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A remote sensing tool to monitor and predict epidemiologic outbreaks of Hanta virus infections and Lyme disease

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Lyme disease and Hanta virus infection are the result of the conjunction of several climatic and ecological conditions. Although both affections have different causal agents, they share an important characteristic which is the fact that rodents play an important role in the contagion.
One of the most important agents in the dispersion of these diseases is the bank vole (Clethrionomys 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 Nephropatia epidemica which is caused by Puumala Hantavirus and affects kidneys in humans.
The prefered habitat of bank voles is broad-leaf forests with an important presence of beeches (Fagus sylvatica) and oaks (Quercus sp.) and a relatively dense low vegetation layer. These vegetation systems are common in West-Europe and their dynamics have a great influence in the bank voles population and, therefore, in the spreading of the infections this study is concerned about.
The fact that the annual seed production is not stable in time has an important effect in bank voles population and, as it has been described in other studies, in the number of reported cases of Hanta virus infections and Lyme disease. The years in which an abundant production of seeds is observed are referred to as mast years which are believed to obey to cyclic patterns and to certain climatologically characteristics of the preceding years. Statistical analysis have confirmed the correlation in the behaviour of the number of infected cases and the presence of mast years.
This project aims at the design of a remote sensing based system (INFOPRESS - INFectious disease Outbreak Prediction REmote Sensing based System) that should enable local and national health care instances to predict and locate the occurrence of infection outbreaks and design policies to counteract undesired effects. The predictive capabilities of the system are based on the understanding and modelling of the interactions between relevant climatic parameters (temperature, humidity, precipitation) and the main features of vegetation systems which host the vectors and determine the survival and infectious potential of the causal agents.
Among the most important study subjects in this research initiative one can mention the time series analysis of vegetation parameters derived from satellite remote sensing and its relation to climatic time series and historical records of infected cases; with special attention to the assessment of remotely sensed evidences of the mast phenomenon. This analysis will constitute important buildind bricks in the construction of the INFOPRESS system in what concerns the assessment of the potentials of satellite remote sensing as information source for the prediction of infection outbreaks.
The bank voles habitat description will also be supported by on-ground remote sensing techniques, specially LiDAR technology and soil humidity modelling. These measurements are to be coupled to bank voles epidemiologic features obtained from field capturing and lab analysis in which the presence of Hanta virus will be assessed.