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## Climate Governance and the Future of Smallholder Agriculture Under Increasing Environmental Uncertainty in Zimbabwe

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### ABSTRACT

This paper investigates the intersection of climate governance and the resilience of smallholder agriculture under conditions of increasing environmental uncertainty. The study employed a qualitative methodology. Data were acquired through semi-structured interviews, focus group discussions, and documentary scrutiny of relevant policy texts. The sample comprised thirty (30) participants consisting of farmers, agricultural extension officers, and representatives of non-governmental organizations in the Mutoko district of Zimbabwe. Thematic Analysis was employed to analyse data. The findings of the study revealed systematic divergences between policy aspirations and grassroots implementation, particularly in domains of land tenure security, equitable allocation of agricultural inputs, and the inclusivity of support schemes. The study also established that governance instruments remain predominantly prescriptive and centralized, effectively blocking the experiential contributions of women, youth, and economically marginal farmers, all of whom shoulder disproportionate climatic risk and live on the edges of subsistence.

### INTRODUCTION

Zimbabwe is experiencing, in common with numerous sub-Saharan African nations, an escalation in the severity and frequency of climatic alarms alongside pervasive environmental uncertainty (Muzerengi & Tirivangasi, 2019; Jiri et al., 2015). The nation has recorded marked alterations in rainfall distribution, an augmented incidence of protracted droughts, the resurgence of tropical cyclones, and the escalation of flooding episodes (Ndlovu et al., 2020; Adeyeye et al., 2023). Each of these manifestations undermines agricultural yield and undermines the subsistence of rural populations (Rankoana, 2025; Gutsa, 2017; Karki et al., 2020). Zimbabwe's rural economy is anchored by smallholder farming systems, defined by small plot sizes, minimal capital investment, and predominant dependence on household labor (Chipenda & Adesina, 2025; Mafirakurewa et al., 2023). Collectively, these farmers play a pivotal role in producing staple crops, generating rural employment, and sustaining household incomes.

Operating within a high-risk climate, smallholder farmers possess marginal capacity to buffer against shocks, rendering them susceptible to worsening food insecurity, deepening poverty, and chronic livelihood distress (Nkonya et al., 2023; Kuang et al., 2019).

In Zimbabwe, climate governance is anchored in a constellation of national instruments, including the National Climate Policy (2017), the National Climate Change Response Strategy (2014), and the National Adaptation Plan. Together, these texts articulate a national intention to enhance climate resilience, yet the actual efficacy of these governance frameworks is frequently undermined by dispersed institutional linkages, chronic funding shortages, and inadequate engagement at the local level. Smallholder agriculture constitutes the backbone of Zimbabwe's economy and the primary livelihood strategy in its rural districts, a fact that inheres both archival and contemporary dimensions of the country's developmental trajectory (Mapfumo, 2013; Oyakhilomen & Zibah, 2014).

The smallholder category originated in colonial rubrics that dispossessed black citizens of more fertile land and subsequently confined them to agriculturally marginal zones characterised by poor soil fertility and skeletal infrastructure (Maganga & Conrad, 2022).

The land reform programme in Zimbabwe sought to rectify historical injustices by redistributing land and formalising the smallholder segment (Moyo & Chambati, 2013), yet economic and political turbulence weakened their impact. Currently, smallholder farmers produce more than 70 per cent of staple crops, thereby serving as the first line of defence against both household and national food insecurity (FAO, 2020). Nevertheless, their production systems remain systemically at risk, constrained by recurrent droughts, erratic rainfall, and deficient access to finance, output markets, timely advisory services, and climate-smart technologies (Kuchimanchi et al., 2021). Despite this substantiated contribution, smallholder interests are frequently marginalised within formal agricultural policy discourse, undermining the legitimacy and sustainability of interventions that might otherwise foster more robust, inclusive, and climate-resilient agrarian futures (Olabanji & Chitakira, 2025).

Environmental uncertainty ranks among the gravest challenges confronting smallholder agriculture in Zimbabwe (Newsham et al., 2023). Over recent decades, the nation has endured a rise in both the frequency and the severity of climatic extremes characterized by extended droughts, most notably in 1992 and 2019, unseasonable rainfall distribution, and recurrent flooding (Frischen et al., 2020; Lamichhane et al., 2020). Such phenomena severely affect production in a variety of ways, such as depressing yields, degrading soil structure, exhausting available water, and precipitating the mortality of livestock, cumulatively dismantling rural livelihoods (Mutekwa, 2009). With the trajectory of climate change broadening and intensifying, the enhancement of smallholder adaptive capacity is not only advisable but essential in the mission to preserve food security and promote equitable rural advancement.

Climate governance signifies the policy and institutional architecture that is mobilised to meet climate-related challenges (Zulu et al., 2025). It comprises both formal and informal mechanisms

whereby state and non-state stakeholders formulate decisions, assign resources, and execute strategies to mitigate and adapt to climate change (Eriksen, 2021; Lamichhane et al., 2021). This study probes the ways in which climate governance currently mediates the sustainability of smallholder agriculture in Zimbabwe amid intensifying climatic variability. Climate governance has become an indispensable element of international discourse regarding society's adaptive and mitigative responses to the intensifying threats posed by climate change. Understanding the intersection of climate governance and agricultural resilience necessitates a robust theoretical grounding in how social-ecological systems absorb and reorganize after perturbations.

Resilience theory frames rural agricultural systems as entities capable of withstanding disturbances, adjusting practices in the face of altered conditions, and, over longer temporal scales, undergoing fundamental reconfigurations in response to persistent climate stressors (Sundstrom et al., 2023; Mishra et al., 2019). Within this conceptual apparatus, adaptive governance emerges as a particularly salient construct, promoting institutional architectures that are dynamic, participatory, and multilayered (Rist et al., 2014; Titttonell, 2014). Such architectures theoretically empower communities to navigate inevitable uncertainties and to iterate governance arrangements as conditions evolve. Moreover, adaptive governance deliberately fosters the co-production of knowledge, ensuring that local experience, scientific evidence, and policy insight are synthesized in the co-creation of climate response measures, thereby enhancing both procedural legitimacy and the contextual appropriateness of adaptation interventions.

## **MATERIALS AND METHODS**

The present study employed a qualitative design to investigate the interplay between climate governance and the resilience and future viability of smallholder agriculture in Zimbabwe under escalating environmental uncertainty. A qualitative method was employed to prioritise the interpretation of human experience, perception, and institutional dynamics conditioned by particular socio-ecological environments. Fieldwork was conducted in two purposively selected rural villages of Mutoko

district, namely Matedza and Nyamuzizi. Selection criteria encompassed a pronounced reliance on rain-fed cropping, a documented history of climate-related perturbations (including both recurrent drought and occasional flooding), and participation in ongoing climate adaptation initiatives.

Data collection combined semi-structured interviews, focus group discussions, and an analysis of policy documents. Thirty key participants took part in the study; these include agricultural extension officers, traditional leaders, NGO practitioners, and community members. Thematic analysis was employed to analyse data. The process involved thematic identification, coding, and interpretation. Manual coding was applied to transcripts from individual interviews and focus-group discussions, with emerging themes subsequently grouped around core analytical dimensions.

## **RESULTS AND DISCUSSION**

### **The Impact of Land Reform on Smallholder Farmers**

The Fast-Track Land Reform Programme of the early 2000s successfully redistributed productive land to smallholder households, thereby enlarging the agrarian base. Nevertheless, the reform process concomitantly engendered a new set of governance dilemmas, notably the absence of durable land tenure arrangements and the shortfall of technical and material assistance during the critical post-settlement phase. National agricultural support initiatives, articulated through the Presidential Input Scheme and Command Agriculture, purport to strengthen food security and household incomes, yet empirical evaluations reveal that the benefits frequently bypass the most resource-poor households, exposing a recurring chasm between policy intent and practical effect.

Some participants had this to say, “Acquisition of the land brought profound relief to the community, as for the first time the promise of persistent and productive agriculture appeared to materialize. Nevertheless, the passage of time reveals an unchanged situation formal documentation of ownership remains elusive. Security of tenure, therefore, is not just an administrative formality, but it is the essential precondition for long-term agronomic and economic commitment” (Agricultural extension

officer). “Government programmes like the Presidential Input Scheme and Command Agriculture are good on paper. The problem is that the inputs often reach a few politically-connected farmers, while the majority of smallholders are left struggling without essential inputs like seed or fertilizer” (Smallholder farmer, Matedza). “When we arrived in this area, we expected support, but most of the assistance never came. Clearly, the poor, like widows and youth, are the ones who suffer most. The land is there, but without equipment and inputs, it is difficult to make it productive” (Smallholder farmer, Nyamuzizi).

Participant narratives illuminate a central paradox of Zimbabwe’s fast-track land reform. The broadening of land access has failed to generate the anticipated productivity gains because governance and support deficits remain deeply entrenched. Data on land tenure insecurity demonstrates that farm households lack the durable institutional frameworks indispensable for long-term investment and for the technical and ecological improvements that productive land use requires. Furthermore, the narratives consistently show that large-scale state programmes, most notably the Presidential Input Scheme and Command Agriculture, despite their proclaimed aim of securing food sovereignty, rarely reach the country’s most resource-poor households.

Observers within the study identify a continuing divergence between the proclaimed policy intent and the realities of implementation. Embedded within this divergence are enduring structural inequities: access to support, credit, and productive inputs is consistently skewed toward farmers who are resource-privileged or who benefit from political patronage networks. Such skewed allocation denies administrative and agro-ecological resources to smallholders, particularly to women and to other historically marginalized groups, thereby entrenching cycles of material and agricultural vulnerability. Under these circumstances, land reform has not produced the anticipated transformations of rural livelihoods because the structural impediments to technical, financial, and institutional support remain unaddressed.

These findings corroborate with Murken & Gornott (2022), who assert that the lack of secure tenure particularly affects smallholder farmers, who crucially depend on their land and the right to use it.

Land is valuable to farmers not only in an economic sense. It also shapes social relations, people's identity, and is often deeply intertwined with cultural practices.

The participation of state and non-state actors in national climate governance is unmistakably important, though the degree of their effectiveness varies considerably. Boone (2014) asserts that governments, with the support of international experts and donor organizations, play an important role in resolving such problems. However, land reform efforts have often proven ineffective, slow, and at times even harmful, particularly in sub-Saharan Africa (Ebhuoma and Simatele, 2019). In Zimbabwe, the primary roles fall to the Ministry of Environment, Climate, Tourism and Hospitality Industry and the Ministry of Lands, Agriculture, Fisheries, Water and Rural Development, which are charged with crafting and executing climate-related policies. However, the effectiveness of their mandates is frequently undermined by duplicative responsibilities and a lack of coordinated communication across departments, resulting in policies that are seldom harmonised. Non-state actors ranging from international NGOs and multilateral donors to local community organisations have sought to compensate for these governance shortcomings by offering specialised technical assistance, training, and climate adaptation assets. These entities are essential in the deployment of community-level resilience initiatives, yet their contributions tend to remain compartmentalised and temporally limited, primarily because of reliance on external funding and their marginalisation within the national policy architecture.

#### **Climate Change and Agricultural Production**

Smallholder farmers in the Mutoko district now confront climate hazards as an ongoing lived experience. Interviewees uniformly reported extended dry spells, late-onset rainfall, mid-season droughts, and sporadic floods as persistent dangers to production. Each of these episodes has inflicted severe damage on primary staples, including maize, groundnuts, and sorghum. Farmers in the region described entire season losses recurring across multiple years, while those in Mutoko noted erosion of horticultural yields linked to unpredictable water supplies. Widespread food insecurity marked the accounts, with households frequently turning to

food assistance or informal markets during seasonal shortages. Compounding the situation, market access remains hindered by inadequate transport networks, volatile pricing, and insufficient storage capacity, deepening the already high sensitivity of smallholder farmers to external shocks.

Participants reported, "These days, the rains do not come like they used to. Sometimes they start very late, even as late as December or January, and stop before the season reaches its midpoint. Our crops, like maize, groundnuts, and sorghum, wither without any help. Year after year, we fail to get a proper harvest, and some crops simply perish in the fields" (Smallholder farmer, Nyamuzizi). "The water for irrigating our vegetables has become very scarce. Rivers and wells dry up so quickly that the vegetables end up spoiling. Even if we manage to harvest a little, the next problem is reaching the market. Bad roads, few vehicles, and prices changing every day make life very difficult, leaving us relying on food aid or buying from expensive informal markets" (Horticulture farmer, Matedza).

Farmer concerns from Nyamuzizi and Matedza serve as urgent case studies for the increasing fragility of Zimbabwe's agricultural output in the face of fundamental climatic change. One testimony succinctly conveys that the erratic rainfall marked by postponed start dates, premature finishes, and abrupt mid-season dry spells has precipitated serial crop and pasture collapses, directly undermining family food reserves and the basic viability of farming as an economic endeavour. Horticulturists in particular feel an intensified double squeeze, contending first with inadequate irrigation supplies and then with outdated market architecture, including unreliable road networks and price shocks, which prevent transforming meagre harvests into predictable economic returns. Collectively, such evidence denotes an intertwined predicament to the effect that climatic hazards are reducing the biophysical capability of the land, yet inadequate governance and infrastructure compound the suffering by separating production from stable consumption and income (Mthembu et al., 2025; Nguyen, 2016).

#### **Multifaceted Coping Strategies**

In reaction to increasingly variable climatic conditions, smallholder farmers have adopted a mixed portfolio of adaptive responses that draw harmoniously on endogenous agronomic traditions

and emergent technologies. Solakis-Tena et al. (2025) assert that households persist in using ancestral phenological calendars that read avian migratory shifts, foliar phenology of recurrent legumes, and altered wind regimes to fine-tune planting windows. In several zones, pearl millet and sorghum, once prominent in the cropping lexicon, have been re-cropped to re-establish drought-resilient cereal ladders (Chaturvedi et al., 2023; Ghatak et al., 2016; Prasad et al., 2021; Chaturvedi et al., 2022). Despite recent advances, the climate governance architecture exhibits persistent deficiencies. A foremost obstacle is the fragmented interaction between government bodies and development partners, which results in redundant programs and inconsistent geographical reach.

The study further established that women who constitute a sizeable contingent of the rural agricultural workforce continue to be sidelined in climate-related decision-making. Although several policies ostentatiously endorse gender-responsive strategies, actual execution is inconsistent, and prevailing cultural norms restrict female presence in local governance bodies. Youth perspectives also remain peripheral, even as that demographic is pivotal to labor markets and technological experimentation. This finding is in line with Sibiya et al. (2022), who assert that advancing a genuinely participatory climate governance framework demands deliberate strategies to elevate historically marginalized populations, guarantee their seats in local institutional design, and foster arenas in which collective learning and mutual accountability can flourish.

Despite noteworthy policy advances, the broader scalability of locally generated agricultural adaptations in Zimbabwe remains constricted (Chirisa et al., 2021; Mpala and Simatele, 2024; Rurinda et al., 2014; et al., 2021). A considerable proportion of context-specific interventions generate efficiencies observable only within the immediate agricultural microenvironments in which they were conceived, resulting in limited horizontal knowledge transfer among geographically disparate smallholder communities. Resource deficits continue to beset public extension agencies, which lack the personnel density and logistical capacity required to transmit climate-resilient practices equitably across farming populations (Olawajaju et al., 2025; Wakweya et al., 2024). Consequently,

Zimbabwe's policy architecture, whilst coherent at the level of strategic design, remains alienated from the operational demands faced at the level of smallholder farms. Farmer-driven practices, which demonstrate considerable ingenuity, are thus fortified only to the extent that external governance architectures facilitate their transmission and replication.

## CONCLUSION

This investigation has illuminated the multifaceted nexus between climate governance and the sustainability of smallholder agriculture in Zimbabwe amid escalating environmental uncertainty. The evidence indicates that while the state has promulgated key instruments, namely the National Climate Policy and the Climate Smart Agriculture Framework, their operationalization remains disjointed and only partially attuned to the heterogeneous conditions of rural communities. Smallholder farmers continue to face acute exposure to climate extremes, recurring droughts, erratic precipitation, and episodic floods, resulting in reduced crop productivity, deepening food insecurity, and diminished integration in formal markets. The viability of smallholder agriculture in Zimbabwe will hinge on the capacities of governance systems to mitigate climate-related hazards. The rising severity and unpredictability of climate perturbations will perpetuate the erosion of rural livelihoods and the fragility of national food security. Conversely, with robust institutional backing and equitable financial mechanisms, smallholder farming could emerge as a catalyst for durable development, income diversification, and enhanced climate resilience.

## REFERENCES

- Adeyeye, S. A. O., Ashaolu, T. J., Bolaji, O. T., Abegunde, T. A., & Omoyajowo, A. O. (2023). Africa and the nexus of poverty, malnutrition and diseases. *Critical Reviews in Food Science and Nutrition*, 63, 641–656.
- Boone, C. (2014). *Property and political order in Africa: Land rights and the structure of politics*. Cambridge University Press.
- Chaturvedi, P., Govindaraj, M., Govindan, V., & Weckwerth, W. (2022). Editorial: Sorghum and pearl millet as climate resilient crops for

- food and nutrition security. *Frontiers in Plant Science*, 13, 851970.
- Chaturvedi, P., Govindaraj, M., Sehgal, D., & Weckwerth, W. (2023). Editorial: Sorghum and pearl millet as climate resilient crops for food and nutrition security, volume II. *Frontiers in Plant Science*, 14, 1170103.
- Chipenda, C., & Adesina, J. (2025). Social policy dimensions of land reform in rural Zimbabwe. *Discover Global Society*, 3, 83.
- Chirisa, I., Gumbo, T., Gundu-Jakarasi, V. N., Zhakata, W., Karakadzai, T., Dipura, R., & Moyo, T. (2021). Interrogating climate adaptation financing in Zimbabwe: Proposed direction. *Sustainability*, 13(12), 6517.
- Ebhuoma, E. E., & Simatele, D. M. (2019). We know our terrain: Indigenous knowledge preferred to scientific systems of weather forecasting in the Delta State of Nigeria. *Climate and Development*, 11(2), 112–123.
- Eriksen, S., Schipper, E. L. F., Scoville-Simonds, M., Vincent, K., Adam, H. N., Brooks, N., et al. (2021). Adaptation interventions and their effect on vulnerability in developing countries: Help, hindrance or irrelevance? *World Development*, 141, 105383.
- Food and Agriculture Organization. (2020, March 23). *Global information and early warning system on food and agriculture (GIEWS): Country brief Zimbabwe*.
- Frischen, J., Meza, I., Rupp, D., Wietler, K., & Hagenlocher, M. (2020). Drought risk to agricultural systems in Zimbabwe: A spatial analysis of hazard, exposure, and vulnerability. *Sustainability*, 12(3), 752.
- Ghatak, A., Chaturvedi, P., Nagler, M., Roustan, V., Lyon, D., Bachmann, G., & Weckwerth, W. (2016). Comprehensive tissue-specific proteome analysis of drought stress responses in *Pennisetum glaucum* (L.) R. Br. (Pearl millet). *Journal of Proteomics*, 143, 122–135.
- Gutsa, I. (2017). *Climate change and the livelihoods of elderly female-headed households in Gutsa Village, Goromonzi District, Zimbabwe* (Doctoral dissertation). University of the Witwatersrand.
- Jiri, O., Mafongoya, P. L., & Chivenge, P. (2015). Indigenous knowledge systems, seasonal ‘quality’ and climate change adaptation in Zimbabwe. *Climate Research*, 66, 103–111.
- Karki, S., Burton, P., & Mackey, B. (2020). Climate change adaptation by subsistence and smallholder farmers: Insights from three agro-ecological regions of Nepal. *Cogent Social Sciences*, 6.
- Kuang, F., Jin, J., He, R., Wan, X., & Ning, J. (2019). Influence of livelihood capital on adaptation strategies: Evidence from rural households in Wushen Banner, China. *Land Use Policy*, 89, 104228.
- Kuchimanchi, B. R., van Paassen, A., & Oosting, S. J. (2021). Understanding the vulnerability, farming strategies and development pathways of smallholder farming systems in Telangana, India. *Climate Risk Management*, 31, 100275.
- Lamichhane, P., Miller, K. K., Hadjikakou, M., & Bryan, B. A. (2020). Resilience of smallholder cropping to climatic variability. *Science of the Total Environment*, 719, 137464.
- Lamichhane, P., Miller, K. K., Hadjikakou, M., & Bryan, B. A. (2021). Survey data on climate change adaptation and barriers to adoption among smallholder farmers in Nepal. *Data in Brief*, 39, 107620.
- Mafirakurewa, T., Mushunje, A., & Zantsi, S. (2023). Factors influencing smallholder farmers’ decisions to participate in loan-based farming in Mutare District, Zimbabwe—A double-hurdle model approach. *Agriculture*, 13(12), 2225.
- Maganga, T., & Conrad, S. C. (2022). The impact of colonial and contemporary land policies on climate change adaptation in Zimbabwe’s communal areas. *Jambá: Journal of Disaster Risk Studies*, 14(1), a1311.
- Mapfumo, M. (2013). An econometric analysis of the relationship between agricultural production and economic growth in Zimbabwe. *Russian Journal of Agricultural and Socio-Economic Sciences*, 23(11).
- Mazwi, F., Muchetu, R. G., & Chibwana, M. (2017). Land and agrarian reform in Zimbabwe viewed from a transformative social policy perspective. *Africanus: Journal of Development Studies*, 47(1), 1–17.

- Mishra, A., et al. (2019). Adaptation to climate change in the Hindu Kush Himalaya: Stronger action urgently needed. In P. Wester, A. Mishra, A. Mukherji, & A. B. Shrestha (Eds.), *The Hindu Kush Himalaya assessment: Mountains, climate change, sustainability and people* (pp. 457–490). Springer.
- Moyo, S., & Chambati, W. (Eds.). (2013). *Land and agrarian reform in Zimbabwe: Beyond white-settler capitalism*. CODESRIA.
- Mpala, T. A., & Simatele, M. D. (2024). Climate-smart agricultural practices among rural farmers in Masvingo district of Zimbabwe. *Frontiers in Sustainable Food Systems*, 7, 1298908.
- Mthembu, B. E., Cele, T., & Mkhize, X. (2025). Climate change impacts on agricultural infrastructure and resources. *Land*, 14(6), 1150.
- Murken, L., & Gornott, C. (2022). Land tenure systems and farmers' resilience to climate change: A review. *Climate Risk Management*, 35, 100419.
- Mutekwa, V. T. (2009). Climate change impacts and adaptation in the agricultural sector: The case of smallholder farmers in Zimbabwe. *Journal of Sustainable Development in Africa*, 11, 237–256.
- Muzerengi, T., & Tirivangasi, H. M. (2019). Small grain production as an adaptive strategy to climate change in Mangwe District, Zimbabwe. *Jambá: Journal of Disaster Risk Studies*, 11(1), 1-9.
- Ndlovu, E., Prinsloo, B., & Le Roux, T. (2020). Impact of climate change and variability on traditional farming systems in south-west, semi-arid Zimbabwe. *Jambá: Journal of Disaster Risk Studies*, 12(1), a742.
- Newsham, A., Naess, L. O., Mutabazi, K., Shonhe, T., Boniface, G., & Bvute, T. (2023). Precarious prospects? Exploring climate resilience of agricultural commercialization pathways. *Climate and Development*, 16(5), 395–409.
- Nguyen, T. P. L., et al. (2016). Perceptions of present and future climate change impacts on water availability. *Water*, 8(11), 523.
- Nkonya, E., Kato, E., Msimanga, M., & Nyathi, N. (2023). Climate shock response and resilience of smallholder farmers in Zimbabwe. *Frontiers in Climate*, 5, 890465.
- Olabanji, M. F., & Chitakira, M. (2025). The adoption and scaling of climate-smart agriculture innovation in South Africa. *World*, 6(2), 51.
- Olarewaju, O. O., Fawole, O. A., Baiyegunhi, L. J. S., & Mabhaudhi, T. (2025). Integrating sustainable agricultural practices. *Sustainability*, 17(14), 6259.
- Oyakhilomen, O., & Zibah, R. G. (2014). Agricultural production and economic growth in Nigeria. *Quarterly Journal of International Agriculture*, 53, 207–223.
- Phiri, K., et al. (2021). Understanding climate smart agriculture in Umguza District, Zimbabwe. *Cogent Social Sciences*, 7(1), 1970425.
- Prasad, V. B. R., et al. (2021). Drought and high temperature stress in sorghum. *International Journal of Molecular Sciences*, 22(18), 9826.
- Rankoana, S. A. (2025). Review of challenges experienced by women in subsistence crop production. *Indonesian Journal of Social and Environmental Issues*, 6(1), 72–79.
- Rist, L., et al. (2014). Applying resilience thinking to production ecosystems. *Ecosphere*, 5(3), 73.
- Rurinda, J., et al. (2014). Sources of vulnerability to a variable and changing climate in Zimbabwe. *Climate Risk Management*, 3, 65–78.
- Sibiya, N., et al. (2022). Securing participation of marginalised groups in climate governance. *Sustainability*, 14(12), 7111.
- Solakis-Tena, A., et al. (2025). Phenological shifts since 1830 in California plant species. *Plants*, 14(6), 843.
- Sundstrom, S. M., Angeler, D. G., & Allen, C. R. (2023). Resilience theory and coerced resilience in agriculture. *Agricultural Systems*, 206, 103612.
- Tittonell, P. (2014). Ecological intensification of agriculture—Sustainable by nature. *Current Opinion in Environmental Sustainability*, 8, 53–61.
- Wakweya, R. B., Abdeta, D., Zerfu, H., Negassa, A., & Lemineh, B. (2024). Smallholder Farmers' Knowledge and Attitudes Toward Adoption of Exotic Bamboo in Southwest Ethiopia.

*Indonesian Journal of Social and Environmental Issues (IJSEI)*, 5(1), 63-74.

Zulu, K., et al. (2025). Determinants of effective participatory multi-actor climate change governance. *Environmental Science & Policy*, 167, 104040.