Project Database of ICP Forests
PROJECT DESCRIPTION

PROJECT INFORMATION

Project title: A remote sensing tool to monitor and predict epidemiological outbreaks of Hanta virus infections and Lyme disease

Project ID: 13

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Background

Recently, the number of cases of Lyme disease and Nephropathia Epidemica (NE) (human kidneys affection produced by the presence of hanta virus) in West-Europe has been increasing. Although both pathologies have different causal agents, they share an important characteristic: the fact that rodents play an important role infecting humans.

One of the most important agents in the dispersion of these diseases is the bank vole (Myodes glareoulus). The bank vole is a common host for both, the Borrelia bacteria which via the ticks (Ixodes ricinus) reaches the human body and causes the Lyme disease, and the Puumala Hantavirus (PUUV) which causes NE. The favourable habitat of bank voles is broad-leaved forests (BLF) where illumination, soil and humidity conditions give rise to the existence of a moderately dense understory vegetation layer. Similar to other forest fauna species, the bank vole population depends on interannual as well as on long term variations in the habitat conditions. Consequently, understanding and monitoring key factors associated to changes in the bank vole habitat is crucial to assess future implications of environmental changes for public health.

One of the clearest evidences of the impact forest ecosystem variations can have in bank vole populations, and thus in NE, is the mast phenomenon. The mast phenomenon is the abnormal abundant production of acorns, nuts and seeds by some tree species in certain years, also known as mast years. Several studies have demonstrated the impact of the mast phenomenon on rodent populations. As for hantavirus infections, recent studies clearly show how masting can be connected to the observed temporal pattern of NE. The fact that several dominant tree species in West-European BLF, like oaks (*Quercus* spp.) and beech trees (*Fagus sylvatica*), are known to have mast years, emphasises the importance of tracking spatio-temporal patterns in vegetation dynamics.

Another influencing key parameter that determines rodent populations is the length and timing of the forest growing season since it affects the number of breeding events. Phenological changes have been mentioned as one of the possible effects of climate change affecting the primary productivity of plants. The connection between vegetation dynamics and the epidemiologic pattern of NE highlights the need of exhausting vegetation monitoring techniques. In this respect, remote sensing (RS) can offer valuable techniques and data sources to expand the knowledge about the interactions forest-rodent-disease by merging epidemiologic analyses and RS in the study of temporal and spatial aspects of vegetation.

Hypotheses

Remotely sensed data of vegetative systems can be the basis of an integrated NE and Lyme disease monitoring and prediction system

Use of ICP-Forest data

Testing our hypothesis implies the analysis of forest spectral responses, as captured by spaceborne sensors, and the evaluation of their relation to actual measured data. Particularly, we are interested in:

a. determine whether there are specific spectral responses associated to the mast phenomenon; and,
b. establish the correlation between phenology data observed in the field and the phenological parameters obtained from remotely sensed vegetation indices

In doing this we plan to construct and analyse time series of remote sensing data as well as climatic data to verify whether patterns in forest conditions (observed in Level II plots), considered relevant to rodent populations, correspond to certain climatic trends and/or changes in spectral signals of BLF forests.

Since the geographical scope of our study is West-Europe (we are particularly interested in the region comprised by France, Belgium, The Netherlands, Germany, Luxembourg), the ICP-Forest database, when combined with other data sources, offers the opportunity to reveal implications of forest dynamics in human health at a broad spatial scale, and allows the evaluation of remote sensing techniques as potential tools in integrated epidemiology prediction and monitoring systems.