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The European Green Deal as a Tool for Improving Food Security in View of Environmental Challenges

O Pacto Ecológico Europeu como Instrumento para Melhorar a Segurança Alimentar face aos Desafios Ambientais

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ABSTRACT: The Green Deal is an important tool for improving food security both through the establishment of general strategic guidelines and through its influence on the European Union (EU) secondary law regulating food security. The aim of the article is to comprehensively assess the economic, social, and legal impact of the Green Deal on EU food security by analysing its implementation at different levels. The research employs regression analysis, case studies, and precedent analysis. Regression analysis for EU countries revealed that the key factor that increases food insecurity is food inflation with a regression coefficient of 0.1422 and, potentially, pesticide sales (0.0103). Factors that can reduce food insecurity were energy consumption in the agricultural sector (-0.3485) and the organic agricultural area (-0.2541). The analysis of the country cases revealed uneven implementation of reforms and potential threats to food security. The EU's case law confirmed that the success of the Green Deal is largely determined by legal mechanisms, and their absorption can have negative consequences. In particular, the risk of reduced production, legal uncertainty, insufficiently effective implementation of directives, which requires further improvement of the regulatory framework. The obtained results are useful for politicians and decision-makers in the field of ensuring food security, providing a basis for further improvement of regulatory mechanisms and practical measures.
KEYWORDS: Green Deal; food security; energy consumption; pesticides; organic crops; European Union law.

RESUMO: O Pacto Ecológico Europeu é uma ferramenta importante para melhorar a segurança alimentar, tanto através do estabelecimento de orientações estratégicas gerais como pela sua influência no direito secundário da União Europeia (UE) que regula a segurança alimentar. O objetivo deste artigo é avaliar de forma abrangente o impacto económico, social e jurídico do Pacto Ecológico Europeu na segurança alimentar da UE, analisando a sua implementação a diferentes níveis. A pesquisa utiliza análise de regressão, estudos de caso e análise de precedentes. A análise de regressão para os países da UE revelou que o principal factor que aumenta a insegurança alimentar é a inflação alimentar, com um coeficiente de regressão de 0,1422, e, potencialmente, as vendas de pesticidas

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(0,0103). Os factores que podem reduzir a insegurança alimentar foram o consumo de energia no sector agrícola (-0,3485) e a área da agricultura biológica (-0,2541). A análise dos casos nacionais revelou uma implementação desigual das reformas e potenciais ameaças à segurança alimentar. A jurisprudência da UE confirmou que o sucesso do Pacto Ecológico é amplamente determinado por mecanismos legais, e a sua absorção pode ter consequências negativas. Em particular, o risco de redução da produção, a insegurança jurídica e a insuficiente implementação das directivas exigem um maior aperfeiçoamento do quadro regulamentar. Os resultados obtidos são úteis para os políticos e decisores políticos na área da segurança alimentar, proporcionando uma base para a melhoria dos mecanismos regulamentares e das medidas práticas.
PALAVRAS-CHAVE: Pacto Ecológico Europeu; segurança alimentar; consumo de energia; pesticidas; culturas biológicas; legislação da União Europeia.

1. Introduction

The European Green Deal (hereinafter – the Green Deal) is a strategy officially approved by the EU aimed at facilitating the transition of the EU to a climate-neutral economy, which was announced by the European Commission in December 2019.

The strategy consists of a package of policy initiatives aimed at reducing carbon emissions by 55% by 2030 and achieving carbon neutrality by 2050. The legal background of the Green Deal is EU primary law, in particular, the obligations enshrined in the Treaty on the Functioning of the European Union (TFEU) of 1957: Art. 11 — integration of environmental protection requirements into all EU policies; Art. 114 — harmonisation for the internal market (regulations on food law, pesticides, organics); Art. 191-193 — environmental policy (precautionary principle, prevention, “polluter pays”), etc.

The strategy has become the basis for the adoption of a number of regulatory acts (e.g. the European Climate Law and policy documents, including the Farm to Fork Strategy, the EU Biodiversity Strategy for 2030, and the Nature Restoration Regulation.[1,2,3,4] The Farm to Fork Strategy is one of the most important parts the

[1]EUROPEAN PARLIAMENT & COUNCIL OF THE EUROPEAN UNION. Regulation (EU) 2024/1991 of the European Parliament and of the Council of 17 June 2024 on nature restoration and amending Regulation (EU) 2022/869. Official Journal of the European Union, L 1991. [online]. 29 July 2024. Available from: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32024R1991 [Accessed: 12 January 2026]

[2] EUROPEAN COMMISSION. A Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system (COM(2020) 381 final). [online]. 20 May 2020. Available from: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0381 [Accessed: 8 January 2026]

[3] EUROPEAN COMMISSION. EU biodiversity strategy for 2030: Bringing nature back into our lives (COM(2020) 380 final). [online]. 20 May 2020. Available from: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0380 [Accessed: 9 January 2026]

[4] EUROPEAN PARLIAMENT & COUNCIL OF THE EUROPEAN UNION. Regulation (EU) 2024/1991 of the European Parliament and of the Council of 17 June 2024 on nature restoration and amending Regulation (EU) 2022/869. Official Journal of the European Union, L 1991. [online]. 29 July 2024.

Green Deal. The strategy identifies both regulatory and non-regulatory initiatives, and the Common Agricultural and Fisheries Policies are key instruments to support a just transition.

Today, the Court of Justice of the EU (CJEU) is actively relying on the principles underlying the Green Deal (precautionary, transparency, biodiversity, etc.) in its case law. The Green Deal sets the benchmarks for legislative initiatives proposed by the European Commission (EC). The CJEU ensures their compliance, and the EU Court of Auditors verifies the correct use of funds allocated for the implementation of the Common Agricultural Policy (CAP) and the Green Deal. Recent political developments, including the 2024 European Parliament elections, have reshaped priorities regarding the pace and scope of Green Deal implementation. Growing farmer protests across EU Member States have highlighted tensions between environmental objectives and economic sustainability in agriculture.

The Green Deal is closely linked to food security, in particular, it provides for initiatives to reduce the use of pesticides and fertilizers, develop the organic sector and reduce the impact of agricultural production on the climate and biodiversity. These goals are achieved through the adoption of acts of secondary EU law that establish specific unified rules for producers and farmers. This underlines the importance of the Green Deal as a strategic framework for the legal provision of food security. However, the effectiveness of the Green Deal is a subject of active debate among researchers, so the search for empirical evidence of both the economic and social feasibility and legal effectiveness of the agreement is a relevant issue.

- regulatory restrictions on the use of pesticides and fertilizers;
- stimulating the development of organic farming and energy efficiency;
- embedding the precautionary and sustainability principles in EU law and case law.

The hypothesis suggests that, despite the short-term negative consequences (reduced yields, inflation), the Green Deal will contribute to increasing food security in the long run. The aim of this research is to comprehensively assess the economic, social, and legal impact of the Green Deal on EU food security by analysing its implementation at different levels. The aim involved the fulfilment of the following research objectives:

Available from: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32024R1991 [Accessed: 12 January 2026]

- analyse the impact of key norms and initiatives under the Green Deal (e.g., restrictions on the use of pesticides, energy efficiency, development of organic areas) on food security;

- examine the positive and negative experience of the implementation of the Green Deal using the example of individual EU Member States;

- reveal the role of case law as a legal mechanism for ensuring the objectives of the Green Deal in the field of food security.

2. Literature review

The effectiveness and impact of the Green Deal on various aspects of sustainable development is a relevant research issue. Boix-Fayos and De Vente examined the policy instruments, key challenges and approaches to achieving the establishment and functioning of sustainable agricultural systems under the Green Deal.[5] Along with this, scholars have not paid enough attention to the legal aspects of the problem. Sikora, Ishchenko, and Chiti considered the legal and financial implications of the green transition but paid less attention to the actual achieved results and the impact on food security.[6,7,8] Adamczak-Retecka and Śniadach focused on the aspects of food security related to climate change.[9] The study touches on legal aspects, but mainly in the context of the evolution of the definition of the term food security and its legal enshrinement.

Żuchowska-Grzywacz examined the legal status of organic products in the Green Deal and the interaction between food safety and organic regulation.[10] The researcher employed content analysis and document analysis, but the findings were not supported by quantitative data. Heuser focused on legal instruments for the protection and

[5] BOIX-FAYOS, C., & DE VENTE, J. Challenges and potential pathways towards sustainable agriculture within the Green Deal. *Agricultural Systems*, 2023, vol. 207. https://doi.org/10.1016/j.agsy.2023.103634
[6] SIKORA, A. Green Deal–legal and financial challenges of the climate change. *Era forum*, 2021, vol. 21, n. 4, pp. 681-697. https://doi.org/10.1007/s12027-020-00637-3
[7] ISHCHENKO, Y., ARTEMOV, V., SYNIAVSKYI, P., SHILIN, M., AHMADOV, V. The Impact of Immigration Law and Policy on Crime Rates in Immigrant Communities in the United States. *Pakistan Journal of Life and Social Sciences*, 2024, vol. 22, n. 2, pp. 4962-4973. https://doi.org/10.57239/PJLSS-2024-22.2.00368
[8] CHITI, E. Managing the ecological transition of the EU: The Green Deal as a regulatory process. *Common Market Law Review*, 2022, vol. 59, n. 1, pp. 19-48. https://doi.org/10.54648/cola2022003
[9] ADAMCZAK-RETECKA, M., & ŚNIADACH, O. Towards a Redefinition of the Food Security Concept in the Light of Climate Change: The European Union Law Perspective. *International Community Law Review*, 2021, vol. 23, n. 2-3, pp. 283-293. http://dx.doi.org/10.1163/18719732-12341478
[10] ŻUCHOWSKA-GRZYWACZ, M. Regulations on Organic Product in the Green Deal in the Context of Food Security. *TEKA Komisji Prawniczej PAN Oddział w Lublinie*, 2023, vol. 16, n. 1, pp. 421-429. https://doi.org/10.32084/tkp.5316

sustainable use of soils.[11] At the same time, the paper lacks attention to instruments regulating pesticide use, organic production, etc., which are also critical for food security within the framework of the Green Deal. Montanarella and Panagos emphasized the importance of the Green Deal for soil protection, mentioning the Biodiversity Strategy 2030, the Farm to Fork Strategy/Programme, and the European Climate Law.[12] However, the paper lacks empirical evidence of the effectiveness of the agreement.

Soininen, Huhta, and Vesa delve into the dynamics between the Green Deal instruments and the EU rule of law.[13] They find that the EU legal system imposes significant constraints on achieving climate change mitigation, biodiversity, and zero pollution. The paper argues that the right to property, the right to conduct business, and various formal criteria of the rule of law are largely at odds with EU environmental law.

Jendrośka, Reese, and Squintani consider the Green Deal as a legal framework for ensuring sustainable development, but they do not cover the impact on food security in their study.[14] Karageorgou and Paleari focus on the legal aspects of the Green Deal, analysing the environmental policies and legal structure of the agreement, but also do not touch on food security issues.[15,16] Knodt shows that the Green Deal and the Energy Union create a legal framework for the energy transformation.[17] Krämer studies the structure and objectives of the Green Deal without assessing the impact on

[11] HEUSER, I. (2022). Soil governance in current European Union law and in the Green Deal. *Soil Security*, vol. 6. https://doi.org/10.1016/j.soisec.2022.100053

[12] MONTANARELLA, L., & PANAGOS, P. The relevance of sustainable soil management within the Green Deal. *Land use policy*, 2021, vol. 100. https://doi.org/10.1016/j.landusepol.2020.104950

[13] SOININEN, N., HUHTA, K., & VESA, S. The rule of law and the EU Green Deal–uneasy interactions between legal instruments and the legal systemic landscape. [online]. August 2025. Available from:https://erepo.uef.fi/server/api/core/bitstreams/d6c38dda-fd50-46ba-9141-842a958a6474/content [Accessed: 13 January 2026]

[14] JENDROŚKA, J., REESE, M., & SQUINTANI, L. Towards a new legal framework for sustainability under the Green Deal. *Opolskie Studia Administracyjno-Prawne*, 2021, vol. 19, n. 2, pp. 87-116. https://doi.org/10.25167/osap.4274

[15] KARAGEORGOU, V. V. The environmental integration principle in EU law: Normative content and functions also in light of new developments, such as the Green Deal. *European Papers-A Journal on Law and Integration*, 2023, n. 1, pp. 159-189. https://doi.org/10.15166/2499-8249/645

[16] PALEARI, S. The impact of the Green Deal on EU environmental policy. *The Journal of Environment & Development*, 2022, vol. 31, n. 2, pp. 196-220. https://doi.org/10.1177/10704965221082222

[17] KNODT, M. Instruments and modes of governance in EU climate and energy policy: From energy union to the Green Deal. In RAYNER, T., SZULECKI, K., JORDAN, A. J., & OBERTHÜR S. (Eds.), *Handbook on European Union climate change policy and politics.* Cheltenham: Edward Elgar Publishing, 2023, pp. 202-215. https://doi.org/10.4337/9781789906981.00027

food security.[18] Faichuk et al. found that the Green Deal creates potential threats to exporters, which may cause instability in the supply of agricultural products.[19] However, this study does not directly address the assessment of the impact on food security. So, the review revealed a lack of research on the impact of the Green Deal on food security. This necessitates further research in this area, in particular on empirical assessments of the actual impact and analysis of case law.

3. Methodology

3.1 Research design

The research design consisted of three consecutive stages, each based on a separate empirical method. The approach enabled a comprehensive assessment of the effectiveness of the implementation of the Green Deal – at the interstate level, at the level of individual countries (including positive and negative examples), and at the micro level (case law). The effectiveness assessment focused directly on the consequences of the agreement for food security and considered the Green Deal as a legal instrument, while covering both legal and socio-economic aspects. The first stage involved conducting a multiple regression analysis, which allowed for an assessment of the impact of factors related to the implementation of the Green Deal. It was found that food inflation, the pesticide use rate, energy consumption, and the organic agricultural area affect the percentage of people experiencing moderate or acute food insecurity. The second stage involved examining country case studies that demonstrated both positive and negative impacts of the Green Deal. The third phase examined individual court cases to identify key trends in the legal interpretation and application of the Green Deal.

3.2 Sample

The choice of independent variables for regression analysis at the first stage of the study is determined by the key areas of the Green Deal, which directly or indirectly relate to food security. These include: pesticide sales, energy consumption in the agricultural sector, area for planting organic crops. Pesticide sales, which characterize

[18] KRÄMER, L. Planning for climate and the environment: The EU green deal. *Journal for European Environmental & Planning Law*, 2020, vol. 17, n. 3, pp. 267-306. https://doi.org/10.1163/18760104-01703003

[19] FAICHUK, O., VOLIAK, L., HUTSOL, T., GLOWACKI, S., PANTSYR, Y., SLOBODIAN, S., SZELĄG-SIKORA, A., & GRÓDEK-SZOSTAK, Z. Green Deal: Threats assessment for agri-food exporting countries to the EU. *Sustainability*, 2022, vol. 14, n. 7. https://doi.org/10.3390/su14073712

the intensity of their use, reflect the environmental aspects of agriculture and possible regulatory restrictions that affect the level of food security. The level of energy consumption in the agricultural sector reflects the efficiency of energy transformation, its impact on the productivity of the agricultural sector and the formation of food prices. The organic agricultural area is an indicator of the implementation of the Farm to Fork strategy and the transition to environmentally friendly production, which affects the availability and cost of food. The selected variables assess the extent to which the implementation of the Green Deal can affect food security. The relationship of the selected variables with food security in terms of economic, environmental, and social channels is visualized below (Figure 1).

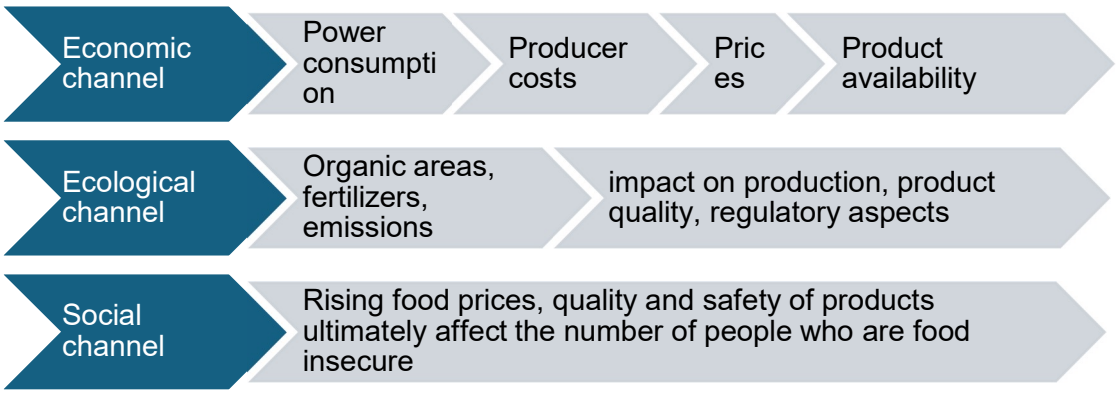

Figure 1. Relationship between variables identified for the study and food security across different channels of influence
Source: Source created by the author

The control variable in the regression analysis was food inflation, which directly affects the availability of products. In general, the variables included in the analysis directly describe food security according to the main criteria: price and physical availability, quality, safety, available resources, and sustainability.

The second stage of the study covered cases describing the consequences of the Green Deal for food security for different countries. Analytical and academic materials containing confirmed information about the impact of the Green Deal on food security were the information base for this stage. The criteria for including countries in the analysis were EU membership, as well as the noticeable consequences of the implementation of the Green Deal — both positive and negative. The analysis included Austria, Denmark, Estonia, the Netherlands, Romania, Slovakia, Hungary, the Czech Republic, and Sweden.

The third stage of the analysis concerned the study of decisions of the CJEU,

which applied the principles of the Green Deal and their impact on food security. The criteria for selecting cases were: connection with the Green Deal, potential impact on food security, and relevance. The analysis of court cases logically continues and complements the regression analysis, which shows the socio-economic impact of the Green Deal factors. The cases, in turn, reveal the legal and security mechanisms that ensure food security.

3.3 Methods

The research employed multiple regression analysis to assess the simultaneous impact of various factors on food security. Panel data of EU countries for 2020-2024 were used for regression analysis. The quality of the results was checked using a standard set of statistical tests (for overall significance, normality of residuals, heteroscedasticity, multicollinearity, autocorrelation of residuals). Case study was also used to investigate and compare the consequences of the Green Deal in different countries. Precedent analysis was used to analyse court cases in order to determine how the norms of the Green Deal are implemented in practice.

3.4 Instruments

Regression analysis was performed using Excel with the StatPlus add-in for statistical data processing and testing of the main assumptions of the model.

4. Results

At the first stage of the study, it was important to assess the actual quantitative impact of the Green Deal on food security. Regression analysis was used for this purpose to assess the relationship between socio-economic factors and the degree of vulnerability of the population to food insecurity. This approach provides information support for further legal analysis.

Table 1. Results of the regression analysis of the impact of socio-economic factors on the degree of vulnerability of the population to food insecurity

	Coeff.	*Std Err*	*LCL*	*UCL*	*t Stat*	*p-value*	*H0 (5%)*	*VIF*	*TOL*	*Beta*
Intercept	0.0351	0.0693	-0.1016	0.1719	0.5074	0.6125	*Accepted*			
Food inflation	0.1422	0.0691	0.0057	0.2788	2.0573	0.0413	*Rejected*	1.0170	0.9833	0.1460
Pesticide sales	0.0103	0.0786	-0.1450	0.1656	0.1315	0.8955	*Accepted*	1.3047	0.7665	0.0106

Power consumption in the agricultural sector	-0.3485	0.0792	-0.5048	-0.1921	-4.4017	0.0000	*Rejected*	1.3043	0.7667	-0.3537
Organic agricultural areas	-0.2541	0.0711	-0.3944	-0.1138	-3.5759	0.0005	*Rejected*	1.0187	0.9816	-0.2540
T (5%)	1,9746									
LCL – Lower limit of the 95% confidence interval										
UCL – Upper limit of the 95% confidence interval										

Source: calculated by the author based on European Commission, Eurostat, Food Systems Dashboard [20,21,22]

First of all, it is worth referring to the regression statistics: the correlation coefficient in the model is 0.4392; the coefficient of determination is 0.1929; the adjusted coefficient of determination is 0.1731. This indicates a moderate correlation between the variables in the model, and that the independent variables can explain about 17% of the variation in the dependent variable. Despite the rather low explanatory power, this result indicates that almost a fifth of the changes in the degree of vulnerability of the population to food insecurity are explained by factors related to the Green Deal. The regression results also indicate that all factors included in the model, except for pesticide sales, have a statistically significant impact. Given that the dependent indicator is inverse – the higher its level, the higher the risks of food insecurity – a negative sign of the regression coefficients would indicate a decrease in vulnerability in the food sector. Conversely, positive regression coefficients indicate factors that increase the risks of food insecurity. So, the key factor that increases food insecurity is food inflation and, potentially, pesticide sales — this indicator has a positive influence, although it is not statistically significant. Factors that can reduce food insecurity were energy consumption in the agricultural sector and the organic

[20] EUROPEAN COMMISSION. Pesticide sales (Indicator code: aei_fm_salpest09). [online]. 20 December 2025. Available from: https://ec.europa.eu/eurostat/databrowser/view/AEI_FM_SALPEST09__custom_16478660/default/table?lang=en [Accessed: 12 January 2026]

[21] EUROSTAT. Agri-environmental indicator - energy use. [online]. November 2023. Available from: https://ec.europa.eu/eurostat/statistics-explained/index.php/Agri-environmental_indicator_-_energy_use [Accessed: 10 January 2026]

[22] FOOD SYSTEMS DASHBOARD. Download Data. [online]. 1 September 2025. Available from: https://www.foodsystemsdashboard.org/downloads [Accessed: 7 January 2026]

agricultural area. This means that the increase in energy consumption, despite the objective negative impact on the environment, contributes to the reduction of food insecurity in the short term due to more stable production and availability of food products. The expansion of the organic agricultural area contributes to the reduction of food insecurity by increasing the environmental and economic sustainability of production.

The results show the impact of selected socio-economic factors on the share of the population experiencing food insecurity at the cross-country level. This demonstrates general patterns of the impact of socio-economic factors but does not examine the specific manifestations of this impact in different countries. Therefore, the logical next step of the analysis is to provide case studies of the consequences of the Green Deal implementation in different EU countries, which are arranged in Table 2.

Table 2. Impact of the Green Deal on food security in EU Member States

Case	Key implications of the Green Deal	Implications for food security
Poland	A modelling method found that implementing the Farm to Fork strategy with a 50% reduction in crop protection products and a 20% reduction in fertilizer use could reduce production, especially on large farms. But the introduction of precision agriculture (Agriculture 4.0) could offset the losses	Reduced production, but sustainability can be achieved through technological modernization
Austria, Estonia, Sweden	Using trend analysis, only Austria, Estonia, and Sweden are projected to reach the target share of organic land of 25% by 2030.	Increased food security through greater resilience and sustainability of agricultural systems
Austria, Denmark, Netherlands	Austria, Denmark, and the Netherlands show the highest rates of implementation of Climate-Smart Agriculture (CSA) among EU countries	Improved food security through reduced risks of climate shocks, greater food stability
Poland, Czech Republic, Slovakia, Hungary, Romania	In Central and South-Eastern Europe, implementation of the Green Deal is hampered by weak administrative capacity, political and economic inequalities, and limited regional cooperation	May pose a potential threat to food security through insufficiently effective implementation of environmental activities
European Court of Auditors (ECA)	ECA found significant discrepancies between the environmental objectives of the Green Deal and national agricultural policy plans: many Member States have weakened or postponed “green” conditions to support the Common Agricultural Policy (CAP)	Weak fulfilment of terms and conditions leads to reduced sustainability of the food system
EU	In order to combat food waste, new legislative measures oblige companies to reduce food losses: by 10% in manufacturing, 30% in retail and catering by 2030. Large food companies will also be obliged to provide the possibility of donating unsold but safe food.	Reducing food risks, increasing food availability for the population
Nature Restoration Plan	The Nature Restoration Plan is part of the EU’s Green Deal, under which member states will have to achieve targets for restoring specific habitats and species to cover at least 20% of the region's land and sea areas by 2030	A balance between ecology and food production will contribute to the long-term sustainability of ecosystems that support the agri-food base
Tariff for Russian fertilizers	A levy on nitrogen fertilisers has been introduced (gradually to €315/t by 2028), which has reduced dependence on Russia, but has led to significant price increases and rising costs for farmers	In the short term, pressure on farmers increases, in the long term, the overall sustainability of food supply chains increases

Source: based on Pawłowski & Sołtysiak, Krajewski et al.; European Court of Auditors,

Financial Times, Petrequin, Marrow [23,24,25,26,27,28,29]

The analysis showed different approaches to implementing the terms of the Green Deal: technological adaptation (Poland), weak implementation in Central and South-Eastern Europe, active implementation (in Austria, etc.). However, the implementation of the Green Deal is not limited to socio-economic and technological aspects. The success of the deal is largely determined by the legal mechanisms and case law governing compliance with environmental standards and the precautionary principle. Table 3 contains an analysis of current case law illustrating the application of legal norms in the context of the Green Deal and food security. Recent protests by farmers in several EU countries demonstrate increasing resistance to regulatory constraints, particularly regarding pesticide reductions and cost pressures. Policy responses have included delays or revisions of certain Green Deal targets, reflecting the need for more flexible implementation mechanisms.

Table 3. Case law of the CJEU on environmental standards, food security, and the Green Deal

Block	Case	Decision	Importance for food security
Pesticides, the precautionary and derogation principle	C-162/21 (19.01.2023)	Member States cannot grant 'exceptional' derogations for banned neonicotinoids for seed treatment	Improves food security by protecting pollinators and ecosystems
	T-429/13, T-451/13, T-584/13 (2018)	General Court upholds neonicotinoid restrictions despite scientific uncertainty	Preventive restriction of pesticide use improves ecosystem protection and food security

[23] CIOT, M. G. Implementation perspectives for the Green Deal in Central and Eastern Europe. *Sustainability*, 2022, vol. 14, n. 7. https://doi.org/10.3390/su14073947

[24] PAWŁOWSKI, K. P., & SOŁTYSIAK, G. The Potential Impact of the Green Deal on Farm Production in Poland. *Sustainability*, 2024, vol. 16, n. 24. https://doi.org/10.3390/su162411080

[25] KRAJEWSKI, S., ŽUKOVSKIS, J., GOZDOWSKI, D., CIEŚLIŃSKI, M., & WÓJCIK-GRONT, E. Evaluating the Path to the European Commission's Organic Agriculture Goal: A Multivariate Analysis of Changes in EU Countries (2004–2021) and Socio-Economic Relationships. *Agriculture*, 2024, vol. 14, n. 3. https://doi.org/10.3390/agriculture14030477

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[27] FINANCIAL TIMES. EU cracks down on fast fashion and food waste. [online]. October 2025. Available from: https://www.ft.com/content/044a6437-6534-457b-a3bf-7022b7770cf7 [Accessed: 10 January 2026]

[28] PETREQUIN, S. Landmark EU nature restoration plan gets the green light despite months of protests by farmers. [online]. 18 June 2024. Available from: https://apnews.com/article/eu-environment-nature-protection-restoration-ecosystem-habitat-e108a5dfb987be413470e41328dd8caa [Accessed: 11 January 2026]

[29] MARROW, A. European farmers facing higher costs after EU tariffs on Russian fertiliser imports. [online]. 22 August 2025. Available from: https://www.reuters.com/business/european-farmers-facing-higher-costs-after-eu-tariffs-russian-fertiliser-imports-2025-08-22/ [Accessed: 13 January 2026]

	C-616/17 (2019)	In France, farmers challenged Regulation (EC) No 1107/2009 because it restricts the use of pesticides (including glyphosate). Farmers considered the restrictions excessive for their activities	The regulation remains in force as it complies with the precautionary principle. Member States can impose stricter restrictions, but only if they have sufficient scientific evidence of the risk
Transparency, access to data and trust	T-716/14 Tweedale v EFSA (07.03.2019)	EFSA (European Food Safety Authority) obliged to disclose toxicological data on glyphosate	Data transparency increases trust in regulation, which is the foundation of food security
	T-329/17 Hautala v EFSA (07.03.2019)	Court clarifies that data relating to environmental emissions have a higher standard of openness	Openness of scientific data is an element of food security assurances
Water, nitrates and agricultural practices	C-576/22 Commission v Spain (2024)	Spain condemned for inadequate definition of vulnerable zones and action programmes under the Nitrates Directive	Water quality directly affects food security
	C-543/16 Commission v Germany (21.06.2018)	Breach of the Nitrates Directive due to excess pollution from agricultural sources	Weak fertilizer regulations create a systemic risk to food security
Organic, genetically modified organisms (GMOs), and labelling	C-442/09 Bablok (2011)	Court rules that honey containing GM pollen is subject to authorisation and labelling rules under Regulation (EC) No 1829/2003	Controlling the spread of GM products protects consumers from potential risks
	C-59/11 Association Kokopelli (2012)	Court upholds variety registration requirement but allows derogation for 'amateur' or 'conservation' seed stocks	This supports agrobiodiversity as a factor in the sustainability of food systems
	C-240/23 Herbaria (04.10.2024)	Court rules that use of the 'Organic EU' logo together with health or value claims must comply with fair labelling requirements	For food security, this means increasing consumer confidence in organic products

Source: generalized by the author based on Court of Justice of the European Union, General Court of the European Union, European Commission v. Spain, European Commission v.

Germany, INFOCURIA [30,31,32,33,34,35,36,37,38,39]

The inclusion of cases that preceded the Green Deal shows that the existing legal mechanisms did not appear suddenly, but are the result of the development of existing practices. However, despite a relatively long evolution, these mechanisms are not perfect, as the analysis has shown — both from an economic, social, and legal perspective. The following shortcomings can be deduced from the results of the analysis:

- the risk of a reduced production because of strict restrictions on the use of pesticides and fertilizers, which leads to a decrease in yields;

- the uneven implementation of reforms, as shown by the example of the

[30] COURT OF JUSTICE OF THE EUROPEAN UNION. Judgment in Case C-162/21, Pesticide Action Network Europe and Others. [online]. 19 January 2023. Available from: https://curia.europa.eu/juris/documents.jsf?num=C-162/21 [Accessed: 11 January 2026]

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[39] COURT OF JUSTICE OF THE EUROPEAN UNION. Herbaria Kräuterparadies GmbH v. Freistaat Bayern, Case C-240/23. [online]. 4 October 2024. Available from: https://curia.europa.eu/juris/document/document.jsf?docid=287229&doclang=EN [Accessed: 10 January 2026]

countries of Central and South-Eastern Europe;

- high dependence on imports of fertilizers and energy, which puts pressure on farmers in the short run;

- the gap between the CAP and the Green Deal due to the insufficient level of implementation of environmental standards;

- legal uncertainty regarding pesticides and GMOs, as shown by court cases that demonstrate the presence of constant disputes regarding the application of the principles of transparency, precaution, and existing standards;

- insufficiently effective implementation of directives in practice even by large countries (Spain, Germany).

The noted aspects require further improvement of the regulatory framework, in particular in the context of the Green Deal as a key legal instrument for improving food security.

4. Discussion

The study empirically demonstrated the actual implementation of the results of individual initiatives proposed in the Green Deal, which demonstrate its potential effectiveness. At the same time, the case study revealed the problematic areas of the document and areas that need improvement. This approach allowed for a comprehensive assessment of the advantages and disadvantages of the Green Deal and to identify common features and differences with a number of previous studies.

The authors of this study, as well as Sikora and Cifuentes-Faura consider the Green Deal as an important tool for improving environmental protection.[40,41] We share the opinion of Guyomard et al. who note that the Green Deal can increase the sustainability of food systems.[42] We also agree with Russell et al., who pointed out the effectiveness of the Farm to Fork strategy for ensuring food security, which is a key

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[42] GUYOMARD, H., SOLER, L. G., DÉTANG-DESSENDRE, C., & RÉQUILLART, V. The Green Deal improves the sustainability of food systems but has uneven economic impacts on consumers and farmers. *Communications Earth & Environment*, 2023, vol. 4, n. 1. https://doi.org/10.1038/s43247-023-01019-6

component of the Green Deal.[43,44] The position of Montanarella and Panagos is also correct, confirming that the Green Deal can significantly impact food security, in particular through mechanisms that provide for soil protection.[45] The opinion of Paleari is also noteworthy, demonstrating the imbalance between environmental objectives and legislative initiatives under the Green Deal.[46] This study confirms the existence of this problem (e.g. weak institutions or nitrate problems in EU countries), focusing on specific cases and aspects of food security. It is also necessary to mention such as Knodt et al., who consider the Green Deal and the Energy Union as legal and strategic instruments for the EU's energy transformation.[47,48] This study adds an empirical dimension to these results, demonstrating the impact of changes in energy consumption and other aspects on food security. The partial revision of pesticide reduction targets illustrates the growing divergence between political feasibility and initial environmental ambitions of the Green Deal. These developments confirm the importance of adaptive governance approaches in ensuring both policy acceptance and effectiveness.

However, comparing the results of the work with individual studies revealed certain contradictions, which are explained by differences in methodological approaches, studied periods, etc. Unlike the work of Heuser which focused on the shortcomings of the Green Deal, in particular regarding insufficient soil protection, this study revealed positive effects of the agreement.[49] For example, an increase in the area for planting organic crops is accompanied by a decrease in the percentage of the

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[45] MONTANARELLA, L., & PANAGOS, P. The relevance of sustainable soil management within the Green Deal. *Land use policy*, 2021, vol. 100. https://doi.org/10.1016/j.landusepol.2020.104950

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[49] HEUSER, I. (2022). Soil governance in current European Union law and in the Green Deal. *Soil Security*, vol. 6. https://doi.org/10.1016/j.soisec.2022.100053

population experiencing moderate or acute food insecurity. Along with this, further studies may involve expanding the composition of variables, which will provide a broader coverage of factors affecting food security.

Despite the assertions of Soininen et al. about the low probability of a breakthrough in the implementation of the Green Deal and achieving long-term sustainability, the analysis conducted in the work revealed a number of positive trends.[50] However, one can agree that ensuring long-term stability and high efficiency should involve improving the legal tools. This should occur both at the level of implementation of the Green Deal and in the field of judicial control and transparency of environmental standards. Boix-Fayos and De Vente noted that the existing tools to promote the transition to greener agriculture are not fully determined.[51] At the same time, the author's article empirically proves that the Green Deal is already bringing tangible results in improving food security. The practical value of the study is the determined actual results of the Green Deal and identified problems through case analysis, which give grounds for providing practical recommendations. The obtained results can be implemented in the working practice of politicians and decision-makers in the field of ensuring food security, as they provide a basis for further improvement of regulatory mechanisms and practical measures. The identification of key factors affecting food security, as well as the identification of bottlenecks in the practical implementation of the Green Deal is of particular practical value. This will optimize the strategy taking into account the identified determinants of the impact on food security and potential shortcomings and threats.

5. Limitation

The limitations of the study are the low explanatory power of the constructed regression model, however, this does not contradict the objectives of the study, although it limits its predictive power.

6. Recommendations

[50] SOININEN, N., HUHTA, K., & VESA, S. The rule of law and the EU Green Deal–uneasy interactions between legal instruments and the legal systemic landscape. [online]. August 2025. Available from:https://erepo.uef.fi/server/api/core/bitstreams/d6c38dda-fd50-46ba-9141-842a958a6474/content [Accessed: 13 January 2026]

[51] BOIX-FAYOS, C., & DE VENTE, J. Challenges and potential pathways towards sustainable agriculture within the Green Deal. *Agricultural Systems*, 2023, vol. 207. https://doi.org/10.1016/j.agsy.2023.103634

- adapting the objectives of the Green Deal to the conditions of different countries, taking into account their economic and institutional capabilities;

- supporting technological innovation through EU instruments, including Horizon Europe, LIFE Programme, and the European Agricultural Fund for Rural Development (EAFRD);

- mobilising additional funding through CAP eco-schemes and the Recovery and Resilience Facility (RRF);

- prioritising subsidies for precision agriculture, digital farming, and energy-efficient technologies to mitigate short-term productivity losses;

- harmonising the CAP and the Green Deal through EU-wide monitoring indicators linking payments to environmental and food security outcomes;

-strengthening conditionality by integrating binding sustainability benchmarks into CAP Strategic Plans with regular audits;

- implementing digital monitoring systems using satellite data and farm-level reporting for real-time compliance verification;

- reducing legal uncertainty through unified interpretation guidelines and stronger coordination between EU and national authorities;

- introducing compensatory mechanisms for farmers, including transitional payments and risk-sharing instruments during adaptation to stricter environmental standards;

- ensuring a high level of transparency and access to data;

- ensuring compliance with the precautionary principle, developing preventive enforcement.

7. Conclusion

The problem of finding effective tools to ensure food security is extremely acute in view of climate change and population growth. A regression analysis for EU countries showed that almost a fifth of the changes in the level of vulnerability of the population to food insecurity is explained by factors related to the Green Deal. The key factor that increases food insecurity is food inflation and potentially the sale of pesticides. Risk reduction factors are energy consumption in the agricultural sector and the organic agricultural area. Country-specific case studies showed different approaches to implementing the terms of the Green Deal: technological adaptation (Poland), weak implementation in Central and South-Eastern Europe, active

implementation (Austria, Denmark, the Netherlands). This indicates uneven implementation of reforms and potential threats to food security. Case law has confirmed that the success of the deal is largely determined by legal mechanisms, but there are certain shortcomings. These include the risk of reduced production because of pesticide restrictions, legal uncertainty regarding pesticides and GMOs, insufficiently effective implementation of directives, which requires further improvement of the regulatory framework. This challenge is intensified by geopolitical instability, supply chain disruptions, and increasing climate-related risks affecting agricultural productivity.

In the medium term, the effectiveness of the Green Deal will depend on the coherence between financial instruments, regulatory enforcement, and technological adaptation in Member States. Future policy design should prioritise integrating economic resilience with environmental sustainability to prevent trade-offs that may undermine food security. Strengthening institutional capacity in Central and Eastern Europe is critical to ensure uniform implementation and avoid asymmetric impacts across the EU. The increasing role of digital technologies in monitoring compliance will redefine governance mechanisms and improve transparency in agri-food systems.

The work confirmed the key hypotheses of the study on the impact of the European Agreement on food security through regulatory restrictions, stimulating development, and strengthening the precaution and sustainability principles. In general, this impact is positive in the long run, while the analysis of the practice of individual states and court cases identified the weaknesses of the agreement. Further research may involve expanding the composition of variables in the regression model, which will provide a wider coverage of factors affecting food security. The findings highlight the need for a more adaptive and evidence-based regulatory framework capable of responding to dynamic environmental and economic challenges. Ensuring long-term food security requires aligning legal instruments with measurable outcomes and strengthening accountability mechanisms at both EU and national levels. The Green Deal has the potential to become a global benchmark if implementation gaps and legal inconsistencies are effectively addressed. Recent political adjustments to Green Deal targets indicate that long-term success will depend on balancing environmental ambition with socio-economic realities in the agricultural sector.

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