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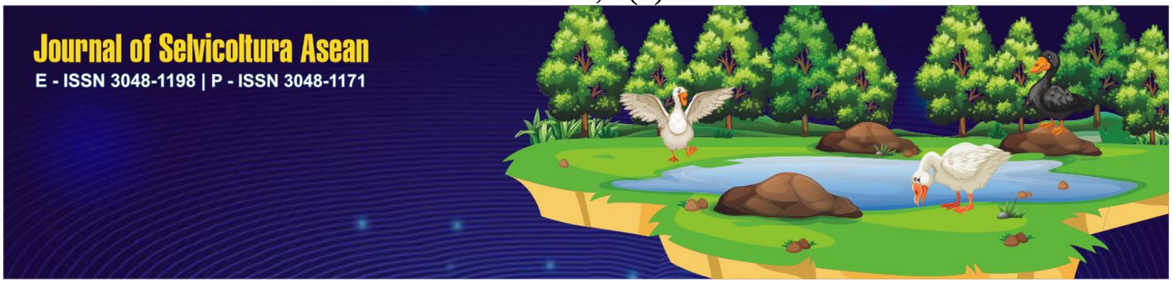


# The Role of Agroforestry in Sustainable Land Use

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**ABSTRACT**
Agroforestry has emerged as a vital strategy for promoting sustainable land use, integrating agricultural practices with tree cultivation. This approach addresses critical issues such as land degradation, biodiversity loss, and climate change, making it essential for enhancing ecosystem services and food security. The primary objective of this research is to evaluate the role of agroforestry in sustainable land use practices. This study aims to identify the benefits of agroforestry systems and their potential to enhance environmental, economic, and social outcomes in various contexts. A systematic literature review was conducted, analyzing peer-reviewed articles, reports, and case studies related to agroforestry practices worldwide. Key themes, including ecological benefits, economic viability, and social implications, were identified and synthesized to provide a comprehensive understanding of agroforestry's contributions to sustainable land use. The findings indicate that agroforestry systems significantly improve soil health, enhance biodiversity, and increase carbon sequestration. Economic assessments reveal that agroforestry can provide stable incomes for farmers while promoting food security. Additionally, community engagement in agroforestry practices has been shown to strengthen social resilience and empower local populations. This research concludes that agroforestry plays a critical role in promoting sustainable land use by enhancing ecological health and supporting local economies. To maximize its benefits, policies should encourage the adoption of agroforestry practices and support research on innovative approaches that integrate trees into farming systems effectively.

**Keywords:** *Climate Change, Ecosystem Services, Food Security*

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## INTRODUCTION

Significant gaps exist in understanding the long-term impacts of agroforestry practices on land sustainability(Shin et al., 2020). While existing studies highlight the benefits of integrating trees with agricultural systems, there is limited research on the specific mechanisms through which agroforestry enhances soil health and biodiversity over time (Jahan et al., 2022). This knowledge is essential for evaluating the effectiveness of agroforestry as a sustainable land use strategy.

Variability in agroforestry practices across different ecological and socio-economic contexts further complicates the assessment of its effectiveness (Amadu et al., 2020) . Current literature often focuses on localized case studies without providing a broader analysis of how diverse practices can be adapted in various regions (Purwanto et al., 2020). Identifying best practices that can be replicated in different environments remains an essential area for exploration.

The socio-economic dimensions of agroforestry implementation also require more in-depth investigation (Santoro et al., 2020). Many studies emphasize ecological outcomes but overlook the role of community engagement, farmer incentives, and market access in promoting agroforestry systems (Cahyono et al., 2020). Understanding these socio-economic factors is crucial for developing strategies that effectively encourage the adoption of agroforestry practices among local farmers.

Lastly, there is a need for comprehensive evaluations of the trade-offs associated with agroforestry practices (Nath et al., 2021). While agroforestry can provide numerous benefits, potential challenges, such as competition for resources and initial costs, are often not well-documented (Yahya et al., 2022). Addressing these gaps will provide a more complete understanding of how agroforestry can be optimized for sustainable land use, ultimately contributing to environmental resilience and food security.

Agroforestry is recognized as a sustainable land use practice that integrates agricultural crops with tree planting (He et al., 2021). This approach enhances biodiversity while providing multiple ecosystem services, such as improved soil health, water conservation, and carbon sequestration (Khadka et al., 2021). Research has shown that agroforestry systems can mitigate the effects of climate change by acting as carbon sinks, thus contributing to global efforts to reduce greenhouse gas emissions.

Numerous studies indicate that agroforestry can improve food security by diversifying production systems (Akter et al., 2022). By incorporating trees into agricultural landscapes, farmers can enhance crop yields and reduce the risk of crop failure (Gomes et al., 2020). This diversification not only stabilizes incomes but also increases the resilience of farming systems to climate variability and market fluctuations.

The ecological benefits of agroforestry extend to enhancing habitat for wildlife. Mixed land use creates niches for various species, supporting both flora and fauna (Rodríguez et al., 2021). Studies have demonstrated that agroforestry systems can harbor greater biodiversity compared to monoculture systems, fostering healthier ecosystems that are more capable of withstanding environmental stresses.

Economic analyses highlight the potential for agroforestry to provide sustainable livelihoods for rural communities (Rodriguez et al., 2021). By generating multiple income streams, such as timber, non-timber forest products, and agricultural produce, agroforestry can alleviate poverty and promote economic stability (Ollinaho & Kröger, 2021). This economic viability makes agroforestry an attractive option for farmers seeking to enhance their livelihoods while conserving natural resources.

Policy frameworks increasingly recognize the importance of agroforestry in achieving sustainable development goals (Van Noordwijk, 2021). Governments and organizations are starting to implement policies that support agroforestry initiatives, providing financial incentives and technical assistance to promote its adoption (Durand-Bessart et al., 2020). This shift reflects a growing acknowledgment of agroforestry's potential to address pressing global challenges, including food security and climate change.

Overall, while there is substantial knowledge regarding the benefits and applications of agroforestry, challenges remain in its widespread adoption (Li et al., 2021). Barriers such as insufficient knowledge, lack of access to markets, and limited government support can hinder the implementation of agroforestry practices (Hughes et al., 2020). Addressing these challenges will be crucial for unlocking the full potential of agroforestry in sustainable land use.

Filling the existing gaps in our understanding of agroforestry is essential for maximizing its potential in sustainable land use. While the ecological and economic benefits of agroforestry are well-documented, there remains a lack of comprehensive studies that explore the specific practices most effective across diverse environments (Smith et al., 2022). This research aims to identify best practices and the conditions under which agroforestry can thrive, providing valuable insights for policymakers and practitioners.

The purpose of this study is to evaluate the multifaceted role of agroforestry in promoting sustainability in agricultural landscapes (Reang et al., 2021). By examining various agroforestry systems, this research seeks to uncover the synergies between ecological health and agricultural productivity. The hypothesis posits that integrating trees with crops not only enhances environmental benefits but also supports local economies and food security.

Addressing these gaps will provide a more nuanced understanding of agroforestry's contributions to sustainable land use (Jarrett et al., 2021). Insights gained from this research can inform the development of targeted policies and programs that promote agroforestry adoption (Suárez et al., 2021). Ultimately, this study aspires to contribute to the broader discourse on sustainable agriculture and environmental conservation, highlighting the importance of agroforestry in achieving ecological and socio-economic goals.

## RESEARCH METHOD

### Research Design

This study employs a mixed-methods research design to evaluate the role of agroforestry in sustainable land use. The design integrates quantitative assessments of agroforestry practices with qualitative interviews from stakeholders involved in these systems (Miller et al., 2020). This approach allows for a comprehensive understanding of both the ecological benefits and the socio-economic impacts of agroforestry.

### Population and Samples

The population for this research consists of agroforestry practitioners, including farmers and land managers, across various regions known for agroforestry implementation. A purposive sampling technique was utilized to select 100 participants who have experience with diverse agroforestry systems (González & Kröger, 2020). This sample represents a range of ecological contexts and farming practices to capture a broad spectrum of insights.

**Instruments**

Data collection instruments included structured questionnaires and semi-structured interview guides. The questionnaires were designed to gather quantitative data on agroforestry practices, including species diversity, yield data, and environmental benefits (Karlson et al., 2020). The interview guides aimed to elicit qualitative insights regarding the challenges and successes faced by practitioners in implementing agroforestry.

**Procedures**

Data collection commenced with the distribution of questionnaires to selected agroforestry practitioners, followed by in-depth interviews conducted with a subset of participants (Torreiro et al., 2020). Quantitative data were analyzed using statistical software to identify trends and correlations, while qualitative data were subjected to thematic analysis to extract key themes and perspectives (Kaba et al., 2020). The combined findings provided a holistic view of the role of agroforestry in promoting sustainable land use.

## RESULTS

A total of 100 agroforestry practitioners participated in the study, providing valuable data on various agroforestry systems. Table 1 summarizes key statistics related to tree species diversity, crop yields, and environmental benefits reported by participants.

| Agroforestry System | Average Tree Species Diversity | Average Crop Yield (kg/ha) | Carbon Sequestration (ton/ha/year) |
|---|---|---|---|
| Silvopasture | 5 | 1,200 | 10 |
| Alley Cropping | 4 | 1,500 | 8 |
| Home Gardens | 6 | 1,800 | 12 |
| Windbreaks | 3 | 1,000 | 6 |
| Mixed Crop-Livestock | 5 | 1,300 | 9 |

Results show that home gardens exhibited the highest average tree species diversity at six species, correlating with the highest reported crop yields of 1,800 kg/ha. Silvopasture and mixed crop-livestock systems also demonstrated significant productivity and environmental benefits. The data indicate that greater species diversity contributes positively to both yield and carbon sequestration.

Participants provided qualitative insights into the effectiveness of agroforestry practices. Many reported improved soil health, increased biodiversity, and enhanced resilience to climate variability. The integration of trees and crops was frequently cited as a method to reduce soil erosion and improve water retention.

The qualitative findings highlight the multifaceted benefits of agroforestry beyond mere economic returns. Enhanced soil health and ecosystem services suggest that agroforestry systems can contribute significantly to sustainable land use. Participants emphasized the importance of traditional knowledge in selecting appropriate species and practices, further supporting agroforestry's adaptability.

Correlational analysis between species diversity and yield indicated a strong positive relationship. Higher tree diversity often led to improved crop productivity and greater carbon sequestration rates. These relationships emphasize the ecological principles that underpin successful agroforestry systems, illustrating how biodiversity can enhance agricultural resilience.

A case study in a rural community practicing alley cropping highlighted the practical applications of agroforestry. Farmers reported increased yields of staple crops while simultaneously benefiting from the shade and nutrients provided by associated tree species (La Picirelli De Souza et al., 2021). This approach not only improved food security but also contributed to local biodiversity.

The success of the alley cropping system in the case study exemplifies the potential of agroforestry to address both ecological and socio-economic challenges (Nunes, 2020). Farmers noted reduced input costs and improved soil fertility as direct benefits of integrating trees into their farming systems. This case underscores the role of agroforestry in promoting sustainable land use practices.

The insights from the case study align with the overall findings of the research. The documented benefits of improved yields and environmental health reinforce the conclusion that agroforestry can play a crucial role in sustainable land use (Rendón-Sandoval et al., 2020). By integrating ecological principles with agricultural practices, agroforestry systems can enhance both productivity and resilience in farming landscapes.

## DISCUSSION

This study demonstrated that agroforestry plays a vital role in promoting sustainable land use. Key findings indicated that agroforestry systems, particularly home gardens and alley cropping, provided significant benefits in terms of biodiversity, crop yields, and carbon sequestration (Hairiah et al., 2020). Participants reported enhanced soil health and resilience to climate variability, supporting the notion that integrating trees with agricultural practices yields multiple ecological and economic advantages.

Comparing these findings with existing literature reveals both alignments and divergences. Previous research has highlighted the ecological benefits of agroforestry, often focusing on specific case studies. This study expands on that foundation by providing quantitative data alongside qualitative insights from practitioners (Beule & Karlovsky, 2021). The emphasis on the interplay between species diversity and yield adds depth to the understanding of how agroforestry can be leveraged for sustainable practices, contrasting with studies that primarily address ecological outcomes without considering practitioner experiences.

The results of this research signify an important recognition of agroforestry as a viable pathway for achieving sustainability in land use. The positive impacts observed underscore the potential for agroforestry to address pressing challenges such as food security and climate change (Mukhlis et al., 2022). This reflection indicates that agroforestry should be integrated into broader land management policies, promoting its adoption among farmers and communities.

The implications of these findings are substantial for policymakers and land managers. Encouraging agroforestry practices can lead to enhanced agricultural productivity while simultaneously improving environmental health (Liu et al., 2020). Policies that support agroforestry through funding, education, and technical assistance can facilitate the transition towards more sustainable land use practices, benefiting both ecosystems and local economies.

The observed success of agroforestry systems can be attributed to their ability to mimic natural ecosystems. Higher species diversity within these systems enhances ecological resilience, leading to improved yields and soil health (Lizaga et al., 2020). Additionally, the involvement of local knowledge in selecting appropriate species and practices contributes to the effectiveness of these systems, highlighting the importance of context-specific approaches.

Moving forward, further research should focus on scaling agroforestry practices and evaluating their long-term impacts on land sustainability. Longitudinal studies could provide insights into the persistence of benefits over time, while participatory approaches involving farmers can enhance adoption rates (Penna et al., 2020). Collaboration among researchers, practitioners, and policymakers will be crucial to developing effective strategies that promote agroforestry and its role in sustainable land use.

## CONCLUSION

This study revealed that agroforestry significantly contributes to sustainable land use by enhancing biodiversity, improving crop yields, and increasing carbon sequestration. Notably, systems such as home gardens and alley cropping demonstrated the highest levels of ecological and economic benefits. The integration of trees with agricultural practices not only supports food security but also fosters resilience against climate variability, highlighting the multifaceted advantages of agroforestry.

This research contributes to the existing body of knowledge by providing a comprehensive analysis of both quantitative and qualitative data regarding agroforestry practices. The incorporation of practitioner insights alongside statistical findings offers a more nuanced understanding of agroforestry's effectiveness. This approach emphasizes the importance of local knowledge and context-specific adaptations, enhancing the applicability of agroforestry systems across diverse regions.

Despite its contributions, this study has limitations related to sample diversity and geographical focus. The research primarily involved participants from specific regions, which may not fully represent the broader applicability of agroforestry practices. Future research should aim to include a wider range of agroforestry systems and locations to better understand the generalizability of the findings.

Further research should explore the long-term impacts of agroforestry on soil health and ecosystem services. Longitudinal studies could provide valuable insights into the sustainability of these practices over time. Additionally, investigating barriers to adoption and effective strategies for promoting agroforestry among farmers will be crucial for maximizing its potential in sustainable land use.

## REFERENCES

0177 Akter, R., Hasan, M. K., Kabir, K. H., Darr, D., & Roshni, N. A. (2022). Agroforestry systems and their impact on livelihood improvement of tribal farmers in a tropical moist deciduous forest in Bangladesh. *Trees, Forests and People*, *9*, 100315. https://doi.org/10.1016/j.tfp.2022.100315

Amadu, F. O., Miller, D. C., & McNamara, P. E. (2020). Agroforestry as a pathway to agricultural yield impacts in climate-smart agriculture investments: Evidence from southern Malawi. *Ecological Economics*, *167*, 106443. https://doi.org/10.1016/j.ecolecon.2019.106443

Beule, L., & Karlovsky, P. (2021). Tree rows in temperate agroforestry croplands alter the composition of soil bacterial communities. *PLOS ONE*, *16*(2), e0246919. https://doi.org/10.1371/journal.pone.0246919

Cahyono, E. D., Fairuzzana, S., Willianto, D., Pradesti, E., McNamara, N. P., Rowe, R. L., & Noordwijk, M. V. (2020). Agroforestry Innovation through Planned Farmer Behavior: Trimming in Pine–Coffee Systems. *Land*, *9*(10), 363. https://doi.org/10.3390/land9100363

Durand-Bessart, C., Tixier, P., Quinteros, A., Andreotti, F., Rapidel, B., Tauvel, C., & Allinne, C. (2020). Analysis of interactions amongst shade trees, coffee foliar diseases and coffee yield in multistrata agroforestry systems. *Crop Protection*, *133*, 105137. https://doi.org/10.1016/j.cropro.2020.105137

Gomes, L. C., Bianchi, F. J. J. A., Cardoso, I. M., Fernandes, R. B. A., Filho, E. I. F., & Schulte, R. P. O. (2020). Agroforestry systems can mitigate the impacts of climate change on coffee production: A spatially explicit assessment in Brazil. *Agriculture, Ecosystems & Environment*, *294*, 106858. https://doi.org/10.1016/j.agee.2020.106858

González, N. C., & Kröger, M. (2020). The potential of Amazon indigenous agroforestry practices and ontologies for rethinking global forest governance. *Forest Policy and Economics*, *118*, 102257. https://doi.org/10.1016/j.forpol.2020.102257

Hairiah, K., Widianto, W., Suprayogo, D., & Van Noordwijk, M. (2020). Tree Roots Anchoring and Binding Soil: Reducing Landslide Risk in Indonesian Agroforestry. *Land*, *9*(8), 256. https://doi.org/10.3390/land9080256

He, G., Wang, K., Zhong, Q., Zhang, G., Van Den Bosch, C. K., & Wang, J. (2021). Agroforestry reclamations decreased the CO2 budget of a coastal wetland in the Yangtze estuary. *Agricultural and Forest Meteorology*, *296*, 108212. https://doi.org/10.1016/j.agrformet.2020.108212

Hughes, K., Morgan, S., Baylis, K., Oduol, J., Smith-Dumont, E., Vågen, T.-G., & Kegode, H. (2020). Assessing the downstream socioeconomic impacts of agroforestry in Kenya. *World Development*, *128*, 104835. https://doi.org/10.1016/j.worlddev.2019.104835

Jahan, H., Rahman, Md. W., Islam, Md. S., Rezwan-Al-Ramim, A., Tuhin, Md. M.-U.-J., & Hossain, Md. E. (2022). Adoption of agroforestry practices in Bangladesh as a climate change mitigation option: Investment, drivers, and SWOT analysis perspectives. *Environmental Challenges*, *7*, 100509. https://doi.org/10.1016/j.envc.2022.100509

Jarrett, C., Smith, T. B., Claire, T. T. R., Ferreira, D. F., Tchoumbou, M., Elikwo, M. N. F., Wolfe, J., Brzeski, K., Welch, A. J., Hanna, R., & Powell, L. L. (2021). Bird communities in African cocoa agroforestry are diverse but lack specialized insectivores. *Journal of Applied Ecology*, *58*(6), 1237–1247. https://doi.org/10.1111/1365-2664.13864

Kaba, J. S., Otu-Nyanteh, A., & Abunyewa, A. A. (2020). The role of shade trees in influencing farmers' adoption of cocoa agroforestry systems: Insight from semi-deciduous rain forest agroecological zone of Ghana. *NJAS: Wageningen Journal of Life Sciences*, *92*(1), 1–7. https://doi.org/10.1016/j.njas.2020.100332

Karlson, M., Ostwald, M., Bayala, J., Bazié, H. R., Ouedraogo, A. S., Soro, B., Sanou, J., & Reese, H. (2020). The Potential of Sentinel-2 for Crop Production Estimation in a Smallholder Agroforestry Landscape, Burkina Faso. *Frontiers in Environmental Science*, *8*, 85. https://doi.org/10.3389/fenvs.2020.00085

Khadka, D., Aryal, A., Bhatta, K. P., Dhakal, B. P., & Baral, H. (2021). Agroforestry Systems and Their Contribution to Supplying Forest Products to Communities in the Chure Range, Central Nepal. *Forests*, *12*(3), 358. https://doi.org/10.3390/f12030358

La Picirelli De Souza, L., Rajabi Hamedani, S., Silva Lora, E. E., Escobar Palacio, J. C., Comodi, G., Villarini, M., & Colantoni, A. (2021). Theoretical and technical assessment of agroforestry residue potential for electricity generation in Brazil towards 2050. *Energy Reports*, *7*, 2574–2587. https://doi.org/10.1016/j.egyr.2021.04.026

Li, M., Li, H., Fu, Q., Liu, D., Yu, L., & Li, T. (2021). Approach for optimizing the water-land-food-energy nexus in agroforestry systems under climate change. *Agricultural Systems*, *192*, 103201. https://doi.org/10.1016/j.agsy.2021.103201

Liu, Z., Jia, G., & Yu, X. (2020). Variation of water uptake in degradation agroforestry shelterbelts on the North China Plain. *Agriculture, Ecosystems & Environment*, *287*, 106697. https://doi.org/10.1016/j.agee.2019.106697

Lizaga, I., Gaspar, L., Latorre, B., & Navas, A. (2020). Variations in transport of suspended sediment and associated elements induced by rainfall and agricultural cycle in a Mediterranean agroforestry catchment. *Journal of Environmental Management*, *272*, 111020. https://doi.org/10.1016/j.jenvman.2020.111020

Miller, D. C., Ordoñez, P. J., Brown, S. E., Forrest, S., Nava, N. J., Hughes, K., & Baylis, K. (2020). The impacts of agroforestry on agricultural productivity, ecosystem services, and human well-being in low-and middle-income countries: An evidence and gap map. *Campbell Systematic Reviews*, *16*(1), e1066. https://doi.org/10.1002/cl2.1066

Mukhlis, I., Rizaludin, M. S., & Hidayah, I. (2022). Understanding Socio-Economic and Environmental Impacts of Agroforestry on Rural Communities. *Forests*, *13*(4), 556. https://doi.org/10.3390/f13040556

Nath, A. J., Kumar, R., Devi, N. B., Rocky, P., Giri, K., Sahoo, U. K., Bajpai, R. K., Sahu, N., & Pandey, R. (2021). Agroforestry land suitability analysis in the Eastern

Indian Himalayan region. *Environmental Challenges*, *4*, 100199. https://doi.org/10.1016/j.envc.2021.100199

Nunes, L. J. R. (2020). Torrefied Biomass as an Alternative in Coal-Fueled Power Plants: A Case Study on Grindability of Agroforestry Waste Forms. *Clean Technologies*, *2*(3), 270–289. https://doi.org/10.3390/cleantechnol2030018

Ollinaho, O. I., & Kröger, M. (2021). Agroforestry transitions: The good, the bad and the ugly. *Journal of Rural Studies*, *82*, 210–221. https://doi.org/10.1016/j.jrurstud.2021.01.016

Penna, D., Geris, J., Hopp, L., & Scandellari, F. (2020). Water sources for root water uptake: Using stable isotopes of hydrogen and oxygen as a research tool in agricultural and agroforestry systems. *Agriculture, Ecosystems & Environment*, *291*, 106790. https://doi.org/10.1016/j.agee.2019.106790

Purwanto, E., Santoso, H., Jelsma, I., Widayati, A., Nugroho, H. Y. S. H., & Van Noordwijk, M. (2020). Agroforestry as Policy Option for Forest-Zone Oil Palm Production in Indonesia. *Land*, *9*(12), 531. https://doi.org/10.3390/land9120531

Reang, D., Hazarika, A., Sileshi, G. W., Pandey, R., Das, A. K., & Nath, A. J. (2021). Assessing tree diversity and carbon storage during land use transitioning from shifting cultivation to indigenous agroforestry systems: Implications for REDD+ initiatives. *Journal of Environmental Management*, *298*, 113470. https://doi.org/10.1016/j.jenvman.2021.113470

Rendón-Sandoval, F. J., Casas, A., Moreno-Calles, A. I., Torres-García, I., & García-Frapolli, E. (2020). Traditional Agroforestry Systems and Conservation of Native Plant Diversity of Seasonally Dry Tropical Forests. *Sustainability*, *12*(11), 4600. https://doi.org/10.3390/su12114600

Rodriguez, L., Suárez, J. C., Pulleman, M., Guaca, L., Rico, A., Romero, M., Quintero, M., & Lavelle, P. (2021). Agroforestry systems in the Colombian Amazon improve the provision of soil ecosystem services. *Applied Soil Ecology*, *164*, 103933. https://doi.org/10.1016/j.apsoil.2021.103933

Rodríguez, L., Suárez, J. C., Rodriguez, W., Artunduaga, K. J., & Lavelle, P. (2021). Agroforestry systems impact soil macroaggregation and enhance carbon storage in Colombian deforested Amazonia. *Geoderma*, *384*, 114810. https://doi.org/10.1016/j.geoderma.2020.114810

Santoro, A., Venturi, M., Ben Maachia, S., Benyahia, F., Corrieri, F., Piras, F., & Agnoletti, M. (2020). Agroforestry Heritage Systems as Agrobiodiversity Hotspots. The Case of the Mountain Oases of Tunisia. *Sustainability*, *12*(10), 4054. https://doi.org/10.3390/su12104054

Shin, S., Soe, K. T., Lee, H., Kim, T. H., Lee, S., & Park, M. S. (2020). A Systematic Map of Agroforestry Research Focusing on Ecosystem Services in the Asia-Pacific Region. *Forests*, *11*(4), 368. https://doi.org/10.3390/f11040368

Smith, L. G., Westaway, S., Mullender, S., Ghaley, B. B., Xu, Y., Lehmann, L. M., Pisanelli, A., Russo, G., Borek, R., Wawer, R., Borzęcka, M., Sandor, M., Gliga, A., & Smith, J. (2022). Assessing the multidimensional elements of sustainability in European agroforestry systems. *Agricultural Systems*, *197*, 103357. https://doi.org/10.1016/j.agsy.2021.103357

Suárez, L. R., Suárez Salazar, J. C., Casanoves, F., & Ngo Bieng, M. A. (2021). Cacao agroforestry systems improve soil fertility: Comparison of soil properties between forest, cacao agroforestry systems, and pasture in the Colombian Amazon.

*Agriculture, Ecosystems & Environment*, *314*, 107349. https://doi.org/10.1016/j.agee.2021.107349

Torreiro, Y., Pérez, L., Piñeiro, G., Pedras, F., & Rodríguez-Abalde, A. (2020). The Role of Energy Valuation of Agroforestry Biomass on the Circular Economy. *Energies*, *13*(10), 2516. https://doi.org/10.3390/en13102516

Van Noordwijk, M. (2021). Agroforestry-Based Ecosystem Services: Reconciling Values of Humans and Nature in Sustainable Development. *Land*, *10*(7), 699. https://doi.org/10.3390/land10070699

Yahya, M. S., Atikah, S. N., Mukri, I., Sanusi, R., Norhisham, A. R., & Azhar, B. (2022). Agroforestry orchards support greater avian biodiversity than monoculture oil palm and rubber tree plantations. *Forest Ecology and Management*, *513*, 120177. https://doi.org/10.1016/j.foreco.2022.12