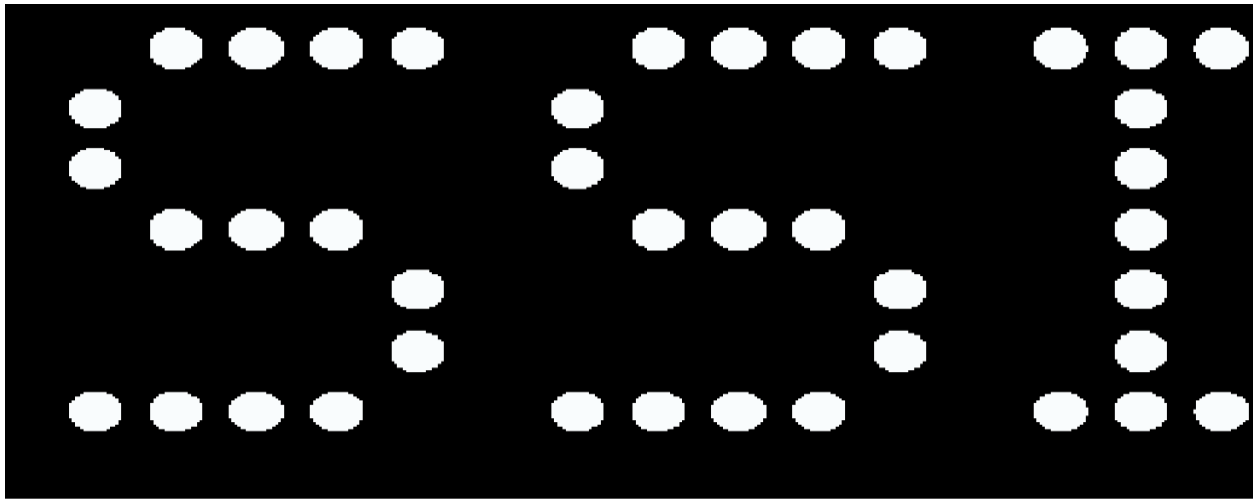
STATENS SERUM INSTITUT

# IMPACT OF CLMATE CHANGE ON HUMAN HEALTH
## – WITH A SPECIAL FOCUS ON EMERGING INFECTIONS

**SDU Climate Thursday Webinar**
Thursday 28 September, 2023

**Lasse S. Vestergaard, MD PhD**
Infectious Diseases Preparedness
Statens Serum Institut
Copenhagen, Denmark
E-mail: lav@ssi.dk



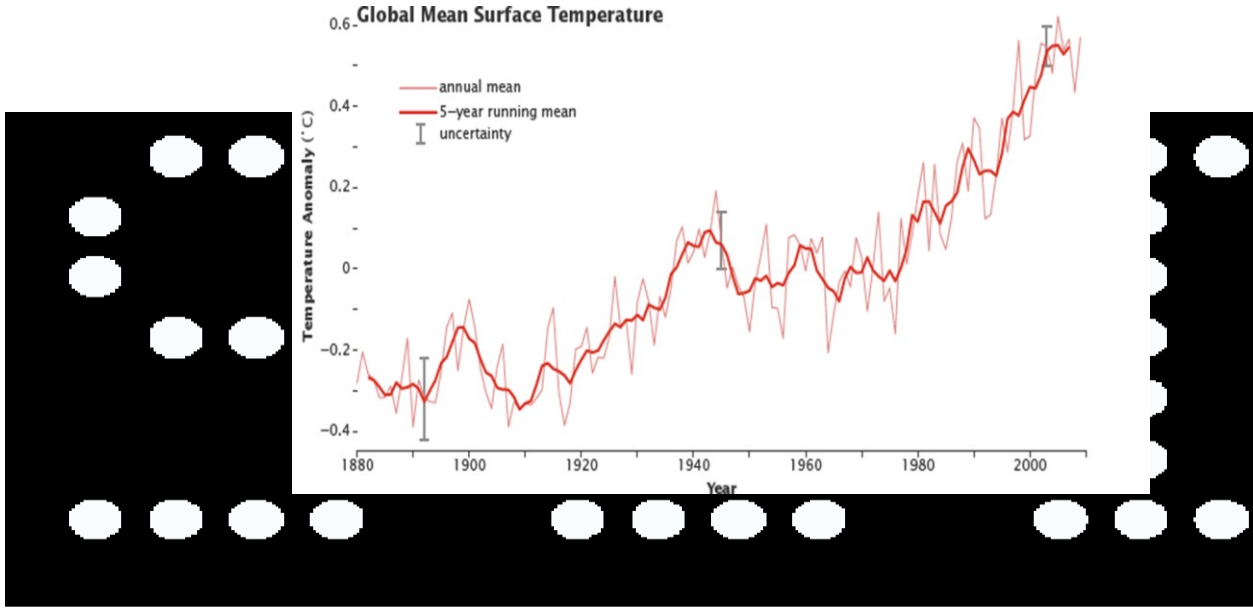
# CONTENT

STATENS SERUM INSTITUT

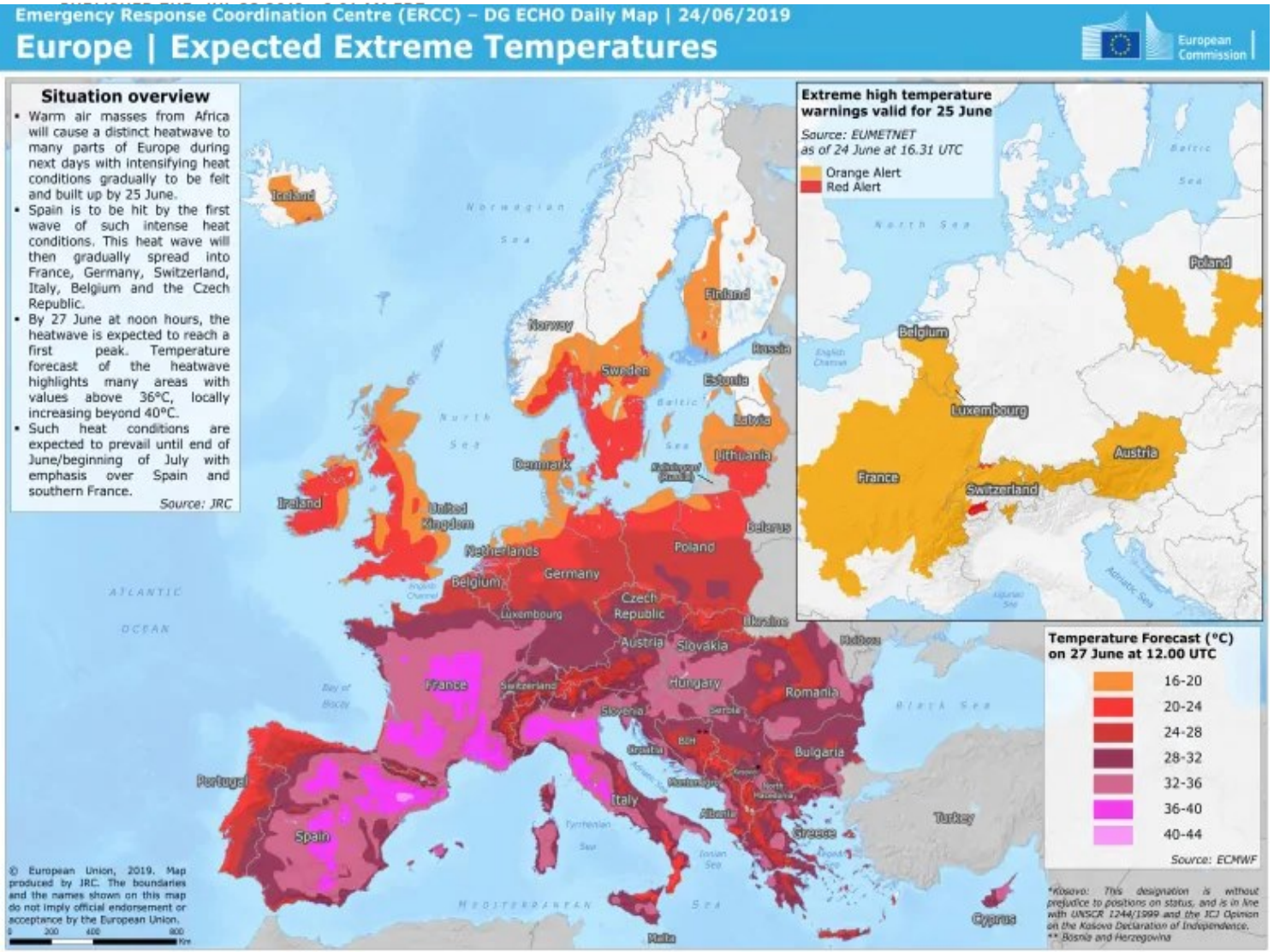
1. The impact of climate change on human health – cause and effects

2. Increasing temperatures and emerging infections – what do we have and what can we expect?

3. What do we do?



# Europe braces for another heatwave as forecasters predict record-breaking temperatures this week




WMO | OMM
@WMO

For the first time on record, #France sees a temperature above 45°C. Gallargues-le-Montueux recorded 45,9 °C, and Villevieille 45.1°C this afternoon. In France. in June. @meteofrance bit.ly/31X81LI #heatwave #climatechange


The temperature in France on June 28 surpassed 45 degrees Celsius (113 degrees F major heatwave, state weather forecaster Meteo France said. Another bout of extre
*ZAKARIA ABDELKAFI | AFP | Getty Images*

**Ekstrem varme og smitsomme sygdomme:** Klimaforandringer har kæmpe konsekvenser for vores helbred

Stor international klimarapport er dystert nyt for vores sundhed.

Ifølge rapporten dade 345.000 mennesker over 65 år på verdensplan af varme alene i 2019. (Foto: ALISHA JUCEVIC © Ritzau Scanpix)

DR VIDEN KROPPEN **KLIMA** TEKNOLOGI NATUR SAMMEN I BEVÆGELSE

# **Ekstrem varme og smitsomme sygdomme:** Klimaforandringer har kæmpe konsekvenser for vores helbred

Stor international klimarapport er dystert nyt for vores sundhed.

Ifølge rapporten døde 345.000 mennesker over 65 år på verdensplan af varme alene i 2019. (Foto: ALISHA JUCE
Scanpix)

Review

The 2021 report of the *Lancet* Countdown on health and climate change: code red for a healthy future

THE LANCET

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REVIEW | ONLINE FIRST

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The 2021 report of the *Lancet* Countdown on health and climate change: code red for a healthy future

Marina Romanello, PhD · Alice McGushin, MSc · Claudia Di Napoli, PhD · Paul Drummond, MSc · Nick Hughes, PhD · Louis Jamart, MSc · et al. Show all authors

Published: October 30, 2021 · DOI: https://doi.org/10.1016/S0140-6736(21)01787-6 · Check for updates

PlumX Metrics

# The Lancet Countdown Report, 2019

For the ***Lancet*** **report** see https://www.thelancet.com/climate-and-health

and for more on the **accompanying materials** see www.lancetcountdown.org

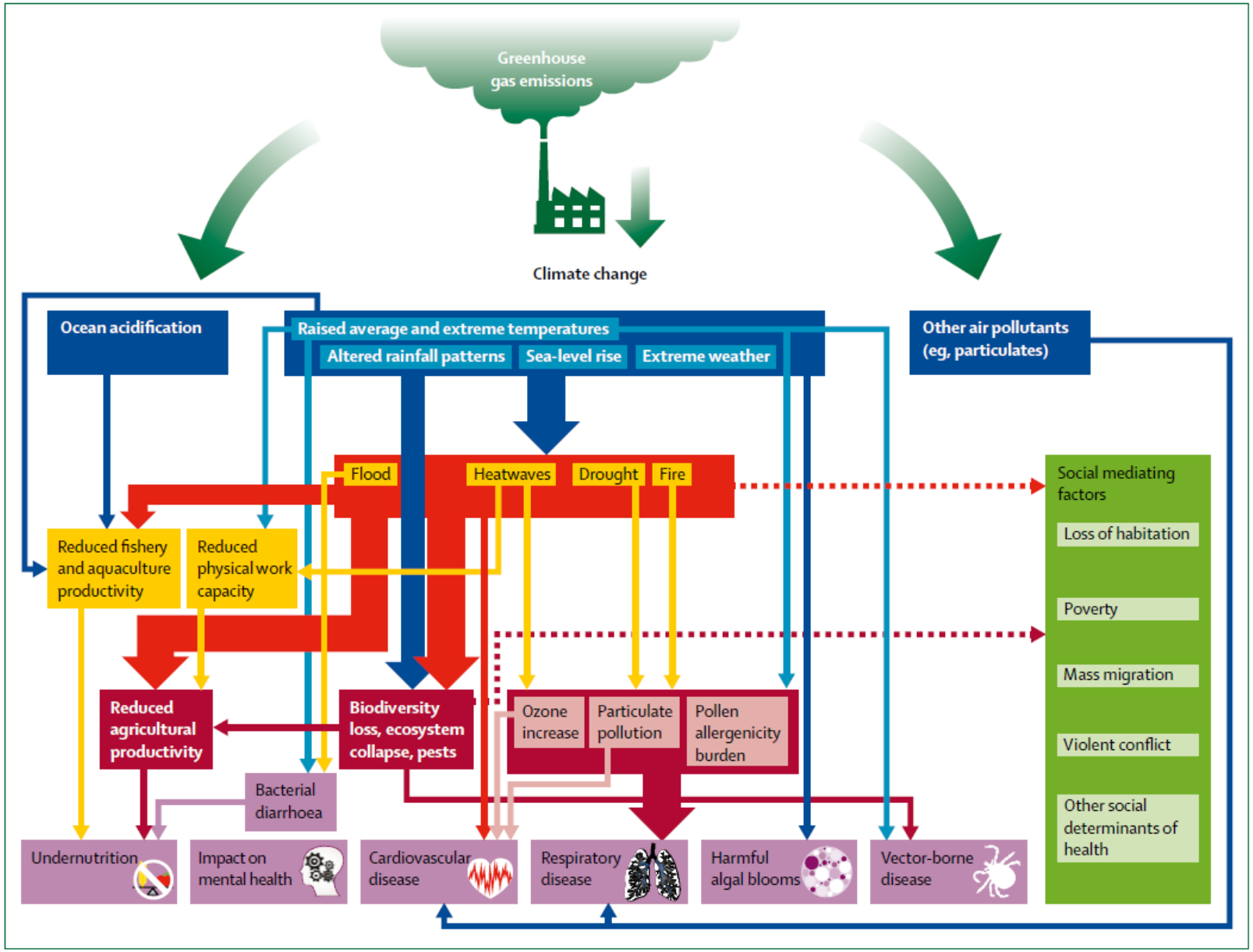
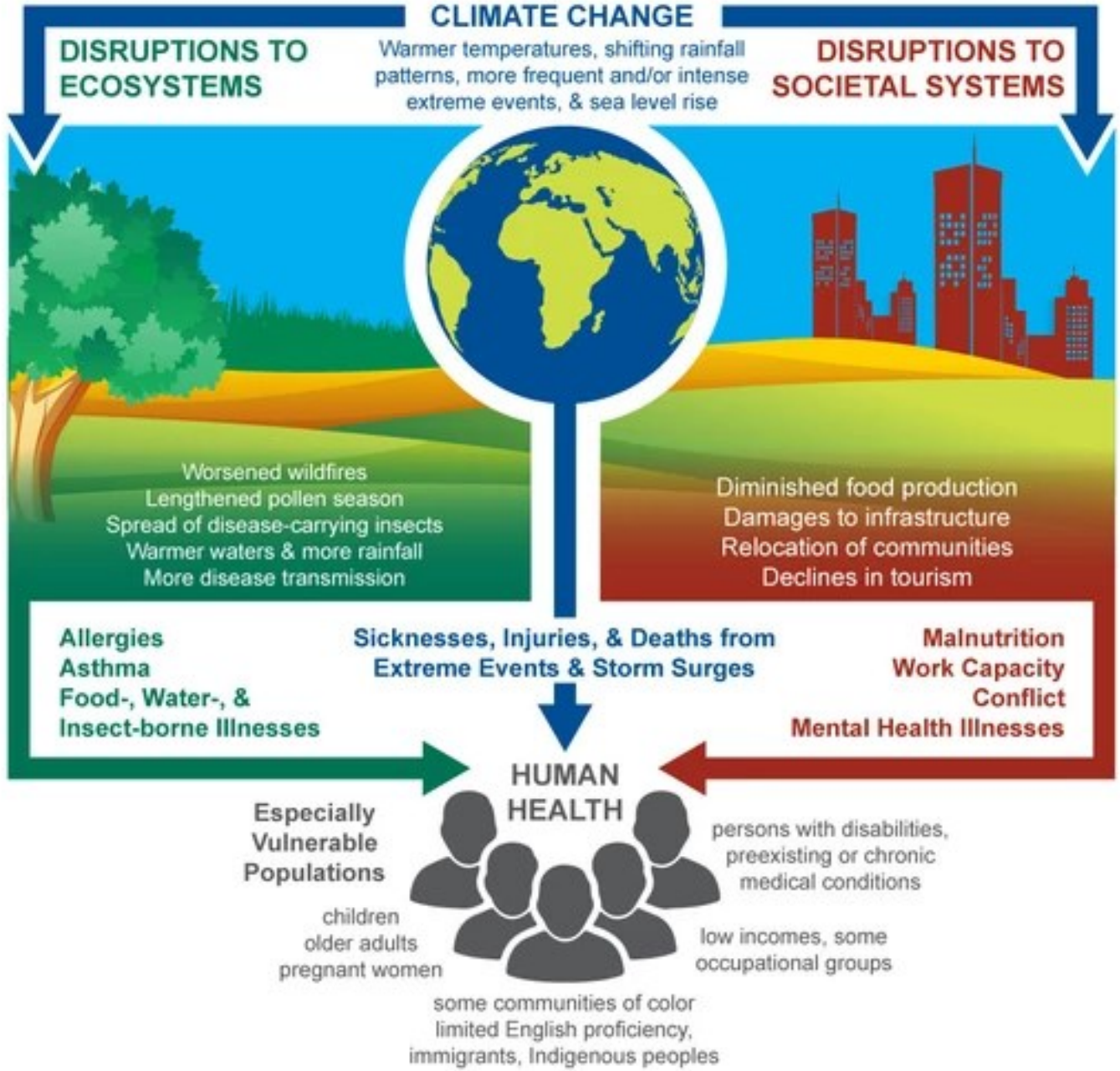
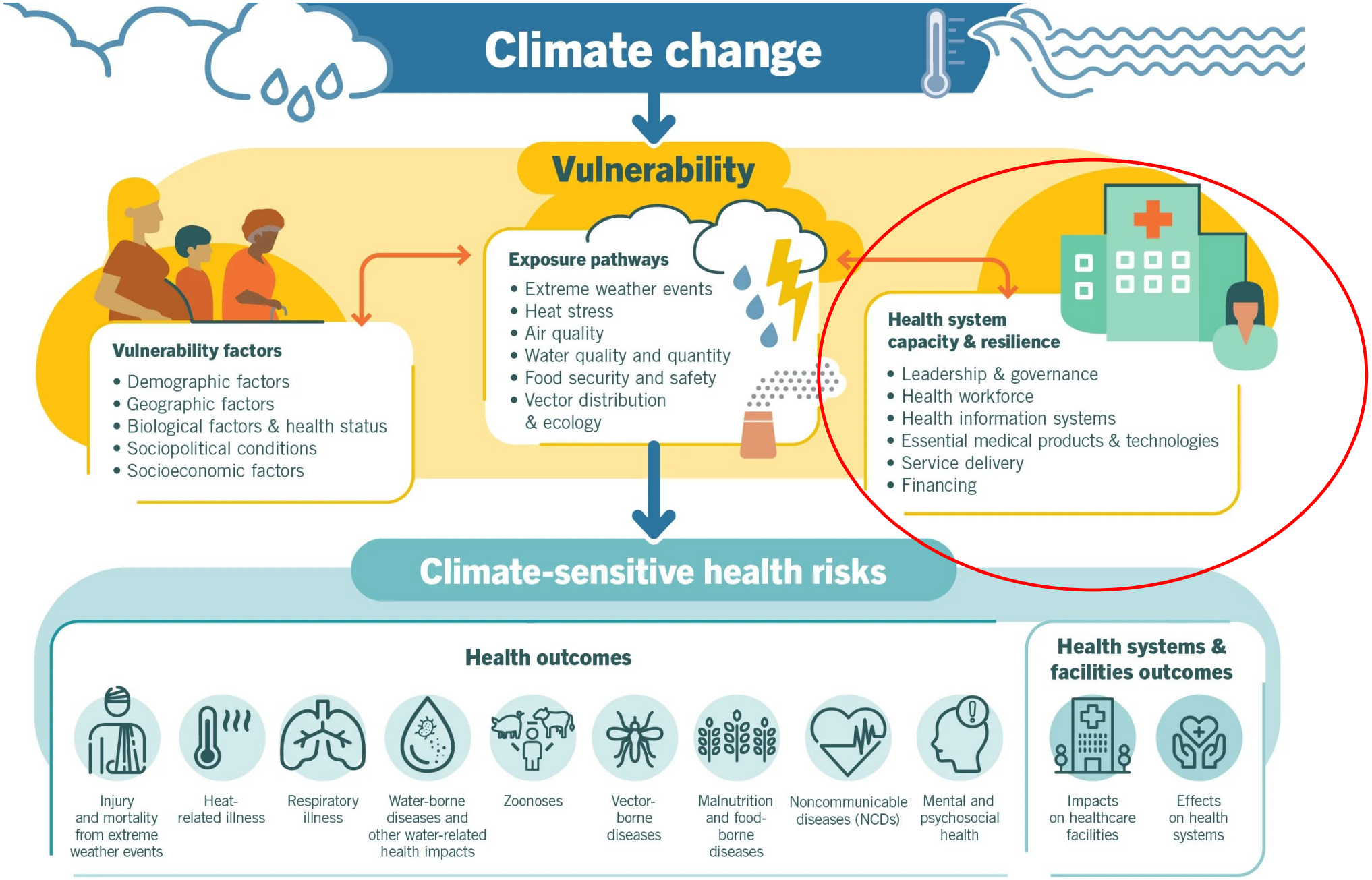



*Figure 1:* The pathways between climate change and human health

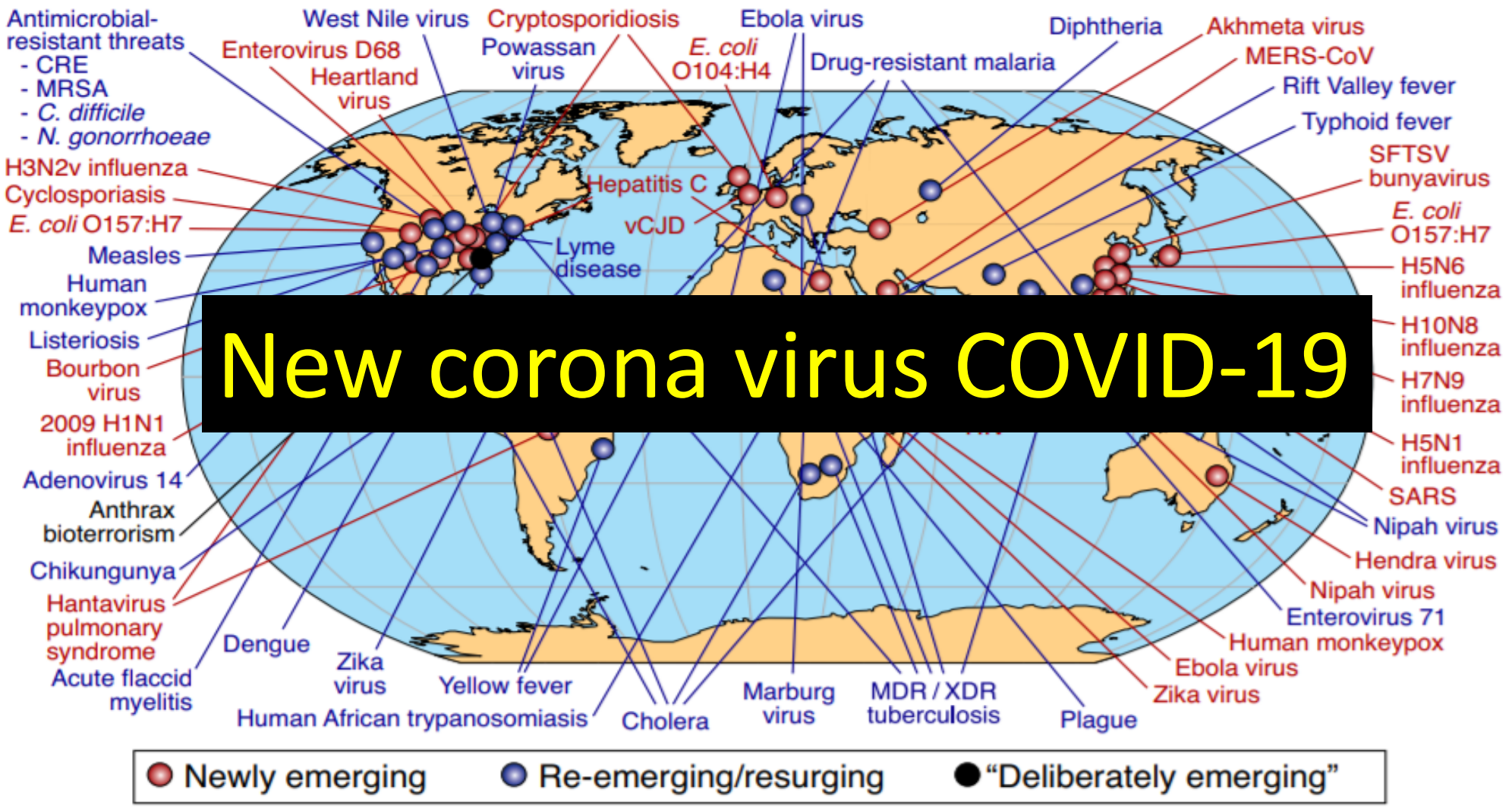
# The Impacts of Climate Change on Human Health




Climate change
Vulnerability
Vulnerability factors
• Demographic factors
• Geographic factors
• Biological factors & health status
• Sociopolitical conditions
• Socioeconomic factors
Exposure pathways
• Extreme weather events
• Heat stress
• Air quality
• Water quality and quantity
• Food security and safety
• Vector distribution & ecology
Health system capacity & resilience
• Leadership & governance
• Health workforce
• Health information systems
• Essential medical products & technologies
• Service delivery
• Financing
Climate-sensitive health risks
Health outcomes
Injury and mortality from extreme weather events
Heat-related illness
Respiratory illness
Water-borne diseases and other water-related health impacts
Zoonoses
Vector-borne diseases
Malnutrition and food-borne diseases
Noncommunicable diseases (NCDs)
Mental and psychosocial health
Health systems & facilities outcomes
Impacts on healthcare facilities
Effects on health systems

# Infectious diseases with epidemic potential

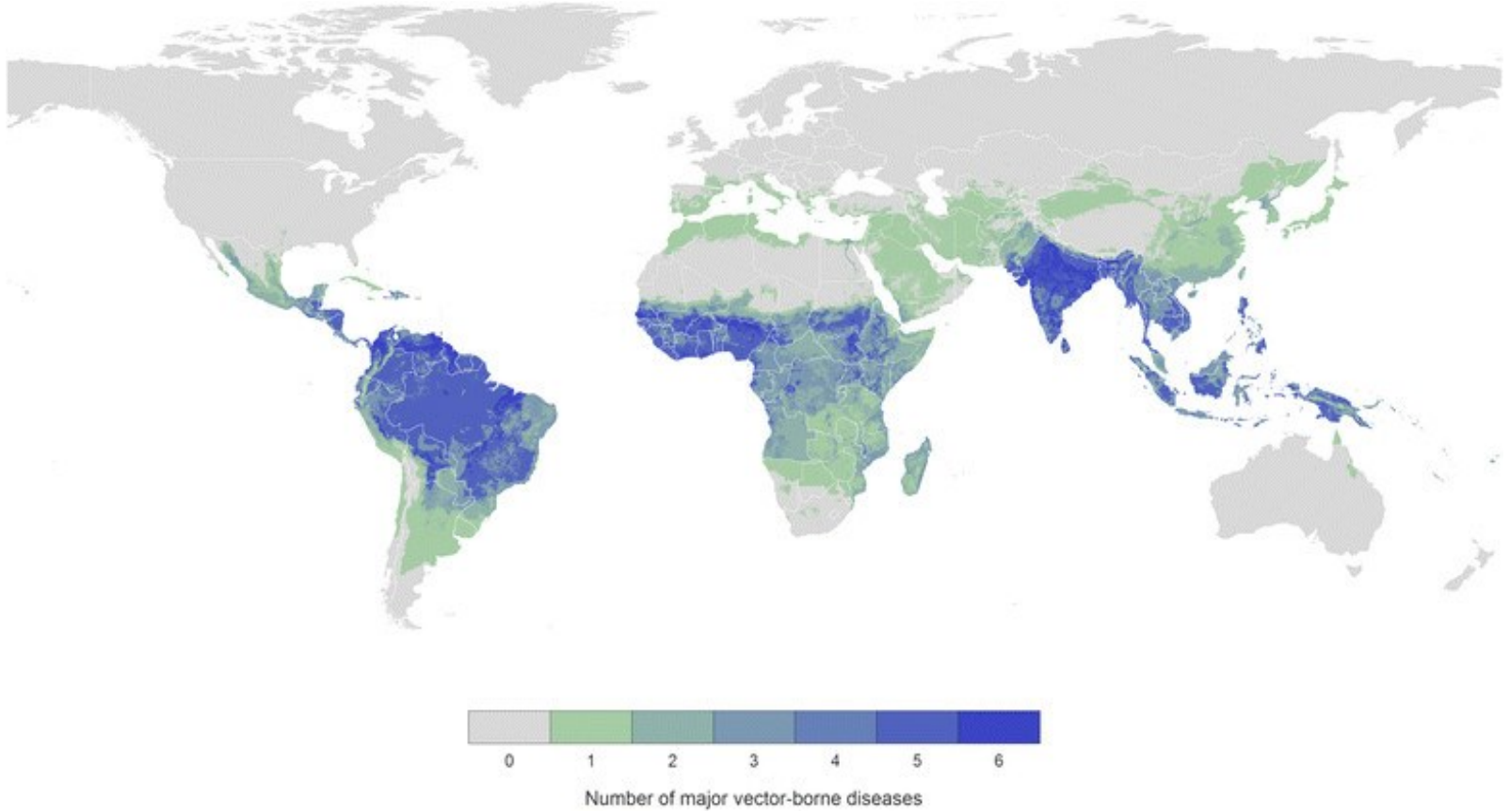
**FIGURE 1** Global examples of emerging and re-emerging diseases




**New corona virus COVID-19**

# Examples of global vectorborne diseases - temperature does matter!

- Dengue fever virus
- Chikungunya virus
- Zika virus
- West Nile virus
- Malaria
- Leishmaniasis
- Trypanosomiasis
- Filariasis
- Borreliosis
- Tick-borne encephalitis (TBE)

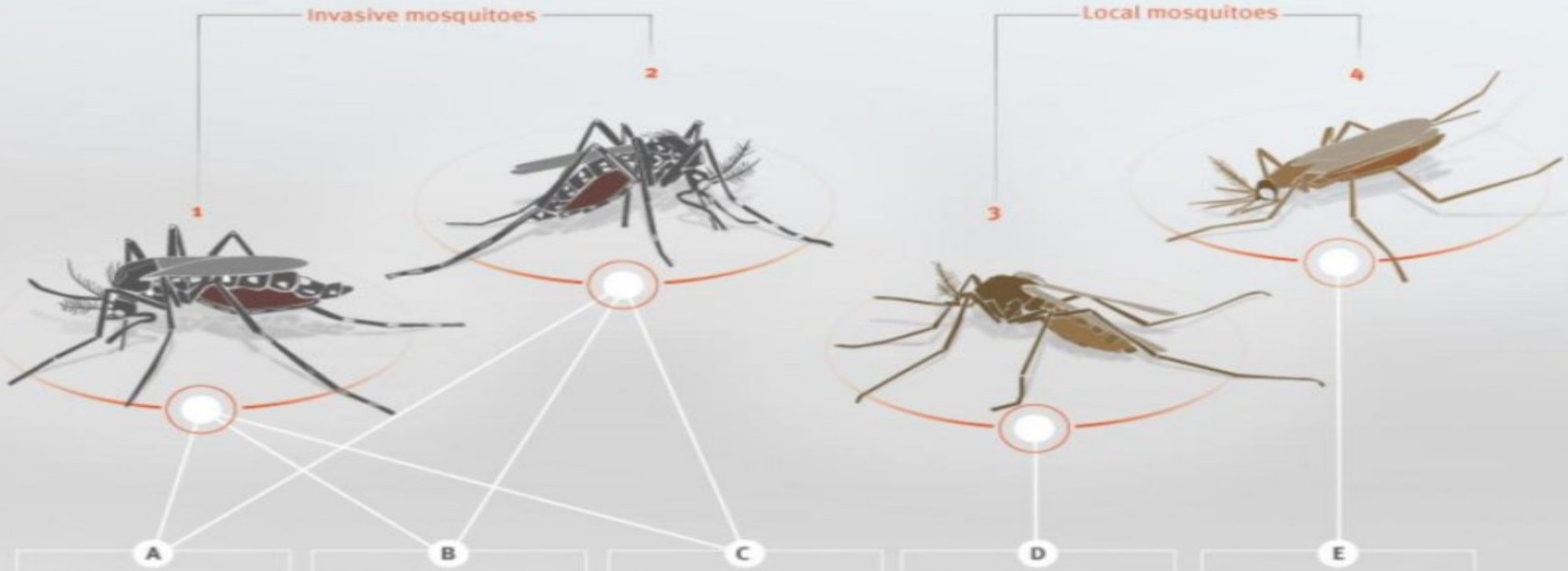


# Mosquito-borne infections – what have we?

## Just one bite away from infection

**Different species of mosquitoes can carry different diseases**

**Invasive mosquitoes** are characterised by their ability to colonise new territories. A considerable increase in the spread of invasive mosquitoes has been observed in Europe since the late 1990s.




1. After its disappearance in the 20th century in Europe, ***Aedes aegypti*** has recently become established in Madeira. It is also present in some areas around the Black Sea coast.

2. ***Aedes albopictus*** is considered to be the most invasive mosquito species in the world. It is present in much of southern Europe.

3. ***Culex pipiens*** is the most widespread mosquito in Europe.

4. The ***Anopheles*** mosquito can be found from south-eastern Sweden to Portugal.

**Chikungunya**
Infected people suffer from fever and severe joint pain, which can last for months.

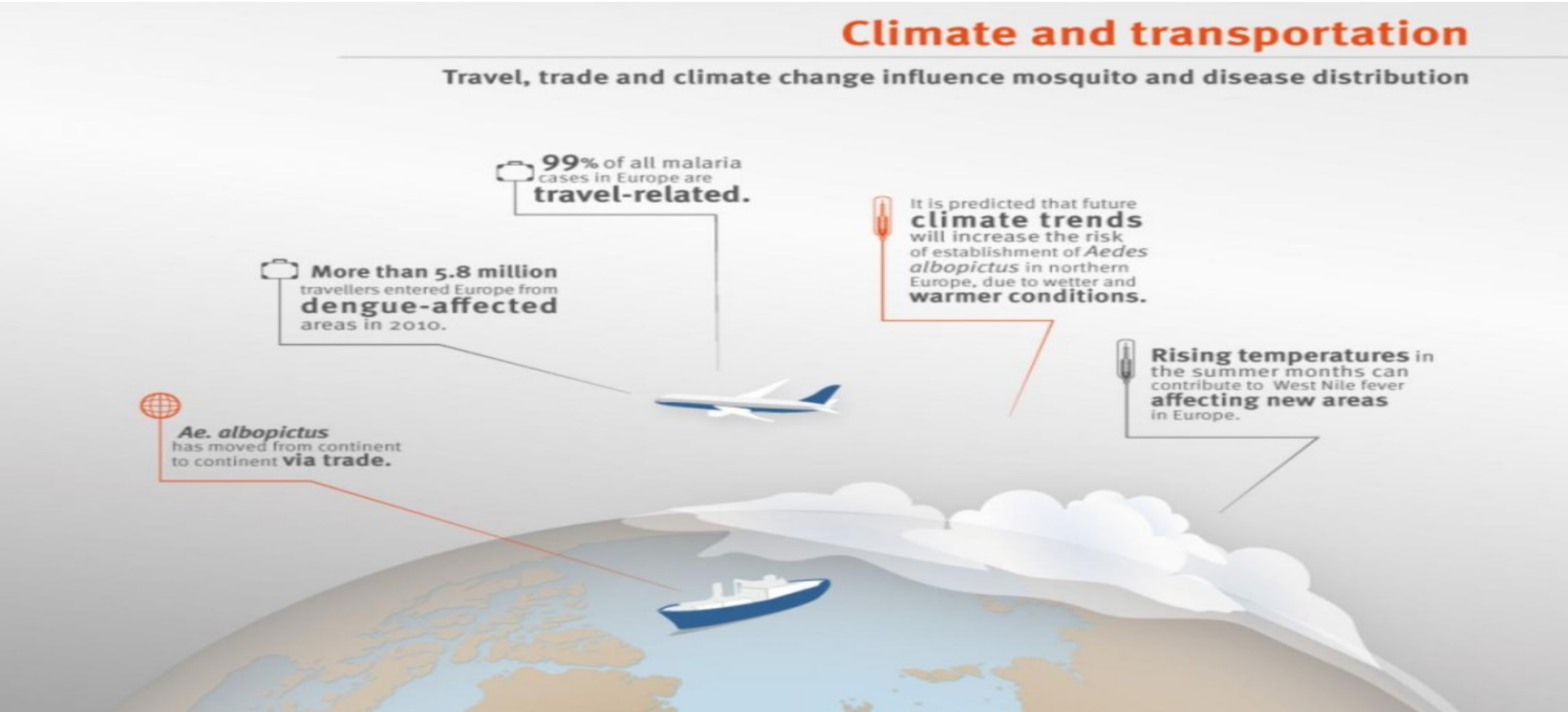
**Zika**
Mild disease with low fever and rash- but most cases are asymptomatic. The risk of serious complications have been identified for some.

**Dengue**
Most infected people have fever lasting seven days. More than 390 million cases are estimated worldwide per year. The most important mosquito-borne disease affecting humans.

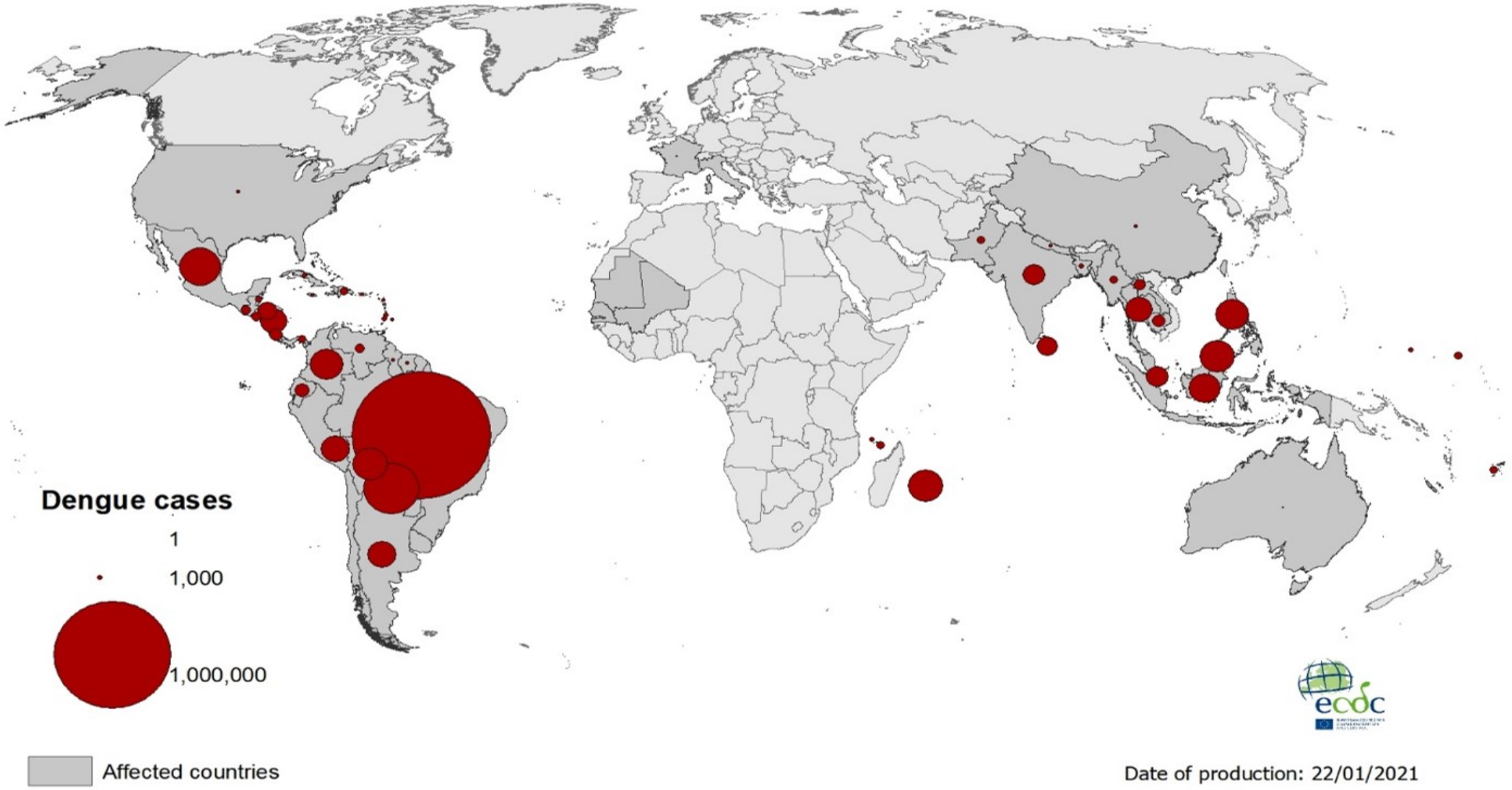
**West Nile fever**
Cases can be severe, most often among the elderly. An estimated 1 out of 140 to 320 persons infected can get severely sick.

**Malaria**
Worldwide, approx. 450 000 deaths every year. Early diagnosis and prompt treatment can prevent illness and death. Prophylaxis is available.

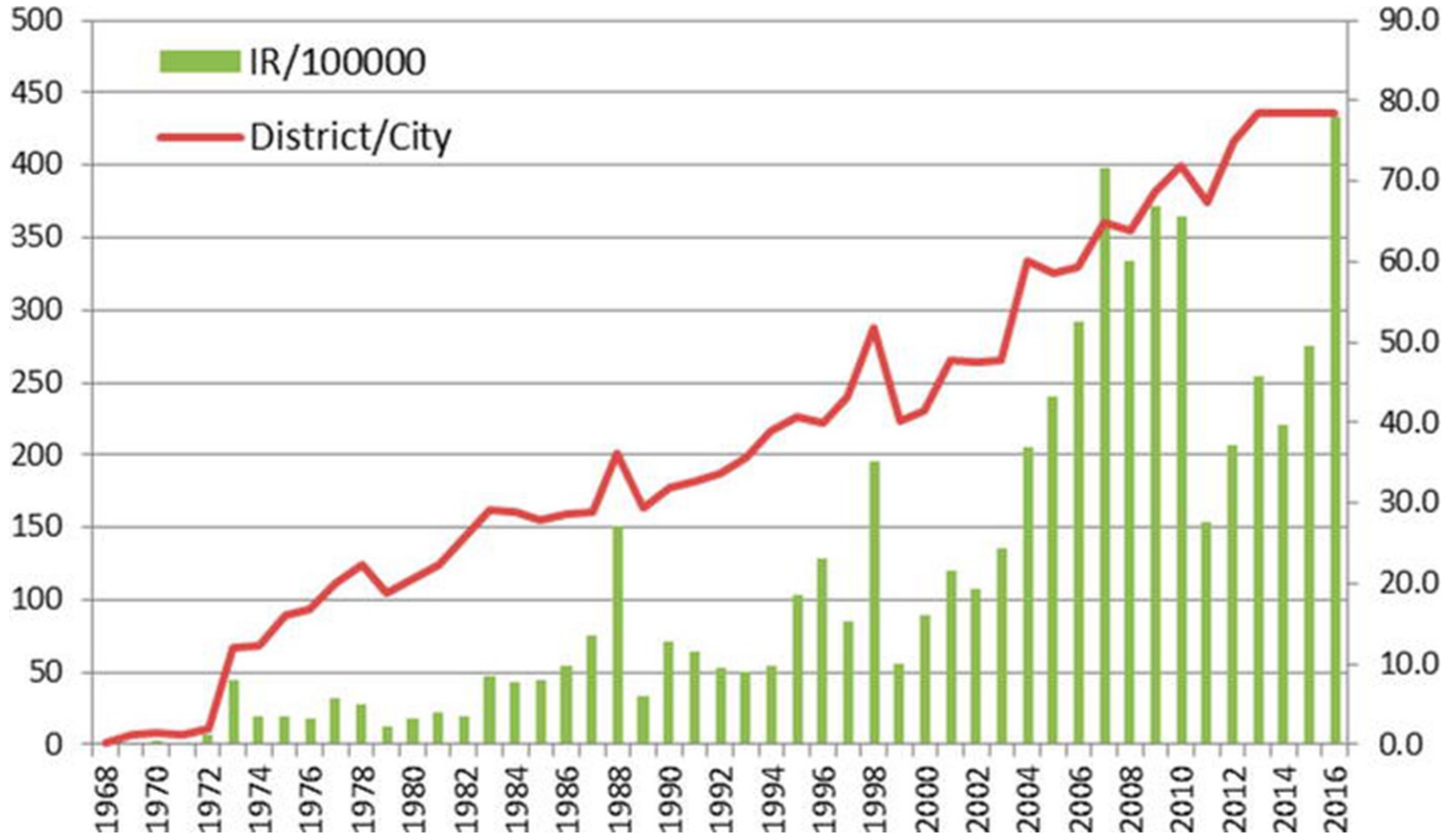
# Climate change and globalization promotes vectorborne diseases



# Dengue cases globally



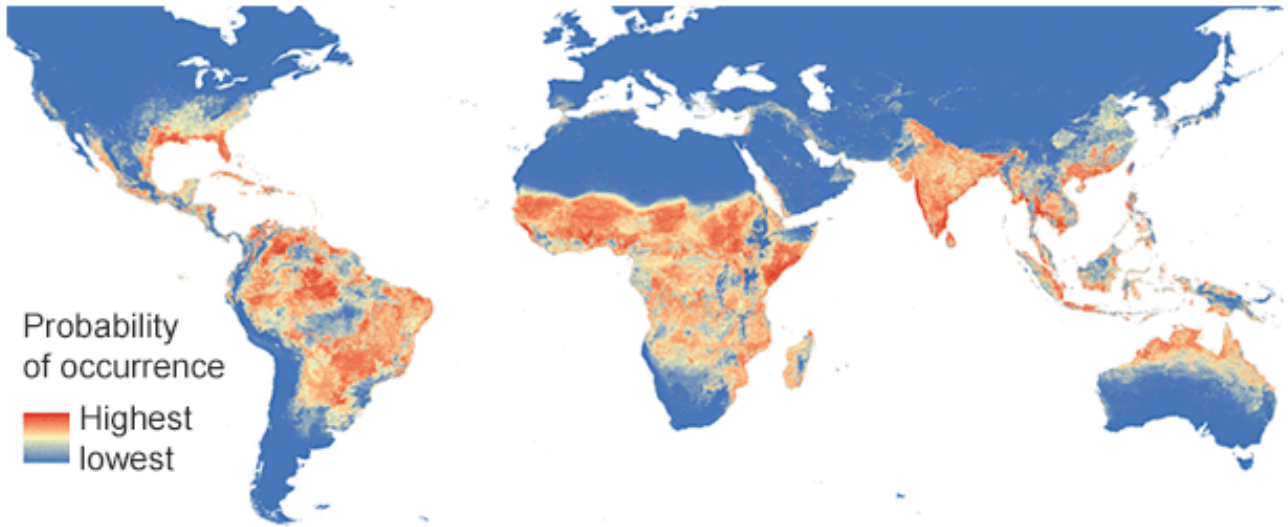
# Example: Dengue cases in Indonesia



## Global distribution of Aedes mosquitoes

Aedes aegypti and Aedes albopictus can spread the Zika virus if infected with it

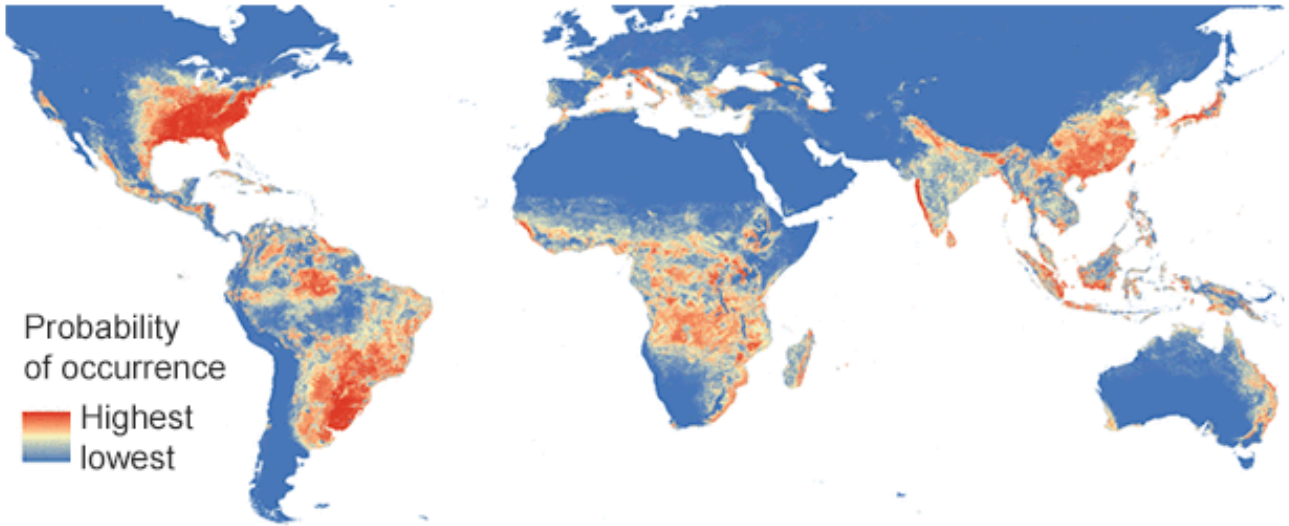
### Aedes aegypti mosquito




***Aedes aegypti***

**Gul Feber myggen**

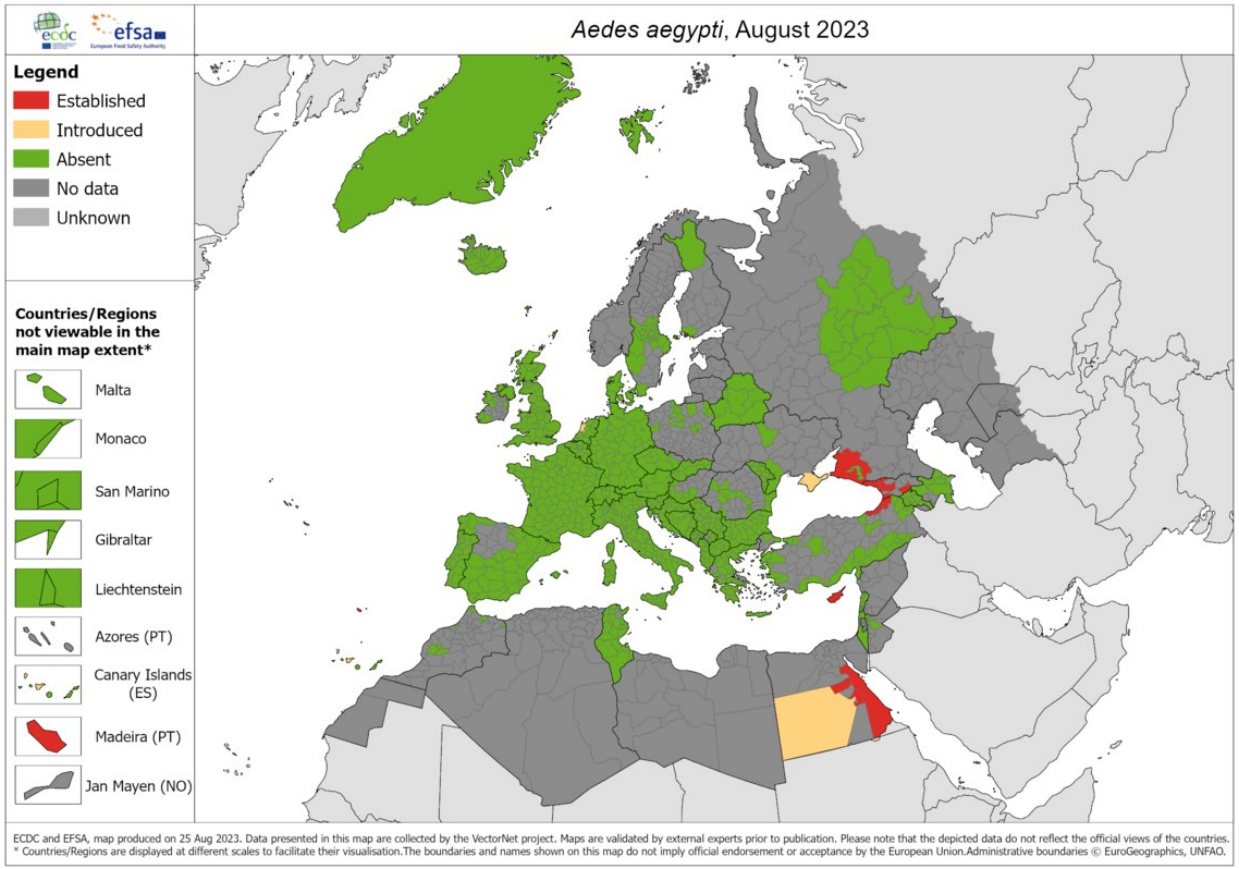
### Aedes albopictus mosquito



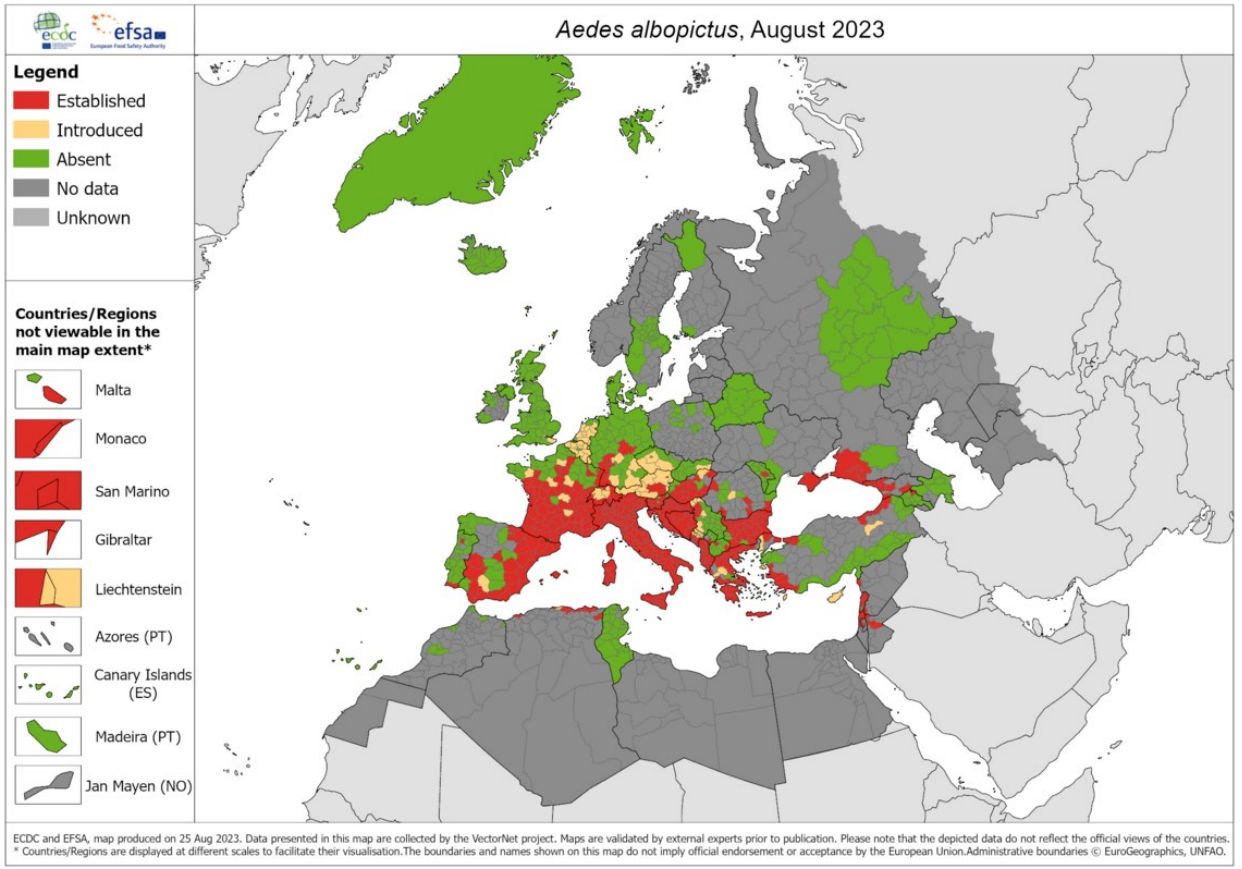

***Aedes albopictus***

**Tiger myggen**

# Distribution of *Aedes* mosquitoes in Europe, 2023




*Aedes aegypti*




*Aedes albopictus*

## Vectorital Capacity (VC)

**Definition:**
Degree of transmission from person to person via infective mosquito bites

***Used to estimate dengue epidemic potential (DEP)***

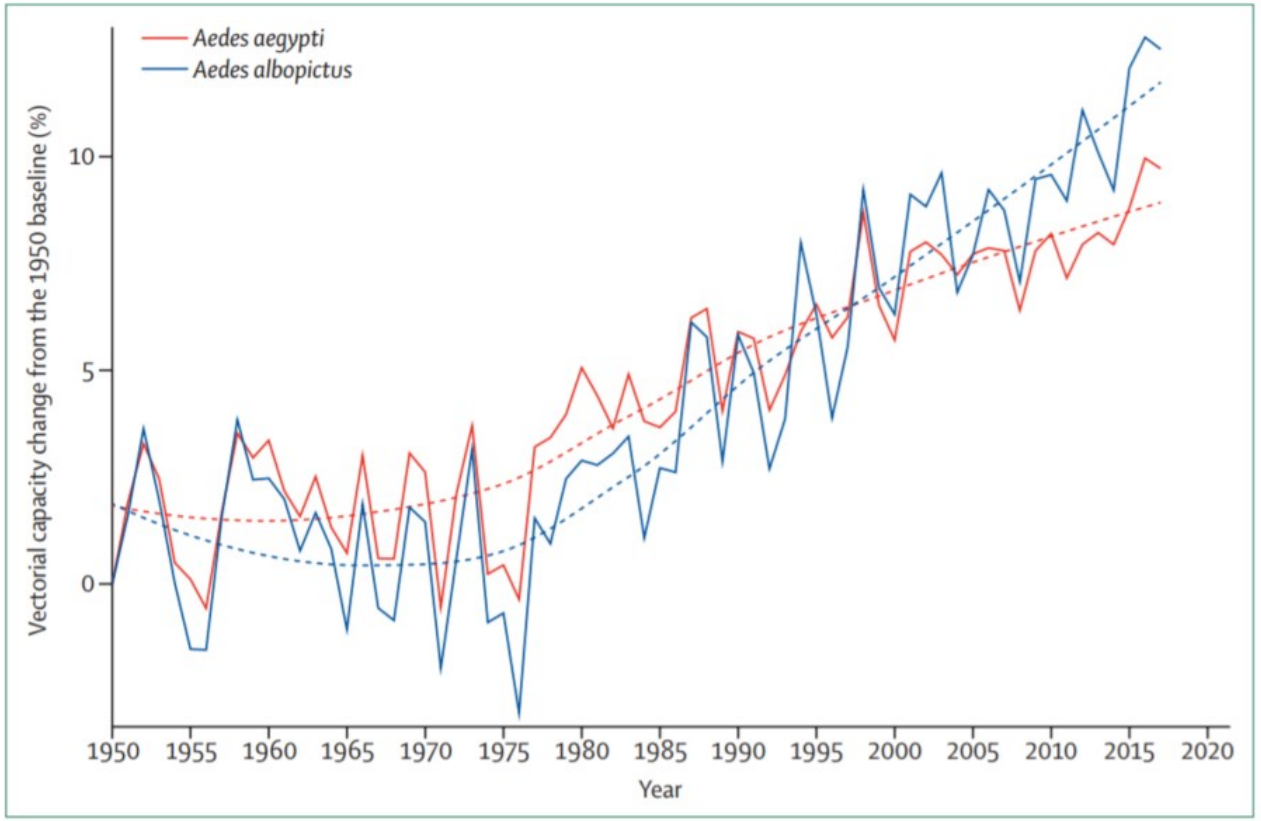



*Figure 6*: Changes in global vectorial capacity for the dengue virus vectors *Aedes aegypti* and *Aedes albopictus* since 1950

Lancet Countdown Report, 2019

# Vectorial capacity (VC) in selected cities

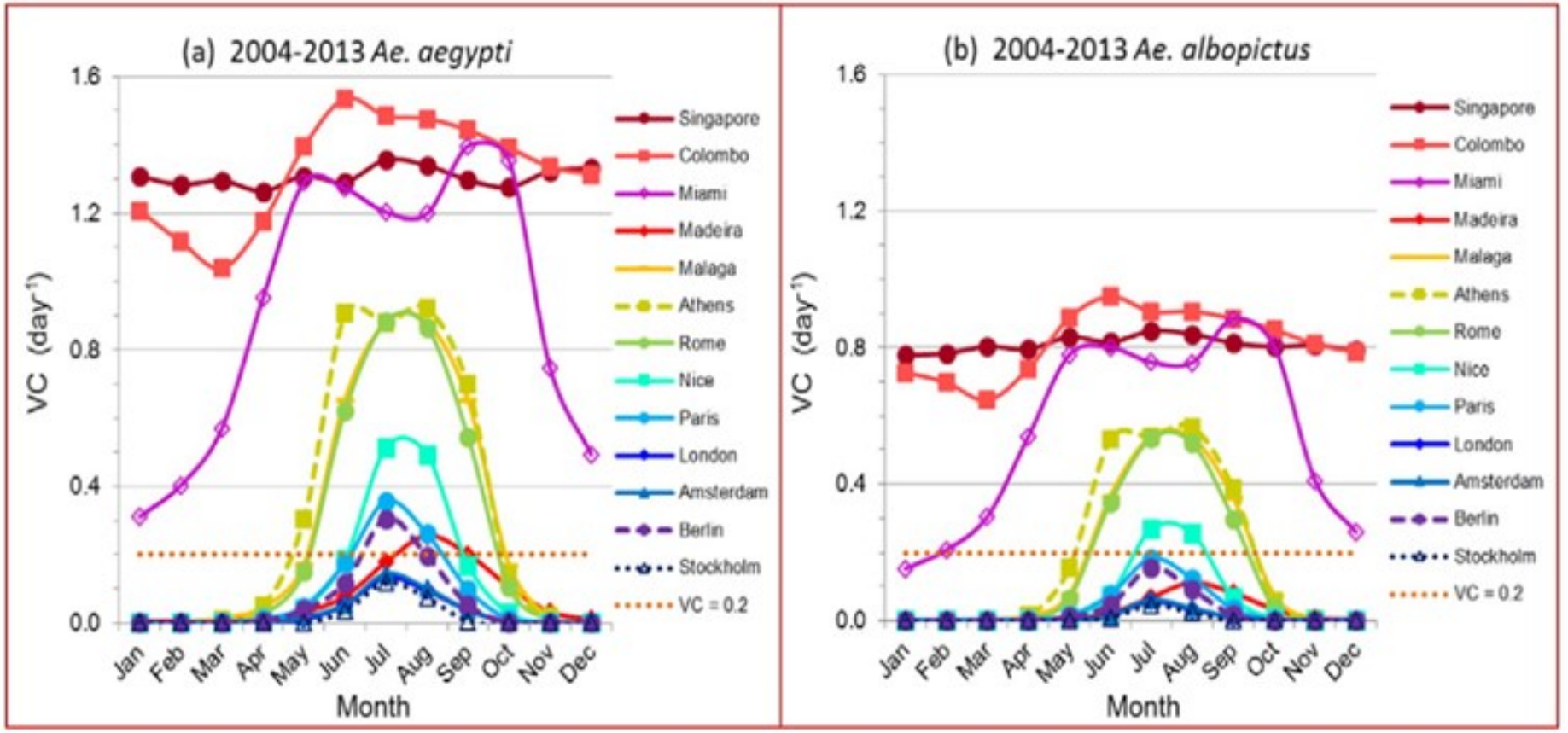
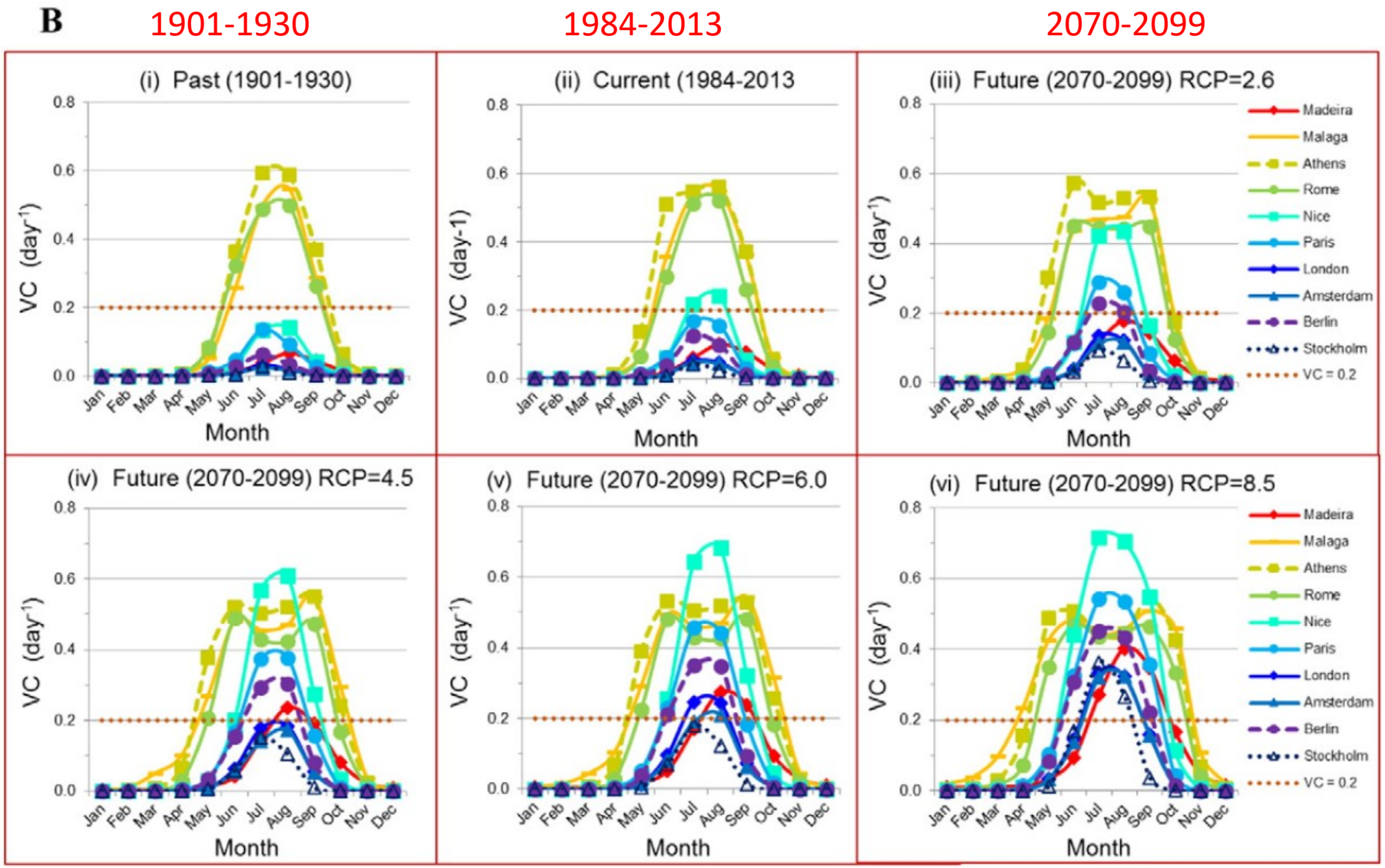



**Fig. 2.** Seasonality of *VC* for 13 selected cities for *Ae. aegypti* (a) and *Ae. albopictus* (b). *VC* was averaged over the recent 10-year period (2004–2013) for each month of the year. DTR was included and $m_{max} = 1.5$ where $m$ is the female vector to human population ratio. CRU-TS3.22 monthly gridded ($0.5 \times 0.5°$) temperature data (Jones et al., n.d.) were used.

# Models of increasing vectorial capacity (VC) with increasing greenhouse gas concentration (RCP) – *Aedes albopictus*



# Global heating driving spread of mosquito-borne dengue fever

**Record numbers across Asia and Americas infected as rising temperatures extend disease to places once seen as safe**

● **'Mystery illness' comes to the hill villages of Nepal**

▲ Asian tiger mosquito (Aedes albopictus). Photograph: Gordon Zammit/Alamy


| Year | Country | Department or regions affected | Number of autochthonous cases | Probable period of virus circulation | References |
|---|---|---|---|---|---|
| **2010** | Croatia | Korčula Island and the Pelješac peninsula | 10 | August–October | [1-3] |
| **2010** | France | Alpes-Maritimes department | 2 | August–September | [4-6] |
| **2013** | France | Bouches–du-Rhône department | 1 | September-October | [6,7] |
| **2014** | France | Var and Bouches-du-Rhône departments | 4 | July-September | [6,8] |
| **2015** | France | Gard department | 8 | July–September | [6,9,10] |
| **2018** | France | Alpes Maritimes, Hérault, and Gard departments | 8 | September–October | [6,11] |
| **2020** | France | Hérault, Var, Alpes-Maritime, and Gard departments | 13 | July-October | [18-20] |
| **2020** | Italy | Veneto region | 10 | August | [21] |
| **2021** | France | Var and Hérault departments | 2 | July and September | [22, 23] |
| **2022** | France | Pyrénées-Orientales, Hautes-Pyrénées, Haute-Garonne, Tarn et Garonne, Var, Alpes-Maritime, and Corsica departments | 65 | June- September | [24,25] |
| **2022** | Spain | Ibiza | 6 | August-October | [26] |
| **2023** | France | Bouches–du-Rhône (4 cases), Pyrénées-Orientales (11 cases), Gard (1 case), Alpes-Maritimes or Var (1 case) departments. | 17 | July-August | [27] |
| **2023** | Italy | Lodi (21 cases), Rome (4 cases) and Latina (2 cases) provinces. | 27 | End of July-August | [28] |
| **2023** | Spain | Catalonia region (1 case) | 1 | August | - |

# Local transmission af Zika virus in France, 2019

**European Centre for Disease Prevention and Control**
An agency of the European Union

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Home > News & events > Epidemiological update: second case of locally acquired Zika virus disease in Hyères, France

News & events

## Epidemiological update: second case of locally acquired Zika virus disease in Hyères, France

Epidemiological update

23 Oct 2019

**On 21 October, French authorities reported a second autochthonous case of Zika virus (ZIKV) disease in Hyères city, Var department, France with no travel history to Zika-endemic countries.**

On 21 October, French authorities reported a second autochthonous case of Zika virus (ZIKV) disease in Hyères city, Var department, France with no travel history to Zika-endemic countries.

The case was identified through door-to-door active case-finding and resides in the close vicinity of the first case. The patient reported symptoms compatible with ZIKV disease (i.e. fever, asthenia, retro-orbital pain and body rash) starting on 6 August 2019, a few days before the onset of symptoms of the first case. Both patients have now recovered.

Aedes albopictus

### Risk Assessment

This new case reinforces the hypothesis of vector-borne transmission of ZIKV in this neighbourhood of Hyères city

## Read more

**Rapid risk assessment: Zika virus disease in Var department, France**

16 Oct 2019 - On 1 October 2019, a case of locally acquired Zika virus

Surveillance and disease data
Weekly updates: 2019 season
About seasonal surveillance
Seasonal surveillance: By year
Annual epidemiological report

# Weekly updates: 2019 West Nile virus transmission season

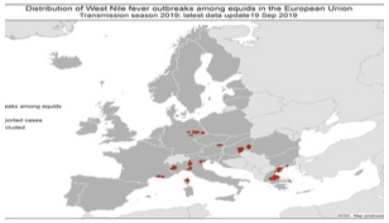
Map

## Situation update

Between 13 and 19 September 2019, EU Member States reported 49 human cases in Greece (23), Ro



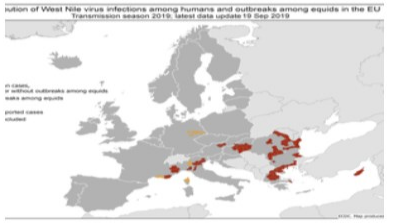
## Weekly updates



### West Nile virus in Europe in 2019 - equine cases, updated 20 September

Nine outbreaks among equids were reported during the week to the Animal Disease Notification System (ADNS) by Germany (4), France (2), Italy (2) and Hungary (1).

Read more >



### West Nile virus in Europe in 2019 - human and equine cases, updated 20 September

Between 13 and 19 September 2019, EU Member States reported 49 human cases in Greece (23), Romania (18), Italy (4), Hungary (3) and Austria (1). EU neighbouring countries reported two cases in Serbia.

### West Nile virus in Europe in 2019 - human cases, updated 20 September

Between 13 and 19 September 2019, EU Member States reported 49 human cases in Greece (23), Romania (18), Italy (4), Hungary (3) and Austria (1). EU neighbouring countries reported two cases in Serbia.

Read more >

# During the 2018 prolonged summer heat wave in Europe – a West Nile virus ”annus horribilis!

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**European Centre for Disease Prevention and Control**
An agency of the European Union

NEW

## Unusual large number of West Nile virus infections in the EU/EEA and EU neighbouring countries

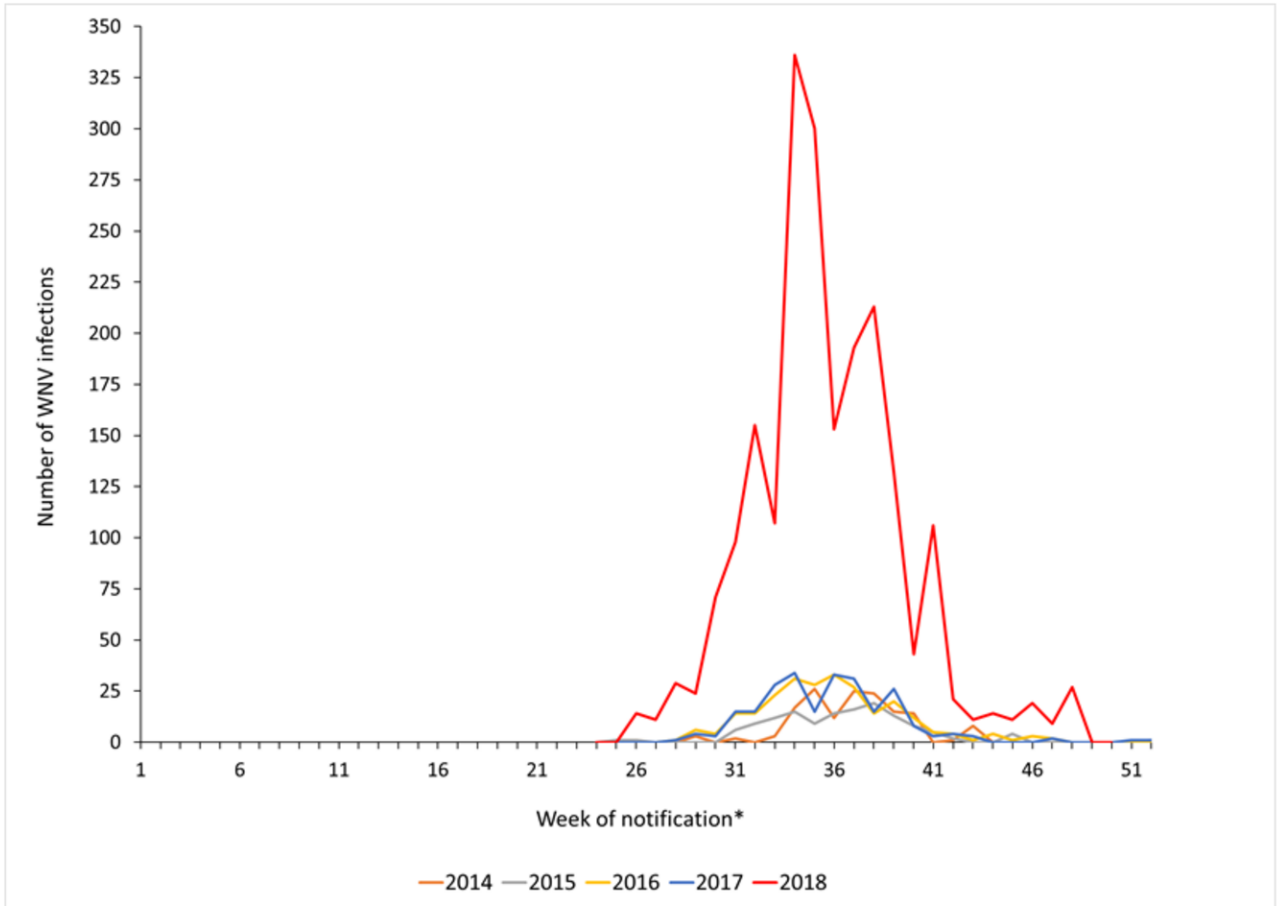
Epidemiological update

31 Aug 2018

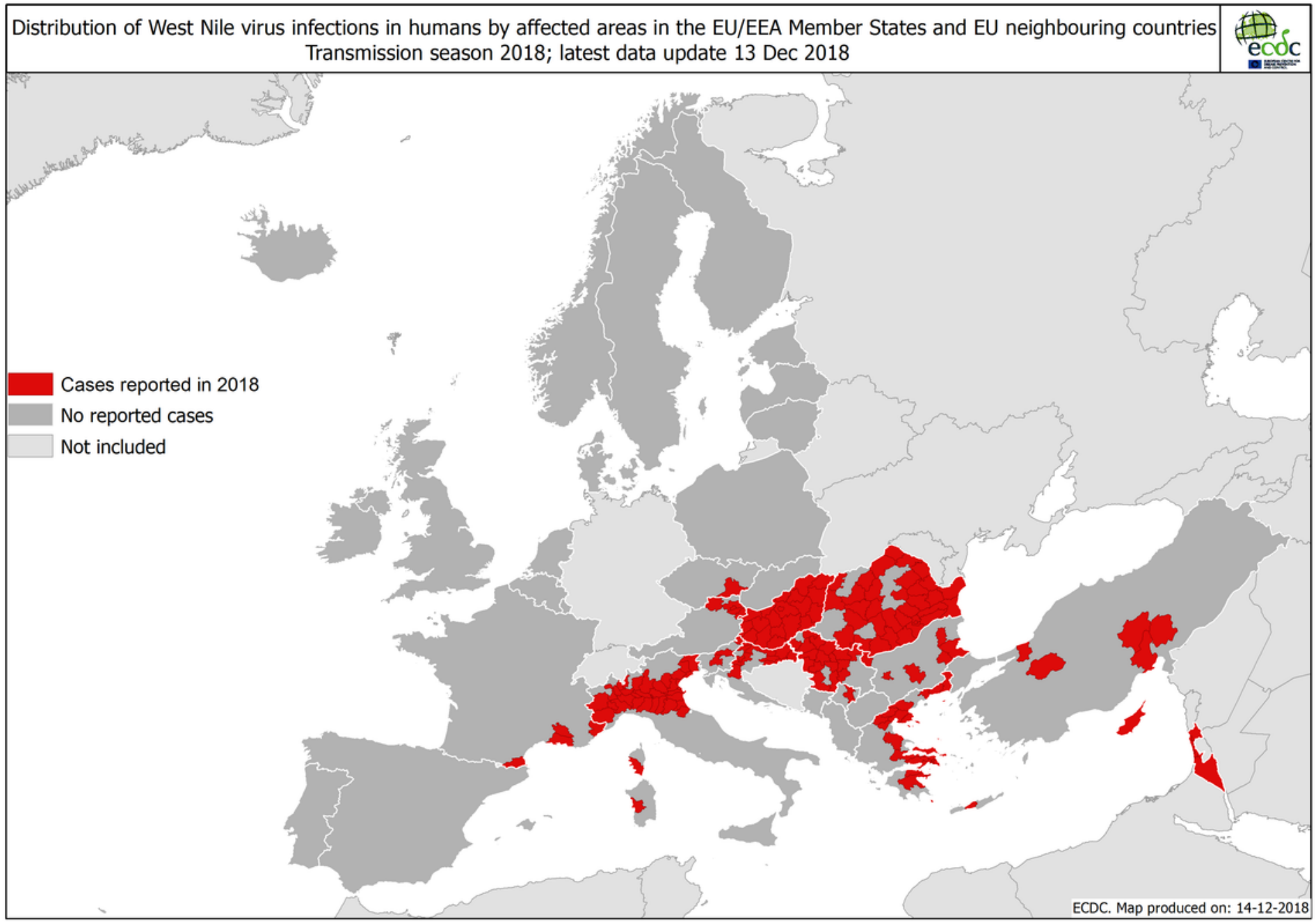
Translate this page

In 2018, as of 30 August 2018, 975 confirmed and probable autochthonous human WNV infections were reported by European countries: 710 in EU/EEA Member States and 265 in EU neighbouring countries. Italy reported 327 cases, Serbia 213, Greece 147, Romania 117, Hungary 96, Israel 49, France 11, Austria 8, Croatia 3, Kosovo 3 and Slovenia 1.

Number of WNV infections in EU/EEA and EU enlargement countries by epidemiological week of notification*, 2014-2018.




2015: 122 cases 2016: 226 cases 2017: 201 cases 2018: 1549 cases 2019: 425 cases


Distribution of West Nile virus infections in humans by affected areas in the EU/EEA Member States and EU neighbouring countries
Transmission season 2018; latest data update 13 Dec 2018
ecdc
Cases reported in 2018
No reported cases
Not included
ECDC. Map produced on: 14-12-2018

# Areas with reported human West Nile virus cases, 2022

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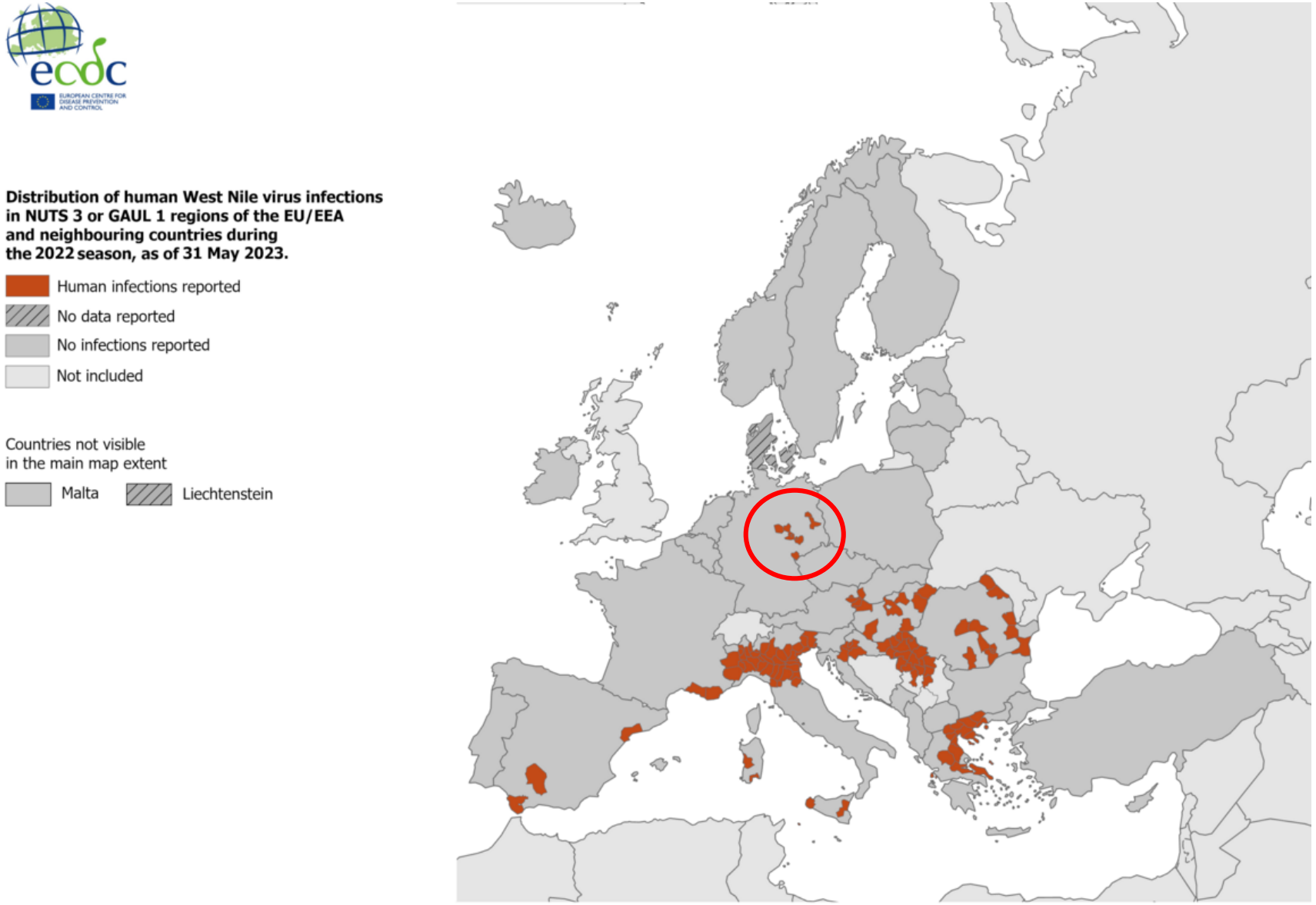


# West Nile virus reaches Germany in 'sign of climate change'

Unusually warm summers mean mosquitos carrying deadly infection moving further north

**Tim Wyatt** | @tswyatt | Friday 27 September 2019 17:08 |

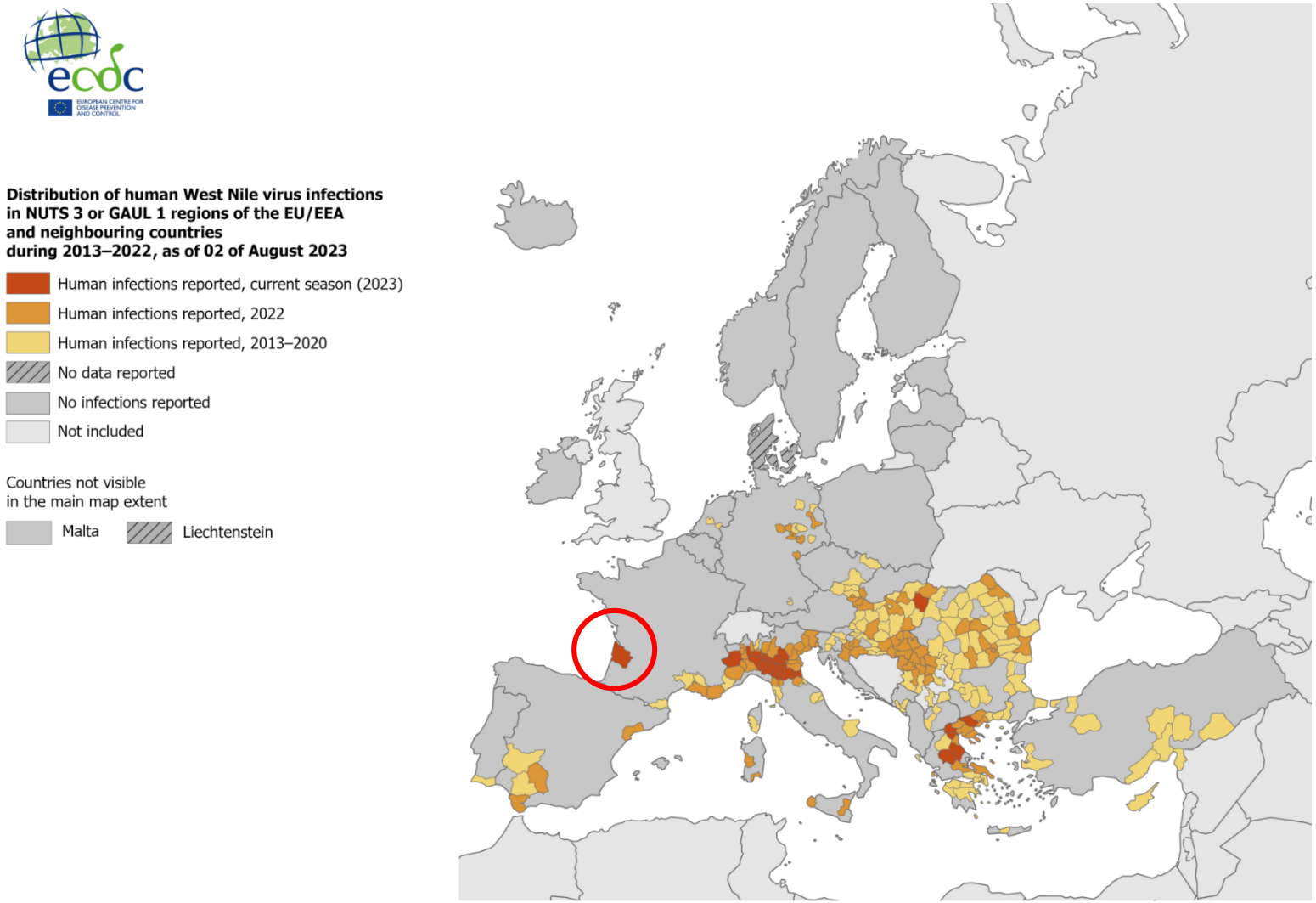
The West Nile virus has been found in Germany for the first time, after years of a warming climate that scientists believe encouraged the mosquitoes which carry the deadly disease to move further north.

Health authorities announced on Friday the first known human case of the virus transmitted by mosquitoes in the country.

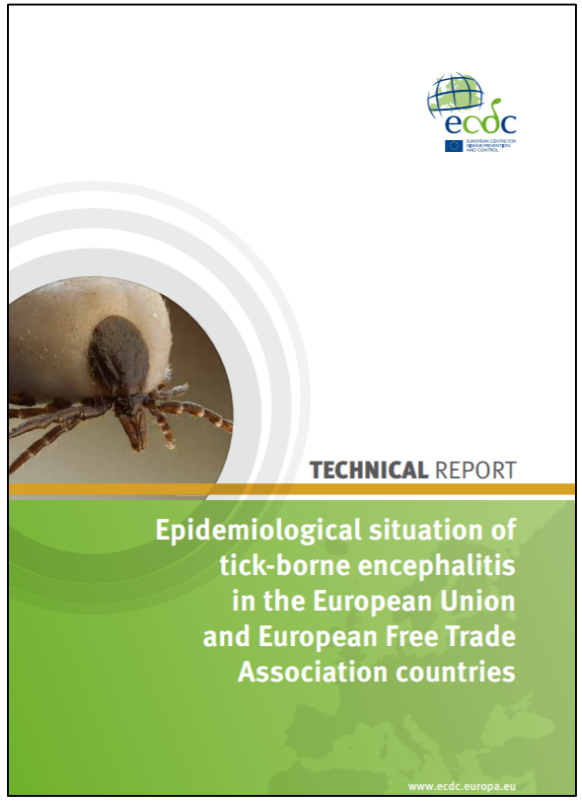
The German national disease control and tropical medicine centres reported the person who was infected then developed encephalitis, a life-threatening condition where the brain swells. They have now recovered after hospital treatment.

There are fears the disease could spread to the UK *( Getty )*

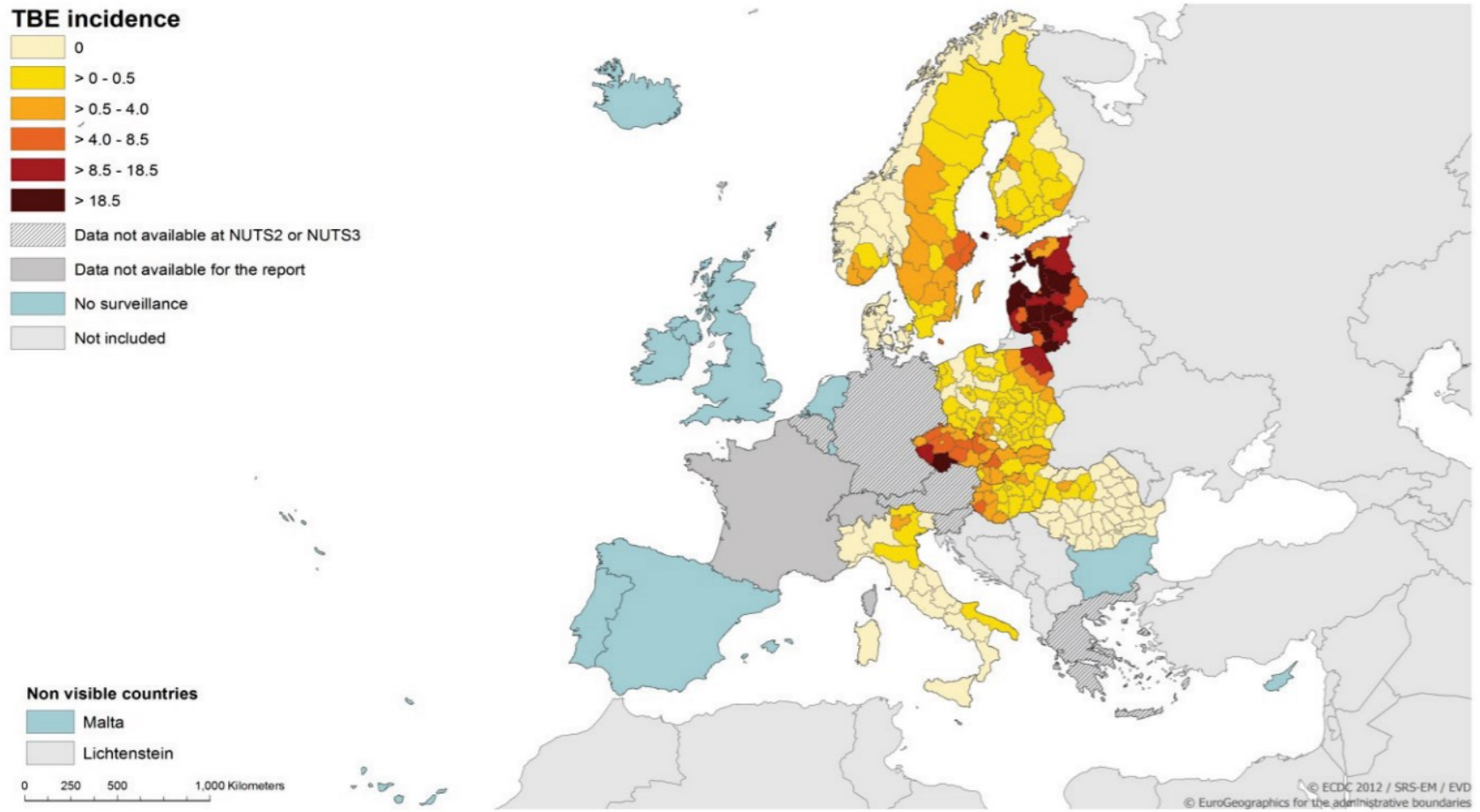
# Geographical areas in Europe with reported human West Nile virus cases in 2023 versus in previous seasons – a new foci reported in France



# Tick borne encefalitis (TBE) in Europe




2012



# New TBE virus foci was detected in North Sealand (Tisvilde hegn) in 2019

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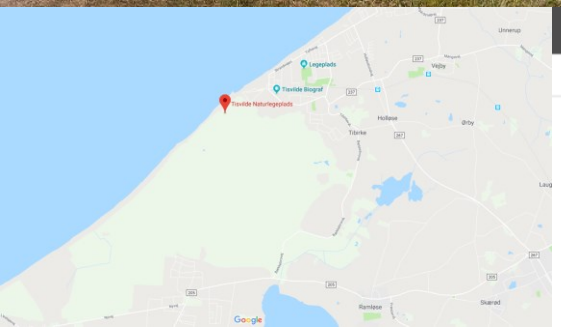
## Flåter indsamlet i Tisvilde Hegn har TBE-virus i sig

Statens Serum Institut (SSI) har undersøgt flåter indsamlet i Tisvilde Hegn for TBE-virus. Det sker efter, at der hen over sommeren har været



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NATUR

### Farlig, men sjælden virus fundet i flåter nær naturlegeplads

Ekspert anbefaler, at du beskytter dig mod flåtbid, hvis du færdes omkring Tisvilde Hegn i Nordsjælland.

TV2 LORRY | Nyheder | TV | Live-TV | Webdok | Podcast | Tip os | Søg | Menu

### Flåter i Tisvilde Hegn indeholder farlig virus

Den farlige, men sjældne virus TBE - også kendt som centraleuropæisk hjernebetændelse - er fundet i flåter, der er indsamlet i Tisvilde Hegn.

Flåten er en mide med otte ben og skal ikke forveksles med en tæge, der har seks ben og ligner en edderkop.

Foto: Bertrand Guay/AFP/Ritzau Scanpix

# In other words: Vectorborne diseases are already spreading in Europe

- Dengue virus in Southern Europe
- West Nile virus in Southern and Eastern Europe
- Chikungunya virus in Southern Europe
- Malaria (*Plasmodium vivax*) introduced locally in Greece by migrants from the Middle East
- Leishmaniasis in Southern Europe
- Borreliose in Northern Europe
- Tickborne encefalitis (TBE) in Eastern and Northern Europe

  - **Estimated scenarios in case of a globale rise in temperature of 1,5 ℃:**

    - Will allow a spread of the **sandfly vector and the leishmania parasite** from **Southern Europe to Middle Europe** (and further to **Northen Europe** if temperature rises above 1,5 ℃)
    - Will lead to a global rise in malaria of 7%

# Lancet Countdown Report, 2022

Countdown

The 2022 report of the *Lancet* Countdown on health and climate change: health at the mercy of fossil fuels

Marina Romanello, Claudia Di Napoli, Paul Drummond, Carole Green, Harry Kennard, Pete Lampard, Daniel Scamman, Nigel Arnell, Sonja Ayeb-Karlsson, Lea Berrang Ford, Kristine Belesova, Kathryn Bowen, Wenjia Cai, Max Callaghan, Diarmid Campbell-Lendrum, Jonathan Chambers, Kim R van Daalen, Carole Dalin, Niheer Dasandi, Shouro Dasgupta, Michael Davies, Paula Dominguez-Salas, Robert Dubrow, Kristie L Ebi, Matthew Eckelman, Paul Ekins, Luis E Escobar, Lucien Georgeson, Hilary Graham, Samuel H Gunther, Ian Hamilton, Yun Hang, Risto Hänninen, Stella Hartinger, Kehan He, Jeremy J Hess, Shih-Che Hsu, Slava Jankin, Louis Jamart, Ollie Jay, Ilan Kelman, Gregor Kiesewetter, Patrick Kinney, Tord Kjellstrom, Dominic Kniveton, Jason K W Lee, Bruno Lemke, Yang Liu, Zhao Liu, Melissa Lott, Martin Lotto Batista, Rachel Lowe, Frances MacGuire, Maquins Odhiambo Sewe, Jaime Martinez-Urtaza, Mark Maslin, Lucy McAllister, Alice McGushin, Celia McMichael, Zhifu Mi, James Milner, Kelton Minor, Jan C Minx, Nahid Mohajeri, Maziar Moradi-Lakeh, Karyn Morrissey, Simon Munzert, Kris A Murray, Tara Neville, Maria Nilsson, Nick Obradovich, Megan B O'Hare, Tadj Oreszczyn, Matthias Otto, Fereidoon Owfi, Olivia Pearman, Mahnaz Rabbaniha, Elizabeth J Z Robinson, Joacim Rocklöv, Renee N Salas, Jan C Semenza, Jodi D Sherman, Liuhua Shi, Joy Shumake-Guillemot, Grant Silbert, Mikhail Sofiev, Marco Springmann, Jennifer Stowell, Meisam Tabatabaei, Jonathon Taylor, Joaquin Triñanes, Fabian Wagner, Paul Wilkinson, Matthew Winning, Marisol Yglesias-González, Shihui Zhang, Peng Gong*, Hugh Montgomery*, Anthony Costello*

**Executive summary**

The 2022 report of the *Lancet* Countdown is published as the world confronts profound and concurrent systemic shocks. Countries and health systems continue to contend with the health, social, and economic impacts of the COVID-19 pandemic, while Russia's invasion of Ukraine and a persistent fossil fuel overdependence has pushed the world into global energy and cost-of-living crises. As these crises unfold, climate change escalates unabated. Its worsening impacts are increasingly affecting the foundations of human health and wellbeing, exacerbating the vulnerability of the world's populations to concurrent health threats.

During 2021 and 2022, extreme weather events caused devastation across every continent, adding further pressure to health services already grappling with the impacts of the COVID-19 pandemic. Floods in Australia, Brazil, China, western Europe, Malaysia, Pakistan, South Africa, and South Sudan caused thousands of deaths, displaced hundreds of thousands of people, and caused billions of dollars in economic losses. Wildfires caused devastation in Canada, the USA, Greece, Algeria, Italy, Spain, and Türkiye, and record temperatures were recorded in many countries, including Australia, Canada, India, Italy, Oman, Türkiye, Pakistan, and the UK. With advancements in the science of detection and attribution studies, the influence of climate change over many events has now been quantified.

Because of the rapidly increasing temperatures, vulnerable populations (adults older than 65 years, and children younger than one year of age) were exposed to 3·7 billion more heatwave days in 2021 than annually in 1986–2005 (indicator 1.1.2), and heat-related deaths increased by 68% between 2000–04 and 2017–21 (indicator 1.1.5), a death toll that was significantly exacerbated by the confluence of the COVID-19 pandemic.

Simultaneously, the changing climate is affecting the spread of infectious diseases, putting populations at higher risk of emerging diseases and co-epidemics. Coastal waters are becoming more suitable for the transmission of Vibrio pathogens; the number of months suitable for malaria transmission increased by 31·3% in the highland areas of the Americas and 13·8% in the highland areas of Africa from 1951–60 to 2012–21, and the likelihood of dengue transmission rose by 12% in the same period (indicator 1.3.1). The coexistence of dengue outbreaks with the COVID-19 pandemic led to aggravated pressure on health systems, misdiagnosis, and difficulties in management of both diseases in many regions of South America, Asia, and Africa.

The economic losses associated with climate change impacts are also increasing pressure on families and economies already challenged with the synergistic effects of the COVID-19 pandemic and the international cost-of-living and energy crises, further undermining the socioeconomic determinants that good health depends on. Heat exposure led to 470 billion potential labour hours lost globally in 2021 (indicator 1.1.4), with potential income losses equivalent to 0·72% of the global economic output, increasing to 5·6% of the GDP in low Human Development Index (HDI) countries, where workers are most vulnerable to the effects of financial fluctuations (indicator 4.1.3). Meanwhile, extreme weather events caused damage worth US$253 billion in 2021, particularly burdening people in low HDI countries in which almost none of the losses were insured (indicator 4.1.1).

Through multiple and interconnected pathways, every dimension of food security is being affected by climate change, aggravating the impacts of other coexisting crises. The higher temperatures threaten crop yields directly, with the growth seasons of maize on average 9 days shorter in 2020, and the growth seasons of winter wheat and spring wheat 6 days shorter than for 1981–2010 globally (indicator 1.4). The threat to crop yields adds to the rising impact of extreme weather on supply chains, socioeconomic pressures, and the risk of infectious disease transmission, undermining food availability, access, stability, and utilisation. New analysis suggests that extreme heat was associated with 98 million

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For the French translation of the executive summary see Online for appendix 1
For the Chinese translation of the executive summary see Online for appendix 2
For the Spanish translation of the executive summary see Online for appendix 3
For the Arabic translation of the executive summary see Online for appendix 4

*Co-chairs of the Lancet Countdown
School of Agriculture Policy and Development (C Di Napoli PhD) and Department of Meteorology (N Arnell PhD), University of Reading, Reading, UK; Institute for Sustainable Resources (P Drummond MSc, C Dalin PhD, P Ekins PhD, D Scamman PhD), UCL Institute for Global Health (M Romanello PhD, A Costello FMedSci, I Kelman PhD, F MacGuire PhD, M B O'Hare PhD), Institute for Risk and Disaster Reduction



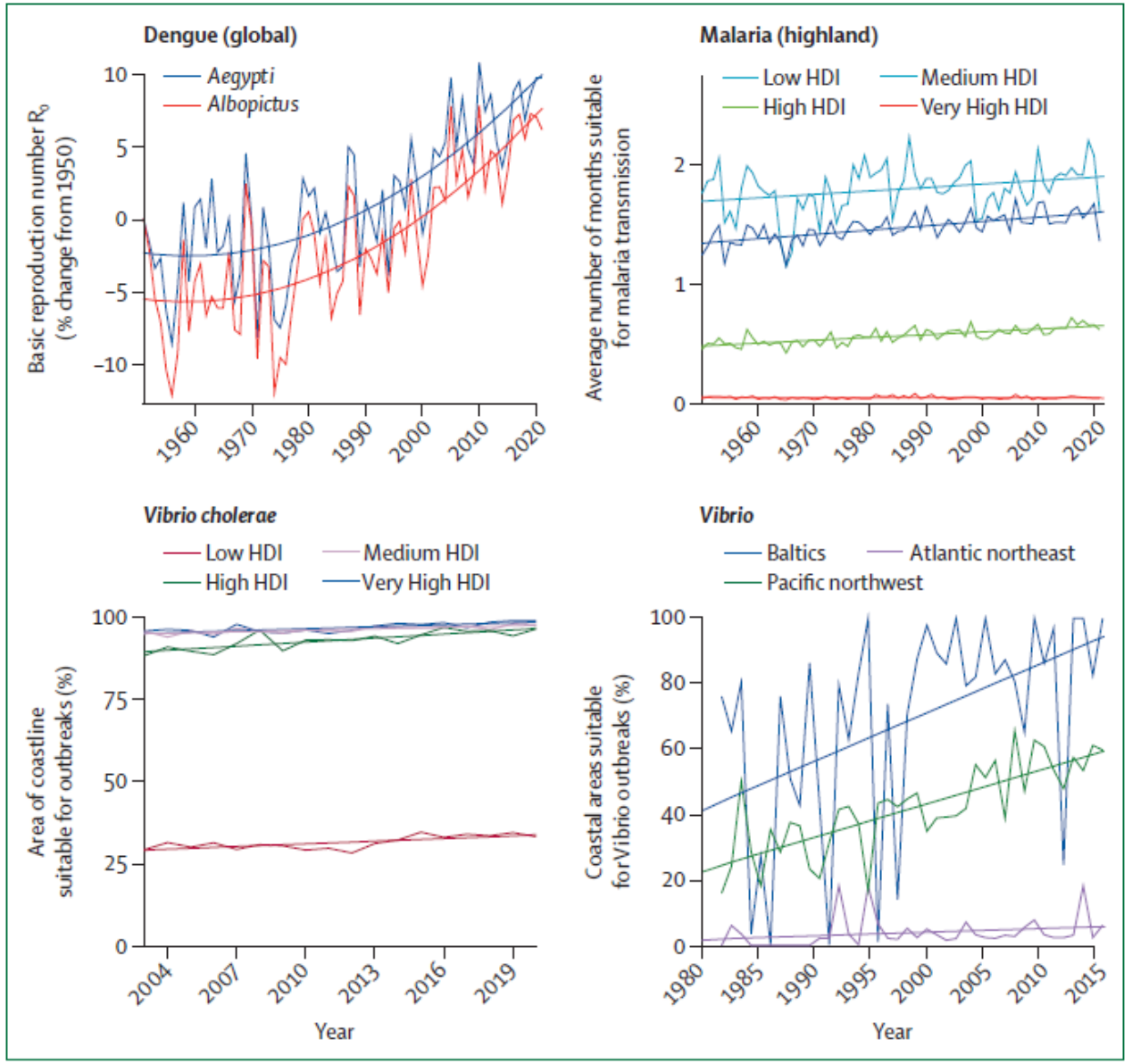


***Figure 4:*** **Change in climate suitability for infectious diseases**
Thin lines show the annual change. Thick lines show the trend since 1951 (for malaria), 1951 (for dengue), 1982 (for *Vibrio* bacteria), and 2003 (for *Vibrio cholerae*). HDI=human development index.

# SO WHAT TO DO?

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- Need for better risk awareness in the general public (including during travel)
- Need for more training and awareness among health professionals
- Need for increased capacity in the health sector to manage additional health threats
- Need for preventive measures, e.g. mosquito repellents, especially for risk groups such as pregnant women and elderly people
- Need for enhanced disease surveillance
- Need for expanded preparedness and response capacity
- Need for special attention to vulnerable groups, e.g. migrants

# ESSENTIAL NEED FOR IMPROVED DISEASE SURVEILLANCE

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Infectious disease topics | Data | Analysis and guidance | Training and tools | About ECDC

## Featured

### Guidelines for mosquito surveillance

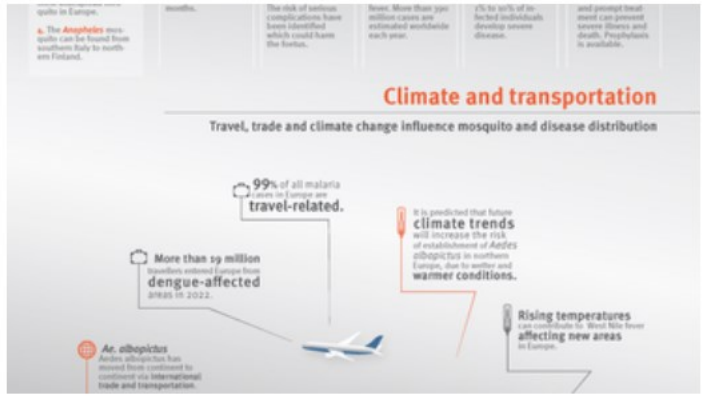
Guidelines for surveillance for invasive and native mosquito species of public health relevance.

Read more

### West Nile virus risk assessment tool

The main objective of this tool is to assist countries in determining the risk of West Nile virus human transmission in their territory.

Read more




### Mosquito-borne diseases: An emerging threat

What are emerging/tropical mosquito-borne diseases? What are the different species of mosquitoes in Europe and the diseases they can carry?

# Conclusions of the Lancet Countdown Report, 2022

(https://www.thelancet.com/article/S0140-6736(22)01540-9/fulltext

- Climate change is undermining every dimension of global health monitored, increasing the fragility of the global systems that health depends on, and increasing the vulnerability of populations to the coexisting geopolitical, energy, and cost-of-living crises.
- Climate change is increasingly undermining global food security, exacerbating the effects of the COVID-19, geopolitical, energy, and cost-of-living crises. New analysis of 103 countries shows that days of extreme heat, increasing in frequency and intensity due to climate change, accounted for an estimated 98 million more people reporting moderate to severe food insecurity in 2020 than the average in 1981–2010 (indicator 1.4).
- Well-prepared health systems are essential to protect populations from the health impacts of climate change. However, global health systems have been drastically weakened by the effects of the COVID-19 pandemic, and the funds available for climate action decreased in 239 (30%) of 798 cities (indicator 2.1.3), with health systems increasingly being affected by extreme weather events and supply chain disruptions too.
- Insufficient climate change adaptation efforts have left health systems vulnerable to climate change-related health hazards. Only 48 of 95 countries have assessed their climate change adaptation needs (indicator 2.1.1) and only 63% of countries reported high to very high implementation status for health emergency management in 2021 (indicator 2.2.5). Increasing adaptation to climate change has the potential to simultaneously improve the capacity of health systems to manage both future infectious disease outbreaks and other health emergencies (indicator 2.3.1).

Thanks for your attention

Any questions or comments?