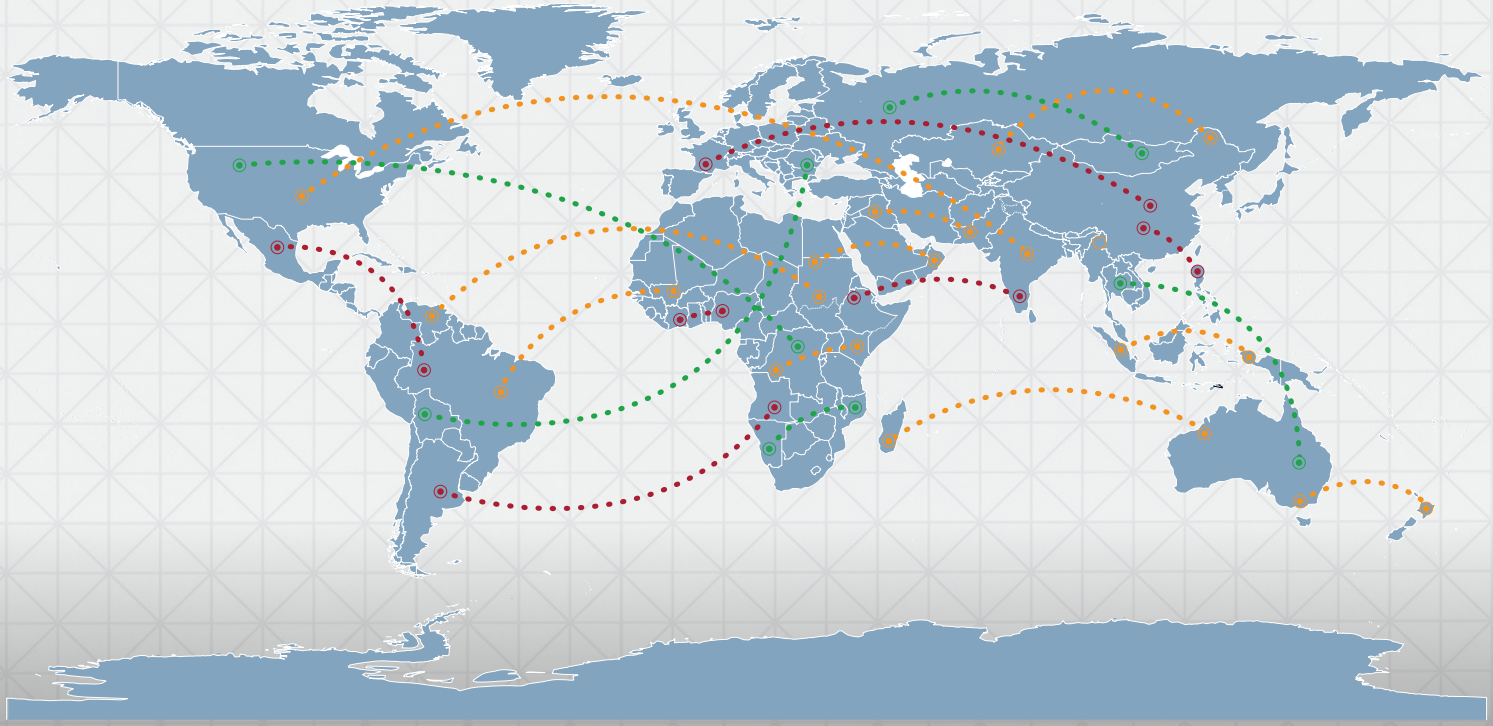
Food and Agriculture Organization of the United Nations

PREVENTION

SAVES LIVES
SAVES LIVELIHOODS
SAVES MONEY

FOOD CHAIN CRISIS | EMERGENCY PREVENTION SYSTEM

With globalization, climate change and climate variability altering the presence and distribution patterns of pathogens, the challenges ahead are daunting.
Knowing how to face animal, aquatic animal, plant and forest diseases and pests and food safety threats is critical in the fight against hunger, malnutrition and poverty.



Source: Map Adapted from United Nations, 2020.

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Food Chain Crisis Management Framework

Preventing animal and aquatic animal diseases, plant and forest pest outbreaks and food safety incidents before they occur is essential to protect the food chain.

Most food chain crises are preventable with timely actions and the right investments.

The Food Chain Crisis Management Framework (FCC) is the approach taken by the Food and Agriculture Organization of the United Nations (FAO) to boost, scale up and pursue these preventive efforts.

Did you know?

The **globalization of trade**, **intensive food production systems**, and the impact of **climate change and climate variability** have increased food chain emergencies resulting from transboundary animal and aquatic diseases, plant and forest pests and diseases, and food safety threats.

Globally, **annual crop losses to plant pests** are estimated to be between **20 to 40 percent of production** (FAO, 2017). In terms of economic value, **plant diseases alone cost the global economy around USD 220 billion annually** (Agrios, G.N., 2005) and **invasive insects approximately USD 70 billion** (Bradshaw,C.J.A, *et al.* 2016). As an example, Locust invasions can destroy the crops of entire communities, Fall armyworm can affect vast areas rapidly, and Wheat rust diseases can cause yield losses of up to 80 percent. Similarly, Cassava diseases threaten the food and nutrition security and livelihoods of the millions of people in Africa who depend on the crop.

Animal diseases, if not controlled, may kill large numbers of livestock, which are often the only assets of poor farmers. Almost 70 percent of the world's 1.4 billion extremely poor people depend on livestock for their livelihoods. Emerging public health threats of animal origin are also on the rise. Over the past decades, **over 70 percent of new diseases of humans have animal origin**.

References

FAO. 2017. *The future of food and agriculture – Trends and challenges*. Rome. FAO. 165 pp. (also available at http://www.fao.org/3/a-i6583e.pdf)

Agrios, G.N. 2005. *Plant pathology*. Fifth edition. New York, USA, Elsevier Academic Press.

Bradshaw, C.J.A., Leroy, B., Bellard, C., Roiz, D., Albert, C., Fournir, A., Barbet-Massin, M., Salles, J.M., Simard, F. & Courchamp, F. 2016. Massive yet grossly underestimated global costs of invasive insects. *Nature Communications*, 7(12986): 1–8.

World Health Organization (WHO). 2015. *WHO estimates of the global burden of foodborne diseases: foodborne disease burden epidemiology reference group 2007-2015*. Geneva, Switzerland. (also available at https://www.who.int/foodsafety/publications/foodborne_disease/fergreport/en/).

FAO. 2010. *Global Forest Resources Assessment*. Rome. FAO. 344 pp. (also available at http://www.fao.org/3/a-i1757e.pdf)

INTENSIVE FOOD PRODUCTION SYSTEMS

CLIMATE CHANGE

- rising temperatures
- extreme weather conditions
- droughts and floods
- changes in precipitation patterns

SOME **20% TO 40%** OF GLOBAL CROP YIELDS ARE LOST EACH YEAR TO PLANT PESTS AND DISEASES

PLANT DISEASES ALONE COST THE GLOBAL ECONOMY AROUND **USD 220 BILLION** ANNUALLY

NEARLY **1,4 BILLION** OF THE WORLD'S POOREST PEOPLE DEPEND ON LIVESTOCK FOR THEIR LIVELIHOODS

APPROXIMATELY **70%** OF DISEASES AFFECTING PEOPLE HAVE ANIMAL ORIGINS

Did you know?

It is estimated that **every year**, consuming **contaminated food causes almost one person in ten around the world to fall ill**, and approximately **420 000 people** to **die**. Foodborne diseases affect individuals of all ages, but particularly children under five years of age and persons living in low-income subregions of the world (WHO, 2015).

It is estimated that **insect pests damage around 35 million hectares** (FAO, 2010) **of forest each year**, with particularly catastrophic impacts recorded when non-native species enter ecosystems in which they have no natural enemies. This has a major impact on forest cover, the livelihoods of forest-dependent people and forest ecosystem services. The scale of this impact is increasing. In the United States alone, **crop and forest production losses from invasive insects and pathogens** have been estimated at almost **USD 40 billion per year** (Paini, D.R., *et al.* 2016).

In aquaculture, approximately every three to five years, serious diseases appear, spread rapidly and cause major losses. Estimates of **economic losses** from decreased production, export earnings and jobs caused by Acute hepatopancreatic necrosis disease (AHPND) and other shrimp diseases are estimated at **USD 12 billion** in **Thailand** (2010–2016) and exceed **USD 26 million** in **Viet Nam** (2015) (Shinn, A.P., *et al.* 2018). In 2017, the **economic losses** due to several pathogens in **China's tilapia aquaculture industry** were estimated at **USD 450 million** (Bureau of Fisheries, 2017). The number of disease outbreaks, responses and economic losses reflect an immature industry.

References

Paini, D. R., *et al.* 2016. *Global threat to agriculture from invasive species*. Proc. Natl. Acad. Sci. U. S. A. 113: 7575–7579.

Shinn, A.P., Pratoomyo, J., Griffiths, D., Trong, T.Q., Vu, N.T., Jiravanichpaisal, P., and Briggs, M. 2018. Asian shrimp production and the economic costs of disease. Asian Fisheries Science 31S: 29-58 pp.

Bureau of Fisheries, Ministry of Agriculture and Rural Affairs. *Aquatic Animal Health in China 2017*. 2018. [M]. Beijing: China. Agriculture Press.

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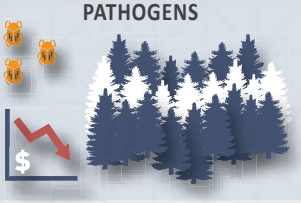
IN THE US, AN ESTIMATED
USD 40 BILLION
PER YEAR ARE LOST TO INVASIVE INSECTS AND PATHOGENS



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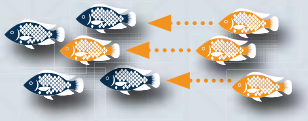

IN 2017, AN ESTIMATED
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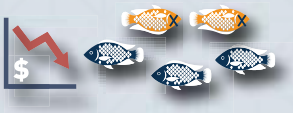
WERE LOST TO SEVERAL PATHOGENS IN CHINA'S TILAPIA AQUACULTURE INDUSTRY



Dealing with a food chain crisis

The FCC is FAO's primary tool for action in support of countries in the global governance of threats to the human food chain, at all stages from production to consumption. Established in 2008, the FCC manages food chain crises through three units: **Intelligence and Coordination** (ICU); **Prevention and Early Warning System** (EMPRES) for Animal Health, including Aquatic Animal Health, Plant Protection, including Forest Health, Food Safety; and **Response**.

Adopting multidisciplinary and intersectoral approaches such as "One Health",[1] the FCC tackles the complex drivers of disease threats to terrestrial and aquatic animals, plants, forests and food – focusing essentially on prevention, in addition to containing or responding to outbreaks. The FCC approach integrates prevention, early warning, early action, preparedness, and response.

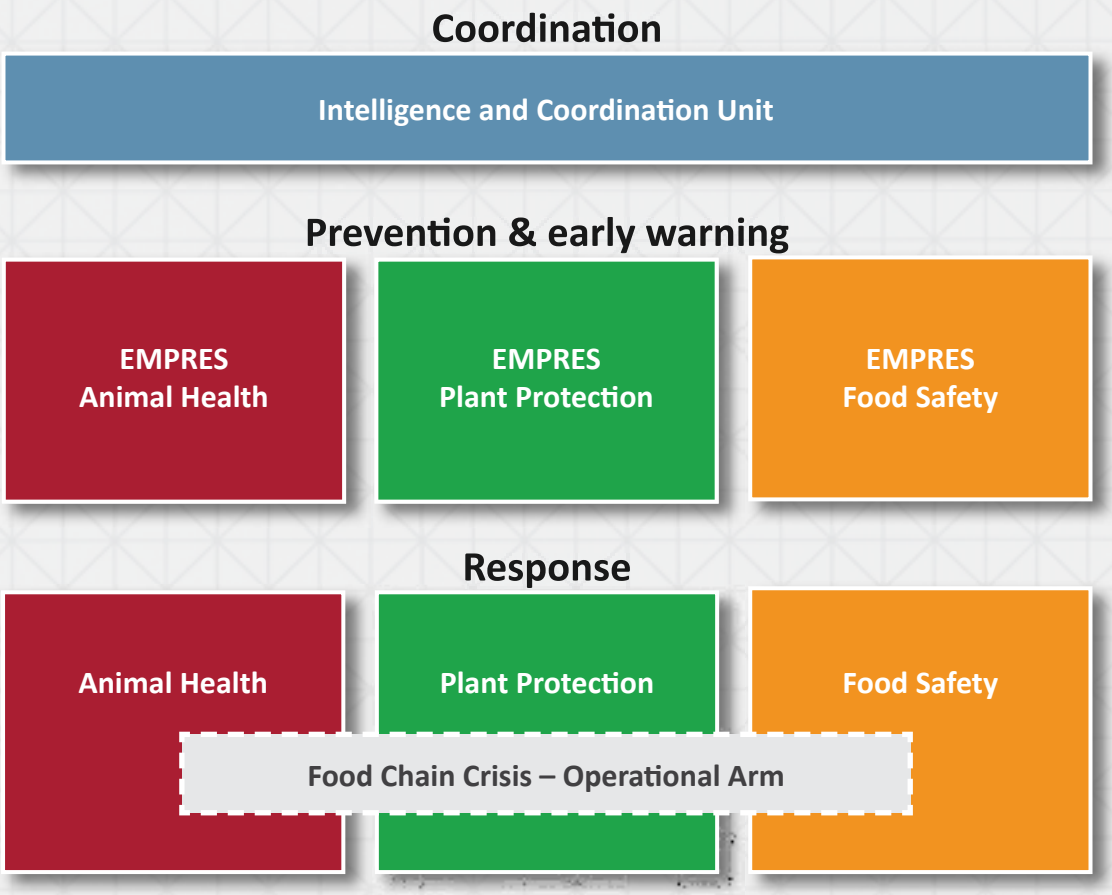
The corporate framework envisages collaboration between experts in animal and aquatic health, plant and forest protection, food safety, nuclear techniques applied to agriculture, emergency preparedness and response, and communication, at global, regional and country level to address challenges related to these threats, particularly when they are transboundary in nature.

Through the FCC, FAO tackles transboundary threats by:

- Monitoring threats, tracking and reporting events, early detection, early warning and timely response;
- Enhancing the capabilities of laboratories and specialized units within government ministries;
- Strengthening preparedness through contingency planning and simulation exercises;
- Developing environmentally sound control technologies;
- Developing new technological tools;
- Conducting risk and impact analyses;
- Forming international and national technical networks;
- Establishing partnerships with national authorities, international and regional organizations, and research institutions and ensuring communication with all stakeholders;
- Enhancing institutional collaboration in the global governance of transboundary threats to the food chain, at all stages from production to consumption.

1. One Health is an approach to safeguarding human and animal health, reducing disease threats and ensuring a safe food supply through the effective and responsible management of natural resources. The areas of work in which a One Health approach is particularly relevant include food safety, the control of zoonoses (diseases that can spread between animals and humans) and combatting antibiotic resistance.

Food Chain Crisis Management Framework



Acronyms:

EMPRES: Emergency Prevention Systems

Animal health

EMPRES Animal Health addresses a wide range of transboundary animal diseases and zoonoses with a high impact on food security, including African and Classical swine fevers, Avian influenza, Contagious bovine pleuropneumonia, Foot-and-mouth disease, Lumpy skin disease, *Peste des petits ruminants*, Rift Valley fever, Rabies, Ebola and other animal diseases and related health threats.

The FAO Highly Pathogenic Avian Influenza Global Programme, established at the beginning of the HPAI crisis in 2004, has evolved over the years to help countries build capacities for managing avian influenza and other emerging and zoonotic diseases.

FAO is engaged in the *Peste des Petits Ruminants* Global Eradication Programme to achieve eradication of the disease by 2030.

Through the FAO-OIE Global Strategy for Foot-and-Mouth Disease, FAO helps countries develop and implement sustainable control programmes using the Progressive Control Pathway (PCP).

FAO continues to work on rinderpest, which was officially declared eradicated in 2011, to prepare countries for and reduce the risk of any re-emergence, and to ensure that the world remains free of this disease.

FAO is also at the forefront of the global and regional efforts to contain the ongoing African swine fever outbreaks in Asia, eastern Europe and Africa, and of assisting emergency preparedness against potential introduction of the disease into the Americas.

To help countries develop their veterinary capacities, FAO has developed specialized tools to assess national epidemiological and laboratory capacity, as well as the performance of animal health surveillance systems.

The FAO EMPRES Global Animal Disease Information System (EMPRES-i) supports global disease intelligence as well as veterinary services and organizations, by facilitating secure collation and analysis of, and access to, animal disease information.

Plant protection

EMPRES Plant Protection focuses on transboundary threats having a potentially high impact on food security, livelihoods and national economies.

These include plant pests, such as Locusts, Armyworms, Red palm weevils and Fruit flies; and crop diseases, such as Wheat and Coffee rust diseases, Banana bunchy top and Fusarium wilt diseases, Cassava virus diseases and Maize lethal necrosis disease.

Over the years, Desert Locust plagues have had major consequences on the food and nutrition security and livelihoods of vulnerable populations.

Today, the frequency, severity and duration of Desert Locust plagues have fallen thanks to the adoption of a preventive control strategy relying on early warning and early reaction.

This system includes innovative tools, such as eLocust3 for real-time data transmission; Reconnaissance and Management System of the Environment of *Schistocerca* geographic information system (RAMSES GIS) for data analysis; and drones for survey and control.

FAO's Desert Locust Information Service (FAO DLIS) keeps locust-affected countries informed of the latest situation and provides forecasts, alerts and warnings.

To assist countries in Africa and Asia to quickly respond to Fall Armyworm infestations, FAO developed a five-year framework programme – the Global Action for Fall Armyworm Control – and worked with member countries and several partners to establish the Framework for partnership, which takes into account all Fall Armyworm response interventions, regardless of funding source.

FAO has developed the Fall Armyworm Monitoring and Early Warning System (FAMEWS) that consists of a mobile app for farmers and a global platform for decision-makers.

At global level, Tropical Race 4 (TR4) of the Banana Fusarium wilt fungus is considered the world's greatest threat to banana production.

FAO and the World Banana Forum have established the TR4 Global Network, a leading platform for exchange and collaboration that supports tools, information on technologies, and capacity development materials that generate awareness and knowledge to contain the disease.

Food safety

EMPRES Food Safety supports countries and regions in establishing prevention-oriented food control systems. This includes the development of effective strategies for managing food safety events and for minimizing the negative effects of food safety emergencies both on public health and trade.

Through EMPRES Food Safety, FAO, jointly with the World Health Organization (WHO), coordinates the International Food Safety Authorities Network (INFOSAN), the mission of which is to facilitate the rapid exchange of relevant information during food safety-related incidents and information on important food-safety-related issues of global interest; promote partnerships and collaboration among countries and food-safety-related networks; and help countries strengthen their capacities to manage food safety emergencies.

In our rapidly globalizing and changing world, the food safety landscape is constantly shifting.

Drivers such as developments in technology, trade, intensification of food production, consumer behaviour, climate change and evolving biology all have an impact on the emergence and occurrence of food safety issues.

Food safety systems need to be flexible and to take into account the changing environments, as well as to adjust to new trends, in order to be strategic and effective.

In the context of food safety, the shift from “reaction and response” to “prediction and prevention” requires holistic and structured approaches to collecting and analysing intelligence for the early identification of emerging issues.

Through EMPRES Food Safety, FAO works with different partners and member countries to develop intelligence and foresight systems that inform broad food chain decisions and provide guidance on key emerging issues.

Applying foresight can help countries explore and develop possible scenarios anticipating emerging food safety issues, and ultimately use this information to inform policy-making, strategy development and decision-making.

Aquatic animal health

The Aquatic Animal Health component, in partnership with FAO members, donors (e.g. African Development Bank, Africa Solidarity Trust Fund, Norwegian Agency for Development Cooperation) and intergovernmental organizations (e.g. European Union, Network of Aquaculture Centres in Asia Pacific, World Animal Health Organisation, South African Development Community, Southeast Asian Fisheries Development Center, the World Bank) and the producer/academic/research sector (e.g. National Aquaculture Group, Mississippi State University, and Norwegian Veterinary Institute), assists national competent authorities and farming communities in preventing and managing diseases through enhancing capacities on biosecurity governance, risk assessments, surveillance and emergency preparedness.

The complexity of the aquaculture sector (due e.g. to the large number of farmed species, systems and practices, environments and diverse forms of management) makes biosecurity challenges more difficult to handle.

Threats such as Acute hepatopancreatic necrosis disease (AHPND), *Enterocytozoon hepatopenaei* and Tilapia lake virus have emerged in the past few years.

The geographical distribution of Epizootic ulcerative syndrome, Koi herpesvirus and Infectious myonecrosis virus has recently expanded.

FAO Member Countries are encouraged to develop national strategies on aquatic animal health within the context of the Progressive Management Pathway to improve Aquaculture Biosecurity (PMP/AB), a new paradigm and initiative endorsed and supported by the Tenth Session of the Committee on Fisheries Sub-Committee on Aquaculture.

The PMP/AB focuses on building management capacity through combined bottom-up/top-down approaches, with strong public-private sector stakeholder engagement to promote risk assessment and management at the enterprise level as part of the national approach.

The PMP/AB is risk-based, progressive and collaborative and offers enabling policy environments that support the adoption of sound aquaculture production and biosecurity practices.

Forest health

The Forest Health component provides direct technical assistance to countries on specific pest problems affecting forests and food security, and offers assistance to countries not only in response to pest outbreaks and emergencies but also in establishing long-term prevention and forest protection strategies.

It provides advice on preventive measures and Integrated Pest Management (IPM), and on recommended action to minimize risks of transboundary transfer.

The Forest Health component implements projects to manage forest pests and diseases, addressing for example forest invasive species control and management, capacity building for improving forest health and vitality, and the development of a national forest monitoring system.

Its activities aim to assist, advise and support countries and national institutions in safeguarding the health and vitality of forests, forest ecosystems and trees outside forests, with special reference to insect pests, diseases and other harmful biotic and abiotic agents.

Capacity development and the utilization of technical networks are critical to improve early warning.

The Forest Invasive Species Network and the Asia-Pacific Forest Invasive Species Network (APFISN), facilitated by FAO, provide platforms for the early exchange of transboundary pest and disease information.

In particular, through the Forest Health component, FAO facilitates four regional forest invasive species networks: the aforementioned APFISN, the Forest Invasive Species Network for Africa (FISNA), the Near East Forest Health and Invasive species Network (NENFHIS), and the Forest Invasive species Network for Europe and Central Asia (REUFIS).

The International Plant Protection Convention (IPPC) is the main partner of the Forest Health component at the global level.

Key messages

Pests and pathogens are travelling faster and further and are becoming more virulent due to several factors, such as globalized trade, intensive farming, deforestation, overgrazing, climate change, and population and livestock movement due to conflicts and crises.

Preventing animal and aquatic diseases, plant and forest pest outbreaks and food safety incidents before they occur is essential to protecting the food chain. Most food chain crises are preventable with timely actions and the right investments.

Investing in the prevention of transboundary animal diseases, plant pests and diseases (including forest pests and aquatic diseases) and food safety threats is more cost-effective and protective of people's livelihoods and the environment than to respond to fully developed food crises.

FAO addresses food chain crises using an integrated approach, covering prevention, preparedness, early warning and timely response, which are needed to face food chain crises caused by transboundary animal and aquatic diseases, plant and forest pests and diseases, food safety threats and radiological emergencies.

FAO addresses the rising number of transboundary animal and plant pests and diseases and food safety threats through a set of emergency prevention methods and tools, proving that prevention, early warning, preparedness and good food chain crisis management can improve food security and save lives and livelihoods.

Key messages

Surveillance, early detection, early warning and timely response, combined with capacity development, coordination and communication are key components of the integrated approach that FAO has adopted to prevent animal diseases (including aquatic diseases), plant pests and diseases (including those affecting forests) and food safety incidents.

Carrying out intelligence, monitoring threats and trends, reporting events, developing and utilizing innovative tools and environmentally sound control technologies, are at the heart of the Emergency Prevention Systems.

Developing capacity at the international, regional, national and local levels increases the resilience of people, communities or systems to transboundary threats and ensures that methods and tools are operational and adapted to the needs on the ground.

Strengthening global and regional coordination, building networks and partnerships, enhancing advocacy and communication, implementing effective response campaigns, improving information services, and conducting training are among the numerous effective emergency preventive methods and tools available to neutralize threats to the food chain.

Controlling transboundary animal and aquatic animal diseases, plant and forest pests and diseases and food safety incidents contributes to achieving multiple goals and targets set by the 2030 Agenda: ending poverty, eradicating hunger, achieving food security and improved nutrition, promoting sustainable agriculture, ensuring healthy lives, empowering women and girls, promoting sustainable economic growth and halting biodiversity loss.

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