

# Ticks and the City



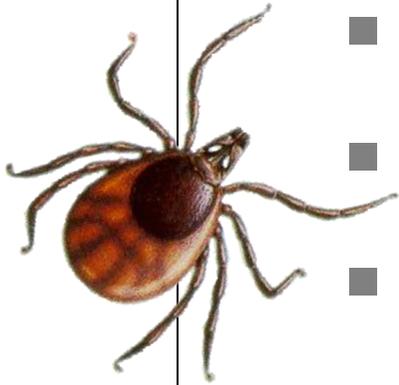
BBIB  
Berlin-Brandenburg Institute of  
Advanced Biodiversity Research



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**4th ECBC**  
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**Bonn**

# Vector tick *Ixodes ricinus*



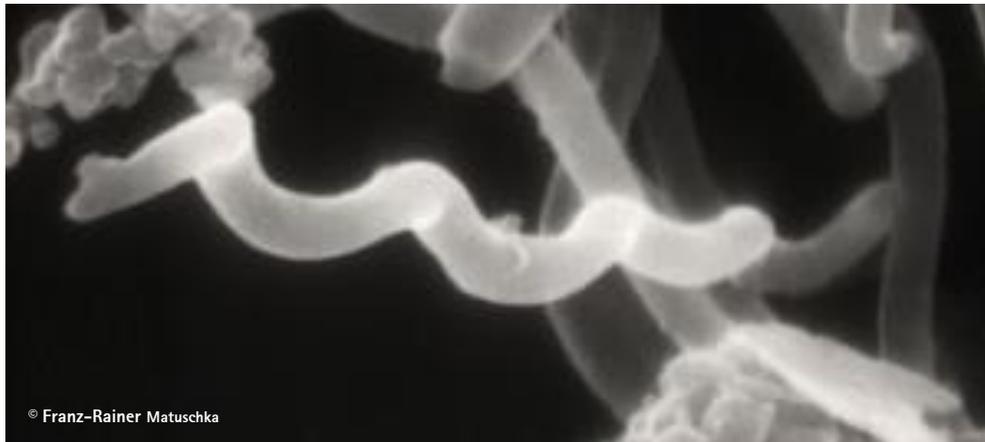
- quests for hosts in the ecotonal vegetation
- parasitizes a wide variety of hosts
- feeds once in each of three stages
- lives an estimated span of 3 to 5 years
- requires high relative humidity
- is seasonal and diapauses
- transmits an array of disease agents



# Lyme borreliosis in Germany

Estimates derived from health insurance data

- Approx. 100.000 cases p.a.
- 50 Mio € costs p.a. for diagnostic tests (incl. suspected cases)
- 30 Mio € costs p.a. for therapy and lost work hours

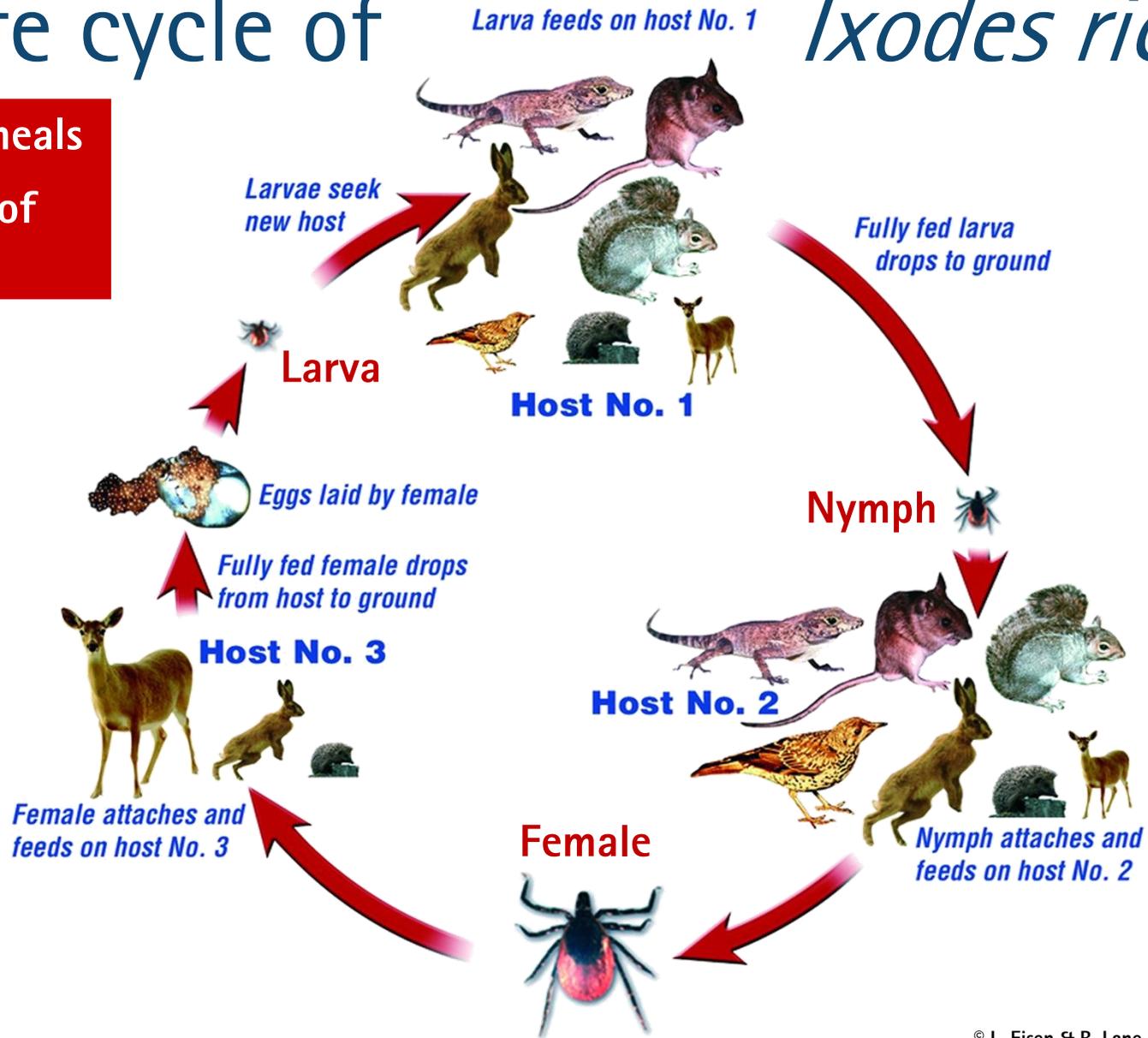


Lohr B et al. 2015. Epidemiology and cost of hospital care for Lyme borreliosis in Germany: lessons from a health care utilization database analysis. *Ticks Tick Borne Dis* 6:56–62; Müller I et al. 2012. Evaluating frequency, diagnostic quality, and cost of Lyme borreliosis testing in Germany: a retrospective model analysis. *Clin Dev Immunol* doi: 10.1155/2012/595427.



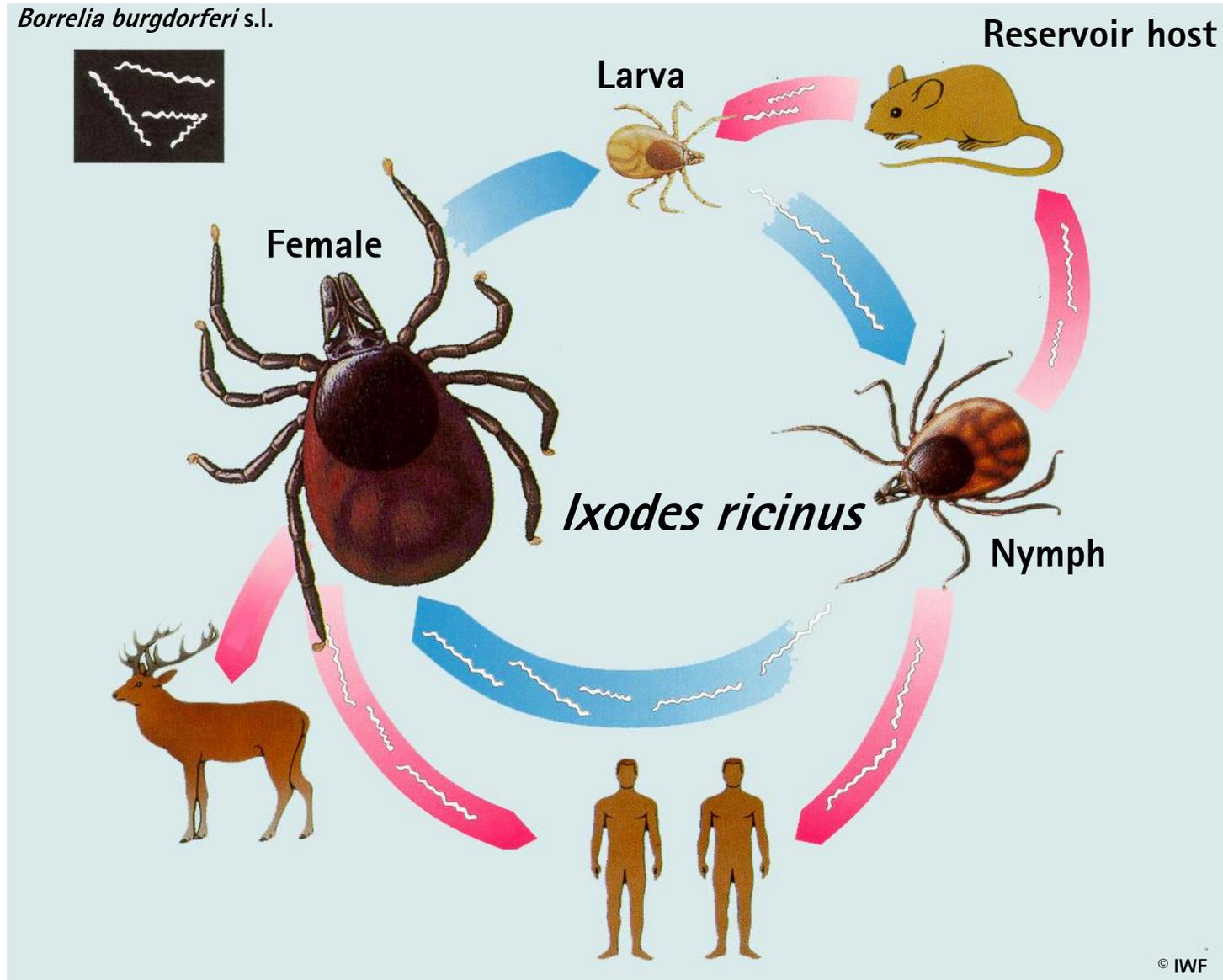
# Life cycle of *Ixodes ricinus*

3 blood meals  
Diversity of hosts



© L. Eisen & R. Lane

# Transmission cycle - *Borrelia burgdorferi* s.l.



# Reservoir hosts

- attractive for vector ticks
- permit repeated feeding of vector ticks
- susceptible for the tick-borne pathogen
- maintain the pathogen
- infectious for vector ticks



# ~~Reservoir hosts~~

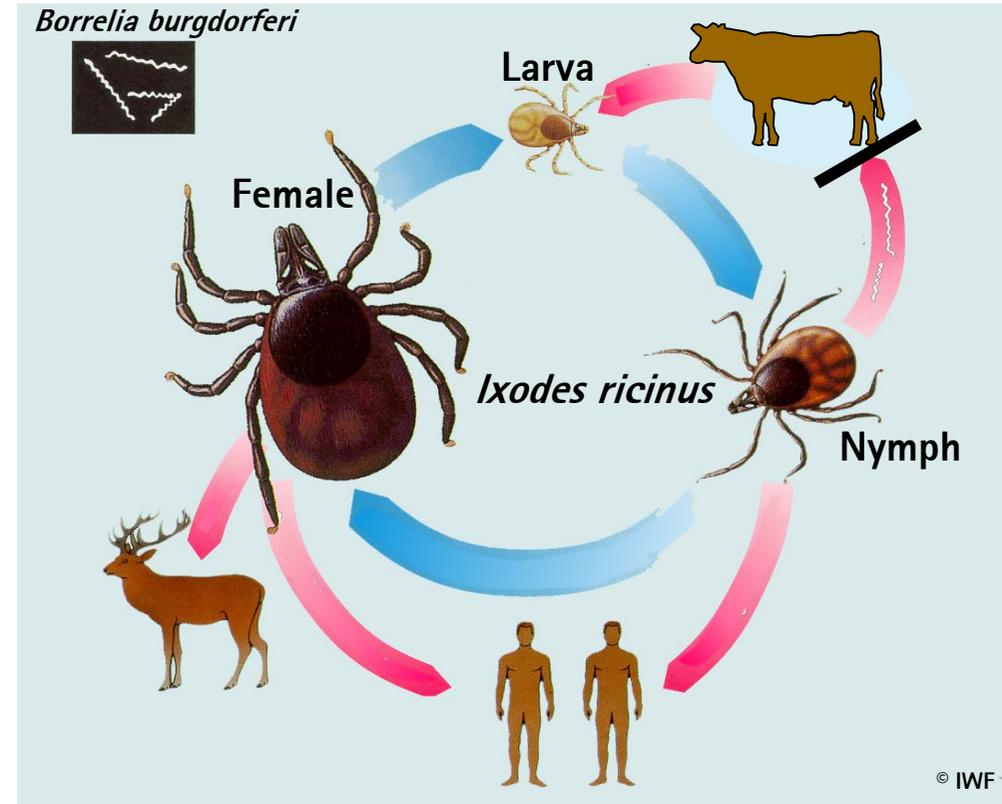
- attractive for vector ticks
- permit repeated feeding of vector ticks
- ~~■ susceptible for the tick-borne pathogen~~
- ~~■ maintain the pathogen~~
- ~~■ infectious for vector ticks~~

**diverting ticks from the efficient transmission cycle**

**→ Non-competent host**



# Non-competent hosts

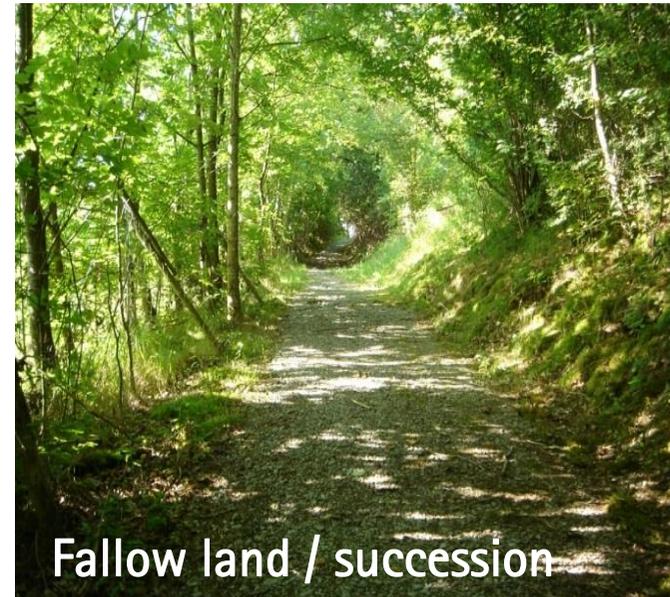
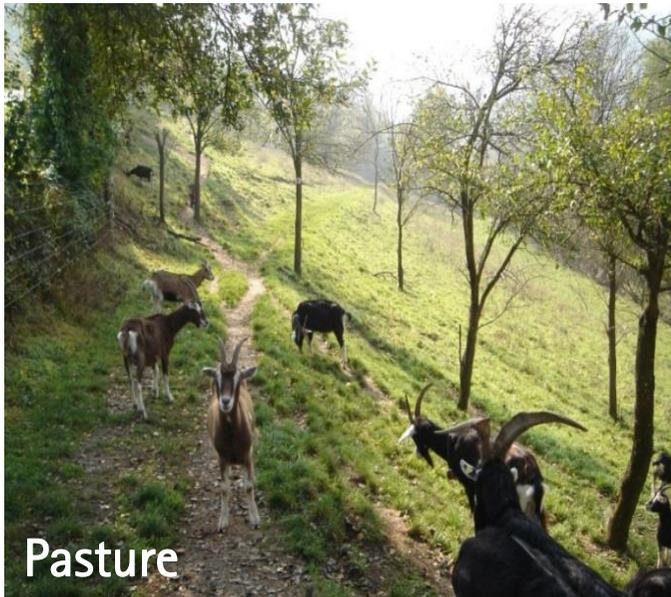


Does the presence of hosts, incompetent for Lyme *Borrelia*, affect the overall prevalence of infected ticks and thus infection risk?



# Effect of ruminants

- Extensively grazed pasture in Hohenlohe, Baden-Württemberg
- Infection risk: tick density  $\times$  prevalence of *Borrelia*

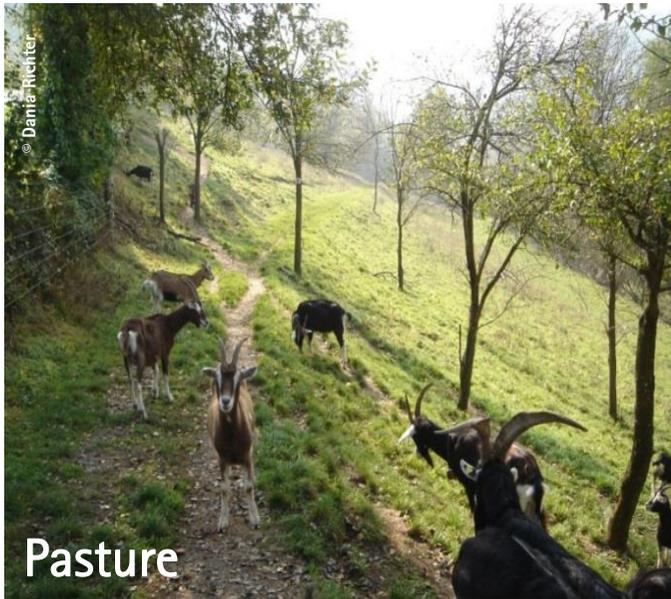


Does the presence of hosts, incompetent for Lyme *Borrelia*, affect the overall prevalence of infected ticks and thus infection risk?

# Density of questing ticks per hour

14 ticks

167 ticks



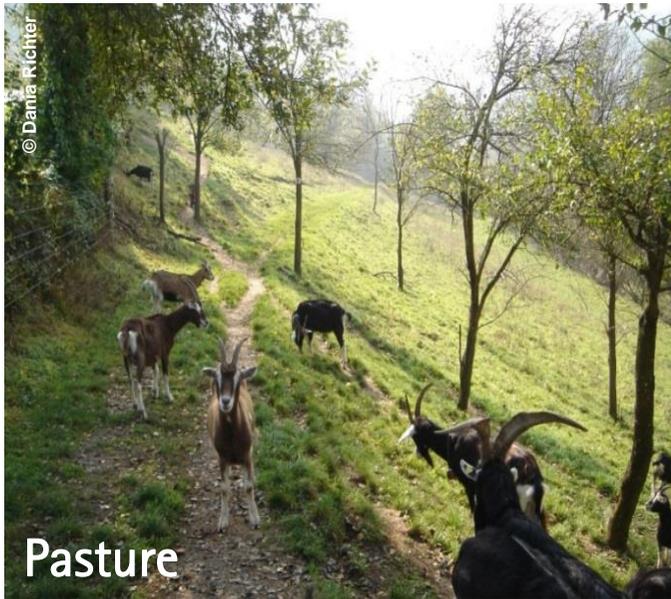
Less suitable habitat



# Infection rate in questing ticks

< 4%

16%



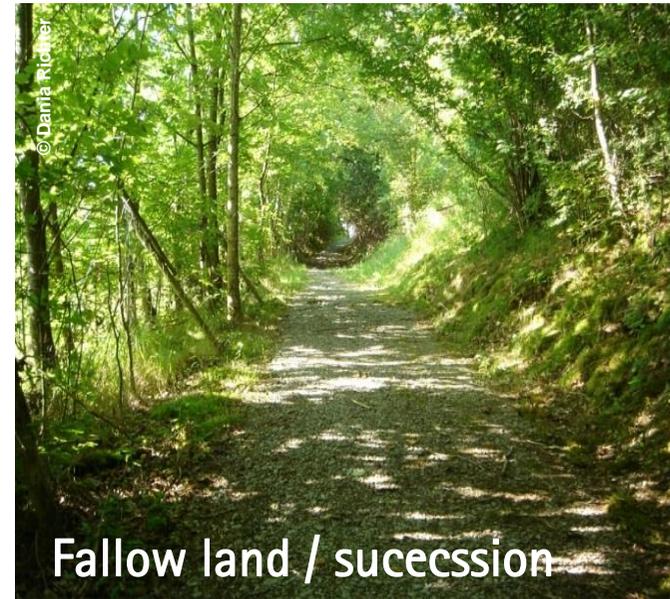
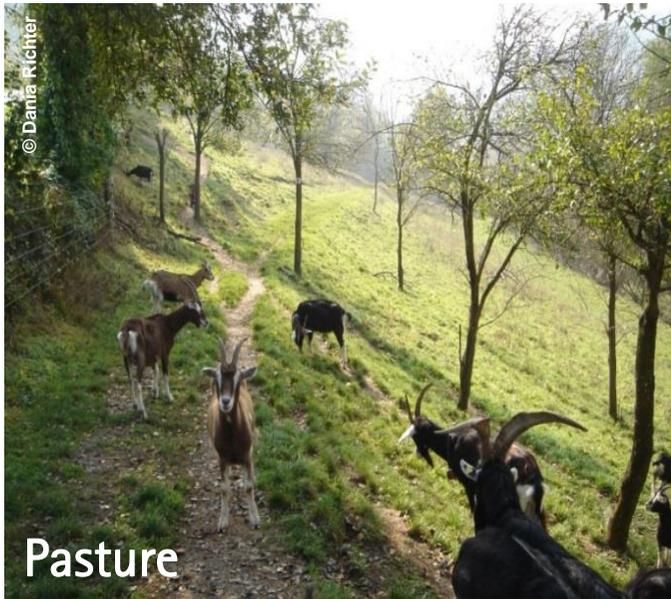
*Borrelia* eliminated during blood meal on ruminant



# Theoretical risk of exposure

1 infected tick  
in 2 hours

56 infected ticks  
in 2 hours



Risk 60 times lower!  
Zooprophylaxis!



# Ticks and the City

## Transmission in parks & private gardens

Typical urban habitats  
of *Ixodes ricinus*



In a Dutch survey,  
1/3 of 8,000 respondents acquired ticks in their own garden



# Urban transmission in urban green?

## Which synanthropic animals drive/break the urban transmission cycle?

- Reproduction hosts for ticks
  - For introduction, establishment and maintenance of tick populations in inner-city gardens
- Urban reservoir hosts
  - Mice, voles, rats and diverse turdid birds (blackbirds et al.)
- Urban zooprophyllactic hosts
  - Ruminants are generally not present, except in urban pasturing projects
  - Competence/incompetence of synanthropic animals need to be defined

**Diversity and composition of host community – i.e. ratio of competent to incompetent hosts – as urban management options**





Richter D, Matuschka F-R,  
Spielman A, Mahadevan L.  
How ticks get under your skin  
– Insertion mechanics of the  
feeding apparatus of  
*Ixodes ricinus* ticks.  
Proc Roy Soc B, 2013

**Thank you !**