

Executive Summary

Saline agriculture refers to agricultural practices that utilize saline soil or/and water sustainably. Effective management of such resources requires careful and deliberate strategies. To date, scientific studies have primarily focused on freshwater and pristine lands for sustainable production. However, increasing food demand, increasing climate variability, and widespread degradation of soil and water resources are now demanding greater productive attention from these previously unproductive lands. Moreover, salt-affected areas are rapidly increasing year by year. This policy brief describes how salt-based agriculture can contribute to achieving several Sustainable Development Goals (SDGs) identifies key challenges and offers practical recommendations for policymakers.

The Problem

Since the dawn of settled agriculture, the management of land and water has led to the rise and fall of civilizations. For example, in Mesopotamia, advanced irrigation systems allowed societies to increase food production and experience periods of prosperity. However, poor management of these systems led to salt accumulation, soil degradation, and decreased productivity. Historians (e.g., Jacobsen & Adams, 1958; Artzy, 1988; Sissakian et al., 2020) often point to salinity as one of the primary pressures contributing to the eventual collapse of these once-prosperous societies. This historical lesson reinforces the importance of adopting sustainable land and water practices in today's salt-affected agriculture.

Beginning in the 1960s and 70s, the "Green Revolution" led to a dramatic increase in total global food production. In this period, the world witnessed extraordinary productivity growth. Fifty years ago, this problem was overcome to some extent, but the following years will be more difficult. Due to the limited conditions in all aspects, careful use of lower quality and quantity of water has vital importance for the upcoming years (Semiz et al., 2023). Therefore, scientists, in collaboration with policymakers and other stakeholders, must develop innovative management strategies that not only ensure the sustainable use of degraded resources but also contribute to the achievement of the Sustainable Development Goals (SDGs).

Links to Sustainable Development Goals

SDG 2 (Zero Hunger): Saline agriculture directly contributes to the Zero Hunger goal by increasing the area of arable land in salinity and water stressed areas. By allowing staple and cash crops (halophytes) to be grown on marginal or degraded lands. It increases overall food availability, supports rural livelihoods, and strengthens the resilience of food systems to climate change and population growth.

SDG 6 (Clean Water and Sanitation): Saline agriculture reduces the demand of irrigation water in areas with limited freshwater resources resulting in reducing pressure on the amount of water needed for clean water and sanitation. It helps reduce pressure on aquatic and other freshwater ecosystems by facilitating the safe and efficient use of brackish or saline water for irrigation. This approach not only protects vital water resources for domestic and industrial use but also contributes to long-term water security and sustainable water management by minimizing the risk of over-extraction and environmental degradation.

Sustainable Development Goal 12 (Responsible Consumption and Production): Saline agriculture leads responsible consumption and production by promoting the efficient and sustainable use of marginal soil and water resources. By growing crops on marginal or saline soils and using saline or brackish water, it enables the use of land that was previously uncultivated. Pressure on freshwater

resources can be reduced. This approach not only maximizes the efficiency of otherwise underutilized resources, but also minimizes environmental degradation, supports circular resource management, and contributes to the long-term sustainability of agricultural systems.

SDG 13 (Climate Action): SDG 13 (Climate Action): Saline agriculture supports climate action by increasing the resilience of agricultural systems to droughts, water scarcity, and soil degradation caused by climate change. By using salt-tolerant crops and efficient water management practices, it helps farming systems adapt to climate variability while maintaining food production. Compared to uncultivated or degraded lands, saline agriculture can also enhance carbon capture, contributing to climate mitigation. This approach strengthens the resilience of both the land and the communities that depend on it, ensuring more sustainable and reliable agriculture under changing climatic conditions.

SDG 15 (Life on Land): Saline agriculture helps reduce land degradation by effectively utilizing marginal or salinized soils, which are otherwise susceptible to erosion and desertification. By growing salt-tolerant crops and adopting sustainable soil and water management practices, salt agriculture contributes to ecosystem restoration and maintenance. This approach not only improves soil health and fertility, but also strengthens the resilience of landscapes and communities, contributing to long-term sustainability and biodiversity conservation.

Key Challenges

Limited Awareness and Policy Integration

Many policymakers, farmers, and stakeholders still remain unaware of the full potential of saline agriculture. The limited integration of this approach into national agricultural policies continues to restrict investment, research, and practical implementation. Since even fertile and problem-free soils face production challenges, saline agriculture is often seen as a distant or unrealistic goal.

Nonetheless, the demand for saline agriculture is expected to grow substantially in the near future, highlighting its emerging importance for sustainable food production.

Limited Availability of Salt-Tolerant Crops

One of the main challenges in saline agriculture is the limited availability of salt-tolerant crop varieties. Although recent research has made progress in developing and identifying salt-resistant crops such as halophytes, quinoa, amaranth, and improved cultivars of staple crops, these varieties are not yet widely accessible to farmers. Supporting projects and programs that focus on breeding, developing, and disseminating salt-tolerant crops is crucial, but such initiatives often require significant investment, technical expertise, and long-term commitment. **Without adequate support, the adoption of these crops on saline lands remains limited, restricting the potential of saline agriculture.**

Adapting Traditional Farmers to Saline Agriculture

One of the key challenges in promoting saline agriculture is enabling farmers who are accustomed to traditional cropping systems to adopt new practices. These farmers often lack experience with halophytes crops, saline water management, and soil amendments necessary for productive cultivation on salt-affected lands. Training, extension services, and demonstration plots are essential to build their knowledge and practices. **Supporting farmers through hands-on learning and guidance helps ensure successful adoption, increases resilience, and maximizes the potential of saline agriculture in previously underutilized or marginal areas.**

Limited Market Awareness and Promotion Needs

Many halophytes and non-traditional salt-tolerant crops have not yet gained visibility in the market, limiting their adoption and economic potential. Farmers and stakeholders often lack information about potential uses and market demand for these crops. **Promoting these crops through awareness campaigns, demonstration projects, and market development initiatives is essential to create demand, build value chains, and provide economic incentives for farmers to adopt saline agriculture.**

Technical Challenges for Environmental Protection

Implementing saline agriculture in a way that preserves environmental integrity presents several technical challenges. Efficient water management is crucial to prevent over-extraction and avoid salinization of nearby freshwater sources. Proper soil management, including monitoring salinity, pH, and nutrient levels, is necessary to prevent land degradation and maintain soil fertility. In addition, the use of fertilizers and amendments must be carefully managed to avoid negative impacts on surrounding ecosystems. Finally, **irrigation and drainage systems need to be designed and maintained to minimize runoff and leaching, which could harm aquatic habitats or contribute to soil salinization in adjacent areas.**

Recommendation	Description	Supported SDG(s)
Strengthen Awareness and Policy Integration	Integrate saline agriculture into national policies, conduct awareness campaigns, workshops, and pilot projects to educate policymakers, extension officers, and farmers.	SDG 2, SDG 12, SDG 15
Support Breeding and Dissemination of Salt-Tolerant Crops	Invest in breeding programs to develop new salt-tolerant crop varieties and promote their rapid dissemination.	SDG 2, SDG 12
Farmer Training and Extension Services	Provide hands-on training, demonstration plots, and guidance on halophyte cultivation, saline water management, soil amendments, and integrated crop management.	SDG 2, SDG 6, SDG 12, SDG 15
Develop Market Opportunities	Support the development of value chains for halophytes and other non-traditional salt-tolerant crops, promoting their wider use and developing value-added products, as these crops have previously been underutilized.	SDG 2, SDG 12
Implement Environmentally Sound Practices	Promote sustainable irrigation, drainage, salinity and soil monitoring, and judicious use of fertilizers to protect ecosystems and maintain soil fertility.	SDG 6, SDG 13, SDG 15
Encourage Collaborative Research and Investment	Foster partnerships between scientists, policymakers, farmers, and private sector actors to develop cost-effective solutions. Support infrastructure, research, and technology investments.	SDG 2, SDG 6, SDG 12, SDG 13, SDG 15

Conclusion

Saline agriculture presents a promising pathway to address the dual challenges of food security and land degradation in salt-affected areas. By expanding the use of marginal lands, adopting salt-tolerant crops, and implementing sustainable water and soil management practices, it can contribute directly to multiple Sustainable Development Goals, including Zero Hunger, Clean Water and Sanitation, Responsible Consumption and Production, Climate Action, and Life on Land. However, realizing this potential requires overcoming key challenges, such as limited awareness, restricted availability of salt-tolerant crops, adaptation of traditional farming practices, market development, and technical constraints for environmental protection. Coordinated efforts among scientists, policymakers, and farmers—supported by targeted investments, training programs, and market promotion initiatives—are essential to unlock the full benefits of saline agriculture. With such collaborative action, saline agriculture can transform previously unproductive lands into resilient, productive, and sustainable systems, contributing to long-term food security, environmental stewardship, and rural livelihoods.

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