

"Agroterrorism: A Theoretical Exploration of Global Threats to Agriculture and Food Security"

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Abstract: One of the most intricate and little-studied aspects of unconventional warfare is agroterrorism, which is generally defined as the deliberate targeting of agriculture using biological, chemical, digital, or ecological means. Agroterrorism causes economic shocks, disrupts food systems, and undermines confidence in the safety of everyday life, all of which destabilize societies indirectly in contrast to conventional bioterrorism, which aims to cause direct human casualties. As the backbone of human civilization, agriculture supports social stability, trade, employment, and food production. Therefore, its disruption goes beyond the agricultural sphere and poses a serious threat to both national and international security.

Theoretically, agroterrorism is an example of the logic of asymmetry, which states that hostile or non-state actors can have low-cost interventions with disproportionately large results. Ecological warfare theory presents agriculture as a component of a delicate biosphere that can be purposefully weaponized, while systems theory emphasizes how food supply networks are susceptible to cascading failures as intricate and interdependent systems. In a similar vein, network theory shows how increased trade increases risks by facilitating the quick cross-border spread of contaminants or pathogens. Beyond the tangible repercussions, agroterrorism's sociopsychological component exacerbates consumer and farming community mistrust, anxiety, and uncertainty, which fosters social unrest.

By focusing on universal vulnerabilities and conceptual models rather than region-specific case studies, this article creates a global theoretical framework for comprehending agroterrorism. It makes the case that agroterrorism needs to be at the center of security discussions in the twenty-first century by combining ideas from human security discourses, resilience studies, and international relations. A comprehensive intellectual model that informs global governance, strategic policy, and collective resilience against emerging agricultural threats is urgently needed, as the study acknowledges food as both a weapon and a target.

Keywords: Agroterrorism, Food Security, Non-Conventional Warfare, Global Security, Asymmetric Threats, Ecological Warfare, Systems Theory, Resilience, Agriculture Vulnerability, Human Security

I. Introduction: Theoretical Dimensions of Agroterrorism

Agriculture as a Strategic Target

In addition to being a vital economic sector, agriculture has long served as the cornerstone of political legitimacy and social stability in human civilization. Since food systems support trade, livelihoods, and populations, any disruption could have a cascading effect on both national security and international order (Wheelis et al, 2002). One especially dangerous type of unconventional warfare is agroterrorism, which is defined as the deliberate use of biological, chemical, digital, or ecological methods to target crops, livestock, or agricultural infrastructure (Monke, 2005).

Agriculture's strategic importance stems from both its centrality and vulnerability. Agricultural systems are diffuse, interdependent, and extremely vulnerable to ecological and biological shocks, in contrast to traditional military targets. Agroterrorism risk is increased by supply chain globalization, monoculture dependence, and digital technology integration, which makes agriculture a "soft target" for asymmetric actors (Chalk, 2004).

Distinction between Agroterrorism and Bioterrorism

Despite their frequent confusion, agroterrorism and bioterrorism have different main goals and effects. According to Koblenz (2010), bioterrorism has historically aimed to directly harm human populations by releasing viruses like smallpox or anthrax, which would create immediate casualties and psychological fear. In contrast, agroterrorism causes long-term economic instability, disruptions in commerce, and food shortages by targeting ecosystems, livestock, or food systems (Parker, 2002).

This difference has important theoretical implications. The immediate crisis model of bioterrorism is focused on mortality and morbidity, whereas the systems disruption model of agroterrorism emphasizes the threat through sluggish onset, delayed discovery, and cascade failures across economic and social systems (Kesan et al, 2012). So, agroterrorism is not just a subset of bioterrorism; rather, it is a unique strategic category in the larger discussion of unconventional security threats.

Conceptual Framework of Agroterrorism

Defining Agroterrorism in Global Security Theory

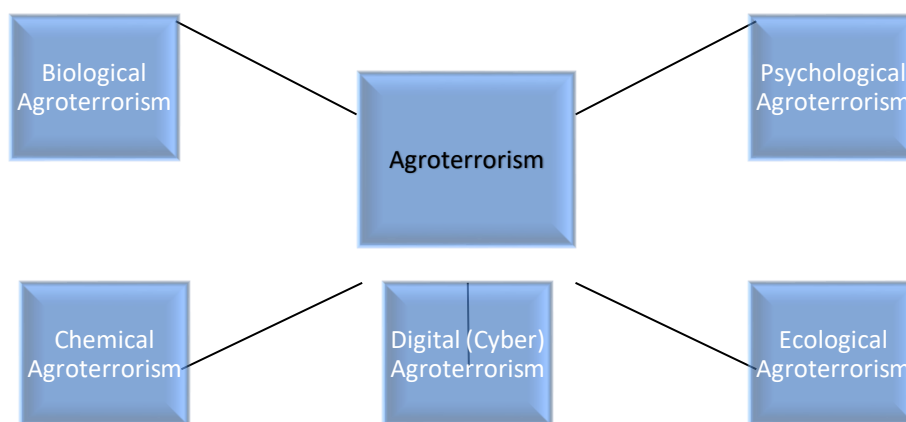
In the context of international security discourse, agroterrorism is increasingly recognized as a non-traditional security threat. The deliberate introduction of ecological, chemical, biological, or digital agents into agricultural systems is known as agroterrorism, and it threatens state legitimacy and destabilizes food supply chains (Monke, 2005). Although conventional warfare targets military infrastructure, agroterrorism aligns with theories of asymmetric conflict, where non-state actors exploit civilian vulnerabilities to achieve disproportionate political and psychological outcomes (Chalk, 2004). According to security theory, agriculture is considered a critical infrastructure, much like energy or water, and its disruption could result in systemic crises in the fields of governance, the economy, and health (Wheelis, 2002).

Classification of Agroterrorism

Agroterrorism can be theoretically classified into distinct but interrelated forms:

- **Biological Agroterrorism** – The intentional release of pathogens, pests, or invasive species targeting crops and livestock (Koblentz, 2010).
- **Chemical Agroterrorism** – The deliberate contamination of soil, water, or food supplies with toxic substances, creating long-term ecological and health consequences (Parker, 2002).
- **Digital (Cyber) Agroterrorism** – Sabotage of smart farming systems, AI-driven irrigation, or agricultural supply chain networks through cyber-attacks (Kesan et al, 2012).
- **Ecological Agroterrorism** – Manipulation of ecosystems, including the spread of invasive weeds, alteration of pollinator populations, or genetic sabotage of seeds (Wheelis, 2002).
- **Psychological Agroterrorism** – The use of threats, rumors, or symbolic contamination to instill fear in farming communities, reduce trust in food safety, and destabilize rural economies (Chalk, 2004).

This typology underscores agroterrorism's multidimensionality, where attacks may simultaneously involve physical, digital, and psychological components.



Agroterrorism as a Form of Non-Conventional Warfare

Theorists increasingly frame agroterrorism as a subset of **non-conventional warfare**, where the battlefield extends beyond human casualties to encompass food systems, economies, and ecological balance (Wheelis, 2002). Its **silent** and **delayed manifestation** distinguishes it from conventional terrorism. Unlike **immediate bombings** or **armed attacks**, agroterrorism operates through **latency** and **invisibility**, often mimicking natural outbreaks. This aligns with chaos and systems theory, where small disruptions in agricultural ecosystems can generate cascading failures across global trade and social stability (Koblentz, 2010).

Agroterrorism is a low-cost weapon for **asymmetric actors** and a high-impact vulnerability for states as globalization increases agricultural interdependence. A paradigm shift has occurred with its inclusion in global security theory, as agriculture is now seen as a strategic front in the politics of survival and resilience rather than just a sector of production.

Global Theoretical Perspectives

Agroterrorism in International Relations and Conflict Theory

In international relations, agroterrorism is increasingly conceptualized as a non-traditional security threat that blurs the boundary between war and peace. From **the lens of realist theory**, agriculture is a strategic resource comparable to oil or water; its disruption

undermines state sovereignty and weakens national resilience (Buzan, et al, 1998). According to **liberal viewpoints**, agroterrorism presents systemic risks that cut across national boundaries and necessitate collective governance, highlighting the interconnectedness of global food supply chains (Keohane et al, 2011). **Constructivist approaches** highlight how agroterrorism reshapes identities and threat perceptions, embedding food systems within the politics of fear and securitization. In this sense, agroterrorism operates both as a material attack on food systems and as a discursive tool that redefines agriculture as a battlefield in global security discourse.

Role of Asymmetry: Why Agriculture is a “Soft Target”

The **logic of asymmetric conflict** is best illustrated by agroterrorism, in which weaker actors take **advantage of weaknesses in civilian infrastructure** to cause **disproportionate damage** to more powerful adversaries (Arreguín-Toft, 2001). Agricultural systems are **open, scattered, and ecologically vulnerable**, which makes them desirable targets in contrast to hardened military installations. **Markets, food security, and public trust** can all be negatively impacted by a single act, such as the introduction of a pathogen or the contamination of a seed supply (Chalk, 2004). Attacks on agriculture can be low-cost, high-impact, and hard to attribute, which attracts asymmetric actors. The strategic advantage is increased by the delayed visibility of the consequences, which are frequently indistinguishable from natural outbreaks. Agriculture becomes a soft target in this situation, not because it is unimportant, but rather because of its importance and susceptibility.

Agroterrorism in the Lens of Ecological Warfare

Agroterrorism can be understood in the context of ecological warfare, which is the intentional disruption of ecosystems as a means of conflict. Ecological warfare undermines the environmental underpinnings of survival, such as soil, water, crops, and livestock, rather than directly attacking people (Dalby, 2009). Accordingly, agroterrorism is a contemporary form of ecological warfare, with threats ranging from intentional contamination of agricultural resources to the introduction of invasive species or genetic sabotage of seeds (Wheelis, 2002). From the standpoint of ecological systems, even small disturbances have the potential to trigger intricate adaptive crises, resulting in instability that lasts longer than the initial act of terror. Ecological agroterrorism causes harm to the environment itself, making recovery a generational challenge, in contrast to traditional warfare, which ends when hostilities cease.

II. Theoretical Threat Models

Systems Theory: Food Systems as Critical Infrastructures

The best way to view agriculture from the standpoint of systems theory is as a complex adaptive system made up of interdependent subsystems, such as markets, supply chains, livestock, and crops. When one component of the system is disrupted, the entire system is affected, exhibiting non-linearity and interdependence (Checkland, 1999). Accordingly, food systems are considered critical infrastructures, much like communication networks or energy grids, where security lapses cause a chain reaction of failures (Perrow, 1999). By taking advantage of these dynamics, agroterrorism can quickly turn a localized contamination incident or pest introduction into a systemic crisis that threatens not only food production but also trade, government, and public confidence.

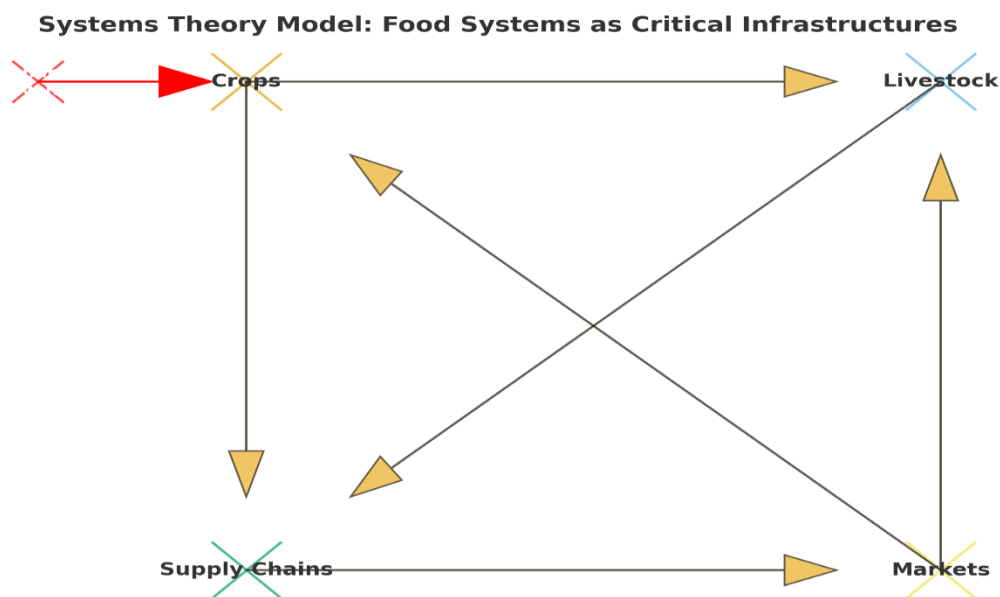


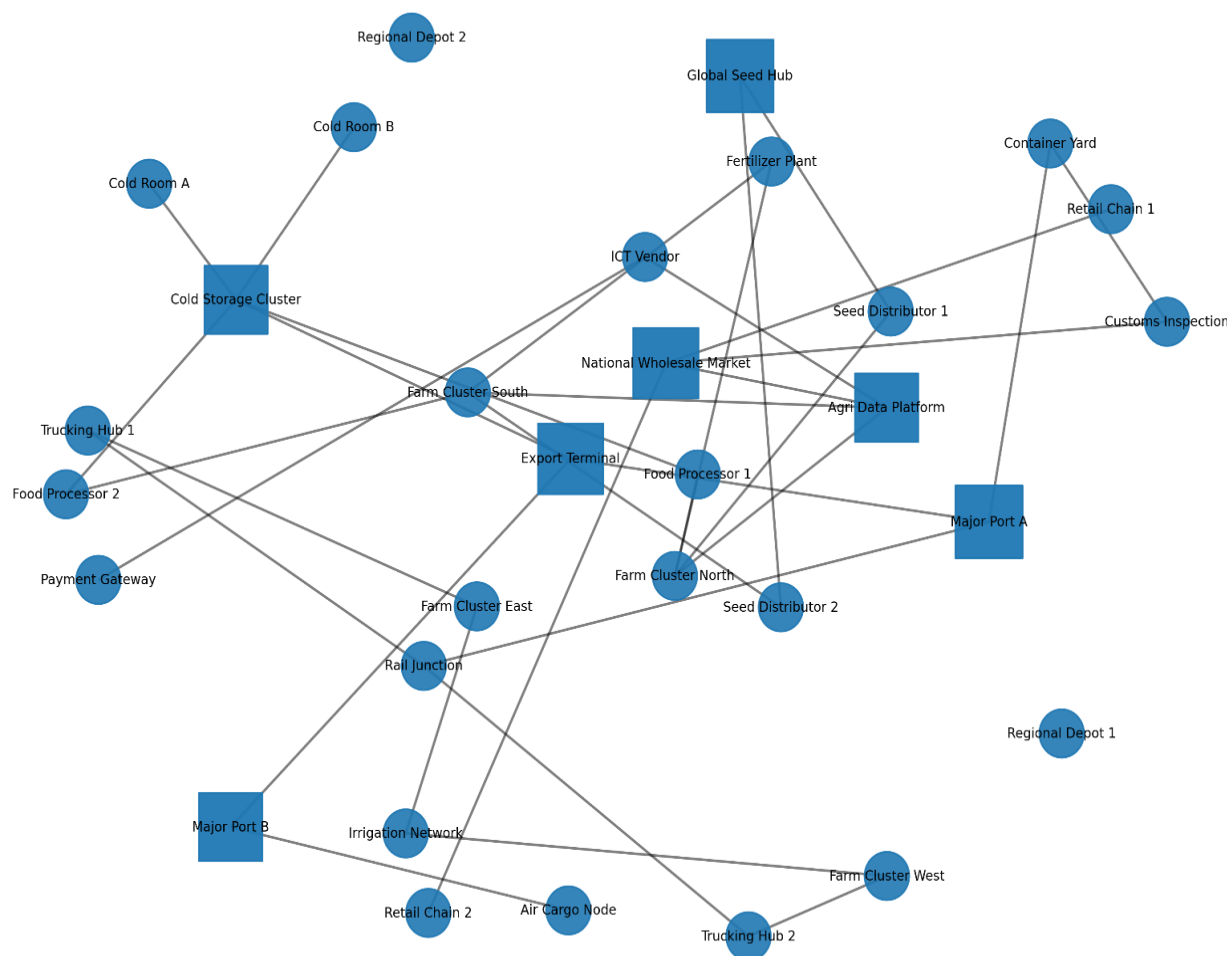
Figure 1. Systems theory model of food systems as critical infrastructures. Agriculture is represented as an interdependent network of subsystems—crops, livestock, supply chains, and markets. A localized contamination event (red) can propagate across the system, producing cascading failures and systemic crises, illustrating non-linearity and interdependence.

Network Theory: Vulnerabilities in Global Supply Chains

According to network theory, agriculture has become a **highly interwoven web of production, transportation, and consumption nodes as a result of globalization**. Agroterrorism can take advantage of network vulnerabilities brought about by the interdependence of seed suppliers, global markets, and digital logistics systems (Barabási, 2003). A few hubs (such as **seed companies, cold storage facilities, or export terminals**) hold disproportionate importance in modern supply chains, which frequently have a scale-free network structure. Attacks on these hubs have the power to paralyze entire networks, with far-reaching consequences (Albert, et al, 2000). The theoretical implication is clear: agroterrorism need not target every node, only the most critical hubs, to trigger systemic disruption.

Figure 2. Conceptual network graph of the global agricultural supply chain. Central hubs (e.g., global seed hub, export terminal, major ports, national wholesale market, agri data platform, cold storage cluster) are sized larger to indicate higher systemic importance. Edges denote functional dependencies where targeted disruption can propagate through the network, illustrating scale-free vulnerability predicted by network theory.

Conceptual Network Graph: Global Agricultural Supply Chain Hubs and Vulnerabilities



Chaos Theory: Unpredictability of Agroterror Impacts

Agroterrorism's inherent unpredictability can be understood through **the lens of chaos theory**. Agricultural systems are susceptible to initial conditions; even **small changes**, like the **introduction of a pathogen** or the **modification of pests** that are sensitive to climate change, can have disproportionately large and unexpected consequences (Lorenz, 1993). This is consistent with the idea of the **"butterfly effect,"** which holds that minor changes can have unforeseen long-term effects. Accordingly, agroterrorism produces a crisis environment with **complex socio-economic effects, delayed detection, and non-linear feedback loops** (Cilliers, 1998). The effects of agroterrorism develop gradually, defying forecasting and making response tactics more difficult, in contrast to the immediate and quantifiable effects of conventional attacks.

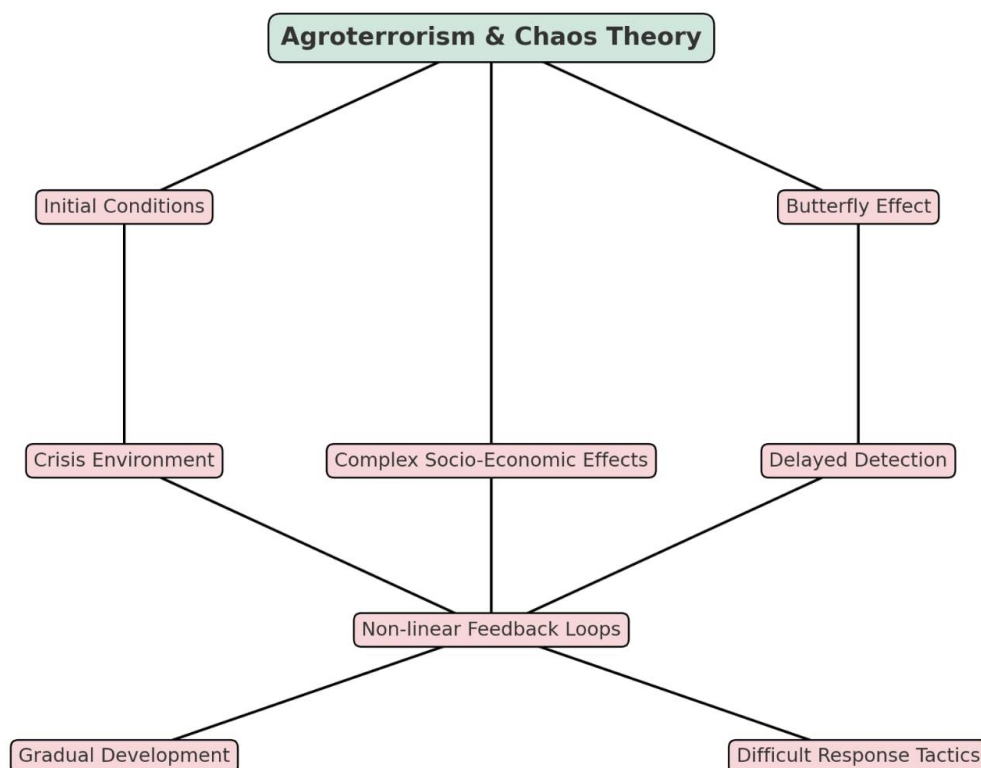


Figure 3. This diagram illustrates the unpredictable nature of agroterrorism through the lens of chaos theory. It shows how an agricultural system is vulnerable to even a small initial change, such as introducing a pathogen or modifying a pest. Like the "butterfly effect," this minor act triggers a chain of disproportionately large and unforeseen consequences. The result is a complex crisis environment that defies traditional analysis and response tactics. This crisis is defined by a delayed detection, non-linear feedback loops, and the gradual development of effects that are difficult to forecast, making it challenging to manage and contain.

Philosophy of vulnerability and resilience

Agriculture as human civilization's foundation

Agriculture was a driving force behind the growth of civilizations. Beginning around 12,000 years ago, human beings in some parts of the world – particularly in what we call the Near East – abandoned their traditional hunter-gatherer lifestyle. Instead, they became sedentary and started to build permanent dwellings near the fertile river valleys. This change in human behaviour, which took place in the Stone Age, is known to history as the Neolithic Revolution (*Singh, et al, 2024*).

Domestication of crops such as wheat, rice, and maize allowed for surplus food production, which in turn supported population growth, permanent settlements, and social stratification. More abundant food supplies could support denser populations and farming tied people to their land. This allowed early human societies to transition from a nomadic hunter-gatherer existence to permanent settlements, leading to the birth of the first villages, cities, and nations.

Agricultural surpluses also laid the foundation for economic and political systems. Food could be exchanged or stored, enabling the settlements to strengthen their power. Religion and culture too were tied to agricultural cycles. Many different deities, festivals, rituals and celebrations had emerged that revolved around planting and harvest seasons.

Food as a weapon: historical and theoretical discourse

The use of food as a weapon is as old as written records. Siege, blockade, and starvation are well-documented military strategies, as are political strategies that use food as a tool to attract supporters and deter opposition. Since food scarcity has harmful effects on health, environment and livelihoods, the concept of 'food as a weapon' can also be seen as 'food wars', which links food insecurity and conflict in both directions (*Messer et al, 2024*).

Some of the incidents of 'food wars' include:

Siege warfare in ancient Mesopotamia (c. 2,500 BCE)

One of the earliest recorded instances of using hunger as a weapon can be traced back to ancient Mesopotamian city-states. The supply for food and water to the cities was cut off and the armies had surrounded the settlements, blocking the trade routes and farmlands, waiting for the defenders to weaken from hunger. This tactic was used to not only weaken the enemies but was also a psychological strategy to ensure a quicker surrender (*Joaquín Álvarez, 2024*).

The Holodomor: Infamy in Ukraine (1932-1933)

The Holodomor was a man-made famine in Ukraine under Joseph Stalin, is one of the prominent examples of food being weaponized. The Soviet authorities imposed strict quotas that exceeded the available food supply, leaving peasants without enough food for themselves and their families. The famine killed an estimated three to seven million people. Food was used as a political instrument, with starvation and access to food used as tools to punish dissenters and enforce collectivization policies (*Joaquín Álvarez, 2024*).

The Nazi Hunger Plan (1941-1944)

This was devised by Food Minister Herbert Backe, aiming to starve millions of Ukrainians, Russians, and other Slavs so their food could feed German civilians and soldiers during Operation Barbarossa. The plan sought to clear land for German settlers through famine (*Runge et al*).

Resilience theory in the context of agricultural security

Resilience theory explores how individuals, families, communities, and even systems adapt and grow through adversity, stress, and change. In agriculture, it would mean sustaining the farm assets like crops, soil, and livestock despite the disturbance from pests, diseases, natural disasters, theft, vandalism, and cyberattacks (*Folke, C, 2006*).

More recently resilience science, developed within ecology, has offered a new perspective on the vulnerabilities and viability of modern intensive agricultural systems. Its application in the agricultural systems has brought a valuable perspective that asks hard questions about the long-term viability of modern agricultural systems (*Shana M et al, 2023*).

Climate change dynamics, stressed agro-ecological systems, political conflicts, mass migrations, and volatile economic conditions are commonly viewed as risks that threaten food security and damage the elements of a given food system on which food security depends. To recover from risk-exposure events, the concept of resilience has frequently been often paired with that of food security.

Resilience in agriculture works on many levels. At the ecological level, practices such as crop rotation, agro-ecology, and integrated pest management help maintain soil fertility, biodiversity, and water cycles. Social resilience comes from a good farmer network, cooperatives, and local institutions that allow communities to share their knowledge. Economic resilience is built by diversifying crops, income sources, and markets so that farmers are less vulnerable to sudden shocks. Finally, technological and infrastructural resilience through irrigation systems, grain storage, and early warning tools will provide a buffer against natural disasters like droughts and floods, helping communities adapt and survive in the long term.

Global Security and Governance Dimensions

Agroterrorism in International Law and Ethics

International law has traditionally focused on prohibiting the use of biological and chemical weapons against human populations, yet agriculture remains a comparatively underregulated domain. The **Biological Weapons Convention (BWC)** of 1972 explicitly bans the development of biological agents for hostile purposes, implicitly covering agroterrorism but without a dedicated enforcement mechanism (Kellman, 2000). From an ethical standpoint, agroterrorism represents a **crime against humanity's subsistence base**, as it undermines not only immediate food production but also long-term ecological sustainability (Falk, 2002). The deliberate targeting of agriculture challenges foundational principles of humanitarian law by weaponizing food—a resource universally recognized as a human right under the **International Covenant on Economic, Social and Cultural Rights (ICESCR, 1966)**.

Role of Global Institutions (FAO, WHO, UNODC, WTO)

Many international organizations are involved in the governance of agroterrorism. Through agreements like the International Plant Protection Convention, the Food and Agriculture Organization (FAO) is essential in coordinating responses related to plant and animal health. Agricultural biosecurity and global health are linked by the World Health Organization (WHO), which conducts food safety surveillance under the International Health Regulations (WHO, 2005). Through conventions on organized crime and terrorism financing, the United Nations Office on Drugs and Crime (UNODC) indirectly addresses agroterrorism (UNODC, 2018). The World Trade Organization (WTO) offers legal frameworks for controlling agricultural trade in the face of biological threats through the Sanitary and Phytosanitary (SPS) Agreement (WTO, 1995). Collectively, these institutions provide fragmented but complementary layers of governance, though none directly defines agroterrorism as a distinct global security threat.

Agroterrorism in the Framework of Collective Security

Agroterrorism is a shared vulnerability that cuts across national borders in the larger context of collective security. Similar to how pandemics and climate change are viewed as global security issues, agroterrorism necessitates collaborative mechanisms for

response, prevention, and surveillance (Buzan, Waever, & de Wilde, 1998). Although the **United Nations Security Council (UNSC)** has recognized biological threats in its resolutions, agriculture is still only a small part of its agenda. According to the **theory of collective security**, no state can protect its agricultural systems alone; multilateral cooperation and mutual trust are necessary due to the interconnectedness of food supply chains (Keohane et al, 2011). Conceptually, agroterrorism highlights the moral necessity of preserving food as a vital component of human survival and shows how security has evolved from military defense to the protection of civilizational infrastructures.

Strategic Policy Implications (Theoretical Outlook)

Integration of Agroterrorism into National Security Paradigms

Military defense and counterterrorism have historically dominated national security paradigms. However, the field of security studies has broadened due to the emergence of non-traditional security threats like **cyberterrorism**, **pandemics**, and **climate change** (Buzan et al 1998). Since attacks on agriculture jeopardize not only economic stability but also **political legitimacy** and **social order**, agroterrorism fits neatly into this enlarged paradigm. Governments must acknowledge agriculture as vital infrastructure and incorporate agro-biosecurity into defense, intelligence, and emergency preparedness frameworks in order to incorporate agroterrorism into national security (Chalk, 2004). By redefining national security, it now includes the protection of livelihoods and survival systems in addition to territorial defense.

Philosophical Arguments for a “Right to Food Security”

Political ethics and **human rights philosophy** are the foundations of the theoretical discussion surrounding food security. The right to enough food is guaranteed by the **International Covenant on Economic, Social, and Cultural Rights (ICESCR, 1966)**, which makes food security a basic human right rather than just a developmental objective. Philosophically speaking, agroterrorism violates this right by purposefully destroying humanity's means of subsistence (Falk, 2002). **The social contract theory**, which holds that governments have a moral duty to guarantee their citizens consistent access to sufficient and safe food, is another perspective on food that goes beyond rights-based ethics (Rawls, 1999). As a result, protecting agriculture from agroterrorism becomes not only a matter of security but also a **philosophical requirement** linked to **justice** and **human dignity**.

Global Solidarity vs. National Sovereignty in Agro-Biosecurity

The conflict between national sovereignty and international solidarity is highlighted by agroterrorism. On the one hand, agriculture is a shared vulnerability because **contaminants**, **diseases**, and **pests cross national boundaries** and necessitate global collaboration, early warning systems, and shared governance mechanisms (Keohane et al, 2011). However, nationalist discourses of **food independence** and **protectionism** frequently frame food systems in relation to issues of sovereignty and self-reliance (Clapp, 2012). Critical theoretical questions are brought up by this tension: Should agro-biosecurity be handled as a **global common**, similar to mitigating climate change, or should it continue to be **primarily a national defense issue**? According to a balanced perspective, international solidarity is essential for fostering resilience in an interconnected food system, even though states maintain sovereignty over their agricultural systems. Ultimately, agroterrorism challenges both the **Westphalian notion of sovereignty** and the **cosmopolitan ethic of shared responsibility**, urging a new model of cooperative security for agriculture.

III. Conclusion

Agroterrorism must be viewed as a unique and systemic threat that requires its own conceptual framework, not just as a subset of bioterrorism. A global theoretical model that acknowledges agriculture as both a critical infrastructure and a strategic vulnerability is produced by combining ideas from chaos theory, network theory, and systems theory. Agroterrorism is reframed in this way as a multifaceted phenomenon that operates at the nexus of security, ethics, and governance. It is biological, chemical, digital, ecological, and psychological. This theoretical change forces academics, international organizations, and policymakers to view agroterrorism as a primary focus of global security studies rather than as a side issue.

Future security discourses will increasingly focus on agriculture, along with energy, cyber systems, and climate stability. The resilience of food systems will dictate the resilience of societies as a result of the growing interdependence of the world. Thus, agroterrorism draws attention to the intersection of national, environmental, and human security, highlighting the pressing need for coordinated theoretical and policy responses. From a conceptual standpoint, protecting agriculture is the same as protecting the legitimacy and continuity of civilization. In this way, the fight against agroterrorism cuts across national borders and calls for both international cooperation and moral obligation to guarantee that food continues to be a cornerstone of human security rather than a tool of asymmetric warfare.

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