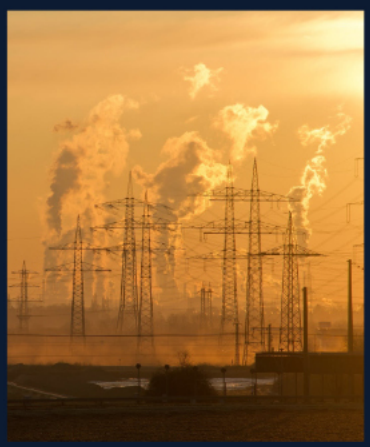
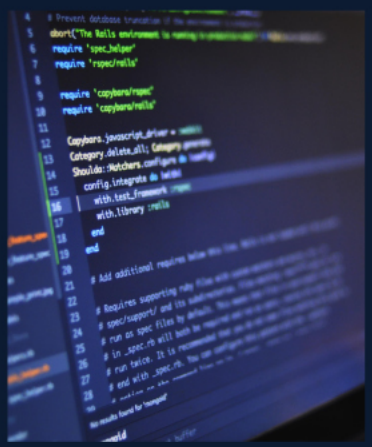
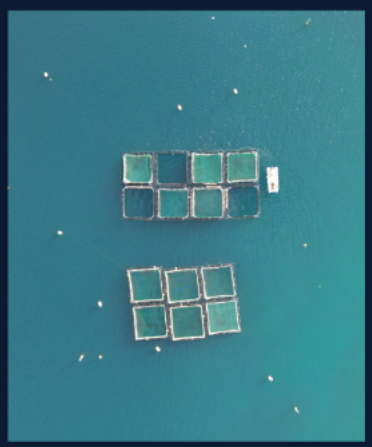
Hellenic Association for Information & Communication Technologies in Agriculture, Food & Environment (HAICTA)

HAICTA 2024

The 11th International Conference
on Information and Communication Technologies
in Agriculture, Food & Environment

Book of Abstracts

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Book of Abstracts

HAICTA 2024

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Editorial

This volume contains the abstracts of the papers presented at the 11th International Conference on ICT in Agriculture, Food & Environment (HAICTA 2024), that took place in Karlovasi, Samos, Greece, October 17-20, 2024.

HAICTA is the Greek Branch of the European Federation for Information Technology in Agriculture (EFITA). The series of HAICTA conferences are an international venue for research in ICT, innovations and best practices in the agri-food sector and in rural development and constitute a leading international professional and scientific forum for IT experts, agronomists, animal husbandry experts, agri-food scientists, environmentalists, water engineers, veterinarians, spatial engineers and decision-makers. These conferences constitute an interdisciplinary forum in which researchers, practitioners, and policy makers can present and discuss the results of their research, the recent policies and development on agriculture, food and environment, new technologies and ICT emerging applications.

The HAICTA 2024 conference received 118 paper submissions, out of which 106 were accepted. The main topics covered included Precision Technologies: Crop and Livestock Production; Farm and Animal Health Monitoring, Sustainable Management of Natural Resources / Ecosystem Services, Information Systems and Web Applications / Digital Farming, Decision Support Systems, Sustainability and Resilience of Rural Areas and Agri-food Systems, Environmental Design and Policy, Sustainable Crop and Livestock Production, Climate Change Modeling / Climate Vulnerability, Adaptation and Mitigation, Innovation in Farms and Rural Areas, Sustainable Food Value Chains, and more. Out of those 106 papers, 67 were short papers and 39 were abstracts; 35 papers were presented as e-posters. This volume of abstracts covers all 106 of them.

HAICTA 2024 was the 3rd Conference in the series to offer both in-person attendance, remote participation, and live streaming for those who couldn't attend, giving the chance for an even wider audience. Authors had the option to either present in-person at the Conference or remotely through teleconferencing. 37 papers were presented orally, while 34 through teleconferencing. The first three days of the conference were live-streamed through the official YouTube channel of HAICTA (https://www.youtube.com/@haicta), and they remain available online and on-demand for anyone interested.

We are grateful to all authors who submitted their papers to the conference and to all HAICTA 2024 participants. We would also like to thank the reviewers, members of the Scientific Committee, for ensuring the Proceedings quality. HAICTA 2024 used a blind review process, and each submitted abstract and short paper was evaluated by one, two or more -in some cases- reviewers, respectively, who provided their valuable comments.

We are also grateful to the invited keynote speaker Dr. Samir Mili (CSIC Madrid, Spain), who shared his ideas and the results of their research with HAICTA community through his inspired lecture. We would also like to thank the Organizing Committee Chairs and the Conference Chairs for their support to our task.

We hope that the Book of Abstracts of HAICTA 2024 will promote the discussion within the scientific community regarding the integration of innovative ideas, solutions and practices, new digital technologies and research applications towards the development of sustainable and resilient environmental and agricultural systems.

The Editors

Thomas Bournaris
Professor

Athanasios Ragkos
Researcher

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Economic benefits of biological pest control in urban forestry: A sustainable management approach - Abstract

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Summary

This paper examines the potential economic benefits of biological pest control in urban forests by evaluating its effectiveness in controlling these pests and assessing its economic benefits. It also analyzes the advantages and disadvantages of using biological pest control as a sustainable method for managing specific pest populations.

Urban forests improve the quality of life in cities, leading to more sustainable communities. Urban trees are more vulnerable to insect excursions and pest infestations are increasingly threatening urban forests. Pest control methods are necessary to confront this threat, which risks tree health and vitality. However, traditional chemical pest control methods pose significant environmental and human health risks, highlighting the need for more sustainable solutions.

Biological pest control methods have many advantages and a few disadvantages compared with traditional chemical methods. Biological pest control is an environmentally friendly method that, as an investment, could lead to long-term economic benefits in terms of return on the initial investment, reducing costs over time, and a high benefit-to-cost ratio.

Keywords

Environmental economics, urban trees, ecosystem services, sustainable pest management

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Economic losses due to climatic damage in viticulture: Adaptation proposals - Abstract

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Summary

In the wine production chain, climate change affects yields and the wine's quality. Several studies have found that high temperatures have a significant impact on the value of wine production. In this context, the adaptation measures represent a good practice to face the damage caused by negative climatic events. Since these practices have a cost, this study aims to provide an estimate of economic convenience for its adoption, using the methodology developed within the LIFE Adaptation in Agriculture project. In this paper four measures used in winemaking processes and useful for reducing damage from climatic risks were analyzed. Findings shows that the adaptation measures considered in wine sector have an initial investment cost, usually medium/high. Large farms, due to their size and resources, can opt for one or more measures with greater ease of cost depreciation. Overall, the analysis shows that although the implementation of measures presents medium/high investment costs, it is always appropriate to make an assessment on the specific business case, even where the results indicate a lower degree of cost-effectiveness. When deciding on the adoption of measures, it should be borne in mind that costs depend not only on farm characteristics, but also on the choice of implementation method and staff training and specific public subsidies.

Keywords

Climate change, wine, sustainability, adaptation

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Development and performance evaluation of self-healing PVA-PAA coated PES membrane for water pollution mitigation - Abstract

Kok Chung Chong [1,2], Woon Chan Chong [1,2], Yean Ling Pang [1,2], Siew Hoong Shuit [1,2], Eng Cheong Wong [1], Yung Xin Koh [1] and Grace Qian Von Lim [1]

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Summary

Water pollution is a major environmental issue caused by the discharge of untreated or partially treated wastewater into rivers and oceans. Self-healing materials, which can repair localized damage, have become a promising approach to counter membrane performance decline from mechanical wear. However, ensuring stability and effectiveness in self-healing membranes remains a challenge. Polyvinyl alcohol (PVA) has been widely studied for its self-healing properties, and polyacrylic acid (PAA) is often used as a crosslinking agent due to its compatibility with PVA, especially in biomedical and filtration applications. In this study, a self-healing PVA-PAA coating was applied to a PES membrane. The PVA solution (5 wt%) was prepared by dissolving beads in distilled water and stirring at 80 °C for 6 hours, while PAA solution was diluted to match this concentration. The two solutions were mixed in a 3:1 molar ratio and heated to form a homogenous mixture, then coated onto PES membranes and crosslinked at 140 °C. Scanning electron microscopy (SEM) revealed a uniform, crack-free coating on the membrane surface. The mechanical properties of the membrane showing a tensile strength of 4.85 MPa and elongation of 71.9%. Filtration tests showed that the PVA-PAA coated PES membrane achieved a water flux of 36.16 L/m²h. The performance of the PVA-PAA coated PES membrane remained stable in terms of water flux and dye rejection after it healed, and the water flux was recorded at the range of 34.24 to 36.02 L/m^{2}h after the seal healing. This self-healing PVA-PAA coated PES membrane demonstrates practical potential for sustainable water treatment, offering reduced maintenance and extended lifespan for filtration systems.

Keywords

Self-healing membrane, water pollution, water management, water and wastewater treatment

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Drivers and barriers to transition to agroecology in Tunisia: A policy review - Abstract

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Summary

In the last decades, several criticisms were raised against conventional agriculture systems that were held accountable for the current natural resource degradation, biodiversity loss and the resulting yield decrease.

Assuming that the conventional agriculture has reached its limits, a wave calling for an agro-ecological transition of agrosystems spread at the global level leading to the concrete involvement of several countries in the process through the implementation of technological and policy changes that can support the shift towards sustainable agrifood systems.

In Tunisia, the damages of the intensive farming practices have affected cereal croplands where degradation level is the highest and the groundwater resources, whose levels of exploitation reached 118% for the surface aquifers and 129% for deep aquifers leading to water quantity and quality decrease. At the same time, climate change is severely impacting the country with a decrease in precipitation and enhanced heat waves resulting in exacerbated pressure on natural resources and yield losses.

Given the high vulnerability and low resilience of the current farming and food systems to the climate change and their decreasing capacity to secure food for the population, the Tunisian government, through its ministries of Agriculture and Environment elaborated several strategies aiming to conciliate sustainability and productivity of food production systems.

Through an intersectoral review of public policies in Tunisia conducted in the framework of NATAE project, we have analyzed the incentives supporting the transition to agroecology in the recent national strategies, regulations and policies developed by the Tunisian government as well as the barriers to this transition at both local and national level.

The agricultural and environmental strategies explicitly mentioned the principles of agroecology. Technical, social, institutional, governance, policy measures were proposed to promote climate resilient and remunerative agriculture that respects ecological balances and social equity. Priority was given to the strengthening of the institutional governance and financing systems in order promote sustainable water and soil resource management, biodiversity and awareness raising activities. These measures need to be implemented by multiple actors at local, regional, and national levels.

The study also points out the existence of several complex and interconnected policies, institutional and socio-economic barriers that are slowing down or blocking the transition to agroecology, creating a gap between the actions proposed in the strategies and the practices being actually implemented. The recent short-term programs aiming at increasing national cereal production to reduce trade deficit are an example of policies that run counter to the long-term strategies goals as they limit crop rotations.

In conclusion, the efforts to develop the agricultural sector and initiate an agro-ecological transition will remain incomplete due to the lack of a holistic and horizontal vision of the sector and the absence of real reforms based on an inclusive approach that will solve the structural

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problems and allow the gradual transition towards a more sustainable and equitable production systems.

Keywords
Agroecology, policies, drivers, barriers

Multidimensional and multiscale evaluation framework considering Water-Energy-Food-Ecosystem Nexus - Abstract

Leonidas Sotirios Kyrgiakos [1], Georgios Kleftodimos [2], Marios Vasileiou [1], Christina Kleisiari [1], Vasileios Angelopoulos [1], Asimina Oikonomou [1], Dimitra Tosiliani [1], Paolo Prosperi [2], Hatem Belchouchette [2] and George Vlontzos [1]

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Summary

The agricultural sector is the primary consumer of water in the Mediterranean Basin. In summary, 70% of freshwater resources are allocated for the purpose of crop irrigation, which in turn contributes to 85% of the total agricultural output in the Mediterranean region. Considering the worldwide and local circumstances of climate change and population increase, it is anticipated that the availability of water resources will decrease. Energy is the second most significant constraint on food production, since approximately 7% of commercial energy production is allocated to the management of freshwater supply. Several cereal-, orchard-, vegetable-, and livestock-based food production plains in the Mediterranean area have significant social, economic, and food-security importance. Nevertheless, numerous strategic products experience a structural imbalance, shown by the grain market, which stands as one of the largest net importers globally. That's the reason why DIONYSUS project aims to develop practical adaptation solutions for the efficient use and conservation of water, energy, food, and ecosystem resources. This will be achieved through the co-design, testing, and development of innovative business models. The project will focus on four demonstration sites in Egypt, Greece, Morocco, and Italy. These sites produce key agricultural products such as cereal crops, fruits, vegetables, cotton, and other industrial crops. The ultimate goal is to promote a transition to a Green Economy and Sustainable Development by mobilizing local and regional initiatives, engaging stakeholders, and utilizing a Cross-Sectoral Nexus adaptation tool.

To achieve the above mentioned, a multidimensional and multiscale evaluation framework was needed in order to collect information about the current status of these countries, regarding Water-Energy-Food-Ecosystem (WEFE) Nexus. More precisely, data regarding demographics (both urban and rural), climatic conditions (precipitation, temperatures, extreme weather events), agricultural data (soil types, crops, local water resources) have been collected per demonstration site. Special focus has been paid on the involvement of stakeholders on water management issues, such as responsible entities for water collection, storage and distribution as well as the end-users (farmers). It should be noted that this framework is essential for the adoption of the proposed solutions as long as it captures the current situation of each region, describing in great detail the challenges and needs of each of the involved stakeholders, while it aims to propose the adaptation of innovative technologies to mitigate climate change effects and increase resilience of local communities. Lastly, cooperation between North and South countries is promoted as indicated from Sustainable Development Goal 17 about "Partnership for the Goals".

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Keywords
Evaluation framework, water, energy, food, ecosystem, sustainability

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Identification of agroecological practices in Siliana, northwestern Tunisia through a combination of survey and participatory workshop - Abstract

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Summary

The region of Siliana, in northwestern Tunisia, faces environmental challenges such as water scarcity and soil degradation, impacting agricultural productivity. Additionally, climate change is threatening the region, exacerbating existing vulnerabilities and necessitating sustainable agricultural practices. Agroecological practices include the integration of ecological principles into agricultural systems to enhance productivity and resilience and enclose sustainable farming methods. To this end, our study constitutes a comprehensive investigation to identify agroecological practices, if there, in Siliana region through a survey with farmers and a participatory workshop with different stakeholders involved in the farming system. The survey was conducted with 30 farmers who were asked about their adoption of 8 agroecological practices such as recycling, crop diversity, irrigation water management, soil health, animal health, no-tillage, reduction of chemical inputs and reduction of phytosanitary treatments. The participatory workshop included 26 participants, comprising farmers, researchers, engineers, agronomy expert, administrators and stakeholders from the upstream or downstream segments of the value chains. With these participants, we identified the most practiced agroecological practices (AEPs) in Siliana, the qualification criteria for AEPs and the evaluation of AEPs according to qualification criteria. The data obtained from the survey was analyzed by computing response percentages using the R software version 4.2.3 and the 'questionr' package version 0.7.8. The results of the survey showed that soil health (93%), crop diversity (77%) and animal health (70%) are among the most cited AEPs by farmers in Siliana while recycling (10%) was the least one. Moreover, the AEPs in Siliana proposed by the different participants of the participative workshop were no-tillage, crop rotation, organic fertilization (manure), contour plowing to combat erosion, intercropping/ crop association, utilization of drip irrigation for water economy and irrigation water management, reduced tillage and soil enhancement and consulting a veterinarian for animal health. The AEPs suggested by the workshop participants and those proposed by the researchers responsible for conducting the survey share several common points, emphasizing sustainable agricultural practices, resource preservation, and the health of crops and animals. A total of 11 criteria were proposed by the

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participants to qualify the AEPs and each two criteria have been paired together to form a single criterion. Therefore, criterion 1 was cost reduction and productivity, criterion 2 was the type of vaccine/insemination for cattle and product quality, criterion 3 was the reduction in cryptogamic diseases and weed control, criterion 4 was the sustainability of agricultural production and diversity of crops and products, criterion 5 return to local seeds and finally criterion 6 was self-sufficiency and environmental protection. For the evaluation of the AEPs according to the criteria, the crop rotation received the highest score (+48) among the agroecological practices, closely followed by water saving through drip irrigation (+31), while no-tillage and organic fertilization using manure tied for third place with the same score (+24). In conclusion, the identification and evaluation of various AEPs with different approaches revealed significant differences in their effectiveness and acceptance among participants. Understanding the preferences and priorities of farmers regarding sustainable agricultural practices can aid in promoting the agroecological transition in the future and assist political and governmental decision-makers.

Keywords
Agroecological practices, Siliana, Survey, Participatory workshop

Estimation of soil organic carbon content using remote sensing and GIS techniques - Abstract

Grigorios Karampetian [1], Konstantinos Zoukidis [1], Athanasios Gertsis [1], Athanasios Falaras [1], Christos Vasilikiotis [1], Antonios Apostolidis [1], Evangelos Vergos [1] and Panagiotis Tziachris [2]

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Summary

The depletion of Soil Organic Carbon (SOC) due to intensive agricultural practices poses a significant threat to soil health, impacting agricultural productivity, soil structure, and carbon sequestration. Remote methods to evaluate the surface SOC content will enhance efficient mapping and therefore, apply appropriate methods for remediation. A research study was developed to provide a cost-effective, non-invasive method for SOC estimation and mapping, contributing to sustainable agriculture and environmental conservation. The focus of the study included using remote sensing (RS), satellite imagery and Geographic Information Systems (GIS) software to estimate soil organic carbon (SOC) content through various vegetation indices (VIs).

The research was conducted in a field of the American Farm School, Thessaloniki, Greece, over an area of approximately 12 hectares of non-irrigated cropland cultivated with durum wheat *(Triticum durum L.)*. A total of 73 soil samples were collected from the top 10-15 cm of the soil and analyzed for SOC content using the Dumatherm C and N analyzer. Simultaneously, satellite data on the approximate sampling dates were obtained from the Copernicus Sentinel-2 satellite, which provides 13 spectral bands with varying resolutions.

Four key vegetation indices (VIs) were selected for analysis: Normalized Difference Vegetation Index (NDVI), Green Normalized Difference Vegetation Index (GNDVI), Soil Adjusted Vegetation Index (SAVI), and Bare Soil Index (BSI). QGIS, an open-source software was employed to calculate these indices and create detailed study area maps. Their values were extracted for each soil point. The SOC values were then correlated with the VI values through multivariate correlation and ordinal logistic regression analyses.

Statistical analysis included both descriptive statistics and multivariate analyses. The SOC data did not follow a normal distribution, necessitating the use of non-parametric tests. The study employed multivariate correlation, Spearman's rho as non-parametric tests, and ordinal logistic regression to create SOC estimation models. The transformation of SOC data into ordinal classes allowed for more robust regression analysis, improving the predictive power of the models.

The results showed significant correlations between SOC and the VIs, particularly with NDVI, GNDVI, and SAVI, with correlation coefficients above 0.9, indicating strong predictive capabilities. BSI exhibited an inverse relationship with SOC, as expected. The distribution analyses of the indices highlighted varying vegetation health and density across the study area, confirming the suitability of these indices for SOC estimation. The study underscored the potential of RS and GIS technologies in providing reliable SOC estimates, promoting Precision Agriculture (PA) and sustainable land management. It also suggests further refinement and validation of the models using Unmanned Aerial Systems (UASs) equipped with multispectral cameras of high resolution, to enhance spatial resolution and accuracy. Additionally, future

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research should explore the integration of more environmental variables and advanced statistical techniques to improve SOC prediction models.
In conclusion, the utilization of RS and GIS for estimating SOC through VIs a promising avenue for enhancing soil management and conservation efforts. By leveraging advanced technologies and statistical methods, this study provides valuable insights into the complex interactions between vegetation and soil carbon dynamics, paving the way for more effective and sustainable agricultural practices. The study is under further validation in the same and other areas.

Keywords
Soil Organic Carbon, Remote Sensing, Vegetation Indices, GIS, Precision Agriculture, Sentinel-2, NDVI, GNDVI, SAVI, BSI

Landscape-level analysis of farming practices and their impacts on wild pollinators in the Nestos region of Greece - Abstract

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Summary

Pollinators provide ecosystem services to agriculture and contribute to the production of more than 75% of food crops globally. Pollination services are responsible for the reproduction of wild plants and are mostly provided by bees, both managed and wild ones. Nevertheless, recent years have witnessed a significant decline in pollinators worldwide and particularly in Europe. This has been partly associated with some farming practices, such as increased pesticides use, habitat deterioration and monoculture. In particular, pollinators are threatened by the modern agricultural systems as their practices degrade the pollinators' natural habitats and chronically expose them to parasites and chemicals. This exposure on agrochemicals, and more specifically pesticides, is one of the main causes of the decreasing number of pollinators in many European countries. There are many policy measures that tried to tackle these problems but failed to do so due to low farmers' participation and low technical efficiency. Moreover, all existing measures are plot or farm specific and don't take into account the complex interactions that are found in the landscape. Indeed, the adoption of pollinator friendly practices by a small number of farmers cannot guarantee their conservation as pollinators fly within the landscape and can be negatively affected by the surrounding agricultural systems. Therefore, it is necessary to treat pollinators holistically and in relation to the agricultural systems at a landscape level. However, there is a lack of landscape-oriented research methods which would allow us to create more inclusive and efficient measures for the protection and conservation of wild pollinators. This is mostly due to lack of studies on thorough characterization of the impact of the diversity of farming systems on a series of indicators (e.g. productivity, natural resource use efficiency, economic, etc.), including biodiversity.

Consequently, this study aims to provide a detailed characterization of the existing farming systems in the Nestos area in Greece as a first step, in order to examine the farmers' perception and behavior towards wild pollinators. This analysis will permit us to identify at the landscape level the main agricultural systems that characterize the examined area, as well as to assess the potential trade-offs between farmers decision-making and impacts on wild pollinators. The selected are characterized by intensive agricultural systems with the trend towards kiwi monoculture. This rapid transformation of the landscape raises concerns regarding the future of wild pollinators.

Our research consists of many different steps, that by merging them, we can have a holistic idea of how the landscape in the area operates in collaboration with the farmers. Our first and most crucial step was to use a method which would allow us to learn and analyze our study area thoroughly and as a whole. A detailed questionnaire was developed and implemented in several farmers identified by the expert interviews' method. The questionnaire included a series

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of bio-physical and socio-economic questions to identify the main agricultural systems of the area. In addition, through these questionnaires, we had the opportunity to examine the farmers' decision-making process for different agricultural systems, how they perceive the dynamics of the landscape, their general perception of pollinators and if they acknowledge their importance in the production.
Our findings identified four dominant agricultural systems, namely: i) Kiwi-Perennial, ii) Kiwi-Arable land, iii) Asparagus-Arable land, and iv) Arable land. We also identified the same patterns per system concerning the use of pesticides and other elements like pruning, equipment used, labor requirements etc. These results showed that in the case of wild pollinator restoration, different measures should be applied according to the needs and the requirements of the examined systems.

Keywords
Wild pollinators, Agricultural systems, Pesticides, Landscape-level analysis, Farmer perception

Rosalie Edge: Life, work and impact - Abstract

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Summary

Rosalie Edge was a great conservation activist of the 20th century who brought innovation to the conservation movement by introducing different activist practices. She fought to bring changes to conservation policies as well as other conservation organizations which she believed had strayed from their responsibilities to preserve wildlife, especially birds in extinction. She was also an advocate for the establishment of national parks and helped in the creation of a number of them. In addition, she organized a wildlife sanctuary for migratory birds of prey, the Hawk Mountain Sanctuary, which is regarded her most well-known achievement.

Keywords

Rosalie Edge, life, work, impact

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Innovative technologies (nanobubbles and electronic water treatment) to manage highly saline irrigation water in hydroponic systems - Abstract

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Summary

Irrigation water salinity presents a major and increasing problem worldwide. Methods to treat it and achieve higher efficiency will provide valuable tools to farmers to achieve more sustainable and profitable crop production systems. Most systems currently used for saline water treatment represent high energy consumption and large costs, not affordable by small and medium size farms. Also, the environmental footprint is very negative. Any new systems that can reduce the irrigation water salinity effects, will contribute significantly to the more sustainable crop production and indirectly mitigate the climate effects, by reducing the crop stresses by abiotic factors. The objective of this study was to evaluate high salinity levels of irrigation water, for growth and productivity of leafy vegetables. Two innovative and inexpensive technologies were used. One is the application of a nanobubbles system (NB: http://hal.teiemt.gr/index.php/agronb) and the other is an electronic water treatment system, based on low frequency radiation waves (MAXGROW: https://MAXGROW.tech/).

The NB system produces very small size water cavities and are defined as: "*Nanoscopic gas cavities in aqueous solutions which diameter is smaller than 1 micron (d<1μm)*."

The MAXGROW cutting edge electronics ensemble generates up to two million pulses per second in a constantly altering transmission bandwidth, enabling the system to dissolve all the ions of the metallic salts, particularly the ions of calcium, carbonate, nitrate and sodium, altering their given by nature, electrochemical charge.

The research was conducted in the Greenhouse Laboratory of Perrotis College/American Farm School Thessaloniki, Greece under a floating disks hydroponic system, in which three leafy vegetables species (endive, and two lettuce varieties- COS and Batavia) were grown in 4 different sections/tanks each one filled with different salinity irrigation water: a. Control ($E.C._i$ ~1 dS/m), b. saline water ($E.C._i$ = 10 dS/m) enriched with NB, c. saline water ($E.C._i$ = 10 dS/m) + MAXGROW and d. saline water ($E.C._i$ = 10 dS/m) + MAXGROW + NB). Various vegetable agronomic parameters (total fresh weight, height, root weight, SPAD units, etc.) and water parameters (Dissolved Oxygen, pH, EC, nutrients, temperature, size and concentration of NB, etc.) were periodically recorded. The results indicated that a combination of the two devices was the best treatment used, as compared to using one device separately and provided higher final fresh yield than the regular water treatment. A very important result that was also shown, refers to MAXGROW's system ability reduce the size of water cavities by itself, thus producing additional NBs and in combination with the NB system increased the concentration of NBs. Therefore, the two devices can provide a very sustainable and affordable tool to mitigate high salinity problems in crop production systems.

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Keywords
nanobubbles (NB), electronic water treatment system (MAXGROW), floating disk systems, hydroponics, leafy vegetables, saline water

Honey Cost: An experimental approach for determining honey production costs - Abstract

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Summary

The Honey Cost project, conceived and developed by the CREA Policies and Bioeconomics research center (CREA PB), develops a methodology and tools for data collection and evaluation ad hoc for the Bees and Honey sector and sets up a sample survey on the sector. The determination of the cost of honey production is carried out through a questionnaire submitted to a sample of 434 farms with an economic size of at least 8,000 euros of Standard Output. In the methodology adopted, 3 cost levels are envisaged, a first level referring only to current expenses, a second level, in which other general expenses are added, and finally, a third level to which also the cost of family labor is added.

The first survey, carried out in 2023, is referred to the two-year period 2021-2022. It emerges that among the variable costs, those incurred for packaging and marketing represent, in percentage, the most important item, followed by nutrition costs and their incidence varies depending on farm type and on the economic size. Even among the components of general costs (depreciation and other non-direct expenses) a strong variability was found, and it attenuates when moving from small to large farms. The total production cost stands, as a sample average, at around 9 euros per kilogram of honey produced, for many farms this value is well above the price recognized by the market for their product.

Keywords

Bee and honey supply chain, economic sustainability, production costs, efficiency of beekeeping companies

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Growing lettuce (*Lactuca Sativa* L.) in floating disks systems under variable and high salinity water range enriched with nanobubbles - Abstract

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Summary

One of the most detrimental factors to plant growth and productivity is water salinity. It has been directly responsible for a 20% decrease in average global yield over the past few years. It is estimated that by 2050, half of all arable land will be affected by salinization. Especially desalinized or mixed with fresh water, saline water is a reasonable choice in farming. Due to economic factors, desalination has yet to be widely implemented in underdeveloped countries, even though these regions frequently suffer from water shortages. Another alternative is to use seawater as supplementary irrigation water, provided that it is diluted to a level that will not hurt the crops grown. The salt concentration in full-strength seawater causes hazardous effects for most plants. A very detrimental factor to plant growth is salinity in soil and irrigation water. Hydroponic systems, which use commercial hydroponics technologies, are cheaper and easier to maintain than traditional farming methods in soils. The objective of this study was to evaluate various salinity water ranges ($E.C._i$ ~1 - 14 dS/m) enriched with nanobubbles (NB), for growth and productivity of lettuce plants in floating disk hydroponic system. The critical level of irrigation water salinity is considered to be 4 dS/m, although most cultivated plant species cannot tolerate more than 2 dS/m, especially vegetables.

This research investigated how using floating discs in a greenhouse with a Nanobubbles (NBs) generator (http://hal.teiemt.gr/index.php/agronb) may affect lettuce (*Lactuca sativa* L.) morphological and physiological responses to salt stress. The lifetime of nanobubbles is very extended, lasting weeks or even months. Nanobubbles (NB) are gas cavities with a diameter of 1 μm or less that exist at the nanoparticle scale. The incredible lifespan and the unique physicochemical properties of NB structures have piqued the scientific community and interest. The mechanisms and processes underlying this trait have been the subject of much more research. Many industries, including agriculture, have taken notice of nanotechnology and nanobubbles because of their expanding importance and unique qualities. NBs are intended to guarantee adequate dissolved oxygen in the roots of the plants and to combat stressful conditions brought on by the high salinity of the nutrient solution. It has been recognized that the stable existence of NBs may have significant effects on many essential processes like protein folding, boundary slip and activities of electrochemical reactants.

The research took place in the greenhouse of Perrotis College, Thessaloniki, Greece under a floating disks system, in which lettuce variety Batavia, was grown in 24 plastic square containers of 40 liters volume (6 plants per plastic container) under a range of saline water (~1, 2, 4, 6, 8, 10, 12, and 14 dS/m) enriched with NB, Control filled 18 plastic containers with regular tap water/nutrient solution under a range of saline water (E.C.i : ~1, 2, 4, 6, 8 & 10 dS/m) and 4 plastic containers enriched with NB ($E.C._i$: ~1 dS/m) every 7 days, 3 days, 1 day

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and once. The goal of this experiment was to examine the results of the influence of NB and without NB on agronomic traits and yield. Nutrient solution parameters were recorded, such as: pH, Electrical Conductivity, Dissolved Oxygen, temperature, nutrients and NB size and concentration. Additional measures of plant physiological and growth properties were determined by SPAD units (Relative Leaf Chlorophyll Level) and Chlorophyll fluorescence emission (PSII), fresh green and root weight and length.
The results indicated that the NB device was proven to be an innovative and very effective technology for sustainable lettuce production under high saline nutrient solution. This device presents a valuable solution to the global issue of increased salinity of irrigation water.

Keywords
Nanobubbles (NB), floating disk systems, hydroponics, lettuce, saline water

Internet of Things systems and Big data analytics for Smart Agriculture: A bibliometric analysis - Abstract

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Summary

By giving farmers access to real-time data on crop yields, soil moisture, and weather patterns, the Internet of Things (IoT) has grown in importance and transformed the agricultural sector. The goal of this study is to present a bibliometric analysis of the most recent advancements in Scopus-based research on IoT for smart agriculture during the previous several years. The study's findings may offer insightful information to academics, professionals, policymakers, and funding agencies that want a thorough understanding of the goals and trends going forward in this field. The findings of this research can offer great chances for collaboration and make it easier to get current information on smart agriculture.

Keywords

Internet of things, Smart agriculture, IoT systems, Big Data Analytics, Sustainability

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Consumers' attitudes towards novel products: The case of cereal bars with sea buckthorn - Abstract

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Summary

Hippophae (Sea buckthorn) is a plant cultivated in several pedoclimatic and geographical zones for its berries, which are used in food manufacturing. Its bioactive components have several medicinal properties and can act as flavoring ingredients. Although research on the medicinal and therapeutic effects of sea buckthorn shows significant growth, consumers' perceptions of hippophae-based food products remain under investigated. Our main objective for this study is to offer a preliminary view of the factors affecting potential consumers' attitudes toward a novel product: cereal bars enriched with sea buckthorn. The product is developed within the framework of an ongoing project aiming at producing high nutritional value food products enriched with sea buckthorn. To meet the purpose of the study, we developed an instrument consisting of 19 items, referring to potential antecedents of consumers' attitudes toward sea buckthorn-based products. The attitude-shaping parameters examined include nutritional value awareness, social influence, taste perception, safety perceptions, health benefits beliefs, trust toward food manufacturers that distribute relevant products, convenience, price judgments, products' appearance, quality certification, environmental friendliness, and support of small-scale farmers. Data were derived from a sample of Greek consumers. The results of our quantitative analysis indicate that consumers have a limited level of awareness toward sea buckthorn. Participants perceive that hippophae-based food products have high prices, not pleasant taste, and lack attractive appearance. In addition, they do not trust the companies that produce related products. On the contrary, they agree that foods enriched with sea buckthorn are healthy, their production complies with environmentally friendly practices, and their purchase contributes to the economic sustainability of small-scale producers. These perceptions shape a moderate willingness to buy cereal bars with sea buckthorn. Our findings showed that beyond the health-related benefits of sea buckthorn products, their marketing should emphasize their sustainability orientation and the ability of hippophae production to sustain small-scale farmers' income. Moreover, the results that emerged through our analysis

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stress the need to ensure that hippophae-based products have a high sensory profile (referring both to their taste and appearance) that meets potential buyers' expectations. Finally, an essential precondition for building a robust market for similar products is cultivating trust between companies operating in the sector and consumers. From a theoretical point of view, our study reveals the importance of integrating consumer data in the process of developing new products. Such a consumer-led production process can uncover unknown expectations and perceptions, thus facilitating the success of a novel product in the market.

Keywords
Sea buckthorn, consumer attitude, novel products

The role of citizens in transforming cities into smart cities: The case of Greece - Abstract

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Summary

In recent years, the concept of "smart cities" has increasingly emerged. Various issues are explored regarding their development in both international and domestic literature. One of the most popular issues at the center of research is the participation of citizens at every stage of urban development. However, although the literature recognizes the value of citizen participation, ultimately little research has been conducted regarding the actual practices of citizen participation and the responsiveness of relevant policies to their real needs. From this point of view, the present work aims to investigate the degree of citizen participation in Greek "smart cities" under development, based on bibliographic data and sources. In the Greek literature it is observed that the expected contribution of citizens during the development of smart cities is small. New technologies are used as a means to guide citizens, change their behavior and accept public services and projects. Therefore, conducting research on city representatives involved in the decision-making process regarding the transformation and development of cities into smart cities is deemed necessary and essential.

Keywords

Smart cities, citizen participation, Greece

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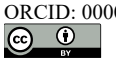
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Consumers' willingness to buy novel functional food products - Abstract

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Summary

Functional foods are products that have clinically evidenced health benefits for consumers due to one or more of their ingredients. While research indicates that consumers are highly interested in these products and are often willing to pay premium prices to buy them, stories of market failure are frequent for the specific category. Hence, a critical question is what determines consumers' willingness to purchase functional food products. A hypothesis confirmed by many studies is that health concerns are positively associated with purchasing intentions. Nevertheless, other factors may also positively or negatively affect consumers' willingness to buy functional foods. Our work examines this contention by focusing on a novel functional food product: yogurt enriched with sea buckthorn. The product, which is developing in the framework of an ongoing project, is expected to combine the health benefits of yogurt with the medicinal properties of sea buckthorn.

Drawing on a sample of Greek consumers and following a quantitative research design, we investigated the influence of five categories of factors on potential consumers' willingness to buy this specific product. The first one refers to the perceived health benefits of functional foods. The second concerns the expected sensory attributes of the product. The third is related to the sustainability performance of the product, involving an environmental and a social dimension. The fourth is centered around the social acceptability of similar products. Finally, we added a dimension that refers to the ease of finding the product.

The analysis revealed that all the examined parameters affect consumers' willingness to buy sea buckthorn-enriched yogurt, exposing the need to pay more attention to the secondary attributes of functional foods, like their ability to promote environmental and social sustainability during the production process. In addition, the uncovered associations confirmed the crucial role of the sensory characteristics of functional foods and the convenience they offer

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in their approval by consumers. Moreover, the results suggest that the success of such products in the market largely depends on their capacity to generate social acceptance, which acts as a pushing force for consumers. Nevertheless, the analysis indicated that the link between willingness to buy the product under examination is loosely linked with willingness to pay premium prices. This finding calls for a more cautious examination of functional foods' price/value ratio. In sum, our results further confirm the association between perceived health benefits and willingness to buy novel functional food products. However, the analysis also indicates the importance of sensory attributes, sustainability performance, and convenience.

Keywords
Functional foods, consumes, novel products

Greek students' food welfare knowledge, attitude and eating behavior: A multi-level statistical analysis - Abstract

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Summary

Food waste is one of the biggest problems with an enormous impact on people's lives as well as on the environment. In addition, this problem has colossal ecological, economic and social costs. The global individuals' greenhouse gas emission problem has equal importance. Food waste not only squanders resources but also indicates environmental harm as well as social inequality.

Food waste is influenced by a range of intricate and complicated parameters. Various habitual and emotional factors and attitudes play crucial roles in individuals' motivation as well as commitment to reduce food waste and their existing waste behaviors. Moreover, family structure and household habits also as major contributors to food waste.

It is difficult to identify individuals' knowledge regarding food waste and to portray purchaser's stimuli to prevent food waste. Motivations have a significant role regarding food waste in relation to eating behaviors.

The purpose of the current research is to evaluate Greek students' attitudes towards food waste, and this is evaluation is significant because Understanding attitudes toward food waste is crucial for suggesting effective interventions. 237 Greek male and female students participated in the survey. Respondents completed a purpose-built questionnaire including 5 demographic questions and 21 questions regarding food waste during the academic year 2023-2024. The study used the MAFW-scale consisted of four conceptual constructs name environmental, moral, financial and social motivations. The scale was assessed for its reliability and validity in a pilot sample of 40 individuals and then distributed and completed by the 237 male and female students. The methodology of factor analysis of correspondences and implicative statistical analysis were applied to analyze the data.

The research finding showed that there is a big difference regarding attitudes toward food waste and motivations and behaviors toward their eating behavior and food consumption. The awareness regarding environmental consequences related to greenhouse gas emissions as well as resource running down can motivate people to take real actions aiming the waste reduction. As more informed the individuals are the more measures that could be taken.

Another major motive is the comprehension of the economic variable as well as the societal one regarding good waste.

The study addresses the environmental, moral, financial and social motivations toward food waste paying attention to waste reduction behaviors as well as actions.

Keywords

Students, attitude, food, welfare, knowledge, eating, behavior

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Challenges and perceptions of Greek beekeepers: Socio-economic issues and the importance of pollination services in the Mediterranean apiculture sector - Abstract

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Summary

Apiculture industry is an important economic sector in the Mediterranean Basin as it provides a variety of products (i.e. honey, royal jelly, propolis, pollen and beeswax) and contributes an estimate €14.2 billion per year in the Mediterranean countries' economic welfare. Moreover, the EU beekeeping industry numbers approximately 620,000 professional beekeepers, while in the other Mediterranean countries this number varies between 1000 and 50,000 depending on the country.

Moreover, apart from the beehive products themselves, beekeeping also offers vital ecosystem services to agriculture as the 76% of the Mediterranean crops destined for food production are dependent on pollination. For example, only in France, the value of pollination services offered by bees varies between €2.3 and €5.3 billion per year. In addition, bee pollination services are responsible for the maintenance of the Mediterranean wild flora as approximately the 80% of Mediterranean wild plants are estimated to depend on them.

Therefore, Mediterranean apiculture is an important agro-food chain with significant economic, environmental and cultural aspects. However, despite its importance, the great majority of the Mediterranean countries face a structural imbalance between the supply and demand for honey. Even EU which is the 2nd world's producer, after China, with an average production of 230,000 tons per year, is only 60% sufficient in honey. Hence, the honey trade balance of the Mediterranean countries is largely negative concluding to imports mostly from Ukraine and China.

The main reason for this structural imbalance is the decreasing profitability of the Mediterranean apiculture sector. In general, like other agricultural sectors, the beekeeping industry has to cope with production and market challenges in order to maintain its sustainability. However, when it comes to honey production, several motives and phenomena can affect bees' productivity. Among them, the high bee mortality and the decreasing number of professional beekeepers are the main drivers of the decreasing profitability of the sector. This decline has significantly increased the installation (e.g. beehives, queens) and maintenance (e.g. disease management) costs of beekeepers. Moreover, world competitors with lower production costs and cheaper prices pose an extra pressure to Mediterranean beekeepers. If the above phenomena are further aggravated, the sustainability of the Mediterranean apiculture sector may collapse with serious economic and environmental consequences on human's welfare.

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Consequently, this study focuses on examining deeper the perception of Greek beekeepers towards the main socio-economic issues of the sector as well as their perception of the importance of pollination services. Greece is one of the biggest honey producers in the Mediterranean region with a decreasing population of professional beekeepers and external threats, such as the wildfires of 2022 and 2023 which heavily impacted the abundance of flora resources. In order to do so, a national qualitative survey was designed and implemented. Tests of differences between professional vs. hobby beekeeper were conducted using pairwise Kruskal–Wallis tests. Correlations between beekeeper years of experience and number of hives were explored using Spearman's Rank correlation analysis.
The results highlighted that high maintenance costs and the climate change are the main threats of the Greek apiculture sector. Moreover, the majority of the beekeepers are not willing to rent their hives for pollination services as they are afraid of the risk of pesticides. However, they perceive an increasing demand for pollination services for the farmers, especially in areas with perennial crops, such as kiwi.

Keywords
Apiculture, pollinators, sustainability, Mediterranean

Towards a freshwater crayfish rearing protocol through laboratory grown field-release of juveniles within plastic cages - Abstract

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Summary

Pontastacus leptodactylus constitutes an indigenous freshwater crayfish species inhabiting many lakes and water bodies in Northern Greece. Apart from its native distribution range, during the last decades many human-mediated translocations of the species took place, mainly due to its high economic value. Namely, in lake Polifitou in the Region of Western Macedonia it represented the main income source for local fishermen who exported the product in Northern European countries, where it is characterized of cultural importance as well. However, during the last years its populations were significantly reduced mainly due to an epidemic outbreak, attributed to *Aphanomyces astaci* infestation, the responsible pathogen for the crayfish plague disease, detected for the first time in Greece in 2023. It becomes therefore evident that there is a need for a breeding protocol development both for biodiversity retention and aquaculture purposes. Towards this perspective, we developed and present here a freshwater crayfish rearing protocol within plastic cages of dimensions 60 cm x 60 cm that can be folded into cylindrical shape. Immature crayfish individuals of different developmental stages were transferred inside the cages and separated according to their morphometric measurements. The animals were kept under laboratory conditions 120 days after their acclimation period. The density in each cage was determined by the ellipsoid shaped area occupied by each individual. Two different feeding regimes were given, one of which, the control diet included fishmeal while the other had a partial substitution of fish meal with *Hermetia illucens* insect meal. At the end of the experiment, the survival rate of the individuals and the growth performance were evaluated for each diet and for each developmental stage that were both high in all cases. Furthermore, the release of reared individuals within cages into the wild was examined, which was completed successfully. The proposed rearing protocol presents numerous benefits including reduced cost in comparison with other materials and practices, as well as the user-friendly manipulation. Crayfish individuals can use cage net holes in order to climb in the upper part of the cage providing approximately double available space for the animals and possessing the ability to increase the density of the animals to the maximum possible, while not hampering their growth performance. Thus, taking into consideration the important role that this species possesses not only towards ecosystem services but for local economy and regional development as well, the establishment of an aquaculture protocol is of major importance. The present study represents a first evaluation of laboratory-grown individuals release into the wild, in easily-handled and low-cost plastic cages.

Keywords

Pontastacus leptodactylus, freshwater crayfish, aquaculture, insect meal

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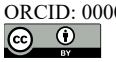
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Building a global aquatic resources knowledge base for fisheries - Abstract

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Summary

Fisheries management is a complex task aiming to ensure the long-term sustainability of fish populations and the ecosystems they depend on. To achieve those goals, it is essential that the fisheries are described with precise and non-ambiguous information. Different agencies are reporting fisheries data by relying on several vocabularies or thesauri. Just indicatively for the description of aquatic species there are different official and widely used data sources that can be used. As a result, there are different identifiers or names for describing the same resource. In this paper, we describe the construction of a global aquatic resources knowledge base, that is the result of the integration of different data sources using semantic web technologies. By focusing on aquatic species, we show that the information provided by different data sources is complementary, and we provide a unified way for accessing them. We finally describe how the same process was adopted for other information domains as well.

Keywords

Fishery, Semantic Data Integration, Knowledge Base, Species, Taxonomy, Water Area, Fishing Gear

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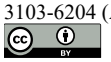
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iRunMon: A real-time ruminant monitor - Abstract

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Summary

Present paper presents a real-time animal monitoring solution envisaged for ruminants. The complete solution includes a wearable collar enabled with inertial sensors and a thermometer, a sensor gathering gateway that generates alarms and interfaces with a cloud hosted application that implements system analytics, and video recording tools that allow the supervision of telemetry data. System operation supports a triple mode: it operates in a learning mode where it gathers sensor data, an enriched version integrated with video recording information to enable learning data supervision, and a monitoring mode where the wearable system autonomously classifies animal behavior.

Keywords

Ruminant monitoring, wearable sensor, accelerometry, behavior, activity, calving detection

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A decision support tool to evaluate economic performance of small ruminant farms - Abstract

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Summary

Management of dairy sheep and goat farms requires specific skills and comprehensive planning of daily activities to ensure profit and sustainability. In practice, most farms are characterized by lack of professional management and operate close to profitability thresholds. Digital technologies and decision support tools could help farmers manage their farms more efficiently and hence achieve higher profit. The objective here was to develop a farmer-friendly web-based application to help farmers manage finances of their farms by projecting daily income over feed cost. Input parameters included daily milk yield (volume in cooling tanks) and price of milk sold (€/kg), cost of individual feedstuffs (€/kg) and feeding allowances. Daily feeding comprised of lucerne hay, straw, silage, and concentrates offered to individual animals according to production stage. Default values and hypothetical boundaries were set for input parameters as well as prices of milk and feedstuffs. Then, an algorithm was developed to estimate daily income (total and per animal) over feed cost. The algorithm was used as backend for a web-based application. The latter has farmer friendly designated forms for data entering and visualization of financial outputs. The idea is that the app will help farmers monitor daily economic performance of their farms and make decisions towards higher efficiency and profitability. Next steps include the integration of other farm operating costs to calculate net income. This work is funded by "Measure 16 'Cooperation" in the framework of National Rural Development Program, co-financed by the European fund for rural development (EAFRD) and national budgets (ProudFarm; Project code M16SYN2-00016).

Keywords

Small ruminants, web application, milk production, feeding costs, income over feed cost

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Investigation of gene polymorphisms in *FGF2* and *STAT5A* genes in the Greek Red Cow breed - Abstract

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Summary

The aim of this study was to investigate the presence of polymorphisms at the Fibroblast Growth Factor 2 (FGF2) and Signal Transducer and Activator of Transcription 5A (STAT5A) genes loci in the Greek Red Cow breed. Genotyping was performed using PCR-RFLP. One hundred seventy-four Greek red cows were used for this study. PCR-RFLP analysis revealed that for FGF2, genotype GG had a frequency of 0.25, GA 0.55 and AA 0.20, while the frequency of allele G was 0.52 and of A 0.48. For STAT5A, genotype GG had a frequency of 0.22, GC 0.48 and CC 0.3, with frequencies of alleles G and C being 0.46 and 0.54, respectively.

The molecular results presented in this study indicated that all genotypes of the two genes were present in the investigated population. Therefore, these SNPs could be incorporated in a larger panel of markers to assist breeders in selecting cows with improved reproductive traits.

Keywords

SNP, FGF2 gene, STAT5A gene, Greek Red Cow, PCR-RFLP

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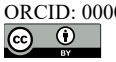
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Enhancing precision livestock management with IoT: Insights from the WELLNESS project - Abstract

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Summary

The utilization of Information and Communication Technologies (ICT) in livestock management has revolutionized traditional farming practices, enabling farmers to operate with precision and efficiency. ICT technologies facilitate real-time monitoring of animal health, behavior, and environmental conditions supporting productivity and sustainable farming practices. The objective of WELLNESS Project is to use ICT technologies in small ruminant systems located in Bourinos mountain region. GPS trackers were fitted on individual sheep and goats that were randomly selected from three flocks raised semi-intensively in order to monitor movement patterns and behaviour. In two farms portable meteorological stations were mounted in the outside walls of the barn to collect weather data. One station used LoRaWAN technology for efficient, long-range data transmission. This approach aims to allow for the correlation of environmental factors with livestock behavior, enabling the development of wellbeing indices and the assessment of milk quality specific to the Bourinos mountain region.

Keywords

Internet of Things (IoT), precision livestock, animal welfare, sustainable agriculture, smart collars

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Comparative analysis of LS-SVM and random forest models for sensor-based lameness detection in cattle - Abstract

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Summary

Lameness is a significant concern in dairy cattle management, affecting both animal welfare and farm productivity. Despite efforts to mitigate its impact, traditional methods of lameness detection often overlook early signs, leading to delayed intervention and prolonged suffering for affected cows. This challenge underscores the need for more effective and proactive approaches to identifying and managing lameness. This study seeks to create an objective lameness detection methodology using sensor data from cattle limbs. Inertial Measurement Units (IMUs) were attached to cattle in Eastern Macedonia and Thrace, Greece, to record movement data. The collected data were preprocessed to address missing values, and features from both the time and frequency domains were extracted. Key gyroscope and accelerometer features were selected through Neighborhood Components Analysis. These features were then used to train Least-Squares Support Vector Machine (LS-SVM) and Multiclass Random Forest (MRF) models to classify lameness severity into healthy, mild, and severe categories, achieving an overall accuracy of more than 0.90 for both models. MRF has shown a better performance than LS-SVM.

Keywords

Lameness detection, machine learning, inertial measurement unit, cattle, Multiclass Random Forest, Least Squares Support Vector Machine

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Development and laboratory testing of a bucket milking machine with flow-controlled vacuum, based on a NI data acquisition system - Abstract

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Summary

In the present paper the idea of regulating the vacuum level by the means of a variable frequency drive (VFD) in order to control the speed of the vacuum pump of a milking system was considered. Wet tests (using water instead of milk) were performed in order to tune the PID controller which drives the VFD; then, the virtual instrument built using the LabVIEW environment was adapted in order to regulate the vacuum level as a function of the flowrate.

The system was tested in order to verify vacuum stability and system response time. Wet tests have proven that the vacuum level in the system was affected by presence of the liquid column in the milk line; as a result, the standard deviation of the vacuum level was comprised between 0.067 kPa and 1.43 kPa (depending on the flowrate and vacuum level), while in the previous dry tests the standard error was comprised between 0.186 kPa and 0.194 kPa. Nevertheless, vacuum fluctuations did not exceed the imposed limit of ±2kPa relative to the nominal vacuum in the flow controlled vacuum system.

In order to reduce the vacuum fluctuations, the original claw of the installation was replaced with a larger one, with a volume of 330 cm^3; under these conditions, the standard deviation of the vacuum level decreased to 0.134-0.288 kPa.

Keywords

Machine milking, flowrate, vacuum level, vacuum stability, response rate

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Towards Agriculture 5.0 in the European Union: Training and digital skill trends in the agricultural sector - Abstract

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Summary

Sustainability and digital transformation are two processes that significantly impact the agricultural sector. Digital transformation alone requires companies to highly coordinate them available human capital and new technologies. Sustainability makes sure this happens in an environmentally friendly way. These principles brought changes to the sector, and today Agriculture 5.0 has started to replace Agriculture 4.0, which integrates digital technologies alongside with focusing on optimizing resources, improving efficiency and applying sustainable practices in firm operations. As technology advances, the range of skills and competencies required for employees also changes, as proper digital competencies are necessary to integrate them into business processes. Thanks to new digital technologies, human resources can be even more effectively managed as a strategic resource within organizations.

Organizations face challenges in terms of how to introduce and manage new digital technologies. In the new digital environment, management needs to be agile and proactive in handling changes. At the management level, human resource needs to possess comprehensive knowledge not only in the specialized areas closely related to agriculture, but also in broader macroeconomic, microeconomic and business processes that directly or indirectly impact the organization. Additionally, they should understand the potential range of digital technologies applicable within the organization and the conditions for their implementation. Such a complex set of competencies can primarily be obtained by university education, with different training outcomes at various levels of education.

In our study, we review the trends of the past 10 years related to agricultural education at BSc/BA and MA/MSc levels. We also examine the current digital skills of those working in agriculture, highlighting competencies related to data analysis. We present the digital technologies characteristic of the sector and those anticipated in the future, along with the associated required digital competencies. Our results are presented from the perspective of digital, data-driven decision support, which helps quantify and collect various indicators of effectiveness and sustainability within a framework, thus achieving the set economic and environmental goals. Our research is supplemented with data related to agricultural education in Hungary, showing where students have been employed after graduation. These job positions are further analysed with respect to the expected general, specific, and digital skills required for each position. The necessity for digital and soft skills creates a demand in agriculture for employees who possess adequate ICT and professional skillsets. In the absence of such skills, it becomes necessary to recruit in external experts who have dynamic (not just digital) competencies and high level of expertise. However, due to the adaptation process, this may not always be an efficient and a financially wise solution in the long term. Developing existing workforce can help overcome obstacles related to digitalization, such as a lack of awareness about digital tools, digital skills, infrastructure and business processes. This can be achieved by launching training programs aimed at the digital reskilling or upskilling of the current workforce.

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Keywords
Digital skills, Agriculture 5.0, data analysis

DANIA database for selecting irrigation investments in coherence with WFD and DNSH principle: A case study within Next Generation EU funds - Abstract

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Summary

This work aims to describe the use of DANIA (National Database on Investment for Irrigation and Environment) as the implementation tool in the projects' selection procedure of Italian National Recovery and Resilience Plan (NRRP) (I4.3 - M2C4) for funding irrigation network improving according to WFD objectives and DNSH principle. DANIA was the instrument through which irrigation boards submitted their projects for funding, then selected by Ministry of Agriculture according to eligibility and selection criteria defined and automatically applied to submitted projects basing on information collected in DANIA. The efficacy of this selection procedure in term of reduction of procedural times and data reliability have been analysed. Comparing the time of the different evaluation steps with that of the previous investment Programs, the use of DANIA has allowed to significantly reduce the time needed for the completion of all evaluation procedure, both in terms of days occurred per funded project (70% less than the previous procedure) and in terms of funded amount per days of evaluation (approximately double of the previous one). About data reliability, the information inserted in DANIA, and then the relative score assigned to projects, were confirmed by expert evaluation for the 69% of the funded projects and none of these differences is related to technical feature of the project. This allows us to argue that the applied selection procedure is reliable and that, in general, the irrigation boards enter accurate information.

Keywords

DANIA, irrigation investments, funding procedure, water management in agriculture, WFD DNSH.

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Enhancing data accuracy in agri-food forecasting: Methods and implications for informed decision-making - Abstract

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Summary

In the era of data, making informed, data-driven decisions is paramount, which require careful selection of appropriate data sources, proper data management and interpretation practices. By leveraging existing data sources, businesses can gain valuable insights and discover their competitive advantage. The European Commission has devised a comprehensive strategy known as the Food 2030 strategy to address various aspects of the food industry. This strategic framework sets specific goals aimed at enhancing sustainability, innovation, competitiveness and resilience within the sector, which heavily relies on data analytics.

In our article, we aim to demonstrate how enterprises can apply secondary economic data and use methodologies for trend analysis and forecasting. By utilizing secondary databases, organisations can effectively evaluate market stability and conduct comprehensive industry analyses. This approach not only enhances the accuracy of their assessments, but also supports strategic decision-making processes.

In the context of production-related data (including both volume and price data), missing values may occur. These gaps can be found in survey data and secondary data sources, highlighting the critical importance of addressing and filling in missing values. Missing or inaccurate data can introduce significant biases and distortions in time series in analyses, potentially leading to false results, flawed decisions and ineffective resource allocations. Estimating supply and demand data from secondary databases helps in predicting market trends, preventing market gluts or shortages. This contributes to price stability, reducing the volatility that can negatively impact both producers and consumers. Understanding the economic value of agri-food products assists in the efficient allocation of resources for agri-food companies. This ensures that resources are utilized where they can generate the highest economic return, promoting sustainability and profitability.

Our methodology involved utilizing monthly market price and production volume data (the analyzed period was 2004-2023) for different processed food products, which we transformed into a common framework using the ETL process. For forecasting, we applied the SARIMA (Seasonal Autoregressive Integrated Moving-Average) method using Python. Then we measured the forecasted error by comparing the predicted results with the actual, valid secondary dataset. This study focuses on evaluating how different estimation methodologies can be applied on datasets and how missing data can distort results.

The more accurate estimation of missing data (such as production volumes and prices) enables more precise market forecasts, helping companies better understand demand and supply trends. This allows them to optimize their production and inventory management strategies, such as deciding what to produce and in what quantities. It can also improve cost planning and pricing, as decisions can be based on more reliable data, including anticipated selling prices. It also aids in determining the necessity of investments, such as new equipment or technology, to enhance productivity and efficiency. In overall, the ability to accurately estimate missing data supports informed decision-making in the agri-food industry.

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Keywords
Forecast methodology, food industry, trend analysis

Comparative analysis of agroecology and agroecological transition curricula in Mediterranean countries - Abstract

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Summary

Agroecology and agroecological transition (AET) are gaining interest worldwide as promising paths to produce more sustainably, with significantly reduced environmental impact while addressing farmers' and consumers' wellbeing and needs. Agroecological transition requires capacity building of diverse targets, including farmers, actors in the farming products value chains, salespersons and policymakers. This has led to the development of learning approaches, dedicated educational programs, and training courses to foster the adoption of agroecology and enable innovative solutions. This study offers a comprehensive review of agroecology-related educational programs across seven Mediterranean countries: Algeria, France, Greece, Italy, Libya, Morocco, and Tunisia. Utilizing a standardized template, data were collected on course titles, institutions, study levels, durations, and languages of instruction. The analysis focused on the integration of key agroecological principles as defined by the Food and Agriculture Organization (FAO), including diversity, synergies, efficiency, recycling, resilience, human and social values, responsible governance, and culture and food traditions.

Findings reveal considerable diversity in teaching approaches, course content, and delivery methods among the surveyed institutions. While some programs emphasize practical skills and local environmental management, others adopt a more interdisciplinary approach, incorporating themes such as biodiversity, climate change, and food sovereignty. Notably, European countries in the study tend to offer more comprehensive curricula in agroecology compared to their North African counterparts, which may benefit from further development and integration of advanced and interdisciplinary courses to fully support agroecological transitions.

To address these disparities, the study recommends the development of new curricula that encompass both introductory and advanced agroecological principles, with a strong emphasis on practical applications and regional challenges. Initiatives like the NATAE project are instrumental in fostering international collaboration, designing new training programs, and sharing best practices across Mediterranean countries. The establishment of an international master's program in agroecology, as proposed by the NATAE project, could further enhance knowledge exchange and capacity building in the region.

Keywords

Agroecology, curriculum analysis, Mediterranean countries, sustainable agriculture education, NATAE Project

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Greek farmers' perceptions of precision agriculture technologies - Abstract

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Summary

How do farmers view precision agriculture technologies and evaluate their impacts on farming and agrifood systems? Our study aims to answer this question using qualitative data from a sample of Greek livestock farmers. The results indicate that farmers have a positive attitude toward these technologies. Nevertheless, they cannot clearly define precision agriculture, while they express several concerns about the adoption cost and the potential negative social and cultural impacts of precision technologies. These findings reveal the many different angles through which farmers view precision agriculture technologies.

Keywords

Precision agriculture, farmers, impacts, digital technologies, smart farming

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The impact of data, information and knowledge from precision agriculture on the economy and business management - Abstract

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Summary

The principles of precision agriculture are gradually becoming a trend in the entire agricultural sector – crop production, animal production, the use of technology, but it is necessary to incorporate the principles into the economy and management of agricultural enterprises. Precision agriculture enables efficient and economical management in the mentioned agricultural companies. Precision agriculture is therefore oriented towards the maximum use of the potential of soil, plants, machines, animals and, of course, also the human factor. In order to maintain the competitiveness of enterprises, it is necessary to address the use of data obtained from plant production, animal production and the use of technology in a complex manner in connection with the economy and management of the agricultural enterprise. The aim of the contribution is to propose a structure of data usage for improving the economic situation of the company and for its management.

Keywords

Precision agriculture, economics, information, data, knowledge, management

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AI in Wildlife rights and ethics - Abstract

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Summary

Machine learning, deep learning, neural networks, and artificial intelligence now could monitor ecosystems, record and protect the planet's biodiversity, contribute to resource management and save energy sources, record the overfishing of the seas, the pollution of the wetlands, the behaviour of wild animals, health prevention and the illegal wildlife trade, to identify and identify the various species etc. Artificial intelligence helps process large amounts of data related to wildlife monitoring, environmental DNA collection and environmental data analysis, nature of endangered species in an effort to preserve ecosystems. The aim of this work is to investigate the views of students on the use of technical intelligence in wildlife monitoring. For the purposes of the work, a research tool was developed which consisted of 30 items, which recorded the pros and cons of using machine learning algorithms to monitor wildlife. There were questions that captured the ethical and bioethical issues of wildlife monitoring through artificial intelligence.

The research instrument was evaluated for reliability and validity in a pilot sample of 35 respondents and found to have high reliability as well as high validity. 428 respondents took part in the survey. Data analysis was carried out with the help of fact or analysis of correspondences and the main trends of the respondents' responses were recorded. The findings showed that demographic factors differentiate respondents' opinions regarding the use of technical intelligence in wildlife monitoring.

However, no one doubts the potential of artificial intelligence to contribute to the sustainability of wildlife and the planet in general. However, there are bioethical dilemmas regarding whether we can intervene in such a way in wildlife monitoring. Also, cutting-edge technologies themselves raise special issues related to the transparency of algorithms, the bias in their decisions, and the ownership of the data they collect, process, and on which they develop their challenging models and drive decision-making.

More research needs to be done so that we can use artificial intelligence aimed at the sustainability of the planet, its ecosystems and the protection of fauna and flora.

Keywords

Students, AI, Wildlife, rights, ethics

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Digital Learning Hub for future green and ethical leaders: A mapping of educational initiatives related to sustainability in Higher Educational Institutes - Abstract

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Summary

Ethical business management practices (in terms of environmental, social, and economic ethics) are at the forefront of the public debate. Towards this direction, a critical question is whether Higher Education Institutions (HEIs) are prepared to contribute to the creation of future "green" and ethical leaders. Indeed, many institutions in Europe engage in the effort towards a socio-ecological transformation and are playing a pivotal role in utilizing methodologies of transformative education to enhance student's competencies, knowledge, and ethics towards a more sustainable and resilient future. This paper, outcome of the ERASMUS+ project PermaLABS (https://www.permalabs.eu/), tries to map educational initiatives related to sustainability in HEIs and then incorporate the principles & ethics of Permaculture into business and management studies which could further enable graduates capable of creating and leading sustainable, innovative, and resilient business that can better navigate the complex challenges of the modern world. Ultimately, learning materials such as syllabus, lesson plans, best practices from living labs and the creation of a digital social space for interaction among various stakeholders-students, business sector stakeholders, and citizens- would enhance peer-to-peer communication and cooperation and facilitate connections between academia and the business world, enabling students from different HEIs to exchange ideas and co-develop common projects.

Keywords

Permaculture, ethics, principles, Higher Education Institutions, sustainable business, management, training

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Openness in businesses: A case study of food businesses in Thessaly - Abstract

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Summary

The communication of the organizations with the internal and external environment is one of the most important tools for the growth and development of both the organization and the employees, over time. Considerable importance is attached to the way in which information is received and transmitted, as well as to the dissemination of knowledge. In the era of the 4th Industrial Revolution, e-government and digital transformation, special communication skills and competences are required of everyone. Especially in the pandemic era, new and complex problems have emerged. Communication helps to overcome friction and disagreements and at the same time influences the performance of employees. Communication spreads knowledge directly and effectively through all hierarchical levels, so that all employees are involved in decision making. One of the features of communication is openness which refers to unrestricted access to information and knowledge to all stakeholders.

The article presents the results of a study conducted among industrial food executives. The study presents the main factors that contribute to effective communication in organizations.

The results are particularly important, and any use of the results will contribute significantly to improving communication in companies.

Keywords

Communication, effectiveness, food industry, Greece, quality

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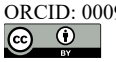
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Alternative protein sources: Generation Y's food neophobia, entomophagy acceptance, self-assessed environmental concern and intention to recommend entomophagy - Abstract

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Summary

The aim of this paper is to explore the Greek generation Y cohorts' food neophobia, intention to engage in entomophagy, self-assessed environmental concern, and intention to recommend entomophagy as an alternative for meat protein intake. Lastly, it groups participants based on the abovementioned variables. An online questionnaire applying a convenient sampling method collected data from 234 members of the generation Y cohort. Mean values (MV) revealed that the statement "If I don't like the look/appearance of a food/dish I won't try it" was the highest rated (MV=4.72 on a 7-point Likert scale). As to acceptance of entomophagy, the statement "I would only try insect-based foods abroad (e.g. in the Far East)" with MV=3.98 on a 7-point Likert scale. As to self-assessed environmental concern, results revealed that participants answered that "I am quite interested in environmental issues, but they are not my immediate priority" (MV=3.00 on a 5-point Likert type scale) and they are not likely to recommend entomophagy to others (MV=1.69 on a 5-point Likert type scale). K-means cluster analysis provided with three clusters. Communication marketing and sustainability education is discussed to raise awareness on entomophagy and possible acceptance.

Keywords

Entomophagy, generational cohorts, segmentation, marketing communication, Greece

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Students' evaluation of vulnerabilities towards climate change - Abstract

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Summary

The effects of extreme weather events around the world are enormous and have an incredibly substantial impact on humanity. Recent extreme weather events demonstrate the effects of climate change from Europe to Asia, from the Americas to Africa from the North and South Poles to Australia. These effects are both environmental and economic, social and even political. The risks from these effects include, among others, that of human life.

Very important are the effects in terms of natural disasters. However, the distribution of these disasters is not uniform. There are countries where disasters leave a big spot. Special mention is made here of disasters that occur in poverty-stricken countries. This has the result that the populations of such areas, on the one hand, do not easily deal with natural disasters, on the other hand, the possibility of recovery to the previous situation is minimized, making these populations extremely vulnerable. In these countries drinking water is missing, the destruction of agriculture is great, and the lack of resources maximizes the difficulties.

The purpose of this work is to study the views of students towards the dimensions of climate change and the degree of people's vulnerability towards it. 316 Greek male and female students participated in the survey. Respondents completed a purpose-built questionnaire including 5 demographic questions and 30 questions regarding vulnerability to climate change during the academic year 2023-2024. The questionnaire was evaluated for its reliability and validity in a pilot sample of 50 individuals and then distributed and completed by the 316 male and female students. The methodology of factor analysis of correspondences was applied to analyze the data. The results showed that the factors affecting vulnerability concern access to resources, governance and management of climate change, natural disaster prevention and environmental protection policies in general, the cultural level based on which threats or threats are understood and the risks posed by the climate change. Even social inequalities can lead not only to different sensitivity towards the dramatic effects of climate change but are an inhibiting factor in any equal access to resources, in access to food, clean water, education and disaster relief policies. Finally, the educational level is another factor that affects the response to climate change. It is also what shapes the interest in environmental ethics that is constantly being discussed, the development of which helps to understand the need to protect the environment to the greatest extent.

Keywords

Students, evaluation, vulnerabilities, climate, change

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Bicycle and cycling paths in Trikala city: Citizens' attitudes and opinions - Abstract

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Summary

In recent years, Greece has witnessed a noticeable increase in the number of citizens who decide to use bicycle as a means of transport for their daily commute. More and more people choose to abandon the car and switch to a more compatible means of transport with the urban environment, based on their ecological and social duty. The pursuit of a growing trend in use and a strategy to promote cycling for daily commuting requires the provision of appropriate conditions, both in terms of infrastructure and legal conditions, together with a change in the road behavior of all users of the transport infrastructure. This paper explores the views of the citizens of Trikala on the use of bicycle in their movements, as well as on the contribution of cycling paths to their quality of life. The research was carried out with the help of a structured questionnaire and through personal interviews. Data were collected and analyzed using the SPSS statistical package and descriptive statistics and multivariate analysis methods were used. From the results of the survey, it is found that citizens respond positively to the use of bicycle and consider that they face many problems in terms of the infrastructure available for its use. The construction of a cycling path should not only take into account the existing bicycle load but should aim to attract new users to meet the future demand that will develop. Expectations differ between cyclists, depending on whether they travel long or short distances, on the vehicle they have and on the purpose of the movement.

Keywords

Social research, recreation infrastructure, eco-friendly development, statistical analysis, sustainability

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Farmers' perceptions of the organic product certification procedure: A preliminary investigation in North Greece - Abstract

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Summary

This paper examines farmers' perceptions about organic certification procedures by focusing on complexity and effectiveness of the procedures required. Also, the paper tries to shed some light on the challenges faced by farmers in implementing the certification specifications and look for ways to improve the process. Overall, investigating farmers' perceptions of the organic certification standards is an important step towards promoting and improving organic agriculture, as it helps to tailor the certification system to better meet farmers' needs and concerns. The conducted analysis provides some first valuable insights into the general knowledge of farmers' motivations and preferences to adopt organic farming. The analysis revealed the influence of concurrent agricultural activities (conventional and organic), on the perceptions and preferences of farmers. Thus, the study highlights the differences between organic and conventional growers regarding compliance issues and perceptions of specifications, adding depth and practical significance of this study. Overall, the research constitutes a important contribution to the understanding of organic agriculture, deepening general knowledge of farmers' motivations and preferences in this field.

Keywords

Farmers' perceptions, organic farming, certification

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An evaluative approach of corporate sustainability in agrifood system - Abstract

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Summary

In recent decades, companies have developed innovative sustainable business management models capable of integrating green, resilient and inclusive approaches. Recently, partly as a result of EU and international regulatory guidelines, Corporate Sustainability (CS) is becoming more diffuse in business models through which companies have attempted to integrate the three dimensions of sustainability (economic, social and environmental). The objective of this research is to analyze the processes of integrating CS into business management and the related online communication of implemented sustainable actions, through an integrated methodological approach based on the analysis of the websites of Italian agribusinesses, using the "7S" method of analysis, supplemented by specific Focus Groups, to acquire qualitative information directly from a sample of companies to analyze the motivations for companies to move toward sustainable actions. In the paper, the methodological approach will be proposed, as the research is in progress and includes among the objectives, the identification of key drivers and the implementation of strategies for a CS in line with the SDGs related to the corporate ecosystem.

Keywords

Corporate Sustainability, website analysis, "7S model", SDGs, agri-food system

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Pro-environmental vs anti-environmental perceptions - Abstract

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Summary

Climate change is obvious nowadays. Human activities contributing to climate change have implications for ecosystems and natural resources, catches, agriculture and animal husbandry, health, nutrition and food, biodiversity, climate, clean water and reserves, clean atmosphere, the economy, and society as a whole [1]. The Theory of Ecological Attitudes suggests that individuals who appear to share Preservation attitudes in the framework of biocentric attitudes do not inevitably share anemic Utilization in the framework of anthropocentric attitudes. According to this theory, people are placed in one out of four quadrants rather than on each end of a continuum. Young people are the group most heavily involved in educational processes. The present project attempts to investigate students' Environmental Attitudes based on the Theory of Ecological Attitude. The research methodology involves a literature review and questionnaires. The research is carried out in three countries: Greece, Latvia, and the Netherlands. A certain number of students from each country participated in a survey regarding the purpose of the project. The analysis of the collected data illuminates the intricate interplay between students' attitudes and two contrasting perspectives: biocentric and human-centered attitudes towards the environment. It begins with an exploration of the prevalence of each attitude type and the correlations between these attitudes and various demographic factors are examined to discern potential patterns and associations. The findings shed light on the nuanced relationship between attitudes and environmental behaviors among students from different countries. The respondents predominantly fell within the age bracket of 19 to 23 years old, primarily comprising students from the three universities under study. A mere 15.3% of the participants were aged 24 years and greater than 24. It is noteworthy that although the distribution of questionnaires was consistent across all three countries (Greece, Latvia, and the Netherlands), the responses received were not evenly spread among these nations. Specifically, 42.3% of the total responses originated from Greece, followed by 35.6% from Latvia, with a notably lower contribution of 16.6% from the Netherlands. This lower percentage from the Netherlands can be attributed to the focus solely on Dutch students in our sampling strategy, despite the knowledge that universities in the Netherlands host a significant number of international students. The comparative evaluation among the students of the three countries highlighted that the biocentric (pro-environmental) and human-centered (anti-environmental) perceptions may co-exist at the same time. The results indicated that a new theory for environmental ethics has been deemed necessary.

Keywords

Environmental attitude, preservation, utilization, students

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Assessing students' perceptions and attitudes towards Wildlife by Principal Components Analysis and Implicative Statistical Analysis - Abstract

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Summary

Purpose: Wildlife has always been of interest to man, both because it aided him in his own sustenance and consequent survival, and as a means of acquiring wealth. The tracking, killing, or even exploitation of wild animals both for the exploitation of the fur skin state and for their use and tooling in zoos. For years now, people's demands for land, sea and drinking water have been an important priority. However, these demands have had a huge impact on the climate and the sustainability of wildlife. But the need for the sustainability of wildlife is more evident than ever as climate change and its effects have been realized the hard way. Floods, fires, global warming, and disasters are now more than evident.

A signal point concerns that Wildlife can pose a threat to human life both from attacks by wild animals, destruction of pastures and crops, as well as their transport, even fatal ones, which lead to new human diseases which can take on an extent pandemic. Consequently, there was a need to control the wildlife population. Transcendental ethics and animal ethics are now widely accepted. For this purpose of this research is the investigation and evaluation students' perceptions and attitudes towards Wildlife.

Design/methodology/ approach: For the survey aims, a questionnaire was released that explores the views and attitudes of students about wildlife. The questionnaire consists of 4 conceptual constructions which concern a. Wildlife damage management and includes questions exploring the right of farmers to protect their property, wildlife damage management, b The necessity of wildlife population control asks questions that explore the necessity of such control, c. The values of protecting wildlife, and wild nature and includes questions that express concerns about the protection of wild animals and ecosystems, the importance of all species and the value of animal welfare and d. The protection and sustainability of the environment and includes questions related to policies and actions for the protection of wild nature and eight demographic items. 322 Greek students from various university departments and faculties participated in the survey. Initially, a pilot survey was carried out with the participation of 50 students to assess the reliability and validity of the measurement tool and then it was distributed to 322 Greek students. Principal Components Analysis was used to analyze reliability and validity, while Implicative Statistical Analysis was used to analyze the research data. The completion of the questionnaires was carried out through the laboratory of biostatistics and biomedical research of the University of Western Macedonia, Greece and the University of Neapolis Pafos, Cyprus, after the relevant permission. The questionnaires were completed electronically.

Findings: The results showed that the male and female students of our sample understand the need to protect wildlife, and the environment with its ecosystems. Finally, they recognize the values of environmental ethics.

Practical Implications: The results and the limitations showed what a great need there is to protect the environment, its ecosystems and the wild fauna. Ethical concerns are raised regarding the protection of wild animals. Climate change will certainly motivate governments

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researchers and scientists to continue to study and fight for the protection of the planet and what will be left behind for generations to come.
Originality: The interest in climate change and the sustainable development of the planet and the protection of wildlife and animals in general is intense. What is important is the awareness of the situation and the effort to make animal rights accepted. Wildlife ethics makes its presence felt. However, approaching this ethics requires more research in the future.

Keywords
Students, perceptions, attitudes, Wildlife

Preservice students' knowledge and Attitude Biodiversity Conservation: A multi-level statistical analysis - Abstract

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Summary

Biodiversity is extremely important for the preservation of ecosystems, the viability of all living organisms and the protection of the planet. It contributes both to the maintenance of the food chain and the sustainable use of natural resources, the preservation of all living organisms and forests, the deforestation of which has a huge impact on climate change, environmental pollution, agriculture and livestock, public health and economic well-being. The biodiversity crisis has reached an unprecedented level. Natural disasters in habitats, ecosystems are irreversible just as climate change and environmental pollution are irreversible.

It shows how important the role of education and teachers is in order for students and students to learn the importance and value of preserving biodiversity which plays such an important role in the lives of modern people as well as future generations. Teachers are the ones who are called upon to make students or students aware of the need to preserve biodiversity. They are the ones who will highlight the impact of the effects of human activities on biodiversity across the planet.

They are the ones who are called upon to contribute to the formulation of educational policies as well as curricula, which will aim at the preservation of all life forms of terrestrial, aquatic and marine ecosystems as well as their care.

The aim of this work is to investigate the attitudes and beliefs of teachers regarding the conservation of biodiversity.

218 teachers were asked to answer a structured 5-point Likert-scale questionnaire, which recorded their tendencies towards biodiversity conservation.

Multivariate statistical analysis was used to process the data and analyze the results. The results of the research showed that there is a positive attitude towards the preservation of biodiversity, the need to protect their environment, the preservation of renewable energy sources, and in cultivating a deeply sensitized environmental and ecological consciousness. The consequences of human actions on the environment are thoroughly discussed, and the way in which educational programs can change the attitude of pupils and students towards the preservation of ecosystems, and care towards the environment in general. It is very important that pupils and students who are the hope of future generations with confidence and vision contribute with actions to the protection of the environment. Even the use of technical intelligence can greatly contribute to knowing exactly how all organizations develop and with the help of predictive models to support their sustainability.

Keywords

Students, attitude, biodiversity, conservation

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Residents' views and perceptions for the use and design of the urban green infrastructure to the second largest municipality of metropolitan area of Thessaloniki - Abstract

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Summary

Urban green infrastructure captures an appreciation of urban green as essential infrastructure that is as important to a good quality of urban life as technical or social infrastructures. The approach emphasizes the multitude of services and functions performed by urban green, all of which impacts the quality of life and on sustainability. we design green spaces; we pass from the meaning of the maintain of a natural landscape to the designing and construction of an artificial landscape that make the users feel close to nature or to a beautiful and useful environment. About the landscapes of Kalamaria, most of the residents find them more artificial than natural and the designing of the green spaces in their municipality as simple.
The unity between green spaces and neighboring buildings is also evaluated as important and the functionality of the green spaces that are different spaces satisfied different users considered as important. Then, the respondents asked how important it is that urban green constitutes an imitation for nature. Also, the infrastructure is the dominant element of the park. There is unity between green spaces and neighboring buildings. and the green space helps to socialization of the immigrants and refugees.

Keywords

Use, design, urban green spaces, parks, green infrastructure

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Data assimilation of LAI improved crop growth modeling: Comparison between in-situ measurements and satellite estimations - Abstract

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Summary

A digital twin of a crop can be created by the integration of real-time measurements into existing crop growth models. In this study, we used data collected at field level during the 2023 growing season and the WOFOST crop simulation model. The field experiment was conducted in Čenej (Serbia), where maize and soybean were cultivated. The field was subdivided into 20 management zones, but the study focused on 12 zones characterized by the highest variability. Six zones were allocated to each crop based on multi-year average NDVI values. Daily weather data on maximum and minimum air temperature, precipitation amount, wind speed and relative humidity were collected from a meteorological station placed next to the field, and additionally surface solar radiation was downloaded from ERA-5 reanalysis available at Climate Data Store. When the intensive crop growth started, data on the in-situ measured leaf area index (LAI) were collected biweekly, while the satellite LAI estimations were calculated from the cloud-free Sentinel-2 images by using Sentinel Application Platform (SNAP). The yield data were obtained at the end of the growing season from a GPS-equipped yield monitor mounted on the combine harvester and the values were aggregated at the zone level. The study focused on the LAI and investigated the performance of the crop growth model after data assimilation of LAI, obtained in two different ways. Data assimilation was performed using the ensemble Kalman filter, with 50 ensemble members, varying the total initial dry weight (TDWI) as initial condition, and life span of leaves (SPAN) as a parameter, both related to the leaves. Adjustment of each model state was based on standard deviation of the observed LAI and simulated LAI, as a measure of the uncertainty of the observation and model state. The WOFOST model was run for each zone and the results for yield prediction were compared in three different cases: simulation without data assimilation, data assimilation of in-situ measured LAI (M), data assimilation of LAI estimated from satellite images (E). Performance of the WOFOST model was evaluated for the final yield, comparing it to the observed yield, by using standard error metrics such as mean absolute error (MAE) and root mean squared error (RMSE). For maize and soybean, the WOFOST model without data assimilation has an average MAE across all six zones 1198,50 kg/ha and 240,71 kg/ha, and an average RMSE 1492,57 kg/ha and 275,76 kg/ha, respectively. In the second case, the performance of WOFOST simulation with data assimilation using in-situ measured LAI was improved for both crops. For maize, a decrease is observed in both average MAE and RMSE across all six zones (MAEM=947,27 kg/ha and RMSEM=1011,03 kg/ha). Similarly for soybean, MAEM=217,43 kg/ha and RMSEM=231,92 kg/ha. In the third scenario where the data assimilation is performed using LAI estimated from

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satellite images, for maize the model overperformed the two other cases, where MAEE=543,69 kg/ha and RMSEE=632,59 kg/ha, while for soybean the model performed better compared to the model without data assimilation and worse compared to data assimilation with in-situ measured LAI, where MAEE=227,61 kg/ha and RMSEE=256,27 kg/ha. The results show that data assimilation can lead to an improvement in crop growth model performance in terms of predicted yield.

Keywords
Digital twin, Data assimilation, WOFOST, Ensemble Kalman Filter, LAI

Machine learning modeling exploration for under-bark tree bole volume estimation - Abstract

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Summary

This paper investigates the potential of utilizing both probabilistic and ensemble supervised machine learning modeling strategies to accurately estimate under-bark tree bole volume. For this purpose, primary measurement data from pine trees (*Pinus brutia* Ten.) in the Seich–Sou suburban forest of Thessaloniki, Greece, were used. The described analysis can offer a strong foundation for understanding the performance of both non-parametric modeling approaches. Specifically, the study employed the probabilistic Gaussian Process Regression (GPR) modeling methodology with an integrated radial basis function (RBF) kernel. Furthermore, based on its well-known ability to predict values for continuous variables, the ensemble learning technique chosen for investigation was Random Forest regression (RFr), which integrates the bootstrap aggregation methodology. A cross-validation procedure, combined with an exhaustive grid-search methodology, was employed to determine the optimal hyperparameter combination for each constructed model. Despite the challenge of identifying the optimal combination of numerous hyperparameters unique to each modeling approach, the results demonstrated that both methodologies, due to their flexibility, have significantly strong potential to provide reliable under-bark tree bole diameters and volume estimations. This contributes to the sustainable management of forest resources and highlights potential areas for further exploration and improvement.

Keywords

Gaussian Process Regression, Random Forest regression, pine trees

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A novel low-cost system for Xylella fastidiosa early detection using electrical conductivity probes - Abstract

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Summary

Xylella fastidiosa is a devastating pathogen that has significantly impacted olive cultivation, particularly in Southern Italy since 2013. Monitoring and early identification is crucial for managing the spread of this disease and minimising associated economic losses. This study presents a low-cost system employing electrical conductivity (EC) probes to monitor the water status of olive tree stems, enabling the early detection of *X. fastidiosa*. The system provides real-time data by detecting changes in EC, which are possibly correlated with the presence of the pathogen. In contrast to traditional detection methods like PCR, which are expensive and require laboratory facilities, this system offers a practical, field-deployable, and sustainable solution. In a testbed EC probes were installed on an olive tree in Southern Italy, with data transmitted via a GSM network to a central server for analysis. Powered by solar energy, the system successfully detected changes in the stem's water content, which were subsequently confirmed to be associated with pathogen presence. This low-cost EC probe system initially demonstrates promising potential for the early detection of *X. fastidiosa*, enabling proactive management strategies. Future research will focus on improving the system's sensitivity and conducting extensive field trials across diverse environments and applications.

Keywords

Xylella fastidiosa, low-cost sensors, early warning, signal analysis

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Simulation scenarios of red palm weevil dispersion in Corfu, Greece - Abstract

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Summary

This paper presents a simulation study investigating the possible dispersal of the red palm weevil, a highly destructive pest affecting various palm species, across the island of Corfu, Greece. The simulation incorporates ecological modeling and geographical data to analyze the dynamics and their spread of red palm weevil populations over time and space. Key findings indicate that factors such as tree density and spatial distribution significantly influence infestation rates, with densely populated areas being more susceptible to rapid spread. The study underscores the importance of early detection and targeted interventions to control red palm weevil populations and mitigate their impact on affected regions. This research contributes to the development of effective pest management strategies that could potentially be adapted to address similar invasive species challenges in other agricultural contexts.

Keywords

Rhynchophorus ferrugineus, date palm, simulation, spaciotemporal, dispersion. population

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Gamification of Agrotourism industry to maximize efficiency - Abstract

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Summary

In the last two decades, rural regions have been suffering from profound populational abandonment, due to a lack of economic dynamism, motivated by a declining agricultural sector. Conversely, in these regions the tourism sector has been maintaining economic vigour, even recovering old houses, thus creating a new rural tourism offer. The synergies between the agricultural and the tourism sectors are obvious, despite not being frequently explored, especially by smaller operators.

The project GAIME aims to boost agricultural activities in rural regions through cooperation between operators from both sectors. The project strategy is based on a gamification-based process of agritourism experiences, seeking mutual gains between all actors.

Keywords

Agrotourism, Gamification, Promotion of Rural Areas

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Assessment of autonomous mower effect on Phyla nodiflora and pollinator presence in urban lawns - Abstract

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Summary

Planning and management of green spaces play a key role for the biodiversity conservation and enhancement in urban context. Among these green areas, lawns can provide different ecosystem services including the biodiversity promotion. Furthermore, residential, and public lawns are crucial for bees and other pollinator populations, that support plant reproduction, thereby enhancing overall biodiversity. However, lawn management practices, especially intensive mowing, can negatively affect plants diversity and abundance, and disrupting pollinators' activity. Since the use of traditional mowing machines (i.e., ride-on mowers and walk-behind mowers) produces local noise and pollution, can be dangerous for the operators, and is a time-consuming activity, autonomous mowers are becoming very popular in both public and private green areas. Nevertheless, very little is known about their influence on biodiversity and particularly on pollinators. In this perspective, the use of Phyla nodiflora, a creeping plant species frequently visited by pollinators, obtained positive results when managed with an autonomous mower. In this study, P. nodiflora plants are transplanted in spots within a turf mainly composed of bermudagrass (Cynodon dactylon × C. transvaalensis "Patriot") with the aim of promoting greater floral diversity and the conservation of pollinators. The research aim is to evaluate two different autonomous mowers navigation systems (random vs systematic) and two different cutting height (2 cm vs 6 cm) in terms of the effect on P. nodiflora. The percentage of surviving individuals, the average coverage of the single individual, the number of flowering individuals, and the flowers height are evaluated. Moreover, correlated with the flowering parameters and plants habitus adaption to the cutting system, the pollinators abundance and diversity are visually evaluated. According to an initial hypothesis, the systematic navigation system, being more efficient and thus ensuring less overlapping, could potentially have a lower impact on P. nodiflora individuals promoting greater survival and flowering. Alongside systematic navigation system, the higher cutting height might further enhance flowering and consequently attract more pollinators.

Keywords

Biodiversity, turfgrass, entomofauna, mowing activity

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Evaluation of flight directions and other canopy coverage characteristics from aerial spraying, using Remotely Piloted Aerial Application Systems (RPAAS aka drones), in a high-density linear olive grove - Abstract

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Summary

The use of Remotely Piloted Aerial Application System (RPAAS, aka drones) for applications of various plant protection products, fertilizers, biostimulants, air seeding and air-fertilization is becoming the most effective way for to provide sustainable solutions in all crop species. It is also the faster developing agricultural technology and very much accepted and used by farmers and other stake holders. However, few studies exist to evaluate precisely the overall effectiveness and efficacy of these systems. The RPAAS Currently used mainly in field crops and not much on tree production systems. This study was established to specifically evaluate the flight direction (parallel vs. perpendicular to planted lines) in a linear and high-density olive grove, at the premises of the Perrotis College/American Farm School, Thessaloniki. The olive grove adapted for mechanical harvesting, was established in 2011 and consists of two varieties used in these systems (Arbequina and Koroneiki), three planting densities a Super high Density (SHD), a High Density (HD) and a Medium Density (MD) with 1670, 1000 and 500 trees/ha, respectively, spaced at 4 m between the rows. The traditional olive systems use ca. 250-350 trees/ha spaced in orthogonal systems. These density systems represent a much more dense plant canopy than the traditional olive groves and it is a unique case to evaluate penetration studies with aerial spraying systems. The drone used two Flight Directions (FD), a parallel (Par FD) and a perpendicular (Per FD) to the planted lines, using various flight settings (volume, height and speed). The percent Canopy coverage (PC%) and other droplet characteristics were recorder with Water Sensitive Papers (WSP) in all three planting Densities and in three heights (low –medium –high) within each olive tree replicated. The overall results indicated that the Perpendicular flight (Per FD) provided a better coverage and also planting densities and tree profile, were not shown to significantly vary among all three densities These results can be used by users of RPAAS to achieve better canopy coverage in foliar applications. Therefore, using the same volume of spraying, a higher coverage can be achieved. The results presented in this study are only applicable to the specific type of high-density olive linear systems and should not be extrapolated directly to other linear systems such as vineyards, fruit trees, due to the differences in plant canopy, geometry and density and to traditional olive groves. Comparative aerial spraying studies between high and traditional olive densities and in vineyards are in progress at Perrotis College/American Farm School.

Keywords

RPAAS, UAS, spraying drones, high density olive, flight direction evaluation

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Spatiotemporal patterns of olive fly movements: Impact of variety, temperature and altitude in five olive oil production areas in Greece - Abstract

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Summary

Olive fruit fly (*Bactrocera oleae*) is a pest affecting olive production, causing both qualitative and quantitative damage in all regions of the Mediterranean. This study investigates the spatiotemporal dynamics of olive fruit fly populations which have obtained from an extensive trap network in five olive-growing regions of Greece - Chalkidiki, Samos, Lesvos, Lasithi and Chania - over a two-year period (2022-2023). The aim is to understand if and how, factors such as variety, temperature and altitude affect the population of the olive fruit fly. Using Geographical Information System (GIS) tools and spatial analysis, we correlated olive fruit fly numbers with temperature thresholds and altitude categories to analyze different patterns of pest movement. Results show significant variation in population dynamics based on these factors, for altitudes, region and a temperature threshold (at least above 32^{O}C) for population reduction. These insights are necessary for developing effective and sustainable pest management practices considering spatial and temporal variability of olive fly movements.

Keywords

Olive fruit fly, spatial analysis, pest management, olive variety, sustainable agriculture

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Development of Rust disease prediction models with the use of satellite derived vegetation indices from wheat and maize parcels in Kenya and Uganda - Abstract

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Summary

Rust disease in wheat and maize severely limits crop production in Africa, impacting smallholder farmers and causing economic losses in the hundreds of millions annually. Agriculture employs 70% of the workforce and contributes 30% to GDP in African economies, making smallholders particularly vulnerable due to limited resources and access to modern technologies. Frequent crop losses and food insecurity underscore the need for effective rust monitoring. Advances in satellite-derived vegetation indices combined with on-site rust scoring offer potential for early detection. These indices help identify early rust infections by tracking subtle changes in crop health. In this study rust detection models were developed using satellite data and on-site rust scoring to guide interventions and reduce the impact of rust on production. The models, tested across various regions, showed early detection accuracy but varied by location due to environmental factors. Successfully implementing these models could revolutionize rust management in African agriculture, enabling farmers to apply timely measures like fungicides, irrigation adjustments, or crop rotation. This proactive approach can safeguard yields, ease economic burdens, and improve food security. Despite the need for further customization, these technologies could transform agricultural practices and benefit millions of smallholder farmers across Africa.

Keywords

Food security, Rust disease, predictive modeling, disease outbreaks

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On transforming FoodEx2 to a standardized and interoperable thesaurus - Abstract

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Summary

Food resources management plays a pivotal role in addressing global challenges related to food security, sustainability, public health and economic development. To facilitate the collection and reference of food resources, various collections and systems have emerged from the scientific community. One such system is FoodEx2, which has been developed by the European Food Safety Authority and is used for classifying and describing food-related information. In this paper, we describe how FoodEx2 can be transformed into a standardized thesaurus using well-established technologies and standards that enhance its interoperability and exchange of data resources. The new thesaurus also promotes its usage, through the adoption of unique and global identifiers for its contents and through a variety of tools that can be used for accessing and visualizing it. In addition, we describe how the thesaurus can be reconstructed from the original sources, as they evolve.

Keywords

Thesaurus, FoodEx2, SKOS, taxonomy, semantic web

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Current status of augmented reality marketing in the food and beverage industry - Abstract

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Summary

The demand for sustainable, high quality and safe food products is pressing businesses in the food and beverage industry (F&B) to deploy innovative technologies that can change the way food is produced, processed, distributed, advertised, and consumed. Augmented Reality (AR) can be widely regarded as one of the most exciting cutting-edge technologies that rapidly gains popularity. Currently, it has been applied in different sectors for serving various goals, such as education, tourism, and marketing. AR marketing represents a novel marketing approach providing businesses with innovative opportunities to support interactive experiences, enhance customer engagement and brand visibility, and potentially drive sales growth. The application of AR in the F&B industry can transform the way consumers interact with food products and beverages, offering a glimpse into a future where menus come alive and food packaging unlocks hidden stories.

In this context, this study presents a review of the state-of-the-art of AR marketing focusing on the F&B industry. Through a systematic analysis of existing research, this review aims to establish a comprehensive understanding of the current landscape and future potential of AR marketing within the F&B industry. There are three primary goals that underpin this study: (a) to depict the overall evolution of the research landscape with regards to AR marketing in the F&B industry; and (b) to identify the application area and context of AR marketing in the F&B industry; and (c) to study which approaches and methodologies are being utilized to AR marketing research in F&B industry.

For the aims of the study, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) method was employed for searching two scientific databases, namely Scopus and Web of Science. The search employed a combination of relevant keywords pertaining to the field of AR marketing and the F&B industry and included journal articles or conference papers written in the English language. No limitation was applied to the year of publication, given the novelty of the research topic. The search returned a total of thirty-three (33) studies published from 2011 to 2024, namely twenty-one (21) of these studies were retrieved from Scopus database, while the remaining twelve (12) from Web of Science. Nevertheless, the analysis identified seven (7) studies that are included in both databases, therefore twenty-six (26) studies were assessed as eligible.

Despite the promising potential of AR marketing, the research in the F&B industry remains limited. Concerning the area and context of application, AR marketing is mainly deployed for interactive information supporting the provision of nutritional data on consumer food selection packaging, virtual try-on experiences, wine tourism experiences, and gamification elements. Research studies are also conducted for evaluating the influence of AR on consumer behavior, focusing on decision-making, satisfaction, and brand perception. Regarding the methodologies that are being utilized, empirical approaches dominate. These approaches leverage technology and models to superimpose digital information into the physical world, fostering a dynamic and interactive experience. Overall, the results reveal that in the context of utilizing AR for

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marketing purposes, the F&B industry currently lacks extensive analysis, and it is underlined that the impact of AR on food supply chains is a novel area of investigation.

Keywords
Marketing, augmented reality, food and beverage industry, wine

Unveiling the secrets of embeddings: Does the importance of agricultural terms relate to the context they occur in? - Abstract

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Summary

Advances in language modeling have provided affordances for term extraction based on the capture of the lexical context and its semantics, and encoding this in real-valued vectors (embeddings). Term importance is usually computed using quantitative measures ignoring the semantic context. Till now, there is limited or no research on the effect of context on term importance using machine learning methods. In this paper, we investigate whether there is a relation between the importance of agricultural terms and the context of their occurrence as represented by text embeddings. Using a dataset of almost 33.7K AGRIS abstracts containing 50 concepts randomly extracted from AGROVOC, we computed the correlation between the concept tf-idf scores and each of three semantic distances (cosine similarity of embeddings) used as a proxy to context: (i) semantic distances of the various occurrences of the concept; (ii) semantic distances between the concept and the abstracts it appears in; (iii) semantic distances of the abstracts in which the concept occurs. Embeddings were generated using Agriculture-BERT. We present a methodology and initial results from the computation of correlations. The novelty of our work is in the systematic investigation of the relation between term importance and semantic context.

Keywords

Term importance, term occurrence semantic context, semantic distance, correlation

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Security aspects in the Agriculture IoT infrastructure: Network segmentation and security infrastructure perimeter - Abstract

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Summary

This thesis focuses on the analysis of security aspects within the Internet of Things (IoT) infrastructure, specifically targeting endpoint unmanaged devices. Security issues within the IoT infrastructure are intricate, presenting a broad spectrum of potential challenges that can be addressed or optimized. In this domain, the fundamental elements constitute an integral part of the overall infrastructure security. The study examines the issue of inadequate communication security from endpoint devices, which requires detailed exploration and an effort to define universal security standards. The primary challenge lies in the design of the infrastructure and the implementation of network segmentation, which was successfully identified.

Keywords

Internet of Things (IoT), security, network segmentation, endpoint devices, infrastructure, communication

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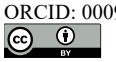
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Exploring consumer intention to purchase blockchain-traced pasta - Abstract

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Summary

This study explores consumers' purchase intentions for organic pasta with blockchain-based traceability, employing an extended theory of planned behaviour (TPB) model. Analysing responses from 190 Italian respondents via a structured online questionnaire, the research investigates how attitudes, subjective norms, perceived behavioural control, trust in quality certifications, and attitudes toward technology shape purchase intentions for blockchain-based food. Structural equation modelling (SEM) reveals that subjective norms, perceived behavioural control, and positive attitudes toward technology significantly influence purchase intention. In contrast, trust in quality certifications and general attitudes toward blockchain traceability show no direct impact. The findings highlight the importance of social influence and technological familiarity in promoting blockchain adoption for food transparency.

Keywords

Consumer purchase intention, Theory of Planned Behaviour (TPB), organic pasta, blockchain, traceability, food transparency, Italian consumers, blockchain adoption, food quality certification, technology acceptance, agri-food sector

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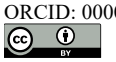
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Modeling wildfires' spread based on low-cost sensors measuring real-time moisture content - Abstract

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Summary

This study addresses the growing challenge of accurate wildfire prediction by integrating low-cost, real-time sensors into fire spread simulations. Traditional models, which often rely on static data, tend to underestimate risks, particularly concerning plants' moisture content, a crucial factor in fire dynamics. Our research enhances an existing cellular automata model by incorporating real-time data from dense networks of low-cost sensors that monitor environmental variables such as temperature, humidity, and plant moisture levels. The simulations reveal that lower moisture conditions significantly accelerate fire spread and increase the total burned area. These findings underscore the importance of real-time data integration in wildfire management, improving the precision of predictions and enabling more effective prevention and response strategies. By deploying these low-cost sensors, especially in remote and high-risk areas, fire management teams can better anticipate and mitigate the impact of wildfires. This approach has the potential to significantly enhance wildfire resilience in the face of increasing fire incidents driven by the climate crisis.

Keywords

Wildfire prediction, Wildfire modeling, Low-cost system, Real-Time Sensors

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GreenDriedFruits-App: Dynamic disinfestation modelling and application within dried currants commodity warehouse - Abstract

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Summary

Food products play a crucial role in the sustenance and health of human populations worldwide. Among these, dried currants are highly valued not only for their rich nutritional content but also for their versatility in various culinary applications and are among the primary dried fruits cultivated in Mediterranean regions due to their exceptional nutritional value. However, there is a gap regarding data concerning their storage and disinfection processes. The utilization of extreme temperatures offers a promising alternative to chemical methods for effectively disinfecting various stored commodities, including dried fruits and grains. Nevertheless, the lack of data concerning the influence of commodity presence on Thermal Penetration (TP) and the efficacy of such methods creates the potential for misconceptions to arise. This study aims to assess the efficacy of both cold and heat treatments under real-world conditions, considering the crucial factor of product presence. An initial Thermal Treatment (TT) model is developed using TP algorithms based on Newton's Law of Cooling (NLC) for simulating thermal penetration over time and determining the time required for the entire pallet to reach temperature. Predicated on storage facility settings, a simulation model was tested, demonstrating the feasibility of designing an algorithm that is based on the different time-mortality combinations for the different application scenarios and TP. In addition, temperature/humidity sensors were utilized to record temperature values in different settings. As a solution to storage and disinfection processes, a web application is developed that calculates the disinfestation duration given the appropriate parameters and stores all relevant disinfestation data providing a holistic tool to support actors. This tool was tested in – Agricultural Cooperatives' Union - Aeghion S.A. warehouse located in Aeghion, Greece. Our findings indicate a significant impact of product presence on the effectiveness of the TT method on major pests of currants. In conclusion, the results of our study highlight cold and heat treatment as a viable, more sustainable disinfection strategy for enduring stored products, while the utilization of the web tool facilitated the processes.

Keywords

Thermal treatment, thermal penetration, modelling pests, integrated control, application

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Planetary health and digital Agriculture: Rethinking technological innovation - Abstract

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Summary

Currently we are in the middle of an environmental crisis of ever greater severity. This is in large part a consequence of the industrial agricultural methods used, but equally agriculture is one of the areas of human activity suffering the most severe impacts from environmental disruptions. The promise of precision agriculture and smart farming has been significant reductions in the environmental impacts of agriculture. This promise is dependent on a narrow view of the environmental impact of using advanced technologies on the farm. A wider perspective is needed to assess the impact of these technologies such as that provided by the concept of Planetary Health. We present a tripartite approach to evaluating technological innovations inspired by the climate emissions reporting standard and the Planetary Health paradigm. Scope one concerns purely the activities and impact on the farm, scope two concerns the landscape as defined by geographic and social delimiters, and scope three concerns the whole planet. We provide a set of questions at each level to consider the direct and indirect/long distance impacts of any given technological solution.

Keywords

Digital agriculture, planetary health, food system, climate breakdown, biodiversity collapse

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Segmentation models using active contours for environmental disease images - Abstract

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Summary

An important factor in the processing of images that capture natural phenomena (such as environmental spreading diseases) is the isolation of specific areas where the phenomena take place. Models that interpret the phenomena are proposed in order to process the specific images by taking the changes in space in different time periods (spatiotemporal models). Isolation of homogeneous regions can be achieved using segmentation techniques. During the image segmentation process, specific regions with similar characteristics are separated. Usually for the development and selection of a segmentation technique the properties of discontinuity and similarity are used by applying active contour techniques. In this work, precipitation image segmentation techniques are applied where areas of uncertainty are analyzed using active contour models.

Keywords

Spatial models, environmental diseases, segmentation, active contours

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Assessing consumer awareness and willingness to pay for agroecological products in Egypt: An explanatory study - Abstract

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Summary

The demand for more nutritious and sustainable food is projected to increase by 50% by 2050, especially after the covid-19 pandemic created considerable pressure to improve productivity. However, productivity gains must align with sustainable environmental goals, since conventional agriculture has already failed to meet the food insecurity problem and has destructive effects on earth system functioning through changes in biogeochemical cycling, greenhouse gas emissions, and drastic loss of biodiversity. It also has an indirect negative impact on nutritional health. The recommended solution, according to previous research, is to replace conventional practices with agroecological (AE) practices. However, implementing agroecological practices faces some obstacles. The most critical is a lack of consumer awareness and a decrease in willingness to pay for innovative products, especially in developing countries. Therefore, this explanatory study aims to fill the literature gap by providing comprehensive data on the level of consumer awareness toward AE products, as well as identifying and understanding different socio-economic aspects that affect consumer complex purchasing behavior toward innovative agroecological (AE) products in North Africa. To ensure the diversity and representativeness of the sample, 446 questionnaires were randomly collected based on the Egypt population census for age, gender, and different participants' socio-economic characteristics. First, descriptive analysis was run to understand the demographic characteristics of the sample. Principal Component Analysis (PCA) was performed to collect information about consumer awareness based on a 5-Likert scale. Almost 62% of the variation in Egypt's data was explained by the nine factors from PCA that were retained due to their eigenvalues that were greater than 1. Multiple linear regression analyses were conducted between different socio-economic characteristics as independent variables and between each retained principal component as a dependent variable. Components "consumer perspectives on the environment's future", "consumer awareness of farming practices", "consumer knowledge about AE practices", "consumer awareness about environmental problems", and "consumer beliefs and impact on the environment" proved to have a significant impact on consumer behavior and can help in future prediction. ANOVA analysis was run for components "consumer perspectives on the environment's future" and "consumer awareness of farming practices "as they met the test assumptions. The results showed that participants with higher educational levels had higher perspectives on environment's future and an increased level of awareness of farming practices. In addition, participants living in rural areas, especially those in age groups "20-24", "25-29", and "34-39" are considered to have a higher

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awareness of farming practices. Finally, multiple linear regression analysis was conducted for the second time between socio-economic characteristics as an independent variable and each question related to willingness to pay in the questionnaire as a dependent variable. The study found significance in the "Willingness To Pay (WTP) for cereal AE products in Egypt", indicating a rise in WTP among participants with lower professional status, such as students or the unemployed. Additionally, willingness to pay increases as average monthly income, and the number of adults in households increases. These results can be used to develop effective marketing strategies and encourage different stakeholders to support agroecological practices.

Keywords
Consumer behavior- Agroecological practices – Principal Component Analysis

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Agroecological perspectives in North African National Public Policies: A transversal analysis of trends, strengths and weaknesses - Abstract

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Summary

North Africa's natural resources are facing significant degradation due to overexploitation of renewable water resources and climate change. The region is particularly vulnerable to climate shocks, having experienced rising temperatures, reduced precipitation, and increasing water scarcity, with more severe conditions anticipated in the future. This abstract represents the findings of a transversal analysis which was performed to improve the understanding of public policies as a context for the practice of agroecology in North Africa and which could thus constitute either obstacles to its adoption, or levers favourable to its development. It is based on the work made under the deliverable D6.2 of the NATAE project (Horizon Europe: ID 101084647) which was produced through the investigation of policy documents collectively by five North African and two European partners. It also revolves mainly around agricultural policies at national level but touches on other sectoral strategies as environmental, water, and climate change, particularly in Algeria, Egypt, Mauritania, Morocco, and Tunisia. Under this task, agroecology is understood as an interdisciplinary approach that integrates ecological concepts with agronomic practices, focusing on sustainable soil and plant management, promoting biodiversity, and enhancing food security and sovereignty while also addressing socio-economic dimensions by fostering local cooperation and minimizing external inputs. Main observations of the analysis show that, despite their unique and different contexts, North African countries are seen to share certain similarities, such as the economic and social significance of agriculture, varying but important levels of food dependence, and high vulnerability to climate change. Current national agricultural policies do not sufficiently address the scarcity and fragility of natural resources, with climate change exacerbating soil and water degradation. In fact, there is a dominating agricultural growth model emphasizing food security and increased production for domestic needs and exports, often disregarding environmental sustainability. Although environmental considerations are increasingly mentioned in policy documents, they are not effectively applied in practice. This was particularly evident in cases where rational resource management were introduced for increased productivity, cultivated surfaces and export objectives. Water remains a central issue, and many policies exist around water-saving technology, such as the application of drip irrigation, or water collection infrastructure. Yet, it is seen that these policies tend to encourage this optimization with the objective of increasing irrigated areas and production. A paradox therefore remains between the reality of food dependence, which leads to policies of intensification and maximum exploitation of resources to increase production, and the insufficiency of resources threatened by climate change. Efforts towards sustainable development are often disconnected from broader policies, such as environmental. Agroecology is not explicitly mentioned, with only rare exceptions introduced by international cooperation agencies. Practices comparable to agroecology are however observed among family and small farmers, though driven by necessity and cost-efficiency rather than policy

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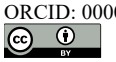
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support. Sustainable development efforts in North African countries are in fact frequently supported by international cooperation and NGOs, yet public policies continue to encourage intensive resource exploitation. Although environmental actions are mentioned in national strategies, they are usually driven by external organizations and executed in localized projects, which limits their impact and integration into broader agricultural policies. The transition to agroecology thus requires better alignment between public policies and environmental strategies, and with cohesive implementation programs which remain dispersed today with no clear linkages. Reconciling short-term food security measures with long-term sustainable development goals is essential for a balanced and sustainable agricultural approach in North Africa. A first step for a path towards that goal would be to bridge the research gap by generating place-based scientific knowledge leveraged by local civil society and professional organisations for demonstration and advocacy.

Keywords
North Africa, agroecology, public policy, agriculture

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Understanding the impact of Agroecology on consumer behavior: A systematic review - Abstract

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Summary

Agroecology has emerged as a critical approach to sustainable agricultural practices among global challenges such as climate change, food security, and biodiversity loss. This systematic review synthesizes findings from various studies on consumer behavior towards sustainable and agroecological food products. The primary goal is to identify key factors influencing consumer decisions and evaluate the effectiveness of different marketing strategies. Agroecological practices combine agricultural methods with scientific principles, promoting farming systems that minimize the need for external inputs like chemical fertilizers and pesticides. At the same time, consumer trends have shifted towards greater environmental sustainability, with modern consumers increasingly seeking organic, locally produced, non-GMO products cultivated with ethical practices. This trend highlights the potential for agroecologists to realign the agricultural market model to better meet ecological and economic goals by covering consumer demands.

Key factors influencing consumer preferences for sustainable products include price sensitivity, environmental awareness, health concerns, and demographic characteristics such as age and gender. Despite a strong interest in sustainable options, barriers such as higher costs and limited awareness hinder extensive acceptance. However, factors like enhanced environmental awareness, perceived health benefits, and targeted marketing enhance consumer engagement with agroecological products significantly. The review identifies several critical gaps in the literature, particularly the need for more multidisciplinary research focusing on underrepresented regions and a deeper exploration of the impact of digital media on consumer behavior. Most of the studies examine agroecology from an environmental and production perspective, creating a gap in understanding how these methods affect consumer behavior and market dynamics. Addressing these gaps could lead to the development of alternative strategies to promote sustainable consumption and align agricultural practices with consumer expectations.

To implement these practices, businesses should take into account the environmental awareness and health concerns incorporating them in their marketing strategies to attract more consumers to agroecological products. Policymakers need to foster regulations that support sustainable agricultural practices and educate consumers on the benefits of agroecology. Educators should focus on increasing consumer awareness and knowledge about sustainable practices to drive demand for agroecological products. Future research should aim to provide a comprehensive analysis of how agroecological practices influence consumer behavior, considering the socio-economic and psychological factors involved. This approach is essential for ensuring the long-term viability of farming communities and meeting global food demands in an ethical and environmentally responsible manner.

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This systematic review highlights the significant role of agroecology in shaping consumer behavior towards sustainable food products. By addressing the identified barriers and motives, stakeholders can cultivate a more sustainable global food system. Aligning agricultural practices with consumer preferences and promoting the adoption of sustainable consumption patterns is crucial for the achievement of a more sustainable agricultural sector.

Keywords
Agroecology, Consumer Behavior, Systematic Literature Review, Agroecological Practices, Agriculture

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Identifying the producing systems in the area of Upper Egypt regarding their crop pattern activities and their linkages to the market - Abstract

Christos Galanis [1], Georgios Kleftodimos [1], Hatem Belhouchette [1], Seyhan-Sevde Cagiran [1], Amelie Bourceret [1], Leonidas Sotirios Kyrgiakos [2], Christina Kleisiari [2] and George Vlontzos [2]

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Summary

In low-income countries agriculture is often the mainstay of the economy and the main driving force regarding food security and lifestyle maintenance, especially in rural areas. It is dominated by small-holders and family farms which are characterized by small size, lack of labor, low productivity and diversity of crops mainly cultivated for self-consumption. At the same, the booming population that exist in the area has create imbalances regarding the ability of the sector to properly nourish the people, while the GDP of the region of North-Africa dropped almost 15% between the years of 2014 to 2017. Also, this cropping method makes the agricultural systems vulnerable to climate change, by increasing the amount of human effort that is required. One of these cases is Egypt and specifically Upper Egypt is consisted of vulnerable small sized producing systems, with limited access to the market and labor setting a thorny issue to their resilience. As a solution in this area, agroecology appears as a set of practices that can assist into succeeding the fortification of the success in the cultivation process of farmers. However, even if its benefits can be highlighted, the adoption of these practices is strongly governed by determinants that the farmers have. These determinants are of plethora of dimensions such as economic, environmental or social, strongly affecting the decisions of farmers. Thus, this study aims to examine farmers decision-making process towards the adoption of agroecological practices in the area of Luxor. In this context, in the area of Luxor, four different agricultural systems were identified with different drivers for each one. To generate the agroecological scenarios a bioeconomic model was utilized (DHABSIM) and simulations were performed to indicate the benefits in profitability of adopting the proposed practices. Indeed, a change in salinity varieties, the technology of irrigation, and the introduction of crop rotation for example indicated an increased profitability for the farms.

Keywords

Agroecology, Agroecological practices, Resilience, Bioeconomic modeling, North Africa

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Fostering agroecological transitions in North Africa through a multi-actor participatory approach (WP4: Living Labs and Replication Labs) - Abstract

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Summary

North-Africa is facing critical challenges to their food systems related to ever-increasing pressures on water resources and land degradation (Goetz et al. 2023). The region is also the most food-import-dependent region in the world and a climate change hotspot (Lemaître-Curri et Tode, 2020; MedECC, 2020). Agroecology has been promoted as a means of breaking the cycle of land and water resource degradation, enhancing food security, and providing greater resilience and better livelihoods for farmers (Ayeb & Bush, 2019; Bush & Martiniello, 2017). The North African Transition to Agroecology (NATAE) consortium, an EU Horizon funded project, brings together high-level research and education institutions from around the Mediterranean, international organisations and specialized NGOs with long-term presence on the ground to demonstrate that agroecological approaches, tailored locally to the diversity of farming systems, can offer adequate solutions to food system challenges in North Africa. NATAE will foster agroecological transitions in the North African region by establishing seven Living Labs in different agroecological contexts to set-up, run and monitor participatory research. Living labs have been used in the context of agroecological transitions in different regions of the world for over a decade (McPhee et al. 2021, Marselis et al. 2024, Kaufmann et al. 2023). In addition to seven Living Labs, the project will scale the work undertaken, by supporting the creation of five additional Replicant Labs, which will look to apply locally adapted methodologies that have been co-created by the original project Living Labs. The core participatory methodologies were co-created among the Living Labs and research partners. The main tasks and methodologies co-created in Work package 4 include: 1) a territorial diagnosis and farming system typology analysis based on data collected from interviews with farmers and stakeholders, and literature reviews; 2) an analysis and validation process to explore the broader context of the Living Labs based on two surveys on the existing value chains and consumer preferences. 3) the identification of key agroecological practices of interest, the barriers and opportunities to their greater use, potential scenarios for future agroecological transitions, and a participatory method for strategic prioritization in a context of environmental threats; 4) the participatory experimental methodology and assessment of innovative agroecological practices on key concerns to farmers; and 5) a process for the validation of the results of farming system and territorial modelling from other work packages in the project through the use of focus groups and workshops to discuss trade-offs and strategic options for agroecological transitions and improved policy design. In addition to regular inter-Living Lab meetings in the form of a Living Labs leaders board and regular project meetings to share experiences and best-practices, in WP4 also entails cross-Living Lab learning via a series of visits to all project Living Labs. The findings from this tour and testimonies collected will be compiled in a Travel Book and feed into video capsules and illustrated booklets. Through this innovative approach, it is expected that around 50% of farmers in LL territories will use more resource-efficient and environmentally sustainable practices demonstrating the potential role Living Labs can play in creating agroecological transition pathways.

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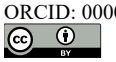
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Keywords
Living Labs, North Africa, Agroecology, participatory processes, scaling, transitions

Utilization of ddRAD sequencing methodology to identify Greek indigenous grape varieties - Abstract

Eirini-Slavka Polovina [1,2], Emmanouil Kontaxakis [1], Glykeria Mermigka [1,2], Ioanna Cheiladaki [1], Georgios Kousis-Tsampazis [3,4], Panagiotis Matzavras [4], Emmanuel Ladoukakis [3], Pavlos Pavlidis [3,4], Dimitrios Goumas [1], Filippos Ververidis [1,2] and Emmanouil Trantas [1,2]

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Summary

Vitis vinifera ssp *vinifera*, the common vine, is a species with significant economic importance and high degree of genetic heterogeneity. Most studies suggests that while the species was domesticated in the Caucasus region 6000-8000 years ago, wine production in Greece, is dated to have started around 4500-4000 BC. Today in Greece there are about 300 grape varieties cultivated, many of which are indigenous. Although there are data on the genetic diversity of the cultivated varieties, these are based, mainly, on conventional molecular markers (e.g. RAPD, SSR, AFLP, etc.). The aim of this study was to identify native grapevine cultivars using next generation sequencing (NGS) technology. To this end, we first optimized the DNA extraction process to maximize yield and purity for all varieties. A standard DNA extraction protocol was meticulously refined to handle plant tissues rich in secondary metabolites, notorious for hindering the process. Denaturing agents were adjusted to counteract the metabolites' interference. Stringent purification steps were employed to remove contaminants. The comprehensive approach ensured efficient DNA extraction of adequate quantity and quality for downstream library preparation steps. Genomic DNA was extracted from five individuals from each of twenty-one selected cultivars from all over Greece, namely Vidiano, Thrapsathiri, Kotsifali, Tsardana, Melissaki, Mavrodafni, Moschato aspro, Malagousia, Zakinthino, Skiadopoulo, Assyrtiko, Aidani, Mavrathiro, Mavrotragano, Xinomavro, Koiniariko, Asprouda Serrwn, Papas Karas, Moschato mavro, Ritino, Fokiano. According to the ddRAD method, genomic DNA was double digested with NsiI and CviQI restriction enzymes, and specific barcoded adaptors were integrated at both ends of each fragment to allow sample multiplexing. Next, size selection of the fragments was performed with Pippin Prep ranging from 326 to 526 bp followed by PCR amplification with appropriate Illumina indexed primers to create sequencing libraries. Libraries were finally sequenced on an NovaSeq X Illumina platform. Bioinformatics analyses of the sequencing data are currently in progress which aim to a) identify genetic diversity within each variety and b) to identify SNPs that are useful in characterizing each of these varieties. SNPs characteristic for each variety, will eventually lead us to design primers specific for varietal identification. Besides the lower cost compared to whole genome sequencing, ddRAD genotyping can detect plethora of SNPs that

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can be used to study grape genetic diversity. To date, the ddRAD method, has been applied to many animal and plant species but the use in grape genotyping has not been extensively used.

Keywords
Grape genotyping, Greek varieties, SNP, ddrad

Elucidating the virome of important indigenous grapevine varieties cultivated in Greece - Abstract

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Summary

Grapevine is an economically important and widespread crop in Greece, and it is infected by numerous viruses and viroids. Within the framework of the research program "NATIVINE" a total of 20 indigenous cultivars originating from seven viticultural areas of Greece were tested for the presence of viruses. More specifically the varieties included Black Muscat from Tyrnavos, Mavrodaphni, Malagousia and Xinomavro from Naoussa, Aidani, Mavrotragano, Athiri and Asyrtiko from Santorini, Asprouda of Serres, Pamidi, Zoumiatiko and Kiniariko from Xanthi, Kara Pappas from Komotini, Vidiano, Thrapsathiri, Tsardana and Kotsifali from Crete and Fokiano, Muscat of Samos and Ritino from Samos. Phloem scrapings were isolated from mature canes of the samples and were subjected to total RNA extraction. Subsequently, they were tested for the presence of grapevine leafroll-associated virus 1 (GLRaV-1), grapevine leafroll-associated virus 3 (GLRaV-3), arabis mosaic virus (ArMV) και grapevine fanleaf virus (GFLV) according to the Commission implementing directive (EU) 2020/177 using molecular detection methods. All samples were also examined for the presence of grapevine virus A (GVA) and grapevine virus B (GVB) that are widely spread in Greek vineyards. The results unveiled the coexistence of more than one virus in the same vine. Black Muscat was found to be infected mainly by GLRaV-3 and GVA, while a small number of samples were also infected by GLRaV-1, GFLV and GVB. In the samples of Mavrodaphni, Malagousia and Xinomavro from Naoussa GLRaV-3 and GVA were found in all tested samples, while GVB was present in all samples of Xinomavro and in a sample of Malagousia. In Santorini, GLRaV-3, GVA and GVB seem to be the most commonly detected viruses, mostly in mixed infections in Aidani, Mavrotragano, Athiri and Asyrtiko, while a sample of Aidani and two of Mavrotragano were found to free from the viruses included in the legislation. Pamidi and Kiniariko from Xanthi and Kara Pappas from Komotini were infected by GLRaV-3 and GVA, while Asprouda of Serres and Zoumiatiko were also infected by GFLV. In addition, in a sample of Zoumiatiko only GVA was identified. In Crete, GLRaV-1 was detected in all samples of Tsardana and Kotsifali in mixed infections with GLRaV-3, GFLV and GVA, while Vidiano and Thrapsathiri were mixed infected by GLRaV-3, GFLV and GVA. Samples of Fokiano from Samos were shown to have a different viral profile, with three of them being infected only by GVA, several samples by GFLV, GVA and GVB and other two samples by GVA and GLRaV-3. In Muscat of Samos GVA and GLRaV-3 were precent in all of them, while GLRaV-1 and GFLV were also detected in three and one vines, respectively. Finaly, the combination of GLRaV-3 and GVA was the most common in Ritino from Samos, with GFLV being also present in three vines. To further investigate the virome of the twenty indigenous cultivars of Greece, 25 samples were selected and subjected to high-throughput sequencing (HTS). Analysis of the HTS data is in progress.

Keywords

Grapevine, indigenous varieties, Greece, virome, HTS

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Qualitative and quantitative characteristics of the grapes of different biotypes of grapevine cultivar Assyrtiko in Santorini - Abstract

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Summary

The polyclonal synthesis of many Greek grapevine varieties leading to the existence of different biotypes-possible clones within the same cultivar is of great importance, in view of climate change, since different biotypes exhibit different qualitative and quantitative characteristics, leading to different phenolic potential. The aim of the present study was to assess the qualitative and quantitative characteristics of the grapes and berries of seven different biotypes (A1-A7) of grapevine cultivar Assyrtiko, cultivated in Santorini. All biotypes of grapevine cultivar Assyrtiko are cultivated in the same soil and climatic conditions in the area of Akrotiri. Grapes from the different biotypes were collected during technological maturity. In the must of all samples, the following measurements were carried out: total soluble solids concentration, active acidity (pH) and total titratable acidity. Also, mechanical analyses of the grapes and berries of all the biotypes under study were performed. Moreover, using a spectrophotometer the content of grape's skin in total phenolics, condensed tannins, total ortho-diphenols, total flavonoids, total flavanols, total flavonols and flavones and their antioxidant capacity with the use of FRAP and DPPH methods were quantified, while high-performance liquid chromatography (HPLC) identified the most important individual acids and individual sugars. The same measurements were carried out also in the grape seeds. The results of the present study revealed the effect of the biotype both in the qualitative and the quantitative characteristics of grape cultivar Assyrtiko, with statistically significant differences being observed among the different biotypes. More specifically, biotypes A5 and A7 exhibited the highest phenolic content, therefore, they are the most suitable for the production of high-quality wines. Biotype A5 recorded the highest concentration in total phenolics, total flavanols, total flavonoids, total flavonols and flavones. Furthermore, the possibility of producing wines of of high-quality characteristics can probably be confirmed by the values of total acidity of their musts, which is of great importance of white grape cultivars, and therefore of Assyrtiko, which is close to the range of total acidity at full maturation. At the same time, regarding the total soluble solids, there are biotypes characterized by early maturation compared to others, meaning that these biotypes can be used in areas of Santorini characterized by late harvest, as well as for the production of sweet wines, such as Vinsanto. In conclusion, it is evident that there is phenolic variability among the different biotypes of the same cultivar, in this case Assyrtiko. This variability will help identify the most suitable biotype according to the intended use of the final viticultural product.

Keywords

Grapevine, indigenous varieties, Assyrtiko, biotypes, phenolics

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Identification of Vitis cultivars using machine learning-selected SNPs from NGS data - Abstract

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Summary

Despite the advancements in genomic sequencing techniques and computational algorithms, there is still a need for precise and time- and cost-effective methods. Techniques like double digest Restriction-site Associated DNA (ddRAD) sequencing are gaining popularity due to their efficiency. At the same time, the progression of artificial intelligence (AI) and its implementation in genomic data analysis has led to data-driven techniques that emphasize generalization over simple interpretation. Our study aims to leverage machine learning algorithms to identify informative SNPs that can help distinguish different Vitis cultivars. First, we developed an optimal data mining pipeline to call variants from different cultivars. A dataset of 476 Vitis Whole Genome Sequencing (WGS) samples, from different worldwide cultivars, was used to create a multisample variant table (VCF). Then by implementing a Random Forest algorithm, we were able to distinguish cultivars based on representative samples using only 152 missense SNPs.

Informative SNPs were then used to identify the best combination of restriction enzymes in a silico-ddRAD approach. This pre-analysis provides insight into how effectively the future ddRAD library can be used to identify different cultivars. In our current work, we expand our database of informative SNPs with 21 Greek cultivars derived from a ddRAD library.

Keywords

Machine learning, ddRAD, Greek cultivars, NGS, identification

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Evaluation of an eco-friendly reproduction management protocol on the reproduction efficiency of three Greek sheep breeds - Abstract

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Summary

Sheep farming has been traditionally the most important sector of Greek livestock farming, mainly due to environmental, social, religious, and economic factors. It is performed in lands that are unsuitable for cultivation or any other agricultural operation and the farms are extensive, small-sized and family-owned, with a low level of mechanization in most cases. Traditional breeding and management practices are followed resulting to a pronounced seasonal character of a 5-6 months productive duration. Specifically, the interval for sheep reproduction lies between September and mid-March, reducing the availability of fresh milk in some periods of the year. Naturally, sheep in temperate latitudes present a seasonal character of breeding, controlled mainly by the photoperiodism. Many strategies have been proposed to either premature or to extend the reproduction period, including the "ram effect" and the use of exogenous hormones (mainly progestogen sponges or melatonin implants). In general, the hormonal treatments are considered practical and easy-to-use but raise concerns lately, regarding their effects on human health and their environmental footprint. The aim of this study was the evaluation of the effects of two different methods/treatments of controlling ovine reproduction (ram effect and a combination of eco-friendly substances) in three Greek indigenous sheep breeds, namely Florina, Karagouniko and Chios. 180 ewes, aged 2–3 years old, were used, equally divided between the three Greek sheep breeds. Each breed was divided in two equal experimental groups: In Group ECO (combination of eco-friendly substances), a dose of GnRH was administered at day 0, followed by an intramuscular injection of prostaglandin seven days later and another dose of GnRH at day 9. In group ME (male effect), sexually active males were introduced to the females that have been isolated for 3 months. The experiment was conducted in three consecutive years, i.e. 2020, 2021 and 2022. Average oestrus expression and fecundity in all three examined breeds was comparable, with the exemption of Florina ewes treated with the eco-friendly substances in the first year, a result that could be attributed to the strong seasonal pattern in oestrus expression of the Florina breed. The average length to oestrus expression in days was significantly lower in the eco-friendly method than the procedure using male effect and the prolificacy was higher for the Chios sheep than the Florina and the Karagouniko breeds. Overall, both methods for the induction and synchronization of oestrus (male effect and PGF2a administration) could be used in sheep reproduction with promising results. Nevertheless, the male effect seems to be more efficient in indigenous breeds with long anoestrus periods. This research work was supported by the Hellenic Foundation for Research and Innovation (HFRI) under the 'First Call for HFRI Research Projects to support Faculty members and Researchers and the procurement of high-cost research equipment grant' (Project Number: HFRI-FM17- 2987).

Keywords

Sheep, reproduction, prostaglandin, male effect

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MTNR1A and GDF9 gene alleles as selective breeding targets for estrus synchronization in autochthonous sheep - Abstract

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Summary

Milk production in sheep is usually not achievable year-round due to the seasonality of reproduction. However, as Greece has many regional products using ovine milk that boost the local economy, its production is necessary throughout the year. The goal of this study was to evaluate and compare three environment friendly reproductive treatments in two indigenous Greek sheep breeds, and the correlation effect between each treatment with the genotype of each breed, regarding the MTNR1A and GDF9 genes. These genes were specifically selected for their correlation with the seasonality and reproduction in general. In 2020 six experiments were conducted in total, using three different reproductive treatments (A: male effect, B: Ovsynch protocol, C: intravaginal sponges) in two breeds (Florina and Karagouniko ewes). In total, 150 ewes of each breed were used, divided in three groups, one for each treatment. Using marker-assisted selection based on the results of the molecular analysis of the MTNR1A and GDF9 genes, all six experiments were repeated in 2021 and 2022, under the same conditions. After the implementation of selective breeding, regarding the first treatment (male effect), the first breed (Florina ewes) developed a 20% fecundity increase. Karagouniko ewes, in contrast, showed no difference in fecundity rates. On the second treatment (ovsynch protocol), Florina ewes saw a 13% increase in fecundity, following the use of selective breeding. However, with only a 5% increase in fertility, Karagouniko ewes did not exhibit any variation in fecundity rates. On the third treatment (progesterone sponges), Florina ewes saw an 11% decline in fecundity after the implementation of selective breeding. Fecundity was also decreased by 15% in Karagouniko ewes. Regarding the prolificacy, Karagouniko ewes had no significant differences before and after the use of selective breeding, in all treatments. Conversely, Florina ewes showed significant variations (30% decrease in prolificacy) but only in ovsynch protocol. In conclusion, although some breeds—like Florina ewes as opposed to Karagouniko ewes—are more receptive than others, the application of marker-assisted selection with the MTNR1A and GDF9 genes is a successful strategy for achieving the optimal estrus synchronization for milk production throughout the year in indigenous Greek sheep breeds.

Keywords

Reproduction, sheep, MTNR1A, GDF9

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Thornthwaite's water balance components in Greece with the use of gridded data - Abstract

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Summary

Thornthwaite's water balance approach serves as a fundamental tool for assessing hydrological dynamics, particularly in regions vulnerable to aridity and water stress. This study evaluates the performance of gridded datasets in estimating Thornthwaite's water balance attributes in Greece, leveraging climatic averages of the period 1960-1997. Ground station data from 91 meteorological sites, and gridded data from the Climate Research Unit (CRU) of the University of East Anglia, were utilized to assess key water balance components. Results indicate that while gridded datasets offer an alternative for regions with limited ground data, local calibration is required due to notable discrepancies. More specifically, it was found that gridded data tended to underestimate precipitation, with estimates approximately 25% lower compared to ground station data. Potential evapotranspiration (PET) estimates using gridded data were more accurate, with underestimation on the order of 10%. Moreover, gridded data produced overestimations for all water balance key components including soil moisture (St), monthly changes in soil moisture (ΔSt), and actual evapotranspiration (AE) compared to ground station data. Water surplus (S) estimates showed significant dispersion of values when using gridded data, particularly in regions characterized by more arid conditions. In addition, the application of gridded data led to a great increase in the aridity index (AI) values, altering the desertification classification of sites from semi-arid to sub-humid or humid categories. These findings underscore the importance of careful consideration when utilizing gridded datasets for hydrological and bioclimatic assessments, particularly in Mediterranean climate regions characterized by complex topography and temporal climatic variability.

Keywords

Potential evapotranspiration, precipitation, aridity, thornthwaite water balance, Greece, meteorological gridded data

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Performance evaluation of nine potential evapotranspiration methods against the FAO-56 Penman-Monteith at the broadleaf forest of Taxiarchis in N. Greece - Abstract

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Summary

Potential evapotranspiration (PET) is a critical component of the water cycle, driving plants' growth and survival. This study focuses on estimating daily potential evapotranspiration (PET) in a forest site in Northern Greece and assessing the performance of nine empirical PET estimation methods. These methods, categorized into mass transfer, temperature-based, and radiation-based models, were compared against the widely used FAO-56 Penman-Monteith benchmark. The results highlight significant seasonal and monthly variations in vegetation water requirements. Among the methods tested, radiation-based models, particularly the Makkink equation, outperformed others, followed by Turc and Priestley-Taylor models. Temperature-based methods showed moderate performance and could serve as viable alternatives in forests with limited data availability, though local calibration is advisable.

Keywords

Potential evapotranspiration, comparative evaluation, Mediterranean, forest, Greece

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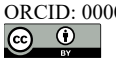
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Performance evaluation of CHIRPS satellite-derived precipitation product at a high-altitude Mediterranean forest - Abstract

Stefanos P. Stefanidis [1], Nikolaos D. Proutsos [2] and Panagiotis S. Stefanidis [3]

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Summary

The aim of this study is to investigate the accuracy of the Climate Hazards Group Infrared Precipitation with Stations (CHIRPS) satellite-derived precipitation product against rain gauge data at a high-altitude Mediterranean forest in Central Greece over a 40-year period (1981-2020). Given the difficulties of establishing and maintaining rain gauges in forested regions, satellite-derived products such as CHIRPS may offer valuable information. However, the accuracy of this precipitation product, specifically in mountainous areas remains underexplored. This study comprised the use of statistical metrics to compare the monthly, seasonal, and annual precipitation estimates from CHIRPS to those of the observed ground measures. The findings reveal that CHIRPS effectively captures the pattern of monthly precipitation, although there is in general a bias towards significantly overpredicting precipitation and strong seasonality of its performance. Thus, CHIRPS presents significant potential as an efficient source of information in the absence of ground observations for autumn and possibly summer precipitation in ungauged Mediterranean mountainous forest sites, though it should be used cautiously for winter and spring.

Keywords

Forest meteorological station, satellite precipitation, Mediterranean, statistical evaluation, Greece

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Unlocking agricultural potential: The role of irrigation practices and cropping intensity in Vojvodina, Serbia - Abstract

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Summary

Agriculture is essential for ensuring food security and driving economic development, particularly in rural areas. Due to the high pressure of climate change, it is crucial to increase food production while carefully managing natural resources. Cropping intensity involves maximizing agricultural land productivity by increasing the frequency and intensity of crop cultivation. Effective irrigation is vital for achieving high cropping intensity and supporting intensive agricultural production. Understanding the interactions between irrigation practices and cropping intensity is critical for developing effective climate change adaptation and mitigation measures in agriculture. Understanding these interactions is important for developing effective climate change adaptation and mitigation measures in agriculture.

This study emphasizes the critical need for targeted strategies to optimize irrigation and promote intensive cropping practices in Vojvodina. This research presents an analysis of irrigation practices and cropping intensity in the Vojvodina region. Vojvodina is notable as a main agricultural region in Serbia with a significant contribution to the country's agricultural output.

Using remote sensing data and statistical analysis, we investigate the extent and distribution of irrigated agriculture, as well as the intensity of various crops cultivated in this region. Based on a classification of irrigated fields over three years, a final map of irrigated parcels was generated for Vojvodina region. In order to see what kind of crop is usually under irrigation in this region, machine learning-based maps of cropping intensity were generated for 2022 and 2023. These maps contain three main classes: single winter crops, single summer crops, and double cropping. Both irrigation maps and cropping intensity maps were generated using Sentinel-2 images and ground truth data collected for each year. Statistical analysis indicates that only 6.26% of the agricultural areas in Vojvodina are equipped with irrigation systems. Our revealed that irrigation systems are predominantly utilized for single summer crops, accounting for 85.97% and 71.36% of usage in each respective year. In contrast, irrigation of single winter crops increased from 8.77% in 2022 to 20.94% in 2023. Notably, double-cropping, which represents the highest level of cropping intensity, involved only minimal use of irrigation systems: 4.17% in 2022 and 5.60% in 2023. Given that irrigation is crucial for double-cropping practices in Vojvodina, these statistics highlight a significant underutilization of available resources.

Our research analysis suggests that approximately 95% of parcels equipped with irrigation systems are not fully utilized. This underutilization points to a significant opportunity for enhancing agricultural productivity. The current irrigation practices are often suboptimal, leading to inefficient water use and limiting the potential for multiple cropping cycles within a year. By addressing the current inefficiencies and leveraging the region's agricultural potential, we can significantly enhance productivity and contribute to sustainable agricultural development. Policymakers, researchers, and farmers must collaborate to implement these

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strategies, ensuring that Vojvodina remains a cornerstone of Serbia's agricultural output and a model for other regions facing similar challenges.

Keywords
Irrigation, cropping intensity, food security, agriculture, water management

Enhancing SWOT analysis with DEMATEL and AHP for NbS and ES in Wetland Restoration: The landscape of outstanding features – Vlasina, Serbia - Abstract

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Summary

The comprehensive environmental, economic, and societal analysis plays a vital role in the strategic planning and management process for wetlands in the Landscape of Outstanding Features – Vlasina, Serbia. Given its simplicity and practicality, a SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis will be conducted, followed by the application of two analytical tools, DEMATEL and AHP, for an in-depth evaluation of potential causal relationships. These tools will also help prioritize SWOT aspects and sub-aspects, guiding further development within the study area.

Keywords

NbS, ES, wetland, restoration, SWOT, DEMATEL, AHP

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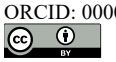
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Exploring soil conservation service in Europe's urban and peri-urban forests: A comparative analysis - Abstract

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Summary

With global urbanization on the rise, urban and peri-urban forests (UPFs) have emerged as critical green infrastructure. This study conducts a comprehensive analysis of soil conservation (SC) services provided by UPFs across European Union (EU) member states. Utilizing an erosion modeling approach and open-access Earth Observation (EO) data, the distribution and magnitude of SC services within UPFs are evaluated. Significant disparities in SC service supply among EU countries are revealed, with Mediterranean nations exhibiting higher values compared to central and northern European counterparts. The study underscores the pivotal role of UPFs as Nature-based Solutions (NbS) in enhancing ecosystem services (ES) provision for citizen well-being. By integrating SC and ES concepts into forest management strategies, UPFs can effectively contribute to achieving Sustainable Development Goals (SDGs) and improving citizen well-being. This research provides valuable insights for EU policymakers and stakeholders, laying the groundwork for integrated UPF management strategies. Through prioritizing SC measures and adopting integrated approaches, policymakers can ensure the resilience and ecological integrity of UPFs, enhancing their capacity to provide vital ecosystem services in Europe's urbanized landscapes.

Keywords

Erosion, RUSLE, ecosystem services, earth observation data

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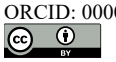
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Application of precision livestock farming to monitor the grazing behavior of goats - Abstract

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Summary

The advancement of remote monitoring technologies, such as global positioning systems (GPS) and three-axis accelerometers, offers valuable opportunities for gaining insights into the behavior of grazing animals by capturing data at various spatial and temporal scales. This study aimed to classify different behavioral patterns in grazing goats through the integration of GPS collars, accelerometers, and satellite remote sensing. The research was conducted in the mountainous forest rangeland of Beni Arouss, Northern Morocco, using goats from an extensive local farm. Goats were equipped with GPS collars and leg sensors to track their grazing behaviors across seasons. A calibration process combined with classification tree analysis was employed to predict these behaviors. The results indicated that goats allocated the majority of their time to foraging in spring and autumn, while they increased their resting time during summer ($p<0.001$) at the expense of grazing. The number of steps was numerically consistent and significantly higher in both summer and autumn ($p<0.001$). Goats spent 48% of their feeding time grazing in the spring, compared to 27% in the summer and 31% in the autumn. Analysis of GPS data revealed a significant seasonal impact on the parameters measured ($p<0.001$). Utilizing GPS collars and sensors to monitor grazing behavior offers reliable data that can inform grazing management strategies and improve livestock performance.

Keywords

Sensor, GPS collar, accelerometer, behavior, grazing, goat

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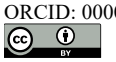
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Radial growth characteristics and climate on the East and West Banks of the Nestos River, Greece: Vegetation strategic management insights - Abstract

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Summary

In Greece, water scarcity is a key factor limiting forest growth, with a strong correlation observed between water availability and tree ring growth in Mediterranean forests. The LIFE-PRIMED project in the Nestos Delta, northeastern Greece, studied tree growth patterns on both riverbanks, noting significant fluctuations towards the east and varying increases towards the west. Drought index revealed decrease in drought over time, and no clear link between tree growth and drought conditions was found. Severe droughts and dam-induced flooding appear to affect tree growth by altering hydrological patterns. Key years with notable growth deviations include 1995, 1998, 2000, 2002, 2007, and 2017 (east), and 2002, 2004, 2007, and 2017 (west). Significant droughts in 1990, 1993, and 2001 had limited immediate impact but may have affected growth in subsequent years. Further research is needed to understand the impact of climatic conditions and prolonged floods on tree growth to improve management decisions.

Keywords

Climate-growth relationship, *Alnus glutinosa*, Nestos River, LIFE-PRIMED, riparian forests

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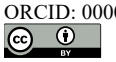
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Understanding consumers purchase intention: An extended TPB model for food products with a pollinator friendly label - Abstract

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Summary

Pollinators play a critical role in maintaining ecosystems and supporting food production. However, their populations face a decline in recent years due to the agricultural practices applied. Thus, there is a need for measures that aim to their restoration. Consumers can contribute to addressing this challenge by choosing products that have been produced with pollinator friendly methods and they have been certified with a label. Eco-labels provide information to consumers about their environmental impact and can influence their purchase decision. A framework that can be used to understand consumers behavior is the Theory of Planned Behavior (TPB), which has been applied to various contexts, although, its specific application to food products with pollinator-friendly labels remains unexplored. Thus, our study aims to bridge this gap by developing an extended model of TPB and identifying additional constructs that can give us a more comprehensive understanding of the purchasing intention of consumers towards these products. We conducted a literature review through the databases of Scopus, Web of Science and Google Scholars with the keywords of extended model of TPB, eco-labelled food products and consumer willingness to pay for pollinator friendly practices. After the literature review, the variables were chosen based on the most frequent appearance and on the significance of their impact on the examined models, as well as we considered the criteria of Ajzen for additional variables. Therefore, the additional variables that were chosen for the TPB were environmental awareness, environmental concern, green perceived value, trust, eco-label knowledge and environmental self-identity. For each construct of the model, we formulated hypotheses for their effect on the purchasing intention of consumers. The significance of this study is that it will contribute to the European Project RestPoll, where there is a need to identify the external stimuli and internal motives that influence the final choices of people to either support or not pollination services and pollinator conservation. The extended model of the TPB will be used as a methodological instrument for the development of a questionnaire for the consumer survey that will be conducted in the participating countries of the project. The data that will be collected will help us to test the hypotheses that were formulated and consequently we will identify the most important factors for the consumers' intention to buy food products that bear a pollinator friendly label.

Keywords

Extended model of Theory of Planned Behavior, pollinator friendly label, consumers purchase intention

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Assessment grazing capacity in the riparian zone of Axios River Delta using Earth observation data - Abstract

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Summary

Information about grazing capacity is essential for land management and sustainability of livestock production systems. The objective here was to assess grazing capacity and quality of grasslands in the Axios River Delta, which is part of the Axios-Loudias-Aliakmonas national park. There is a population of approximately 650 animals that are raised semi-extensively in this area. To identify and map land uses in the aforementioned area, Copernicus land data, including Riparian Zones (2018), CORINE Land Cover (2018), and Grassland (2018), were utilized. Spatial data were processed using QGIS to estimate grazing capacity expressed in Animal Unit Months (AUMs); amount of dry matter required to cover the nutritional needs of a cow. Field visits were conducted from April to September and 15 random samples of plants were collected and subjected to chemical analyses. Results showed a low grassland cover in the studied area, with a flat geomorphic form (lower altitudinal zone <600m) and an average slope of about 0.8%. Approximately 50% of total pasture production is considered usable for shrublands (phrygana, 12,517.1str), grass (3,514.7str), and forested (1,171.6str) pastures, and 65% for scrub pasture (6,817.2str). Based on national grazing management plans, grazing capacity of grass pastures, scrub pastures, shrublands, and forested pastures was 0.16, 0.19, 0.09, and 0.12 AUM/str, respectively. Grazing capacity values ranged from 140.6 AUM (forested pastures) to 1,294.7 AUM (scrub pasture), with a total value of 3,124.2 AUM. This capacity ensures the highest possible production without compromising grazing material availability and soil productivity. The area can sustain approximately 781 and 520 animal units (AU) over a 4-month and 6-month grazing period, respectively. The results indicate that the area is not overgrazed, maintaining ecological balance.

Keywords

Grazing capacity, beef cattle, Earth observation, remote sensing, ecological balance

Acknowledgements

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Economic performance of extensive beef cattle farms in the Axios Delta region of Greece - Abstract

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Summary

Extensive beef cattle production plays a significant role in Greece's agricultural economy by enhancing beef production and reducing reliance on imports. However, the sector faces several economic challenges that threaten its viability. The objective here was to assess the economic performance of extensively reared beef cattle in natural grasslands of Axios River Delta in Greece. Three beef cattle farms were randomly selected. A designated questionnaire was used to collect farm technical and economic data. Specifically, data included information regarding management practices (herd size, meat production, grazing, feeding, reproduction, animal health and welfare), income (subsidies, meat production, and animal sales) and variable costs (feeding, labor, transportation, utility, land, veterinary expenses, and equipment). The average farm comprised 83±101.5 crossbred beef cattle, with an average age and body weight at the slaughter of 23±1.0 months and 586±11.5 kg, respectively. The average annual meat production per farm was 25±30.4 tons. Animals covered their nutritional requirements mainly by grazing on natural grasslands; supplementary feeding was provided during periods of poor vegetation. Average farm income and variable costs were 194,342±239,450.4€ and 128,800±134,186.6€, respectively. Income was primarily based on meat sales (76.9%), followed by subsidies (23.1%). Feeding accounted for the largest share of total variable costs (56.7%), followed by labor (13.7%), land renting (11.3%), transportation (8.5%), veterinary services (8.1%), utility bills (0.9%), and equipment services (0.9%) costs. Two of the studied farms operated under profitability thresholds with the average gross margin excluding subsidies being negative at 7,700±6,929.7€; average annual meat production in the latter farms was 7±2.3 tons. Results indicate that extensive beef cattle farms cope with economic challenges, exhibiting low gross margins and substantial reliance on subsidies for economic viability. Strategies such as increasing meat production, reducing feeding costs, and achieving better market prices could enhance economic performance of extensive beef cattle farming systems in Greece.

Keywords

Beef, extensive systems, economic performance, profitability

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Effects of feeding management practices on meat quality traits in intensively beef cattle - Abstract

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Summary

Intramuscular fat (IMF) content in skeletal muscle, commonly known as marbling fat, is considered a crucial factor in determining beef quality. Several factors, such as genetics, breed, management and feeding practices, influence IMF deposition. The objective here was to apply designated feeding to improve the quantity and quality of beef's IMF deposition. A total of 56 Black Angus heifers, reared intensively in one commercial farm, were randomly selected, and equally allocated into two groups (Control C, n=28 and Treatment T, n=28), further separated into four subgroups each. During the experimental period, lasting 90 days, both groups received a total mixed ration composed primarily of ground corn, wheat bran, barley, linseed, wheat straw, and vitamins and minerals premix. The experimental diet was additionally supplemented with phospholipids, biotin, choline chloride, and chelated zinc. Feed and water were provided ad libitum. The average carcass weight was 369.5±24.93Kg and 359.5±37.93Kg for Group C and T, respectively. A total of 30 (C=15, T=15) meat samples from 13th rib were collected and subjected to chemical analyses and quality assessment. In Group C, results of texture parameters including Hardness1, Hardness2, springiness, cohesiveness, and chewiness were 740.9±494.70g, 602.1±384.00g, 0.7±0.07, 0.5±0.06, and 248.4±128.8g, respectively. Likewise, the values of the parameters mentioned above in Group T were 1152.6±875.35g, 901.3±659.49g, 0.7±0.07, 0.5±0.06, and 374.8±259.9g, respectively. Furthermore, the mean values of meat chromatic parameters (Lightness—L*, Redness—a*, and Yellowness—b*) were 40.6±1.44, 19.2±2.44, and 10.7±1.59 for the C group, and 40.5±1.49, 19.2±2.94, and 10.9±0.93 for the T group, respectively. Average IMF and protein content were 7.5±3.24% and 20.3±1.08% in group C, and 5.9±2.57% and 20.3±1.58% in group T, respectively. Monounsaturated fatty acids (MUFAs) were higher in group C by 1.9%, with notable concentrations of oleic acid of 47.9% and 46.0% for groups C and T, respectively. Independent samples t-tests were performed to compare the values among the groups. No significant ($p < 0.05$) differences between the two groups and studied traits were observed. Preliminary results suggest that adding phospholipids, biotin, choline chloride, and chelated zinc in the ration of Black Angus heifers during the last 90 days of fattening had no significant effects on meat quality traits. However, the findings will be validated by further analysis included in the project.

Keywords

Beef, meat quality, intensive systems, feeding practices, phospholipids

Acknowledgements

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Meat quality of Holstein calves fed diets supplemented with linseed - Abstract

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Summary

Beef production in Greece accounts for about 25% of consumption and the notion is that the country should seek options to become more self-sufficient. Greece has a dairy herd of approximately 120.000 cows and hence, dairy beef production could cater a significant part of national need for beef subject to changes in farming practices. The objective here was to investigate options for transitioning the existing dairy sector for beef production by using male calves from dairy herds. The study was conducted in two dairy herds with 350±70.71 and 212±190.92 heifers. In each farm, 40 male calves were randomly selected and allocated in two groups (Control, C, n=20 and Test, T, n=20) with four subgroups each. Both groups were offered a total mixed ration, TMR (maize silage, wheat straw, ground corn, cottonseed, and soybean meal). The TMR in group T, had 4% extruded linseed that replaced the equivalent amount of ground corn. Feed and water were provided ad libitum. The experiment lasted 90 days. Animals were weighed every month and before slaughter. Preliminary results were obtained by analyzing 14 meat samples (13th rib of C=7 and T=7, respectively). Statistics were done using the R programming language. Independent t-tests were performed to compare group means on studied traits. Average daily gain was 1.5±0.39Kg for C and 1.4±0.30Kg for T. In Group C, results of texture parameters including Hardness1, Hardness2, springiness, cohesiveness, chewiness, chroma, and hue angle were 1279.7±889.48g, 840.9±623.01g, 0.7±0.08, 0.4±0.11, 472.3±404.57g, 216.9±57.85, and 0.6±0.07, respectively. Likewise, the values of the above-mentioned parameters in Group T were 1023.5±538.47g, 854.2±458.60g, 0.7±0.08, 0.5±0.07, 430.6±321.6g, 243.0±31.87, and 0.6±0.04, respectively. Mean values of meat chromatic parameters (Lightness—L*, Redness—a*, and Yellowness—b*) were 39.6±1.70, 17.2±2.78, and 11.5±1.42 for group C, and 39.0±1.25, 18.7±1.54, and 11.6±0.7 for group T, respectively. The pH values of meat for groups C and T were 5.7±0.06 and 5.6±0.11, respectively. Group T, had significantly higher ($p<0.05$) meat cohesiveness compared to C. The results suggest that designated feeding can improve meat quality in dairy beef production.

Keywords

Holstein, meat quality, feeding, extruded linseed

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Online training platform for the Agricultural Knowledge and Innovation System (AKIS) in Greece - Abstract

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Summary

The Agricultural Knowledge and Innovation System (AKIS) promotes innovation by utilizing various tools such as application technologies, practices, and e-learning platforms. It is crucial for farmers and those involved in agriculture to continually update their knowledge to reflect changing technologies and best practices in agricultural production. One of the main goals of the project, which was funded by the Hellenic Foundation for Research and Innovation (HFRI) under the PhD thesis titled "Evaluation of the Perceived Efficiency of the Agricultural Knowledge and Innovation Systems in Greece", is creating an eLearning platform as the repository of knowledge for AKIS. This paper aims to present materials from an online training platform course designed for agronomy students. The course aims to encourage potential farmers or farm advisors to participate in the AKIS system by developing knowledge of AKIS and an understanding of how AKIS works regarding interactive innovation processes. The proposed course can help increase awareness of AKIS among farmers by facilitating further support for developing innovative solutions in agriculture.

Keywords

AKIS, e-learning, innovation, knowledge, training

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Woody species dynamics in the priority habitat 91E0* in Nestos, Greece - Abstract

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Summary

Tree species composition, stand structure and growth dynamics were assessed in the priority habitat 91E0* (Alluvial forests with *Alnus glutinosa* (L.) Gaertn. and *Fraxinus excelsior* L.) in the Nestos area of northeastern Greece. This study aimed to understand the ecological dynamics of this unique habitat and to properly plan restoration actions. Measurements were conducted in May and July 2023 across 14 plots distributed randomly along both banks of the Nestos River (east and west). A total of 667 trees with a DBH≥2.5 cm were recorded, representing 13 species and 10 families. Tree densities varied from 14 to 541 stems ha^{-1} and the average basal area was 8.77 m^2 ha^{-1}. Both density and basal area significantly differed between the two riverbanks. Our results indicate that *Alnus glutinosa* dominates in the alluvial forest, forming more resilient communities with *Populus alba* L., *Populus nigra* L. and *Salix alba* L.. However, *Fraxinus angustifolia* Vahl was not as prevalent as expected. These findings highlight the need for conservation actions and draws attention to the threats facing the alluvial forest.

Keywords

Alluvial forests, *Alnus glutinosa*, tree species composition, stand structure, biodiversity

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Rice productivity performances reviewing between different African countries underlying same Chinese technology - Abstract

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Summary

The paper exploits the rice production changes occurring with the dissemination of Chinese rice technology across Egypt, Ghana, Kenya, Mali, Mozambique, and Tanzania (a group of treated countries) through hybrid rice trials from 1990 to 2010. The Difference-in-Differences model has been used for these above-treated groups. Another group, Burkina Faso, Burundi, Cote d'Ivoire, Rwanda, and Togo, was named the control group which did not receive treatment in the data. Through hybrid rice trials, Sino-Africa cooperation changed rice production levels. The Chinese rice dissemination technology performed well in increasing rice yield (about an average of 8.5 tons per hectare in treated countries against 3.5 tons per hectare in control countries) and ensuring rice self-sufficiency in Africa. An empirical study shows that, among the countries under treatment, Egypt stayed the only African country to have established hybrid rice breeding programs and released and produced domestically hybrid varieties. A redesigned pattern in the rice technology dissemination in the Sino-Africa cooperation could, in long, improve rice production and productivity in the beneficiary countries.

Keywords

African-Rice-Productivity, game-theories, Sino-Africa-Rice-Cooperation

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Quantitative evaluation of sustainable weed management adoption using principal component analysis: Empirical evidence from Greek arable farmers - Abstract

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Summary

Environmental degradation combined with the need to ensure food security for a rapidly growing world population have prompted the adoption of Sustainable Weed Management Practices (SWMP), which are expected to reduce crop losses while preserving natural resources. However, evidence shows that farmers are reluctant to adopt them and European farming remains dependent on chemical herbicides. The objective of this study is to analyze the adoption of SWMP in Greece by identifying common factors that may explain the information (variance) included in each of two initial sets of variables describing separately: i) factors that hinder the adoption of SWMP in Greece; ii) factors and strategies to promote the use of SWMP in the country. To achieve this purpose, 121 farmers cultivating annual arable crops at the Region of Thessaly in Central Greece were surveyed by means of a structured questionnaire. Using Principal Component Analysis (PCA) to reduce both initial sets of variables and categorize farmers' responses into two smaller sets of uncorrelated components (dimensions) without missing valuable information, the analysis yielded five factors that limit the adoption of SWMP ("Costs and availability of resources"; "Environment and land ownership"; "Compatibility and easiness of use"; "Economic performance"; "Social capital and education") as well as four factors to promote their use ("Policy, research and Cooperatives"; "Training and mandatory regulations"; "Technology and networking"; "Targeted approaches"). The derived factors can be used in terms of policy objectives, as each dimension represents different aspects to be considered when developing effective strategies and integrated policies for the evolution and further expansion of SWMP.

Keywords

Sustainable Weed Management Practices (SWMP), questionnaire survey, adoption barriers, promotion strategies

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An electronic platform for farm accounting and decision making - Abstract

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Summary

In the contemporary agricultural landscape, efficient management of agricultural holdings necessitates the integration of technical and economic data. This paper introduces an electronic platform that integrates data monitoring to meet the demands of modern agricultural practices. The platform offers a comprehensive solution, enabling farmers and stakeholders to collect, analyze, and utilize both technical and economic information. Through the utilization of modern technology, the platform provides user-friendly data input, processing, and visualization. It encompasses various features, including real-time monitoring of crop growth parameters, yield estimations, resource utilization, and financial performance indicators. Furthermore, the platform is designed to promote interoperability, allowing integration with existing agricultural management systems and data sources. This interoperability enhances the scalability and adaptability of the platform, ensuring its relevance across diverse agricultural contexts. By providing a unified solution for the integrated monitoring of technical and economic data, our electronic platform empowers agricultural stakeholders with the tools necessary for optimized resource management, increased productivity, and sustainable agricultural development. This paper presents the development, functionalities, and potential applications of the electronic platform, underscoring its significance in advancing agricultural practices towards greater efficiency and sustainability.

Keywords

Electronic platform, technical and economic data, farm accounting, decision making

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Enhancing agricultural sustainability: A decision support model approach to optimize water and fertilizer usage - Abstract

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Summary

The aim of this research is to change land use through the implementation of a Decision Support Model. Initially, this model will focus on minimizing land fertilization and unnecessary water use while also enhancing farm economic efficiency and profitability. Through this model, producers will have the ability to customize their own production plans, setting specific limits for the inputs used to optimize production. The research addresses the problem of inefficient water and fertilizer usage in the agricultural sector. The research objective will be achieved by analyzing the outcomes of a carefully chosen set of pilot fields owned by a group of farmers located in the Central Macedonia region. To select the pilot farms, relevant data is gathered and then processed using multicriteria weighted goal programming. This process aims to develop a Decision Support Model focused on reducing water and fertilizer usage. By managing these resources more effectively, it will be possible to reduce production costs, ensure compliance with regulations, prevent water table pollution, curb soil degradation, and boost overall productivity.

Keywords

Decision Support Model, input minimization, water usage, profitability, economic performance.

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Consumers' perceptions for endogenous animal and plant genetic resources - Abstract

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Summary

Globalization is a brake on endogenous food. This fact is a challenge for the farmer/breeder to choose to cultivate native plant varieties or breed endogenous farm animals, since sometimes low productivity is observed. Nevertheless, the consumer can provide an encouraging perspective, since their perceptions and preferences may push the producer to turn to the conservation of endogenous genetic resources. The consumer understands that there is a connection between the concept of sustainability and the production of endogenous food through the cultivation of native plant varieties and the breeding of endogenous breeds of farm animals. Furthermore, their perceptions of food derived from endogenous genetic resources play a critical role in maintaining agrobiodiversity and the sustainability of the primary sector, particularly in rural areas where short food supply chains can be more easily developed. Thus, reducing the extent of agri-food chain transactions at the local level may be a promising solution for more sustainable food production systems. Endogenous foods are deeply connected to the cultural identity and livelihoods of local communities and often reflect their historical relationship with the land and natural resources. Efforts are often made to preserve and promote native foods as part of cultural heritage conservation. The purpose of this study was to investigate how consumers perceive and deal, in the market and in their daily lives, with native plant varieties, endogenous breeds of farm animals and products derived from these endogenous genetic resources in the region of Western Macedonia, in Greece, an area of low population density and of particular agricultural importance. The sample was random and defined within specific geographic boundaries so as to strengthen the reliability of our findings. Some of the respondents were located and interviewed on the street, others in the squares, and some of them via the internet since the questionnaire had a digital format in addition to the printed one. The data was collected from September to December 2022, with the help of a structured questionnaire that included close-ended and a few open-ended questions to 146 people. The Chi-Square test (x2 test) was the method we used in order to carry out the statistical exploratory analysis with a mixed model test according to a number of hypotheses. More specifically, the questions addressed willingness to pay for products derived from endogenous genetic resources, trust in their provenance, the potential of these products to provide satisfactory incomes to producers and the local economy, labelling, perceptions of purity and the quality of the products, the contribution to the protection of tradition and cultural heritage, the possibility of increasing the awareness of the region of Western Macedonia and the need to preserve these resources for future generations. Awareness about the conservation of sustainability and endogenous genetic resources appears to be positively influenced by both the age of the respondents and their income and education level. In addition, young people and low-income earners consider these products to be safe and pure. At the same time, the results show that respondents even with low income are willing to pay to acquire products derived

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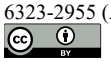
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from domestic genetic resources, which confirms their positive perception, while emphasizing the need for reliable labeling and information about these products both from young people as well as from those with a high level of education. Respondents appeared from their responses to be more familiar and knowledgeable about native plant varieties and their products than endogenous animal breeds.

Keywords
Perceptions, consumer, native, endogenous genetic resources.

Evaluating blockchain adoption for Greek PDO feta cheese integrity - Abstract

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Summary

Feta cheese, a distinct and culturally significant dairy product from Greece, has gained global recognition for its unique characteristics and nutritional value. Since 2002, it has been designated as a Protected Designation of Origin (PDO) product by the European Union, requiring it to meet specific criteria regarding its name, origin, production methods, geographical region, inspection requirements, and labeling specifications. However, the industry faces challenges such as food fraud and authenticity issues. Blockchain Technology (BT), with its distributed and immutable record-keeping system, presents a promising solution for enhancing traceability and maintaining the integrity of PDO Feta cheese and other high-value food products. This study aims to investigate the complexities of the PDO Feta cheese SC, focusing on identifying vulnerabilities with a view to improving the product's authenticity. Using rigorous methodologies, including the Delphi Technique, the study examines the operations and vulnerabilities within this supply chain. The Delphi Technique gathers and integrates expertise from a panel of experts in food safety, security, and supply chain management through iterative surveys and questionnaires. This process maps the entire SC, identifies technological ecosystems, pinpoints vulnerabilities, and highlights critical control points. The PDO Feta cheese SC involves ten sequential steps, from milk production to consumer purchase. Each step contributes to the product's journey, beginning with milk production sourced exclusively from designated geographic areas, followed by milk collection, pasteurization, quality control, cheese production, aging, packaging, storage, distribution, and finally, retail. Weaknesses identified in the SC include low digital literacy among milk producers, manual data entry errors during milk transportation, challenges in authenticity control based on sampling, limited internet connectivity in rural areas, and low connectivity between PDA software and GPS telematics. These issues lead to data inaccuracies, delays in updating supply chain data, and difficulties in real-time monitoring and traceability. To address these vulnerabilities, a comprehensive set of control measures is proposed. Enhancing digital literacy among milk producers through training and support programs and adopting user-friendly digital tools to streamline data entry and communication, are recommended. Implementing automated data capture processes, such as IoT sensors in iceboxes and smart contracts, ensures immutability and reduces manual data entry errors. Improved sampling protocols, third-party verification, and smart samplers tracking location can enhance authenticity control. Implementing an integrated system to enable real-time monitoring and

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data synchronization addresses connectivity challenges. Finally, adopting BT for enhanced transparency, traceability, and data integrity across the entire supply chain can overcome scattered data and lack of digitalized critical information in retail stores. In conclusion, the integration of BT in the PDO Feta cheese SC holds promise for improving traceability, transparency, and overall integrity. By addressing identified vulnerabilities and implementing the proposed control measures, the SC can enhance efficiency, foster trust among stakeholders, and ensure the authenticity of PDO Feta cheese, benefiting all involved parties.

Keywords
Blockchain technology, Feta cheese, food supply chain, Protected Designation of Origin (PDO), digital transformation

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Factors shaping consumer trust in supermarket food safety - Abstract

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Summary

This study examines the primary factors influencing consumer perceptions of food safety in supermarkets, aiming to clarify the demographics, purchasing behaviors, and attitudes that shape consumer views on the safety of supermarket food products. Participants were asked to rate their purchasing habits from various retail chain stores, local stores, and restaurants. Additionally, the questionnaire assessed perceptions of food safety across different food categories—vegetables, fruits, meat, packaged foods, and ready-to-eat foods—along with past experiences of food poisoning. Measures of satisfaction with food hygiene and safety in supermarkets were also incorporated.

The research uncovers many critical facets that draw in consumer impressions. Firstly, demographic characteristics such as age, gender, and educational background were significant. Older consumers and those with higher education levels exhibited greater concern for food safety compared to younger and less educated individuals. This demographic sensitivity underscores the need for targeted communication and education strategies by supermarkets to address specific consumer concerns. Secondly, the source of food emerged as a critical factor. Consumers who regularly shopped at large supermarkets reported higher satisfaction with food safety than those who frequented local stores or markets. The perceived reliability of supermarkets, attributed to their adherence to stringent safety standards and regulations, played a crucial role in shaping this positive perception. This outcome indicates that food stores are committed to maintaining high safety standards and is a major factor that is acknowledged and appreciate by consumers.

The safety assessment across different food categories indicates that packaged foods and ready-to-eat meals are perceived as safer than fresh products. This perception may be due to the rigorous safety protocols involved in the processing and packaging of these products. The results show that consumers have confidence in the safety measures used in packaging and face them as a guarantee of food safety. Hygiene and sanitation practices in supermarkets also significantly influenced consumer satisfaction. Participants expressed high levels of satisfaction with the cleanliness of supermarkets, appreciating efforts such as regular sanitation of shopping carts, checkout areas, warehouses and the overall store environment. This emphasis on hygiene highlights the importance of monitoring and displaying hygiene practices to build consumer trust.

The consumer attitude towards food safety was significantly influenced by past experiences of foodborne illnesses. Those who had been sick or witnessed their family members suffering from foodborne illnesses shopped carefully from supermarkets which were presumed to have a higher safety level, again social influence aspect. When the safety of food in supermarkets was positively affirmed by family and friends, then this built consumer trust and also positively affected people's propensity to buy from the markets. This social affirmation again affirms that

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it is most important that supermarkets gain a strong positive reputational standing within their customer base.

This study has shown that consumer perception towards food safety in supermarkets is hedged upon a combination of different factors such as their demographic profile, individual experiences, and social influence, including perceived food source reliability. Supermarkets are preferred overall because of their strict levels of food safety, where importance placed on hygiene, packaging, and social validation is high. This finding is very important not only for policymakers but also for supermarket management, in their efforts to improve food safety levels and consumer trust. Understanding these facts supermarkets will be able to infer in precise strategy framing that would address consumer concerns with regard to food safety, therefore enhancing the overall satisfaction with food safety in supermarkets.

Keywords

Food safety, consumer behavior, supermarkets, principal component analysis

Acknowledgments

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Implementing cost-effectiveness and cost-benefit analysis for portable cleaning stations for spraying machines - Abstract

Leonidas Sotirios Kyrgiakos [1,2], Christos Kavalaris [1], Marios Vasileiou [1], Christina Kleisiari [1,2], Dimitrios Kateris [2], Georgios Kountios [3], Dionysis Bochtis [2] and George Vlontzos [1,2]

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Summary

Use of agro-chemicals is almost inevitable to protect crops from various diseases, entomological enemies or to provide essential elements to plants through foliar spraying. This method, while more user-friendly and effective in eliminating pests, comes with a host of drawbacks for both human health and the environment. Residues luck after the end of agro-chemicals use is one of the least studied stages in the life cycle of these items both in the packages and sprayers. Although several stations for cleaning sprayers and the disposal of used agrochemicals have been created, thus in practice farmers are in need of innovative solutions adapted to their needs. From the producer's perspective, it appears that fewer empty routes, less leaks from and to stable stations to the actual place of application, and quick access to such structures are crucial. That's the reason why this study aims to implement cost-effectiveness and cost-benefit analyses for assessing the potential adoption of portable cleaning stations for spraying machines compared to the traditional ones. Data regarding the involved costs, labor requirements and environmental have been collected. More precisely, initial investment costs, operating costs, labor needed for maintenance and environmental impacts of both structures were analyzed. Moreover, the economic aspect of the materials used for the creation of the portable stations are also examined, considering their appropriate density in the drying panel, time for drying and easiness of use. It should be noted that the overall assessment has been made considering the three sustainability principles of economic competitiveness, environmental protection and amelioration of living conditions or rural communities. Results indicated that portable stations are cheaper and more modular structures with lower operational costs. Additionally, the ability of portability seem to reduce the dead routes, while immediate cleaning reduced chemical spillage and water wastage, contributing to the overall increase of economic and environmental efficiency of the proposed system. However, low adoption rates from farmers side is a significant issue and it is of great importance to provide them with appropriate knowledge, incentives and motivation for adopting the proposed solution. Portable stations are emerging as a possible alternative to conventional stable ones as the agricultural sector seeks sustainable and effective solutions. Future research should prioritize the examination of the enduring effects, advancements in technology, and wider suitability in various agricultural environments as well as assessing their use under scenarios where drones are used as spraying machines.

Keywords

Portable filling stations, cost-effectiveness, cost-benefit analysis, sustainable agriculture

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Integration of digital tools and agricultural advisory services for sustainable farming: A case study from Serres, Greece - Abstract

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Summary

The European Union (EU) implemented Eco Schemes under the new Common Agricultural Policy (CAP) 2023-2027, supporting the transition towards a more sustainable, resilient, and environmentally friendly agricultural sector in the EU. In Greece, ten (10) Eco Schemes where finally implemented, that are tailored to support the unique features of Greek agriculture, promoting sustainability, environmental protection, and economic viability.

This conference paper examines the implementation of the Eco Scheme with the code P1-31.6 "Financing Producers for the Implementation of Environmentally Friendly Management Practices, Using a digital Application of Input Management and Monitoring of Environmental Parameters", in the Regional Unit of Serres, Greece. Farmers now have the opportunity, using digital tools, to monitor in real time, data concerning the use of agricultural supplies, the stages of cultivation and the management of natural resources.

As part of the study, a comprehensive market survey of the digital applications available to farmers was conducted. Also, the farmers of the RU of Serres, were asked to answer questionnaires regarding the degree of application of digital tools. The results showed that although a high number of producers were beneficiaries of the ES P1- 31.6, only a few farmers are familiar with these applications, while the rest have difficulty understanding them, mainly due to insufficient digital training.

Digital applications are closely related to Farm Advisory Services. This synergy leads to the more efficient use of these digital tools, as they are combined with the provision of Farm Advisory Services by qualified scientists and aim at the sustainable management of natural resources and the optimization of agricultural production.

Ultimately, the study evaluates the factors that influence the degree of implementation of such digital tools, such as cost, user-friendliness and expected benefits enjoyed by the user. Also, the importance of agricultural advisory services is recorded, which contribute to the substantial success of the implementation of the specific Eco Scheme.

Keywords

Digital agriculture, eco schemes, environmental monitoring, precision farming, sustainable agriculture, farm advisory services, CAP 2023-2027, Regional Unit of Serres, Greece

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A segmentation of Greek fresh fruits and vegetables consumers and suggestions for target cooperative product concepts - Abstract

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Summary

This is the first empirical study which has segmented consumers based on cooperative product concepts and perceived the barriers in purchasing fresh fruits and vegetables. From this research, we analyzed specific factors of satisfaction and beliefs on cooperative movement, through segmentation with hierarchical cluster analysis. An empirical study was conducted via personal interviews with a questionnaire on a sample of 400 Helenian food consumers. In such a way, we identified three consumer segments: 1) Moderately Satisfied (C1), 2) Dissatisfied (C2), 3) Satisfied (C3). The Satisfied consumers are characterized with the highest mean of satisfaction for "Taste-Safety" in purchasing cooperative fresh fruits and vegetables compared to the other segments. Also, they are the unique consumers of other clusters, who believe that cooperative producers enjoy fair prices for their agricultural products. The moderately satisfied consumers are more satisfied with the quality control which exercised by agricultural cooperatives and they are prone to being influenced by similar products of the competition market. The Dissatisfied consumers appear to be very low satisfied with price-availability of cooperative fresh fruits and vegetables and they are available to pay the "proper" price for cooperative fruits and vegetables, if and only if agricultural cooperatives change their commercial policy for better quality and safety. This empirical study fills the research gap in cooperative products regarding: a) specific factors of satisfaction, b) demographic characteristics of sample and c) beliefs for agricultural cooperatives.

Keywords

Agricultural cooperatives, hierarchical cluster analysis, satisfaction

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Regeneration status and diversity of woody plant species in the priority habitat 91E0* in Nestos, Greece - Abstract

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Summary

The priority habitat 91E0*, consisting of alluvial forests with *Alnus glutinosa* (L.) Gaertn. and *Fraxinus excelsior* L., represents a vital ecosystem along Europe's riverbanks and floodplains. In Greece, the alluvial forests of the Nestos Delta are particularly notable for their unique composition and ecological importance. The present study aimed to assess woody species' regeneration status and diversity in the priority habitat 91E0* in Nestos, Greece. In the studied area, 13 plant species belonging to 12 genera from 10 families were recorded. The most numerous families were Salicaceae (23.07%) and Moraceae (15.38%). The regeneration index (IR) for *Amorpha fruticosa* L. and *Acer negundo* L. exhibited a substantial decline, decreasing from 31.75 and 21.12 cm m^{-2} to 2.07 and 2.6 cm m^{-2}, respectively. This intervention created space for expanding native tree species such as *Cornus sanguinea* L., *Morus alba L.* and *Populus alba* L. The results demonstrate that the regeneration of *P. alba* L. is currently the most extensive (31.1%) in the alluvial forest, with *C. sanguinea* L., *M. alba* L. and *A. glutinosa* (L.) Gaertn. also showing significant regeneration. In contrast, the regeneration of *F. angustifolia* Vahl remains very limited (0.21 cm m-2), indicating the necessity for targeted restoration efforts.

Keywords

Alluvial forests, habitat, conservation, biodiversity, *Alnus glutinosa* (L.), *Fraxinus excelsior* L.

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Fostering vocational excellence in Apiculture: The BeeLieve project - Abstract

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Summary

Apiculture plays a crucial role in our ecosystems, agricultural systems, and the preservation of biodiversity, serving also as a linchpin for sustainable agriculture, rural development, and economic growth. Nowadays, the apiculture sector faces various challenges, including declining bee populations, changing environmental conditions, and the need for sustainable practices. To address the challenges faced by beekeepers, it is crucial to establish reliable channels for accessing relevant information and expert advice.

In this study the goals and the methodological approach of the project BeeLieve that focuses on the importance of strengthening the vocational education and training (VET) system in apiculture and foster closer collaboration between VET institutions and apiculture businesses are presented. The project deals with the status of regional policy and development, with the ways of how institutions in individual countries support beekeepers and how the non-profit and educational sector can get involved in the field of promoting this activity. BeeLieve unites a consortium of 20 partners from Poland, Bulgaria, Italy, Slovenia, and Greece who share a deep commitment and passion for the apiculture sector. With a shared vision, these partners collaborate to bridge the gap between education and industry by establishing collaborative environments where expertise, knowledge, and resources can be effectively shared. The project enhances the quality of vocational training, align it with industry needs, and elevate the overall competitiveness and employability of individuals within the apiculture field.

BeeLieve creates a comprehensive, pan-European platform dedicated to the development of apiculture. By establishing Centres of Vocational Excellence (CoVEs) in the strategic locations of partner countries, the project seeks to develop industry-relevant curricula that equip learners with practical, hands-on training and the essential skills required in the workplace. The BeeLieve consortium comprises a diverse group of partners, including **beekeepers, researchers, industry experts, policymakers, vocational education and training providers, and universities of applied sciences**. This collective expertise and experience enable a holistic approach to addressing the challenges and opportunities within the apiculture sector. Through collaborative efforts and resource pooling, the partners in the BeeLieve project are committed to driving innovation, promoting knowledge exchange, and facilitating the adoption of best practices in apiculture across Europe. By leveraging the strengths of each partner and fostering strong **industry-academia collaboration**, the project aims to transform the apiculture landscape, ensuring sustainable and thriving beekeeping practices. The BeeLieve project engages in comprehensive sector analysis to identify current and future skill requirements, industry trends, and labor market needs specific to apiculture. This analysis informs the development of state-of-the-art vocational training programs and curricula within the CoVEs.

BeeLieve envisages providing beekeepers with a reference of skills in beekeeping. BeeLieve aims to foster for beekeeping bridges through innovative and participative vocational training, by developing a course curriculum, based on personalized b-learning adapted to different realities and different regions and guaranteeing European qualification. An Apicultural Capacity Building Program is designed based on: 1. a set of thematic training activities regarding testing and improving the Bee roadmaps for citizens, testing and improving the

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Cross-visiting method and involving trainers, technicians and researchers in the area of beekeeping and/or in active learning by sing gamification to assess and manage the beehive will be developed according to a strategic training programme designing, 2. an Apicultural Summer Academy, 3. a Collaborative B-Learning Platform for Apiculture with Innovation and Knowledge, as a virtual environment 4. Beekeeping Technician Certification System Establishment after the possibility to be trainees in relevant Businesses. With BeeLieve, the apiculture sector experiences a transformative shift, benefiting beekeepers, industry professionals, and the wider community.

Keywords
Apiculture, Beekeeping, Vocational training, Centres of Vocational Excellence

Acknowledgements
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Innovative cotton management system: From field to cotton gin - Abstract

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Summary

This paper presents an innovative cotton management system designed to enhance the marketability of cotton in Greece by preventing the mixing of different varieties during harvesting and ginning. The system involves grouping fields by cotton variety, using baling cotton pickers, and assigning each bale a unique identity with information on variety, weight, and moisture content. The study explores various routing algorithms to optimize the transportation of cotton, including the Traveling Salesman Problem (TSP) and its variations, ensuring efficient and cost-effective logistics. The proposed system provides cotton producers and cooperatives with the tools to manage their production and strengthen their bargaining power independently, marking a significant advancement in cotton management in Greece.

Keywords

Cotton, harvest, management system, standardization, transportation

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Digital transformation in Agriculture: Navigating challenges and opportunities for sustainable development - Abstract

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Summary

Amidst the evolving landscape of agriculture, there exists an urgent imperative to address the multifaceted challenges confronting the sector while striving for efficient and sustainable practices. The agricultural industry, vital for sustaining regional economies and ensuring food security, faces mounting pressures ranging from the depletion of natural resources to the impacts of climate change. In this context, the optimization of agricultural practices and the entrance of new technologies assume paramount importance, necessitating a simultaneous reduction in environmental burdens. Aligned with the Sustainable Development Goals (SDGs), digital agriculture presents a transformative opportunity to unlock economic, social, and environmental benefits. From enhancing agricultural productivity and market opportunities to fostering social inclusivity and environmental management, the potential impact of digitalization on the agri-food sector is profound. However, the realization of this potential is contingent upon overcoming various challenges, particularly in rural areas, where access to technology and infrastructure may be limited. The introduction of Information and Communication Technology (ICT) in agriculture, though supported by policymakers globally, necessitates a comprehensive and systematic approach to ensure equitable access and meaningful adoption.

This work presents the results of the application of high-tech services in the Greek agriculture ecosystem. In more detail, high-tech services are provided by the partners of the DigiAgriFood project to Greek beneficiaries in five regions of Greece. This action aims to empower the digital and green transformation of the entire spectrum of the agri-food value chain with immediate benefits for citizens, small and medium-sized enterprises (SMEs) and public sector in the Regions of Eastern Macedonia and Thrace, Central Macedonia, Western Macedonia, Epirus and Thessaly. It also presents the application of a Digital Maturity Assessment Tool (DMAT) enabling stakeholders to identify strengths and weaknesses, prioritize resources effectively, and chart a clear path towards comprehensive digital transformation.

The results show that the adoption of innovative technologies in agriculture is a multifaceted process influenced by various factors, including farmer age, education level, organizational affiliations, farm characteristics, and external motivations or deterrents. Older farmers may exhibit a more conservative approach towards technology adoption due to entrenched farming practices and limited familiarity with digital tools, whereas younger farmers often display greater openness to innovation, fueled by their digital fluency and adaptability. Education level emerges as a significant predictor of technology adoption, with higher education associated with greater receptiveness and access to resources. Participation in agricultural organizations facilitates knowledge-sharing and access to specialized resources, enhancing farmers' capacity to stay informed and competitive. Furthermore, farm size and geographical location play crucial roles, with larger farms and those situated near urban centers showing higher rates of technology adoption. External factors such as information access, risk perception, financial considerations, and social influences further shape farmers' adoption behaviors, highlighting

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the need for targeted interventions and support mechanisms to promote technology uptake across diverse farming communities.

Keywords
Digital Agriculture, sustainability, Digital Maturity Assessment Tool, Information and Communication Technology

Acknowledgments
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Advanced web-based decision support tools for climate-smart Agriculture - Abstract

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Summary

This work presences developing an advanced web-based decision support platform to enhance climate-smart agriculture practices. This platform developed within the STARGATE project, integrates various tools to aid farmers and agricultural consultants in tactical and strategic decision-making regarding farm cultivation, seasonal climate risk management, and long-term adaptation to climate change. It leverages data from satellite imagery, weather forecasts, soil analyses, and machine learning algorithms to provide real-time insights for optimizing farming operations, such as tillage, irrigation, fertilization, and harvesting. Key features include a Tillage Scheduler that evaluates soil moisture levels for optimal tillage timing, an Irrigation Scheduler that offers recommendations based on soil and weather conditions, and a Harvesting Scheduler that uses weather data to estimate crop maturity. By providing easy access to personalized reports and customizable dashboards, the platform facilitates more efficient resource use, risk management, and compliance with environmental regulations, promoting sustainability and resilience in agriculture.

Keywords

Precision agriculture, decision support tools, climate smart agriculture, sustainable farming

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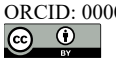
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Contract farming and energy crops in Greece - Abstract

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Summary

This research explores the concept of contract farming, a system where participants agree to sell or purchase production at a predetermined price. This agreement may also include specifications such as the quality, quantity and delivery time of the products. In recent years, contract farming has been applied worldwide to a variety of crops, including energy crops, which is the focus of our paper.

Energy crops have multiple uses: they can be processed into biomass for biodiesel and bioenergy, vegetable oil, provide raw materials for a range of bio-based products and as feed for livestock. Companies involved in transforming and processing these raw materials often implement contract farming programs with energy crop farmers.

This research aims to contribute to the debate concerning contract farming with energy crops in the Prefecture of Serres, one of the most important areas for the production of energy crops in Greece by recording and analyzing the opinions and experiences of local producers, the study aims to draw conclusions regarding the effectiveness and the impact of contract farming on the sustainability of the energy crops cultivation.

The research investigates the performance of contract farming for energy crops in this Region. Data were collected through questionnaires via face-to-face and telephone interviews conducted in April 2024 with 50 farmers. The collected data were processed, quantified and analyzed using SPSS to produce results and give insights regarding energy crop contract farming.

The results indicate that 28% of respondents are engaged in agriculture as a secondary occupation alongside their primary employment. Only for the 16% of the sample, agricultural activity constitutes their main occupation.

For the 18% of respondents farming is an alternative source of income, especially when it involves utilizing privately owned land within the family business.

In the Serres area, most producers are not limited to the cultivation of a single crop. More specifically, concerning energy crops, 90% of the farmers cultivate sunflower, 22% oilseed rape, and only 4% soybeans, findings that show the potential of these crops in the region.

Regarding producers' views on contract farming 58% believe it mitigates market risks, 44% think it enhances product quality and upgrades standards at the national level, and 32% observe an increase in income and stability through contractual relationships. Further, 32% agree with the negotiation opportunities provided by contract farming and 38% acknowledge that contract farming services improved yield quantity and quality per hectare.

Half of the respondents (50%) do not view contract farming as a means of farmer manipulation, as it operates under pre-agreed terms. Additionally, 52% did not encounter difficulties in cooperation regarding quantity or quality during their contracts. Most producers (66%) believe they can adhere to contract terms without issues and appreciate the benefits of rural development programs (36%).

The study concludes that producers are generally satisfied with contract farming, experiencing no significant problems or disruptions. They also believe contract farming enhances product quality and should be more widely promoted in Greece. With better support and improved awareness, contract farming could provide stable profits, secure production, and promote

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quality; however, awareness among the rural population regarding contract farming remains low.

Keywords
Contract farming, energy crops, farmer opinions, Greece

Identification of native Greek wine grapevine varieties using next generation sequencing - Abstract

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Summary

The common grapevine (*Vitis vinifera* ssp *vinifera*) is the most widespread cultivated species of the genus *Vitis*, which includes more than 60 species. Recent studies indicated that the domestication occurred simultaneously about 11,000 years ago in Western Asia and the Caucasus to yield table and wine grapevines. Winemaking in Greece dates back to around 4.500-4.000 BC. Today approximately 300 varieties of grapevine are cultivated in Greece, including a plethora of native varieties. In this study we aimed to find polymorphisms in 21 native *Vitis vinifera* varieties (Vidiano, Thrapsathiri, Kotsifali, Tsardana, Melissaki, Mavrodafni, Moschato aspro, Malagousia, Zakinthino, Skiadopoulo, Assyrtiko, Aidani, Mavrathiro, Mavrotragano, Xinomavro, Koiniariko, Asprouda Serrwn, Papas Karas, Moschato mavro, Ritino, Fokiano) using a Next Generation Sequencing approach. More specifically we constructed 96 double digest restriction-site associated DNA (ddRAD) libraries to identify inter-varietal single nucleotide polymorphisms (SNP) that are distinctive for each variety. Initially, we run simulations of double digestions on *Vitis vinifera* complete genomes, in order to choose the most suitable pair of enzymes for the subsequent analyses, which was the *Nsi*I/*Cvi*qI. The first step for the library construction was the isolation of high molecular weight DNA free of contaminants, suitable for successful library preparation. Even though obtaining high molecular DNA was not difficult, extracting contaminant-free DNA from grapevine leaves was challenging. The most suitable protocol was confirmed to be a CTAB-based extraction protocol. The yield and the purity of the extracted DNA were highly variable and depedent on the age of the leaves, the season of the sampling and the variety of the grapevine. For that, the protocol was altered and optimized accordingly. The modifications which had significant impact to the yield and the purity of the DNA were: the incubation of the tissue in a suspension buffer prior to the incubation in the CTAB solution, the addition of the antioxidants ascorbic acid and PVP-40 (Polyvinylpyrrolidone), and the extension of the incubation and precipitation time. Then, we performed double digestion with the selected pair of enzymes, that resulted in DNA fragments with sticky ends, ready to ligate with properly designed DNA adaptors, at both ends. In general, we used eight differently barcoded adaptors to ligate with the *Nsi*I sticky ends, while the adaptor for the *Cvi*QI end was not barcoded. This allowed the grouping of the samples to be analyzed into groups of eight (eight individuals per

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sequencing library, twelve sequencing libraries in total). Next, a size selection step was done, where fragments with insert size of 250-450 bp (326-526 bp with the adaptors) were selected. The selected fragments were amplified with appropriate Illumina sequencing primers (i5 and i7). At this step, only the double digested fragments were amplified. Each library was evaluated in terms of concentration (qPCR) and size distribution. Because a differently indexed i7 primer was used to amplify each of the twelve libraries, all sequencing libraries could be equimolarly pooled to create a single sequencing library. The sequencing process was performed on a NovaSeq platform and generated 80 Gb of 250 PE sequencing reads. Initially the sequences were analyzed for low quality bases using Phred quality score. The samples were demultiplexed and mapped to a reference genome. They had an average of 1.6 million reads per sample.

Keywords
Grape genotyping, Greek varieties, SNP, ddrad

Conflicting objectives in non-Conventional Water valorization in the Mediterranean - Abstract

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Summary

In recent years, Non-Conventional Water (NCW) has been providing a promising alternative against increasing water scarcity in the Mediterranean. However, little work is available regarding the socioeconomic effects of its use. The purpose of this study is to present effects of different levels of availability of irrigation water in four different Mediterranean areas relevant to the valorization of NCW. The analysis is based on technical and economic data from four Mediterranean Living Labs (LLs), one in Italy, one in Spain, one in Egypt and one transboundary between Tunisia and Algeria. The methodological approach is based on different versions of Mathematical Programming (Linear Programming, Parametric Programming, Multi-Objective Programming). The results of the analysis showed that future scenarios of water deficiencies will have serious implications of the cropping pattern and will affect certain farm types severely, equally affecting employment, incomes and input use.

Keywords

Mathematical programming, irrigation water, employment, agrochemical use, water harvesting, wastewater reuse, desalination

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