Linking Infectious Diseases and the Changing Climate in the Northern/Arctic Region

Presenter: Yan Ma

Stockholm University

Coauthors: Georgia Destouni, Zahra Kalantari, Anna Omazic, Birgitta Evengård, Camilla Berggren, Tomas Thierfelder

Stockholm University

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How does climate change affect infectious diseases?

Art by Matteo Farinella
https://thebulletin.org/2020/04/how-to-explain-climate-change-with-comic-books/

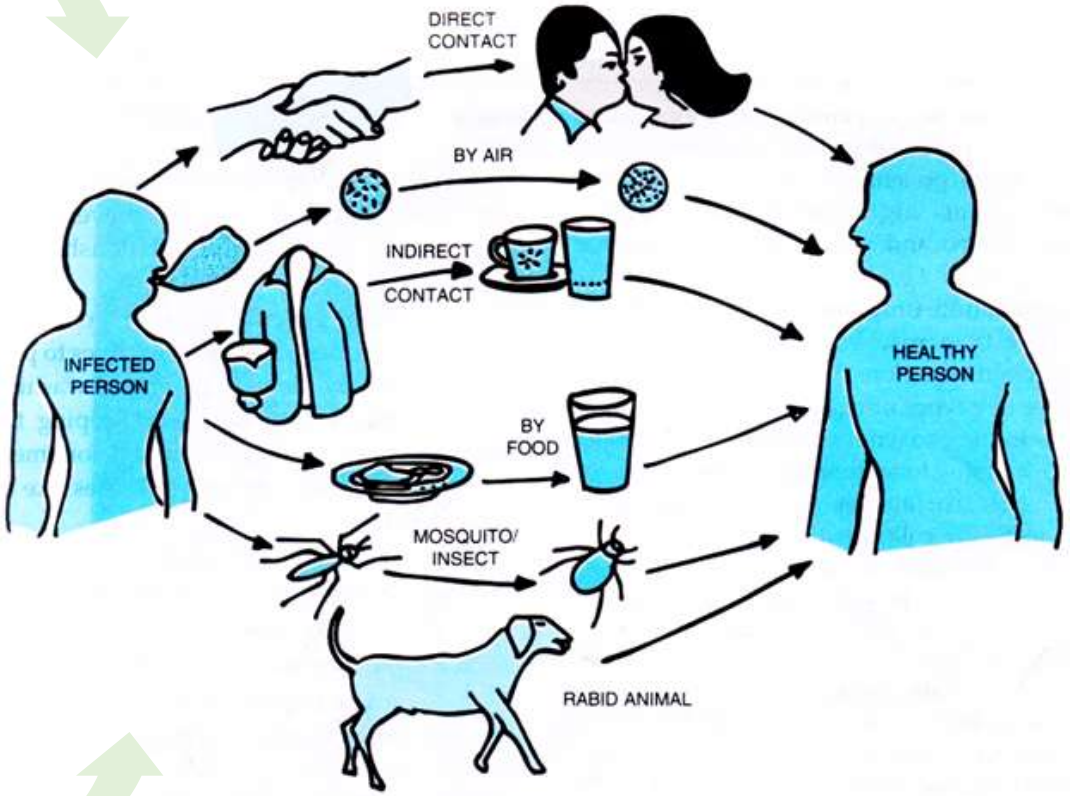
Temperature

Precipitation

River flow

Humidity

… …



Picture by Jessica Regine Masanque
https://www.pinterest.com/pin/593138213395099329/

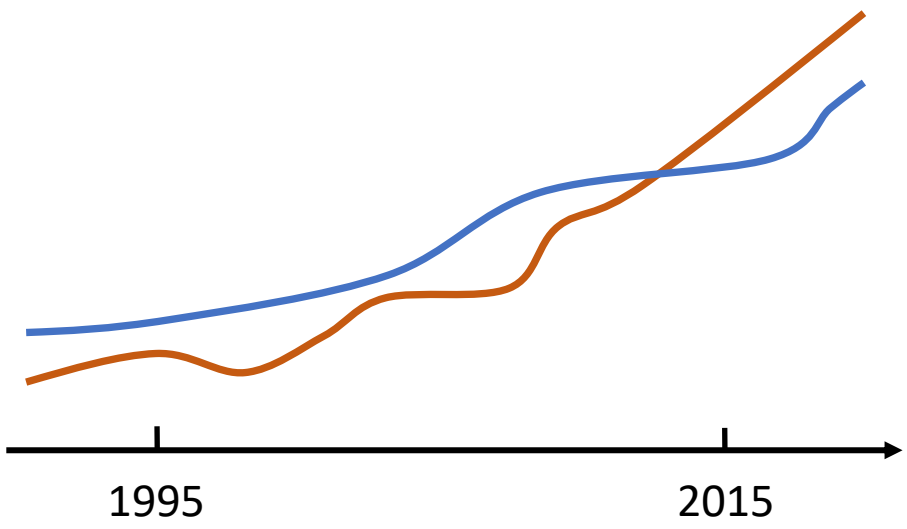
Known:

Previous studies have reasoned about potential climate sensitive infections, such as borreliosis and tick-borne encephalitis (TBE), based on theoretical, laboratory, and mainly local disease incidence indications.

Unknown:

Whether are these sensitivity estimates supported by empirical data for climate and disease outbreaks on a large scale, such as over the Northern/Arctic Region?

Aim:
Linking climate and infectious disease trends in the Northern/Arctic Region for seven selected diseases



Data sources (open access):

Disease:

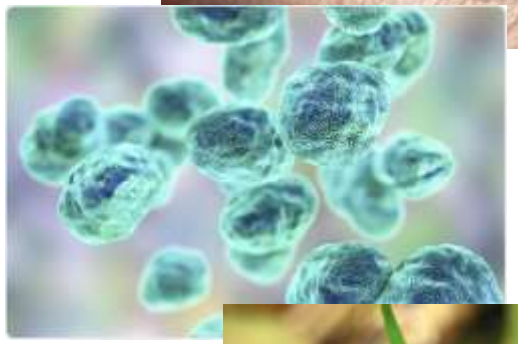
➡ CLINF GIS PUBLIC DATA REPOSITORY

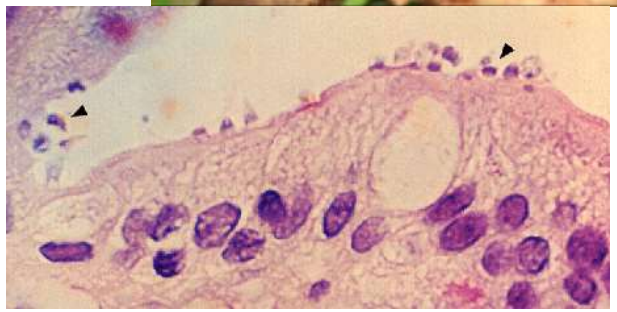
Climate:

➡ High-resolution gridded datasets of the Climate Research Unit (CRU)

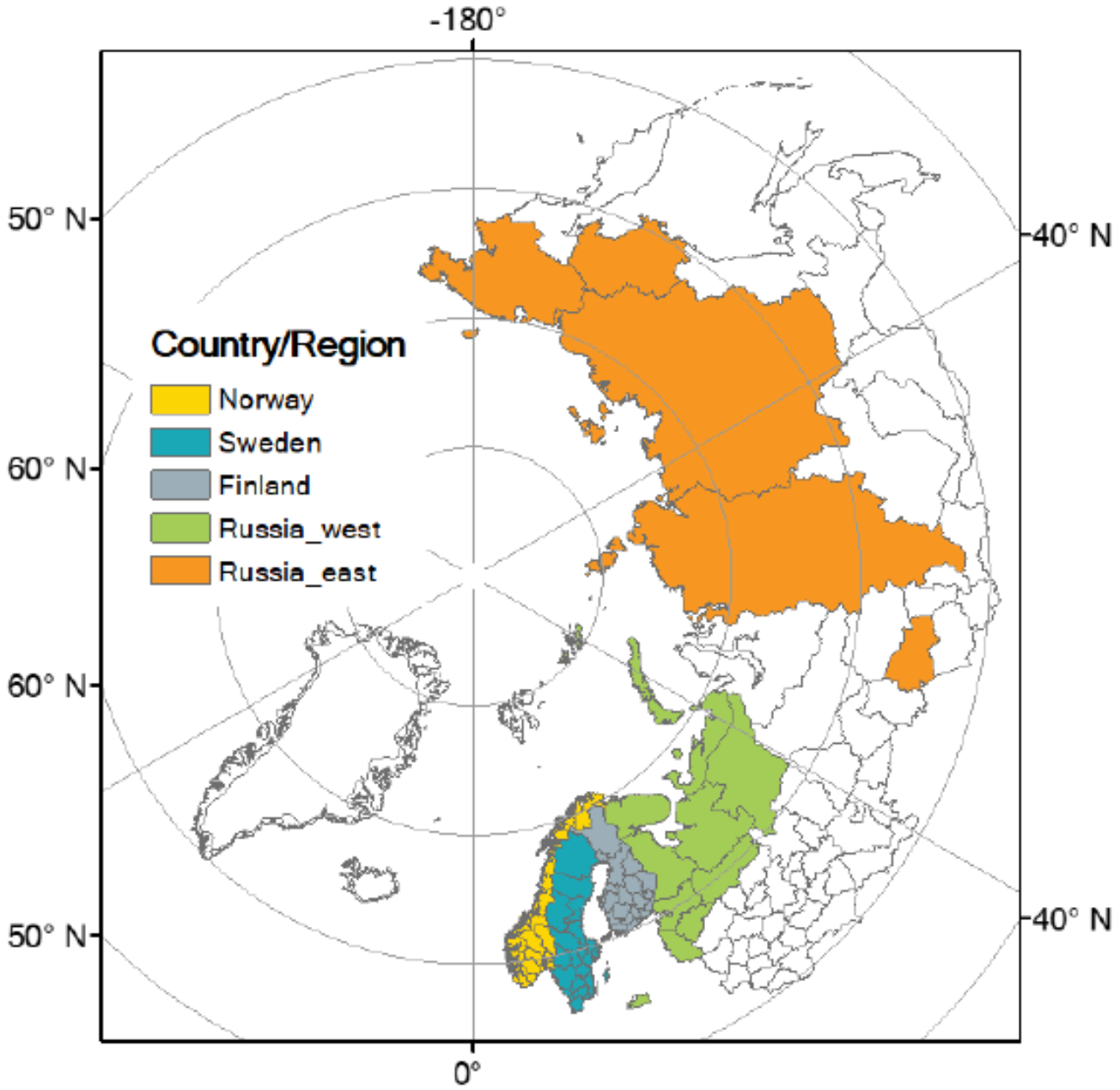
Seven selected diseases

Infection Agent	Disease	Transmission pathways
Bacteria	Borreliosis	By vector *Ixodidae* ticks.
	Tularemia	Multiple transmission modes: vector-borne (mosquitoes, horseflies, ticks); direct contact; oral; airborne; water-borne.
	Leptospirosis	Main hosts are rodent species in natural foci, and livestock and dogs in anthropurgic foci. Leptospira follow the fecal-oral transmission mechanism via water. Humans are usually infected during contact with water contaminated with animal waste.
	Q fever	The main reservoirs are farm animals and pets, and transmission to human is mainly through inhalation of contaminated aerosols.
Virus	Tick-borne encephalitis (TBE)	By vector *Ixodidae* ticks.
	Puumala virus infection	By inhalation of infected rodent excreta.
Parasite	Cryptosporidiosis	By ingestion of cryptosporidium oocysts.





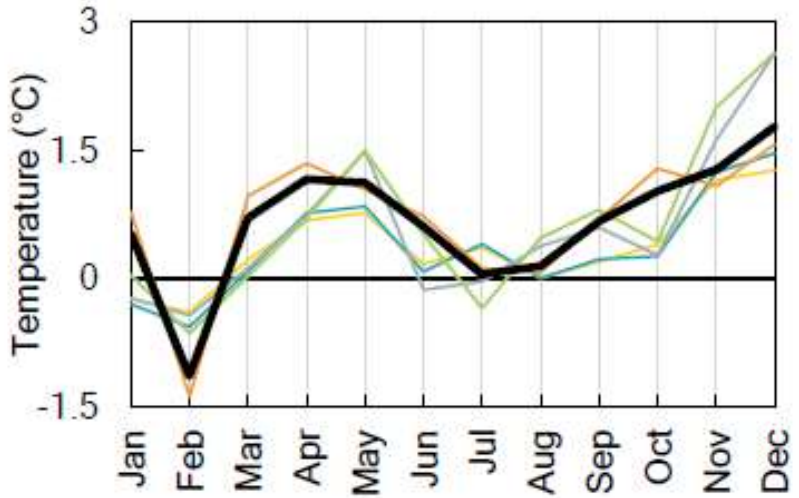
Studied regions:



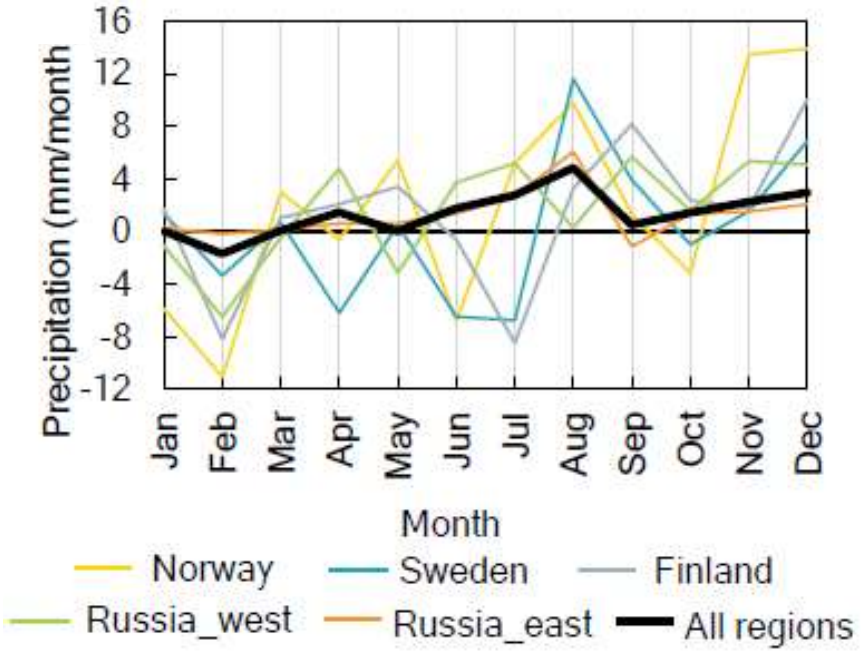
Monthly temperature and precipitation changes from 1995-2005 to 2005-2015:

represented by subtracting the average value of the former period from the average of the latter.

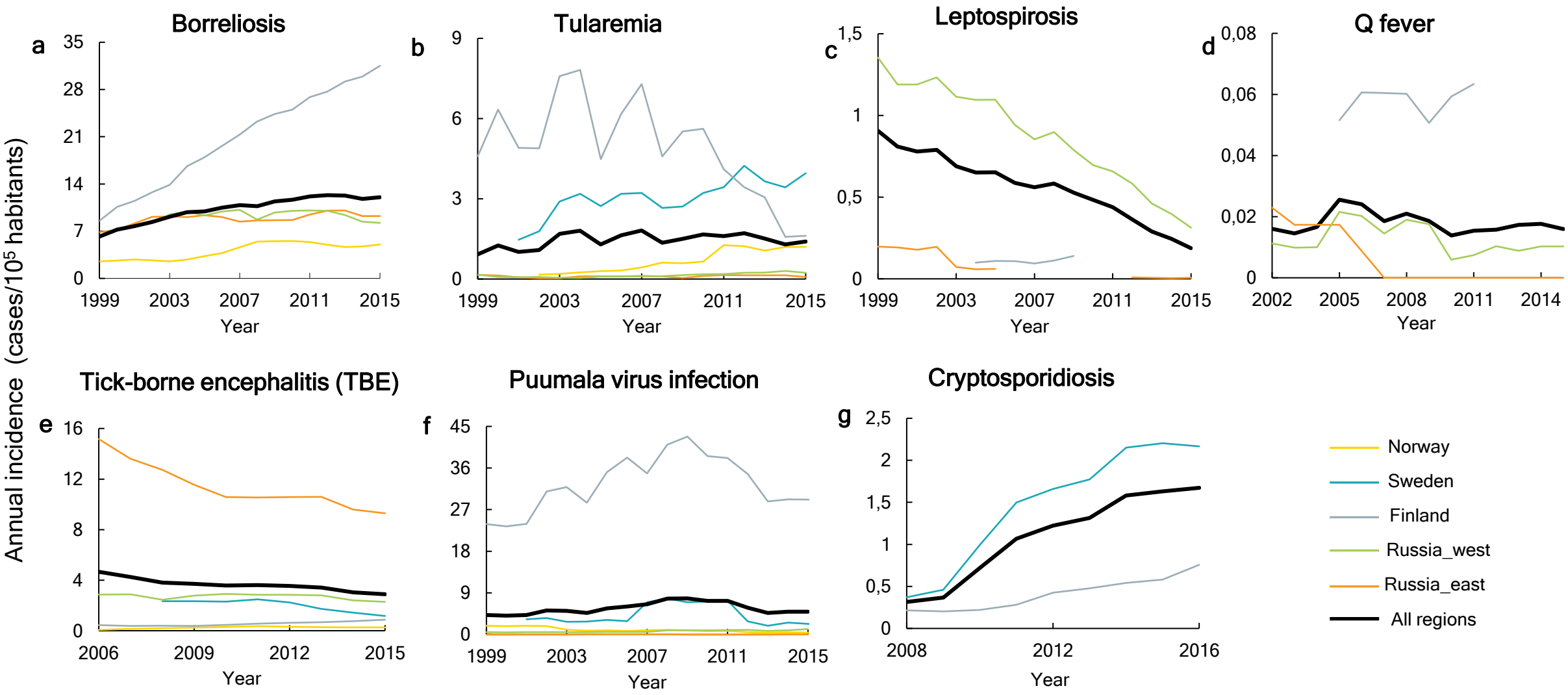
Temperature



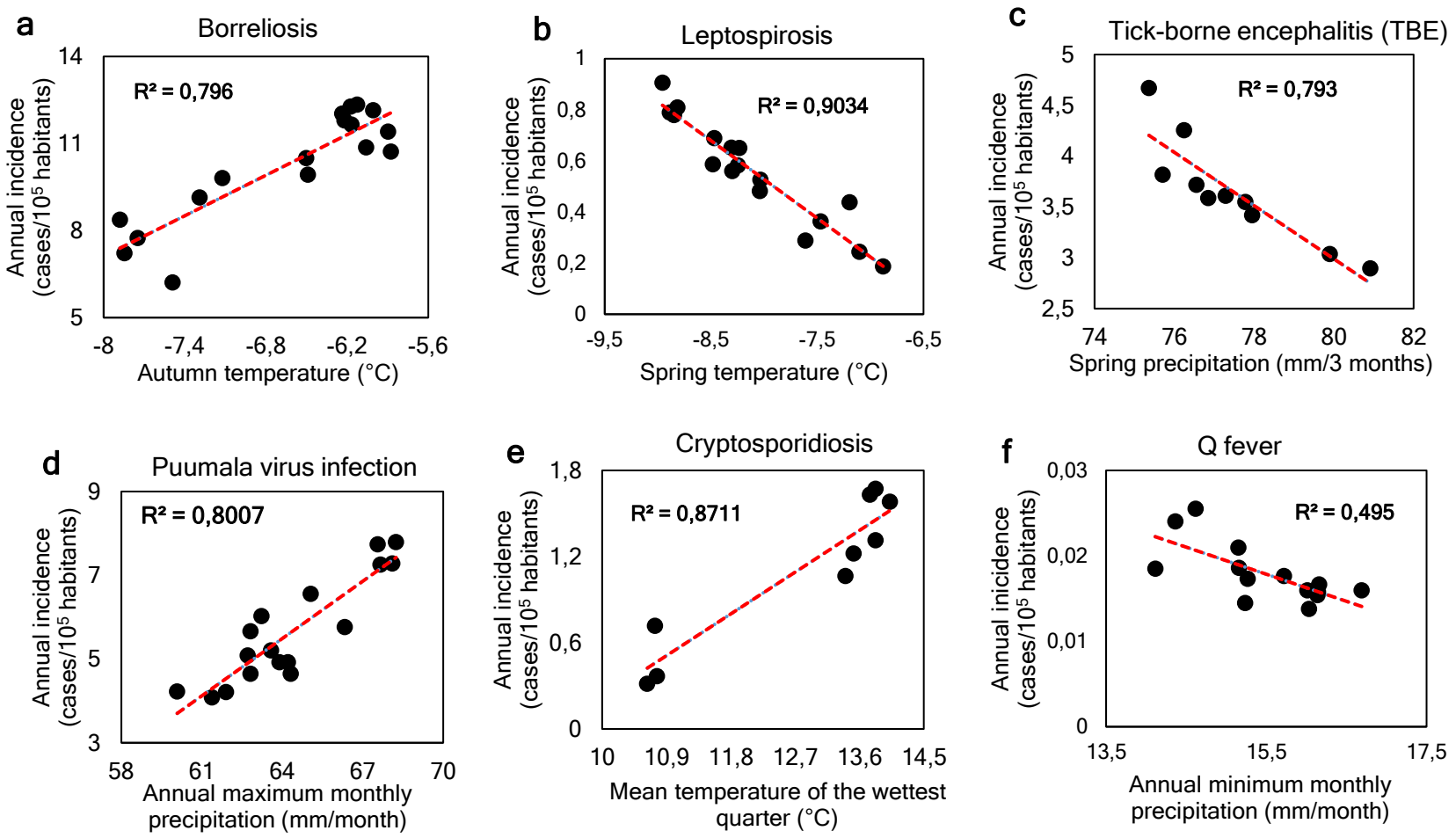
Precipitation



Trends of incidence for each region



Correlations found through stepwise regression (p<0.01)



Conclusion and Discussion:

- Significant relationships of borreliosis, leptospirosis, tick-borne encephalitis (TBE), Puumala virus infection, cryptosporidiosis, and Q fever with climate variables related to temperature and freshwater conditions.

- These data-driven results are consistent with previous reasoning-based propositions of climate-sensitive infections as increasing threats for humans, with notable exceptions for TBE and leptospirosis

- Statistical correlations do not reveal the mechanistic causal relationships that underlie the statistical correlations, and thus need to be interpreted with caution.

References

- Ma, Y., Destouni, G., Kalantari, Z., Omazic, A., Evengård, B., Berggren, C. and Thierfelder, T., 2021. Linking climate and infectious disease trends in the Northern/Arctic Region. Scientific reports, 11(1), pp.1-9.

Thank you for your attention

yan.ma@natgeo.su.se

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