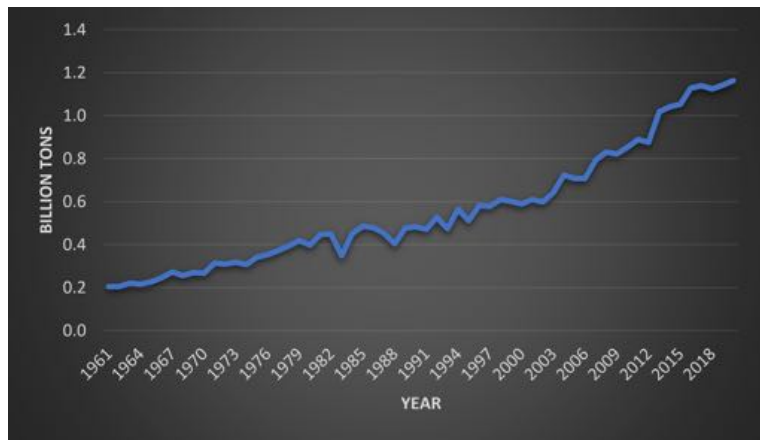




Maize is a key global cash crop, produced in every continent except Antarctica. As a flex crop, it has multiple uses including for direct human consumption, as an ingredient for animal feed, as a key component in processed foods, or in ethanol production.

According to figures from FAOSTAT, global production increased from 0.2 to 1.2 billion tons between 1961 and 2020.

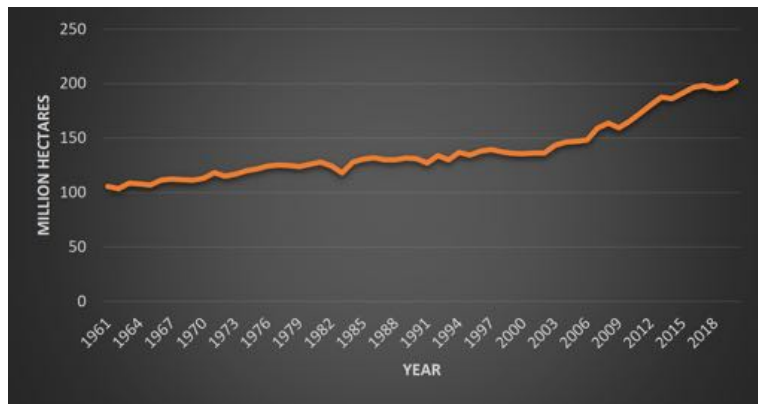


*Global maize production 1961-2020 in billion tons
(Data source: FAOSTAT)*



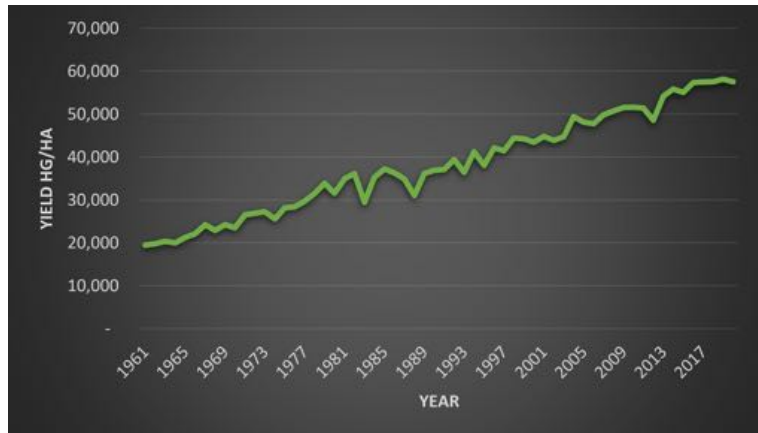
There are two key factors allowing this increase:

1. Increase in land use for maize production



Global area harvested for maize 1961-2020 in million hectares (Data source: FAOSTAT)

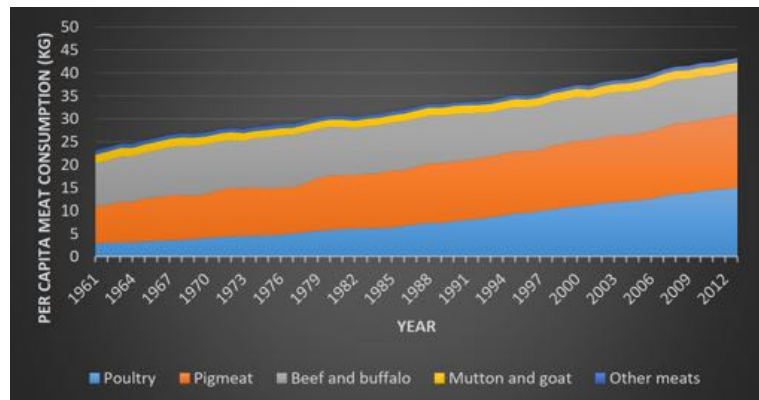
2. Increase in yields through the development of hybrid seeds



Global yield for maize 1961-2020 in hectograms (100g) per hectare (Data source: FAOSTAT)



On the demand side, changing consumer tastes, which relate to the rise of an urban middle class with expendable income, account for a rise in global meat consumption.

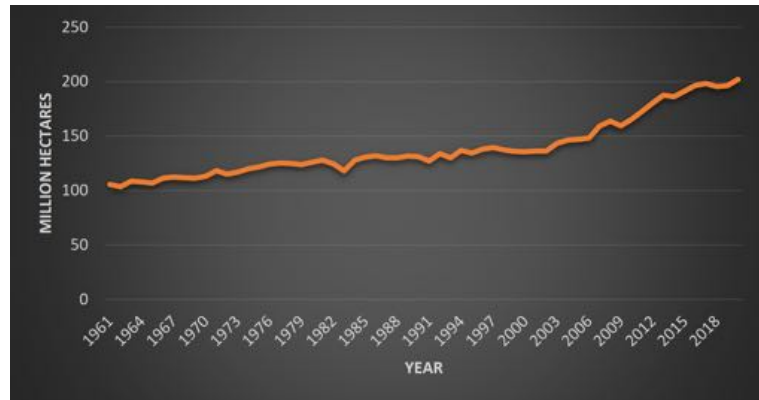


Per capita meat consumption by type, World 1961-2013
 (Data source: FAOSTAT, downloaded from *Our World In Data*) NB. The data is based on per capita food supply at the consumer level, but does not account for food waste at this level.

This drives demand for animal feed and by extension maize. **In Thailand, where this data story is centred, maize is the core ingredient and generally accounts for 55–65% of animal feed.**



Looking again at the globally harvested area for maize, an acceleration in land use can be seen in the latter parts of the 2000s. This links to food price spikes at the time, identified as a key driver towards what is frequently recognised as the global land rush.



Global area harvested for maize 1961-2020 in million hectares (Data source: FAOSTAT)

For this data story, we wish to pick up a specific thread of this story, looking at the increase of maize production in and around Thailand, and its relation to a poultry value chain as an ingredient in animal feed.

Southeast Asia is one of the fastest growing agri-food sectors, and maize is popular with farmers as a crop that is easy to manage. This allows for a diversified livelihood strategy that include non-farm activities.



In mapping out the value chain, the story aims to show how local land-use systems interrelate with global commodity chains, using an environmental perspective. It does not consider the important socio-economic impacts of farming communities entering into cash cropping.

Two principal forms of data are used:

- **National and sub-national land use data** is provided by national statistics offices from countries in the Mekong region. Clear geo-data is missing here, and the datasets should be taken as indicators of land use rather than clear measures. For example, Union-level data collection in Myanmar concerns only formally registered land, and so underrepresents the scale of cultivation.
- **Trade data** is sourced through the International Trade Centre, which is a joint agency of the World Trade Organization and the United Nations. Yet the Mekong region is rife with exchanges that are not formally registered and again the data should be viewed as indicative rather than precise.

In a remote part of Mae Chaem district, Chiang Mai province, a maize silo is found where the locally produced crop is bought, stored and then transported onto an animal feed processing plant. In 2016, 95% of land used to produce maize in this district was untitled.



The story has five parts:



1. Land-use changes in Thailand for maize production

2. The extension of commercial maize through the Mekong region

3. Environmental impacts of the shift in land-use for maize

4. The journey of maize from animal feed to prepared poultry products

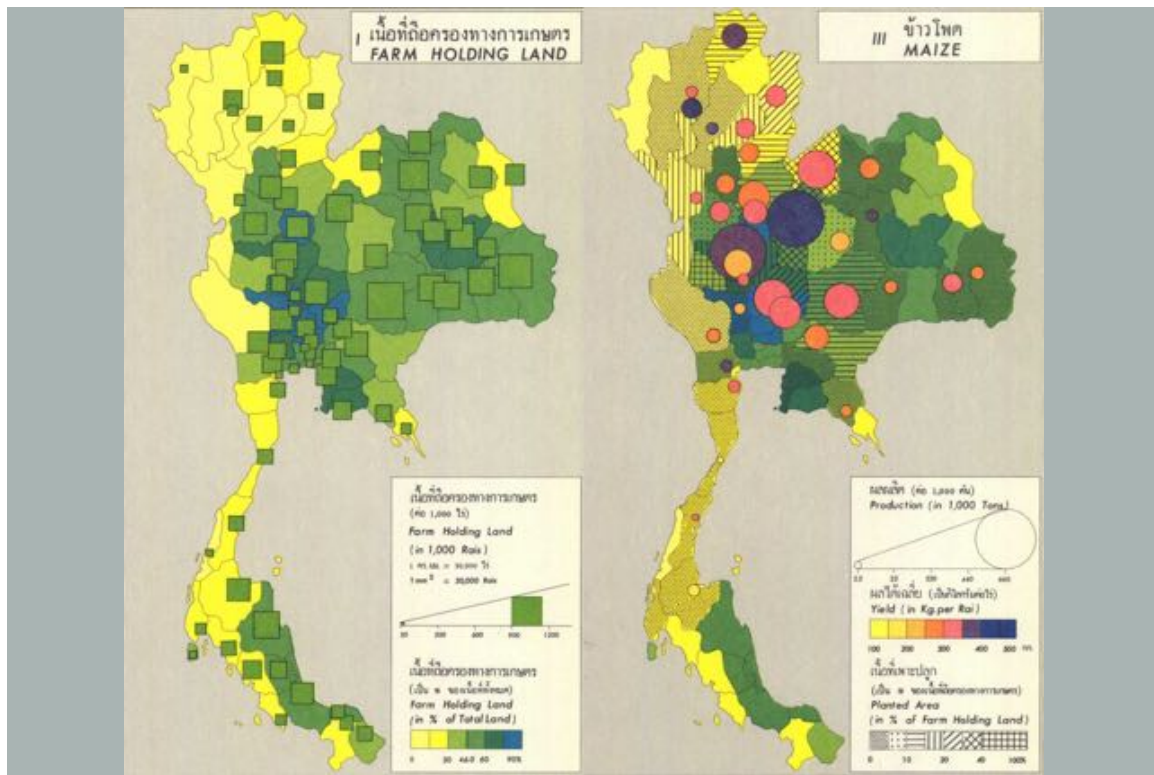
5. The prospects of a new maize boom



1. Land-use changes in Thailand for maize production

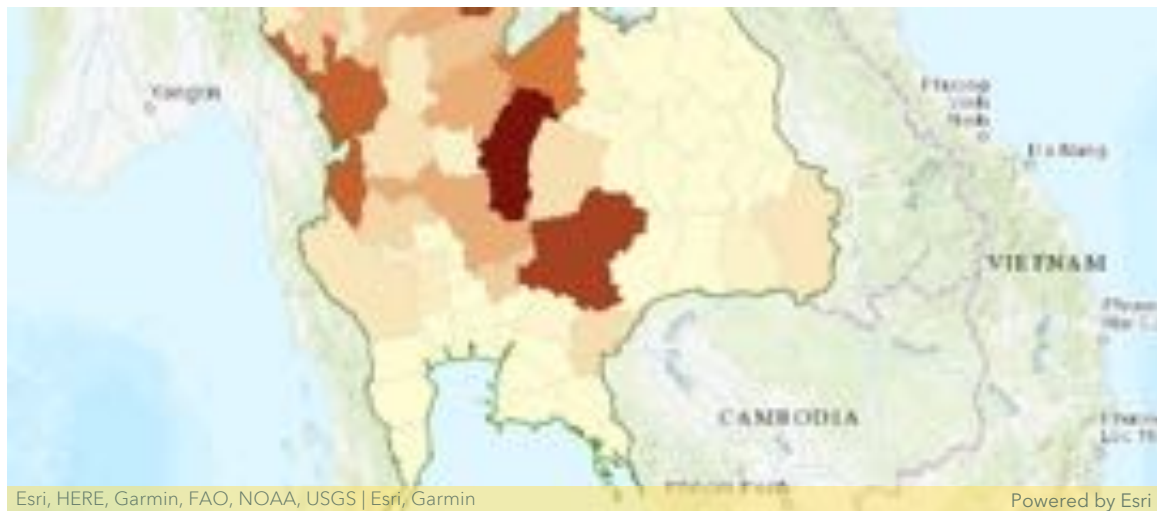
A view of land use for maize in Thailand reflects economic growth in the country. At the beginning of the 1960s, economic policy focused on expanding the export of primary and agricultural products, leading to a rise in cash crops such as maize. In the 1970s, the growth of the Charoen Pokphand Group (CP), which is one of Thailand's largest conglomerates, ran parallel to the development of a vertically integrated value chain leading from maize production to the poultry sector.

Data source: FAOSTAT



Further commercialisation of agriculture in the 1980s led to a peak of land use for maize production. This runs parallel to high GDP growth reaching into double digits between 1986 and 1996, gaining Thailand a reputation as a development success story. The smallholder has been a key actor here as the principal source of production, under technical and financial support from the State.

The maps opposite compare the size of agricultural landholdings (given in rai) and maize production from 1980-81 (in kg per rai), as compiled by the Royal Thai Survey Department. In a time of great expansion for farming, there is nevertheless a concentration of holdings in the centre and northeast of the country, with maize focused in the centre.



Although land use peaked in the mid-1980s, subsequent decreases have been compensated by increased yields through the provision of hybrid seeds.

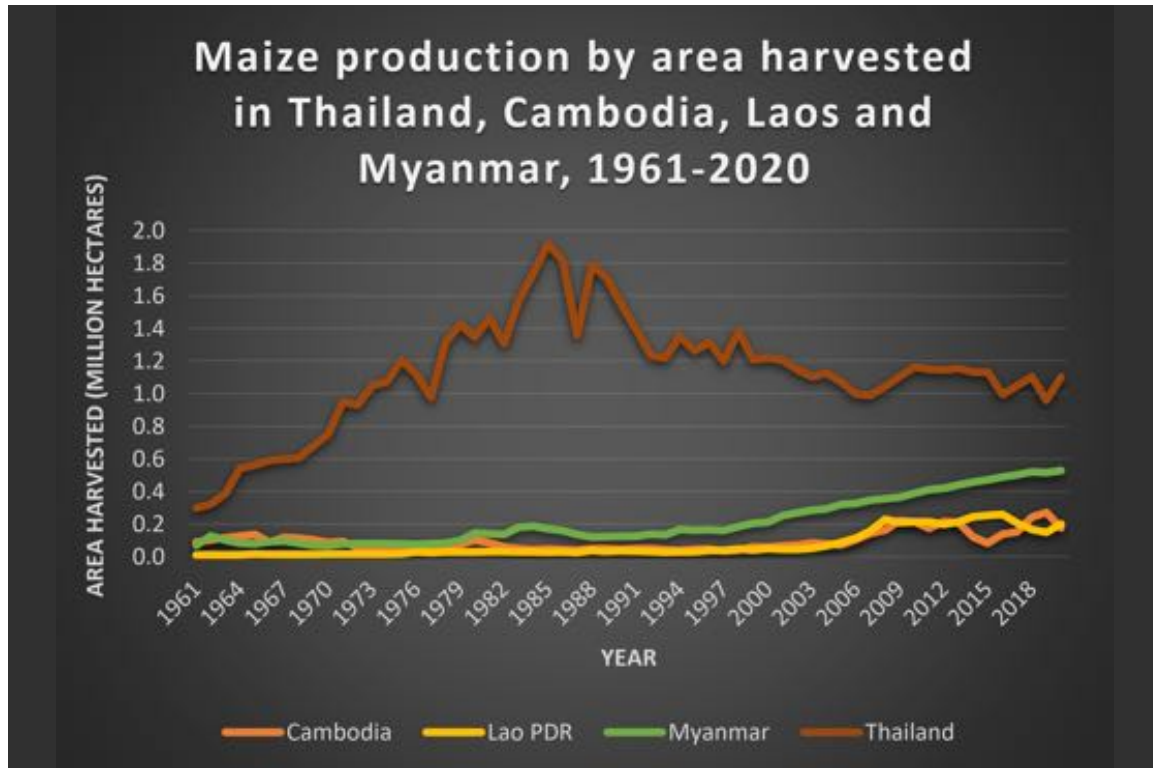
A new boom started around 2007-8 as global food price spikes, increasing the market value of the crop. Using data from the Office of Agricultural Economics, provincial level production can be mapped out. The three visualizations in the map cover a ten-year period, for 2008 (the beginning of the latest boom), 2013 (the peak of land use during the boom) and 2018 (post-boom production). During the second half of the 2000s, there was a shift of production from the central region to the north, particularly in the provinces of [Tak](#), [Chiang Rai](#) and [Nan](#).

There is also a core area of production framed by a band of hills moving through [Loei](#), [Phetchabun](#), and [Nakhon Ratchasima](#) (also known as Khorat) provinces. **Since 2013, production levels have been more volatile,** suggesting the end of the latest maize boom.

Show harvested area (ha) in 2008

Show harvested area (ha) in 2013

Show harvested area (ha) in 2018



2. The extension of commercial maize through the Mekong region

Increased land use for maize production in Cambodia, Laos and Myanmar has been more recent compared to Thailand. There are certain historical dynamics at work here. After experimentations in socialism, these three countries shifted towards open market economies from the late-1980s into the 1990s. This allowed investment from regional corporations, including those from higher income countries such as Thailand.

The global food prices spikes also catalysed land use growth for maize in the 2000s. There has been some expansion of a domestic meat

production system in these countries, but the bulk of the increasing output is exported. The major corporate player in this expansion of regional production is CP, although there are now several multinationals involved in the sale of seeds and other chemical inputs, and domestic animal feed processing plants.

Data source: FAOSTAT



If we look at the sub-national level of production from 2018, the predominant maize-growing areas occupy border areas for convenient export. This is not solely catering to a demand from Thailand.

⊕ **Shan State in Myanmar is the key production area with 60% of the land use for the crop nationally.** Until late 2018, 90% of maize exports went to China, and much of the crop was traded outside of formal registration to avoid high tariffs. However, a clampdown by China resulted in a reorientation of maize trade, primarily overland to Thailand through

⊕ **Myawaddy-Mae Sot border gate.**

Exports from the northwest of Cambodia (primarily ⊕ Battambang province) cross the border to Thailand, while production in the southeast of the country is sold to Vietnamese traders. Maize grown in northeast Laos is also exported to Vietnam, while production in the northwest travels to China and to a lesser extent to Thailand.

It is worth noting here that while the bulk of maize reaching Thailand is used for animal feed towards the poultry sector, in China and Vietnam, swine is the more prevalent sector using animal feed.

Harvested area (in ha) for 2008

Harvested area (in ha) for 2013

Harvested area (in ha) for 2018



Since 2010 the general tariff for maize trading under ATIGA-AEC (ASEAN Trade in Goods

Agreement-ASEAN Economic Community) was reduced to 0% for the whole ASEAN Mekong Subregion (AMS). However, despite importing the crop from Laos, Cambodia, and Myanmar, **Thailand imposes NTBs (Non-Tariff Barriers) to protect its domestic producers.** Since 2015, tariff-free imports of maize from the three neighbouring countries are permitted for seven months (1st February to 31st August).

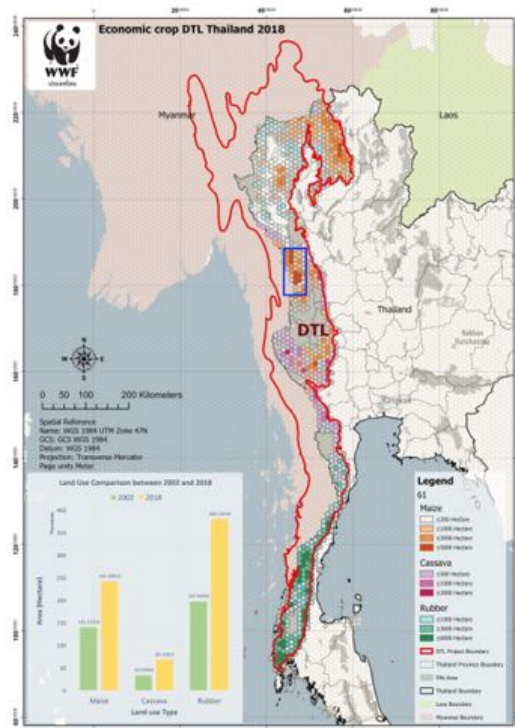
This period lies outside the main harvesting period, during which the tariff is 73%. The Public Warehouse Organisation (PWO), which is a state enterprise under the Ministry of Commerce, has been designated the sole importer of in-quota maize. For example, they struck a deal in 2020 to import one million tons of maize from Myanmar via Myawaddy. However, **there are also additional rules for exporters to follow,** including certification under plant quarantine regulations and Department of Foreign Trade Regulations. These effectively work as NTBs.



3. Environmental impacts of the shift in land-use for maize

Land use for maize production is tied up with issues of deforestation in Thailand. In the north, there has been concern for farmer encroachment on state forestlands, attracting the attention of the military, urban middle-class environmentalists, Buddhist activists, and royalist thinktanks.

For example, **images of “bald” mountains in Nan province** have galvanized public opinion against forestland encroachment and conversion in northern uplands and highlands. In January 2018 it was reported that “up to 8.6 million rai (1.27 million ha) of high-mountain watershed areas in 13 provinces had been heavily cleared, with 800,000 encroachers involved” (Piyaporn Wongruang in [The Nation Newspaper](#)).



Yet one has to be careful about making simplistic assumptions on encroachment, which do not reflect the ambiguity around much land designation in the region or recognise the complex drivers pushing farmers off existing land into frontier areas.

In 2021, the World Wide Fund for Nature (WWF) drew attention to maize as a significant crop eroding the rich biodiverse mountainous and forested landscape of the Dawna Tenasserim stretching along the Thailand-Myanmar border. In particular, this trend was identified on the Myanmar side of the border, in the vicinity of the Myawaddy-Mae Sot border gate (seen in the [blue box](#)) where the crop is exported to Thailand.

The map opposite notes the Dawna Tenasserim Landscape or DTL (enclosed within a [red boundary line](#)), and **maps out production areas for three economic crops**, comparing land use in 2002 and 2018.

Although the bulk of the mapped area is found on the Thai side of the border, it is interesting to note that there is a conglomeration of maize production in Myanmar around the Myawaddy-Mae Sot border gate, which has now become the prime site to export the crop.





A second concern for maize production has been over its contribution to **air pollution**. During the dry hot season, which starts around February time, the north of Thailand endures a choking smog far surpassing the safe limits for levels of PM 2.5.

The map opposite shows **recent measurements of decadal mean PM 2.5 levels** (shown by clicking on a recording represented by a coloured circle).

Zoom out to any global location or in to the vicinity of northern Thailand.

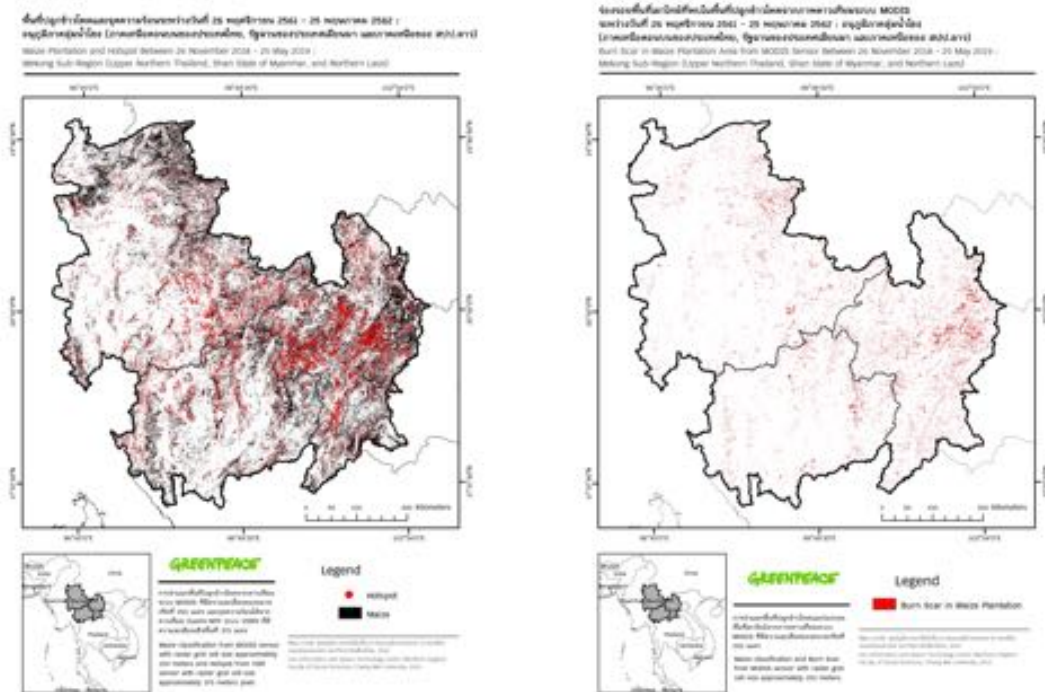


Various factors have been attributed to the haze in North Thailand, including:

- The clearing of forests to create new farmland
- The burning of forest floors to reveal various forest products including valuable local mushrooms
- Naturally occurring forest fires during the hot season
- The burning of maize stubble in preparation for the following season
- Political protest against government policies toward forest dwellers
- Urban-based activities such as car use
- Industrial practices

There are many **hotspot maps** available (such as the one opposite) which allow the public to observe where fires are taking place around the region.

For the north of Thailand bordering into Shan State in Myanmar and northwest Laos, such fires are prevalent from around February to April each year. The map opposite shows hotspots from the last seven days.



There are also fears of **transboundary air pollution** originating from maize production in Shan State, Myanmar, and travelling into North Thailand. Using satellite imagery, Greenpeace Southeast Asia mapped out fire hotspots within maize plantation areas. Between December 2018 and May 2019, they found 6,879 fire hotspots within plantations in Upper Northern Thailand, and 14,828 hotspots within plantations in Shan State.

Although the proportional contribution of maize-related activities to haze is not made clear, the study confirms their influence. It is also noteworthy that **although the Greenpeace study focuses on Shan State and northern Thailand, the highest number of burn scars in maize plantations are found in Laos**. This certainly warrants further investigation.



A third environmental concern involves the **excessive use of chemical inputs in maize production**. An alliance of civil society groups in Thailand, including the Thailand Pesticide Alert Network, the Alternative Agriculture Network, and the Foundation for Consumers, have been campaigning since 2016 to ban or regulate three commonly used pesticides in Thailand. These are:

- **Paraquat**, an herbicide that is already banned in forty countries and impacts upon human respiratory and nervous systems, causing fatalities in the case of extended contact or ingestion.
- **Chlorpyrifos**, an insecticide banned in Europe that carries a risk of neurological complications, impacting on child development.
- **Glyphosate**, a widely available herbicide, despite studies suggesting but not yet proving that it can have a carcinogenic effect.

On May 15, 2020, the National Hazardous Substances Committee voted to ban paraquat and chlorpyrifos, effective from June 1, 2020.

While some farmer groups complain about potential loss of productivity, activists lobby for a further prohibition on glyphosate.

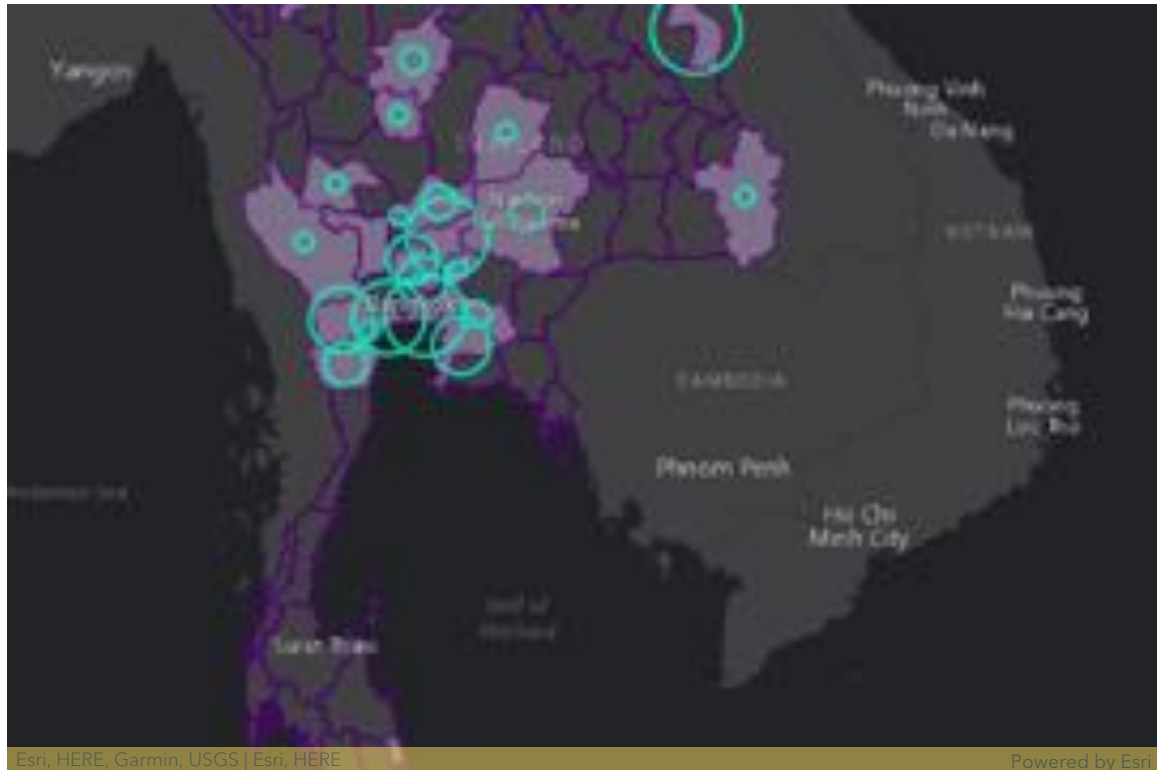
Photo: © Wason Wanichakorn / Greenpeace



4. The journey of maize from processing into animal feed to the export of prepared poultry products

Maize produced in or exported to Thailand predominantly finds its way into a value chain used as animal feed to produce poultry meat products. There are several large corporations involved throughout the value chain. The key player is the multinational CP which was the first foreign investor in China, the first maize-related company to enter regional countries, and is the

largest global producer of animal feed and the sixth highest broiler producer.



While land use for maize production has expanded to peripheral areas of Thailand and across the border into neighbouring countries, subsequent stages in the value chain involve a geographically centralised food system. In 2019, Thailand produced 20.2 million tons of animal feed, 56.4% for poultry and 27.2% for swine.

83% of key commercial feed mills are located in the central region of the country. This is the same for large poultry farms, some of which house more than 100,000 birds, and with many connected directly to feed mills and meat processing plants. The industry is an organised one, involving a highly connected network of corporate associations, financial support institutions, and government extension services.

The map opposite counts the **main feed mills of**

Thailand by province. These include mills belonging to the Thai Feed Mill Association (TFMA) and those independent of the association.

Click on a province to see a breakdown of feed mill numbers.



Map: Prepared of preserved meat and offal from poultry fowls (product code 160232), exported from Thailand in 2019. (Data source: UN Comtrade)

Click on the importing country to see amount by quantity and value.

From 2019 figures (before international trade was disrupted by the COVID-19 pandemic), poultry exports from Thailand can be divided by weight into processed (65.3%), frozen (34%), and chilled chicken (0.7%).

There are two key markets here, namely Japan and the UK. **60-65% of imported processed chicken to Japan comes from Thailand**, along with around 30% of imported frozen chicken (with Brazil the main competitor to the latter product).

Meanwhile, **about 50% of imported processed chicken to the UK comes from Thailand**.

Following Brexit, a WTO quota system determines how much prepared poultry can be imported under preferential tariffs. This presently stands at 122,820 tons for the UK (64.8%) compared to 66,813 tons for the EU (35.2%).

In 2019, the UK imported 165,000 tons from Thailand, showing how some traders are willing to pay higher tariffs outside the WTO quota to satisfy demand. In both the UK and EU, we see a strong presence of CP, who have offices in multiple countries, and have acquired several food companies integrating their meat products.



Processed poultry projects by CP are easy to find in convenience stores around Thailand





Map: Frozen cuts and offal from poultry fowls (product code 020714), exported from Thailand in 2019. (Data source: UN Comtrade).

Click on the importing country to see amount by quantity and value.

The growth of international trade in poultry products on the surface represents a success story for the Thai economy. Yet with a growing international body of consumers comes an increased demand to know that their food is environmentally and socially sustainable.

Concerns have been raised in EU and UK markets as to the traceability of poultry feed, including linkages to deforestation to clear new areas for maize production. In 2015, a report was released by the NGO watchdog Finnwatch highlighting concerns over working conditions for migrant workers in the Thai broiler industry. The report received attention in the European press.

There is a final observation to be made from our analysis of trade statistics in poultry products. **Since 2019, there has been a large increase in the amount of frozen chicken being exported from Thailand to China, reflecting a general increase in imports to that country.** One driver here is the low confidence in pork meat after a 2018-9 outbreak in African Swine Fever, which

wiped out 50% of the domestic herd. Increasing imports of poultry products drive up demand for maize in Thailand. But there is potentially a more significant related dynamic which could instigate a new maize boom in the Mekong region. This is covered in our closing section to this data story



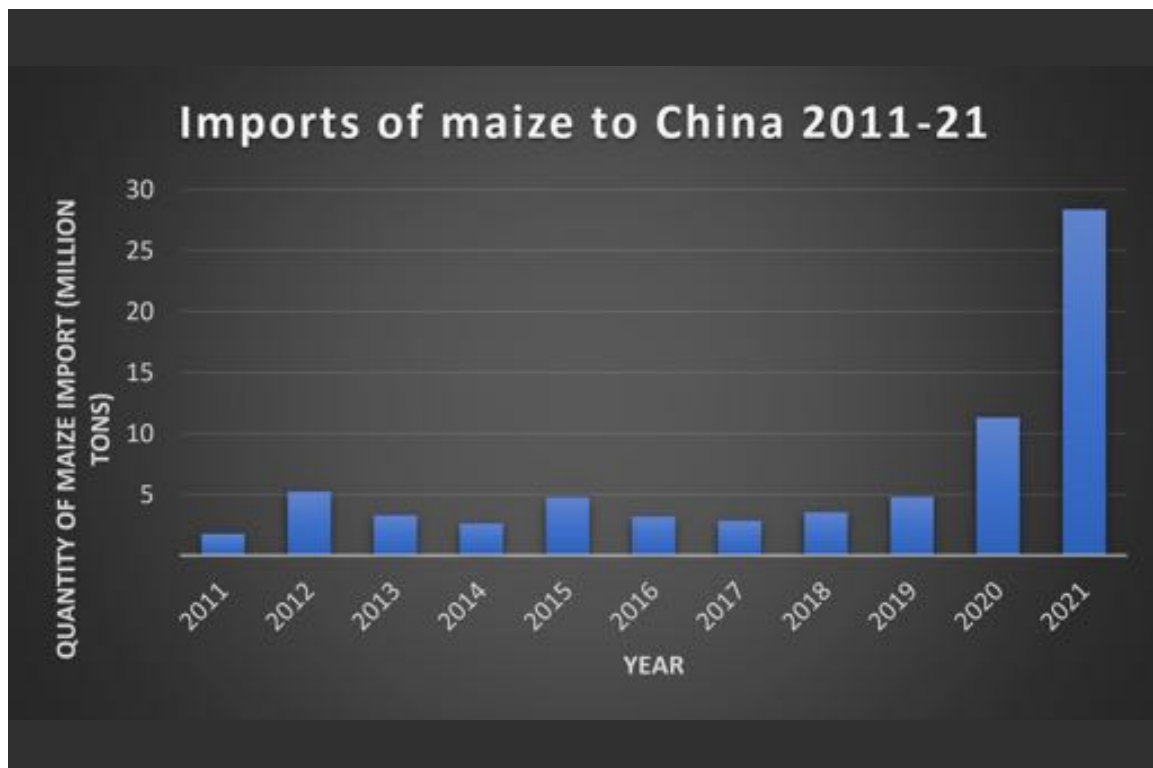
5. The prospects of a new maize boom

What is the future for maize production and trade?

Production figures seem to show that the boom from the latter stages of the 2000s is now over. **But new dynamics emerge that challenge land use for cultivation and may catalyse increases or decreases in production.** For example, what is the impact of the COVID-19 pandemic? Certainly, there has been a limiting factor here, with lockdowns impinging upon industrial

processes, including the production of frozen and processed poultry meat.

A further consequence is the recent global fuel price spikes, which have placed stresses on supply chains, placing rising costs that may be passed onto the consumer. In the short term, these factors can inhibit trade, although the longer-term outlook is unclear.



There is one recent dynamic that could act as a push to an expanded maize production system in the Mekong region. **China has a long-standing policy of self-sufficiency in maize production for domestic use.** Therefore, imports are geared to support domestic supplies. However, following the 2018-9 outbreak of African Swine Fever, in 2020-1 there was a new thirst for maize imports to supply animal feed stocks and help replenish swine herds.

Data source: UN Comtrade, Reuters



As a result, and despite theoretical complications in supply chains due to COVID, imports increased significantly in the last two years, driving up the price of maize on world markets.

A further complication is the fact that most maize exported to China comes from the Ukraine. The Russian invasion of the Ukraine will affect the supply line to China. With maize prices likely to rise further, China may decide to carefully manage its huge domestic output. However, should it decide to relax border restrictions with neighbouring countries that are in place as part of its policy on COVID, we could see a new maize boom that engages land in the Mekong region to supply its giant neighbour.



Conclusion: complexities of scale

These images linking Ukraine, China and the Mekong region are telling and drive home the complex relationship between localised production systems, macro-level economics, and the global trade of commodities. The example of maize sees a highly integrated value chain in Thailand feeding a national export strategy.

Production has expanded through the region, not just to supply Thai markets but also Vietnamese and Chinese animal feed needs. At the local level, there is evidence that maize production contributes to environmental hazards including deforestation, air pollution, and chemical poisoning of humans, animals and water sources. Yet local control of production remains elusive while it remains at the whim of pricing markets and international trade demands.

Will the new Chinese demand for maize instigate clearances of rich biodiverse forests in the

Mekong region? Will it prolong an annual smog, despite all attempts to stamp out the unnecessary burning of land? Can consumer demands for sustainable practices counter some of the risks from production? The boom-and-bust cycles of commodity production do not bode well either for the environmental sustainability of land systems or for smallholders struggling to achieve some semblance of a comfortable livelihood. Surely there must be another way?



Acknowledgements & Sources

References

[See the list of sources](#)

Suggested citation

Hayward, Daniel. (2022). A Story about Maize: Tracing a value chain from land-use to supermarket shelf. Land Portal.

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Konrad Hentze

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