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Integrating Agriculture Policies with Climate Change Strategies and Commitments in Nepal

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Introduction

The world continues to grapple with acute hunger, malnutrition, poverty, income inequality, and other crises. In 2023, approximately 864 million people experienced severe food insecurity (FAO et al. 2024). On the one hand, poor policy adoption disrupts market and supply chain vulnerabilities, exacerbates food insecurity, and causes economic instability and crises (Hélène and Cohen 2020). On the other hand, disasters and extreme weather conditions significantly damage available infrastructure, transportation networks, and storage facilities, disrupting the distribution of agricultural commodities and as well as regular food patterns (Hasegawa et al. 2021). The *COP28 UAE Declaration on Sustainable Agriculture, Resilient Food Systems, and Climate Action* recognizes that agriculture and food systems must urgently adapt and transform to meet the challenges of climate change. It commits to integrating agriculture and food systems into climate action while simultaneously mainstreaming climate action across policy agendas and actions related to agriculture and food systems (UNFCCC 2023).

In developing countries such as Nepal, increasing soil erosion, landslides, flashfloods, and droughts are having a significant impact on agricultural output, food safety, and food security. Integrating agriculture policies with climate change commitments and strategies can offer sustainable solutions by mitigating risks while enhancing productivity, environmental sustainability, and rural incomes. This approach can streamline resource use, reduce redundancies, and foster long-term development.

This policy brief examines the integration of agriculture policies with climate change strategies in Nepal. The analysis recommends that policies place greater emphasis on green energy, flood and landslide mitigation, soil biotreatments, agroforestry, and sustainable practices to enhance agricultural resilience

and sustainability. Aligning these initiatives with investments in resilient infrastructure is crucial for future stability.

Overview of Nepal's Agriculture and Climate Change Policies

National Agriculture Policy, 2004

Nepal's National Agriculture Policy aims to develop a commercial and competitive agriculture sector that extends from regional to global markets while emphasizing the protection and sustainable use of natural resources, the environment, and biodiversity. It promotes the adoption of scientific agricultural systems that prioritize the preservation of fertile soil, particularly in the highland plains, valleys, hills, and the Tarai region. The policy also focuses on providing access to climate information, promoting crop diversification, introducing drought-resistant crop varieties, and improving soil management practices. Additionally, it aims to reduce the use of agricultural chemicals to minimize negative impacts on soil, water storage ponds, and the environment by promoting the use of organic pesticides and fertilizers. Collaboration with local authorities to improve watershed and riverbank management is another key component. The policy highlights the importance of producing high-quality seeds, seedlings, and saplings through localized development sectors and geographic subsectors.

Irrigation Policy, 2013

Nepal has 2.64 million hectares of arable land, of which 2.27 million hectares are potentially irrigable. However, only 30 percent of surface water–irrigated land has year-round irrigation (Lamichhane, Paudel, and Devkota 2022).

Nepal's Irrigation Policy emphasizes the importance of implementing adaptation and mitigation programs to address the impacts and risks of climate change. The policy aims to ensure year-round irrigation through the construction of water reservoirs, implementation of drip irrigation systems, and improved drainage management within irrigation areas. It also promotes the development of multipurpose reservoirs and interbasin water transfer projects to maximize water resource use and improve agricultural productivity.

National Food Safety Policy, 2022

Ensuring food security and safety processes can reduce greenhouse gasses emissions by minimizing energy consumption in processing, transportation, and storing (Gomez-Zavaglia, Mejuto, and Simal-Gandara 2020).

Nepal's National Food Safety Policy ensures that all stakeholders have access to education, extension services, and scientific information systems. This access is crucial for developing and implementing a comprehensive food safety and security management system. Through research and dissemination of information at the grassroots level, the policy aims to guarantee food safety and security across various value chains. Additionally, it emphasizes enhancing local technologies, management practices, and regulatory methods in agriculture to improve overall safety and security. A significant aspect of the policy is its emphasis on strict food safety regulations, regular inspections of facilities, continuous monitoring systems, and quick identification of food safety issues. These measures are essential for ensuring high standards of food safety and security. However, gaps remain in fully aligning these regulations with resilience-building efforts.

The policy also highlights the need for public awareness and good hygiene practices to reduce contamination risks. Promoting sustainable agricultural practices is vital for minimizing the environmental impact of food production and ensuring resilience against climate change. Public education and training programs play a crucial role in this effort. Teaching stakeholders about the importance of hygiene and sustainable practices can help to mitigate risks associated with food contamination and climate variability. Innovation in food production, processing, and preservation is another critical component of the policy. Investing in new technologies and methods can significantly reduce contamination risks and improve food security (Calzadilla et al. 2013). For instance, developing climate-resilient crop varieties, efficient irrigation systems, and advanced preservation techniques is essential for adapting to climate change. Ensuring the integration of these innovations into the food safety framework will strengthen the food system's overall resilience and sustainability.

National Land Utilization Policy, 2012

Nepal's National Land Utilization policy provides a robust framework for sustainable land management. It emphasizes a structured approach by categorizing land use and management into agriculture, residential, business, forestry, industrial, and other public purposes. The policy mandates reserving at least 40 percent of land for forests. It promotes land-pooling for scattered agricultural lands and aims to preserve the land's natural contours while minimizing unnecessary fragmentation. In addition, it assigns local government bodies the responsibility of overseeing the development of green belts, roads, ponds, and irrigation channels.

National Agroforestry Policy, 2019

Nepal's National Agroforestry Policy aims to boost the production of agricultural, livestock, and forest products by increasing land productivity and promoting multipurpose use. It focuses on conserving the environment and biodiversity by reducing pressure on forests, maintaining ecosystem quality, and

developing a climate-resilient ecosystem. The policy emphasizes the need for local communities, especially those with no or minimal natural forests, to implement special programs for the development, expansion, and promotion of agroforestry systems.

National Fishery Development Policy, 2022

Nepal's National Fishery Development Policy is a forward-looking framework aimed at enhancing income and employment by boosting the production and productivity of fish and other aquatic species, which are vital sources of essential nutrition. The policy seeks to improve the fishery value chain, transforming it into a more commercial, competitive, and profitable sector. Its ultimate goal is to achieve self-sufficiency in fish consumption while steadily increasing export potential. In addition, the policy focuses on developing a sustainable fishery sector by protecting, enhancing, and properly using local aquatic biodiversity, the environment, and the livelihoods of local communities.

Rangeland Policy, 2012

Nepal's Rangeland Policy is a visionary framework aimed at transforming agriculture into a commercial and competitive sector in regional and global markets. Central to this policy is the protection and judicious use of natural resources, the environment, and biodiversity. It promotes the adoption of scientific agricultural systems to preserve fertile soils, especially in the plains of the mountains, hills, and Tarai region. The policy includes measures to provide access to climate information and early warning systems, encourage crop diversification, introduce drought-resistant crop varieties, and improve soil management practices. In addition, it emphasizes reducing the use of agricultural chemicals to minimize their negative impact on soil, water storage ponds, and the environment, while promoting the production and use of organic pesticides and fertilizers.

Gap Analysis

By integrating agriculture and climate policies, it is possible to create a more coherent and synergistic policy framework that supports both sustainable agricultural practices and climate resilience. Such integration can help align goals, streamline strategies, and enhance the overall effectiveness of policies, thereby addressing contemporary socio-environmental challenges and contributing to sustainable development.

This section presents a gap analysis to identify areas where Nepal's national policies are not well integrated—comparing agriculture policies with climate change policies and commitments across four key dimensions: goals, strategies, capacity building measures, and performance tracking and reporting systems. The gap analysis considers the climate commitments and strategies outlined in the Nationally

Determined Contributions (NDCs), the NDC Implementation Plan, and the National Adaptation Plan. This analysis is critical for highlighting areas needing improvement and better integration.

National Agriculture Policy, 2004

Gaps exist between the current policy and Nepal's climate change commitments and strategies. Rural electrification remains a key national priority, but the reliance on fuelwood for more than two-thirds of total energy consumption (Pokhrel and Rijal 2020) underscores the need to transition toward green energy for households, industries, and agricultural use. The policy mentions general soil management practices but lacks specific strategies for flood and landslide mitigation, which are crucial for the Tarai and mountainous regions. Recommended measures include constructing embankments, improving drainage systems, implementing floodplain zoning regulations, and enhancing slope stabilization, reforestation programs, and early warning systems for landslide-prone areas. In addition, the policy should promote groundwater recharge systems or ponds to prevent drought on agricultural lands, particularly in the Tarai region.

Effective monitoring of pesticide use is necessary to control its hazardous effects on biodiversity. Promoting the use of biofertilizers and providing subsidies or other incentives to reduce chemical use are also essential (Demeneix 2020). Furthermore, the policy should expand its focus on selecting species that are drought and flood resilient, especially in rural areas. Providing subsidies for agricultural mechanization—particularly for the direct seeding of paddy—along with expanding awareness of this method, can improve economic efficiency and reduce methane emissions as compared with traditional planting systems. This recommendation has been successfully tested by Hussain et al. (2020). Addressing these gaps by incorporating targeted strategies for climate resilience and sustainable practices will enhance the effectiveness of the National Agriculture Policy in mitigating climate change impacts and promoting sustainable agricultural development in Nepal.

Irrigation Policy, 2013

Despite the policy's progressive framework, notable gaps remain in aligning it with climate change commitments and strategies. Currently, subsidies for solar panels and the technical aspects of implementation are critical, yet the pace of these initiatives under current governance is slow. Increasing the speed and efficiency of these programs is crucial to achieving the desired outcomes well before the 2050 target. Additionally, providing facilities for drip system irrigation, as highlighted by Babu et al. (2024), requires greater focus, especially for village farmers, as current efforts are predominantly urban-centric. Addressing these gaps will ensure a more inclusive and effective approach to irrigation efforts and climate change mitigation in Nepal.

National Food Safety Policy, 2022

The policy should encourage the use of sustainable and locally sourced inputs, reduce reliance on chemical fertilizers and pesticides, and integrate renewable energy sources into agricultural processes. Additionally, investing in climate-resistant infrastructure, such as storage facilities and processing units capable of withstanding extreme weather events, is essential. Promoting the restoration of native plant species and adopting efficient planting systems can further enhance the policy's effectiveness in mitigating climate change impacts.

National Land Utilization Policy, 2012

While the policy sets a clear framework, implementation challenges remain. Unplanned urbanization is rampant, leading to a significant loss of green areas. This deviation from the policy has resulted in a disconnect between land use practices and climate change commitments. It is crucial to effectively apply the policy on the ground and curb unnecessary and unplanned urbanization.

Bridging this gap requires adopting soil biotreatments through natural methods, such as bioengineering sequences. Integrating trees and shrubs into agricultural landscapes is essential for enhancing biodiversity, sequestering carbon, and improving soil health. The policy's emphasis on preserving natural land contours and developing green belts aligns with this approach, but institutions must strengthen enforcement and provide incentives to ensure implementation of these practices.

Additionally, using tree planting to create windbreaks and reduce erosion is vital. Cover crops and crop rotation can significantly improve soil fertility, reducing reliance on chemical fertilizers. The policy's support for structured irrigation channels can facilitate these sustainable agricultural practices, contributing to both soil health and climate resilience (Cerdà, Novara, and Moradi 2021).

Adopting organic farming practices that avoid synthetic pesticides and fertilizers is another critical step. These practices reduce greenhouse gas emissions and improve soil health, aligning with climate change strategies. Promoting the use of compost and organic matter to enhance soil fertility and carbon storage is also essential, as these practices support the policy's goals of minimizing land fragmentation and preserving the land's natural shape.

Local governments have a crucial role in ensuring that the policy is not just a document but a guide for real action. Strict enforcement of land use regulations to prevent unplanned urbanization is necessary. Climate-resilient practices, such as creating green belts and using bioengineering techniques for soil conservation, should be integrated into development projects. Local bodies' supervision of roads, ponds,

and irrigation channels ensures that development is sustainable and aligns with Nepal's environmental goals.

National Agroforestry Policy, 2019

The policy promotes agroforestry systems in specific regions to manage riverbank and soil erosion, and to mitigate calamities such as floods and landslides. However, gaps remain when aligning these efforts with climate change commitments and strategies. One key gap is the need to strengthen forest-based institutions through technology development and transfer. This effort would enhance the institutions' capacity to manage and restore ecological connectivity, increasing the resilience of forest ecosystems, biodiversity, and rural communities.

Supporting wildlife during extreme climate events and managing ecological connectivity is another critical aspect that requires greater attention. While the policy indirectly supports biodiversity conservation, explicit measures to protect wildlife from extreme climate events and restore ecological connectivity are necessary. Strategies such as creating wildlife corridors, establishing buffer zones, and implementing habitat restoration projects can contribute significantly to this goal (Mey and Gore 2021).

Addressing climate-induced calamities and building resilience is also essential. The policy highlights the importance of managing riverbank and soil erosion and of mitigating calamities through appropriate agroforestry systems. However, further development and implementation of climate-resilient agroforestry practices tailored to local conditions are needed. Fostering community-based initiatives and capacity-building programs can empower local communities to adopt and maintain these practices.

National Fishery Development Policy, 2022

Despite the policy's commendable objectives and provisions, several gaps remain in aligning it with climate change actions and strategies. One significant gap is the need to encourage the use of sustainable and locally sourced fish feed, which would lower the carbon footprint and reduce reliance on imported feed. Integrating species that can utilize waste products from fish farming could further reduce environmental impact and increase productivity. Investment in climate-resistant infrastructure—such as fishponds, hatcheries, and processing facilities capable of withstanding extreme weather events—is crucial. Harnessing renewable energy sources such as solar and wind power can help reduce greenhouse gas emissions from fish farming operations. Promoting local species and renewable energy can enhance both productivity and profitability in the fishery sector. Increased community awareness and involvement are crucial for successful implementation.

Rangeland Policy, 2012

Despite the policy's comprehensive approach, several gaps remain when aligning it with climate change strategies and commitments. Implementing rotational grazing systems to prevent overgrazing and to allow vegetation recovery is crucial but not yet fully integrated into the policy. Setting appropriate stocking rates to maintain vegetation cover and soil health is vital, along with adjusting grazing periods to match plant growth cycles and climate conditions. The use of physical barriers such as check dams and terraces to prevent soil erosion is essential and should be given greater priority. Water harvesting techniques, such as constructing small ponds and rainwater catchment systems, can enhance water availability but are underutilized (Cardinael et al. 2021). In addition, promoting the restoration of native plant species to improve biodiversity and ecosystem resilience, as well as using efficient planting systems that emit less methane, are strategies that require further development.

The policy's focus on promoting sustainable agricultural practices aligns well with several climate change strategies, yet addressing certain gaps is necessary for effective implementation. Its emphasis on protecting natural resources and reducing chemical use complements climate strategies aimed at preserving soil health and reducing environmental impacts. Integrating rotational grazing, appropriate stocking rates, and climate-aligned grazing periods into the policy would significantly enhance vegetation recovery and soil health. While the use of physical barriers and water harvesting techniques supports the policy's goals, these measures require more robust application. Encouraging the restoration of native plant species and adopting efficient planting systems would further strengthen the policy's impact on biodiversity and ecosystem resilience.

Concluding Remarks

Climate change poses a significant threat to the global food system, affecting agricultural output, food safety, and the overall food security chain, particularly in developing countries. However, climate-resilient farming practices offer a pathway to environmental sustainability by mitigating climate risks while simultaneously enhancing agricultural productivity and improving the incomes of rural populations. Integrating agricultural policies with climate change strategies is therefore vital to achieving sustainable development goals and implementing NDCs. This study explores the integration between Nepal's agriculture policies and climate change commitments and strategies.

Currently, flood and landslide mitigation, especially in the Tarai Plains and hilly regions, lack targeted strategies. To bridge these gaps, measures such as embankments, drainage systems, floodplain zoning regulations, slope stabilization, reforestation programs, groundwater recharge systems, and pesticide monitoring should be more systematically implemented and regulated. Although rural electrification is a

key national agenda, fuelwood still accounts for a significant share of energy consumption. There is a pressing need for green energy solutions for households and businesses.

To enhance agricultural sustainability and resilience, a range of practices is essential, including soil biotreatments, tree and shrub integration, cover cropping, crop rotation, organic farming, use of compost and organic matter, rotational grazing systems, check dams, and terraces. Water harvesting techniques, the restoration of native plant species, and financial incentives for agroforestry practices are also essential. Aligning agroforestry initiatives with national climate-resilient action plans, investing in climate-resistant infrastructure, and promoting sustainable fish feed can further support agricultural resilience and sustainability.

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