

A model to assess effects of climate change on infections



Tularemia

Reported cases

2000-2005:

Finland >2,500

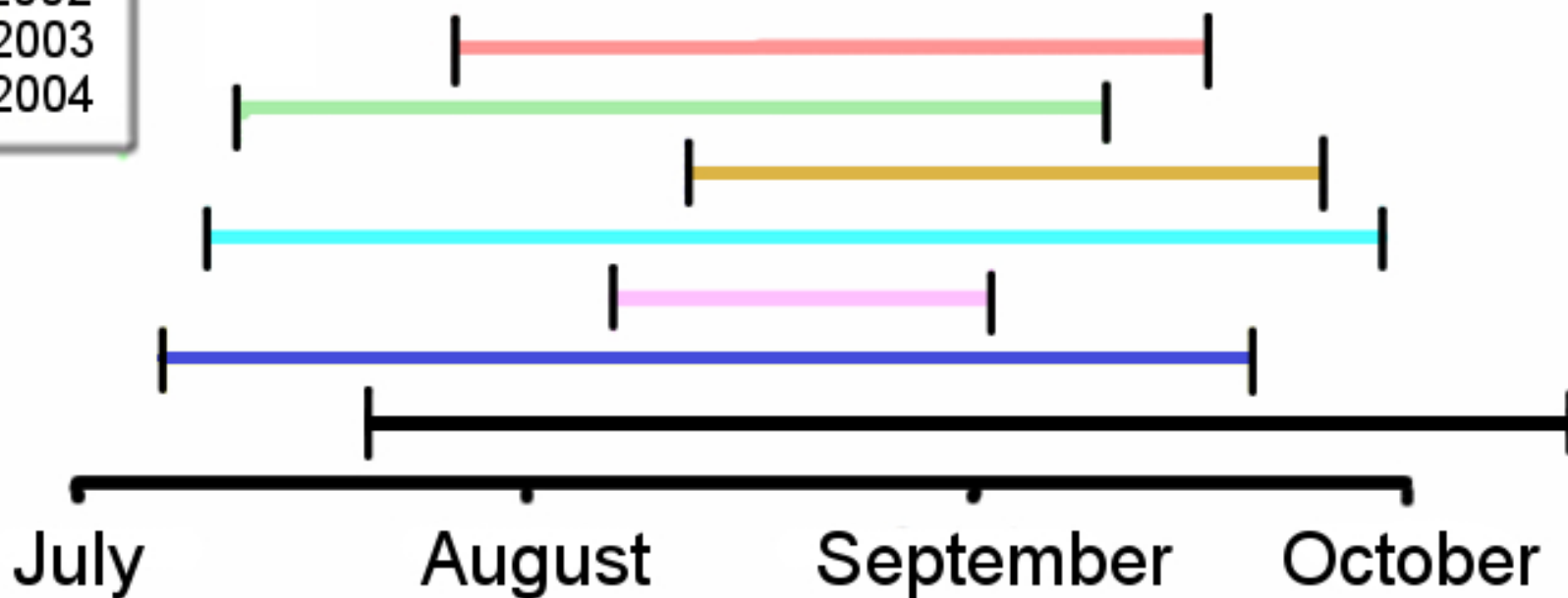
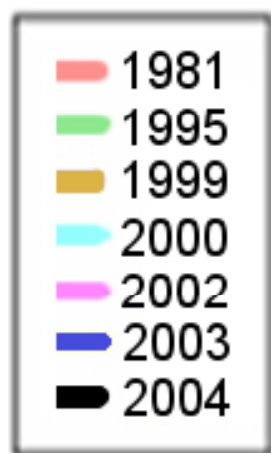
Sweden 2,000

2006-

Finland >1,500

Sweden 1,000

Temporal Range of cases for years with 5 or more cases



Effects of climate change on tularaemia disease activity in Sweden

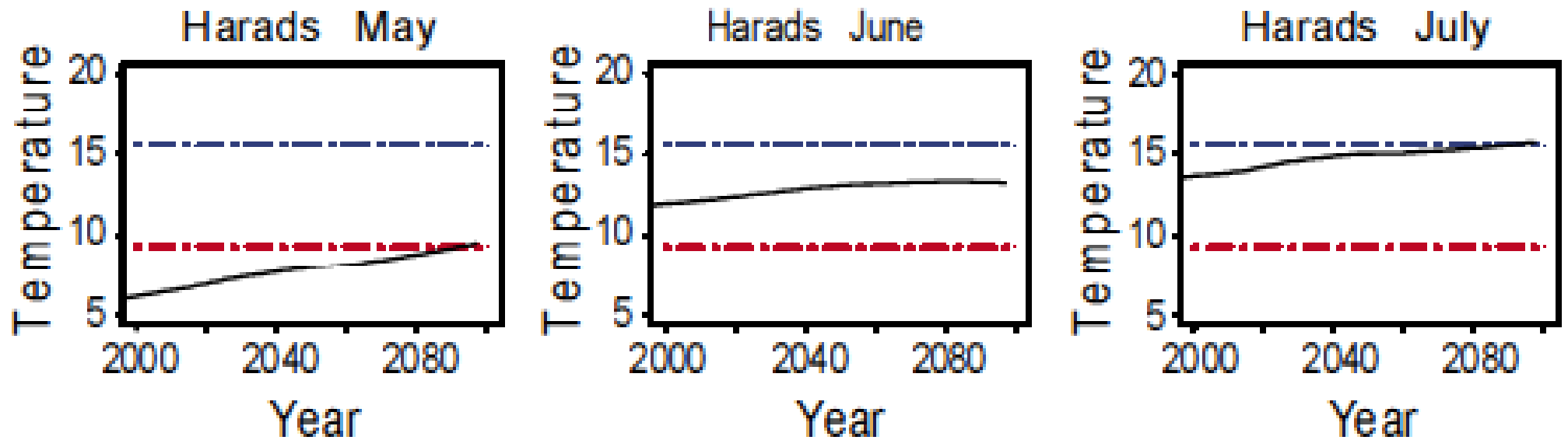
Patrik Rydén^{1,2,3}, Anders Sjöstedt⁴ and Anders Johansson^{5,6*}

Global Health Action 2009 Nov 11;2. doi: 10.3402

Projected future temperatures

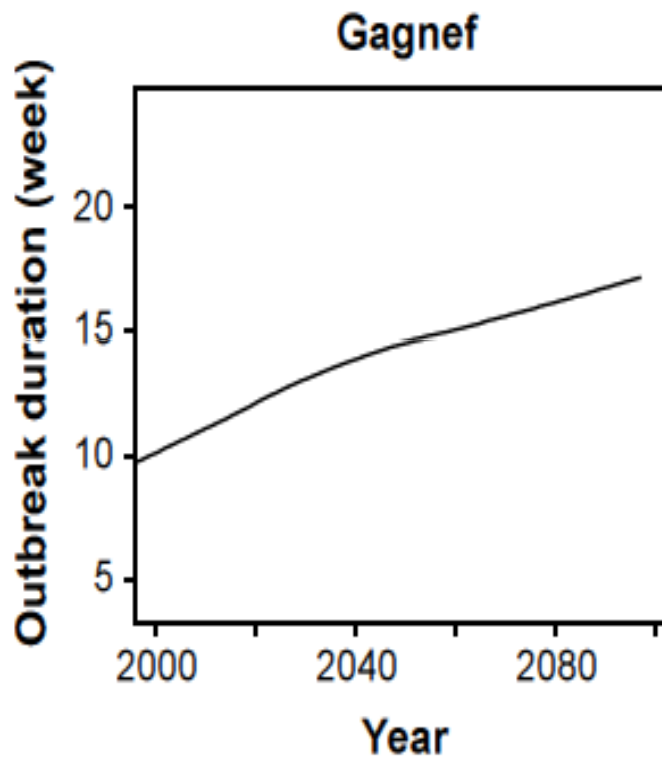
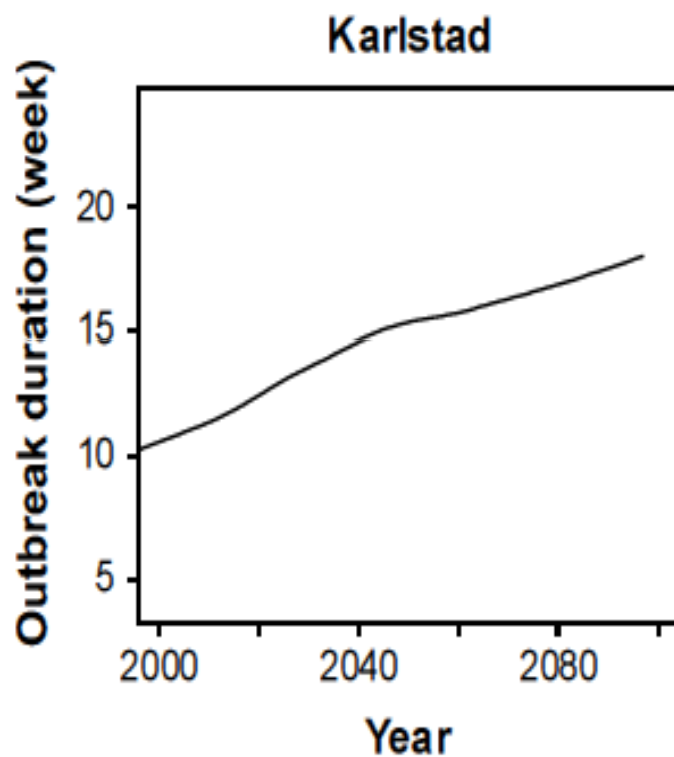
IPCC Special Report on Emissions Scenario B2

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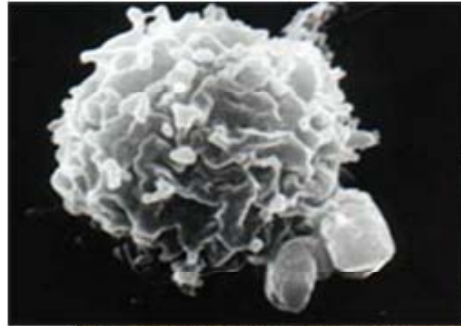


Periods with transmission-permissive temperatures

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The Water Transmission Hypothesis



A) Francisella associated with water



B) Francisella infects mosquito larva



C) Mosquitos transmits the bacteria to humans and rodants

Environmental factors that can explain the occurrence of outbreaks

- Temperature, precipitation, humidity, snow cover, water flow
- Summer precipitation (the mean in June-August)
- Summer humidity (the mean humidity in July- September)
- Lag-1 summer temperature (the mean temperature in June-August for the preceding year)
- Winter temperature ($< -7.3^{\circ}$ C and < 10 cm snow in October-Mars).

The role of mosquitoes for tularemia outbreaks

No mosquito data available for Dalarna

Solution: Predict mosquito abundance using environmental data and a **predictive mosquito model**

Conclusions

- There is a temporal relationship that support a causative relationship
- The predicted future warming will significantly increase the risk of tularemia outbreaks
- There is quantative correlation of mosquito abundance in late summer and tularemia in humans
- The tools are generally applicable for forecasting outbreaks and their relationship to arthropod distribution

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