The LymeAPP: A tool for lyme disease risk management

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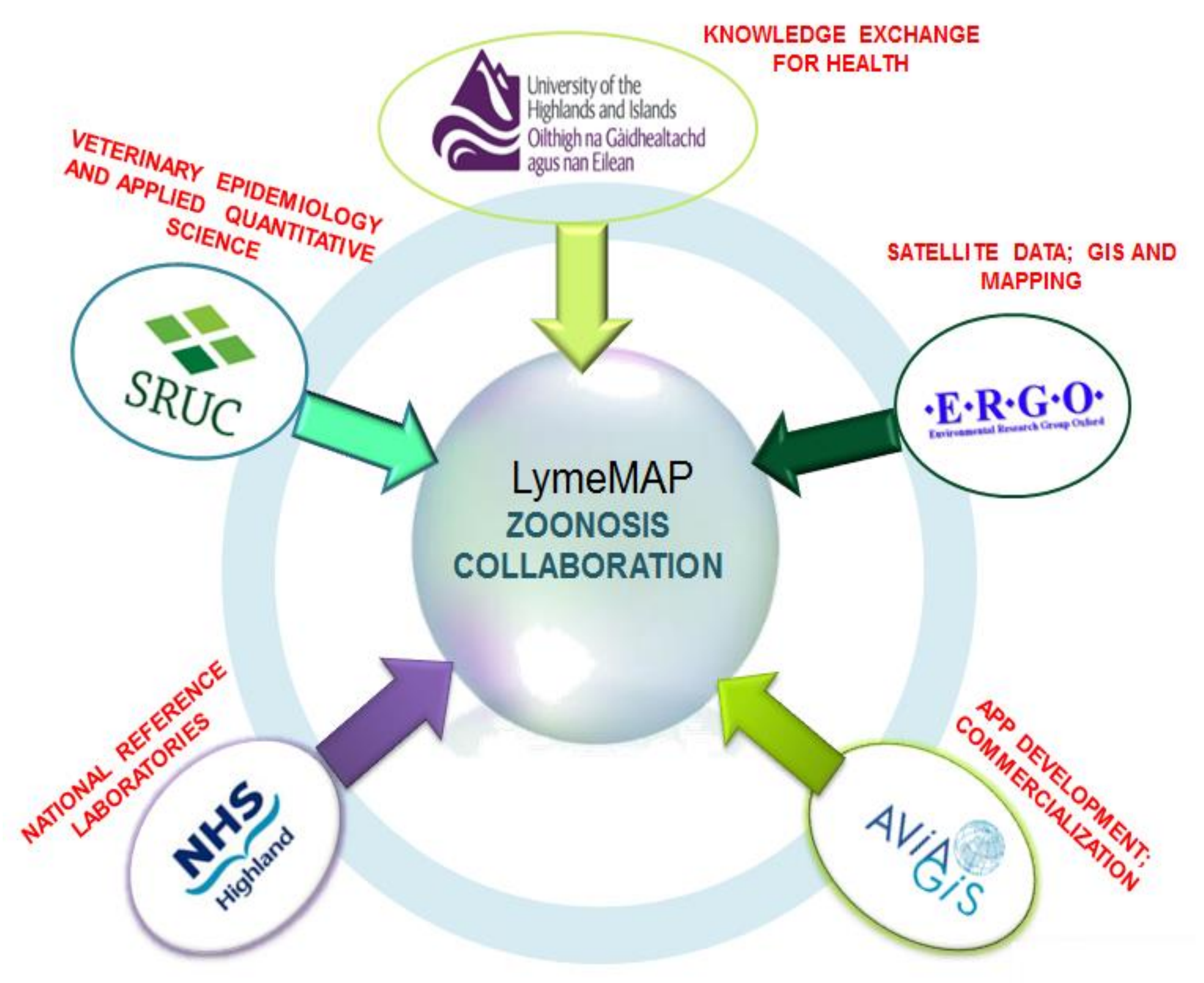
Background

Lyme borreliosis, a zoonotic disease transmitted by ticks and caused by *Borrelia burgdorferi,* is the most commonly diagnosed human tick-borne disease in the northern hemisphere [1, 2]. The disease is increasingly reported in England and Wales with an estimated 2,000 to 3,000 confirmed new cases each year in humans [3]. One of the main issues with Lyme borreliosis is a lack of clear, reliable and consistent information on how to reduce the risk of tick bites and, if bitten, how to reduce the risk of getting the disease. This lack of information extends to the general public, outdoor workers, tourists, and healthcare professionals.

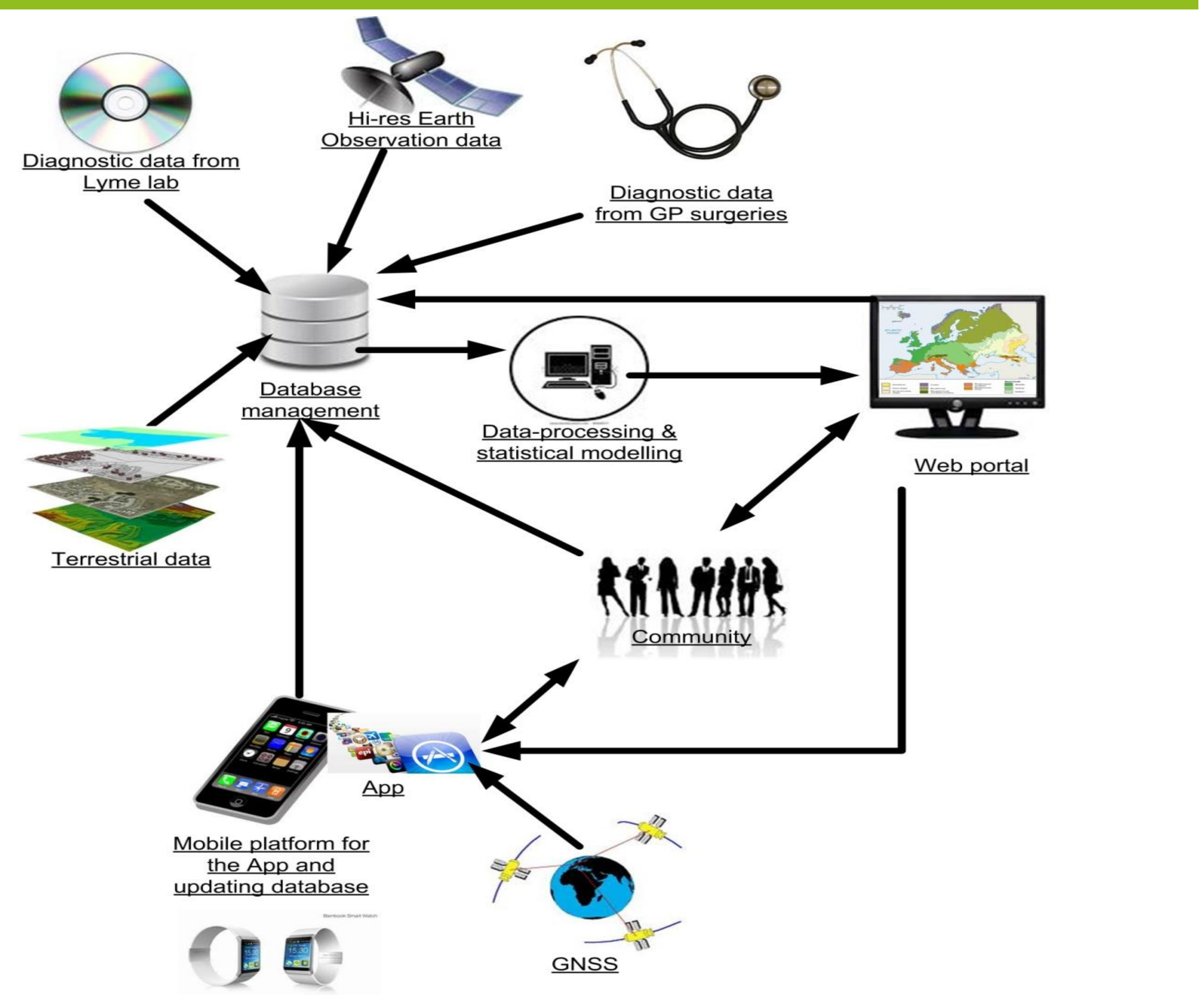
LymeMAP project seeks to test and produce "LymeAPP", an update interactive, spatially accurate Lyme borreliosis identification and risk management system, based on the integration of satellite capabilities with terrestrial data sources, personal mobile devices, GP diagnostic expertise and community engagement. The main objective is to provide a tool to help the general population minimise the risk of exposure and contraction of the disease.

The first phase of the project looked both at the technical feasibility and the commercial viability of the proposed products that are expected as outputs of the project. The Feasibility phase of the project was funded by the European Space Agency (ESA) Integrated Applications Promotion (IAP) programme. We are now developing the Demonstration phase.

Who is involved



How the system works



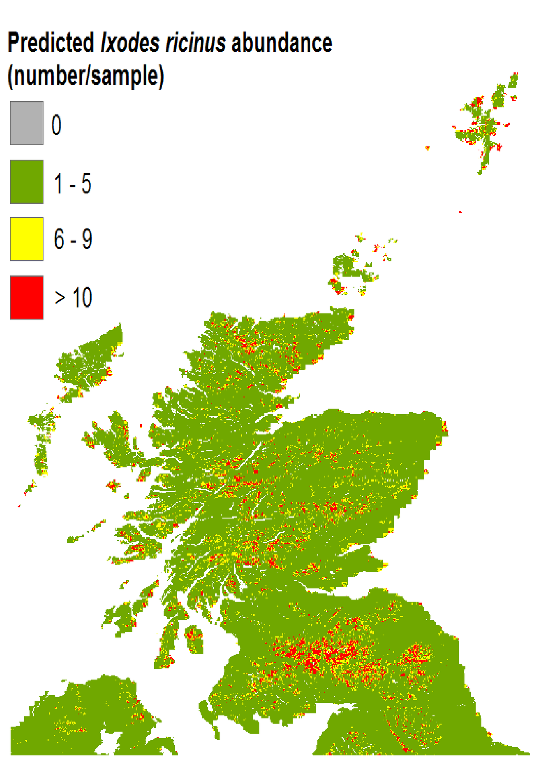
Feasibility phase: what we have done

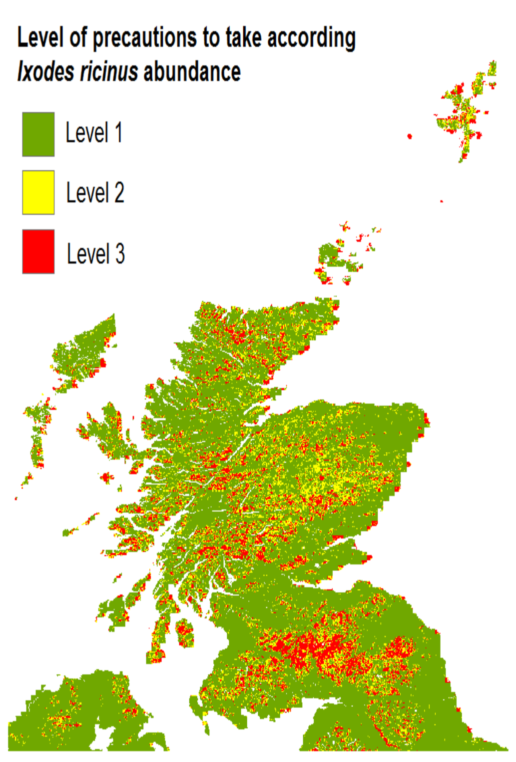
Conducted stakeholders' workshops for requirement gathering.
Designed a proof of concept.
Use INLA [4] statistical method to model ticks and Lyme disease distribution in Scotland

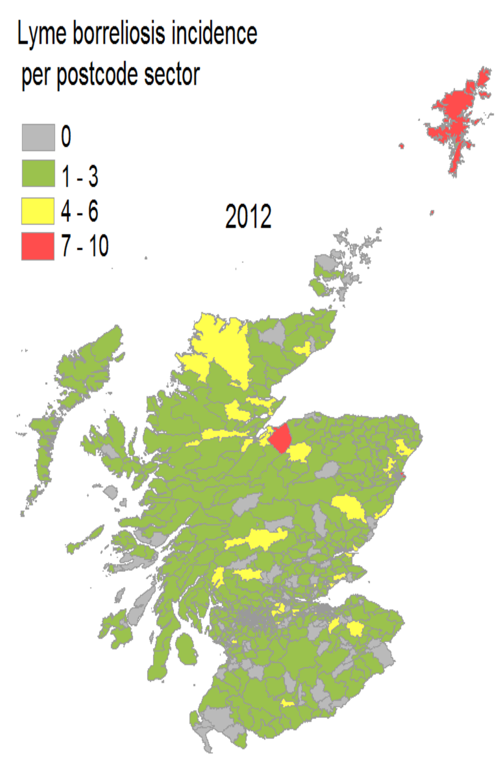
$$Y_i \sim Pois(\mu_i)$$

$$log(\mu_i) = \alpha_i + \sum_j \beta_{ij}(Terresterial\ Data)_{ij} + \sum_j \gamma_{ij}(Space\ Data)_{ij} + f(Location_i)$$

Produce risk maps of tick abundance and Lyme borreliosis incidence







Demonstration phase: what we plan to do next

In this phase, it will be demonstrated that we can build an operational system comprising an app and website with all the characteristics assessed during the feasibility phase. The economic and non-economic viability of LymeAPP have been established during the feasibility phase. The product will be commercialized.

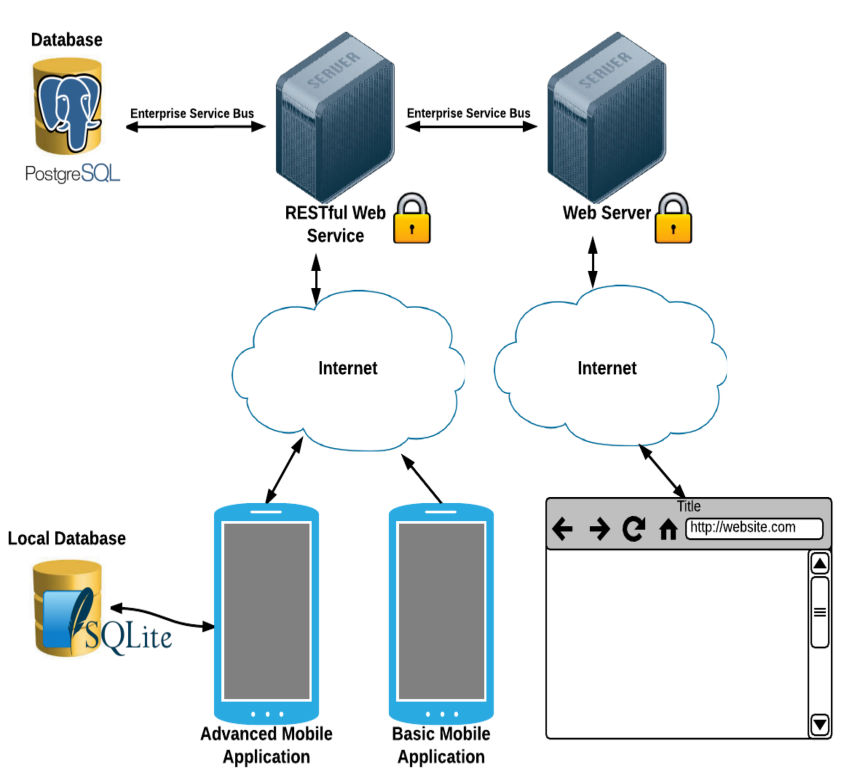


Diagram by AVIA-GIS

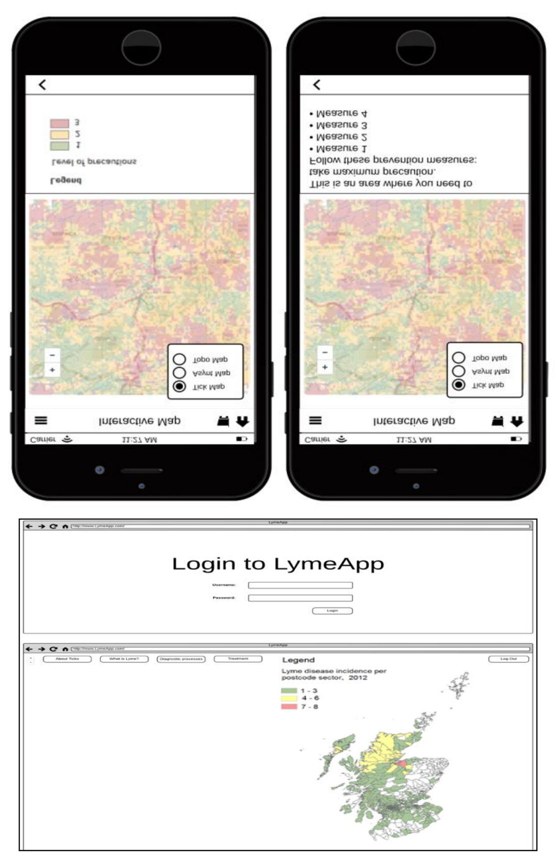


Diagram by AVIA-GIS and SRUC

References / Acknowledgements

1 - Rizzoli A, Hauffe HC, Carpi G, I VhG, Neteler M, Rosà R, 2011. Lyme borreliosis in Europe. Euro Surveillance
2 - Paul REL, Cote M, Le Naour E, Bonnet SI, 2016. Environmental factors influencing tick densities over seven years in a French suburban forest. Parasites & Vectors. 9:309 DOI 10.1186/s13071-016-1591-5
3 - Public Health England, 2015. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/463701/LymeDisease_SignsAndSymptoms.pdf
4 – INLA http://www.r-inla.org/home

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