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The reshaping of European food systems through plant-rich diets

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Citation

Kortleve, A. J. (2026, October 1). *The reshaping of European food systems through plant-rich diets*. Retrieved from <https://hdl.handle.net/1887/4310459>

Version: Publisher's Version

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Note: To cite this publication please use the final published version (if applicable).



Chapter 4. Stranded assets in European agriculture during food system transformations

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Published in *Nature Food*, 1–7 (2026).

This chapter is based on the published article (<https://doi.org/10.1038/s43016-025-01283-z>). To improve consistency across the thesis, the article has been reformatted into the common structure. The scientific content, analyses, and conclusions remain unchanged, apart from minor editorial revisions.

Abstract

Dietary shifts, particularly reduced animal-sourced food consumption in high-income countries, risk stranding substantial animal-sourced-food-related assets. Linking agricultural and economic data to global multi-regional input–output models, we show that animal-sourced food assets represent 78% of EU+UK fixed agricultural assets, with €158 billion linked to livestock and €100 billion to feed production. We estimate that animal-sourced food reductions in EU+UK consumption of 9.5%, 60%, and 100% could strand 18%, 50% and 77% of these assets, respectively. Current depreciation rates suggest there is generally sufficient time to phase out assets, offering pathways to limit stranding. Policy- and climate-induced stranding risks are intertwined and should both be incorporated into financial modelling as overlapping transition pressures. Given food producers' high exposure to stranding, risks can cascade throughout supply chains; integrated policy support to repurpose or phase out animal-sourced-food-related assets is essential to avoid delays in sustainable food-system transformations.

Keywords

Stranded assets; animal-sourced food; food-system transformation; plant-rich diets

4.1 Introduction

The global food system accounts for between one-quarter and one-third of all anthropogenic GHG emissions and is a major contributor to deforestation, biodiversity loss, and water use (Crippa et al., 2021; Ellis et al., 2010; Poore & Nemecek, 2018). Recent studies show that food system emissions alone are sufficient to breach the 1.5°C and perhaps even the 2°C warming thresholds (Clark et al., 2020; Ivanovich et al., 2023). This finding underscores the urgent need for a major food-system transformation, involving dietary change, reductions in food waste, and improvements in food production (Clark et al., 2020; Willett et al., 2019).

Among these approaches, shifting to plant-rich diets offers the largest GHG reduction potential in higher-income regions (Poore & Nemecek, 2018; Sun, Scherer, Tukker, et al., 2022). Transitioning away from animal agriculture would entail a large-scale reorganisation of the food system, with increased investments in legume cultivation, horticulture, and alternative proteins, whereas some assets in meat and dairy could risk being stranded (Marsden et al., 2019; Tingey-Holyoak et al., 2024). Here we define stranded assets as unanticipated or premature write-offs of fixed assets (Caldecott et al., 2013).

Research on stranded assets has largely focused on fossil fuel infrastructure, where stranded assets could reach US\$1 trillion, with most losses occurring in OECD countries (Mercure et al., 2018; Semieniuk et al., 2022; Welsby et al., 2021). The scale of these potentially stranded assets often leads vested interests to resist climate policy and energy transitions (von Dulong, 2023). Although asset stranding is anticipated across the fossil fuel industry under scenarios consistent with meeting climate targets (Kennedy et al., 2023; Mercure et al., 2018; Semieniuk et al., 2022; Welsby et al., 2021), agricultural stranding risks are likely to vary by subsectors, practices, or regions (Rautner et al., 2016). The overall magnitude of future stranded assets will depend on a range of factors including climate impacts, biodiversity loss, extreme weather events, land degradation, resource scarcity, and the proactive or reactive responses of governments, food producers, and consumers (Caldecott et al., 2013; Marsden et al., 2019; Rautner et al., 2016; Reddy et al., 2020; Tingey-Holyoak et al., 2024).

These responses, including dietary change, represent transition risks that can lead to asset stranding, while climate impacts represent physical risks. This study focuses on stranding driven by transition risks, represented as exogenous dietary scenarios rather than policy-specific interventions or endogenous market dynamics. Whereas macroeconomic studies have highlighted the broad economic costs of food-system transitions (for example, Mason-D'Croz et al., 2022), others have argued that proactively addressing stranded assets may be essential for unlocking the policy window through which rapid transformation can occur (Walton et al., 2025).

Stranded assets pose several challenges across society. For businesses, they represent investments that are difficult to sell or convert back into cash (low liquidity) and are at risk of sudden loss in economic or functional value. Governments may face market failures from unregulated externalities, while at a macroeconomic level, prolonging the use of unsustainable assets could harm productivity, economic growth, social welfare, and public finances (Caldecott et al., 2013). The heavy financialisation of the EU+UK food system has heightened vulnerabilities and exposure to asset stranding, especially through an over-reliance on high-carbon-emitting investments (Marsden et al., 2019). The resulting stranded assets are often illiquid and at risk of devaluation, with potential ripple effects across supply chains (Tingey-Holyoak et al., 2024).

In this study, we explore the potential for asset stranding under different levels of animal-sourced food substitution with plant-based foods. We model reductions of 9.5%, 60% and 100% in animal-sourced food consumption from current levels, based on ranges determined in the EAT–*Lancet* diet (representing moderate, low, and zero animal-sourced food scenarios; see section 4.2 Methods for details). We assess the potential stranding of fixed assets (Caldecott et al., 2013), including farm buildings, machinery, equipment, and breeding animals. Land assets are analysed separately due to their greater potential for repurposing and the complexities of valuing future land use. These include distortions from subsidies, tax rules, and commodity prices (Marsden et al., 2019), and the exclusion of ecosystem services, such as biodiversity, water regulation, and carbon sequestration, from market prices (Caldecott et al., 2013). Here we focus on the changes in asset values under different dietary transitions.

4.2 Methods

Agricultural assets are commonly classified into natural, physical, financial, human, and social assets. In this study, we assess the potential stranding of fixed assets including buildings, machinery and equipment, and breeding animals and evaluate land asset value change following dietary transitions.

Asset values are based on FADN data (European Commission, 2024; Supplementary Information Table 4.1 provides details). In this database, fixed assets represent the existing capital stock, whereas investments in fixed assets are recorded separately as annual capital expenditure. Although ongoing investments may contribute to future stranding risk, they are not yet stranded and are therefore excluded from our analysis.

Other asset categories reported in FADN, such as current assets, financial assets, and intangible assets, are not assessed. Financial assets, including short- and medium- to long-term loans, are linked to highly liquid markets which enable risks to be moved (Caldecott et al., 2013). Intangible human and social assets, such as know-how, management practices, and community networks, are less vulnerable due to their association with diverse activities (Caldecott et al., 2013) and, when monetised, represent less than 2% of the total asset valuation.

We use the FABIO database (version 2.0), which provides a global series of physical input–output tables for agriculture and food (Bruckner et al., 2019). FABIO v2.0 covers 186 countries and one RoW region (n^r), 123 commodities (n^s), and six final demand categories (n^v) for 2010–2021. We integrate FABIO with data for 14 farm types (n^f) across EU+UK countries provided by FADN (European Commission, 2024). Asset values for these farm types are proportionally allocated to the n^s food items using each country's total output per commodity and a concordance matrix (Supplementary Information Table 4.2). Most assets were successfully allocated (land 99.6%, buildings 99.8%, machinery and equipment 99.6%, and breeding animals 100%). FADN data, based on annual EU Member State surveys, represent approximately 3.7 million farms across EU+UK in 2020, but do not cover fish and seafood assets.

Our input–output analysis approach is inherently static and represents a snapshot of production, trade, and efficiency for each year. Our scenario modelling assumes constant technical coefficients and trade structures when projecting into the future. The results should be interpreted as broad estimates of stranding risk under current production systems, providing insight into potential transition exposures rather than precise future outcomes.

We performed a contribution analysis to evaluate the embodied assets across the EU+UK food supply chain (that is, agricultural assets accumulated through each supply chain stage). This analysis follows the equation where ($n^r n^s \times n^r$) represents the matrix of embodied impacts for each commodity–region pair. Here is a row vector asset intensity (in € t^{-1}) calculated by dividing the asset flow by the total output, as a . The Leontief inverse is given by $(I - A)^{-1}$, where I is the identity matrix (a matrix with ones on the main diagonal) and A represents the matrix of technical coefficients, all three with the dimensions $n^r n^s \times n^r n^s$. The matrix denotes the final demand ($n^r n^s \times n^r n^v$).

To assess potentially stranded assets following a transition to more plant-rich diets, we model the EAT–*Lancet* diet for high- and middle-income countries, considering impacts on EU food consumption, imports, and exports. We model three scenarios of animal-sourced food intake aligned with the macronutrient intake ranges recommended in the EAT–*Lancet* reference diet (Willett et al., 2019; Supplementary Information Fig. 4.1).

1. Moderate animal-sourced-food scenario, using the upper limit of the animal-sourced food intake range (including dairy, beef and lamb, pork, poultry, lard, tallow, eggs, and fish) and the lower limit of the range recommended for legumes (including dry beans, lentils, peas, soy foods, and peanuts), tree nuts, and vegetable oils (including palm and unsaturated oils) intake.
2. Low animal-sourced-food scenario, applying the midpoint for all animal-sourced foods, legumes, tree nuts and vegetable oils.
3. Zero animal-sourced-food scenario, excluding animal-sourced foods entirely and using the upper range for legumes, tree nuts, and vegetable oils.

All dietary scenarios are scaled to an isocaloric intake of 2,500kcal per capita per day, with other plant-based foods adjusted proportionally as needed. Mass-energy conversions were based on FAO Food Balance Sheets (FAOSTAT, 2020). Food waste is factored into both baseline and the dietary scenarios using fixed food-specific fractions (Coudard et al., 2021). Items not considered by the EAT–*Lancet* recommendation ('alcohol' and 'other') are excluded (Supplementary Information Fig. 4.1). A schematic overview of these methods is provided in Supplementary Information Fig. 4.4.

The sensitivity of the asset values is estimated by calculating the minimum and maximum deviations of the 2020 value from the 2014–2019 values, considering the CAP regime for 2014–2020, for each asset type, region, and food item. Historical data are adjusted for inflation using the gross domestic product at market prices' index from Eurostat (Eurostat, 2025b). As the composition of assets also changes during the dietary transition, we further assessed the sensitivity for each scenario (Fig. 4.3).

To assess depreciation pathways, we derived the mean depreciation rate from the FADN database using total depreciation allocated to 2020 and depreciable asset values (including fixed assets, permanent crops, and quotas; European Commission, 2024). All data processing and analyses were carried out using Python (version 3.8.8) and RStudio (version 2022.07.2).

4.3 Farm-level asset landscape

In 2020, the combined value of farm-level land and fixed assets used for food production in the EU+UK totalled €1.1 trillion. These food system assets were distributed as follows: land and permanent crops (70%); buildings (14%); machinery and equipment (12%); and breeding animals (4%; Fig. 4.1). In addition to these long-term assets, the food system includes faster-circulating assets or current assets (that is, those used within a single operating cycle, typically one year) comprising non-breeding animals, inventories, and other circulating capital, valued at €322 billion (Fig. 4.1). Total liabilities of €226 billion are excluded from fixed assets, being linked to highly liquid markets that enable risk movement (Caldecott et al., 2013). Yearly investments in fixed assets total €42 billion and intangible assets equate to €26 billion (Fig. 4.1). For reference, food-related subsidies from the EU's CAP totalled €51 billion (Fig. 4.1).

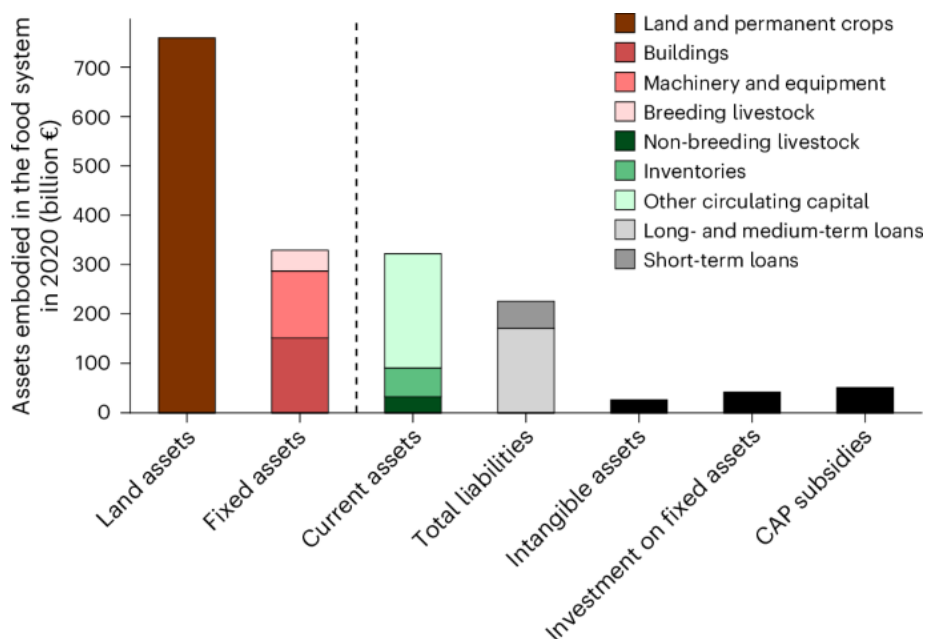


Fig. 4.1 Overview of asset types within the EU+UK food system in 2020. Land assets include land value and permanent crops (for example, orchards, vineyards). Fixed assets are divided into buildings, machinery and equipment, and breeding animals. Current assets include non-breeding animals, inventories (stocks of products owned by the farm for input use or sale, whether produced or purchased) and other current assets (cash, business receivables and assets easily sold or payable within a year). Total liabilities, representing farm debt, include short-term and long- to medium-term loans. Intangible assets are either tradable (quotas, rights) or non-tradable (software, licences). CAP subsidies include the full CAP budget for the EU+UK. Assets within the full agricultural system (food and non-food use) are shown in Supplementary Information Fig. 4.2.

4.4 Asset stranding under dietary transitions

To explore potential stranded assets under a dietary transition, we link assets to specific products, covering all animal- and plant-sourced products (that is, animal feed) required to produce animal-sourced foods. We also split assets for producing plant-based foods for direct human consumption by asset type. Overall, 78% of the fixed assets embodied in the food system are linked to animal-sourced foods, with €158 billion allocated to livestock production and €100 billion to upstream animal feed production. It is important to highlight that approximately 40% of stranded assets from a plant-based shift would be in crop agriculture for feed, indicating the need for distinguishing policies for both animal- and plant agriculture.

Among animal-sourced food assets, EU+UK dairy leads with €109 billion (€71 billion in livestock and €38 billion in feed production; Fig. 4.2), with 16% embodied in breeding animals, 40% in machinery and equipment, and 44% in buildings. Feed assets are highest in the EU+UK dairy value chain (39% of feed assets), followed by pig meat (21%) and bovine meat (16%; Fig. 4.2). Asset intensity, or the asset value per unit of food produced, is highest in beef, lamb, and goat meat products (Fig. 4.2).

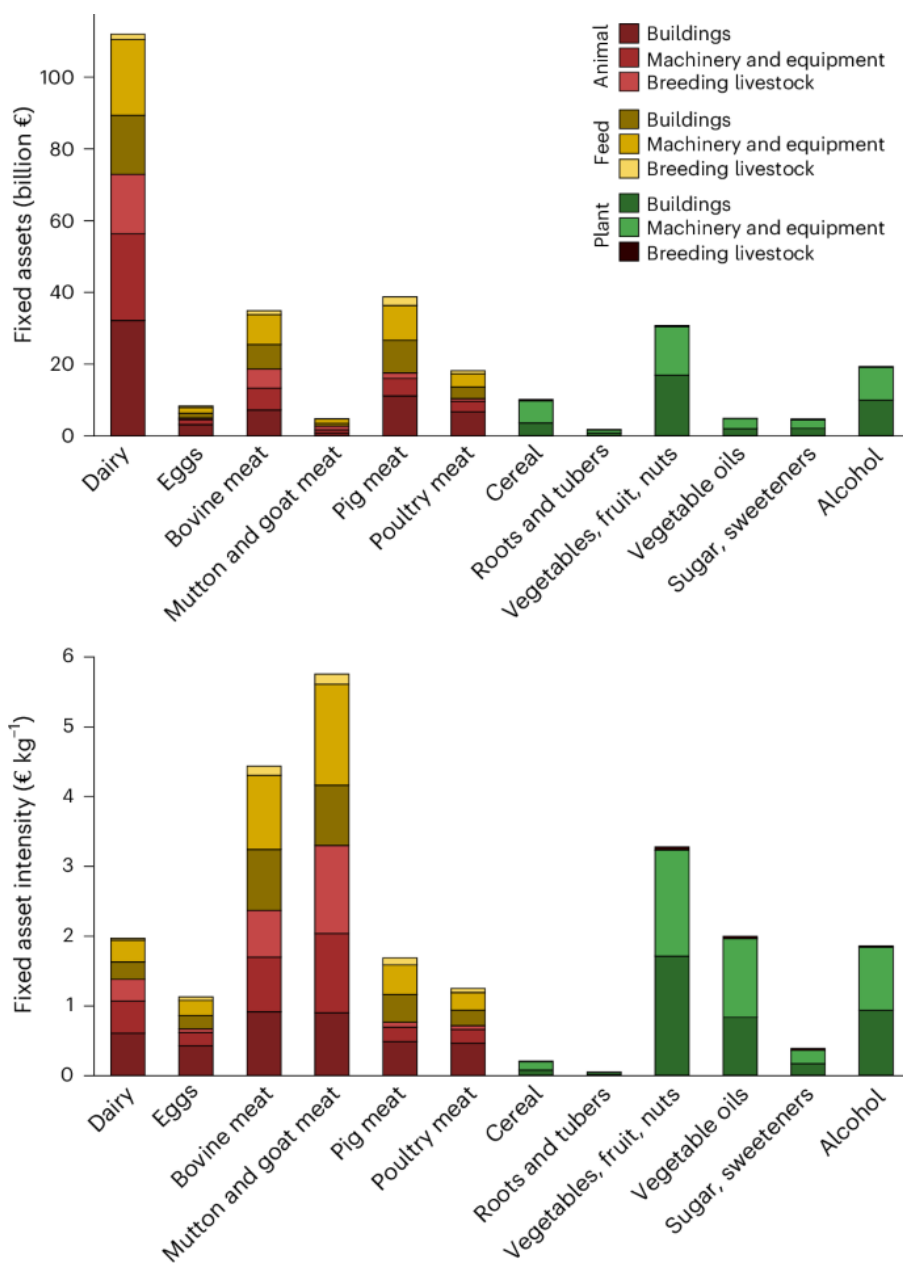


Fig. 4.2 Allocation of animal, feed, and plant assets across food production by asset type. The upper panel shows total fixed assets for the EU+UK in 2020, and the lower depicts average asset intensity (asset value per unit of food produced).

A 9.5% reduction in animal-sourced food consumption in the EU+UK (moderate animal-sourced-food scenario) potentially strands €61 billion of fixed assets (or 20% of the total), a 60% reduction (low animal-sourced-food scenario) potentially strands €168 billion (49%), and a 100% reduction (zero animal-sourced-food scenario) potentially strands €255 billion (73%; Fig. 4.3). The steepest declines are in breeding-animal assets, with reductions of 31%, 67%, and 98% in the moderate, low, and zero animal-sourced-food scenarios, respectively (Fig. 4.3). Buildings and machinery and equipment asset classes follow a similar trajectory, showing a 16–17%, 49%, and 73–75% decline for each scenario, respectively (Fig. 4.3). For zero animal-sourced food, some breeding-animal assets remain, reflecting niche, multifunctional roles of farm animals in crop production (Fig. 4.3).

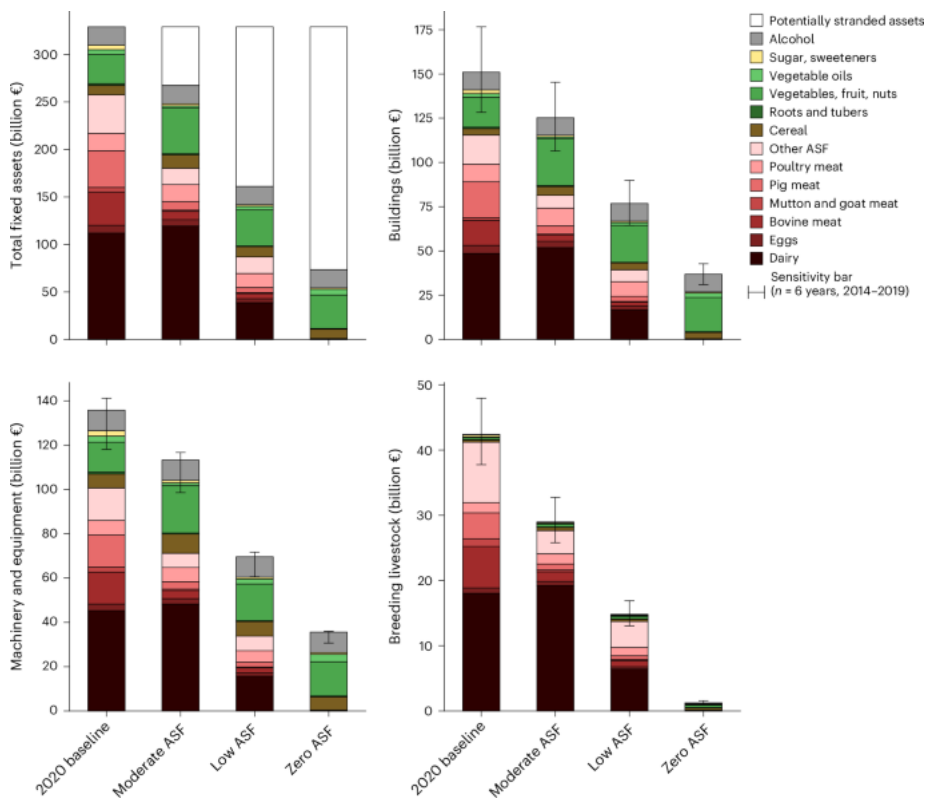


Fig. 4.3 Embodied fixed assets under EAT–Lancet dietary scenarios: 2020 baseline, Moderate, Low, and Zero animal-sourced food (ASF). ‘Other ASF’ refers to other animal-sourced food and includes animal fats, offal, and other meat. Range markers represent sensitivity intervals of asset values ($n=6$ years, 2014–2019; Methods provide details, and Supplementary Information Fig. 4.5 provides the mean deviation of each farm type–region combination).

Land assets could see decreases of 19%, 48% or 71% under the moderate, low, or zero animal-sourced-food scenarios. This implies a land asset value reduction of €153 billion, €370 billion, or €551 billion. The sharpest declines occur in bovine and pig meat in the moderate animal-sourced-food scenario; under the low and zero animal-sourced-food scenarios, there is a steep decline in the dairy value chain. To maintain land asset values under these shifts, the average value of land across all agricultural uses in the EU + UK would need to reach approximately €5,000 ha⁻¹ in 2020, potentially

supported by revenues from environmental services, plant-based food or other economic activities. For context, the same land currently receives approximately €300 ha⁻¹ yr⁻¹ of CAP support.

4.5 Plant-based asset growth and repurposing

The decline in animal-sourced food assets is slightly offset by an increase in plant-based assets, following more plant-based food consumption (Supplementary Information Fig. 4.1). This results in a 3–24% rise in buildings and a 0.5–20% rise in machinery and equipment assets, with the largest increases seen in vegetables, fruit, and nuts (Fig. 4.3). Our analysis does not address whether these assets are newly developed or repurposed from animal-sourced food production systems. Future innovation in plant-based production, such as precision fermentation and vertical farming, may further influence the asset intensity of plant-based production.

4.6 Depreciation and timelines for asset phase-out

Non-land assets depreciate over time. These assets could be phased out following potential dietary transitions (Reddy et al., 2020). The annual depreciation applied in agriculture is generally similar to or higher than in fossil infrastructure (Kennedy et al., 2023). Using the current annual depreciation rates of 9% (European Commission, 2024), all redundant animal-sourced food assets under the low animal-sourced-food scenario would depreciate fully within 10 years, whereas a complete phase-out under the zero animal-sourced-food scenario would require approximately 30 years (Supplementary Information Fig. 4.3). This depreciation analysis suggests that a systematic phase-out of animal-sourced food assets accompanied by a complete investment stop would leave minimal residual value and limit the extent of stranded assets. However, an accelerated phase-out by 2030 could result in €99 billion in stranded assets (Supplementary Information Fig. 4.3). Evaluating trade-offs between different policy-led transition timelines is critical for understanding the potential economic impact of managed transitions compared to a forced phase-out by the climate crisis.

Depreciation is used here as an accounting proxy to estimate the potential pace of asset phase-out under managed transition scenarios. However, this approach does not account for real-world barriers to phase-out, such as subsidies, tax regimes, or financial constraints that may delay disinvestment in animal-sourced food assets. Even fully depreciated assets may remain operational if they continue to generate revenue, which can delay the start of phase-out in the absence of stronger transition policies.

4.7 Policy responses to stranded asset risks

In any of these scenarios, targeted policy intervention is essential, including support for debt and asset depreciation management, and general transition assistance for farmers. A socially just transition that addresses existing social and economic inequalities and vulnerabilities within the food system is crucial to ensure that transition costs and benefits are equitably distributed, ultimately fostering greater public support for the transition (Just Rural Transition, 2023; Kaljonen et al., 2021; Verkuil et al., 2022).

While the general need for a well-managed transition is widely acknowledged (Verkuil et al., 2022), the quantification of stranded asset risks (€61 billion, €168 billion, and €255 billion under the moderate, low, and zero animal-sourced-food scenarios) adds crucial specificity for policy design. By

translating abstract transition risks into concrete financial terms, such figures can guide the scale and timing of depreciation support, inform compensation schemes, and support realistic regulatory timelines. Our analysis also provides asset intensity per kilogram of food for different food items (Fig. 4.2), offering a basis for tailoring compensation and support mechanisms according to food-level exposure. Similar approaches are already used in the energy sector, where compensation for stranded coal assets or displaced workers is estimated per MW or per worker to support labour reskilling and regional diversification (Nacke et al., 2024; Robins et al., 2018; Srivastav & Zaehring, 2024).

The EU's Just Transition Mechanism, established under the Green Deal, allocates ~€55 billion to support social and economic adjustments in high-carbon regions (European Commission, 2020c). Although the mechanism does not currently cover agriculture, the European Economic and Social Committee has called for a dedicated just transition framework for the agrifood sector, an idea under consideration in the post-2027 CAP reform (Ats & Marin, 2024). Without targeted support, high stranded asset exposure, especially in bovine meat, pig meat, and dairy systems, may delay EU dietary and climate action by increasing political resistance or financial vulnerability among producers (Walton et al., 2025). Our analysis helps identify where such friction is likely and the scale of the issue that policy levers, such as aligning depreciation schedules, reforming agricultural subsidies or providing liquidity support, can help address, reduce resistance and enable more rapid transformation.

Whereas some asset stranding may be unavoidable under a transition away from animal-sourced foods and in response to the climate crisis, the key policy challenge lies in determining when, where, and how these costs arise, along with, importantly, how they are distributed. At the farm level, stranded assets pose direct financial risks to farmers, particularly those with high sunk costs or long investment cycles and limited liquidity, who may face loan defaults or business failure if transition support is inadequate (Caldecott et al., 2013). Financial risk is further amplified by short-term decision-making incentives and path dependence, leaving farmers with few viable exit strategies without public support (Caldecott et al., 2013). When such constraints are widespread across Europe, they inhibit the reallocation of land, labour, and capital towards plant-based production systems, creating system-level delays even when such pathways are technically and economically feasible.

In this context, CAP reforms are critical, as current agricultural subsidies may inadvertently contribute to stranded assets by incentivising investment in specific practices or crops that are not aligned with environmental priorities, evolving market demands, and climate risks (Chapter 2). For example, livestock-specific subsidies encourage investments that risk becoming stranded if consumer preferences shift towards more plant-rich diets or if climate change makes livestock production economically inviable (Caldecott et al., 2013; Marsden et al., 2019). Redirecting CAP budgets away from animal-sourced foods and towards repurposing support, liquidity assistance, and crop production is one of the clearest policy levers to weaken existing animal-sourced food lock-ins, which are system-wide but may materialise through farm-level decisions, and to reduce transition delays.

Assets may be repurposed for alternative uses, with emerging opportunities in plant-based agriculture, such as precision farming, alternative protein production, and regenerative farming. Examples include converting chicken sheds, dairy barns, and pig barns into facilities for growing mushrooms, hemp, microgreens, and speciality vegetables and herbs (*The Little Mushroom Company*, n.d.; *Transformation Project*, n.d.). Besides the building structure itself, existing infrastructure such as cooling cells, feeders, watering systems, and computer systems can often be

repurposed to support greenhouse operations (*Transformation Project*, n.d.). In addition, retrofitting infrastructure beyond the farm gate, particularly in the manufacturing sector, presents a capital-efficient strategy for rapidly scaling up production capacity for plant-based proteins (Bess et al., 2023). There may also be opportunities for repurposing assets for other sectors, especially with respect to buildings, energy generation, tourism, and more. Whereas our results show that potential animal-sourced-food-related losses far outweigh gains in plant-based assets, we do not assess whether these gains reflect new or repurposed assets. Further research can target the effects of partial offsets when evaluating transition costs and mitigation opportunities at the farm level.

From a climate perspective, failure to transition away from animal-sourced food production and consumption could exacerbate asset stranding risks as climate impacts on agriculture intensify. Both a faster decarbonisation and more severe impacts of climate change could drive higher levels of asset stranding, increasing the chances of economic, social, and political repercussions (Rautner et al., 2016). Additionally, low-animal welfare practices, combined with climate risks, may increase the likelihood of zoonotic and epizootic events within livestock populations (CDC, 2025). Whereas stronger regulatory responses to animal welfare and biosecurity concerns could help mitigate disease risks, they would also accelerate asset stranding, especially in intensive, high-risk animal agriculture systems (Wright & Stein, 2023).

Despite uncertainties surrounding transition pathways, the inertia of the climate system guarantees that even if GHG emissions were halted immediately, the risks of asset stranding in the food system would continue to grow (Rautner et al., 2016). Climate change is probably already contributing to agricultural asset stranding by driving extreme weather, altering water supplies, and negatively impacting crop yields and the growth of dairy, meat, and fish stocks (Rautner et al., 2016; Reddy et al., 2020). Adaptive food governance is therefore essential, including diversification of agricultural production, investment in sustainable farming practices and transition support for farmers adapting to new market conditions (Marsden et al., 2019). However, while such strategies can mitigate some physical risks from climate change, they are unlikely to address all potential sources of asset stranding (Rautner et al., 2016).

Meanwhile, investors currently favour on-farm climate solutions, such as regenerative agriculture and feed additives, over demand-side measures such as promoting plant-based diets (Raven et al., 2024). This emphasises the need for policy interventions that encourage transitions towards more plant-based diets, for instance, through measures supporting livestock reductions (Harwatt et al., 2024) and promoting plant-based alternatives (Ministry of Food, Agriculture and Fisheries of Denmark, 2023; Planet Tracker, 2023). Given the uncertainties surrounding the efficacy of on-farm livestock solutions and their limited capacity to address broader environmental harms (Arndt et al., 2022; Poore & Nemecek, 2018), investors should take a more proactive role. Rather than viewing at-risk assets solely as financial exposure to be managed, they must support the deliberate phase-out of a large proportion of animal-sourced-food infrastructure through transition finance, helping to avoid prolonged lock-in and enabling a more rapid food-system transformation (Walton et al., 2025).

4.8 Systemic and downstream repercussions

The interconnected nature of the food system, characterised by strong investment synergies across different asset types, means that stranding can propagate through supply chains (Caldecott et al., 2013). The stranding of physical assets such as farm buildings, irrigation systems, and crop fields can

have cascading impacts across food supply chains, affecting other assets such as business networks and cooperatives reliant on consistent agricultural production. These disruptions may destabilise local communities and erode intangible assets such as knowledge, social capital, and place-based expertise, elements often undervalued in financial accounting but difficult to restore once lost (Caldecott et al., 2013). This underscores the need for responses that go beyond financial risk management and consider the broader social impacts of asset stranding (Rautner et al., 2016).

The effects of stranded agricultural assets extend beyond primary production, leading to cascading impacts across multiple sectors (Marsden et al., 2019; Reddy et al., 2020). For example, food processing facilities producing animal by-products such as leather and casein may experience supply constraints (Planet Tracker, 2023), whereas logistics companies could face underutilisation of refrigerated trucks and live animal transport infrastructure. Retailers may need to repurpose meat-focused display areas, and animal-sourced-food-focused financial institutions could see declines in the collateral value of loans tied to livestock assets. Those in the pharmaceutical industry that are heavily reliant on animal agriculture for antibiotic sales (The European Medicines Agency, 2024) would experience reduced demand, affecting upstream supply chains, research, and investments. In regions where tourism is closely linked to animal agriculture, revenue losses could result in additional asset stranding.

As the food system transitions towards plant-sourced foods, assets will shift, but their location, concentration, and size will be naturally very different, creating new vulnerabilities and opportunities. Our stranded-asset calculations may underestimate these broader, cascading risks in infrastructure beyond direct food production, such as transportation, storage facilities, electrification, and other on-farm resources. They also do not account for asset stranding outside the EU+UK, even though global markets are deeply interconnected.

Farmers remain particularly vulnerable in this transition due to their limited profitability across many areas of the EU + UK and high degree of lock-in from long-term investments (Glennie & Alkon, 2018; Kaljonen et al., 2021). In a food system where economic power is largely concentrated among manufacturers and retailers, farmers' capacity to adapt to dietary shifts is restricted. This limited adaptive capacity reinforces the need for broad governmental action to reorganise support mechanisms and ensure a just transition through targeted agricultural policies (Glennie & Alkon, 2018; Just Rural Transition, 2023; Kaljonen et al., 2021; Planet Tracker, 2023; Verkuil et al., 2022), informed by quantified stranded asset risks in the livestock and feed systems.