Journal of Agriculture, Food Systems, and Community Development
ISSN: 2152-0801 online
https://foodsystemsjournal.org

COMMENTARY

Sustaining life: Protecting Pakistan's fertile soil and advocating against soil sealing

Amanullah *
The University of Agriculture Peshawar

Submitted February 12, 2025 / Published online May 18, 2025

Citation: Amanullah. (2025). Sustaining life: Protecting Pakistan's fertile soil and advocating against soil sealing [Commentary]. *Journal of Agriculture, Food Systems, and Community Development*, *14*(3), 13–19. https://doi.org/10.5304/jafscd.2025.143.003

Introduction

Pakistan is facing a growing crisis as rapid population expansion and shrinking fertile land put immense pressure on food production. One of the most alarming threats to agriculture is *soil sealing*—the process of covering fertile land with roads, buildings, and other structures (Amanullah, 2025). This prevents water absorption, damages soil health, and permanently removes land from food production. The uncontrolled expansion of urban areas, often driven by illegal land grabbing and poor governance, is making the situation worse. As a result, food security in Pakistan is at serious risk, with rising food prices affecting millions, especially the poor (Amanullah, 2024a; Food and Agriculture Organization of the United Nations [FAO], 2019).

With a fast-growing population, Pakistan needs more food than ever before. However, as fertile land is lost to unauthorized construction, the country's ability to produce enough food is shrinking. This leads to increased reliance on expensive food imports, putting a strain on the economy and slowing national development. If this issue goes unaddressed, Pakistan could face severe food shortages, making it difficult to meet the basic needs of its people (Amanullah, 2024b; FAO, 2019; Intergovernmental Panel on Climate Change [IPCC], 2019).

A root cause of this problem is weak land governance. The poor enforcement of laws allows land mafias to illegally convert agricultural land into residential and commercial areas. Without strict regulations, fertile soil is being lost at an alarming rate. Additionally, policymakers who lack knowledge of sustainable agriculture fail to recognize the long-term damage caused by soil sealing. Weak policies and lack of proper planning have further worsened the situation, making Pakistan's food system more vulnerable (World Wildlife Fund [WWF]–Pakistan & Global Alliance for Improved Nutrition [GAIN], 2025).

To protect Pakistan's future, urgent action is needed. This includes stronger laws, better enforce-

* Prof. Dr. Amanullah, Department of Agronomy, The University of Agriculture Peshawar, Pakistan; amanullah@aup.edu.pk; https://orcid.org/0000-0003-2289-7755

ment, and public awareness to prevent the further loss of fertile land. By understanding the consequences of soil sealing and taking immediate steps to stop it, Pakistan can secure its food supply, support its economy, and improve the lives of millions of people. This commentary highlights the urgent need to protect fertile land, the impact of soil sealing on food security, and the steps necessary to address this crisis.

Preventing soil sealing on fertile land is crucial for maintaining agricultural productivity, environmental sustainability, and food security in Pakistan. Soil sealing poses significant threats to the country's agricultural sector. With rapid urbanization, industrial expansion, and infrastructure development, Pakistan is losing its valuable arable land, which directly impacts food production and ecosystem health. By implementing measures to prevent soil sealing, Pakistan can safeguard its fertile lands, ensure long-term agricultural viability, and mitigate the adverse effects of climate change (Amanullah et al., 2023). This approach not only preserves soil fertility but also promotes the sustainable land management practices that are essential for future generations.

Benefits of Preventing Soil Sealing on Fertile Land:

1. **Preservation of Agricultural Productivity:** Halting soil sealing preserves fertile land for agriculture, ensuring sustained and enhanced crop productivity.
2. **Food Security:** Protecting fertile land contributes to food security by maintaining a stable and reliable supply of food for the growing population.
3. **Biodiversity Conservation:** Preventing soil sealing helps conserve natural habitats and biodiversity, promoting a healthier ecosystem with diverse flora and fauna.
4. **Economic Stability for Farmers:** Farmers benefit from the preservation of fertile land, as it secures their livelihoods and contributes to economic stability in rural areas.
5. **Water Conservation:** Healthy soils play a crucial role in water conservation. Preventing soil sealing helps maintain soil structure by reducing runoff and enhancing water retention.
6. **Mitigation of Climate Change:** Fertile soils act as carbon sinks. Halting soil sealing aids in mitigating climate change by preserving these carbon-storing capacities.
7. **Resilience to Extreme Weather Events:** Fertile soils contribute to the resilience of agricultural systems, helping crops withstand extreme weather events such as droughts and floods.
8. **Sustainable Land Use Practices:** Preventing soil sealing encourages the adoption of sustainable land use practices, fostering a balance between urban development and agricultural needs.
9. **Protection of Ecosystem Services:** Fertile soils provide essential ecosystem services, including nutrient cycling and water purification. Halting soil sealing protects these services.
10. **Enhanced Soil Health:** Preserving fertile land supports soil health, maintaining a balance of nutrients and microbial activity that is crucial for sustainable agriculture.
11. **Reduction in Environmental Degradation:** Soil sealing contributes to environmental degradation. Halting this practice reduces the loss of fertile land and minimizes the negative impact on natural resources.
12. **Promotion of Sustainable Urbanization:** Encouraging sustainable urbanization practices prioritizes the protection of agricultural land while meeting the needs of expanding urban populations.
13. **Long-Term Economic Benefits:** Protecting fertile land ensures long-term economic benefits by sustaining agriculture, reducing the need for food imports, and promoting self-sufficiency.
14. **Community Well-being:** Halting soil sealing contributes to the overall well-being of communities by securing a stable and nutritious food supply, preserving local traditions, and fostering a connection to the land.
15. **Global Environmental Contributions:** Contributing to global environmental goals by preserving valuable agricultural resources aligns with international initiatives for sustainable land use and environmental conservation.

Soil sealing is an escalating threat to Pakistan's agricultural sustainability. Driven by rapid population growth, unregulated construction, and weak land governance, this trend undermines national food security and exacerbates environmental degradation. As agricultural land continues to shrink, the risk of rising food prices, increased reliance on imports, and socio-economic instability intensifies (Amanullah, 2024a, 2024b). This commentary explores the root causes and policy failures behind soil sealing and proposes practical strategies to safeguard Pakistan's agricultural future.

Key Challenges and Issues

Soil sealing presents a significant challenge to sustainable land use, particularly in rapidly urbanizing regions. This process leads to the irreversible loss of productive land. In many countries, including Pakistan, soil sealing is driven by expanding cities, industrialization, and infrastructure development, often occurring at the expense of valuable agricultural areas. The consequences are far-reaching, including reduced groundwater recharge, increased flood risks, loss of biodiversity, and a decline in food production. Addressing these challenges requires effective land-use planning, policy interventions, and sustainable development strategies to balance urban growth with environmental conservation (Amanullah, 2025; Bouma, 2014).

Figure 1 illustrates the alarming extent of soil sealing in Pakistan, highlighting the loss of fertile agricultural land due to urban expansion and infrastructural development. Soil sealing has become a significant concern in Pakistan due to several interlinked factors.

One of the primary challenges is **population pressure**, which has led to an unprecedented demand for housing, roads, and industrial zones. As cities expand to accommodate their growing populations, agricultural land is increasingly converted into urban settlements, reducing the availability of fertile soil for food production. This pressure is further exacerbated by the **land mafia influence,** where powerful groups illegally acquire and develop agricultural land for commercial gains. Such unauthorized encroachments are often difficult to reverse, as these groups operate with strong political backing, making land reclamation efforts ineffective.

Additionally, **poor governance of fertile soil** has contributed to unregulated urbanization, where policies meant to protect arable land are either out-

Figure 1. Key Challenges and Issues in Pakistan Regarding Soil Sealing

dated or not enforced. There is a **lack of fertile soil security,** as legal frameworks fail to prioritize agricultural land conservation, allowing real estate expansion at the cost of Pakistan's food-producing regions. Compounding this issue is **uneducated leadership and policy deficiencies,** where decision-makers often lack the technical expertise to implement sustainable land management practices. The absence of soil protection laws and the failure to integrate environmental concerns into urban planning further aggravate the problem.

These challenges have severe **consequences for food security.** With declining arable land, domestic food production is at risk, increasing reliance on food imports and making the country vulnerable to price fluctuations in global markets. A shrinking agricultural base threatens the livelihoods of millions who depend on farming, exacerbating rural poverty and migration to overcrowded urban centers. Beyond food security, the **environmental and economic impacts** of soil sealing are profound. Reduced natural water infiltration leads to urban flooding, declining groundwater recharge, and loss of biodiversity. The economic burden of rehabilitating degraded land is immense, yet little investment is directed toward land restoration initiatives.

1. Population Pressure
Pakistan's growing population has intensified the demand for residential areas, leading to rapid urban expansion. As cities expand, competition for fertile land increases, putting agricultural productivity at risk. The encroachment of urbanization into agricultural zones has led to a significant reduction in available farmland, further threatening food security.

2. Land Mafia Influence
The role of land mafias in illegal land conversions is a pressing issue. These groups exploit legal loopholes, engage in corruption, and use coercion to acquire agricultural land for commercial purposes. This unchecked exploitation accelerates soil sealing, depriving farmers of their livelihoods and contributing to unsustainable urban sprawl.

3. Poor Governance of Fertile Soil
Weak governance and inefficient land management policies allow soil sealing to persist. Without stringent regulations and enforcement mechanisms, unauthorized land conversions continue unabated. Strengthening governance through transparent policies and accountability measures is crucial to protecting fertile land.

4. Lack of Fertile Soil Security
The absence of protective measures for fertile soil poses a direct threat to agricultural sustainability. The continued loss of fertile land leads to declining crop yields, increased reliance on food imports, and disruptions in the food supply chain. Proactive soil conservation policies are essential to mitigate these risks.

5. Weak Leadership and Policy Gaps
A lack of technical knowledge among policymakers contributes to ineffective land management strategies. Inadequate understanding of agricultural and environmental challenges results in weak policies that fail to curb soil sealing. Educating policymakers and integrating scientific expertise into governance can help bridge this gap.

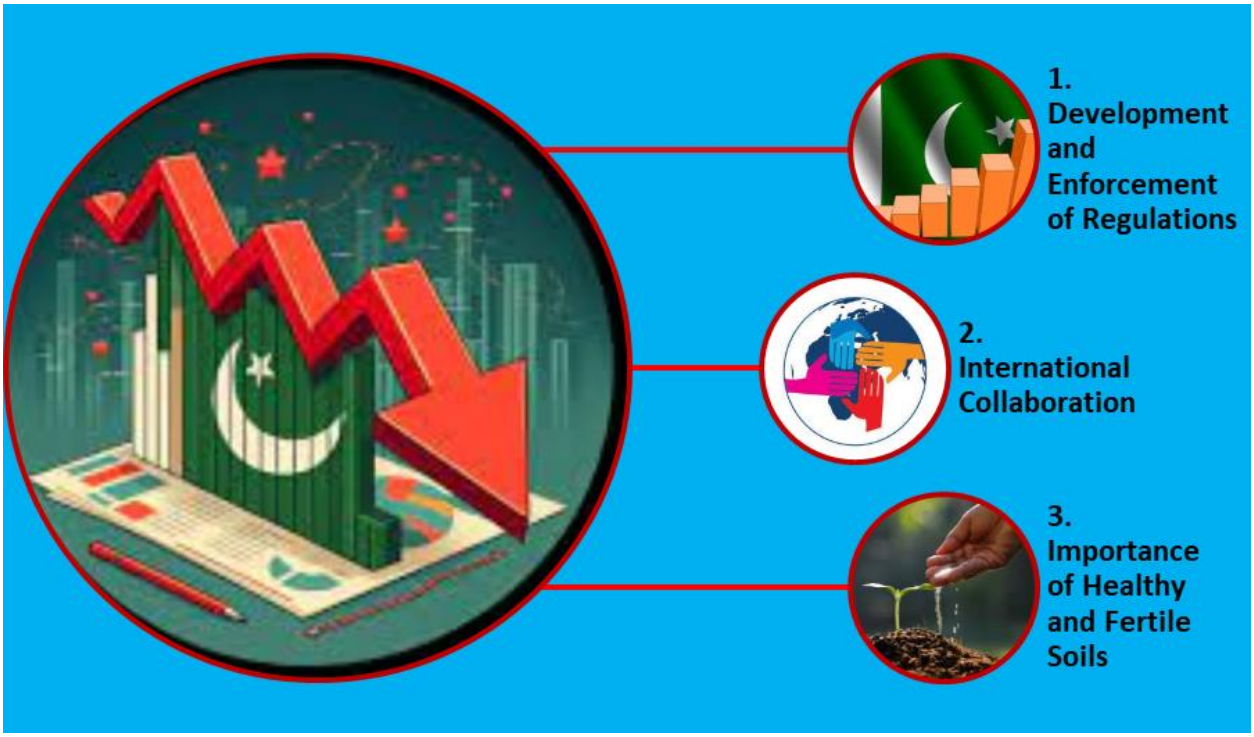
6. Consequences for Food Security
Soil sealing reduces the availability of arable land, directly affecting food production. As agricultural productivity declines, food prices rise, and supply shortages become more frequent. Ensuring food security requires urgent action to halt unnecessary land conversions.

7. Environmental and Economic Impact
The environmental impact of soil sealing extends beyond agriculture. It disrupts biodiversity, alters water cycles, and contributes to climate change. Economically, soil sealing threatens the livelihoods of farmers and increases reliance on imported food, leading to financial instability.

Potential Solutions and Collaborative Efforts

Figure 2 presents a strategic framework for mitigating soil sealing in Pakistan through regulatory measures, international cooperation, and soil conservation efforts. Given the rapid urban expansion and loss of fertile land, implementing effective solutions requires a multifaceted approach that includes governance, global partnerships, and sustainable land-management practices.

Figure 2. Potential Solutions and Collaborative Efforts To Combat Soil Sealing in Pakistan



A crucial step is the **development and enforcement of regulations** to prevent unauthorized land conversions. Strengthening land-use policies, implementing zoning laws, and imposing strict penalties on illegal encroachments can help safeguard agricultural land. Without proper enforcement mechanisms, even well-structured policies remain ineffective. Therefore, establishing monitoring systems and ensuring accountability at local and national levels is essential to curb the unchecked expansion of urban areas onto fertile lands.

International collaboration can also play a vital role in addressing soil sealing. Pakistan can benefit by studying successful land-management models from countries that have effectively balanced urbanization with agricultural preservation. Knowledge-sharing initiatives, technical support, and foreign investment in sustainable infrastructure can provide practical solutions tailored to Pakistan's needs. Global cooperation can also help in accessing resources for soil restoration and adopting innovative agricultural techniques to enhance productivity while minimizing land degradation (Amanullah, 2024b; Bruinsma, 2009; FAO & Intergovernmental Technical Panel on Soils [ITPS], 2015).

Equally important is recognizing the **importance of healthy and fertile soils** for long-term sustainability (Amanullah, 2025; FAO & ITPS, 2015). Fertile soil is the backbone of food security, biodiversity conservation, and climate resilience. By promoting soil conservation techniques, such as crop rotation, afforestation, and organic farming, Pakistan can enhance land productivity while minimizing environmental damage. Educating farmers and policymakers on sustainable land management practices will ensure that soil protection remains a national priority.

To effectively combat soil sealing, Pakistan must adopt a comprehensive approach that combines regulatory measures, global partnerships, and local conservation efforts (Amanullah, 2024b, 2025). Strengthening governance, learning from international best practices, and fostering a culture of environmental responsibility will be instrumental in protecting the country's agricultural future.

1. **Development and Enforcement of Regulations**

Effective land-use policies and their strict enforcement can curb unauthorized land conversions. Implementing zoning laws and imposing penalties on illegal activities will help protect agricultural land.

2. **International Collaboration**

Pakistan can benefit from international collaboration by learning from successful models implemented in other countries. Exchanging knowledge and best practices can help develop sustainable solutions to address soil sealing.

3. **Importance of Healthy and Fertile Soils**

Healthy soils are the foundation of sustainable agriculture and environmental balance. Preserving fertile land ensures long-term food security, enhances biodiversity, and improves climate resilience. Promoting soil conservation techniques and sustainable land management practices is essential for a thriving agricultural sector.

Conclusion

Soil sealing is a growing crisis that threatens Pakistan's agricultural sustainability, food security, and economic stability. If left unchecked, the continued loss of fertile land will not only drive up food prices and increase reliance on imports but also undermine the livelihoods of farmers and weaken the country's ability to feed its rapidly growing population. Addressing this challenge requires urgent and coordinated action from policymakers, local communities, and international partners. Protecting fertile land is not just a national priority but a global concern, as food security and environmental sustainability are interconnected. By implementing proactive policies, fostering community involvement, and adopting international best practices, Pakistan can safeguard its agricultural future and ensure a resilient food system for generations to come.

Key Takeaways:

1. **Urgency of Action:** Soil sealing poses an immediate and severe threat to Pakistan's food security and agricultural sustainability, requiring urgent intervention.
2. **Complex and Multifaceted Challenge:** This issue stems from multiple factors, including rapid urbanization, land mafia influence, weak governance, and ineffective policies, making a holistic approach necessary.
3. **Direct Impact on Food Security:** The reduction in fertile land due to soil sealing directly threatens food production, leading to higher prices and increased reliance on costly food imports.
4. **Global Significance:** The challenge of soil sealing extends beyond Pakistan, emphasizing the need for international collaboration to share knowledge, strategies, and solutions.
5. **Role of Education and Leadership:** Informed and educated leadership is critical to developing policies that protect agricultural land and promote sustainable urban development.
6. **Strengthening Policies and Governance:** Establishing clear regulations, ensuring strict enforcement, and enhancing land management practices are essential to combating soil sealing.
7. **Community Participation:** Raising public awareness and actively involving communities in land conservation efforts will strengthen local resilience against unauthorized land conversion.

Recommendations:

1. **Policy Reforms:** Strengthen land-use policies to regulate urban expansion and prevent unauthorized land conversions.
2. **Educational Campaigns:** Raise awareness at all levels about the consequences of soil sealing and the importance of protecting fertile land.
3. **Community Engagement:** Encourage local communities to participate in land-management decisions to foster a sense of ownership and responsibility.
4. **Sustainable Urban Planning:** Develop comprehensive land-use plans that balance urban development needs with agricultural preservation.

5. **International Collaboration:** Work with global organizations to exchange best practices and technical expertise in soil conservation and land management.
6. **Strict Monitoring and Enforcement:** Enhance surveillance and enforcement measures to penalize illegal land conversions.
7. **Investment in Research and Innovation:** Support research on sustainable land-management technologies and agricultural practices that minimize soil degradation.
8. **Financial Incentives for Farmers:** Provide subsidies and incentives for farmers who adopt sustainable practices that protect soil health.
9. **Capacity Building:** Train local authorities and agricultural extension workers to implement and enforce land-use policies effectively.
10. **Policy Advocacy:** Push for national and international policies that recognize the importance of protecting fertile land for long-term food security.

By taking these proactive steps, Pakistan can mitigate the negative effects of soil sealing, protect its agricultural heritage, and create a more sustainable and food-secure future.

References

Amanullah. (2024a). *Harvesting success: A comprehensive guide to agronomy courses*. Punjab Books.

Amanullah. (2024b). *Integrated agriculture: An approach for sustainable agriculture*. De Gruyter. https://doi.org/10.1515/9783111448077

Amanullah. (2025). *Crop nutrition: Enhancing healthy soils, food security, environmental sustainability and advancing SDGs*. De Gruyter. https://doi.org/10.1515/9783111617671

Amanullah, Ondrasek, G., & Al-Tawaha, A. R. (2023). Editorial: Integrated nutrients management: An approach for sustainable crop production and food security in changing climates. *Frontiers in Plant Science*, *14*, Article 1288030. https://doi.org/10.3389/fpls.2023.1288030

Bouma, J. (2014). Soil science contributions towards Sustainable Development Goals and their implementation: Linking soil functions with ecosystem services. *Journal of Plant Nutrition and Soil Science*, *177*, 111–120. https://doi.org/10.1002/jpln.201300646

Bruinsma, J. (2009, June 24-26). *The resource outlook to 2050: By how much do land, water and crop yields need to increase by 2050?* [Paper presentation] at the FAO Expert Meeting, Rome. https://www.researchgate.net/profile/Jelle_Bruinsma/publication/242268465_by_how_much_do_land_water_and_crop_yields_need_to_increase_by_2050/

Food and Agriculture Organization of the United Nations [FAO]. (2019). *Tackling food insecurity in Pakistan through strengthening of soil health monitoring and soil fertility* (Report No. GCP/PAK/143/USA). https://openknowledge.fao.org/handle/20.500.14283/ca6458en

FAO & Intergovernmental Technical Panel on Soils [ITPS]. (2015). *Status of the world's soil resources (SWSR) – Main Report.* https://openknowledge.fao.org/server/api/core/bitstreams/6ec24d75-19bd-4f1f-b1c5-5becf50d0871/content

Intergovernmental Panel on Climate Change [IPCC]. (2019). *Climate change and land: An IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems.* https://www.ipcc.ch/srccl/

World Wildlife Fund [WWF]–Pakistan & Global Alliance for Improved Nutrition [GAIN]. (2025, January 15). *Experts call for integrating resilient agriculture-food systems in Pakistan's climate policies and plans.* https://www.wwfpak.org/?390278/Experts-call-for-integrating-resilient-agriculture-food-systems-in-Pakistans-climate-policies-and-plans