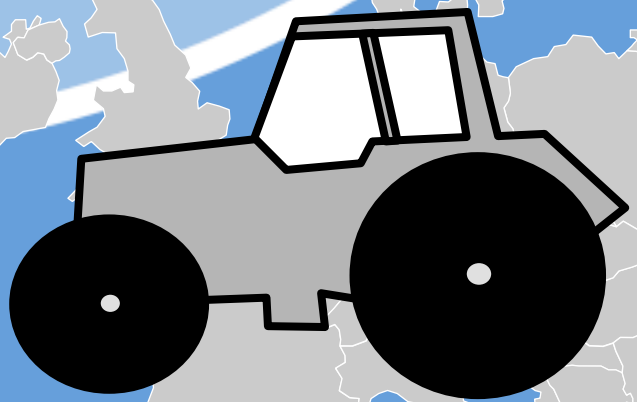
Europe's agriculture in a changing climate

Part 2: Overview impacts on Europe in 19 sheets



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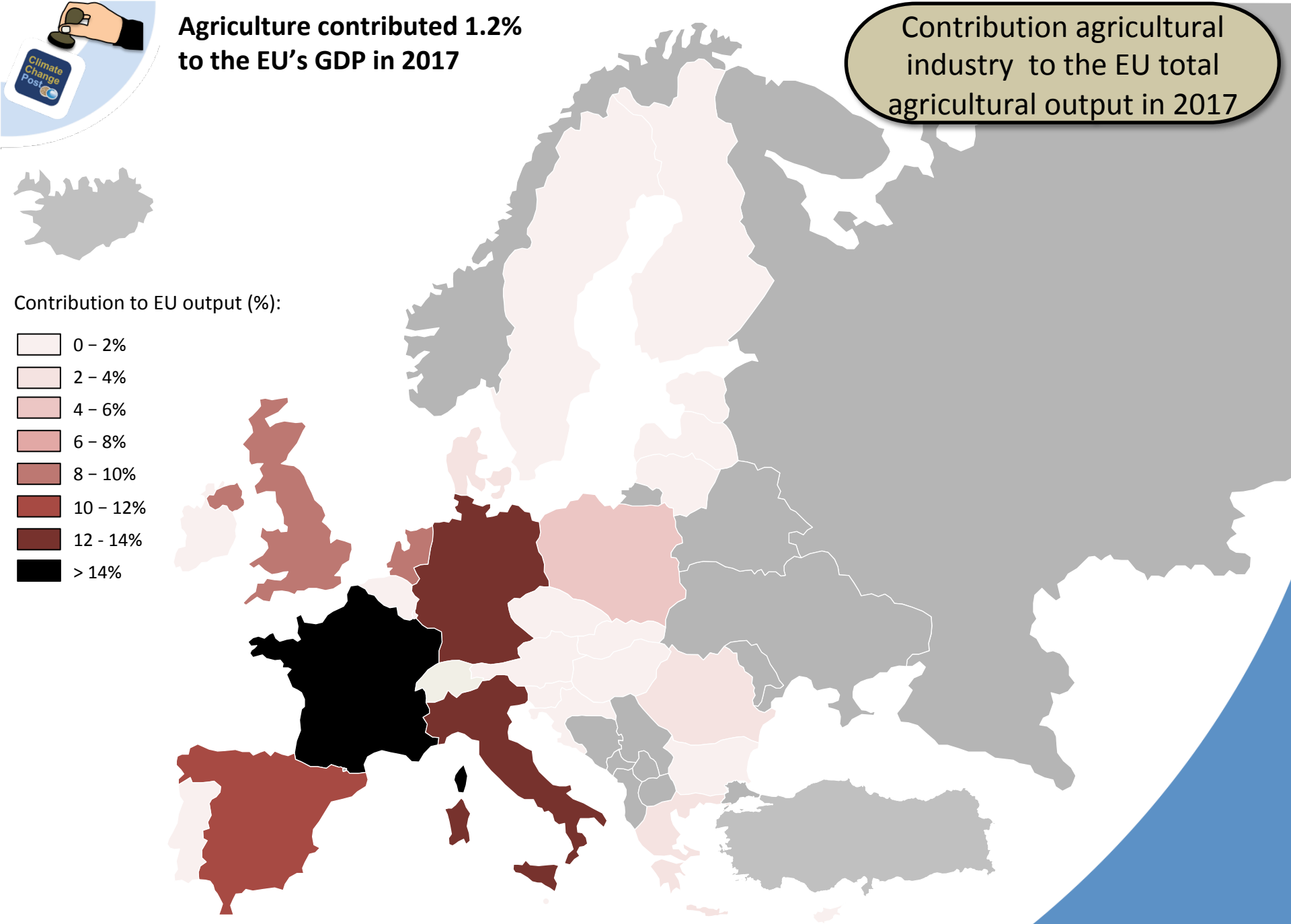
Latest update: 29 March 2019

Agriculture contributed 1.2% to the EU's GDP in 2017

Contribution agricultural industry to the EU total agricultural output in 2017

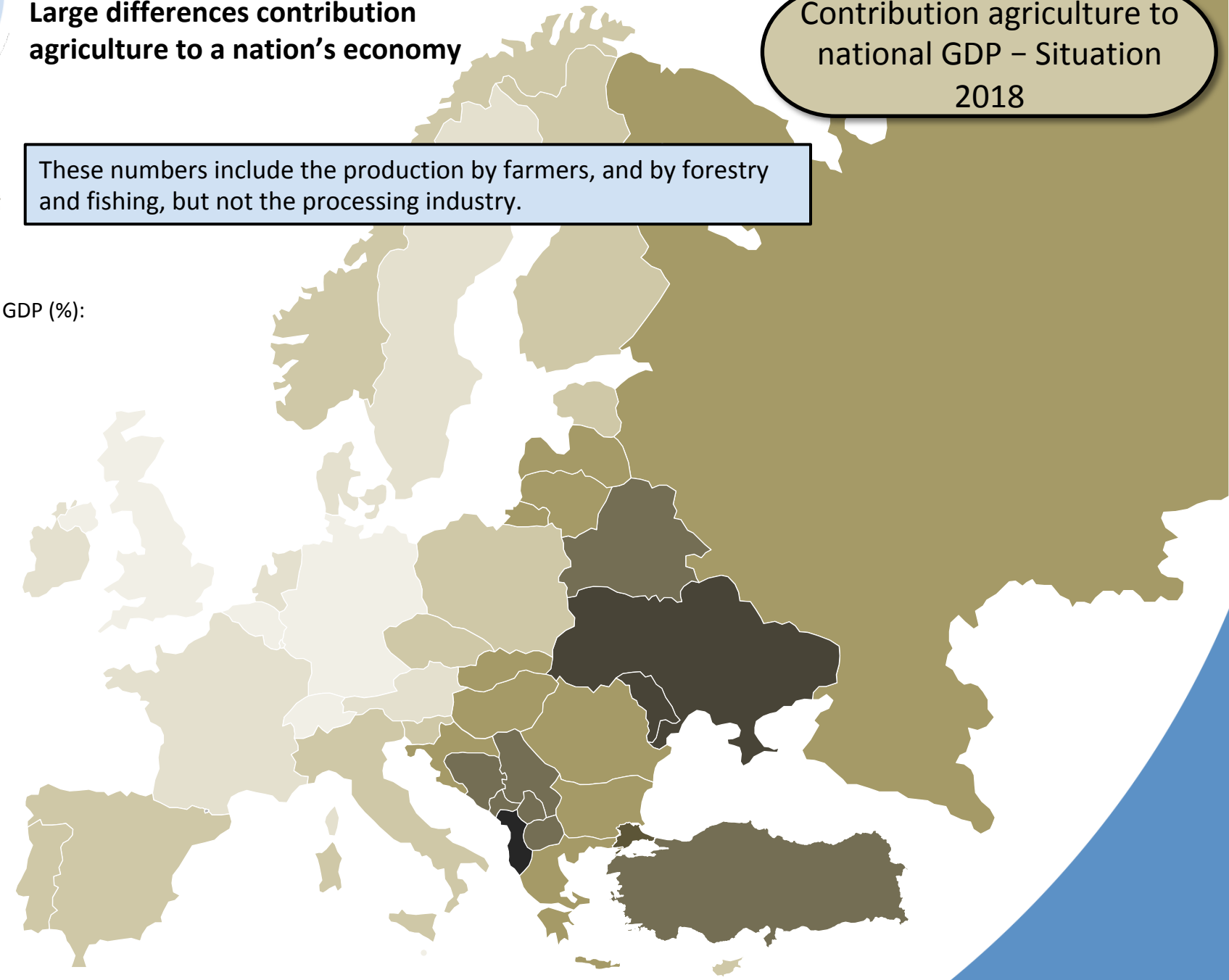


Source: Eurostat; Statistical Factsheet European Union May 2018

Large differences contribution agriculture to a nation's economy

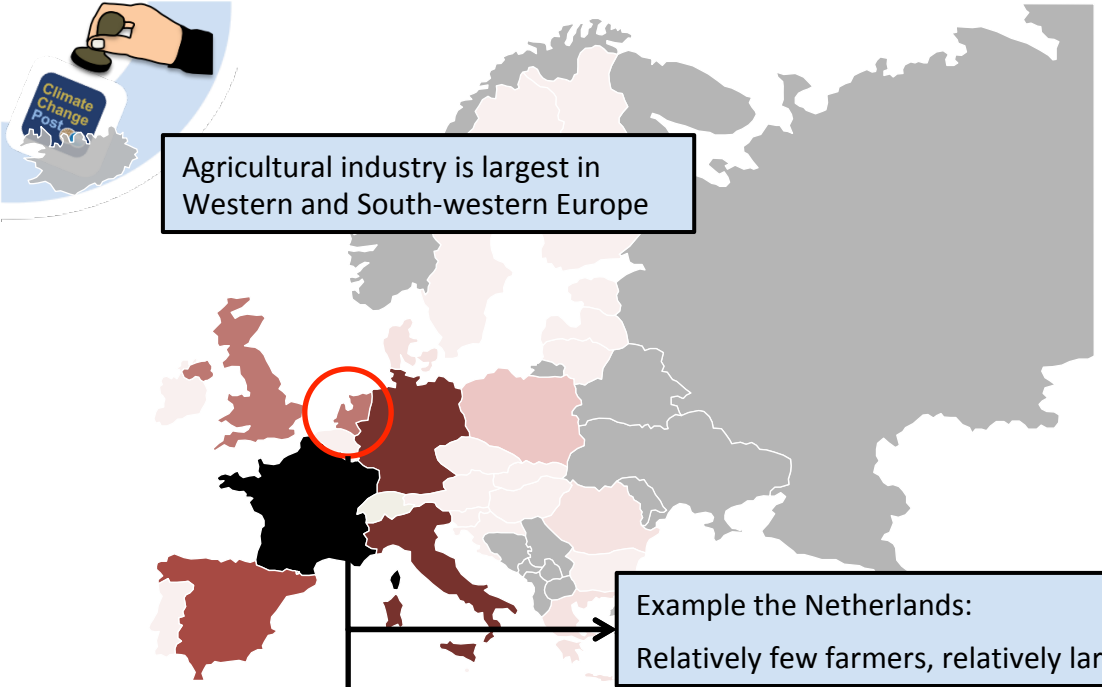
Contribution agriculture to national GDP – Situation 2018

These numbers include the production by farmers, and by forestry and fishing, but not the processing industry.



Source:
UNECE (Iceland and Turkey: World Bank) (downloaded March 2019)

Agricultural industry is largest in Western and South-western Europe

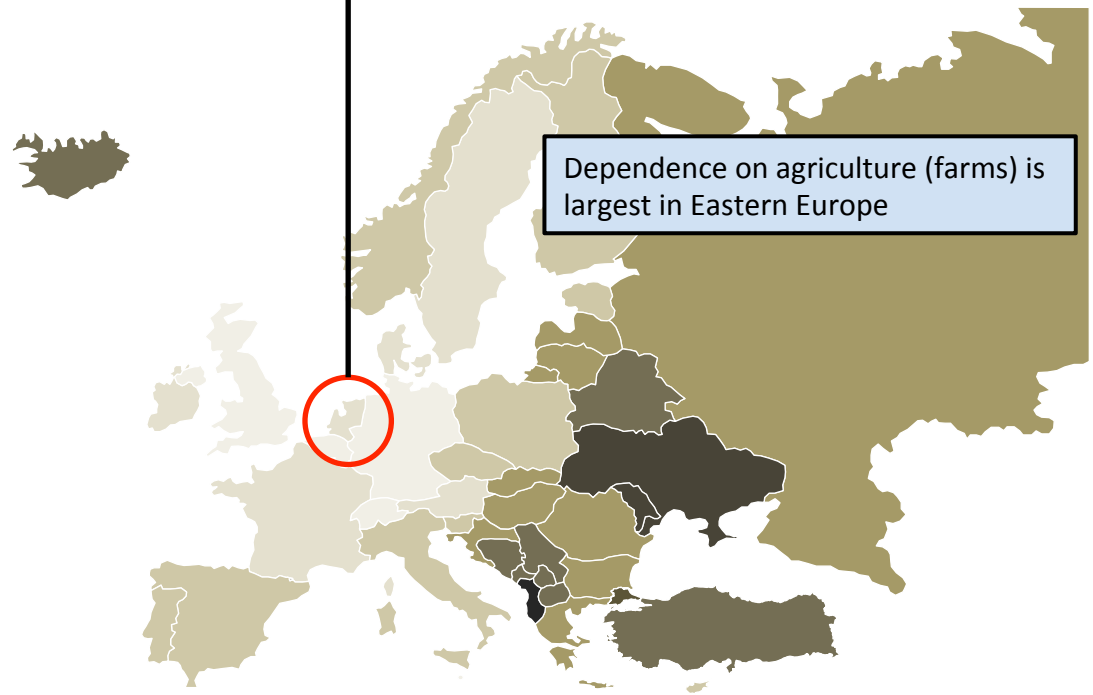


Contribution to EU output (%):
(Eurostat)

- 0 – 2%
- 2 – 4%
- 4 – 6%
- 6 – 8%
- 8 – 10%
- 10 – 12%
- 12 - 14%
- > 14%

Example the Netherlands:

Relatively few farmers, relatively large food industry



Dependence on agriculture (farms) is largest in Eastern Europe

Contribution to GDP (%):
(UNECE and World Bank)

- 0 – 1%
- 1 – 2%
- 2 – 3%
- 3 – 5%
- 5 – 10%
- 10 – 20%
- > 20%

In 2016 the share of the Dutch food industry to world trade was 12% of the nation's GDP.

(source: The Netherlands Compared, facts and figures 2018)

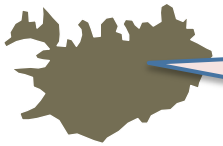
The processing industry dominates the export of Dutch agricultural products. After the USA, the Netherlands is the second largest exporter of agricultural products globally.

In 2018 the production by farmers and market gardeners in the Netherlands was 'only' 1.9% of the nation's GDP.

(source: UNECE 2019)

The north:
Agriculture is a small sector

Characteristics that stand out



Iceland: Agriculture produces sufficient meat and dairy products to satisfy domestic demand. Vegetables and flowers are mainly cultivated in greenhouses heated with geothermal water and steam.

Finland is the world's northernmost agricultural country. The growing season varies from less than 100 days in the north to 180 days in the south. In Central Europe, the thermal growing season lasts for 280 days. The growing season in Finland is too short for the cultivars grown elsewhere and frost-resistant varieties have been developed. However, Finnish cultivars do not yield as much as those in central and southern Europe.

Norway: Agricultural areas account for only 3% of the mainland.

Contribution to GDP (%):
(sources: UNECE and World Bank)

- 0 – 1%
- 1 – 2%
- 2 – 3%
- 3 – 5%
- 5 – 10%
- 10 – 20%
- > 20%

The south:
Large dependence on irrigation

Characteristics that stand out

Contribution to GDP (%):
(sources: UNECE and World Bank)

- 0 – 1%
- 1 – 2%
- 2 – 3%
- 3 – 5%
- 5 – 10%
- 10 – 20%
- > 20%

In **Italy and Spain**, irrigated agriculture contributes more than 50% to total agricultural production and more than 60% to the total value of agricultural products. The area irrigated, however, encompasses only 21% and 14% of total agricultural land in Italy and Spain respectively.

Over 90% of overall water consumption in **Greece, Portugal and Spain** is due to agriculture.

The east:
Large dependence on agriculture

Characteristics that stand out

Contribution to GDP (%):
(sources: UNECE and World Bank)

- 0 – 1%
- 1 – 2%
- 2 – 3%
- 3 – 5%
- 5 – 10%
- 10 – 20%
- > 20%

Hungary has agro-ecosystems on more than 80% of its territory. The role of the sector is much more significant in employment than it is indicated by the statistics, since the vast majority (almost 80%) of labour input used in agriculture is non-paid family workforce in Hungary. In 2010, Hungary became one of the top 5 exporters of maize in the world.

More than two thirds of the land area of **Ukraine** is being used for farming. Winter wheat is the largest crop in terms of area, dominating 95% of the agricultural land.

Agriculture is the most important sector in **Albania**, and accounts for about half of the employment. The main agricultural products are grains (especially wheat), vegetables, potatoes and beans (37%). Livestock constitutes more than half of the total value of agricultural production. In 2018, agriculture contributed 21,7% to the country's GDP.

Only 13% of the arable land in **Moldova** is irrigated. Agriculture is the most vulnerable sector of the Moldovan economy to climate change. The majority of the rural population depends either directly or indirectly on agriculture for their livelihoods.

The west:
Large agricultural industry

Characteristics that stand out

Contribution to GDP (%):
(sources: UNECE and World Bank)

- 0 – 1%
- 1 – 2%
- 2 – 3%
- 3 – 5%
- 5 – 10%
- 10 – 20%
- > 20%

Denmark: The agricultural cluster contributes 25% to the total Danish export of goods.

Germany: Following France and Italy, Germany is the third largest producer of agricultural goods in the European Union. In the last fifty years, agricultural yields in Germany have increased steadily and more than tripled since 1950.

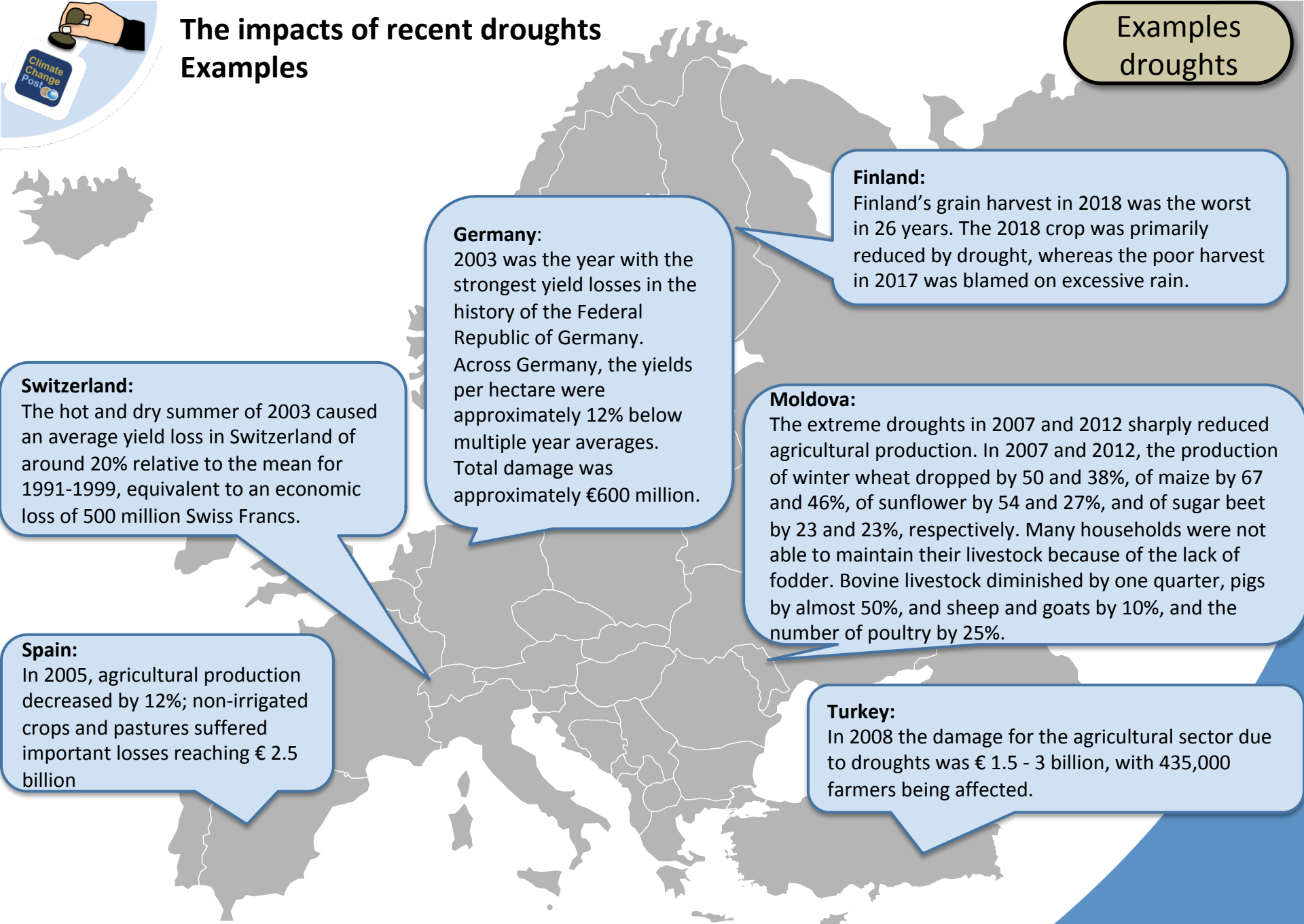
The **Netherlands** is the second largest exporter of agricultural products in the world (the US is number one). In 2018 the export of Dutch agricultural products was 90,3 billion Euros.

About 62% of the total land area of **Ireland** is used for agriculture. Some 80% of the agricultural land is devoted to grass (silage, hay and pasture), 11% to rough grazing and 9% to crop production. Beef and milk production currently account for 56% of agricultural output at producer prices.

Over the last years, **France** was the fifth largest producer of wheat and the second largest producer of barley in the world.

The impacts of recent droughts
Examples

Examples droughts



Finland:
Finland's grain harvest in 2018 was the worst in 26 years. The 2018 crop was primarily reduced by drought, whereas the poor harvest in 2017 was blamed on excessive rain.

Germany:
2003 was the year with the strongest yield losses in the history of the Federal Republic of Germany. Across Germany, the yields per hectare were approximately 12% below multiple year averages. Total damage was approximately €600 million.

Switzerland:
The hot and dry summer of 2003 caused an average yield loss in Switzerland of around 20% relative to the mean for 1991-1999, equivalent to an economic loss of 500 million Swiss Francs.

Moldova:
The extreme droughts in 2007 and 2012 sharply reduced agricultural production. In 2007 and 2012, the production of winter wheat dropped by 50 and 38%, of maize by 67 and 46%, of sunflower by 54 and 27%, and of sugar beet by 23 and 23%, respectively. Many households were not able to maintain their livestock because of the lack of fodder. Bovine livestock diminished by one quarter, pigs by almost 50%, and sheep and goats by 10%, and the number of poultry by 25%.

Spain:
In 2005, agricultural production decreased by 12%; non-irrigated crops and pastures suffered important losses reaching € 2.5 billion

Turkey:
In 2008 the damage for the agricultural sector due to droughts was € 1.5 - 3 billion, with 435,000 farmers being affected.

Sources: Keller and Fuhrer (2004); European Commission (DG Environment (2007); UNDP (2009); Potopová et al. (2016); Eye on the Arctic (March 15 2019); Özden (presentation)

The European Union's yield impacts by mid-century

Projections

Climate change is one of the factors that determine agricultural production

- Climate change
- Carbon dioxide
- Technical development
- Economics

Mid-century (compared with the period 1983-2006):

- Negative effects of climate change on yields of grain maize, potatoes, sugar beet, winter barley and winter wheat range between 12% and 34%, depending on the crop and region. Climate change effects are less pronounced for winter cereals (barley and wheat) as compared to tuber crops (potatoes and sugar beet) or other spring crops (maize).
- Higher CO_2 concentration stimulates yields in wheat, barley, sugar beet and potatoes by 14%, 11%, 14% and 7%, respectively.
- Most substantial yield changes due to technology development. The yield decreasing effect of climate change was compensated and partially superseded when higher CO_2 levels and technology development were taken into account.
- For the winter cereals yield increases of 30% and more are projected compared to the baseline for most European regions under the combined impacts of climate change, increasing atmospheric CO_2 concentration and technology development.
- For potatoes and sugar beet yield increases are also simulated for most regions in Europe except for some areas in Southern Europe (Italy, Greece and Spain), and few regions in Poland and Finland, but in most of the cases the decreases do not surpass 10% in relation to the baseline period 1983 – 2006.

Source: Angulo et al. (2013)

Vulnerabilities and opportunities - European yields

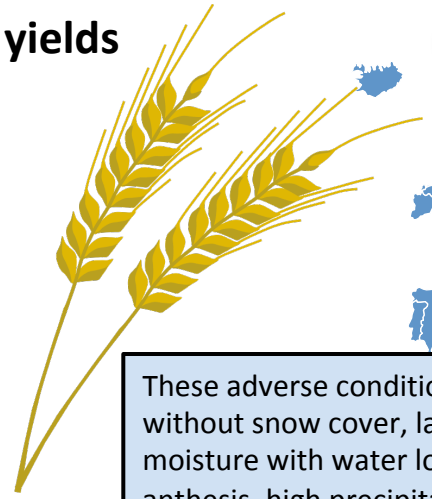
Projections

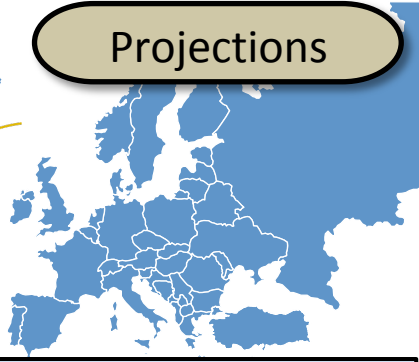
- Climate impacts in Europe are not necessarily all negative. They could be beneficial for many crops and areas of production. Climate change is likely to increase the yield of Europe's major agricultural cropping systems, with more favourable impacts in northern and central Europe.
- Strong regional differences with average crop impacts by the 2050s in northern Europe being higher (+14%) and more variable compared to central (+6%) and southern (+5%) Europe.

Sources: Reviews Iglesias et al. (2012) and Knox et al. (2016)

Vulnerabilities and opportunities - Wheat yields

Projections





European wheat production

- With 29% of global wheat production, Europe is the largest producer of wheat.
- Adverse conditions for the main European wheat-growing areas might substantially increase by 2060 compared to the present, which is likely to result in more frequent crop failure across Europe. This would have profound repercussions given the importance of European wheat production in the global food trade.
- For wheat, projected average yield increase by the 2050s is 14%. This increase is largely due to rising atmospheric CO_2 concentrations.
- Climate change is likely to increase cereal yields in Northern Europe but decrease yields in Southern Europe.

These adverse conditions are: severe winter frost without snow cover, late frost, excessive soil moisture with water logging from sowing to anthesis, high precipitation event with the possibility of widespread lodging, severely dry growing season (sowing–maturity), severe drought event between sowing and anthesis, severe drought event between anthesis and maturity, heat stress at anthesis, heat stress during grain filling, adverse conditions during sowing, adverse conditions during harvest.

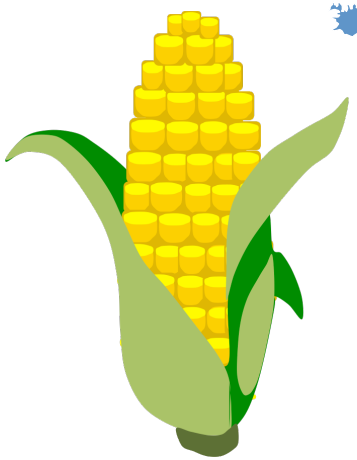
Most important: Heat stress and drought

With respect to the impacts of extreme events on wheat yield anomalies, heat stress is often the most important predictor, in general as important as drought. As a prominent exception, in the Mediterranean countries drought carries a larger detrimental effect on wheat yield than heat stress.

Source: IPCC (2014); Trnka et al. (2014); Knox et al. (2016)

Vulnerabilities and opportunities - Maize yields

Projections



Positive for northern Europe

- Warming has already caused a northward expansion of the area of silage maize in northern Europe into southern parts of Scandinavia. Grain maize is now grown in southern parts of Denmark, reflecting the warming trends. Maize yields have benefited from the longer growing season, especially in northern Europe.
- In contrast, warmer and more variable climatic conditions with increased occurrence of drought have reduced crop yields in parts of central Europe.
- A 30 to 50% increase in suitable area for grain maize production in Europe by the end of the 21st century, including Ireland, Scotland, southern Sweden and Finland.
- Projections for northern Europe show significant higher average yields for maize in the 2050s and 2080s: +12% and +19%, respectively, compared with the period 1961-1990.

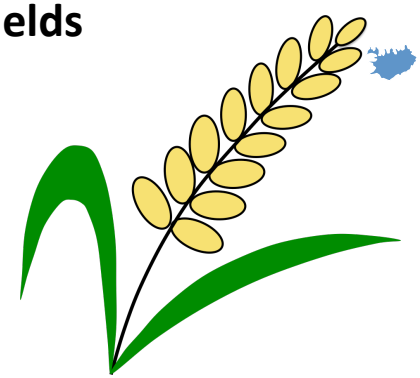
Negative for southern Europe

- The project decrease in average yield for maize in central Europe is 9% for the 2020s and 15% by the 2080s. Maize is projected to suffer the largest mean decrease in southern Europe, up to 28% by the 2080s.

Sources: Several sources in Bindi and Oleson (2011) and Oleson (2016); Knox et al. (2016)

Vulnerabilities and opportunities - Rice yields

Projections



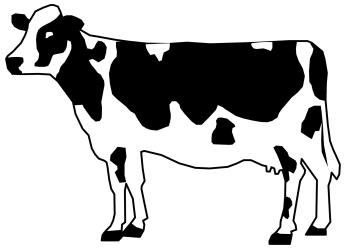
European rice production

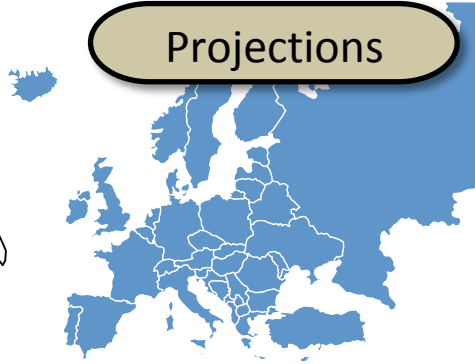
- Although not being a staple food crop in the European Union, rice consumption is steadily increasing in several Mediterranean countries. Italy, Spain, Greece, Portugal and France are the five top European producing countries.
- Average potential rice yield in 2 study areas (in Italy and France) is projected to decrease by 8% in 2030 and 12% in 2070 with respect to current conditions (the period 1991-2010 as a reference) if no adaptation strategies would be implemented. This impact would result from the shortening of the crop phenological phases due to temperature increase and the rising occurrence of heat stress during flowering and ripening due to temperature extremes.
- These yield decreases can be turned into yield increases, however, if adequate adaptation strategies are implemented. The study shows that climate change, rather than being a threat, represents an opportunity for European rice growers, as the implementation of adaptation strategies could overturn the situation, leading to an average yield increase of 28% in 2030 and 25% in 2070 with respect to current yields.
- The effective adaptation strategies are the adoption of varieties with longer crop cycle and, to a lesser degree, anticipated sowing dates.

Source: Bregaglio et al. (2017)

The impacts on livestock husbandry

Projections





Positive impacts:

Especially in northern Europe the grazing season will lengthen into autumn and into the early winter period. This may at least partially compensate for the reduced grazing opportunities in early spring (too much water after wetter winters) and summer (too much heat and drought conditions).

Negative impacts:

Housing period of ruminant livestock will be longer due to wetter winters and hotter summers (heat stress, less-productive pastures). Heat stress of livestock may increase.

More variable and extreme weather may have severe economic impacts on the fodder and feed market.

New parasite species and diseases as well as new or modified vectors to spread them represent new challenges for veterinary measures. For instance, Bluetongue disease risk will increase in northern and western Europe.

The impacts on livestock husbandry - Examples

Projections

Iceland:
The impacts of a warmer climate on animal husbandry are mostly positive: more time for grazing and less need for sheltering livestock during winters.

Sweden:
The conditions for keeping livestock will generally improve as a result of a warmer climate.

Russia:
Cattle breeding conditions will improve due to reduced stabling period and subsequent decline in farm heating costs, an increase of fodder base, and an expansion of pasture areas.

Norway:
The need for winter housing of livestock and feed concentrates may reduce. Introducing new species, like perennial ryegrass, may increase fodder quality, while animals simultaneously might enjoy prolonged grazing periods on fresh grassland.

Ukraine:
Conditions will become more favourable for green fodder. This will stimulate the forming of intensive dairy cattle production and meat livestock production.

Switzerland:
The longer grazing period, as well as new, adapted fodder plant mixtures may increase the potential of animal production. However, feed quality may decline and yield security decrease due to more frequent extreme events. Besides, the increase in heat days will cause problems for livestock husbandry.

The impacts on livestock husbandry - Examples

Projections

Norway:
Increased precipitation may negatively affect fitness of animals. warmer conditions will support the dispersal of disease-bearing insects or other host animals (including new vectors currently limited by colder temperatures) and enhance the survival of viruses, thus increasing risk of infections to livestock.

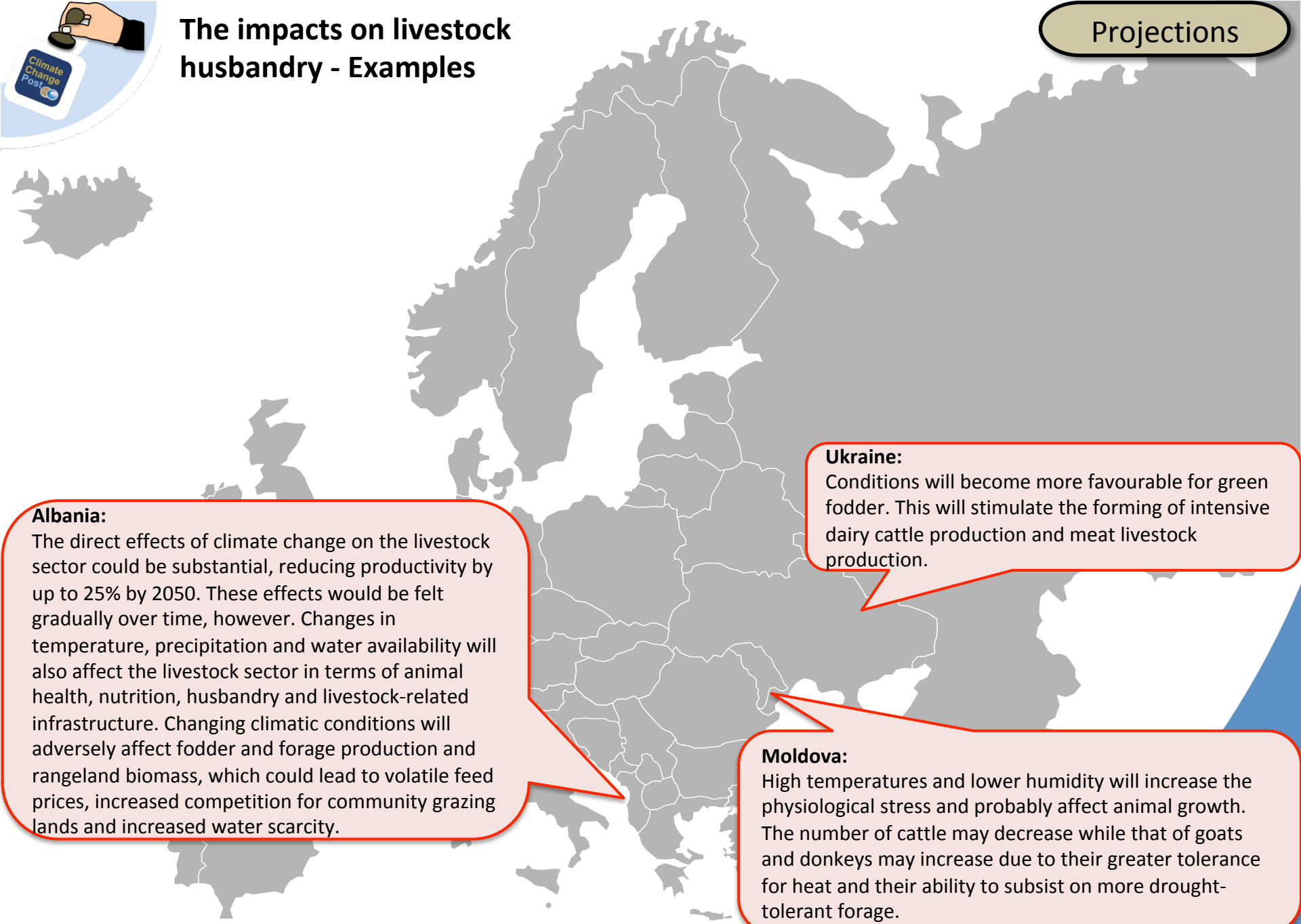
Finland:
The risk of animal diseases may increase, although the risk is expected to be very low. Diseases associated with the quality of water and feed may become more common. If the temperatures in sheds housing cattle and poultry rise very high, this would lead to a reduction in the milk yield of dairy cattle and in the growth of beef cattle and poultry.

The Netherlands:
'Blue-tongue' reached the Netherlands in 2006. As a result of climate change and international transports, outbreaks of other animal diseases that have not yet occurred in the Netherlands, are more likely in the future. The Netherlands are vulnerable to animal diseases because of high animal density, multiple transportations and many contacts abroad.

Italy:
Higher temperatures and more heat waves and droughts in the Mediterranean will reduce livestock productivity.

The impacts on livestock husbandry - Examples

Projections



Albania:
The direct effects of climate change on the livestock sector could be substantial, reducing productivity by up to 25% by 2050. These effects would be felt gradually over time, however. Changes in temperature, precipitation and water availability will also affect the livestock sector in terms of animal health, nutrition, husbandry and livestock-related infrastructure. Changing climatic conditions will adversely affect fodder and forage production and rangeland biomass, which could lead to volatile feed prices, increased competition for community grazing lands and increased water scarcity.

Ukraine:
Conditions will become more favourable for green fodder. This will stimulate the forming of intensive dairy cattle production and meat livestock production.

Moldova:
High temperatures and lower humidity will increase the physiological stress and probably affect animal growth. The number of cattle may decrease while that of goats and donkeys may increase due to their greater tolerance for heat and their ability to subsist on more drought-tolerant forage.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