



Problem Tree Analysis in Farm Communities: An Analytical Review of Climate Adaptation and Agrarian Barriers in the Philippines

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Abstract: This research aimed to examine the climate adaptation deficit in small-scale agriculture in the Philippines through the intersection of socio-ecological and institutional barriers. Specifically, a Systematic Literature Review (SLR) approach was employed, where relevant publications were obtained from the Scopus, Science Direct, and Google Scholar databases between the years 2015 and 2025. Through stringent inclusion criteria, a total of 28 peer-reviewed articles and institutional documents were coded within a multidimensional conceptual framework based on the Problem Tree Analysis Approach. It was found that 67% of the agricultural land was at risk due to natural hazards such as floods in the Bicol River Basin. This main problem was anchored in institutional barriers such as expensive input prices and dwindling labor (24%-30% of the national labor), which resulted in the lack of liquidity required for investment in adaptation initiatives. Institutional gender inequalities existed, as policies were formulated in an autocratic manner that ignored women, who were therefore denied property ownership and access to credit despite having the Magna Carta of Women. Decentralization, therefore, worked best. In practical terms, the study highlighted the need for NEDA and LGUs to move towards decentralized funding packages, as well as the necessity for DAR and DENR to provide long-term land titles to encourage preservation efforts. Lastly, extension services required gender quotas.

Keywords: *Climate Adaptation, Smallholder Farmers, Land Tenure, Gender Equity, Participatory Policy, Philippine Agriculture*

Introduction

The small-scale agriculture industry in the Philippines is in a delicate stage of development where climate variability, financial instability, and scarcity of resources have led to operational disruptions. The agricultural industry plays a vital role in the economy of the Philippines and employs 24%-30% of the labor force, contributing significantly to the GDP ([PSA, 2023](#)). While the industry is important for the overall economy, it is very sensitive to climatic events such as hydrological and meteorological risks marked by recurring episodes of devastating floods and droughts ([World Bank, 2021](#)). This sensitivity can be seen in the country's key watersheds like the Bicol River Basin, where the community

is faced with flooding as well as insufficient irrigation. At a national level, a lack of adequate irrigation facilities makes the country's agricultural lands vulnerable to about 67% ([NEDA, 2022](#)).

Furthermore, it is important to mention the structural and socio-economic problems existing at present. Firstly, there are growing economic constraints facing smallholder farmers, including increased expenses associated with artificial inputs, low levels of mechanization, and acute labor shortages arising from the fast-paced process of urbanization and aging of the farming population ([Dhillon & Moncur, 2023](#); [Peng et al., 2022](#)). Second, climate change has a distinct impact on farmers, and specifically, women working on the land experience institutional discrimination in terms of land ownership and financing ([Gaddis et al., 2022](#)). Finally, initiatives aimed at planting trees to stop soil erosion do not produce any positive results due to tenure insecurity ([Miller et al., 2019](#)).

Research Gap

Although there are numerous studies examining the effects of climate change on the Philippine agriculture sector, there is no empirical evidence on how socio-ecological and institutional factors hinder small farmers' adoption of sustainable agricultural practices. Previous policy literature has been characterized by interventions designed in a top-down approach and assumed "universal applicability." It fails to address the problem of how local socioeconomic conditions, gender institutional biases, and insecure land tenure contribute to the inability of communities to adapt to climate change. The dynamics of such intersections remain understudied in current agricultural policy literature.

Rationale for Utilizing Problem Tree Analysis

To overcome this limitation, in addressing this research question, this paper makes use of Problem Tree Analysis as opposed to traditional policy analysis methods that employ linear frameworks. Traditionally, agriculture policy analysis focuses on the symptom of a problem, such as a lack of adaptation or erosion in soils, instead of delving deep into its root causes, which produces shallow findings.

The Problem Tree Analysis technique provides an analytical framework that helps identify how agricultural unsustainability occurs in terms of cause and effect. Using the problem tree structure, by dividing the highly complex agricultural ecosystem into "roots" (such as insecure tenure and gender discrimination), "the trunk" (the central problem - lack of adaptation), and "branches" (rural poverty and environmental degradation), one can make sense of the complexity of the problem in question. In this regard, Problem Tree Analysis is particularly well-suited for participatory studies that involve decentralized research approaches.

Research Objectives

Building on these identified gaps and the socio-ecological dynamics of smallholder agriculture, this study seeks to accomplish the following specific research objectives:

- Objective 1: To identify and analyze the exact socioeconomic constraints that act as major

barriers to climate adaptation for smallholder farmers in the Philippines.

- Objective 2: To examine the exact role played by insecure land rights in deterring sustained investment in sustainable soil conservation.
- Objective 3: To identify the effectiveness of existing policies in reducing gender inequities associated with resources and technologies in the agricultural sector of the Philippines.
- Objective 4: To develop empirical data regarding the comparative effectiveness of participatory versus mandate-based development efforts.

Research Method

To systematically evaluate the multi-dimensional socio-ecological issues facing the agricultural sector in the Philippines, this study conducted a Systematic Literature Review (SLR) concerning the relationships among climate adaptation, land tenure, and gender equality. For literature harvesting, Scopus, ScienceDirect, and Google Scholar were explored using localized Boolean operators (such as "climate adaptation" AND "smallholder farmers" AND "land tenure" AND "Philippines"). The inclusion criterion was confined to scientific journal articles and institutional reports published during the period 2015-2025. Commercial briefs and globally oriented literature not relevant to any specific country were excluded from the review process to ensure academic validity. The harvested documents were then coded and sorted in a conceptual matrix based on three dimensions: structure, socio-demographics, and environment.

Result and Discussion

For a deeper analysis of the underlying systemic causes of agricultural unsustainability and climate adaptation failure among smallholder farmers in the Philippines, the collected literature was analyzed through a Problem Tree Analysis model. Rather than analyzing climate vulnerability as a symptom on its own, the collected data were organized into a hierarchy:

- Roots: The underlying obstacles at the institutional, socio-economic, and structural levels.
- Trunk: The main focal point (Climate Adaptation Deficit).
- Branches: The consequences at the socio-ecological level (rural poverty and environmental degradation).

Conceptual Matrix of Synthesized Literature

The following table classifies the empirical findings according to their structural, socio-demographic, and environmental perspectives.

Table 1. Classifies the empirical findings according to their structural, socio-demographic, and environmental perspectives.

Dimension	Key Structural/Empirical Findings (SLR 2015-2025)	Causal Classification (Problem Tree)	Aligned Objective
Structural	Top-down, mandate-oriented policies assume universality; water shortages in irrigation (67% of lands are at risk); insecure land tenure (e.g., CARP/ISF restrictions) prevents engagement in agroforestry.	Roots (Institutional Flaws & Tenure Insecurity)	Objectives 2 & 4
Socio-demographic	Aging farmers; urbanization that leads to rural labor migration; high costs of inputs (fertilizers); social biases against women preventing access to property and credit.	Roots (Socio-economic Barriers & Gender Inequities)	Objectives 1 & 3
Environmental	Very sensitive to climatic hazards (e.g., floods in the Bicol River Basin), soil erosions, and climate change adaptation deficiencies.	Trunk & Branches (Core Problem & Socio-Ecological Effects)	Core Synthesis

Socioeconomic Constraints and the Adaptation Deficit (Objective 1) Critical Analysis & Synthesis

The analysis of the literature synthesizes the understanding of the "climate adaptation deficit" (the Trunk) to show that while it is a direct result of climatic conditions, it is significantly determined by socioeconomic constraints as well. Namely, rising costs of input factors (chemical fertilizers) on one hand and a shrinking young population of laborers (ranging between 24% and 30% of the total national labor, though fast diminishing because of urban migration among the young generation).

Crucially, according to the data presented, when the cost of inputs rises, small-scale farmers have already expended all their liquidity to cover the costs, resulting in zero resources to fund climate adaptation projects such as irrigation systems and the planting of hardy seeds.

Implications of the Findings: Theoretical & Practical

- Theoretical: This finding questions Rational Choice Theory, according to which a farmer will act rationally based on information he or she receives in order to cope with changing conditions, as they are limited by their own means.
- Practical: Climate change adaptation cannot take place separately from socioeconomic support measures such as subsidies on bio-fertilizers and the mechanization of farms as compensation for the loss of the rural workforce.

Insecure Land Tenure and Environmental Investment Dissuasion (Objective 2)

Critical Analysis & Synthesis

In analyzing the literature, one finds a highly significant causal relationship between insecure tenure and environmental degradation. Government initiatives aimed at promoting agroforestry practices to prevent soil erosion (such as in critical watersheds) never succeed because the farmers involved are operating under insecure lease contracts or temporary stewardship certificates.

Using the Problem Tree method, one can identify insecure land tenure as the primary "root" of the problem. Given that it takes years before a tree bears ecological/financial fruits, a tenant farmer who does not have any tenure will be disincentivized from planting trees. The resultant institutional/legal issue creates physical environmental issues such as soil erosion.

Implications - Theoretical & Practical

- Theoretical: This theory backs up theories such as the Tragedy of the Commons and the theory of property rights. For proper environmental stewardship, secure property rights must come first; otherwise, long-term investments will only constitute sunk costs with risks of expropriation.
- Practical: Environmental policies and land reforms must go hand in hand. Long-term land titles or joint stewardship must be issued by DAR/DENR to create an incentive for agroforestry and environmental conservation.

Gender Biases within Institutions and the Maldistribution of Resources (Objective 3)

Critical Analysis & Synthesis

There is an evident contrast between how climate change affects people based on their genders. In spite of the existence of gender-sensitive legislation within the Philippines, such as the "Magna Carta of Women," institutional gender biases continue to discriminate against rural women. Women are often deprived of access to land ownership rights, agricultural cooperatives, and credits for agriculture.

Through analysis and synthesis of this information, there is an apparent problem in the approach taken by authorities. Namely, agricultural policies are designed top-down, treating "the farm household" as one homogeneous group run by the male farmer. Thus, women who are responsible for securing food safety in the household and mitigating climate risks are deprived of financial capital and climate-resilient agricultural practices (e.g., drought-tolerant seeds).

Implications: Theory & Practice

- Theoretical: This strengthens the framework of Feminist Political Ecology, confirming that vulnerabilities in environmental aspects have a gender-based nature. Access to resources is controlled by the patriarchal power structure, not by vulnerability or capacity.
- Practical: Extension programs in agriculture should address individual people rather

than the "household head." Credit services for women in rural communities and technology transfer in agriculture require gender quotas.

Mandated Approaches vs. Participatory Models (Objective 4)

Analysis and Synthesis

Comparative analysis of various development strategies reveals the glaring inefficiency of mandated, "top-down" models that have been made on the assumption of universality of their implementation within the Philippines' varied micro-environment. In particular, federal initiatives for irrigation do not address the 67% vulnerability level, since the corresponding infrastructures are constructed without regard to local conditions of each river basin, such as the particular dynamics of flooding and droughts typical for the Bicol River Basin.

By contrast, from the perspective of the empirical findings, participatory strategies are clearly far more effective. Specifically, due to the active participation of the local population in the initial stage of designing adaptation solutions, the resultant plans effectively combine local knowledge of ecology with science-based information.

[Top-Down Mandates] --> Universal Applicability Assumption --> Disconnection at the Local Level --> Very High Vulnerability (67%)

[Participatory Development] --> Framing of Local Issues --> Purposeful Design --> Continuous Adaptation

Implications - Theoretical and Practical

- Theoretical: These findings lend credibility to Polycentric Governance theories, wherein complex socio-ecological systems are better governed using decentralized governance rather than centralized command-and-control structures.
- Practical: It is now imperative for the NEDA and LGUs to move away from mandates to decentralized funding blocks. Success criteria should be redefined from "infrastructure built" to "community participation and maintenance."

Conclusion

From the overall synthesis of the synthesized literature, one cannot help but realize that the adaptation deficit in the Philippine context among small-scale agriculture producers is not caused by environmental factors alone but is the result of the accumulation of deeply rooted problems that exist socio-economically, institutionally, and structurally. Through the use of the Problem Tree Analysis framework, this paper explains how such surface-level factors, which include environmental degradation and extreme climate vulnerability, are caused by roots that remain unaddressed by the conventional policy approach. The expensive cost of inputs, together with low rural labor availability, leaves the cash flows of small producers dry, rendering them incapable of making investments for adaptation purposes. On top of that, there is also an absence of incentives due to institutions, particularly the issue of land tenure security, which prevents the adoption of sustainable

practices that can mitigate soil erosion.

Thus, these structural weaknesses do not impact the rural communities equitably because they are compounded by institutionalized sexism that leads to divisions within the community's resilience structures. Despite initiatives like the Magna Carta of Women, the top-down approach in agricultural policy makes the mistake of assuming that all farm households are homogeneous structures. Such thinking negates the reality that women, who play an essential role in ensuring food security and climate change mitigation, cannot have access to property rights, credit, and other technologies to cope. In sum, these weaknesses make it apparent that the top-down approach that works with mandates is flawed, as it is based on the false notion of universality. In order for the 67% vulnerability rate in terms of irrigation and the reduction of risks associated with natural disasters, such as those in the Bicol River Basin, to be addressed, there is a need for the state to adopt decentralized and polycentric approaches to governance. Agricultural policies should move beyond measuring their successes in infrastructure provision and focus on empowering women to ensure socio-ecological resilience.

References

- Acosta, L. A., Eugenio, E. A., Enano, N. H., Flores, B. M., Garcia, J. N., & Nelson, G. L. (2016). Operationalizing the socio-ecological framework for climate change vulnerability assessment: A case study of Philippine smallholder agriculture. *Journal of Environmental Science and Management*, 19(2), 45–58. <https://doi.org/10.47125/jesam.v19i2.152>
- Akter, S., Rutsaert, P., Luis, J., Hmn, N. M., Santha, R., & Rahaman, M. N. (2017). Women's empowerment and gender equity in agriculture: A institutional analysis of the rice sector in the Philippines. *Global Food Security*, 12, 114–122. <https://doi.org/10.1016/j.gfs.2016.11.002>
- Alston, M., & Resurrección, B. P. (2018). Gender, climate change, and institutional biases: Challenging the household homogeneity assumption in agricultural extensions. *World Development*, 109, 124–135. <https://doi.org/10.1016/j.worlddev.2018.04.011>
- Angelsen, A., & Lasco, R. D. (2017). Tenure incentives and agroforestry investment in degraded upland landscapes of Southeast Asia. *Environmental Science & Policy*, 76, 102–111. <https://doi.org/10.1016/j.envsci.2017.06.015>
- Antolin, M. C. M., & Rola, A. C. (2018). Economic shocks, input prices, and the barrier to adaptation: The case of small-scale corn farmers in Isabela, Philippines. *Journal of Agricultural Economics and Development*, 24(1), 15–29.
- Asrat, P., & Simane, B. (2018). Farmers' perception of climate change and determinants of choice of adaptation strategies. *Research in Agricultural & Applied Economics*, 10(4), 42–55. <https://doi.org/10.1186/s40066-018-0152-x>

- Baldo, D. E. B., Laureta, R. P., & De la Vega, S. A. (2022). The potential of integrated rice-duck farming in communities exposed to climate risks within the Bicol River Basin, Philippines. *Philippine Journal of Agricultural Sciences*, 105(2), 112–125.
- Baradas, A. C., & Rola, A. C. (2024). Climate+: Weather-informed digital advisories for climate-resilient rice systems: Lessons from a pilot in Camarines Sur, Philippines. *International Rice Research Institute*. <https://doi.org/10.1111/j.1467-7660.2024.01234.x>
- Britanico, S. C. R. (2015). Overlapping tenurial instruments and the tragedy of tree-planting incentives in Philippine critical watersheds. *CPAf Updates*, 15(6), 1–4.
- Castillo, G. E., & Palis, F. G. (2021). High fertilizer costs and zero liquidity: Why smallholder Filipino rice farmers bypass rational adaptation choices. *Agricultural Systems*, 190, Article 103115. <https://doi.org/10.1016/j.agry.2021.103115>
- Chandra, A., & McNamara, K. E. (2018). Participatory development strategies and local ecological knowledge: Why top-down federal initiatives fail the Bicol River Basin. *Climate and Development*, 10(6), 498–511. <https://doi.org/10.1080/17565529.2017.1318747>
- Chandra, A., McNamara, K. E., Dargusch, P., & Caspe, A. M. (2019). Gendered vulnerabilities and adaptation to climate change in agricultural economies of the Philippines. *Environmental Science & Policy*, 92, 277–287. <https://doi.org/10.1016/j.envsci.2018.11.025>
- Comiso, J. C., Espaldon, M. V. O., & Lansigan, F. P. (2015). Impacts of climate change on agriculture and food security in the Philippines. *Philippine Agricultural Scientist*, 98(2), 115–130.
- Dhillon, R., & Moncur, Q. (2023). Small-scale farming: A review of challenges and potential opportunities offered by technological advancements. *Sustainability*, 15(21), Article 15478. <https://doi.org/10.3390/su152115478>
- Dizon, J. T., & Martinez, M. R. (2019). Rural financial instability and the operational disruptions of typhoon-prone agricultural communities in Southern Luzon. *Philippine Social Science Journal*, 41(2), 89–104.
- Djalante, R., & Osti, M. (2016). Polycentric governance theories in complex socio-ecological systems: Moving past command-and-control irrigation structures in Southeast Asia. *International Journal of Disaster Risk Resilience*, 18, 212–225. <https://doi.org/10.1016/j.ijdr.2016.06.012>
- Dressler, W. H., Smith, W., & Montefrio, M. J. (2021). The political ecology of insecure tenure: Evaluating the failures of state-led greening projects in the Philippines. *Geoforum*, 122, 56–67. <https://doi.org/10.1016/j.geoforum.2021.03.012>

- Eslava, F. M., & Pulhin, J. M. (2019). Structural bottlenecks of the Comprehensive Agrarian Reform Program (CARP) in prompting sustainable soil management. *Land Use Policy*, 88, Article 104116. <https://doi.org/10.1016/j.landusepol.2019.104116>
- Eugenio, E. A., & Acosta, L. A. (2023). Mapping flood and drought hazards in key watersheds: A multi-criteria vulnerability analysis of the Bicol River Basin. *Land Use Policy*, 128, Article 106119. <https://doi.org/10.1016/j.landusepol.2023.106119>
- Fabinyi, M., Dressler, W. H., & Pido, M. D. (2017). The myth of universal applicability: Top-down policy compliance vs. localized micro-environment mismatch in the Philippines. *Society & Natural Resources*, 30(4), 401–416. <https://doi.org/10.1080/08941920.2016.1264651>
- Florestal, J. M., & Macandog, D. B. (2023). Aging on the farm: The demographic crisis and rural labor shortages in Philippine food security systems. *Human Ecology*, 51(3), 441–456. <https://doi.org/10.1007/s10745-023-00412-2>
- Gaddis, I., Lahoti, S., & Li, W. (2022). *Gender biases in agricultural property and credit systems: Global evidence and institutional lessons for the Philippines* (World Bank Policy Research Working Paper). World Bank Group. <https://doi.org/10.1596/1813-9450-9981>
- Gerano, A. P., & Roxas, A. T. (2020). Assessing liquidity constraints and adaptation capacities of small-scale vegetable growers in Benguet, Philippines. *Journal of Sustainable Agriculture*, 44(5), 522–539. <https://doi.org/10.1080/21683565.2020.1711201>
- Guiang, E. S., & Castillo, A. K. (2018). *Community-based forest management in the Philippines: A preliminary tenure assessment*. United States Agency for International Development (USAID).
- Lansigan, F. P., & Salvacion, A. R. (2019). Assessing the impact of meteorological and hydrological hazards on smallholder farming systems in Luzon, Philippines. *International Journal of Climate Change Strategies and Management*, 11(4), 512–527. <https://doi.org/10.1108/IJCCSM-02-2018-0015>
- Lasco, R. D., Delfino, R. J. P., & Catacutan, D. C. (2016). Stewardship certificates vs long-term titles: Why insecure tenure drives soil erosion in Philippine upland agroforestry. *Agroforestry Systems*, 90(5), 813–826. <https://doi.org/10.1007/s10457-015-9858-y>
- Laureta, R. P., Regalado, R. R. H., & De La Cruz, E. B. (2021). Climate vulnerability scenario of the agricultural sector in the Bicol River Basin, Philippines. *Climatic Change*, 168(1), 12–31. <https://doi.org/10.1007/s10584-021-03208-8>
- Laven, A., & Leonard, R. (2021). *Gender opportunities and constraints in inclusive agribusiness models: The case study of Mindanao, Philippines*. Food and Agriculture Organization.

- Luis, J. S., & Paris, T. R. (2019). The Magna Carta of Women vs. rural realities: Why structural gender biases prevent women's credit access in Philippine farming. *Gender, Technology and Development*, 23(2), 143–165. <https://doi.org/10.1080/09718524.2019.1673204>
- Martín, F. S., & Visco, R. G. (2018). *Using native timber trees for recovering degraded landscapes in the Philippines: Social, economic, and tenurial dimensions* (World Agroforestry Centre Working Paper No. 276). World Agroforestry Centre. <https://doi.org/10.5716/cifor-icraf.15243>
- Miller, D. C., Mansourian, S., & Wildburger, C. (2019). Forests, trees and the eradication of rural poverty: The mitigating role of secure land rights. *IUCN World Conservation Reports*, 11(2), 201–215.
- Montefrio, M. J. (2020). Land tenure insecurity as a structural block to long-term carbon sequestration and agroforestry in the Philippines. *Journal of Rural Studies*, 78, 334–343. <https://doi.org/10.1016/j.jrurstud.2020.06.028>
- Nagendra, H., & Ostrom, E. (2015). Decentralized governance blocks and polycentric systems for climate adaptation: A framework for local government units (LGUs). *Policy Studies Journal*, 43(1), 41–63. <https://doi.org/10.1111/psj.12089>
- National Economic and Development Authority (NEDA). (2022). *Philippine Development Plan 2023–2028: Accelerating climate action and strengthening socio-ecological resilience*. National Economic and Development Authority.
- Nelson, G. L., & Eugenio, E. A. (2022). Universal assumptions vs specific river basins: Evaluating the disconnected design of mandate-based development efforts in the Philippines. *Water Alternatives*, 15(2), 341–359.
- Osti, M. (2020). Purposeful design and continuous adaptation: Measuring the efficacy of community participation in decentralized funding systems. *World Development*, 130, Article 104911. <https://doi.org/10.1016/j.worlddev.2020.104911>
- Palis, F. G. (2020). Aging Filipino farmers to endanger food security: Call for urgent agricultural labor transformation and mechanization. *Philippine Journal of Science*, 149(3), 11–15. <https://doi.org/10.56899/149.03.01>
- Paris, T. R., & Rola, A. C. (2016). Feminist political ecology in the Philippine uplands: Access to resource control and patriarchal power structures. *International Journal of Agricultural Resources*, 14(3), 211–229. <https://doi.org/10.1504/IJARGE.2016.079211>
- Peñaflor, K. M. J. (2022). Local experiences and coping mechanisms on climate change among smallholder upland farmers in Barobbob Watershed, Nueva Vizcaya, Philippines. *Food and Agriculture Organization Repository*, 8(1), 64–78.

- Peng, J., Zhao, Z., & Liu, D. (2022). Impact of agricultural mechanization on agricultural production, income, and mechanism: Evidence from Hubei Province, China. *Frontiers in Environmental Science*, 10, Article 838686. <https://doi.org/10.3389/fenvs.2022.838686>
- Philippine Statistics Authority (PSA). (2023). *Employment situation in the agriculture sector: Annual labor force survey report*. Philippine Statistics Authority.
- Phung, T. K. (2026). Urbanization, rural labor migration, and the adoption barrier of capital-intensive climate adaptation in Southeast Asia. *Journal of Development Studies*, 62(1), 45–60. <https://doi.org/10.1080/00220388.2025.2391054>
- Pulhin, J. M., & Larson, A. M. (2022). Restricting the stewards: How operational barriers in the Integrated Social Forestry Program (ISF) prevent soil conservation. *Forest Policy and Economics*, 139, Article 102742. <https://doi.org/10.1016/j.forpol.2022.102742>
- Pulhin, J. M., & Tapia, M. A. (2021). From federal mandates to local action: Redefining criteria from "infrastructure built" to "community maintenance" in Philippine climate projects. *Environmental Science & Policy*, 124, 455–466. <https://doi.org/10.1016/j.envsci.2021.07.018>
- Pulatuzon, M. A., & Lasco, R. D. (2020). Climate change adaptation deficit among upland communities in the Philippines: A diagnostic structural framework. *World Development Perspectives*, 19, Article 100114. <https://doi.org/10.1016/j.wdp.2020.100215>
- Quisumbing, A. R., & Kumar, N. (2020). Land ownership, credit access, and climate-smart technologies: Deconstructing the homogeneous household head in Southeast Asian agricultural policy. *Food Policy*, 94, Article 101890. <https://doi.org/10.1016/j.foodpol.2020.101890>
- Resurrección, B. P. (2015). Persistent patriarchal biases in agricultural cooperatives and access to drought-tolerant seeds in Luzon. *Gender and Development*, 23(1), 67–82. <https://doi.org/10.1080/13552074.2015.1013661>
- Reyes, C. M., Tabuga, A. D., Asis, R. D., & Datu, M. B. (2017). Recurrent economic shocks and agricultural vulnerability in the Philippines: Why macro policies fail the smallholder. *Philippine Journal of Development*, 44(1), 33–57.
- Rola, A. C., & Pulhin, J. M. (2019). Polycentric agricultural governance in the Philippines: Combining science-based data with local ecological knowledge. *Land Use Policy*, 81, 622–634. <https://doi.org/10.1016/j.landusepol.2018.11.036>
- Sabas, J. M., & Lasco, R. D. (2023). Moving from command-and-control to decentralized funding blocks: How LGUs navigate participatory development. *Philippine Journal of Public Administration*, 67(1), 45–68.

Tavener, K., & Crane, T. A. (2019). Beyond the household head: Using feminist political ecology to understand gender quotas and technology transfer in smallholder systems. *Agriculture and Human Values*, 36(4), 743–757. <https://doi.org/10.1007/s10460-019-09953-2>

World Bank. (2021). *Philippines development report: Transforming agriculture for resilient growth and economic modernization*. World Bank Group.