

Note

AGRICULTURAL RESOURCES AND CLIMATE CHANGE: DEFENCE AND SECURITY ISSUES

January 2023





The Defence and Climate Observatory, launched in December 2016, is tasked with studying climate-related security and defence issues.

The Observatory is coordinated by IRIS under the contract carried out on behalf of the Ministry for the Armed Forces' Directorate General for International Relations and Strategy (DGRIS). The Observatory's multidisciplinary and crossdisciplinary team gathers researcherfellowsspecialised in international relations, security, defence, migrations, energy, the economy, climatology and health. It is led by two scientific coordinators: Julia Tasse and François Gemenne.

The Observatory is strong of multiple partnerships with European partners (Netherlands, Luxembourg), international partners (Australia, United States, India), international NGOs, and national and international public bodies. Such initiatives enabled strengthening cooperation on climate issues and their security implications.

The Defence and Climate Observatory produces reports and notes, organises restricted seminars as well as public conferences, and hosts the podcast « Sur le front climatique »

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The French Ministry for the Armed Forces regularly calls upon outsourced studies from private research institutes, according to a geographical or sectoral approach that complements its expertise. These contracts are part of the development of a defence foresighting approach, which, as the last White Paper on Defence and National Security underlines, enable armed forces to rely on independent, multidisciplinary and original strategic thinking, integrating university research as well as specialised institutes. Most of these studies are made public and available on the website of the Ministry for Armed Forces and the Observatory's website.

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In November 2022, the French Minister of the Armed Forces, Sébastien Lecornu, underlined in the press “the return of high intensity in Europe” induced by the Russian-Ukrainian war (Chapleau, 2022, 6 November). Among the threats hanging over France in this context, the minister cited the “blackmail of food raw materials”. He also highlighted **the intertwining of defence issues and food security issues**¹, defined as the guarantee of access to sufficient, safe, and nutritious food² (*World Food Summit*, 1996). This is threatened by tensions and conflicts, but also by socio-economic phenomena such as population growth and the increasing scarcity of mineral and energy resources, which are essential to the agri-food sector.

Furthermore, **food security is compromised by climate change, which affects all four pillars: availability**³, **accessibility**⁴, **utilisation**⁵, **and the stability**⁶ of these last three pillars. The Food and Agriculture Organisation (FAO) of the United Nations and the *Intergovernmental Panel on Climate Change* (IPCC) have explored the intersection between food and climate change (FAO, 2015; Mbow et al., 2019), while focusing their analysis on resource availability. As for the domain of defence, it testifies to the **growing consideration of food as a crisogenic factor**, but also to the **close link between food sovereignty**⁷ **and national sovereignty**⁸ (Linou, 2019; Gérard & Vollot, 2022, 23 May).

As the securing of fisheries resources is the subject of in-depth reflection by the Navy⁹, it seemed appropriate to explore **the specificities of agricultural resources**. We will therefore study their **climatic vulnerability**¹⁰, before highlighting **the strategic and defence issues involved in securing them**. Finally, we will identify **eight geopolitical and security breaking points**¹¹ illustrating these issues in the world.

¹ The food sector is considered a sector of vital importance according to the Defence Code (Article R. 13332-2) (General Secretariat for Defence and National Security, n.d.). See definition in the glossary.

² See definition in the glossary.

³ Presence of quality food, in sufficient quantity to ensure the feeding of all. see definition in the glossary.

⁴ Physical and economic capacity to access food production.

⁵ All the practices involved in the preservation, preparation and consumption of food. See definition in the glossary.

⁶ The ability to procure food on a long-term basis. See definition in the glossary.

⁷ See definition in the glossary.

⁸ See definition in the glossary.

⁹ This area has been addressed by the Centre d'études stratégiques de la Marine - CESM in a report (CESM, 2019, January) and a podcast (CESM, 2022, 2 March) dealing more generally with food security in relation to the security of maritime spaces.

¹⁰ See definition in the glossary.

¹¹ See definition in the glossary.



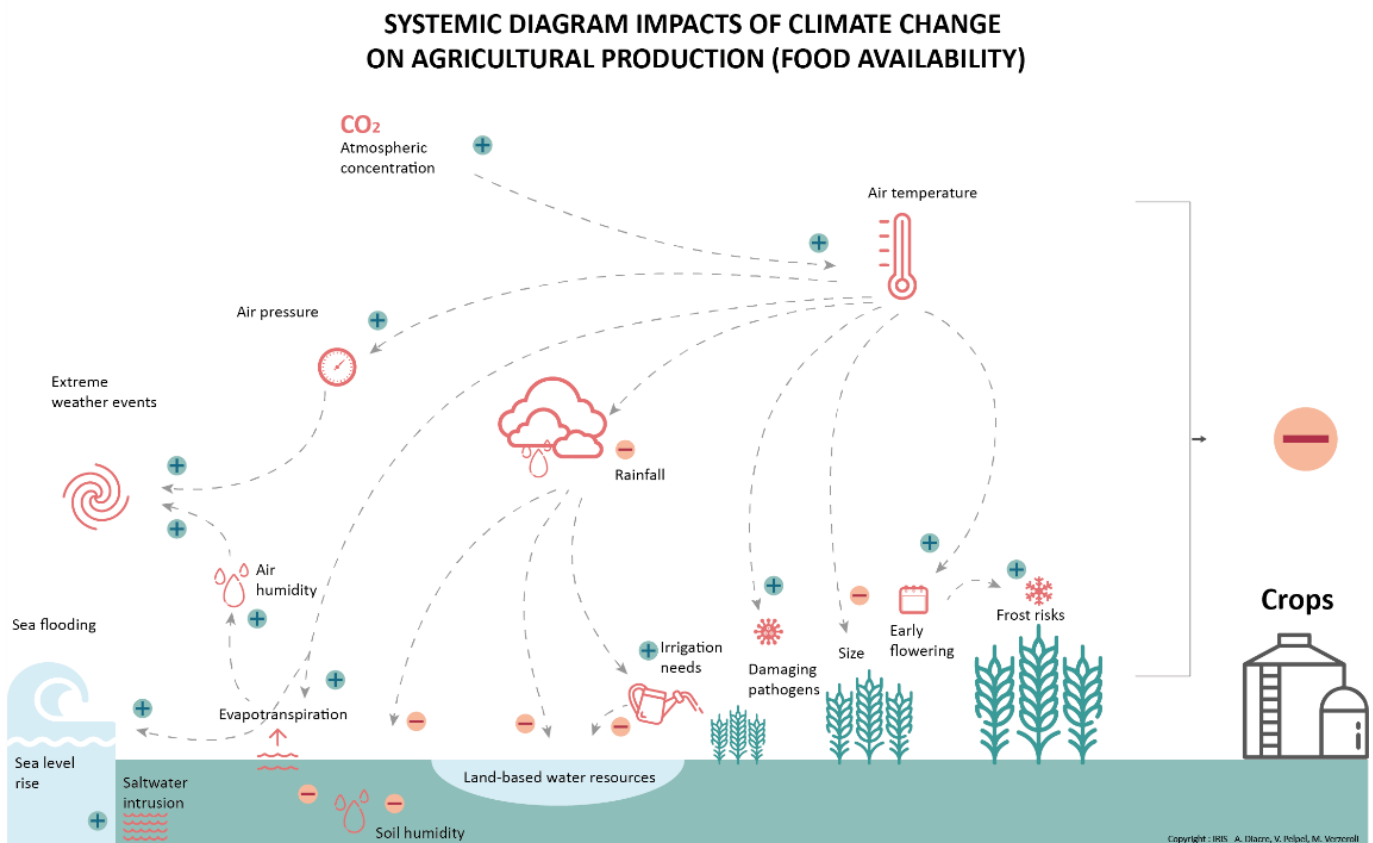
CLIMATE VULNERABILITY OF AGRICULTURAL RESOURCES

Climate change manifests itself in rising temperatures and humidity, variations in precipitations, and an increased frequency and intensity of extreme weather events. In this context, agricultural resources are subject to a reduction in their availability, accessibility, and use, as well as to a destabilisation of these three cursors.

1. Agricultural resource availability and climate change

Climate change leads to a **disruption of water resources, plant renewal cycles and pest species**. This results in **reduced nutritional quality of food** (Nelson et al., 2018; Soares et al., 2019), but also in **reduced agricultural production** (IPCC, 2019). The fall in the quality and quantity of agricultural resources thus translates into a **fall in agricultural availability**.

Infographic: Impacts of climate change on the availability of agricultural resources



Agricultural yields may also be affected by **mitigation policies, including decarbonisation of agriculture**¹². **Political efforts dedicated to the implementation of a decarbonised, resilient and qualitative resource-producing agriculture could thus lead, in the shorter term, to a quantitative decrease in production.** This phenomenon is likely to be amplified by the **acceleration of the European agricultural transition under the effect of the Russian-**

¹² The potential fall in agricultural productivity in Europe as a result of the Green Pact, for example, was the subject of a report by the United States Department of Agriculture (Beckman et al., 2020, November). However, the conclusions of this report should be treated with caution because of its political nature and focus.

Ukrainian conflict, which reduces access to fertilisers (European Think Tanks group, 2022, July; Euractiv, 2022, 31 October).

Agricultural resources, climate change and conflict

Climate change is a producer and amplifier of conflict (Kemmerling et al., 2022). It is increasingly responsible for the emergence of civil conflicts, particularly in Africa and the tropics (Burke et al., 2009; Hsiang et al., 2011). Yet six of the worst food crises originate in protracted conflicts, affecting regions already suffering from climate change (Food Security Information Network & Global Network Against Food Crisis, 2021). **Conflicts undermine agricultural production** (Kemmerling et al., 2022) through physical insecurity, lack of access to land and inputs, and destruction of crops and infrastructure (Kimenyi et al., 2014, July; FAO, 2018, September; Lin et al., 2022). In addition, **the accessibility of agricultural resources is compromised by the interruption of supply chains for geopolitical or security reasons**, as well as by the disruption of food markets (Martin et al., 2008; FAO, 2018, September; Bekker & Góes, 2022; Orhan, 2022). Finally, the use of resources is jeopardised: **processing units (Lin et al., 2022) and food storage facilities are intentionally destroyed, highlighting their strategic, if not vital, importance** (FAO, 2022, 20 July).

2. Accessibility and use of agricultural resources and climate change

The following table summarises **the consequences of climate change on two other pillars of agricultural resource security: accessibility and use. These consequences result in increased instability:**

Accessibility	Use
<p>Declining affordability (FAO, 2015; Mbow et al., 2019)</p> <ul style="list-style-type: none"> Decreased supply, leading to higher food prices Global vulnerability through dependencies on the globalised food system¹³ (Gaupp, 2020) <p><i>For example, droughts in Australia are causing average agricultural commodity prices to rise (Campbell, 2015).</i></p> <p>Decline in physical accessibility</p> <ul style="list-style-type: none"> Extreme weather events can cut off tight supply flows of agricultural commodities (Gaupp, 2020) Emergence of restrictive policies (closures, trade reductions) in response to climate hazards or sobriety measures (Kumar & Ayedee, 2021) Trade wars and climate protectionism (Parker, 2021, 10 November; Khor, 2010, May). <p><i>Example: 2010 Russian grain embargo following droughts (Welton, 2011, 28 June).</i></p>	<p>Destruction of stocks and storage systems</p> <ul style="list-style-type: none"> Extreme weather events can lead to the destruction of agricultural stocks, e.g., by damaging silos, or by causing power outages (breaking the cold chain). <p><i>Example: in 2021, Hurricane Ida damaged a Cargill grain export silo in Louisiana, and paralysed the Mississippi export corridor (Sauvage, 2021, 21 August)</i></p> <p>Food contamination</p> <ul style="list-style-type: none"> Rising temperatures fosters food spoilage and loss of nutritional properties (Koutsoumanis et al., 2022) Increased humidity favors the growth of mould and bacteria leading to an increased risk of disease (Pitt & Hocking, 2009) Extreme weather events increase the risk of food contamination (Lesinger et al., 2020; Tirado et al., 2010; Misiou & Koutsoumanis, 2022). <p><i>For example, after Hurricane Katrina, there was an increase in the number of cases of food contamination due to floodwater.</i></p>

¹³ See definition in the glossary.

3. Food security and climate change: what prospects?

As a result of the phenomena outlined above, **global food security is increasingly affected by climate change**. In this context, **up to 183 million additional people worldwide could be at risk of hunger due to changing weather and climate conditions**, and **cereal prices** can be expected to **rise by up to 29% in 2050** (IPCC, 2019, 3).

Climate change will affect the world's regions in different ways. Although food insecurity has been increasing worldwide since 2014, it is mainly **in sub-Saharan Africa, South-East Asia, Western Asia and, more recently, in Latin America**¹⁴ (FAO et al., 2018). In 2021, hunger affected 278 million people in Africa, 425 million in Asia and 56.5 million in Latin America and the Caribbean. These regions, already highly exposed to environmental hazards, are heading towards a **particular worsening of their food situation as a result of climate change**.

At the same time, **regions at higher latitudes may have benefited from positive effects of climate change on some of their yields and crops**, such as south-west Russia, in particular the Caucasus (Gordeev et al., 2022). Such findings suggest an **increase in productivity and the future expansion of agro-ecological zones** in these regions (IPCC, 2019, 30). **Geographical variability in climate vulnerability is thus likely to restructure geostrategic balances around agricultural resources**. By reducing global agricultural productivity while exacerbating inequalities between regions, climate change creates a **context favourable to the intensification of interdependencies, as well as to the intensification of competition for supplies**.

It has therefore been possible to observe an '**agricultural rearmament of the world**', i.e. a reactivation of agricultural policies aimed at securing the food sector (Abis, 2023). Although such a political will has not been really asserted in Europe until the Covid-19 pandemic and the Russian-Ukrainian conflict, **several powers, such as China and Russia, have put in place long-term strategies to secure and use agricultural resources for power purposes**. Such dynamics underline the strategic nature of agricultural resources and their growing correlation with defence issues, which are likely to be exacerbated by climate change.

¹⁴ For an overview of food insecurity in the world, see Annex 1.

AGRICULTURAL RESOURCES: A STRATEGIC AND DEFENCE ISSUE

1. Securing agricultural resources: a geostrategic power issue

Since the start of the Russian-Ukrainian conflict in February 2022, **the security of agricultural resources has been at the heart of a real security and defence crisis**. In 2020, Ukraine and Russia were respectively the world's third and fifth largest exporters of grain by weight (Chatam House, The Royal Institute of International Affairs, 2020), the result of a century of investments in the agricultural sector by both states to strengthen their economies and their position on the international scene (Abis, 2022). The opposition between Ukraine and Russia is thus putting **great pressure on the supply of essential food resources**¹⁵. **This crisis reveals the vulnerability of our food system, while at the same time underlining its strategic dimension, and its prime importance for national sovereignty.**

Aware of this strategic dimension, some states are implementing **national public food storage policies**¹⁶. **Strategic reserves**¹⁷ contribute to **national food resilience**¹⁸ by allowing the sale or distribution of food in the event of a geopolitical shock. Such reserves are considered essential particularly in areas prone to droughts and crop instability, but where the climate is favourable to grain storage, such as the Sahel (Galtier, 2019, 8 February). Non-governmental initiatives are also building up grain stocks to supply the poorest populations¹⁹ (Janin, 2019).

Finally, **the factors of agricultural production - such as land and water - also constitute a structuring strategic dimension**. This is illustrated by China's policy of land grabbing in Europe, particularly in Ukraine, but also in France (d'Albaret, 2021, 12 October). This phenomenon of **land grabbing**²⁰ by foreign investments, combined with the **decrease in agricultural and arable land in France** (World Bank, 2020), as well as the **drop in agricultural yields due to climate change**, poses a real **challenge to food sovereignty**. **These trends make the legal framework for agricultural land an issue of national sovereignty** (Conseil général de l'alimentation, de l'agriculture et des espaces ruraux - CGAAER, 2017, April).

¹⁵ See definition in the glossary. The FAO identifies wheat, maize, rice and sugar as staple foods (FAO, 2022).

¹⁶ China, for example, has built up strategic stocks of agricultural commodities in case of crop failure (Chaumet & Pouch, 2017). The current food crisis has also prompted other states such as Morocco and Switzerland to do the same (Elafrite, 2022, 25 April; *Issues*, 2022, June).

¹⁷ See definition in the glossary.

¹⁸ See definition in the glossary.

¹⁹ Examples include the FAO's resilience funds, the initiatives of the Inter-State Committee for Drought Control in the Sahel (CILSS), and the West African Economic and Monetary Union (WAEMU).

²⁰ See definition in the glossary. For more details on land grabbing around the world, see Annex 2.

The food weapon: a growing threat in a context of climate change?

Undermining food supplies (accessibility) is an effective way to exert geostrategic pressure on an opposing state. Although the use of food in a military context is considered a war crime by the Rome Statute of the Criminal Court (Rivoal, 2015), a recent example can be found in the Russian strategy. Since the beginning of its conflict with Ukraine, Russia has used food as a weapon in three ways: the **destruction of Ukrainian stocks** (use), the **disruption of Ukrainian production** (availability), and the imposition of **quantitative restrictions on its own exports** (accessibility), with these being used as a lever to deter criticism of its actions (Council of the European Union, 2022, 31 October). The geostrategic power that Russia derives from this food weapon partly explains the reluctance of several states to take a stand in the conflict and condemn the Russian invasion, preferring to secure their food supplies. Thus, on the 2nd of June 2022, the President of Senegal and the African Union, Macky Sall, met with Russia to request the unblocking of Ukrainian grain exports to the African continent. **The Russian monopoly on agricultural resources has in this sense reinforced the rift between the West and several states in the South, which are particularly dependent on Russia and do not adhere to the Western interpretation of the conflict.** The vulnerability of African states, which are affected by recurring food scarcity and crises²¹, to this weaponisation of food products also suggests **the growing power of the food weapon in a context of climate change.** By compromising the availability, accessibility and proper use of agricultural resources, climate change encourages the emergence of power relations - dependence, competition - for their acquisition.

In this sense, agricultural resources raise a first power issue: their securing. **Phenomena such as the instrumentalisation of supplies for geostrategic purposes - in particular through coercion, using the threat of interruption - or land grabbing constitute security challenges** to the extent that they jeopardise the vital needs of populations as well as the stability and sovereignty of States. This first security issue - the security of agricultural resources as a source of geostrategic power - is closely linked to a second security issue: the insecurity of agricultural resources as a source of tension and conflict.

2. Food insecurity: a source of tension and conflict

Food insecurity is a factor that amplifies and generates violence, particularly in developing countries (Randel Caughron, 2016). Rising food prices (economic accessibility) is associated to the **emergence of civil instabilities** (FAO, 2018, September; Breisinger et al., 2015; Maystadt & Ecker, 2014) and to **many popular riots linked to food crises** (Abis, 2022, 24 March). In 2008, increasing food prices were followed by civil unrest in more than 40 countries. The Arab Spring in Tunisia, Egypt and Libya is therefore partly attributable to the surging costs of food (Dago, 2021). In this context, political instability is fuelled by **a structural fragility: the dependence of national economies on an increasingly climate-vulnerable agricultural sector**²².

Moreover, **these food crises experienced at the national level can translate into inter-state tensions and conflicts at the regional level** (Brinkman & Hendrix, 2011; Kemmerling et al., 2022). While it is difficult to isolate specific instances of conflict arising from food issues, these

²¹ See definition in the glossary.

²² For example, agriculture generates one-sixth of Egypt's GDP, and employs 30% of its workforce (Ministry of Agriculture and Food Sovereignty, 2022).

conflicts are clearly amplified by **competition for control over agricultural inputs**. **The likelihood of so-called conventional water wars is increased by climate change, which induces tensions between states around transboundary basins** (Bora et al., 2010, 22 October).

Inter- and intra-state conflicts linked to food insecurity are likely to structure several French theatres of operation. For example, **the food insecurity affecting the Sahel is leading to a governance crisis in rural areas, which is linked to a general collapse of the pastoral economy and social cohesion**. In this context, armed groups and terrorist movements are proliferating and making the theatre of operations more complex (Gérard & Vollot, 2022; Pellerin, 2021, September).

Agricultural resources therefore interact with defence issues in two ways. On the one hand, we can observe **their weaponisation, i.e. a militarisation of their use, as these resources are not only perceived as assets to be secured within the framework of competition and monopolisation, but also as weapons enabling influence and leverage on the positions and strategies of other States, particularly in a conflict context**. On the other hand, **these agricultural resources, increasingly encompassed into security and defence logics, permeate in return the world of defence by generating, exacerbating or structuring conflicts**.

Both phenomena are amplified by climate change, which leads us to expect an **increase in conflicts related to food insecurity and the willingness to secure agricultural resources**. In this context, the question arises as to the role of defence actors in responding to two phenomena: **the increasing militarisation of food issues, and their growing impact on conflicts**.

3. French armed forces and the securing of agricultural resources

The French armed forces are already carrying out missions that contribute to national and international food security, particularly to respond to supply crises (physical accessibility) and weather crises (instability of availability). **The military corps that seems to be the most involved in this respect is the Navy, because of its missions to secure maritime areas, a major transit point for food resources**. These missions can for example consist in securing the supply flows by the maritime and port security platoons (PSMP) of the maritime police (CESM, 2019, January) or the escorting of World Food Programme cargo ships to protect them from piracy (CESM, 2022, 2 March). An example of the latter is the framework of Operation Atalanta, preceded by Operation EUNAV Somalia.

The Air Force and the Army have also been mobilised for their capacity to organise air and road bridges, allowing a rapid response to food crisis situations. On several occasions, they

have been tasked with **harvesting and transporting fodder to regions affected by drought**²³. In the same perspective, the French armies have **significant technical knowledge in securing water resources**²⁴ (Centre interarmées de concepts, de doctrines et d'expérimentations, 2012, 8 March). For example, some farmers have benefited from the installation of irrigation networks by the French army in Mali (Gourlay, 2020, 9 September), or the Air Force has carried out a brackish water desalination mission (Galland, 2018, 22 May).

Finally, the French army contributes to securing land, which is essential to the agricultural sector and threatened by increased inter-sectoral competition for land use. In 2022, the Ministry of the Armed Forces will have 275,000 hectares (ha) of land in metropolitan France, 70% of which will be training grounds for the forces. Some of these areas have been requisitioned for agricultural purposes²⁵.

Because of their already substantial mobilisation in this field, and because of the strategic imperative of food security, **the armed forces are called upon to be at the heart of the defence of French food sovereignty.** However, climate change, by weakening the availability, accessibility and use of agricultural resources and the stability of these components, requires **the development of a transverse and strategic vision of the systemic threats that weigh on the national territory as well as on theatres of intervention.** The development of such a vision is all the more essential as some French territories are showing increased climatic vulnerability and are already affected by food insecurity, such as the overseas territories, which have a low production capacity and are very dependent on metropolitan exports.

These reflections should also be analysed in the light of the decrease in military logistical capacities on national territory, as well as the increase in the demands on the armed forces. The ability to respond at any time to a food crisis on national territory by re-establishing a supply route for agricultural resources must be ensured. More generally, it is necessary to initiate reflections on the maintenance of this capacity in a context of simultaneous mobilisation of the armed forces in a theatre of operation abroad, and/or of a HADR (*Humanitarian Assistance and Disaster Relief*) operation, as this type of operation is likely to become more frequent because of the multiplication of climatic hazards.

²³ One such intervention occurred as early as 1976 (Matalon, 2011, 2 June). More recent examples include the mobilisation in 2003 of ten trucks from the Air and Space Force to transport fodder to Aveyron (Agence France Presse, 2003, 14 October). The Army and its vehicles were requisitioned the same year to transport bales of straw (*Les Echos*, 2022, 5 August), as were 400 Air Force and Space Force trucks in 2011 (Kichkoff, 2011, 9 July).

²⁴ One example is their Mobile Water Treatment Plant (MWTP), which produces and distributes water from natural sources, including salt water (Army, n.d.).

²⁵ In 2011, the Air Force and Space technical school in Saintes made 50ha of land available for farmers (Air Force and Space, 2011, 25 May). At Bannière, on the permanent camp for the 2^e foreign infantry regiment (REI) of the Foreign Legion, the signing of a one-year agricultural lease requires the installation of a farmer on the army's arable land (Dubesset, 2022, 11 August).

A first objective in this perspective could be the **opening of strategic reflection groups on this subject within the Ministry of the Armed Forces, but also interministerial reflection groups**, intended to initiate **real coordination between the Ministry of the Armed Forces, the Ministry of Agriculture and Food Sovereignty, the Ministry of the Interior, and the Ministry of Foreign Affairs.**

In addition to reaction capabilities, **means of anticipation, monitoring and intelligence on the agricultural and food sector** must be generally strengthened, in order to develop a **detailed knowledge of the impact of this sector on national security as well as on the challenges encountered in theatres of operation.**

Moreover, these reflections would benefit from being fed by partnerships with foresight services and organisations, as well as with private players in the agricultural and agri-food sector, on which the security of resources directly depends. Such an intersectoral consultation, backed by interministerial coordination, would make it possible to arrive at a clear and coherent vision of the **strategies to be put in place to secure agricultural resources on national territory and to control the risks associated with the instability of their availability, their accessibility, or their use in theatres of operation.**

Further reading: Food insecurity and competition for land in maps

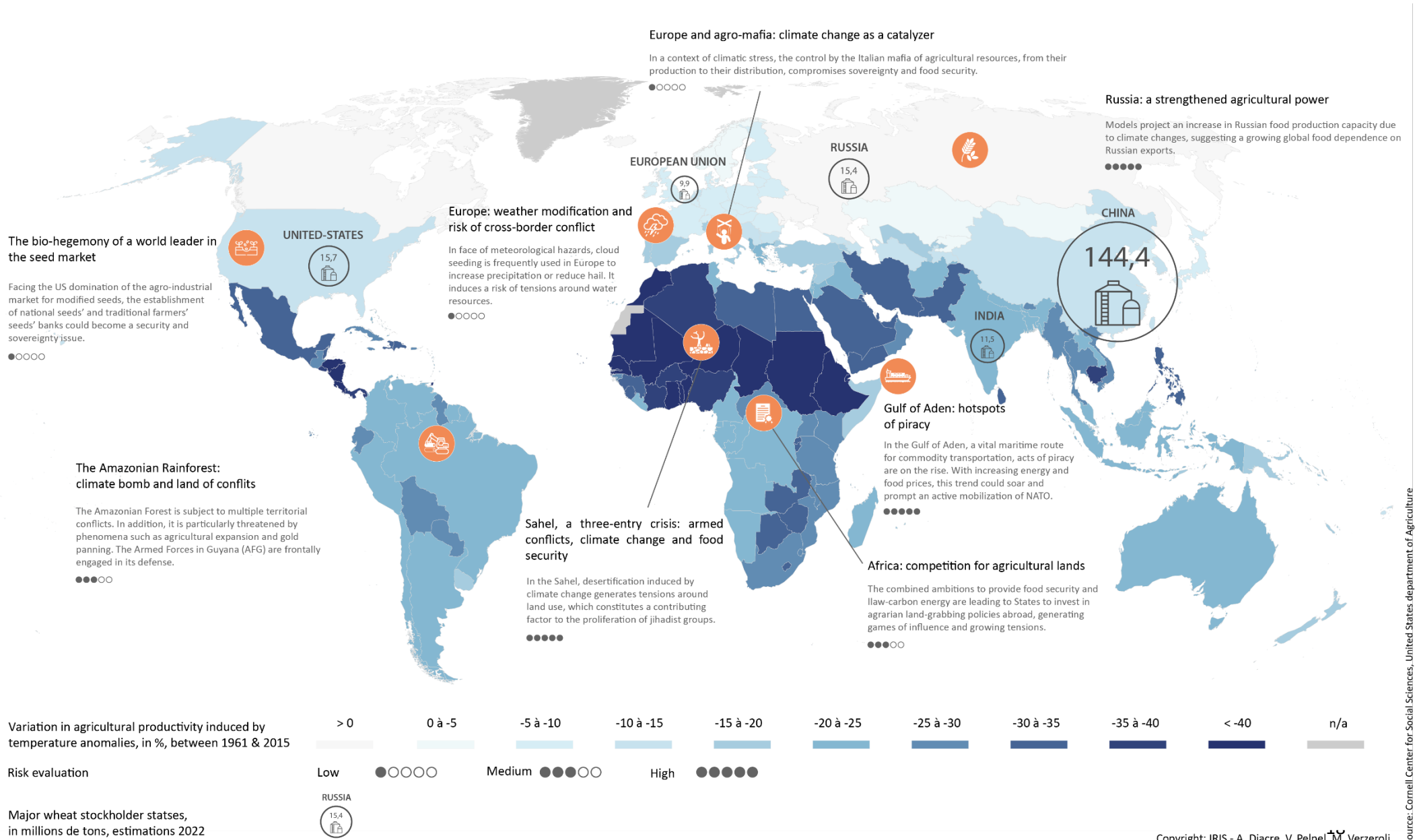
The appendices to this note include two maps: a first map from the Food and Agriculture Organisation (FAO, 2022), representing states' exposure to food insecurity, and a second map, from the Sciences Po Cartography Workshop (2018), representing financial flows of investment in land abroad. By crossing these two maps, it is interesting to note the **overlap between several areas that are both highly exposed to food insecurity and highly exposed to foreign investments in agricultural land.** These include **Africa and Latin America, where food security and sovereignty, compromised by climate hazards, are also affected by land grabbing by China, the European Union and the United States.**

The broad geographical regions drawn by these two indicators - food insecurity and foreign investment - still overlap with the regions delineated in the last part of this note. This is presented in a map form and shows **the consequences of climate change on agricultural resource security through eight geostrategic breakpoints.** The background map used, that of the **variation in agricultural productivity induced by temperature anomalies**, also highlights the **high agricultural vulnerability of South America and the Caribbean as well as Africa, while pointing to a third region: that of the Middle East and Southwest Asia.**



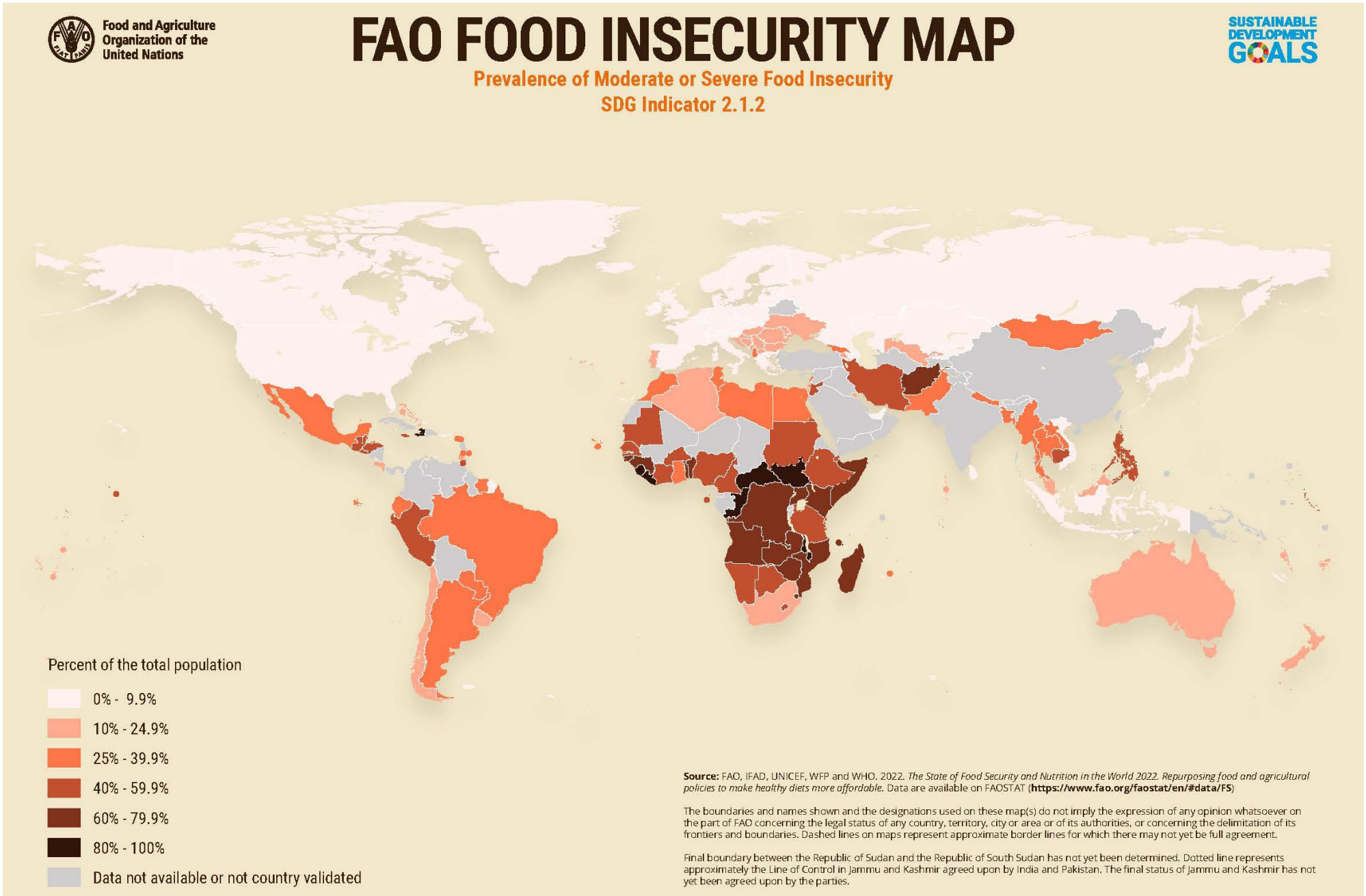
AGRICULTURE, CLIMATE AND DEFENCE: WHAT ARE THE BREAKING POINTS?

Map: The impact of climate change on agricultural resource security: eight geostrategic breakpoints

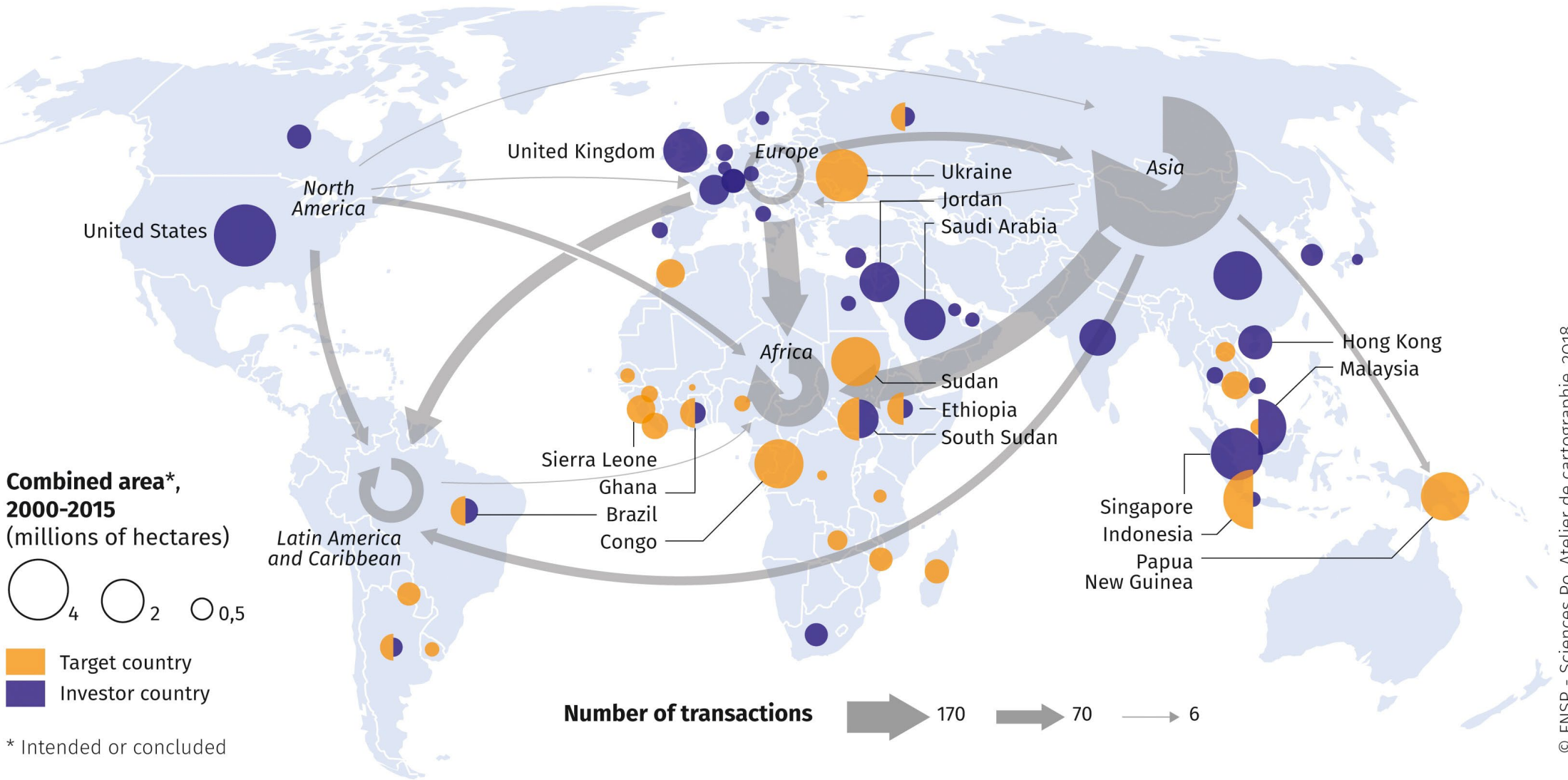


ANNEXES

Annex 1: Map of food insecurity in the world



Annex 2: Financial flows of investment in agricultural land abroad



GLOSSARY

Land grabbing: Private or public acquisition of large tracts of agricultural land. This phenomenon mainly affects developing countries and has tended to intensify since the 2008 food crisis.

Food accessibility: Second component of food security that refers to the physical (supply and distribution) and economic (markets and financial resources) capacity to access food production.

Staple foods: Foods that are consumed regularly, in such quantities that they constitute the dominant part of the diet and provide a major proportion of the total energy intake.

Food crisis: Situation where a long and extreme shortage of food leads to increased rates of hunger and malnutrition at the local, national or global level.

Food availability: First component of food security, it consists of the presence of quality food in sufficient quantity to ensure food for all. It is therefore directly linked to the production of agricultural resources, regardless of their ability to circulate.

Cloud seeding: Intentional modification of weather conditions by the diffusion of particles in clouds to reduce hail or increase rainfall.

Trigger point: Degree of stress beyond which the structural integrity of a unit is jeopardised and a major upheaval can be expected.

National strategic reserves: public stocks of food formed by a state as part of a national policy to preserve its food security. This includes ensuring supplies to the population in the event of an international crisis or extreme weather event.

Food resilience: Ability of a food system to withstand disturbances by preventing shocks that would intrinsically and functionally affect the system.

Sector of vital importance: According to the Defence Code (Article R. 1332-2), a sector of activities related to the production and distribution of goods or services that are essential (to the satisfaction of the essential needs of the population, to the exercise of State authority, to the functioning of the economy, to the maintenance of the defence potential, or to the security of the Nation) and that are difficult to substitute or replace, or that present a serious danger to the population.

Securing: Voluntary and strategic undertaking to ensure the security of people and essential goods. The aim in this case is to ensure food security for people by ensuring the availability, accessibility and appropriate use of food resources, particularly agricultural resources.

Food security: Guarantee that/the state when all people, at any time, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for

an active and healthy life. It is based on four pillars: the availability of resources, their accessibility, their adequate use, and the stability over time of these first three pillars.

National food sovereignty: The state close to food autonomy where a state and its population control the mechanisms and policies of food production and distribution, in order to adapt them to national functioning, culture and ecosystems.

Food stability: Third pillar of food security, it concerns the stability of availability, accessibility and use (preservation and storage chains) and refers to the ability to obtain food over time, as food insecurity can be transitory, seasonal or chronic. It is therefore dependent on any hazard, whether climatic, security or socio-economic.

Food system: Set of interconnected actors and activities involved in the production, aggregation, processing, distribution, consumption and disposal of food products from agriculture, forestry or fisheries.

Food utilization: Fourth component of food safety, it includes food and cultural practices related to the preservation, preparation and consumption of food. It thus takes into account the quality of the water used in these practices and the quality of the products ready for consumption (free of any physical, chemical or biological contamination).

Vulnerability (climate): Propensity or predisposition to be adversely affected by climate change (slow variability and rapid extremes). It depends on the sensitivity of the natural environment, the fragility of the human environment and the adaptation policies.

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