TIMES HIGHER EDUCATION

HUNGARIAN UNIVERSITY OF AGRICULTURE AND LIFE SCIENCES

SUSTAINABLE DEVELOPMENT GOALS

REPORT ON THE SUSTAINABLE DEVELOPMENT GOALS

Reporting 2022

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Introduction

In 2015, the United Nations (UN) Member States embraced the Sustainable Development Goals (SDGs) as a pressing call to action, applicable to all nations, whether developed or developing, through a worldwide collaboration. These goals acknowledge the imperative of simultaneously eradicating poverty and other forms of deprivation while advancing healthcare and education, reducing disparities, stimulating economic advancement, and addressing climate change and its repercussions, such as forced migration, while also striving to protect our natural waters and forests.

The SDGs do not specifically target higher education, the attainment of these goals by 2030 necessitates a collective effort from various sectors and stakeholders, combining financial resources, knowledge, and expertise. This inclusive approach must encompass the assets and contributions of universities and institutions of higher education. The Times Higher Education (THE) Impact Rankings represent the inaugural global endeavour to assess universities' progress with regard to the SDGs. They have the potential to act as a catalyst for mobilizing action, serving as a mechanism to hold universities accountable, and providing them with an opportunity to showcase the significant efforts they are already undertaking in this regard.

In 2022, for the first time in its history, the Hungarian University of Agriculture and Life Sciences (MATE) has been qualified in THE Impact Rankings, a ranking of universities' performance in four areas: research, responsibility, outreach and education. This report aims to summarise the Sustainable Development Goals of MATE for the Impact Rankings 2024 for which the academic year 2022 has been taken into consideration. We would like to emphasise that MATE, in addition to its scientific activities, has a strong social engagement in each SDG, but this report is limited to a brief presentation of significant publications.

An introduction to the university

On the 1st of February 2021, the Hungarian University of Agricultural and Life Sciences was established. At the same time, the eleven research institutes and companies of the National Agricultural Research and Innovation Centre and the Agricultural Research Institutes of the University of Debrecen and the Research Institute of Karcag (Figure 1). MATE is thus not only an educational institution but also a scientific, practical and innovation centre for the sector.

Figure 1. The campuses of the Hungarian University of Agriculture and Life Sciences

As the largest agricultural university in Hungary, Hungarian University of Agriculture and Life Sciences (MATE) is committed to sustainable development, so the THE Impact Ranking reflect the objectives that the university is committed to. It was ranked 401-600 right from the start, putting it in the top 25% of ranked universities. This is already an outstanding performance compared to other Hungarian universities. MATE achieved the 2nd best ranking among the Hungarian universities, with only the University of Debrecen outranking MATE out of the eleven universities that applied.

According to the data available in Scopus, MATE has published more than 3 600 publications in the last five years. More than 47% of this was international and 32% national cooperation. Although the growth in the number of publications has moderated over the last two years, it is clear that the number and proportion of articles published in Q1 and Q2 journals has increased. This trend is expected

to continue. Figure 2 depicts the topics and clusters to which the researchers have contributed most between 2018 and 2022. The field-weighted citation impact (FWCI), which is important for describing the performance of the institution, fluctuates, rising from 0.91 to 1.28 between 2018 and 2020, before stagnating at around 1.03 in 2021 and 2022.

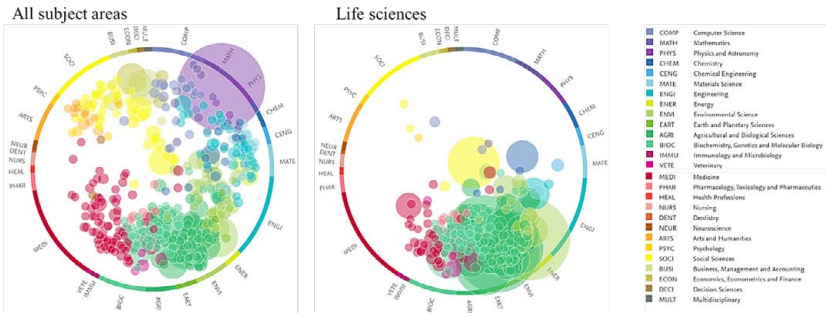

Figure 2. Elsevier ASJC categories to which MATE has contributed between 2018 – 2022

As the last year, MATE applies in four SDGs in addition to the mandatory SDG 17 (see Fig 3.). In the following, the three most important publications will be presented by SDGs.

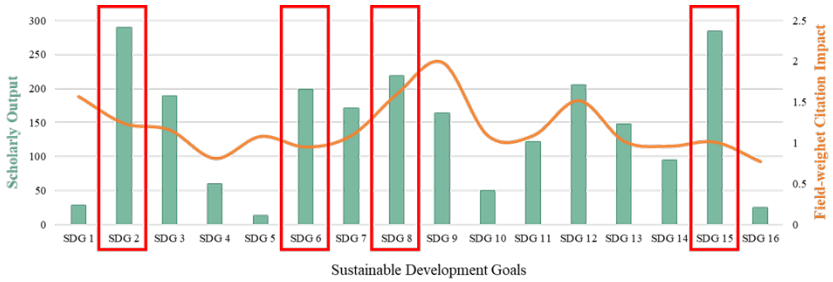

Figure 3. Scholarly outputs and field-weighted citation indices of MATE according to SDGs

SDG 1

No Poverty

At the Hungarian University of Agriculture and Life Sciences, we view Sustainable Development Goal 1 (SDG 1), "No Poverty", as a fundamental cornerstone of our commitment to sustainable agriculture and rural development. Agriculture is a key sector in Hungary, and ensuring that rural communities thrive without facing poverty is central to our mission. We recognize that poverty in rural areas can be particularly challenging, with issues such as limited access to education, healthcare, and economic opportunities. To address this, our institution is dedicated to research, education, and outreach programs that empower rural communities, support sustainable farming practices, and promote equitable access to resources inside and outside our borders. We believe that by addressing poverty at its root causes and fostering economic growth in rural areas, we can play a vital role in achieving SDG 1 while simultaneously contributing to a more resilient and sustainable agricultural sector for the benefit of all Hungarians.

In 2022, there were a total of 12 publications on "No Poverty" and a total of 72 citations. The most influential publications were published by Nathan, Setiawan and Quynh (2022), Ahmad, Khan and Magda (2022) and Liaqat *et al.* (2022) giving more than 58% of the total citation count.

12
Publications

72
Citations

The in-depth descriptive analysis entitled "Fintech and Financial Health in Vietnam during the COVID-19 Pandemic" and conducted by Nathan, Setiawan and Quynh (2022) explored financial literacy, fintech adoption, and their relation to the financial well-being of consumers in Vietnam, driven by the country's higher unbanked population and lower adult financial literacy compared to the Association of Southeast Asian Nations (ASEAN) region. Using judgment sampling, participants experienced with fintech for interviews, and individuals who completed online surveys on their mobile devices were selected. Notably, perceived ease of use, perceived usefulness, trust, brand image, government support, user innovativeness,

and attitude significantly correlated with fintech adoption, while financial literacy did not. Multiple linear regression analysis further revealed that user innovativeness and attitude positively impacted fintech adoption, while financial literacy had a significant negative influence. This inverse relationship suggests that fintech can foster financial inclusion among those with lower financial literacy. Conversely, individuals with higher financial literacy may rely less on fintech due to strong access to traditional financial services.

Ahmad, Khan and Magda (2022) also investigated in the ASEAN region aimed to determine the relationship between financial inclusion and environmental degradation using balanced panel data from 2000 to 2019. The pooled Mean Group-Autoregressive Distributed Lag (PMG-ARDL) model was employed to analyse both short-term and long-term effects of financial inclusion on environmental degradation. The results revealed that in the ASEAN region, financial inclusion, energy use, economic growth, and urbanization contribute to environmental degradation. The financial inclusion coefficient (statistically significant at 5%) indicates that a 1% increase in financial inclusion leads to a 0.15% rise in environmental degradation in the short run. In the long run, financial inclusion and CO_2 emissions are positively associated, with a statistically significant coefficient of 0.42, signifying that a 1% increase in financial inclusion results in a 0.42% increase in environmental degradation. The study suggests integrating financial inclusion into climate change adaptation strategies at local, national, and regional levels to mitigate the adverse effects of rising CO_2 emissions.

Achieving the United Nations' sustainable development goals heavily hinges on financial inclusion, and this topic has grown in importance for both researchers and policymakers. While prior studies have investigated how formal institutions impact financial inclusion, the influence of informal institutions, like culture, has largely been overlooked. To bridge this gap, Liaqat *et al.* (2022) delve into how national culture shapes financial inclusion in 81 Belt and Road economies between 2004 and 2020. Using a two-stage least square (2SLS) approach, the empirical findings reveal that Hofstede's cultural dimensions exhibit significant, yet diverse, links with financial inclusion. It was observed that countries with higher uncertainty avoidance and power distance tend to have lower financial inclusion, while those with greater individualism and masculinity tend to exhibit the opposite. The findings withstand rigorous testing, offering valuable insights for policymakers, regulatory authorities, and other stakeholders working to enhance financial inclusion in Belt and Road countries and thus contributing to the realization of sustainable development goals.

SDG 2

Zero Hunger

At the Hungarian University of Agriculture and Life Sciences, we view Sustainable Development Goal 2, "Zero Hunger", as an essential objective that resonates deeply with our mission and expertise. Agriculture is at the heart of our institution, and we recognize that it plays a pivotal role in addressing hunger and food security challenges. We are committed to advancing sustainable farming practices, agricultural research, and education to enhance food production while minimizing environmental impact. Our research and outreach programs aim to boost agricultural productivity, improve food distribution systems, and promote nutritional awareness. We firmly believe that by equipping future generations with the knowledge and skills needed to address global food security issues, we can contribute to the achievement of SDG 2. Moreover, through collaborations with international partners and local stakeholders, we are actively engaged in finding innovative solutions to eliminate hunger, not just in Hungary but also in the broader global context.

In 2022, there were a total of 98 publications on "Zero Hunger" and a total of 356 citations. The most influential publications were published by Rust *et al.* (2022), Gelybó *et al.* (2022), Nasir, Nugroho and Lakner (2022), Bhagat, Naz and Magda (2022) and Jewehan *et al.* (2022) giving more than 26% of the total citation count.

98
Publications

356
Citations

The exponential growth of available information has broadened our access to knowledge across various subjects. Historically, farmers seeking guidance on agricultural innovations turned to in-person advice from traditional agricultural advisors. With more farmers going online for information, it is unclear whether they now use digital resources to support traditional expert advice or prefer peer-generated information. Rust *et al.* (2022) studied how farmers in Hungary and the UK learned about sustainable soil innovations and who influenced their practices. Interviews showed that farmers in both

countries frequently used online sources for soil information, sometimes influenced by farmer social media influencers. However, online resources were not the primary driver for changes in farming practices. Farmers mostly trusted fellow farmers for learning about new soil practices, while having less confidence in traditional "experts", like agricultural researchers. This suggests some farmers may rely more on peer networks for learning and innovation. The researchers explored ways to enhance reliable knowledge exchange among agricultural stakeholders while acknowledging the value of peer influence and online interactions for innovation and trust-building.

The study by Gelybó *et al.* (2022) explored how soil tillage practices and crop types influence soil respiration (Rs) in a typical Central European agricultural setting characterized by crop rotation. Over a continuous five-year period, weekly Rs and environmental variables were monitored subjected to different crop types under two tillage treatments: mouldboard ploughing (MP) and no-tillage (NT). Rs was consistently higher for NT, regardless of crop type and weather conditions, with more substantial differences observed for summer crops. Soil water content was notably higher in NT, potentially contributing to the differences in Rs. Six models were evaluated to predict Rs in both MP and NT, utilizing observed environmental variables (soil temperature and soil water content). In four of these models, the normalized difference vegetation index (NDVI) was introduced as a predictor to represent root activity. The inclusion of NDVI notably enhanced model performance when considering both vegetated and non-growing season data. The selected models effectively explained 42% and 44% of the observed Rs variance in MP and NT, respectively. Furthermore, explicit Rs model equations were developed for the entire dataset and specific to sunflower, maize, and the non-growing season.

The study performed by Nasir, Nugroho and Lakner (2022) investigated the impact of the conflict between Russia and Ukraine on the global food situation, employing a descriptive analysis and literature review to address this objective. Russia and Ukraine hold crucial roles in global food production and trade. However, the war has disrupted food production in Ukraine, leading to a substantial decrease in estimated wheat, soybean, and maize production for 2022-2023. In contrast, Russia has seen positive growth in the production of these three food products during the same period. The global supply chain and food trade have been disrupted, resulting in a marked increase in worldwide food prices from March to May 2022, compared to levels observed during and before the COVID-19 pandemic. This situation poses a threat to global food security, especially for low-income nations heavily reliant on food imports from both Russia and Ukraine. Hence, it is imperative for all countries to be prepared for the possibility that the achievement of Sustainable Development Goals may be compromised.

SDG 3

Good Health and Well-being

At the Hungarian University of Agriculture and Life Sciences, we recognize the pivotal importance of Sustainable Development Goal 3, "Good Health and Well-being", in our commitment to fostering a sustainable and healthy future. Our institution plays a crucial role in the intersection of agriculture and life sciences, with a focus on enhancing not only food production but also the well-being of individuals and communities. We believe that a sustainable food system is intrinsically linked to good health and well-being, and our research, education, and outreach efforts are geared towards achieving this goal. Through innovative agricultural practices, nutrition education, and interdisciplinary collaborations, we aim to contribute to improved health outcomes, access to nutritious food, and overall well-being, both locally and globally. By aligning our efforts with SDG 3, we aspire to create a healthier and more sustainable world, recognizing that the well-being of individuals is intricately intertwined with the health of our planet.

In 2022, there were a total of 59 publications on "Good Health and Well-being" and a total of 320 citations. The most influential publications were published by Riyazuddin *et al.* (2022), Naz *et al.* (2022) and Nathan, Setiawan and Quynh (2022), the latter has already been included in **SDG 1**. These have given more than 36% of the total citation count.

59
Publications

320
Citations

When discussing health preservation, we cannot ignore environmental pollution and heavy metals. Riyazuddin *et al.* (2022) immersed in reviewing heavy metal (HM) toxicity and its detrimental effects. This issue has emerged as a global issue in recent years, posing a significant threat to both the environment and human health. In the case of plants, when HM concentrations exceed a certain threshold, they disrupt cellular metabolism by generating reactive oxygen species (ROS), which target essential biological molecules. Some HMs (e. g., mercury, arsenic), can directly interfere with protein and enzyme activities by binding to their -SH groups, further impeding cellular

metabolism. Notably, HM toxicity has been found to inhibit photosynthesis by accelerating the degradation of chlorophyll molecules, enhancing chlorophyllase activity, and replacing the central Mg ion in the porphyrin ring. These effects have profound consequences for overall plant growth and yield. As a consequence, plants have evolved various strategies to counteract the adverse effects of HM toxicity. They limit HM uptake and sequester HMs into vacuoles with the assistance of various molecules, including proteins like phytochelatins, metallothionein, compatible solutes, and secondary metabolites.

The effect of COVID-19 in this SDG has also been investigated on several occasions, since it has presented significant challenges and disruptions, underscoring the critical need for supply chain resilience (SCR). Researchers have increasingly turned their attention to understanding how to make supply chain operations resilient in the face of risks and disruptions. In today's competitive market, businesses rely on innovative projects to gain a competitive advantage. Naz *et al.* (2022) conducted research to assess the pivotal role of artificial intelligence (AI) in building sustainable and resilient supply chains while offering effective strategies for mitigating supply chain risks. A comprehensive literature review was undertaken, identifying 162 pertinent articles from the Scopus database in the domain of AI and SCR. Through structural topic modelling (STM), thematic topics related to AI in SCR were extracted from the selected articles. Furthermore, bibliometric analysis was employed to explore research trends in the field of AI and SCR. Building on this extensive literature review, a research framework for AI in SCR was formulated, aiming to guide researchers and practitioners in advancing technological developments within supply chain enterprises. This framework is designed to enable effective project management in a post-COVID-19 context by addressing unforeseen risks and disruptions. Additionally, this study serves as a valuable resource for future researchers and practitioners, offering insights into potential research directions based on the existing literature in the field of SCR.

SDG 4

Quality Education

Hungarian University of Agriculture and Life Sciences hold a profound appreciation for Sustainable Development Goal 4, "Quality Education". Education stands as the cornerstone of progress and development, serving as a fundamental catalyst for a sustainable future. Our institution is dedicated to providing education of the highest quality, fostering a learning environment that empowers students with the knowledge and competencies needed to address the intricate challenges of the contemporary world. We believe that education extends beyond the mere transmission of information; it is a means to cultivate critical thinking, creativity, and a strong sense of social and environmental responsibility. Through our academic programs and research endeavours, we are committed to enhancing the realm of education, particularly in the domains of agriculture and life sciences, to empower individuals and communities alike. Our objective is to promote quality education as a driving force toward a brighter and more sustainable future, in complete alignment with the principles and goals encapsulated in SDG 4.

In 2022, there were a total of 17 publications on "Quality Education" and a total of 30 citations. The most influential publications were published by Józsa *et al.* (2022), Borsos *et al.* (2022) and Issakov *et al.* (2022), giving more than 47% of the total citation count.

17
Publications

30
Citations

Research has consistently demonstrated that the development of cognitive and social skills during preschool years plays a crucial role in forecasting a child's readiness for kindergarten. Józsa *et al.* (2022) conducted an eight-year research to explore the enduring effects of preschool-related predictors, intelligence, and maternal education on a child's performance in the sixth grade including 202 Hungarian children, 89 of whom came from south-east Hungary. The independent variables under consideration include assessments from the preschool period, featuring the widely adopted Diagnostic System for Assessing Development (DIFER), a standardized school readiness test

evaluating cognitive and social competencies, along with the Raven intelligence test and socioeconomic status. The dependent variables evaluated in the sixth grade entail National Standardized tests in mathematics, reading and school grades (GPA). Notably, each of the tests demonstrated a high level of reliability, with Cronbach's alpha scores consistently exceeding 0.76. The analysis applied correlations and a series of multiple regressions, revealing that all three independent variables significantly predict academic performance in the sixth grade. DIFER skills emerged as the most robust predictor for reading, intelligence for mathematical achievement, and maternal education exhibited the greatest predictive influence on GPA.

Bringing students closer to nature has become increasingly vital, especially in the wake of the pandemic. Therefore, it is imperative for schools to actively engage in this process by conducting as many outdoor classes as possible. The adoption of this approach hinges on the readiness of teachers, influenced by the quality of teacher training institutions. A survey was conducted by Borsos *et al.* (2022) involving 551 trainee teachers from Serbia, Croatia, Hungary, Spain, and Norway to assess the perceptions of outdoor education (OE), and to ascertain whether trainee teachers considered OE to be effective, and whether they were content with the knowledge imparted during their studies. The results were examined separately for each country and compared across the five nations. The trainee teachers express intentions to employ this approach; however, they express dissatisfaction with the level of knowledge provided during their studies. There were notable variations in the perceptions of trainee teachers depending on the country in which they were pursuing their education. These provide a solid foundation for further research and offer valuable insights to universities' educational state.

Assessing the role of mobile Geographic Information System (GIS) applications in fostering students' tourist and local lore competencies, which significantly impact future educators' knowledge and skills, is essential. It is equally crucial to gauge teachers' and professors' attitudes towards these applications and to understand students' current usage. The paper by Issakov *et al.* (2022) explored the potential of mobile GIS applications in organizing tourist and local lore activities for "Geography" program students. The effectiveness was assessed through interviews and questionnaires. The findings highlighted the widespread adoption of mobile GIS applications such as 2GIS for "Road navigation" (79.1%), ArcGIS QuickCapture for "Viewing and studying" (56.9%), and Google Earth's "Virtual globe" (52.8%). Evaluations of mobile applications for "Cartography and Navigation" found GIS4MOBILE-x to have a 41.7% adoption rate, and "GPS monitoring" in the City bus app had full adoption (100%). These applications were deemed effective in enhancing tourist and local lore activities, offering modernized educational approaches and innovative pedagogical techniques.

SDG 5

Gender Equality

At the Hungarian University of Agriculture and Life Sciences, gender equality is a fundamental principle that underpins all aspects of our institution's values and practices. We are dedicated to fostering an inclusive and equitable learning and working environment where individuals of all genders have the same opportunities and are treated with respect and fairness. We believe that gender equality is not only a matter of justice but also a catalyst for social and economic progress. Our commitment to gender equality is reflected in our educational programs, research initiatives, and institutional policies. We promote the empowerment of women and the elimination of gender-based discrimination. Through education, awareness, and collaborative efforts, we aim to contribute to a world where every individual, regardless of their gender, has the chance to reach their full potential and participate in building a more sustainable and equitable society, aligning with the values and goals of SDG 5.

In 2022, there were a total of 4 publications on "Gender Equality" and a total of 15 citations. The most influential publications were published by Kabil *et al.* (2022), Muchiri, Erdei-Gally and Fekete-Farkas (2022) and Nguse *et al.* (2022).

4
Publications

15
Citations

Tourism has emerged as an effective economic instrument for advancing gender equality. A study done by Kabil *et al.* (2022) specifically examined articles that employed structured research methods such as interviews, questionnaires, surveys, and observations concerning the Middle East and North Africa (MENA) region. A total of 203 articles were retrieved from the Scopus and Web of Science databases and subjected to comprehensive bibliometric analysis, considering six key factors: the evolution of scientific production, documents, notable authors, sources, participating countries, institutions and keywords. The primary findings of this investigation could be succinctly summarized in two critical observations: the volume of

scientific articles addressing gender issues within the tourism sector in the MENA region remains insufficient and does not align with the contemporary global and regional emphasis on achieving gender equality; among the various countries in the MENA region, Egypt, Jordan, Israel and Oman have demonstrated the most notable attention to gender-related aspects in their publications.

Corporate social responsibility (CSR) serves as a critical avenue for realizing the sustainable development of individual nations. Existing research into the impact of CSR on the financial performance of various institutions has yielded diverse outcomes, revealing disparities rooted in geography, sectors, and academic perspectives. A study of Muchiri, Erdei-Gally and Fekete-Farkas (2022) sought to unveil the influence of CSR on the financial performance of financial institutions in Kenya, known to be lacking of a direct link between CSR and corporate financial performance (CFP). The research focused on the examination of ethical, philanthropic, and gender mainstreaming CSR activities and their impact on the financial performance of financial institutions in Kirinyaga County. The research included a study population of 300 employees within financial institutions, from which 171 participants were selected through stratified and systematic sampling methods. Employing a causal research design, primary data was collected through in-person questionnaire administration. The study discerned a positive correlation between CSR practices and the financial performance of financial institutions, underscoring the importance of increased investments in ethical, charitable, and gender mainstreaming CSR initiatives, as these actions demonstrably enhance financial performance.

Financial inclusion is a recognized economic catalyst for a nation. A study by Nguse *et al.* (2022) investigated the impact of government policies and regulations on women's economic empowerment through financial inclusion, focusing on small and medium-sized enterprises (SMEs) in Ethiopia. The research design is explanatory, utilizing a mixed approach with primary and secondary data sources. Questionnaires gathered primary data, while extensive literature reviews and academic sources provided secondary data. The study encompasses all registered women entrepreneurs in Addis Ababa, with 324 women-owned SMEs participating via judgment sampling. The research findings indicated that government policies and regulations have a positive and significant direct and indirect impact on women's economic empowerment. Moreover, financial inclusion directly contributes to women's economic empowerment, partially mediating the relationship. Notably, constraints on financial inclusion, such as collateral requirements, startup capital, illiteracy, high-interest rates, bureaucratic procedures, and technical skill gaps, hinder women's economic empowerment in Ethiopia. The study serves as a valuable contribution by addressing the nexus of women's empowerment and financial inclusion, informing policymakers on fostering greater financial inclusion.

SDG 6

Clean Water and Sanitation

At the Hungarian University of Agriculture and Life Sciences, we align with the objectives of Sustainable Development Goal 6, which focuses on "Clean Water and Sanitation". Clean water is a precious resource that is vital for life, agriculture, and the environment. Our university places great emphasis on research, education, and innovation in the fields of water management, environmental science, and agriculture. We are committed to developing sustainable practices that ensure the availability and sustainable management of water resources. Through our academic programs, research initiatives, and community outreach, we aim to address the challenges related to clean water and sanitation, not only in Hungary but also on a global scale. We understand that access to safe and clean water is fundamental to human well-being, and we are dedicated to contributing our expertise to achieve SDG 6 and create a more sustainable and equitable world.

In 2022, there were a total of 62 publications on "Clean Water and Sanitation" and a total of 198 citations. The most influential publications were published by Elbeltagi *et al.* (2022), Khaeim *et al.* (2022), Rizk *et al.* (2022), Kondor *et al.* (2022) and Ban *et al.* (2022), giving more than 40% of the total citation count.

62
Publications

198
Citations

Estimation of reference crop evapotranspiration (ETo) is essential for numerous applications, such as water resource management, agricultural planning, and irrigation. The study by Elbeltagi *et al.* (2022) aimed to predict ETo using artificial neural networks (ANN) with a restricted set of meteorological data. Daily records, spanning from 1969 to 2019, included various parameters like minimum temperature (Tmin), maximum temperature (Tmax), mean temperature (Tmean), solar radiation (SR), humidity (H), wind speed (WS), sunshine hours (Ssh), maximum and minimum global radiation, day length, and observed ETo. The dataset was split into two periods:

1969 to 2007 for model training and 2008 to 2019 for testing. The optimal ANN configurations for ETo prediction featured different combinations of input parameters, demonstrating the adaptability of this approach. These ANN models offer valuable tools for water resource managers, planners, and designers, particularly in situations with limited climate data.

Temperature and moisture are critical factors influencing the germination and early growth of wheat (Triticum aestivum L.) seeds. Research conducted by Khaeim *et al.* (2022) at the MATE Agronomy Institute aimed to evaluate the impact of various abiotic stressors on wheat seed germination and growth. Six different temperature levels, ranging from 5 °C to 30 °C, were employed. Drought and waterlogging stresses were assessed using 25 distinct water levels, both in millilitre intervals and as a percentage relative to the thousand kernel weight (TKW). Seedling density was also a subject of investigation. The results highlighted the significant influence of temperature on germination duration and seedling development, with 20 °C identified as the optimum temperature, falling within the range of 15 °C to less than 25 °C. Germination was observed at a water level equivalent to 75% of the TKW, with a narrower and lower optimal range compared to seedling development. Seed size served as a reliable basis for determining water requirements during germination. This study established an optimal water supply range for wheat seedling growth, spanning from 525% to 825% of the TKW. Furthermore, the preference for a seed density of fifteen seeds within a Petri dish of 9 cm was noted over denser populations.

As mentioned earlier, heavy metals are known to have detrimental effects on both human health and the delicate biogeochemical balances within freshwater ecosystems. The contamination of various aquatic environments by heavy metals can be attributed to a range of human activities, including industrial processes, agriculture, urban expansion, transportation, and mining. In Egypt, Lake Nasser serves as a crucial source of freshwater, but it often falls victim to pollution from human activities in the upstream regions of the River Nile's hydrographic basin. Rizk *et al.* (2022) focused their study around this matter and assessed the extent of heavy metal contamination (specifically Cd, Zn, Pb, and Cu) in the water, sediment, as well as two organs of Nile Tilapia (Oreochromis niloticus) fish – the liver and muscles, at six different sampling sites across Lake Nasser. Besides, the research delves into the bioaccumulation of heavy metals within the aquatic ecosystem, tracing their paths through the water, sediments, and fish organs. The findings indicate that the water quality in Lake Nasser meets the safety standards for various applications, including human consumption, agricultural use, and public sanitation.

SDG 7

Affordable and Clean Energy

The Hungarian University of Agriculture and Life Sciences is committed to advancing the ideals of Sustainable Development Goal 7, "Affordable and Clean Energy". We recognize that access to affordable and clean energy sources is pivotal for sustainable development, agricultural practices, and environmental protection. Our institution is dedicated to researching and promoting energy-efficient technologies, renewable energy sources, and sustainable agricultural practices. We actively engage in education, innovation, and knowledge dissemination to address the challenges of energy access, energy security, and environmental sustainability. By fostering research and education in the fields of agriculture, environmental science, and renewable energy, we strive to contribute to a future where clean and affordable energy is available to all, promoting both economic growth and environmental conservation. At our university, we view SDG 7 as a cornerstone for achieving a more sustainable and prosperous world, and we are dedicated to playing our part in making this goal a reality.

In 2022, there were a total of 38 publications on "Affordable and Clean Energy" and a total of 232 citations. The most influential publications were published by Al-Yasiri, Szabó and Arıcı (2022), Ajeena, Vig and Farkas (2022) and Al-Yasiri and Szabó (2022), giving more than 38% of the total citation count.

38
Publications

232
Citations

Cooling and air-conditioning systems play a pivotal role in the energy consumption of buildings situated in hot and mixed climate regions. The predominant reliance on conventional electrically driven systems is the primary driver behind the escalating energy demand in buildings, which not only leads to increased energy consumption but also raises concerns about CO_2 emissions and environmental impacts. In response to these challenges, solar energy has emerged as a promising and sustainable alternative for various applications, including cooling and air-conditioning, demonstrating its reliability and efficiency. Al-Yasiri, Szabó and Arıcı (2022) provide an extensive overview of

solar cooling and air-conditioning systems (SCACSs) tailored for building applications. It delves into solar thermal SCACSs, offering a comprehensive insight into their functionality and evolution. A comparative analysis of different solar thermal SCACSs is conducted, considering various technical, operational, economic, and environmental parameters. Furthermore, the paper identifies research gaps, provides valuable recommendations, and draws meaningful conclusions from the existing literature, aiming to advance this crucial research field.

To combat global rise of energy need, flat plate solar collectors (FPSCs) have long been recognized and commonly used, especially in low and medium-temperature applications in households. FPSCs face limitations in efficiency in converting solar energy into thermal energy. Recent advancements in technology have made it possible to produce nanoparticles at the nanoscale and suspend them effectively in traditional solar fluids, creating what is known as nanofluid (NF) that significantly improved the thermophysical properties of the solar fluid, offering a promising solution for enhancing the performance. Ajeena, Vig and Farkas (2022) gave an overview of recent developments in the use of NFs in FPSCs, examining various factors that influence thermal efficiency (e. g., type of nanoparticles, their size and shape, concentration, mass flow rate, solar irradiance). It also reviews the progress in this field, including applications, types, preparation methods, thermophysical properties, stability, and the evaluation of stability. It further discusses the challenges and future directions identified by researchers working with NFs in solar thermal collectors, covering aspects like viscosity, stability, corrosion, operating costs, pumping power, pressure drop, and surfactant use.

In hot climate regions, phase change materials (PCMs) have proven to be effective in enhancing energy efficiency and thermal comfort in buildings. Al-Yasiri and Szabó (2022) conducted experiments on a building envelope enhanced with PCMs in Al Amarah, Iraq. Two identical rooms, one with PCMs and one without, were constructed and tested. Key factors such as PCM placement in the roof and the integration of high-performing PCM capsules in concrete bricks were considered in constructing the PCM room. The study evaluated various energy and thermal comfort indicators, demonstrating that the PCM-enhanced room significantly improved thermal performance, especially in the roof and east wall, with up to a 3.75 °C reduction in maximum temperature, 6.5 °C less temperature fluctuation, and an increased decrement factor by 25.6%. Moreover, the PCM room enhanced thermal comfort by 11.2% in discomfort hours and reduced maximum heat gain by 34.8%. Adequate ventilation strategies were emphasized to further optimize thermal comfort when using PCMs passively.

SDG 8

Decent Work and Economic Growth

At the Hungarian University of Agriculture and Life Sciences, we wholeheartedly embrace the principles of Sustainable Development Goal 8 centring on "Decent Work and Economic Growth". Our institution recognizes the multifaceted significance of nurturing economic growth while concurrently fostering an environment that offers dignified employment opportunities. We are unwavering in our commitment to preparing the next generation of professionals with the knowledge and competencies essential for meaningful careers in agriculture, life sciences, and environmental sustainability. Our mission extends to actively promoting inclusive economic advancement, minimizing unemployment rates, and advocating for sustainable agricultural practices. Through our academic and research initiatives, we endeavour to contribute to the development of policies and strategies that bolster job creation, safeguard labour rights, and encourage equitable economic practices. By aligning with the core tenets of SDG 8, we aspire to play a central role in shaping a world where individuals can access dignified employment and where economic growth thrives in an inclusive and equitable manner, offering a promising future for all.

73
Publications

408
Citations

In 2022, there were a total of 73 publications on "Decent Work and Economic Growth" and a total of 408 citations. The most influential publications were published by Nekmahmud, Ramkissoon and Fekete-Farkas (2022), Rust et al. (2022) and Desalegn and Tangl (2022), giving more than 25% of the total citation count. The middle was already included in **SDG 2**.

Nekmahmud, Ramkissoon and Fekete-Farkas (2022) investigated the sustainable consumption values and choice behaviour of tourists in Europe when it comes to green products, using a combination of the Theory of Planned Behaviour (TPB) and Consumption Values (TCV). The research also compared the decision-making processes of

European and non-European tourists when purchasing green products and services in selected European cities. A total of 720 usable questionnaires were collected. Advanced analytical methods (e. g., PLS-SEM, MGA, etc.) were employed to test the model and hypotheses. The results indicate that environmental attitudes, knowledge, subjective norms, perceived behavioural control, conditional value, and emotional value all have a significantly positive relationship with green purchase intentions for tourist coming from inside and outside Europe. This study provides a theoretical framework for understanding green purchase choices and sustainable consumption intentions, making both theoretical and practical contributions to the field of green product purchasing by tourists.

Green financing has gained popularity as a means to address environmental issues, but its effectiveness in tackling global environmental challenges remains uncertain due to the significant green investment gap. Desalegn and Tangl (2022) examined various forms, instruments, and measurements of green finance and highlights research trends to promote inclusive green investments while addressing the green finance gap. The study identifies influential authors, countries, publishers, and journals in the field and outlines the methodological approaches commonly used in relevant papers, serving as a reference for researchers interested in green finance. The findings emphasize that the green financing gap often arises from low funding levels, inadequate green project selection and management, trade-offs between risk and return, and a lack of tools and expertise for assessing green project risks. Regulatory issues are identified as the primary obstacle to enhancing green finance. The study recommends further research to explore methods for boosting green finance, attracting private investors to green projects, and introducing additional green financing approaches to bridge the funding gap. Ultimately, the study aims to provide insights that can guide future research efforts by sharing specific experiences and lessons from different countries regarding green finance mobilization and capital contribution.

SDG 9

Industry, Innovation and Infrastructure

Sustainable Development Goal 9, "Industry, Innovation, and Infrastructure" aligns with the mission of the Hungarian University of Agriculture and Life Sciences. As an institution dedicated to agricultural sciences and environmental sustainability, we recognize the pivotal role that industry, innovation, and infrastructure play in driving economic growth and fostering sustainable practices. At our university, we prioritize research and education in areas such as agricultural technology, food production, and environmental conservation. We actively contribute to innovation and the development of modern infrastructure to meet the evolving needs of our society. By nurturing a culture of innovation and entrepreneurship among our students, we aim to equip them with the skills and knowledge to tackle global challenges in agriculture, life sciences, and environmental stewardship. We are committed to fostering sustainable, technologically advanced solutions that not only benefit our region but also have the potential to make a positive impact on a global scale. In alignment with SDG 9, we are dedicated to advancing industry, innovation, and infrastructure as catalysts for a more sustainable and prosperous future.

54
Publications

353
Citations

In 2022, there were a total of 54 publications on "Industry, Innovation and Infrastructure" and a total of 353 citations. The most influential publications were published by Sader, Husti and Daroczi (2022), Naz *et al.* (2022) and Ajeena, Vig and Farkas (2022) giving more than 28% of the total citation count. The second and third publications have already been presented in **SDG 3** and **SDG 7**, respectively.

Quality 4.0 introduces a fresh paradigm in quality management, responding to the dynamic progress in information and communication technologies, catalysed by the advent of "Industry 4.0". The "4.0" designation has permeated various sectors, encompassing Agriculture 4.0,

Agribusiness 4.0, Service 4.0, Logistics 4.0, and Health 4.0, signifying the far-reaching effects of Industry 4.0 on these domains. However, Quality 4.0 remains a relatively unexplored subject in scientific discourse, with only a handful of articles briefly mentioning it without offering a comprehensive scientific foundation. Sader, Husti and Daroczi (2022) take a stride towards rectifying this by proposing a holistic, hybrid definition of Quality 4.0. Quality 4.0, as delineated here, extends the realm of quality management by harmoniously fusing modern technologies with conventional quality methodologies like quality control (QC), quality assurance (QA) and total quality management (TQM) to amplify the reach and effectiveness of quality-related endeavours. The article also determines the key attributes, technological underpinnings, and practical applications associated with Quality 4.0. It also pinpoints the challenges that need to be surmounted and charts a course for future research inquiries within the domain of Quality 4.0.

SDG 10

Reduced Inequality

Sustainable Development Goal 10, "Reduced Inequalities", resonates deeply with the ethos of the Hungarian University of Agriculture and Life Sciences. We firmly believe in the importance of fostering an inclusive society where every individual, regardless of their background, has equal access to education, opportunities, and resources. Our institution is committed to addressing disparities and promoting social equality, particularly in the fields of agriculture, life sciences, and environmental sustainability. Through our educational programs and research initiatives, we actively work towards empowering marginalized communities, promoting diversity, and ensuring fair access to knowledge and skills. By focusing on reducing inequalities within the agricultural sector and environmental conservation efforts, we aim to contribute to creating a more equitable society. We believe that by embracing diversity, supporting underprivileged communities, and promoting equal opportunities, we can pave the way for a future where everyone has the chance to thrive and contribute meaningfully to society, in harmony with the principles of SDG 10.

In 2022, there were a total of 13 publications on "Reduced Inequality" and a total of 61 citations. The most influential publications were published by Nathan, Setiawan and Quynh (2022), Kabil *et al.* (2022) and Mostenska *et al.* (2022) giving more than 62% of the total citation count. The first two publications have been mentioned in **SDG 1** and **SDG 5**, respectively.

13
Publications

61
Citations

Economic security pertains to the economic well-being of individuals and households, offering a path to financial stability and an improved quality of life. In this regard, Mostenska *et al.* (2022) emphasized the significance of comprehending how the economic affordability of food impacts a nation's economic security. The authors advocate the use of the economic affordability of food as an indicator for a thorough analysis of a country's economic security. The research calculates indicators that assess the

affordability of food products in Ukraine from 2000 to 2018. Through regression analysis, a strong connection was revealed between food expenditures and GDP per capita, as well as the relationship between income and food expenditure for different income groups. The study also established correlation coefficients between the consumption of six essential food items and the per capita income level in Ukraine. The findings indicate a deficiency in economic protection, particularly among low-income households, highlighting the need to address economic instability and minimize potential repercussions stemming from limited economic affordability of food. Ensuring robust economic security is thus a paramount goal for Ukraine.

SDG 11

Sustainable Cities and Communities

Sustainable Development Goal 11, "Sustainable Cities and Communities", holds a pivotal place in the vision of the Hungarian University of Agriculture and Life Sciences. While our core focus is on agricultural and life sciences, we acknowledge the profound impact that urban areas and communities have on environmental sustainability. Our commitment to this goal extends to addressing the urban-rural nexus, recognizing that the well-being of both urban and rural populations is intrinsically linked. Our research and educational endeavours encompass the development of sustainable urban areas and the promotion of responsible land use. We actively engage in designing more environmentally conscious cities, with a specific emphasis on eco-friendly urban planning, efficient resource management, and the fostering of urban-rural synergy. By promoting sustainable urban development, we aim to contribute to the creation of communities that are both ecologically responsible and socially inclusive, thereby enhancing the overall quality of life. In our efforts to advance SDG 11, we strive to address the unique challenges of urban and rural areas and work collaboratively to build a more sustainable and interconnected world.

36
Publications

149
Citations

In 2022, there were a total of 36 publications on "Sustainable Cities and Communities" and a total of 149 citations. The most influential publications were published by Ilieș *et al.* (2022), Kondor *et al.* (2022) and Al-Yasiri and Szabó (2022b), giving more than 28% of the total citation count. The second publication has already been included in **SDG 6**.

Ensuring the quality of the indoor microclimate in museums is of paramount importance. It directly impacts the health and comfort, as well as the preservation of exhibits. Ilieș *et al.* (2022) delved into the assessment of indoor microclimate within a historic Romanian museum dating back to the 19th century. The presence of pollutants, stemming from internal and external sources within the

museum, often linked to anthropogenic responses to climate change, poses complex. The research involved continuous monitoring of comprising temperature, relative humidity, CO_2 levels and microbiological contamination over a 21-week period between October 2020 to March 2021. The results unveiled a concerning scenario: the indoor microclimate within the historic museum was conducive to fungal proliferation, leading to significant contamination of both the air and the exhibits. This raised potential health concerns for museum visitors and staff. The study identified six yeast species and five distinct fungal genera present in the air, along with six fungal genera, a yeast species, and a bacterium on the exhibits. In addressing this issue, the application of essential oils, including lavender, mint, and lemon, emerged as an effective solution for materials' cleaning and longevity extension, effectively reducing the health risks associated with exposure to contaminated exhibits.

Using PCMs into buildings in hot climates, offers a promising approach to enhance thermal comfort and energy efficiency. The previously mentioned authors, Al-Yasiri and Szabó (2022b), applied natural night ventilation (NNV) for reducing indoor temperatures at night and maximizing the benefits of PCM. The study explored the impact of different NNV durations on the thermal performance of a room-integrated PCM system under hot summer circumstances in Iraq. Over six consecutive days, six NNV periods (varying in 1-hour increments) were investigated, focusing on the reduction in average indoor and operative temperatures. Additionally, the study assessed the average difference in heat gain over each daily cycle to quantify the PCM's contribution to energy savings. The findings indicated a minor improvement in the average indoor air temperature within the PCM-equipped room compared to an identical room without PCM, irrespective of the NNV duration due to elevated outdoor temperatures at night. Notably, a 4-hour NNV period led to a substantial 28.6% reduction in the average indoor air temperature in contrast to a 1-hour NNV, with only slight additional gains observed for 5- and 6-hour NNV. While NNV had a limited impact on nighttime operative temperatures, it did not significantly influence daytime temperatures, which were primarily affected by solar radiation and high diurnal outdoor temperatures. The study also demonstrated that an average heat gain reduction of 63.1–87.9 W was achieved, with the roof contributing to over 44% of this reduction in each cycle.

SDG 12

Responsible Consumption and Production

Sustainable Development Goal 12, "Responsible Consumption and Production", is one of the Hungarian University of Agriculture and Life Sciences' mission. Our institution is deeply committed to addressing the critical issues of responsible consumption and production, particularly in the realms of agriculture, life sciences, and environmental sustainability. We proactively engage in education and innovation to advocate for and advance sustainable and environmentally conscientious practices. Our academic programs are dedicated to equipping our students and stakeholders with the knowledge and competencies necessary to foster more sustainable and efficient patterns of consumption and production. We underscore the significance of waste reduction, resource preservation, and the ecological impact mitigation of agriculture and related industries. Through initiatives such as reducing food waste, promoting sustainable agricultural methods, and embracing eco-friendly technologies, we aim to make a meaningful contribution of achieving responsible consumption and production, in alignment with the principles of SDG 12. Our commitment extends to raising awareness and actively participating in the shift towards a more sustainable and circular economy.

62
Publications

408
Citations

In 2022, there were a total of 62 publications on " Responsible Consumption and Production" and a total of 408 citations. The most influential publications were published by (Nekmahmud, Ramkissoon and Fekete-Farkas, 2022), (Naz *et al.*, 2022), (Rust *et al.*, 2022), giving more than 26% of the total citation count. The publications were involved in **SDG 8**, **SDG 3** and **SDG 2**, respectively.

SDG 13

Climate Action

Sustainable Development Goal 13, "Climate Action", holds a place of paramount importance. While our primary focus revolves around agricultural and life sciences, we are acutely aware of the pressing global challenges posed by climate change. Our institution is dedicated to conducting research, providing education, and implementing practices that contribute to climate mitigation and adaptation. We emphasize the significance of sustainable and climate-resilient agriculture, as well as environmentally responsible land management. Through our academic programs and research initiatives, we equip our students and stakeholders with the knowledge and tools needed to address climate-related issues and promote eco-friendly practices. By actively participating in climate action, we strive to reduce greenhouse gas emissions, enhance environmental sustainability, and protect ecosystems, in alignment with the principles of SDG 13. Our commitment extends to advocating for sustainable agriculture, fostering climate resilience in rural and urban areas, and supporting international efforts to combat climate change. In all our efforts, we stand as advocates for a more sustainable and climate-resilient future.

In 2022, there were a total of 52 publications on "Climate Action" and a total of 269 citations. The most influential publications were published by Al-Yasiri, Szabó and Arıcı (2022), Riyazuddin *et al.* (2022) and Nasir and Toth (2022), giving more than 37% of the total citation count. The first publication has been already summarised in SDG 7.

52
Publications

269
Citations

The rise in drought-induced crop losses due to global warming and shifting rainfall patterns has become a pressing concern. Plants equipped with natural drought tolerance mechanisms employ an array of metabolites and low-molecular-weight proteins to combat the adverse effects of drought stress. Among these, hydrophilic dehydrin (DHN) proteins have gained prominence that serve as a multifaceted function in safeguarding plant cells under drought stress conditions. Extensive research has

revealed that DHN proteins enhance drought stress tolerance by bolstering water retention capabilities, preserving chlorophyll levels, sustaining photosynthetic processes, facilitating ROS detoxification, and fostering the accumulation of compatible solutes, etc. According to Riyazuddin *et al.* (2022), studies involving their overexpression have indicated their potential for mitigating the detrimental impacts of drought stress and their utility in the development of drought-resistant crops, a crucial atsk in ensuring food security. Their review delves into the mechanisms through which DHNs confer drought stress tolerance in plants and their interactions with various phytohormones.

Potatoes rank as the third most consumed crop worldwide, due to their versatility, adaptability to diverse environments and surging production rates. However, the modern potato is considered sensitive to drought, a vulnerability further exacerbated by the escalating severity, frequency, and scope of drought events attributable to climate change. The shallow root system has been retrieved for drought susceptibility that varies depending on factors such as genotype type, developmental stage, morphology, duration of drought and intensity. Regrettably, these insights have often been overshadowed, with root depth monopolizing discussions on the subject. Nasir and Toth (2022) synthesized these findings to unravel the nuanced responses of different potato genotypes to drought stress. Additionally, it sheds light on the current landscape of potato production and the repercussions of varying degrees of drought stress on yields. In the absence of drought-resistant genotypes, improved agronomic practices emerge as a valuable recourse for drought mitigation. Leveraging late-maturing cultivars, fine-tuning nutrient management, deploying mulching techniques, and applying plant growth regulators via foliar methods can be invaluable strategies during prolonged drought periods. Moreover, adopting irrigation practices during crucial stages like tuber initiation and bulking in the face of early drought can effectively alleviate the detrimental impacts of water scarcity.

SDG 14

Life Below Water

Sustainable Development Goal 14, "Life Below Water", is of profound significance in our everyday life. Our institution's mission encompasses the responsible management and preservation of aquatic ecosystems, aligning perfectly with the goals of SDG 14. We conduct research, education, and initiatives focused on safeguarding freshwater environments. Our academic programs and research projects address issues such as sustainable fisheries management, aquatic biodiversity conservation, and the reduction of water pollution. We emphasize the importance of responsible aquaculture and the protection of aquatic ecosystems to maintain the health and well-being of life below water. By promoting these sustainable practices, we aim to contribute to the global effort to protect and restore aquatic ecosystems and their invaluable resources. Our commitment extends to raising awareness, implementing conservation measures, and supporting international collaborations to ensure the preservation of life below water, in alignment with the principles of SDG 14.

In 2022, there were a total of 25 publications on "Life Below Water" and a total of 78 citations. The most influential publications were published by Waldschläger *et al.* (2022), Ali *et al.* (2022), Bláha *et al.* (2022), Dömölki *et al.* (2022) and Toth *et al.* (2022), resulting more than 74% of the total citation count.

25
Publications

78
Citations

Microplastic research in aquatic environments is still relatively nascent, despite the vast array of related topics explored in various disciplines over decades. Waldschläger *et al.* (2022) aimed to describe the parallels between natural sediments and microplastics and defined the following objectives: the characterization of microplastic particles (1), interaction of microplastics with environmental constituents (2), their vertical distribution (3), erosion and deposition dynamics (4), biota impact on microplastic transport (5), suitable sampling methodologies (6) and microplastic toxicity (7). To better delineate microplastic particles, we can glean insights from natural sediments,

incorporating techniques like shape analysis and dimensions determination for non-spherical particles. Insights from sediment transport can inform our understanding of microplastic transport, although challenges particularly regarding transport modes, biota influences and dynamic behaviour within numerical models. Evaluating microplastic ecotoxicology necessitates distinguishing between polymer effects, physical form, plastic-related chemicals, and associated pollutants. The authors proposed leveraging sedimentology knowledge where applicable while recognizing the need for further microplastic-specific analyses, offering guidance for interdisciplinary microplastic research.

Renewable energy is vital for sustainable development and reducing CO_2 emissions in developing countries. Ali *et al.* (2022) explored how meeting climate change goals impacts biomass and waste incineration and, consequently, GDP growth. The authors used panel-balanced dataset recorded between 2008 to 2020 coming from Balkan and Visegrad countries. The research uncovers a substantial positive impact of waste consumption on GDP per capita and a significant negative effect of CO_2 emissions. It is important to note that biomass energy use can potentially hinder GDP growth in Visegrad and less developed landlocked Balkan countries due to low energy efficiency and a lack of technological innovation. Instead of relying on basic biomass energy, these nations should explore circular, platform-based models to reduce CO_2 emissions and achieve greenhouse gas reductions without negatively affecting economic growth. This aspect should be considered when formulating climate and renewable energy policy targets to avoid hindering economic progress.

The pet industry and ornamental aquaculture often introduce non-native species into new environments, particularly in temperate regions where thermal waterbodies serve as attractive release sites for unwanted freshwater pets, including decapod crustaceans. In Miskolctapolca (Miskolc, Hungary), several non-native ornamental species have previously been reported. To provide updated local records and identify potentially newly released species, Bláha *et al.* (2022) conducted surveys between March 2019 and November 2021. While Neocaridina denticulata and Caridina cf. babaulti were already established at the site, Atyopsis moluccensis, Caridina gracilirostris, C. multidentata shrimps, as well as Procambarus virginalis, P. clarkii, Cherax quadricarinatus, C. boesemani, C. snowden crayfish, and numerous previously undescribed Cherax species from New Guinea have been discovered. Gravid females carrying eggs in most of these species were also observed. Notably, A. moluccensis, C. gracilirostris, and C. multidentata were recorded for the first time in the wild in Europe. Continued monitoring of this area and public awareness efforts to discourage the release of non-native species are highly recommended.

SDG 15

Life on Land

Sustainable Development Goal 15, "Life on Land", holds a central place in the mission of the Hungarian University of Agriculture and Life Sciences. Our institution is committed to the protection and sustainable management of terrestrial ecosystems, aligning closely with the objectives of SDG 15. We aim research, education, and initiatives at conserving biodiversity, reckless felling of forests, and restoring degraded lands. Our academic programs and research projects address issues such as sustainable land use, reforestation, and wildlife conservation. We emphasize the significance of responsible agricultural practices and land management to ensure the health and resilience of terrestrial ecosystems. By promoting good and sustainable practices, we aim to contribute to safeguard terrestrial life and ecosystems, in line with the principles of SDG 15. Our commitment extends to raising awareness, implementing conservation measures, and supporting international collaborations to ensure the preservation of life on land.

In 2022, there were a total of 67 publications on "Life on Land" and a total of 172 citations. The most influential publications were published by Tufail *et al.* (2022), Batmunkh *et al.* (2022), Nel *et al.* (2022) and Kabil, Alayan, *et al.* (2022), giving more than 30% of the total citation count.

67
Publications

172
Citations

As mentioned in a previous SDG, heavy metals and persistent organic pollutants are posing severe environmental threats. The unregulated discharge of heavy metals from untreated industrial waste wreaks havoc on crops and soil. The incineration and combustion of various products contribute to both primary and secondary pollutant emissions. Tufail *et al.* (2022) comprehensively reviewed remediation approaches and current bioremediation technologies, highlighting their applications in both *in situ* and *ex situ* methods. The review offers a detailed rationale for preferring bioremediation over alternative techniques. Furthermore, the fusion of bioremediation methods with

nanotechnology holds the potential to revolutionize environmental cleanup by effectively degrading heavy metals and persistent organic pollutants.

Economic globalization (EG) is rapidly gaining momentum in Central Asia, raising concerns about potential environmental degradation, in line with the environmental Kuznets curve hypothesis (EKC). The study by Batmunkh *et al.* (2022) investigates the impact of EG in the agricultural sector on environmental sustainability in Kazakhstan, Kyrgyzstan, Mongolia, Tajikistan, Turkmenistan and Uzbekistan, spanning from 1994 to 2019. The research formulates several key hypotheses based on secondary data. It incorporates five explanatory variables: agricultural exports value (EXP), agriculture, forestry and fishing value-added (AVA), the exchange rate (EXR), total natural resource rents (RENT), and external debt stocks (DEBT). The study assesses their influence on CO_2 emissions from on-farm energy use (EMS), temperature changes (TEMP) and forest fires (FIRE). The research findings indicate that AVA and RENT contribute to increased EMS, EXR raises TEMP but reduces EMS, and DEBT elevates TEMP while potentially reducing FIRE incidents. In light of these outcomes, the study recommends the implementation of a well-defined roadmap, strengthened partnerships and increased regional and international support to address these challenges.

Soil carbon storage, a vital ecosystem service shaped by intricate ecological processes, plays a crucial role in regulating the Earth's atmosphere. Gauging soil carbon stock serves as a pivotal marker, indicating landscapes functioning as either carbon sinks or sources. Models for soil carbon stock in agricultural landscapes rely on national carbon stock data to set environmental benchmarks and devise land-use management strategies aimed at bolstering carbon sequestration on a broad scale. The InVEST Carbon Storage model has proven instrumental in mapping carbon stock based on this data. In their study, Nel *et al.* (2022) constructed InVEST soil carbon stock models for two Hungarian agricultural landscapes by combining national soil carbon stock data with in-field collected soil sample carbon stock data, which were subsequently mapped, compared, and evaluated. The objective was to assess their efficacy in guiding sustainable land-use management and policy development to optimize soil carbon storage. The study yielded five InVEST soil carbon stock spatial models for each agricultural landscape, unveiling notable variability contingent on the data utilized. Moreover, the aggregate carbon stock potential across the landscape-scale study areas fluctuated between datasets. The amalgamation of soil sample data with national carbon stock data holds potential for evaluating prospective landscape-scale soil carbon stock storage.

SDG 16

Peace, Justice and Strong Institutions

Sustainable Development Goal 16, "Peace, Justice, and Strong Institutions", is another crucial aspect of the Hungarian University of Agriculture and Life Sciences' vision without which it could not function effectively. While our primary focus is on agricultural and life sciences, we understand the integral role that peace, justice, and strong institutions play in achieving sustainability. Our institution supports the principles of SDG 16 by promoting good governance, ethical behaviour, and justice in all aspects of our academic and research efforts. We emphasize the importance of accountability and transparency in institutions, as well as the rule of law and access to justice. By fostering a culture of integrity and strong institutions within our own sphere, we contribute to the global mission of promoting peaceful and just societies. Our commitment to SDG 16 extends to raising awareness, advocating for ethical governance, and collaborating with stakeholders to build a more equitable and just world.

In 2022, there were a total of 8 publications on "Peace, Justice and Strong Institutions" and a total of 20 citations. The most influential publications were published by Valánszki *et al.* (2022) and Fekete *et al.* (2022).

8
Publications

20
Citations

In spite of the increasing volume of research on ecosystem services, there remains a limited grasp of cultural ecosystem services (CES). The perception of CES can significantly differ based on geographic location and the population involved. Valánszki *et al.* (2022) introduced a Public Participation Geographic Information System (PPGIS) approach in a microregion in Hungary. The authors aimed to enhance comprehension of how cultural services are perceived within this specific geographical context and level, and to explore how this perceived importance relates to biophysical landscape features. They also take into consideration the influence of accessibility on landscape perception and compare their findings with

studies conducted in different sociocultural settings. The analysis involving 184 individuals pinpointed areas with heightened CES significance and scrutinize the connection between CES, landscape characteristics, and accessibility. The research outcomes reveal a positive correlation between CES and land cover types associated with built-up areas, along with aesthetic and recreational services in proximity to water bodies. In contrast to other studies, distinct spatial relationships for spiritual services and an increased emphasis on agricultural land cover during CES perception, shaped by the socio-cultural context of Central-Eastern Europe were observed. The study underscores the impact of accessibility on CES perception, with variations based on different infrastructural elements.

Szeklerland, situated in the heart of Romania's Carpathian Basin, preserves its traditional landscape management practices thanks to its diverse topography and small settlements. This region is blessed with abundant natural resources, notably mineral springs renowned for their healing properties. Around 40% of Romania's mineral water originates here due to the ongoing post-volcanic activity in the young tertiary mountain ranges, releasing carbon dioxide that dissolves beneficial minerals from the earth. These minerals create medicinal waters used for centuries by the locals. The traditional practice involved building local baths in settlements with healing springs, fostering a unique cold-water bathing culture. Unfortunately, these vernacular baths were destroyed during the world wars and dismantled by the 20th-century regime. After the 1989 political change, a resurgence of interest in traditions and values led to the reinterpretation and restoration of these vernacular baths. What started as a grassroots effort has grown into an independent heritage conservation program. Over the past two decades, numerous of vernacular baths in Szeklerland have been restored with public participation, focusing on nature-friendly techniques, materials, and a deep connection to the region's environment. The project detailed by Fekete *et al.* (2022) has garnered national and international acclaim, becoming a model for landscape heritage conservation.

Summarising Remarks

As of my last knowledge update in January 2022, the Hungarian University of Agriculture and Life Sciences likely aligns its efforts with the United Nations Sustainable Development Goals to address various global challenges. These goals encompass a range of initiatives related to sustainable agriculture, food security, environmental conservation, and socio-economic development. The University may be actively engaged in research, education, and community outreach programs aimed at promoting sustainable practices, fostering innovation in agriculture, and contributing to the broader objectives of the SDGs in Hungary and beyond.

Published in November 2023

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