Beyond Humanitarian Aid: Reclamation and Reconstruction of Contaminated Soil, Degraded Water Resources and Farmer Livelihoods from Wars and Conflicts

Lois Wright Morton, PhD. Iowa State University, College of Agriculture & Life Sciences; Solutions from the Land; self-employed farmer Outwash Terrace Farm, United States of America

War, Soil and Freshwater Systems Conference
Prague, 15-17 October 2026 https://pdconference.org/





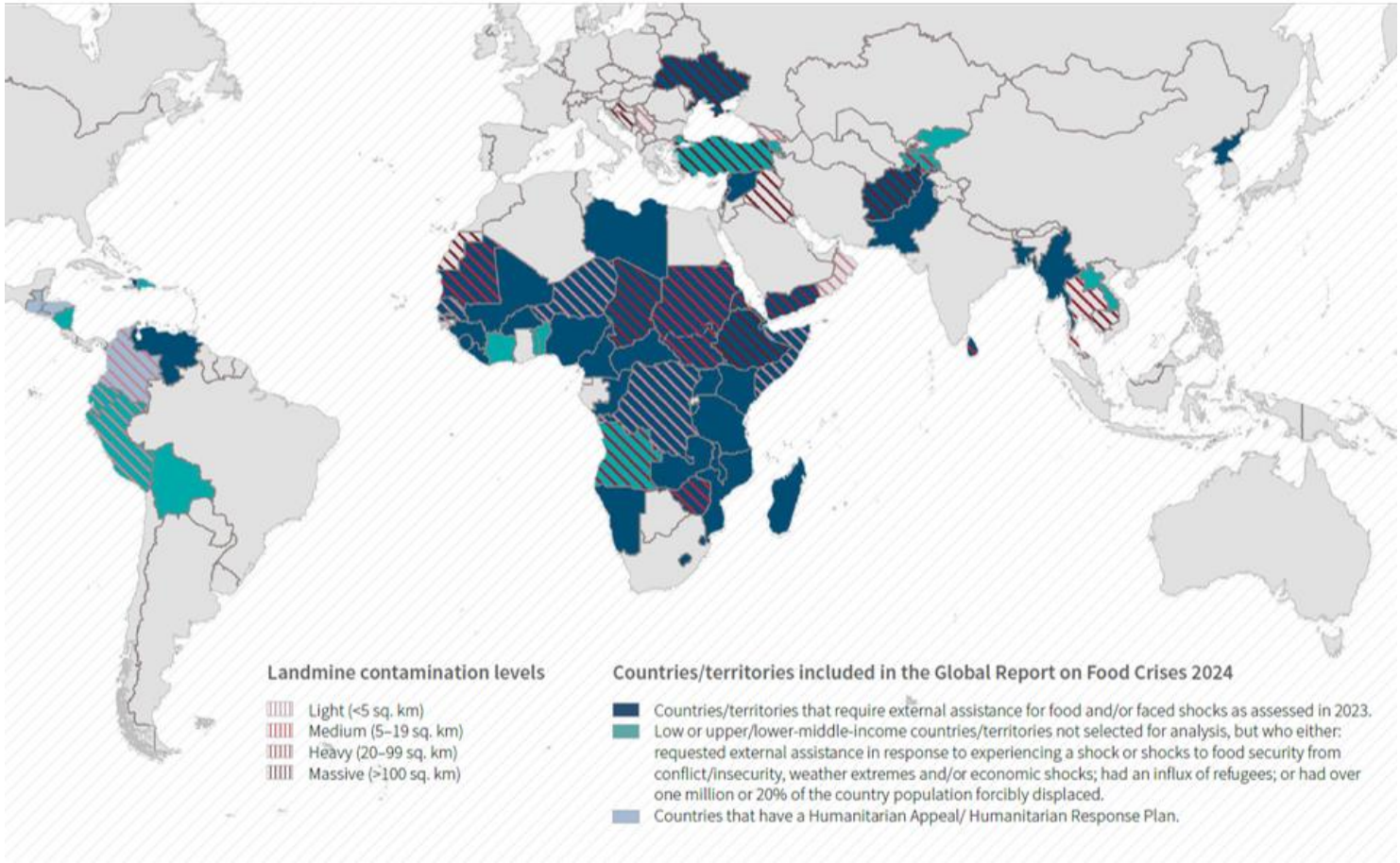
SOLUTIONS FROM THE LAND

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

SITUATION

Military activity transforms soil and water systems with cascading effects

- Disrupts the ecological basis of food production
- Contaminates & degrades agricultural lands & waters
- Creates short & long-term threats to food and nutrition security
- Adversely affects human health
- Disrupts rural livelihoods



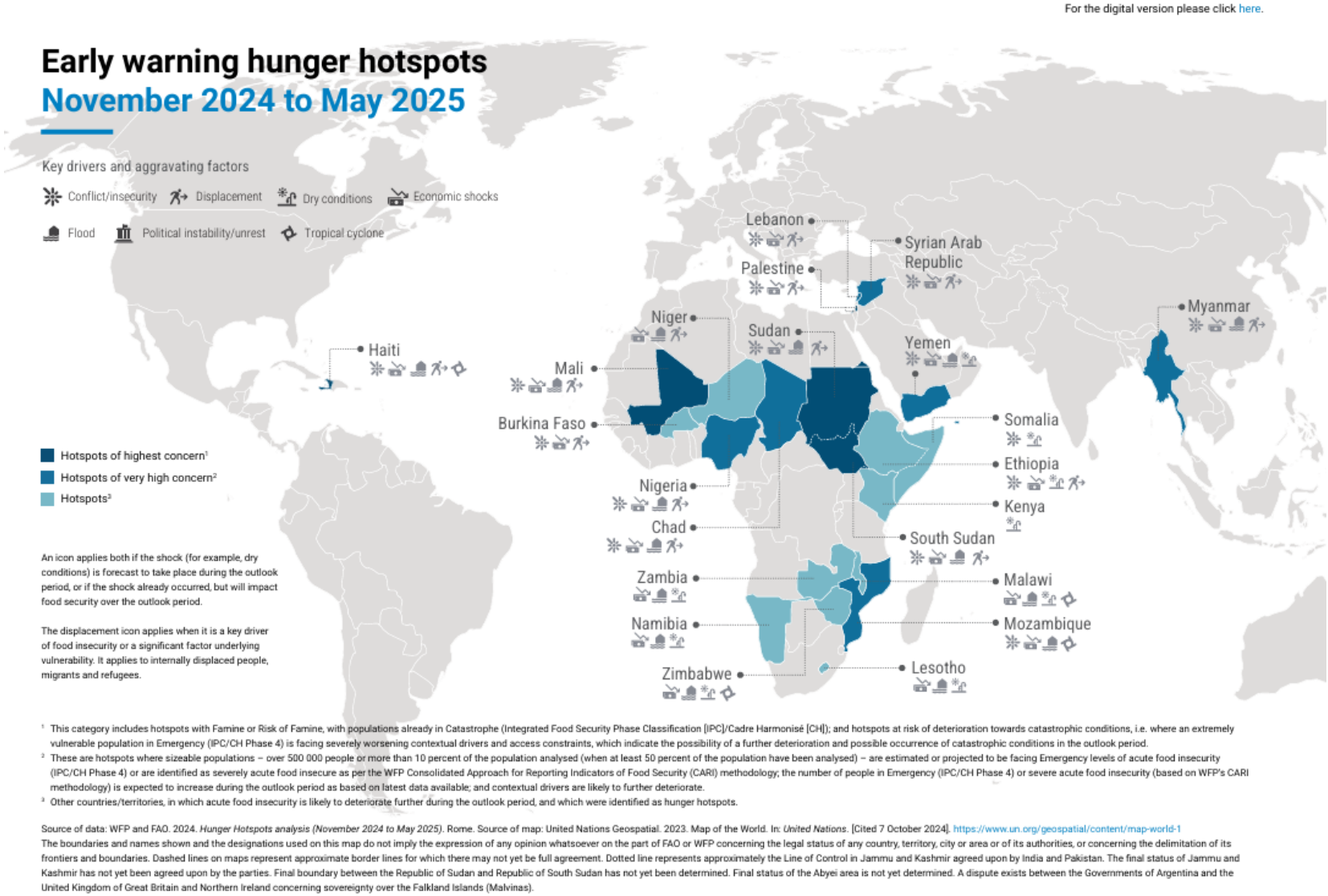
Global Report on Food Crises 2024. Rome. www.fsinplatform.org/grfc2024

POLYCRISES

- Increase in wars and conflicts
- Micro/macro change in weather/climate
- Fresh water supplies compromised
- Ecosystems under pressure

70% acutely food-insecure people live in conflict-affected countries

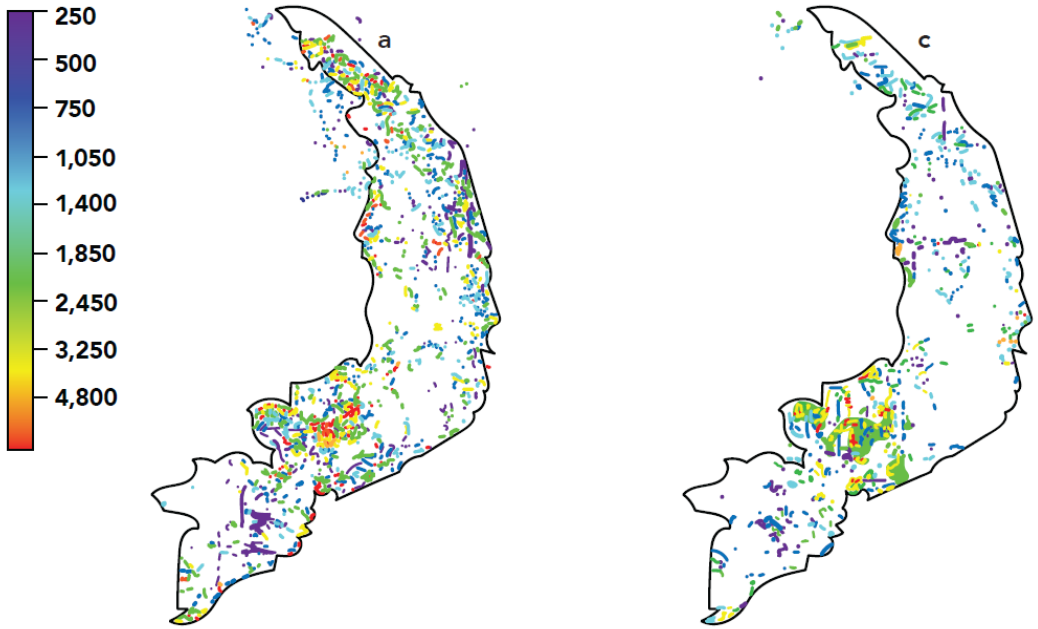
Hunger hotspots: Afghanistan, Democratic Republic of Congo, Somalia, South Sudan, Sudan, Yemen, Palestine



Conflict and hunger | World Food Programme

FOOD SECURITY. FAMINE. WEAPONS OF WAR

Short & long-term effects on military and civilian health



Below the 17th parallel. **Known locations in Republic of Viet Nam where herbicides were sprayed** (1961-1971) in volumes greater than 4,800 liters; a) Agent Orange and c) Agent Blue

United Nations Security Council

"there is a clear connection between war and hunger"

(2018) RESOLUTION 2417

5. *Strongly condemns* the use of starvation of civilians as a method of warfare in a number of conflict situations and prohibited by international humanitarian law;



United Nations Committee on Food Security, High Level Panel of Experts, September 2026
CFS HLPE 4th Note 45 million people faced hunger in 2025
… "geopolitical uncertainty and polycrises" is a global issue

Need for sharper focus on impacts and outcomes of conflicts and war on food and nutrition insecurity and famine to better direct resources

GENERAL PROBLEM STATEMENT

Farmers are the beginning of the food system. Destruction of their means of production…soil and water resources…by military activities lead to hunger, malnutrition, famine, and destroy human health

SPECIFICALLY

A major scientific and technological gap is the lack of recognition and understanding of the critical roles and resources small and mid-sized farms need to reclaim, reconstruct, and regenerate agricultural lands, watersheds and ecosystems that have been degraded and destroyed by war and conflicts

WAY FORWARD

Theory to guide the way forward; research, policy and practice

A multi-level problem…individual, local, region, nation and world

Structural and human agency approaches, complex and multi-dimensional

* earth systems (climate, soil, water, biogeological systems)
* people (values, culture, skills, legacy histories)
* power (social, political and economic structures)

Structural incomplete information

- lack of scientific, political, and social recognition that farming is a valuable occupation to society
- fragmentation of scientific data, integrated models that connect earth, people, and power
- weak systems applications

Agency incomplete information about capacity of individuals/groups

- to make choices about their livelihoods:
  what is produced, how it is produced, processed and distributed
- to engage in policy processes that shape soil, water, production and market systems

KEY CONCEPTS

- Agricultural productivity depends on restoring soil-water-biological relationships
- Farmers and their value chains are central to bridging science, evidence, assessment, decision making, application, and adaptation
- Power relations are both structural and agency

Methods

1. Establish baseline conditions
2. Identify pathways to restored landscapes

Science. System-based approaches integrating scientific and local knowledge, experience, robust high-quality data to measure and model systemic relationships, interpret, apply, adjust and recalibrate

Evidence.

- Who. What. Where. Individual-level/community decisions, policies and public investments
- Biogeological. Observational data micro/macro climate, soil, water and land conditions
- Social. Economic. Farm sizes, cropping systems, land ownership/tenure patterns
- Bundling innovations and governance models that enable farmers/communities to retain/recover agency
- Policies and institutional arrangements that support farmer agency

Principle	Practices	Benefits
Minimize soil and vegetation disturbance	Notil, reduced tillage rebuild wetlands, plant/maintain forests and grasslands	Reduce runoff and soil erosion, carbon storage
Maximize continuous living roots	Extended crop rotations, intercropping, forests and grasslands	Enhance infiltration, water and carbon storage; improve nutrient movement; promote microbiome activity
Maximize soil and vegetation cover in cultivated and perennial systems	Cover crops, residue management, intercropping, plant/maintain wetland plants, forests, and grasslands	Reduce evaporation and erosion, reduce storm runoff and floodwaters, store carbon, increase microbial activity
Maximize plant and microbial biodiversity	Diversified rotations, organic amendments, integrated pest management	Improve resilience, nutrient cycling, carbon capture
Protect headwaters, small streams, and wetlands	Riparian buffers, reduce/eliminate riparian grazing, restore stream-wetland complexes, vegetated waterways, manage drainage water, bank stabilization, sediment storage areas to decontaminate water	Improve biogeochemical and biological functions, increase water quality, filter and store contaminants, physical and biological processing/removal of contaminants, slow water flows and storm runoff

Results

Framework for reclaiming, reconstructing, regenerating ecosystem relationships within agricultural landscapes

Soil-Water-Biological Relationship Principles

POLICY

Guiding Principles to Achieve Food and Nutrition Security, Soil and Water Functions: Reconstructing War-Ravaged Agricultural Lands and Waters to Enable Co-production of Food and Nutrition Security and Natural Resource Reclamation and Resilience

View of Transformation of Soil and Water Properties in Agricultural Lands by Military Activity: Perspectives and Guiding Principles for the Reconstruction of War-Ravaged Agricultural Lands and Waters http://doi.org/10.66659/pd.2026.004

KEY TAKEAWAYS

1. Contamination of agricultural lands and watersheds from war and conflict disrupts the production of food, harms ecological systems and threatens farmers' livelihoods.
2. Reclamation and reconstruction of agricultural productivity and food and nutrition security depend on system level approaches to restored soil–water–biological relationships, repaired infrastructure, and robust profitable farmer livelihoods.
3. Farmers as key partners in reconstruction of agricultural landscapes and creation of resilient food systems must be integrated into science, policy, and implementation.

References

Hatfield, J.L., Racetter, K.A., Birge, H.E., Wecker, D. J., Wyatt, B.M., Wacha, K.M., Lal, R. 2026. Soil health and hydrological process: Keys to sustainable agriculture. *Advances in Agronomy*. 199:129-166 https://doi.org/10.1016/bs.agron.2026.05.003

Morton, L.W. 2014. Achieving Water Security in Agriculture: The Human Factor. Greening the Agricultural Water System. *Agronomy Journal* 106:1-4 https://doi:10.2134/agronj14.0039

Morton, L.W. and Olson, K.R. 2018. The Pulses of the Mekong River Basin: Rivers and the Livelihoods of Farmers and Fishers. *Journal of* Environmental Protection, 9, 431-459. https://doi.org/10.4236/jep.2018.94027

Morton, L. W. 2020. Social understanding and expectations: agricultural management and conservation of soil and water resources in the United States Ch 4 in *Soil and Water Conservation A celebration of 75 Years*, J.A. Delgado, C. J. Gantzer, G. F. Sassenrath. Soil and Water Conservation Society Ankeny, IA

Morton, L.W. and Culbertson, C. 2022. Persistence of Dioxin TCDD in Southern Vietnam Soil and Water Environments and Maternal Exposure Pathways with Potential Consequences on Congenital Heart Disease Prevalence in Vietnam. *Open Journal of Soil Science*. 12, 119-150. https://doi.org/10.4236/ojss.2022.124005

Morton, L.W., and Shea, E. 2025. Farm level circularities as solution pathways to sustainable development goals (SDGs). J. *Nat. Resour. Agric. Ecosyst*., 3(2) https://doi.org/10.13031/jnrae.16192

Morton, L. W. 2026.Transformation of Soil and Water Properties in Agricultural Lands by Military Activity: Perspectives and Guiding Principles for the Reconstruction of War-Ravaged Agricultural Lands and Waters. *Pollution and Diseases*. 2: 43–64. https://doi.org/10.66659/pd.2026.004

Nikolaenko, D. 2026. Miliary Contamination and regimes of scientific recognition: a conceptual framework. *Pollution and Disease*. Repository. 22222026.doi https://doi.org/10.66659/bb4q9n88

Nguyen, K. N., Chau, T.AT., Nguyen, T.K.O., Le, T.X., Morton, L.W., Demyan, M.S., Huu, T.T., Dang, H.G., Duong, M.V., Vu, N.T., Huseyin, B.T. 2025. Isolation of biosurfactant producing bacteria from dioxin-contaminated soil and their biodegradation capacity to dibenzofuran. *Biocatalysis & Agricultural Biotechnology* https://doi:10.1016/j.bcab.2025.103490

Olson, K.R. and Al-Kaisi, M.M. 2015. The importance of soil sampling depth for accurate account of soil organic carbon sequestration, storage, retention and loss. *Catena*. http://dx.doi.org/10.1016/j.catena.2014.10.004

Olson, K.R. and Morton, L.W. 2019. Long-term fate of Agent Orange and dioxin TCDD contaminated soils and sediments in Vietnam hotspots. *Open Journal of Soil Science* 9:1-34 doi.org/10.4236/ojss.2019.91001 https://file.scirp.org/pdf/OJSS_2019022115214447.pdf

Discussion question.

Q. **What are the reclamation and scaling-up policies and resources** needed to reduce information and resource fragmentation and provide farms of all sizes (smallholders, mid-sized, and large) access and capacities to customize and bundle complementary innovations, technologies, practices, interventions, services, education and training to concurrently achieve reclamation and regeneration of soil and water resources, profitable production systems, and food and nutrition security?