Ticks and Lyme disease in the Highlands of Scotland
• Incidence rate (based on seropositive cases) within Highlands = 44.1 cases per 100 000 (2013)
• Case data = based on patient postcode information; not where tick bite occurred
• Anecdotal reports suggest: anticipated underreported figure = 5 – 10 times below true number of treated cases
• To get a real picture of incidence: correlate clinical data with lab data

(Source: Mavin et al., 2015)
Timeline for Lyme disease

PLEASE NOTE: This is a general guideline and differences will occur between individuals.

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
<th>Day 6</th>
<th>Up to 6 months</th>
<th>Between 6 and 12 months</th>
<th>From 12 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tick bite</td>
<td>Bacteria can start to spread from tick to human</td>
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<tr>
<td>You should safely remove tick (it will drop off when fully fed between Day 3-6)</td>
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<td>Early presentations: Bulls-eye type rash (erythema migrans) Flu-like symptoms Problems affecting the nervous system</td>
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<tr>
<td>Late presentations (if untreated): Pain / swelling of joints Problems affecting the nervous system Heart problems Skin problems</td>
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<tr>
<td>Persistent presentations: Over active immune system may cause symptoms to persist even after antibiotic treatment</td>
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</tbody>
</table>

You should consult your GP if you have symptoms

(Source: LymeAPP Consortium; Inverness; September 2015)
Ixodes ricinus (tick) ecology/lifecycle

Adapted from Manelli et al. 2011
Which Habitats are worse for ticks?

Tick surveys at 77 sites across Scotland

(Source: Lucy Gilbert; Cairngorms National Park Tick Talk Strathdon; 18/11/2015)
Effect of animal densities on tick abundance?

Red deer

\[ y = 0.1016x + 0.1546 \]

\[ R^2 = 0.1062 \]

Variance due to different habitats and regions
- need to test the effect of deer experimentally
- Test deer vs no deer in same habitat, same place, same time...

(Source: Lucy Gilbert; Cairngorms National Park Tick Talk Strathdon; 18/11/2015)
What is the prevalence of *Borrelia* in ticks in Scotland?

Surveys of 25 woodlands

Average prevalence = 5.6%
Range = 1-14%


(Source: Lucy Gilbert; Cairngorms National Park Tick Talk Strathdon; 18/11/2015)
Project Objectives

- Explore feasibility of using satellite data to map tick environment in the Highlands of Scotland (and potentially outwith)
- Establish how users of such information might interact with the data
- Establish if such data would be useful to users
- Explore what is missing from information currently available about ticks and Lyme disease
- Explore options for filling these gaps in knowledge
- Improved health benefit by reducing incidence/new cases of Lyme disease (risk mitigation)

Key stakeholders:
- Forestry Commission Scotland
- Healthcare professionals (incl. GPs)
- Recreational land users (incl. tourists)
- Activity providers
- Professional land users (eg. Foresters, farmers, vets)
- Accommodation providers
- Land managers
- Tourism representatives
- Wildlife managers
- Woodland managers
Co-design (user driven design) process

1. Problem identified
2. Potential solution hypothesised
3. Define user needs
4. Validate user needs
5. Define user requirements
6. Draft product design (storyboard)
7. Validate user requirements
8. Refine product
9. Develop prototype
10. Test with potential end user (demonstrator phase)

Potential end users (stakeholders/customers) identified and recruited (feasibility phase)

Workshop One
Workshop Two
Workshop Three
Current Position

User groups identified

Recreational Land Users

Occupational Land Users

Healthcare Professional Users

User requirements validated

Propose: tick and Lyme risk management strategy appropriate for each user group

Risk Maps

Smartphone app
Smartphone app

- Provides awareness raising information about ticks and Lyme disease
- Allows users to make informed decisions based on location, environment and risk level
- Allows reporting by users
- Provides users with information about what to do in the event of a tick bite, including follow up procedures
Precaution Maps

- Allows users to identify risk areas
- Provides users with behavioural actions that may reduce chances of getting a tick bite (and potential exposure to Lyme disease)
- Potential to increase understanding of spread of ticks and Lyme disease
- Potential to be used to information work planning activities
- Potential to be used to inform/compliment accident and near miss reporting systems
Maps of predicted human incidence of Lyme disease: in Highland

2010
Lyme disease incidence per postcode sector, 2010

2011
Lyme disease incidence per postcode sector, 2011

2012
Lyme disease incidence per postcode sector, 2012

Mapping of Lyme incidence from Laboratory data; 2010, 2011 and 2012
How the system works
Thank you

If you would like any further information about the UHI input to the LymeAPP project, or have any comments, please do get in touch:

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- lymemap@uhi.ac.uk