



## SCIENTIFIC FINAL REPORT

### Two- and three-year projects and postdoctoral projects

Registration number, Östersjöstiftelsen: 52/18

Project manager: Patrik Dinnetz

Project title: Human – environment interactions and the epidemiological periurban landscape of tick – borne diseases

#### 1. The three most important results of the project and what conclusions can be drawn from them

- Even if ticks are more abundant in rural environments, both ticks and tick-borne pathogens are commonly present in urban parks and gardens.
- There exist significantly more ticks in forested compared to open habitats, and ticks are mainly found close to the ground.
- Visitors to green periurban green spaces are aware of the risks with ticks and tick-borne diseases, but they do not protect themselves during outdoor activities except for individuals engaged in foraging for berries and mushrooms.

Our conclusions are that we are surrounded by ticks and that tick-borne pathogens like *Borrelia burgdorferi* s.l., *Borrelia miamotoi*, and *Anaplasma phagocytophilum* are present both in rural and urban settings. However, the risk for being infected and developing a disease is much lower than risk for being bitten by a Tick. It takes at least 15 hours before an infected tick starts transmitting bacteria to a host, and against virus induced infections like tick-borne encephalitis (TBE) we can be vaccinated. There is also a possibility to minimize the risk for being tick infested by avoiding forested habitats with low filed vegetation for a pick-nick. Even if visitors to green spaces are quite knowledgeable there is still a need for information on the importance to dress properly and to check your body for ticks after a day in the forest. If you remove a tick that has attached to your body before 15 hours the risk for infection is very small, at least if you are also vaccinated against TBE.

#### 2. The project's contribution to the international research frontline

Our contribution to the international frontline is the new knowledge of tick and tick-borne pathogen distributions in the hemiboreal zone in the Baltic Sea region. It is also the extremely consequent completely randomized inventory design we have developed that allow for comparison both within and among different countries. We have applied the same inventory design in Stockholm County in Sweden, in Jurmala in Latvia, in and around Tallin in Estonia and on the islands of Åland. We have also combined the field inventories assessing the tick densities and the densities of infected ticks with visitor data to different green spaces. Visitor data that include both number of visitors but also interviews with visitors. These data can together give us estimates of individual risks for being infested with infected ticks, but also the public health risks affecting the health care systems and the public economy. The main outcome of the project are important contributions to our



understanding of the effects of physical planning of green spaces on environmental, social and economic sustainability.

### **3. The contribution of the research to the knowledge of the Baltic Sea Region and Eastern Europe**

We have applied the same inventory design in Stockholm County in Sweden, in Jurmala in Latvia, in and around Tallin in Estonia and on the islands of Åland. This is the first time that anyone is conducting identical tick research in four different countries in the Baltic Sea region. Our findings are that there exist both similarities and differences. There are ticks and tick-borne pathogens in all sites we have visited. However, we can see differences in the densities of infected ticks. We are still working on these data, and they are not published yet. We also need to handle ethical considerations regarding the consequences that may arise from publications of pathogen distributions. We will therefore discuss the results we have with the different countries authorities before we go public.

We have conducted approximately 100 interviews with visitors to urban green spaces in each of Estonia, Latvia, and Sweden. The data from Sweden is published but the result from the Baltic states has only been presented in conferences. The main result is that Swedes are more often infested by ticks but the public in Estonia and Latvia are more aware of the risk for infections resulting serious diseases.

### **4. New research questions that the project has led to**

The most important research questions we would like to continue working with are both concerning the unavoidable colonisation of the Baltic Sea region by new tick species and by new tick-borne pathogens, and how to increase the knowledge levels of public health risks from tick borne diseases.

We need to increase the awareness of our authorities and among the public on likely future scenarios with climate changes leading to habitat alternations allowing for tick species that now are established in Southern and Southeastern Europe to continue their spread towards the Baltic Sea region. Therefore, we need good monitoring systems that can alert us when new tick species start to develop viable populations in the Baltic Sea region. We also need to monitor for non-endemic tick-borne pathogens that may come with new tick species or manage to infect the endemic tick species in our region.

There is a need to start projects focusing on how we can develop green spatial planning that can maximize health benefits from out-door leisure activities and at the same time minimize the ecosystem disservice delivered by ticks.

### **5. Dissemination of the results of the project within and outside the research community**

#### **Conferences**

Snäff (Swedish Network for Tick Research), Ystad, Sweden. 3 to 5 June 2019.

Janzén T. 2019. The periurban transition and its effect on tick distribution. Oral presentation



- Petersson M. 2019. landscape structure, and tick abundance at human TBE infection sites. Oral presentation Nordtick (Nordic Network for Tick Research) , Fevik, Norway. 13 to 15 June 2022.
- Janzén T., Hammer M., Petersson., & Dinnetz P. 2022. Risk factors for tick exposure across an urbanization gradient. Oral presentation by Dinnetz P.
- Janzén T., Larsson J., Hammer M., Petersson., & Dinnetz P. 2022. Assessing public health risk due to ticks along the urbanization gradient in Stockholm County, Sweden. Oral presentation by Janzén T. Snäff, Lund, Sweden. 7 to 9 February 2023.
- Janzén T., Choudhury F., Hammer M., Petersson., & Dinnetz P. 2023 Bevare of ticks! Assessing public health risks due to ticks in greenspaces used for recreation. Oral presentation by Janzén T.
- Lindell H., Lehtilä K., & Dinnetz P. 2023. : Wild boar's contribution to the prevalence of tick-borne diseases in the Baltic Sea area. Poster presentation by Lindell H. International Symposium on Tick-Borne Pathogens and Disease ITPD 2023. Vienna, Austria, 22 to 25 October 2023 Organised by the ÖGHMP and under the auspices of ESGBOR.
- Frimpong Dumfeh M., Dinnetz P., Mayerhofer R. 2023. Skin color in Lyme disease and erythema migrans diagnosis: implications for clinical practice. Oral presentation by Dinnetz P.
- Janzén T., Choudhury F., Hammer M., Petersson., & Dinnetz P. 2023. Ticks-public health risks in urban green spaces. Poster presentation by Dinnetz P. Nordtick Nyborg, Denmark. 16 to 18 April 2024.
- Dinnetz P., Janzén T., Tijare G., Hammer M., & Petersson M. 2024. Human tick encounters in the Baltic Sea area. Poster presentation by Dinnetz P.
- Dinnetz P., Janzén T., Tijare G., Hammer M., & Petersson M. 2024. Human behavior and exposure to ticks and tick-borne pathogens in recreational green spaces in the Baltic Sea region. Poster presentation by Janzén T.

### Popular press and information to the public

Researchers from the project have informed the public about ticks in different news media, yearly update in [TT](#), [SR](#), [SR](#), SVT, TV4, DN, [Ämnesläraren](#), [Universitetsläraren](#), [MåBra](#), SHs forskarpod, [Norrtälje Tidning](#). Our Tick project was one of Södertörn University's most acknowledged research in media in 2024.

Participation in [Researchers' Night and Borrow a Researcher](#). Researchers from the project have visited 50 different school classes grade preschool to upper secondary school. During the last three years.

### Publications

Published all open access

- Janzén, T., Petersson, M., Hammer, M., Aspán, A., & Dinnetz, P. (2019). Equine granulocytic anaplasmosis in Southern Sweden: Associations with coniferous forest, water bodies and landscape heterogeneity. *Agriculture, Ecosystems & Environment*, 285, 106626. <https://doi.org/10.1016/j.agee.2019.106626>
- Janzén, T., Hammer, M., Petersson, M., & Dinnetz, P. (2023). Factors responsible for *Ixodes ricinus* presence and abundance across a natural-urban gradient. *PloS one*, 18(5), e0285841. <https://doi.org/10.1371/journal.pone.0285841>
- Janzén, T., Choudhury, F., Hammer, M., Petersson, M., & Dinnetz, P. (2024). Ticks-public health risks in urban green spaces. *BMC Public Health*, 24(1), 1031. <https://link.springer.com/article/10.1186/s12889-024-18540-8>



Janzén, T. (2024). Ticks-ecology, new hazards, and relevance for public health (Doctoral dissertation, Södertörns högskola). <https://www.diva-portal.org/smash/record.jsf?pid=diva2%3A1840903&dswid=-4638>

Work in progress

- Janzén, T., Larsson, J., Hammer, M., Petersson, M., & Dinnétz, P. Tick densities and densities of infected ticks in different habitats across a natural-urban gradient. MS in prep
- Janzén, T., Tijare, G., Maiman, H., Petersson, M., Hammer, M., & Dinnétz, P. Knowledge, attitudes and behavior towards ticks and tick-borne diseases among visitors to urban greenspaces in the Baltic Sea Region. MS in prep.
- Lager, M., Janzén, T., Petersson, M., Hammer, M., & Dinnétz, P. Ticks and tick-borne pathogens in urban centers in Estonia and Latvia. MS in prep.
- Janzén, T., Lager, M., Petersson, M., Hammer, M., & Dinnétz, P. Risk of tick-borne diseases in urban greenspaces in the Baltic region. MS in prep.
- Carlströmer Berthén, N., Olausson, S., Wilhelmsson, P., Dinnétz, P., & Nordberg, M. Prevalence and abundance of questing ticks and tick-borne pathogens in the Åland Islands. MS in prep.
- Carlströmer Berthén, N., Olausson, S., Janzen, T., Dinnétz, P., & Nordberg, M. Factors affecting tick densities and the distribution of tick-borne pathogens on the Åland Islands. MS in prep.