UN Women and DESA, 2023; FAO et al., 2024). Farmers – especially smallholder farmers in the Global South – suffer from power imbalances in industrialised food systems (De Schutter et al., 2024). Food waste generated in the various stages of food production, distribution, and consumption is estimated to range between 19% and 40% (WWF-UK, 2021; UNEP, 2024)[4]. Food systems form the main driver of biodiversity loss (Benton et al., 2021)[5] and account for some 31% of global greenhouse gas emissions (IPCC, 2022). Meanwhile, the agricultural sector is also suffering from climate change (FAO, 2023)[6]. Food systems are also a major resource user. They utilise 72% of available fresh water (FAO, 2022) and occupy 40% of inhabitable land (WWF, 2020), and 3.52 planet Earths would be needed if everyone in the world consumed as much food per capita as we do in the EU (Loken and Declerck, 2020). This is why the food system must be transformed in order to sustainably feed a growing world population.

Why a focus on EU food systems and on biodiversity?

Food systems, how they function and are governed, and the main sustainability challenges, differ greatly around the world (see Figure 1). In subsistence food systems, food is mainly produced for the farmer's family. Typical challenges include the availability of inputs such as fertiliser and the affordability of nutritious and healthy diets (Marshall et al., 2021). In so-called industrial food systems, food is widely available and affordable, but environmental pressure is high and there is a relatively high prevalence of nutrition-related chronic diseases such as obesity, cardiovascular disease, and type 2 diabetes (Marshall et al., 2021; Forouhi, 2023).

	N	Agriculture value added per worker, USD Mean (25th-75th pctl.)	Share of dietary energy from staples Mean (25th-75th pctl.)	Supermarkets per 100,000 inhabitants Mean (25th-75th pctl.)	Percent urban population Mean (25th-75th pctl.)
Rural and traditional	30	1,062 (653-1,444)	65 (61-70)	0.5 (0.3-0.5)	33 (26-42)
Informal and expanding	31	3,235 (1,698-3,866)	56 (50-61)	1.6 (0.6.9)	50 (37-58)
Emerging and diversifying	32	6,217 (3,999-7,527)	45 (41-49)	4.4 (2.2-6.1)	58 (50-70)
Modernizing and formalizing	31	18,478 (11,261-20,060)	38 (33-43)	9.6 (4.1-15.4)	74 (66-84)
Industrial and consolidated	31	115,287 (29,726-82,625)	30 (27-33)	17.3 (10.5-22.5)	84 (77-92)

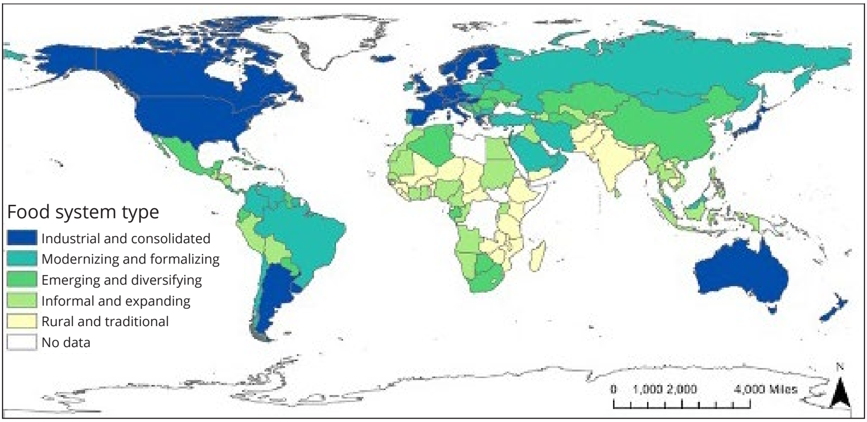

Figure 1: Global distribution of food system types
Source: reproduced from Marshall et al. (2021: 6).

For an in-depth understanding of food systems and to create societal impact, focus is necessary. I focus on food systems in the *EU* because of the EU's huge problems in terms of ongoing biodiversity loss (see e.g. Figure 2), environmental degradation, climate change and diet-related health problems (Crenna et al., 2019; Lécuyer et al., 2021; Matthews et al., 2021; Timmis et al., 2022; EEA, 2024; Zinngrebe et al., 2024). In addition, the regimes of EU food systems are rather specific, due to the EU policies in place. But my focus on EU food systems is also because I know this context best.

There is no such thing as a typical EU food system, not only because there are different ways of defining food systems (e.g. Gaitán-Cremaschi et al., 2019), but particularly because in practice, we observe variety in the ways food is produced, distributed, and consumed. Yet by looking at how a *substantial part* of the food is produced and consumed in EU Member States, we can identify some key characteristics. One: the agriculture used to produce food in EU Member States is typically high-input/high-output: it's highly productive due to specialisation, mechanisation, and the intensive use of fertiliser, agrochemicals, and other external inputs.

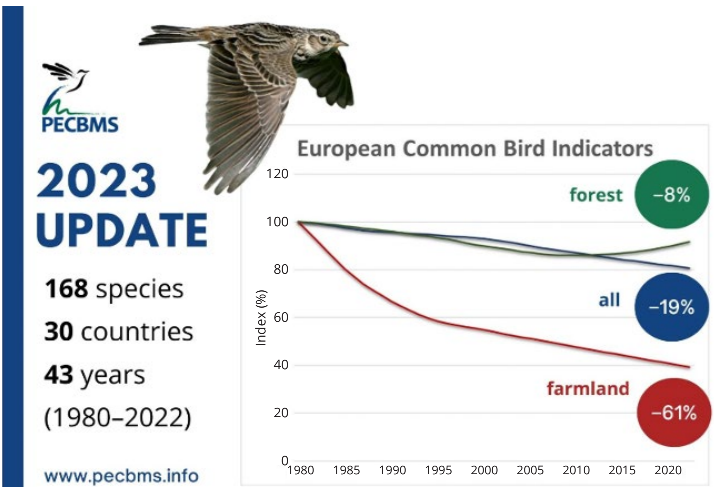

Figure 2: The percentage decline in the EU's forest and farmland bird populations and total bird population 1980-2022 Source: European Bird Census Council, https://www.ebcc.info/.

Two: food production and consumption are highly internationalised. For instance, in the Netherlands, the amount of potatoes, sugar, cheese, butter, and pork produced is two to three times what is consumed here (Berkhout et al., 2023)[7], and yet much of the food people in the Netherlands eat is imported (PBL, 2019). Three: processing, trade, and retail companies have much market power (PBL, 2019). EU farmers are usually price-takers and strive ceaselessly to improve efficiency. Food system *governance* in the EU is neoliberalist, leaving a large role for international trade, agri-food companies, and consumers, and with governments responsible for regulating food security, for keeping food systems within environmental, health, and animal welfare limits, and for rural development. This dominant food system exists alongside alternative food systems or subsystems. For instance, Marieke and I buy much of our food from Albert Heijn and Lidl supermarkets but buy our dairy products from Odin, which is part of the organic food system, and we buy a substantial part of the vegetables we consume from the Kraaijbekerhof, a community-supported farm typical of a very localised and sustainable food system[8].

I pay special attention to *biodiversity recovery* because of the alarming decline in biodiversity, which, as I have already mentioned, is largely driven by food systems globally (Benton et al., 2021). Biodiversity refers to the richness and abundance of species in agricultural landscapes and other areas impacted by food systems. Biodiversity loss is problematic not only to biodiversity itself. In the long term, some of the key driving forces of biodiversity loss – such as soil degradation, water pollution, and climate change – will also pose threats to food production. If we manage to restore biodiversity in agricultural landscapes and in places where animal feed is produced, we will also have effectively addressed these sustainability challenges. In addition, biodiversity, or nature more generally, can provide all kinds of services from which food production can benefit. I will illustrate that later.

So far, I have presented the scientific justification for focusing on biodiversity. I also have my own personal reason: I care deeply about nature and biodiversity. Since my childhood I have been fascinated by nature and I am worried (and sometimes get angry) about the devastating impacts caused by humans, particularly in the context of our food systems. The statistics on biodiversity loss in the EU over the last few decades are alarming. Nonetheless, I am convinced that if we as humans have been able to have this impact on biodiversity and on our living environment, we are also capable of contributing positively and reversing the damage.

There is potential. As many of you know, in my leisure time, I monitor badger populations in Driebergen and in Groenekan. This means counting the numbers of badgers, particularly the young ones, and keeping an eye on their setts – their homes. And of course this gives me an excuse to enjoy these beautiful, enigmatic creatures. They thrive in agricultural landscapes bordering nature reserve areas. During the many cycle tours Marieke and I made with our children and that we continue to make as a couple, we have crossed so many beautiful agricultural landscapes with high biodiversity and have enjoyed watching birds such as the red-backed shrike or the skylark. Not so long ago the skylark was abundant in Dutch fields. Here in the Netherlands, I have met many farmers who manage high-biodiversity fields and thereby prove that food systems and biodiversity can go together. But this combination does not happen on its own.

Rethinking connections in food systems

So, after having sketched the bigger picture and how I position my work in that, let's now turn to my views about the causes of unsustainability in food systems and which directions should be pursued to resolve them.

From a food system perspective, many causes of sustainability challenges find their origin in *problematic connectivity* between system components.

For instance, there is often a disconnect between food production and local and regional environmental conditions, resulting in pollution and biodiversity loss (Gomiero et al., 2011; Duru et al., 2015; Dubey et al., 2021)[9]. We also often observe a disconnect between food and feed production locations, leading to deforestation, climate change, and food insecurity (Heron et al., 2018; Schwarzmueller and Kastner, 2022; Zinngrebe et al., 2024). Typically, there is a disconnect between places where food is produced and where it is consumed, contributing to consumers becoming alienated with farmers and agricultural landscapes (Runhaar et al., 2019; Sutherland et al., 2020). In general, farmers have become disconnected from the final product and are limited in their choices about what to produce, where, how, and for whom, due to their dependency on large agri-food companies (Hendrickson, 2015; see also Williams et al., 2024)[10]. More generally, there is often a disconnect between the benefits and the burdens of food systems. An important reason for this is that food prices generally do not reflect the societal costs of food production, and these costs must be viewed in relation to the unequal power positions between the various food system actors (Ruggeri Laderchi et al., 2024).

More diversity in connections for more sustainable food systems

The transformation into sustainable food systems therefore requires rethinking the physical, socio-economic, and actor connections in food systems, and how these are governed. In general, I believe *more diversity* in food systems is an interesting principle to apply when addressing the sustainability challenges and underlying connectivity problems[11,,12,13]. Let me give a few examples.

One: more variety at *field and farm level* can contribute to both biodiversity recovery and productivity. For instance, species-rich grasslands seem more drought-resistant than conventional grasslands dominated by English ryegrass, which is an advantage in the context of climate change (Isbell et al., 2011; Komainda et al., 2022). More diverse fields and farms can provide other ecosystem services as well, such as carbon storage in soils, water retention, and natural pest control, which reduces the need to use agrochemicals (Ditzler et al., 2021).

Two: replacing homogenous agricultural *landscapes* by mosaic landscapes that consist of a variety of fields with different crops and pastures, connected via ditches, hedges, and other 'landscape elements', and connected with surrounding nature reserve areas; not only are mosaic landscapes visually more attractive, they also have high biodiversity and are less vulnerable to pests (Grass et al., 2021; Nicholson and Williams, 2021; Brooker et al., 2023)[14].

Three: eating more varied diets and replacing animal proteins with plant-based proteins can improve human health and reduce the environmental impacts of agriculture, such as greenhouse gas and nutrient emissions (Sranacharoenpong et al., 2015; Baldwin et al., 2021; Crippa et al., 2021; Ridoutt et al., 2022). More variety can also come from eating more *seasonally*: that is, eating vegetables and fruits when they are in season.

Four: (and this is where my expertise lies), more diversity in *actors* and in *actor connections* can enable more sustainable food systems. For instance, community-supported agriculture and short food supply chains (such as farmers' markets) bring farmers and consumers together and enable more sustainable food production at a local scale, because risks are shared and farmers have more influence on prices (Egli et al., 2023; Mosadegh Sedghy et al., 2024)[15]. Community-supported agriculture and short supply chains also connect consumers to the farms, fields, and landscapes their food comes from. By delivering multiple ecosystem services in addition to food, *multifunctional* agricultural fields, farms, and landscapes can serve a greater diversity of customers, thereby potentially strengthening farmers' economic positions (Van den Pol-Van Dasselaar, 2021; Reed et al., 2022; Gupta et al., 2023)[16,17]. And for consumers, more diversity in 'food environments' can enhance healthy diets[18].

Five: more diversity is also needed in *knowledge systems.* Rethinking food systems requires new ideas instead of sub-optimising current, unsustainable food systems, and for new ideas we need to bring in new researchers, disciplines, and cross-disciplinary collaboration[19,20].

Towards sustainable food systems: governing new connections for more diversity

More diversity for more sustainable food systems will not emerge spontaneously; it requires a revision or even abandonment of current governance arrangements. Monofunctional agricultural landscapes, for instance, are the result of policies and food supply chain incentives that steer towards high-input/high-output food production (Sanderson et al., 2013; Clay et al., 2020) and which individual farmers cannot easily evade (Vermunt, Wojtynia et al., 2022; Williams et al., 2024). In transition studies, these policies and ways in which supply chains are organised and function are often analysed through the lens of 'regimes', a term that I mentioned earlier in this lecture. Regimes, formally known as 'sociotechnical regimes', are *"the semi-coherent set[s] of rules that orient and coordinate the activities of the social groups that reproduce the various elements of sociotechnical systems* [such as food systems]" (Geels, 2011, p. 5). From the perspective of my chair, regime rules that determine the roles actors play and the connections between actors are of special interest. Some of these rules are visible and formalised, such as the mandates of governments at various administrative levels to develop and implement food policies, but others are less visible, such as the rules that determine who is or is not at the table negotiating new food policies.

Food regimes are often highly resistant to change (Oliver *et al.*, 2018; Runhaar, 2021; Ruggeri Laderchi et al., 2024), as the Dutch food system shows. The 'nitrogen crisis' has been going on in the Netherlands for over five and a half years and has halted housing construction, infrastructural, and other projects (Stokstad, 2019). Moreover, the Netherlands will very probably soon be faced with a 'water crisis', as the country is unlikely to achieve the EU Water Framework Directive's water quality objectives by 2027 (Wuijts et al., 2023), largely because of excessive nutrient and pesticide discharges from agriculture (Van Gaalen *et al.*, 2020). But despite these pressures and even though in 2021 the incoming national government committed to an 'agricultural transition' to address the 'substantial challenges' of biodiversity, climate, and water[21], the food system has remained unchanged. Intensive, high-input/high-output agriculture remains the default model, efforts to agree on a new perspective for Dutch agriculture have failed[22], and roles and power positions in the food system have remained unchanged (e.g. Runhaar, 2022). The national government that took office in 2024 has even abandoned the transition fund of almost 25 billion euro and has distanced itself from the need for any agricultural transition (PVV et al., 2024).

The EU food regime is also very resistant to change. The Farm to Fork strategy launched in 2020 included very ambitious sustainability objectives and envisaged substantial regime reform in the form of 'rebalancing power in the food system'[23], but it was put on hold after massive farmers' protests (Ruig, 2024).

So, apparently, food system transformation, and regime change as an important dimension and precondition, are troublesome, even though they are essential if we are to effectively address the many sustainability challenges I mentioned at the start of this lecture. Stability and change in food systems and food system regimes are therefore important role in my current work and in my plans for research, teaching, and societal impact.

Research: evaluating governance arrangements, analysing actor roles and interactions, and understanding regime stability and change

Let me start by outlining my research, which is organised around four topics:

1. The roles that key actors play or could play to achieve food system transformation.
2. The formation (or absence) of actor coalitions for food system transformation.
3. The effectiveness of current governance arrangements for food system sustainability.
4. Resistance to change in food system regimes and how to overcome it.

Roles of key food system actors
Farmers are important actors in food systems. Nataliia Pustilnik in the DivGrass project and Emma Windey in the COMBINED project are investigating how a more large-scale adoption of multifunctional grassland management among dairy farmers in the Netherlands and in other EU

Member States could be stimulated. In these projects, advice and practical tools will be co-developed with and for farmers, policymakers, and other stakeholders. Evelien Remorie contributed to DivGrass with her Master's thesis on barriers to the adoption of species-rich grasslands in the Netherlands and in Flanders.

Other important players in the food system are supermarkets, to which Frits Kremer has been given unique access. His research has generated very interesting insights into the efforts to help improve animal welfare by introducing voluntary standards. I conclude that commercial interests, low consumer demand, and complex interactions with animal welfare NGOs appear to be important limitations to supermarkets' potential to contribute to achieving more sustainable food systems.

The *government* is a unique actor because of its responsibility to serve public interests and its fiscal and regulatory powers (e.g. Johnston and Newell, 2018). Unsurprisingly, in sustainability transitions literature, governments are often assigned an important role to facilitate transitions (e.g. Maher et al., 2023; Wright et al. 2024)[24]. Yet the literature on the roles that a government can play is fragmented, obscuring what this specific actor can mean for and in sustainability transitions, particularly *food system* transitions. I had three reasons for wanting to delve into this topic. One: it is a knowledge gap, and that is the obvious and usually only reason you mention in a scientific paper. Two: I had a desire to connect my 'discipline' – that of environmental governance – with transition studies. That field is very appealing to me as it addresses the structures within which unsustainability is created and maintained and in which governance takes place. However, it seemed to me that the *governance* of transitions is an underdeveloped area. Three, and this is my main reason: I was annoyed with how governments worldwide, but particularly in the EU, and in the Netherlands specifically, are failing to take on their responsibility to initiate, facilitate, force, and in short, govern, a transition towards sustainable food systems.

I have focused on how governments relate to niche actors who represent alternative, more sustainable food practices. I was triggered by two contrasting roles reported in the literature: one, of governments facilitating niche actors, and two, governments actively refusing or even blocking the further development and adoption of niche innovations (e.g. Markard et al., 2016; Van Dokkum et al., 2023). Sitting in our garden one Friday afternoon, thinking about other roles, I was inspired by this sign, which visualises a very particular way in which an actor relates to other actors: stop, stay where you are – or even, go away. For me, this visualised the second role I've just mentioned. The sign, given to me by my dear old friend Bob van Driel, inspired me to think of other roles, using the hand metaphor as starting point[25]. Bobby, many thanks – I think that wasn't what you expected me to do when you sent me the sign 😊.

Figure 3: A typology of roles of governments vis-à-vis niche actors

Competitor	**Co-opter**	**Co-exister**
		
• Niche innovation competes with incumbent regime • Government, being part of the regime, actively resists niche innovation • Niche innovation remains in a niche or fades out	• Niche innovation (potentially) aligns with incumbent regime • Government makes niche innovation compatible with the regime (in favour of the niche and regime or of the regime) • Niche innovation potentially scales up (but in a different form)	• Niche innovation neither competes nor aligns with incumbent regime • No direct interaction between government and niche actors • Niche innovation remains in a niche
• Illustrative case: tax on non-alcoholic beverages that excluded milk, thereby disfavouring plant-based milk	• Illustrative case: agri-environment schemes in the EU Common Agricultural Policy	• Illustrative case: agroecology

Source: Runhaar et al., 2025.

Collaborator	Compromiser	Collapser
		
• Niche innovation (potentially) aligns with incumbent regime and/or the government's objectives • Niche actors more or less equal partner of government • Some regime change to create space for the niche innovation	• Niche innovation competes with incumbent regime • Government has to negotiate with niche actors • Some regime change to create space for the niche innovation	• Niche innovation competes with incumbent regime • Government is forced to change the regime in favour of the niche innovation • Niche innovation becomes mainstream
• Illustrative case: nature-inclusive dairy farming on Schiermonnikoog	• Illustrative case: implementation of EU policy for 25% organic agriculture	• Illustrative case: ban on battery cages in poultry farming

Governments as competitors are embedded in the regime and use their power to effectively resist niche innovations and actors. Governments as co-opters make a niche innovation compatible with the regime, whether or not in line with the niche actors' aims. Governments as co-existers take a 'laissez-faire' stance, and as a result, the niche innovation can exist alongside the dominant technology or practice. Governments as collaborators actively cooperate with niche actors so that their innovation can thrive and possibly be upscaled. Governments as compromisers are forced to de-align from the regime and negotiate with niche actors and with other stakeholders about regime change in favour of the niche innovation. Finally, governments as collapsers actively dismantle a regime or change it substantially to create space for the niche innovation and actors. (Runhaar et al., 2025)

We – that is, Sophie van Doorm, Laura Bello Cartagena, Sabine de Graaff, Charlotte Offringa, Laura van Oers, Nataliia Pustilnik, Evelien Remorie, Willem Lageweg, and Rob Raven – refined the typology (see Figure 3) and illustrated it by means of concrete examples from the Dutch food system. This led to interesting insights (for instance, that governments may play multiple roles at the same time) and interesting follow-up questions, such as 'how much freedom do governments have in choosing roles?'.

Governance arrangements for food system sustainability
Other research I am involved in is about empirically analysing governance arrangements in the food system. Governance arrangements involve actors and how they interact around particular issues or objectives. Think of top-down legislation and regulations, whereby national or supranational governments are in control. But governance arrangements can also be more bottom-up, as in the case of community-supported agriculture.

Empirical analysis of governance arrangements reveals insights into 'what works' and it can yield helpful lessons to apply in other contexts. Together with students and colleagues, I am analysing a diversity of such arrangements. Among the important categories we are studying are agri-environment schemes: subsidies for farmers who implement conservation measures on their land, such as flower-rich field margins[26]. The professionalisation of farmer collectives in the Netherlands which are responsible for implementing agri-environment schemes is the topic of Lyda Dik's recent PhD thesis. Her work has improved understanding of what are the key competencies of different types of farmer collectives and how governments can best support and interact with them (Dik, 2025).

In the REWIRE project, Sophie van Doorm is analysing governance arrangements in the provinces of Overijssel and Noord-Brabant relating to a transition towards circular agriculture. Sophie is currently exploring commonalities in the visions on sustainable agriculture held by farmers, governments, and other stakeholders, as a basis for a shared, long-term perspective and joint action.

Actor coalitions for (or against) food system transformation
It is also important to understand why and how particular coalitions of actors for or against food system transformation form or do not form.

Governments are often strongly aligned with incumbent companies that represent productivist or industrial agriculture (e.g. Sievert et al., 2021; Vallone and Lambin, 2023). Coalitions between other actors form sporadically. For instance, in the Netherlands, animal welfare NGOs, farmers, and agri-food companies have often been in dispute with each other, but at other times they have collaborated on animal welfare issues (Bos et al., 2013; Runhaar et al., 2020). What explains coalition forming? I addressed this question a few years ago in a study on the very broad coalition of stakeholders formed to stimulate farmers to re-adopt grazing practices in order to bring cows back into meadows (Runhaar et al., 2020). And Laura Bello Cartagena has analysed coalitions that support agroecology in the Netherlands.

Stability and change in food system regimes
Regime change and stability plays a role in various research projects I'm involved in. Charlotte Offringa will research how the agricultural sector[27] can be stimulated to contribute more to achieving the targets set by the EU Water Framework Directive. This necessitates overcoming the pattern of voluntary collaboration – an important regime principle[28]. Emma Windey will investigate what regime changes are needed for the large-scale adoption of multifunctional grasslands in the Netherlands. And postdoctoral researcher Matthijs Mouthaan has just started a 3-year research project on the politics of EU sustainable food policies. I have already mentioned the troublesome implementation of the Farm to Fork strategy. It also appears to be very hard to increase sustainability objectives in the EU Common Agricultural Policy, which, because of its large budget, has a strong influence on the agricultural sector. Matthijs, Koen Beumer and I will together investigate the causes of the persistence of this situation, and, moreover, what is needed to break through it. Leroy van Rhijn's MSc research is providing a very interesting basis for our study.

Education for impact

The four topics in my research also play an important role in my teaching. I play an active role in the new specialisation or 'track' Sustainable and Healthy Food in the Global Sustainability Sciences bachelor programme. I was involved in the development of this specialisation and in a few weeks' time will teach in the Theory of Food Systems course. Meanwhile, I am developing the new Transforming Food Systems course, together with Sophie van Doorm, and I am supervising students who are writing their bachelor theses on sustainable food system governance. I also supervise MSc students working on this subject.

In the Future Food Utrecht community, we have been discussing options to develop Utrecht University-wide courses or specialisations on sustainable food. I believe that students currently in separate programmes can learn a lot from each other, just as I have learned a lot from, for instance, veterinary science colleagues.

Our students are the future change agents, and we probably achieve our largest impact by helping them develop as critical academic thinkers and preparing them for a future career in society. In the Sustainable and Healthy Food specialisation, we not only teach students relevant theories of food systems and research methods but also help them build up skills to analyse sustainability challenges from a systems perspective, understand the relevance of various disciplines and how to combine them to develop holistic solutions, and to bridge the gap between science and practice. But teaching is not a unidirectional activity where we are the experts and share our wisdom with our students. Over the years, through working with students from different backgrounds and with different ideas, I have myself learned a lot about how food systems elsewhere function and how sustainability challenges are defined and put in context.

I have always involved professionals in my teaching, mostly as guest lecturers, to familiarise students with environmental governance in real life and to bring theories to life. At the Copernicus Institute, a growing number of colleagues are involved in education for professionals. I believe this has great potential for mutual learning, enabling us scientists to test the societal and practical relevance of our theories and frameworks and to identify new research questions. Mixed classrooms – in which professionals and students are brought together – not only bring students in contact with practice, but the interaction may also provoke interesting discussions on taken- for-granted assumptions among professionals, teachers, and students.

Science for impact

Finally, there is societal impact, which is *"The contribution made by scientific research, in both the short and the long term, to changes in, or the development of, sectors of society and to challenges facing society"* (KNAW, 2018; UU, 2019).

I consider societal impact not as a stand-alone activity but as part of, and of value to, research and education. I have not said much about what *kinds* of impacts I am aiming for, and how I want to achieve them. As a starting point, I take the so-called impact journeys that we as the Copernicus Working Group on Societal Impact developed last year. These impact journeys describe the various impacts we wish to achieve in different societal domains – public policy, industry, society, and academia. (Runhaar et al., 2024)

I mainly focus on public policy, society at large, and industry, with an emphasis on the first of these[29]. Through the *analysis* of sustainability challenges and how they are governed, I aim to identify new entry points for public policy. An example is our research in 2020 on the structural barriers of a transition to more 'nature-inclusive' dairy farming in the Netherlands, commissioned by the Ministry of Agriculture[30]. We gave multiple presentations for the Ministry and other stakeholders and shared our findings in the media. The ultimate impact is difficult to assess, as some recommendations were also voiced by others. But our findings were recognised and considered by policymakers, and even appeared in a policy document (Provincie Gelderland, 2021). Through the *evaluation* of policies, I want to provide evidence particularly of the *effectiveness* of policies. An example is the scientific assessment of the buy-out policy for 'peak nitrogen emitters' I conducted with Wim de Haas for the Dutch Parliament[31]. Again, it is difficult to assess our impact, as there were so many influences on this policy. At least, we put the facts on the table. Finally, regarding *policy design*, in the COMBINED, REWIRE, DivGrass, and the 'STOWA Water Framework Directive after 2027' projects, we are closely collaborating with a wide range of stakeholders to co-create policy recommendations. I have also started a more informal collaboration with policymakers at the Ministry of Agriculture, to share and discuss our research findings. The first three meetings showed that we share an interest in many research questions. However, the Ministry is also part of the incumbent food regime that is so hard to change[32]. In the coming years, we need to find out how to have impact and what impact is feasible.

I also find it important to share and discuss scientific findings with the wider public, mainly in order to inform citizens, to combat fake news, and to raise awareness about policies that do not deliver. I do so through public lectures and through the media. NGOs are an important societal actor category. I have served on various advisory and supervisory committees and am proud to be on the Scientific Advisory Committee of BirdLife Netherlands.

At the Utrecht Science Park, we (that is, the Biodiversity Council, Future Food Utrecht, and colleagues from the Tolakker, our organic farm) work on enhancing biodiversity at the Tolakker, and actively involve students.

So, to conclude, in the coming years, my research, teaching, and impact activities will concentrate on the governance of sustainable food systems, whereby actors and their connections, actor coalitions, governance arrangements, and regime change are important topics. The focus is on food systems in the EU and on biodiversity recovery as one of the key sustainability challenges.

Dank

I now come at the final part of my inaugural lecture, which I want to use to express thanks to a number of people. I will do this in Dutch.

Ik ben vele mensen dankbaar waarvan ik heb geleerd en met plezier mee heb samengewerkt. Figuur 4 laat zien met wie ik in de afgelopen 20 jaar heb gepubliceerd – en dat is dat zijn lang niet alle mensen waarmee ik heb samengewerkt. Teveel om te noemen, en daarom wil ik graag een paar mensen expliciet bedanken die belangrijk zijn geweest voor mijn benoeming en hoe ik mij in mijn nieuwe rol verder ga ontwikkelen.

Ik dank Stefan, als voorzitter van de benoemingsadviescommissie en als bestuurslid van het departement Sustainable Development, de overige leden van de benoemingsadviescommissie, onze decaan Wilco, en Ellen en Karin vanuit het departementsbestuur voor het in mij gestelde vertrouwen.

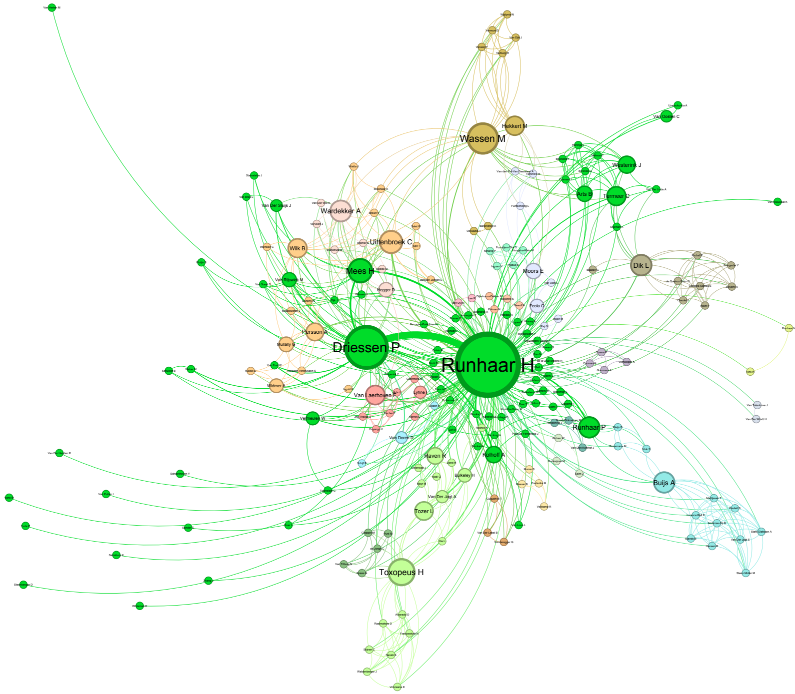

Figure 4: Hens Runhaar's co-author network
Source of data: Scopus. This visualisation by Dr. Janpieter van der Pol depicts people with whom I have published scientific papers. The clusters of people, depicted with different colours, indicate communities that publish together. The closest clusters are the communities with which I publish(ed) most frequently. Each circle represents a person: the larger the circle, the more papers we have co-authored and/or the more important this person was/is in connecting me to clusters of authors.

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References

Ambikapathi, R., K.R. Schneider, B. Davis, M. Herrero, P. Winters and J.C. Fanzo (2022), Global food systems transitions have enabled affordable diets but had less favourable outcomes for nutrition, environmental health, inclusion and equity, *Nature Food*, 3 (9), pp. 764-779.

Avelino, F., S. Hielscher, M. Strumińska-Kutra, T. de Geus, L. Widdel, J. Wittmayer, A. Dańkowska, A. Dembek, M. Fraaije, J. Heidary, M. Iskandarova, K. Rogge, A. Stasik and F. Crudi (2023), Power to, over and with: Exploring power dynamics in social innovations in energy transitions across Europe, *Environmental Innovation and Societal Transitions*, 48, 100758.

Baldwin, J.N., P.M. Forder, R. Haslam, A. Hure, D. Loxton, A.J. Patterson and C.E. Collins (2021), Lower vegetable variety and worsening diet quality over time are associated with higher 15-year health care claims and costs among Australian women, *Journal of the Academy of Nutrition and Dietetics*, 121 (4), pp. 655-668.

Bello Cartagena, L., D. Hegger, P. Tittonell and H. Runhaar (2024), How transformative is agroecological knowledge co-creation? Insights from a systematic literature review, *Agroecology and Sustainable Food Systems* (published online).

Benton, T.G. C. Bieg, H. Harwatt, R. Pudasaini and L. Wellesley (2021), *Food system impacts on biodiversity loss. Three levers for food system transformation in support of nature,* London, Chatham House.

Berkhout, P. (ed.), H. van der Meulen and P. Ramaekers (2023), *Staat van Landbouw, Natuur en Voedsel, editie 2023*, Wageningen, Wageningen Economic Research, Rapport 2023-124.

Braun, J., von, K. Afsana, L.O. Fresco, M. Hassan and M. Torero (2021), Food system concepts and definitions for science and political action, *Nature Food,* 2, pp. 748-750.

Brooker, R.W., C. Hawes, P.P.M. Iannetta, A.J. Karley and D. Renard (2023), Plant diversity and ecological intensification in crop production system, *Journal of Plant Ecology*, 16(6), rtad015.

Budzyńska, A. and M. Durakiewicz (2024), The role of food trade in the European Single Market in the years 2000-2022, *Agronomy Science*, 79 (1), p101.

Chege, C.G.K., R. Wanyama, M. Lundy, W. Nguru and M. Jäger (2021), Does retail food diversity in urban food environments influence consumer diets? *Sustainability (Switzerland)*, 13(14), 7666.
Clay, N., T. Garnett and J. Lorimer (2020), Dairy intensification: drivers, impacts and alternatives, *Ambio*, 49 (1), pp. 35-48.
Coudard, A., Z. Sun, P. Behrens and J.M. Mogollón (2024), The global environmental benefits of halving avoidable consumer food waste, *Environmental Science and Technology*, 58 (31), pp. 13707-13716.
Crenna, E., T. Sinkko and S. Sala (2019), Biodiversity impacts due to food consumption in Europe, *Journal of Cleaner Production,* 227, pp. 378-391.
Crippa, M., E. Solazzo, D. Guizzardi, F. Monforti-Ferrario, F.N. Tubiello and A. Leip (2021), Food systems are responsible for a third of global anthropogenic GHG emissions, *Nature Food,* 2, pp. 198-209.
CropXR (n.d.), *Making crops more resilient, sustainable, and climate-adaptive,* https://cropxr.org.
De Freitas, P.P., M.S. Lopes, M.C. de Menezes, P.C. Jaime and A.C.S. Lopes (2024), Consumer food environments change over a 5-year period, *Public health nutrition*, 27(1), pp. e187.
De Schutter, O., C.W.-Y. Clément and N. Jacobs (2024), Addressing power and poverty in a crisis-prone food system, in: J. D'Silva and C. McKenna (eds.), *Regenerative farming and sustainable diets: human, animal and planetary health*, London, Routledge, pp. 13-21.
Dik, L. (2025), *Collaborating on agro-biodiversity. Professionalisation of farmer collectives for effective Agri-Environmental Schemes,* PhD thesis, Wageningen, Wageningen University and Research.
Ditzler, L., D.F.V. Apeldoorn, R.P.O. Schulte, P. Tittonell and W.A.H. Rossing (2021), Redefining the field to mobilize three-dimensional diversity and ecosystem services on the arable farm, *European Journal of Agronomy,* 122, 126197.
Dubey, P.K., A. Singh, R. Chaurasia, R.K. Dubey and P.C. Abhilash (2021), Planet friendly agriculture: Farming for people and the planet, *Current Research in Environmental Sustainability*, 3, 100041.
Durevall, D. (2020), Fairtrade and market efficiency: Fairtrade-labeled coffee in the Swedish coffee market, *Economies*, 8 (2), 30.
Duru, M., O. Therond and M. Fares (2015), Designing agroecological transitions; a review, *Agronomy for Sustainable Development*, 35 (4), pp. 1237-1257.

EC (2023), *State of Food Security in the EU. A qualitative assessment of food supply and food security in the EU within the framework of the EFSCM*, Brussels, European Commission, https://agriculture.ec.europa.eu/system/files/2023-11/efscm-assessment-autumn-2023_en.pdf.

EEA (2024), *Agriculture and food system, key facts*, Copenhagen, European Environmental Agency, 19 November 2024, https://www.eea.europa.eu/en/topics/in-depth/agriculture-and-food?activeTab=fa515f0c-9ab0-493c-b4cd-58a32dfaae0a&activeAccordion=4268d9b2-6e3b-409b-8b2a-b624c120090d.

EFA (2023), *EU: record agri-food flows in 2022 with 36.9 billion euros*, Brussels, European Food Agency, https://www.efanews.eu/item/29933-eu-record-agri-food-flows-in-2022-with-36-9-billion-euros.html.

Egli, L., J. Rüschhoff and J. Priess (2023), A systematic review of the ecological, social and economic sustainability effects of community-supported agriculture, *Frontiers in Sustainable Food Systems*, 7: 1136866.

Eurostat (2024), *Extra-EU trade in agricultural goods*, Brussels, Eurostat, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Extra-EU_trade_in_agricultural_goods.

Fałkowski, J., C. Ménard, R.J. Sexton, J. Swinnen and S. Vandevelde (authors), Marcantonio, F. Di and P. Ciaian (eds.) (2017), *Unfair trading practices in the food supply chain: A literature review on methodologies, impacts and regulatory aspects*, European Commission, Joint Research Centre.

FAO (2022), *The state of the world's land and water resources for food and agriculture 2021 – systems at breaking point*, Rome, Food and Agriculture Organization of the United Nations.

FAO (2023), *The impact of disasters on agriculture and food security 2023 – avoiding and reducing losses through investment in resilience*, Rome, Food and Agriculture Organization of the United Nations.

FAO, IFAD, UNICEF, WFP and WHO. (2024), *The state of food security and nutrition in the world 2024 – financing to end hunger, food insecurity and malnutrition in all its forms*, Rome, FAO, IFAD, UNICEF, WFP and WHO.

Forouhi, N.G. (2023), Embracing complexity: making sense of diet, nutrition, obesity and type 2 diabetes, *Diabetologia* 66, pp. 786-799.

Gaitán-Cremaschi, D., L. Klerkx, J. Duncan, J.H. Trienekens, C. Huenchuleo, S. Dogliotti, M.E. Contesse and W.A.H. Rossing (2019), Characterizing

diversity of food systems in view of sustainability transitions. A review, *Agronomy for Sustainable Development*, 39 (11), 1.
Gliessman, S.R. (2020), Transforming food and agriculture systems with agroecology, *Agriculture and Human Values*, 37, 547-548.
Gómez, M.I. and D. Lee (2023), Transforming food supply chains for sustainability, *Journal of Supply Chain Management*, 59 (4), pp. 79-92.
Gomiero, T., D. Pimentel and M.G. Paoletti (2011), Environmental impact of different agricultural management practices: conventional vs. organic agriculture, *Critical Reviews in Plant Sciences*, 30 (1-2), pp. 95-124.
Grass, I., P. Batáry and T. Tscharntke (2021), Chapter Six – Combining land-sparing and land-sharing in European landscapes, *Advances in Ecological Research*, 64, 251-303.
Gupta, S.S., S. Misra and A. Ghos (2023), Biodiversity: goal and driver of agricultural sustainability, in: Kripal Singh, Milton Cezar Ribeiro and Özgül Calicioglu (eds.), *Biodiversity and bioeconomy: status quo, challenges, and opportunities*, Elsevier, pp. 143-164.
Hendrickson, M.K. (2015), Resilience in a concentrated and consolidated food system, *Journal of Environmental Studies and Sciences*, 5, pp. 418-431.
Heron, T., P. Prado and C. West (2018), Global value chains and the governance of ‘embedded’ food commodities: the case of soy, *Global Policy*, 9, pp. 29-37.
Ingram, J. (2011), A food systems approach to researching food security and its interactions with global environmental change, *Food Security*, 3 (4), pp. 417-431.
IPCC (2022), *Climate change 2022: mitigation of climate change*, contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge, UK and New York, USA, Cambridge University Press.
IPES-Food (2016), *From uniformity to diversity: a paradigm shift from industrial agriculture to diversified agroecological systems*, Brussels, International Panel of Experts on Sustainable Food systems.
Isbell, F., V. Calcagno, A. Hector, J. Connolly, W.S. Harpole, P.B. Reich, M. Scherer-Lorenzen, B. Schmid, D. Tilman, J. van Ruijven, A. Weigelt, B.J. Wilsey, E.S. Zavaleta and M. Loreau (2011), High plant diversity is needed to maintain ecosystem services, *Nature*, 477 (7363), pp. 199-202.

Johnston, P. and P. Newell (2018), Sustainability transitions and the state, *Environmental Innovation and Societal Transitions*, 27, pp. 72-82.
Jongeneel, R., W. Baltussen, S. van Berkum and K. Poppe (2020), *White paper on true and fair food prices,* Wageningen, Wageningen Economic Research.
Jukema, G.D., P. Ramaekers and P. Berkhout (ed.) (2024), *De Nederlandse agrarische sector in internationaal verband – editie 2024,* Wageningen/Heerlen/Den Haag, Wageningen Economic Research en Centraal Bureau voor de Statistiek, Rapport 2024-002.
KNAW (2018), *Maatschappelijke impact in kaart,* Amsterdam, Koninklijke Nederlandse Akademie van Wetenschappen.
Komainda, M., P. Muto and J. Isselstein (2022), Interaction of multispecies sward composition and harvesting management on herbage yield and quality from establishment phase to the subsequent crop, *Grass and Forage Science*, 77 (1), pp. 89-99.
Lécuyer, L., D. Alard, S. Calla, B. Coolsaet, T. Fickel, K. Heinsoo, K. Henle, I. Herzon, I. Hodgson, F. Quétier, D. McCracken, B.J. McMahon, I. Melts, D. Sands, E. Skrimizea, A. Watt, R. White and J. Young (2021), Conflicts between agriculture and biodiversity conservation in Europe: Looking to the future by learning from the past, in: D.A. Bohan, A.J. Dumbrell and A.J. Vanbergen (eds.), *Advances in Ecological Research*, *the future of agricultural landscapes, part iii,* 65, pp. 3-56.
Loken, B. and F. Declerck (2020), *Diets for a better future: rebooting and re-imagining healthy and sustainable food systems in the G20,* Olso, EAT.
Maher, R., J. Yarnold and N.N.C. Pushpamali (2023), Circular economy 4 business: A program and framework for small-to-medium enterprises (SMEs) with three case studies, *Journal of Cleaner Production*, 412, 137114.
Markard, J., M. Suter and K. Ingold (2016), Socio-technical transitions and policy change – advocacy coalitions in Swiss energy policy, *Environmental Innovation and Societal Transitions,* 18, pp. 215-237.
Marshall, Q., J. FanzoJessica Fanzo, C.B. Barrett, A.D. Jones, A. Herforth and R. McLaren (2021), Building a global food systems typology: a new tool for reducing complexity in food systems analysis, *Frontiers in Sustainable Food Systems*, 5, 746512.
Matthews, K.B., A. Renner, A., K.L. Blackstock, K.A. Waylen, D.G. Miller, D.H. Wardell-Johnson, A. Juarez-Bourke, J.F. Schyns and M. Giampietro, M. (2021), Old wine in new bottles: Exploiting data from the EU's farm accountancy data network for pan-EU sustainability assessments of

agricultural production systems, *Sustainability (Switzerland)*, 13(18), 10080.
Molenaar, E., W. Viechtbauer, J. van de Crommenacker and S.A. Kingma (2024), Neonicotinoids impact all aspects of bird life: a meta-analysis, *Ecology Letters*, 27 (10), e14534.
Mosadegh Sedghy, B., M. Nematollahi and A. Tajbakhsh (2024), Market dynamics between retail channels and short food supply chains: A case of organic fruits, *Journal of Retailing and Consumer Services*, 79, 103775.
Mulvany, P. (2021), Chapter 14 – Sustaining agricultural biodiversity and heterogeneous seeds, in A. Kassam and L. Kassam (eds.), *Rethinking Food and Agriculture*, Darya Ganj, Delhi, Woodhead Publishing, pp. 285-321.
Nicholson, C.C. and N.M. Williams (2021), Cropland heterogeneity drives frequency and intensity of pesticide use, *Environmental Research Letters*, 16(7), 074008.
Omar, A. and M.H. Thorsøe (2024), Rebalance power and strengthen farmers' position in the EU food system? A CDA of the Farm to Fork Strategy, *Agriculture and Human Values*, 41 (2), pp. 631-646.
PBL (2019), *Dagelijkste kost. Hoe overheden, bedrijven en consumenten kunnen bijdragen aan een duurzaam voedselsysteem*, Den Haag, Planbureau voor de Leefomgeving.
Provincie Gelderland (2021), *Toekomst voor de Gelderse boer 2021-2030. Kadernota Agrifood*, Arnhem, provincie Gelderland, https://media.gelderland.nl/Kadernota_Agrifood_2021_1a5c3087e4.pdf.
PVV, VVD, NSC and BBB (2024), *Hoop, lef en trots – Hoofdlijnenakkoord 2024-2028*, Den Haag, coalitie, www.kabinetsformatie2023.nl/documenten/publicaties/2024/05/16/hoofdlijnenakkoord-tussen-de-fracties-van-pvv-vvd-nsc-en-bbb.
Reed, M.S., T. Curtis, A. Gosal, H. Kendall, S.P. Andersen, G. Ziv, A. Attlee, R.G. Fitton, M. Hay, A.C. Gibson, A.C. Hume, D. Hill, J.L. Mansfield, S. Martino, A.S. Olesen, S. Prior, C, Rodgers, H. Rudman and F. Tanneberger (2022). Integrating ecosystem markets to co-ordinate landscape-scale public benefits from nature, *PLOS ONE*, 17(1), e0258334.
Resnick, D. and J. Swinnen (eds.) (2024), *The political economy of food system transformation. Pathways to progress in a polarized world*, Oxford, Oxford University Press.

Ridoutt, B., D. Baird and G.A. Hendrie (2022), Diets with higher vegetable intake and lower environmental impact: evidence from a large Australian population health survey, *Nutrients*, 14(7), 1517.
Ruggeri Laderchi, C., H. Lotze-Campen, F. DeClerck, B.L. Bodirsky, Q. Collignon, M.S. Crawford, S. Dietz, L. Fesenfeld, C. Hunecke, D. Leip, S. Lord, S. Lowder, S. Nagenborg, T. Pilditch, A. Popp, I. Wedl, F. Branca, S. Fan, J. Fanzo, J. Ghosh, B. Harriss-White, N. Ishii, R. Kyte, W. Mathai, S. Chomba, S. Nordhagen, R. Nugent, J. Swinnen, M. Torero, D. Laborde Debouquet, P. Karfakis, J. Voegele, G. Sethi, P. Winters, O. Edenhofer, R. Kanbur and V. Songwe (2024), *The economics of the food system transformation*, Food System Economics Commission (FSEC), Global Policy Report.
Ruig, P. (2024), Farm-to-fork, to protestors with pitchforks: the death of EU's sustainable food policy, *EU Observer*, Brussels, April 29, 2024, https://euobserver.com/green-economy/arf1589b03.
Runhaar, H.A.C. (2017), Governing the transformation towards 'nature-inclusive' agriculture: insights from the Netherlands, *International Journal of Agricultural Sustainability,* 15 (4), pp. 340-349.
Runhaar, H.A.C., Th.C.P. Melman, F.G. Boonstra, J.W. Erisman, L.G. Horlings, G.R. de Snoo, C.J.A.M. Termeer, M.J. Wassen, J. Westerink and B.J.M. Arts (2017), Promoting nature conservation by Dutch farmers: a governance perspective, *International Journal of Agricultural Sustainability*, 15 (3), pp. 264-281.
Runhaar, H., A. Buijs and P. Runhaar (2019), What explains citizens' valuations of and attitudes towards agricultural biodiversity? Results of an exploratory survey of Dutch students, *NJAS – Wageningen Journal of Life Sciences*, 89, 100303.
Runhaar, H. and W. de Haas (2020), *Toets conform artikel 3.1 Comptabiliteits-wet 2016. Gerichte opkoop van veehouderijlocaties met hoge stikstof-depositie nabij stikstofgevoelige Natura 2000-gebieden,* Den Haag, Tweede Kamer.
Runhaar, H. (2022), *Sturen op een duurzaam watersysteem in Nederland: Eerst duidelijke keuzes over de ruimtelijke ordening!* Essay ten behoeve van het advies over de Kaderrichtlijn Water van de Raad voor de Leefomgeving en Infrastructuur, Utrecht: Universiteit Utrecht.
Runhaar, H., C. Ballard, A. Amanatidis, K. Bogner, J. Chambers, I. Dorre-steijn, E. Long, P. Schipper, T. Stacey, L. Suarez Visbal, P. Verweij and J. Vervoort (2024), *Copernicus Institute Societal Impact Plan. Advice from*

the Copernicus Working Group on Societal Impact (CWGSI), Faculty of Geosciences, Utrecht, Utrecht University.
Runhaar, H., S. van Doorm, L. Bello Cartagena, S. de Graaff, C. Offringa, L. van Oers, N. Pustilnik, E. Remorie, W. Lageweg and R. Raven (2025), What roles do governments play vis-à-vis niche actors? A typology illustrated with transition dynamics in the Dutch agri-food system, *Environmental Innovation and Societal Transitions* (under review).
Sanderson, F.J., M. Kucharz, M. Jobda and P.F. Donald (2013), Impacts of agricultural intensification and abandonment on farmland birds in Poland following EU accession, *Agriculture, Ecosystems and Environment,* 168, pp. 16-24.
Schwarzmueller, F. and T. Kastner (2022), Agricultural trade and its impacts on cropland use and the global loss of species habitat, *Sustainability Science*, 17(6), pp. 2363-2377.
Sranacharoenpong, K., H. S. Soret, H. Harwatt, M. Wien and J. Sabaté (2015), The environmental cost of protein food choices, *Public Health Nutrition,* 18 (11), pp. 2067-2073.
Stringer, L.C., Fraser, E.D.G. D. Harris, C. Lyon, L. Pereira, C.F.M. Ward and E. Simelton (2020), Adaptation and development pathways for different types of farmers, *Environmental Science & Policy,* 10, pp. 174-189.
Sutherland, C., C. Sim, S. Gleim and S.J. Smyth (2020), Canadian consumer insights on agriculture: addressing the knowledge-gap, *Journal of Agricultural and Food Information*, 21 (1-2), pp. 50-72.
Tilman, D., M. Clark, D.R. Williams, K. Kimmel, S. Polasky and C. Packer (2017), Future threats to biodiversity and pathways to their prevention, *Nature,* 546 (7656), pp. 73-81.
Timmis, A, P. Vardas, N. Townsend, A. Torbica, H. Katus, D. De Smedt, C.P. Gale, A.P. Maggioni, S.E. Petersen, R. Huculeci, D. Kazakiewicz, V. de Benito Rubio, B. Ignatiuk, Z. Raisi-Estabragh, A. Pawlak, E. Karagiannidis, R. Treskes, D. Gaita, J.F. Beltrame, A. McConnachie, I. Bardinet, I. Graham, M. Flather, P. Elliott, E.A. Mossialos, F Weidinger and S. Achenbach (2022), European Society of Cardiology: cardiovascular disease statistics 2021, *European Heart Journal,* 43, 716-799.
Tittonell, P.A. (2013), *Farming systems ecology. Towards ecological intensification of world agriculture,* inaugural lecture upon taking up the position of chair in Farming Systems Ecology, Wageningen, Wageningen University.

UNEP (2024), *Food waste index report 2024. think eat save: tracking progress to halve global food waste*, Nairobi, United Nations Environment Programme.
UN Women and DESA (2023), *Progress on the Sustainable Development Goals: the gender snapshot 2023*, New York, UN Women Headquarters Office.
UU (2019), *Societal impact of your research. How to design and organise your impact activities?* Faculty of Geosciences, Utrecht, Utrecht University.
Van den Pol-Van Dasselaar, A., T. Becker, A. Botana Fernández and G. Peratoner (2021), Societal and economic options to support grassland-based dairy production in Europe, *Irish Journal of Agricultural and Food Research*, 59 (2), pp. 258-269.
Van Dokkum, H.P., A.M.C. Loeber and J. Grin (2023), Understanding the role of government in sustainability transitions: a conceptual lens to analyse the Dutch gas quake case, *Technological Forecasting & Social Change*, 194, 122685.
Van Oers, L., G. Feola, H. Runhaar and E. Moors (2023), Unlearning in sustainability transitions: insight from two Dutch community-supported agriculture farms, *Environmental Innovation and Societal Transitions,* 46, 100693.
Venema, T.A.G. and N.H. Jensen (2024), We meat again: a field study on the moderating role of location-specific consumer preferences in nudging vegetarian options, *Psychology and Health*, 39 (10), pp. 1337-1351.
Vermunt, D.A., N. Wojtynia, M.P. Hekkert, J. van Dijk, R. Verburg, P.A. Verweij, M. Wassen and H. Runhaar (2022), Five mechanisms blocking the transition towards 'nature-inclusive' agriculture: a systemic analysis of Dutch dairy farming, *Agricultural Systems,* 195, 103280.
Williams, T.G. M. Bürgi, N. Debonne, V. Diogo, J. Helfenstein, C. Levers, F. Mohr, A.E. Stratton and P.H. Verburg (2024), Mapping lock-ins and enabling environments for agri-food sustainability transitions in Europe. *Sustainability Science,* 19, pp. 1221-1242.
Wright, S., M. Frost, A. Wong and K. Parton (2024), Australian microgrids: Navigating complexity in the regional energy transition, *Energy Research and Social Science*, 113, 103540.
Wuepper, D., I. Wiebecke, L. Meier, S. Vogelsanger, S. Bramato, A. Fürholz and R. Finger (2024), Agri-environmental policies from 1960 to 2022, *Nature Food,* 5, 323-331.
Wuijts, S., H.F.M.W. van Rijswick, P.P.J. Driessen and H.A.C. Runhaar (2023), Moving forward to achieve the ambitions of the European Water

Framework Directive: lessons learned from the Netherlands, *Journal of Environmental Management*, 333, 117424.
WWF (2020), *Bending the curve: the restorative power of planet-based diets*, Gland, World Wide Fund for Nature.
WWF-UK (2021), *Driven to waste: the global impact of food loss and waste on farm*s, Woking, World Wide Fund for Nature United Kingdom.
Zimmermann, S., B.J. Dermody, N. Davis, L.M. Divine, V.M. Padula, K. Lestenkof-Zacharof, M.J. Wassen and I. Dorresteijn (2024), The importance of diversity in local food systems: a network analysis of food-related interactions in the indigenous food system on St. Paul Island, Alaska, *Regional Environmental Change*, 24 (2), 91.
Zinngrebe, Y., J. Berger, C. Bunn, M.R. Felipe-Lucia, N. Graßnick, T. Kastner, G. Pe'er, C. Schleyer and S. Lakner, S. (2024), Prioritizing partners and products for the sustainability of the EU's agri-food trade, *One Earth,* 7 (4), pp. 674-686.

Notes

1 These authors define sustainable food systems as *"those that contribute to food security and nutrition for all in such a way that the economic, social, cultural and ecological bases that generate food security and nutrition for future generations are safeguarded"* (Von Braun et al., 2021: 748).
2 See Vermunt, Wojtynia et al. (2022) for definitions.
3 The share of the population that can afford the cheapest variant of a nutritious diet varies from 15% (median) in countries with predominantly rural food systems up to almost 100% in countries with industrialised food systems (Ambikapathi et al., 2022).
4 Almost half of total food waste is 'avoidable' and therefore contributes unnecessarily to sustainability challenges such as climate change (Coudard et al., 2024).
5 Agriculture, for instance, is responsible for 90% of deforestation in the tropics (FAO, 2022) and forms the largest threat to 86% of species at risk of extinction (Tilman et al., 2017; WWF, 2020).
6 For instance, between 2007 and 2022, 65% of total global economic damage as a result of (extreme) droughts related to the agricultural sector (FAO, 2023).
7 Most food exported from the Netherlands goes to neighbouring countries (in 2023, 24% to Germany, 12% to Belgium, 9% to France, and 8% to the UK) (Jukema et al., 2024). The EU is reasonably self-sufficient in relation to food, although not for certain product categories (EC, 2023a). There are substantial import and export flows to and from the EU (EC, 2023b), but most food trade is intra-EU (in 2019, before Brexit, total intra-EU food export amounted to ca. 300 billion euros whereas extra-EU exports amounted to ca. 180 billion euros (Budzyńska and Durakiewicz, 2024; Eurostat, 2024).
8 To give an impression of the size of the different food distribution channels: in the Netherlands, the main channel is retail (about 71% of the expenditure on food); within food retail, the main distribution channel is supermarkets (59%) (Berkhout et al., 2023).
9 This disconnect is caused, among other things, by draining agricultural fields, lowering water tables, and the use of external inputs *"to try to overcome environmental heterogeneity and, more particularly, effects of limiting and reducing production factors"* (Duru et al., 2015: 1238)

10 Food supply chains show high concentration at the levels of processors, traders, and retail, which often puts farmers in a weak economic position (Fałkowski et al., 2017). There is often price competition in the market, whereas in order to produce in a more sustainable way farmers usually need to be incentivised with premium prices (Jongeneel et al., 2020; Stringer et al., 2020), but research on fair trade coffee (Durevall, 2020) suggests that the premium prices that consumers are willing to pay for more sustainable food are not always captured by farmers.
11 I am not the first to advocate for more diversity for sustainable food systems; see e.g. also IPES-Food, 2016.
12 The sharp reduction in the diversity of crop species used to produce food worldwide is the consequence of agricultural intensification. For instance, nowadays, four species (maize, rice, wheat, and potatoes) provide 60% of industrially produced food whereas 12 species provide 75% (Mulvany, 2021). In the 20th century, 90% of all crop varieties and 50% of domesticated cattle and animals were lost (WWF, 2024).
13 My focus is on EU food systems. Silja Zimmermann and colleagues delved into the value of diversity in Arctic Indigenous food systems, reporting that this diversity not only contributes to food security but also to preserving traditional practices (Zimmermann et al., 2024).
14 The Dutch policy paradigm of 'water en bodem sturend', that is, water and soil conditions as the starting point for land use, is a way to promote more diversity in agricultural landscapes, bringing food production more in line with environmental conditions.
15 Solidarity payments in community-supported agriculture can also enhance the access of low-income people to this alternative food system (Van Oers et al., 2023).
16 In this context, agroecology, a form of agriculture that relies on healthy soils and ecosystem services rather than on external inputs and that has also become an international movement, explicitly aims at empowering farmers and communities and enhancing their livelihoods (Gliessman, 2020; Bello Cartagena et al., 2024).
17 More conventional farmers can also reduce their dependence on suppliers of agrochemicals by relying more on natural pest control (Gómez and Lee, 2023).
18 However, this requires action on the part of retailers, which, in turn, seems to require governmental action, partly to ensure that all citizens

can benefit from more healthy diets (Chege et al., 2021; De Freitas et al., 2024; Venema and Jensen, 2024).

19 The regime we scientists operate under is increasingly stimulating and facilitating such inter- and transdisciplinary, impact-oriented research – among others, via the TRIPLE Recognition and Rewards scheme. This kind of research is also facilitated by funding from the European Commission and NWO. Yet the wider food system knowledge regime also hinders the creation of innovative knowledge for more sustainable food systems. In the Netherlands, for instance, much research funding focuses on conventional agriculture (Tittonell, 2013; Vermunt, Wojtynia et al., 2022). The research budget available for 'niet-WUR' from our Ministry of Agriculture is relatively limited. The co-funding required for many practice-oriented research projects forms a specific barrier to novel and transformative research, particularly if it has to come from companies. Many of the co-benefits of more sustainable food production and consumption are public in nature and are difficult or impossible for companies to capture. Those companies that can do so are usually niche players with limited research budgets. Co-funding for practice-oriented research projects is therefore mainly supplied by incumbent food industry companies, which favour research that is incremental rather than transformative.

20 In Utrecht University's Faculty of Geosciences' Copernicus Institute of Sustainable Development and in the university's wider Future Food Utrecht community, new connections are made between scientists from different disciplines who are seeking to develop new solutions for food-related sustainability challenges. I have already mentioned the COMBINED project, which brings together ecology, agronomics, governance and transition studies, and psychology. Under the guidance of Jerry van Dijk, Utrecht University is playing an important role in the large ReGeNL project focusing on transitioning towards more regenerative agriculture. Utrecht university is one of the key partners in the CropXR Institute, which develops new knowledge, technology, and tools "to generate new crop varieties that are better adjusted to climate change and less dependent on harmful agricultural interventions" (CropXR, n.d.). And so on.

21 The need for transition has been restated several times since (see https://www.kabinetsformatie2023.nl/documenten/publicaties/2021/12/15/coalitieakkoord-omzien-naar-elkaar-

vooruitkijken-naar-de-toekomst and https://www.rijksoverheid.nl/actueel/nieuws/2022/06/10/onontkoombare-transitie-naar-een-vitaal-landelijk-gebied).

22 See https://www.landbouwakkoord.nl/, https://www.nieuweoogst.nl/nieuws/2023/12/11/adema-nu-geen-convenant-dierwaardige-veehouderij, and https://www.rijksoverheid.nl/documenten/convenanten/2022/11/04/convenant-dierwaardige-veehouderij.

23 But see Omar and Thorsøe (2024) for a critical analysis of how this objective has been watered down.

24 The FAO (2024) also points to governments as important actors for food system transformation, as they have an active role in all 13 levers for system change that FAO identifies (and that include, for instance, trade and market interventions; laws and regulations; fiscal subsidies to consumers; labeling and certification; and research and development).

25 We later discovered that Avelino et al. (2023) had also used images of hands to visualise their conceptual framework.

26 Agri-environment schemes are being implemented all over the world and play an important role in EU food policy. In the EU – and particularly in the Netherlands – they are not sufficient to halt biodiversity loss, even though they often succeed at farm, field, and landscape levels, and without them biodiversity loss would probably have been even greater. From a governance perspective, there are various reasons for their limited effectiveness. These include limited budgets, relatively short-term contracting, subsidies that are not always attractive because they cover costs only, voluntary participation, and, – maybe most important – conservation measures are 'add-on' and do not address the forces driving biodiversity loss: that is, intensive agriculture (Runhaar et al., 2017). But within this context, farmers – and in the Netherlands, particularly also farmer collectives – are trying to maximise their contributions to biodiversity recovery.

27 This includes not only farmers but also the government agencies involved, such as the Ministry of Agriculture.

28 Her work and that of Tessa Rötscheid in the Law Faculty will result in policy recommendations that we will develop with and for STOWA, the knowledge institute for the Dutch regional water authorities.

29 The impacts I want to have on public policy are related to policy analysis, evaluation, and design. I have taught BSc and MSc courses on these same topics for many years with colleagues such as Carel Dieperink, Heleen Mees, and Frank van Laerhoven.
30 We identified 5 mechanisms: lack of financial incentives, a limited action perspective, problems in knowledge transfer, resistance to change, and no shared concrete perspective (Vermunt, Wojtynia et al., 2022).
31 We concluded that the 350 million euros budgeted for this policy most probably would not be spent effectively, among other things, due to unclear goals, farmer collaboration being voluntary, and unclear agreements with provinces (Runhaar and De Haas, 2020).
32 Thank you, Koen Frenken, for raising this issue.

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