Expression of Interest for Call : *"Climate Smart Agriculture"*

Project: **Build a model which will explain how the risk of an outbreak of each of the animal diseases in the monitored areas changes under different climate conditions**

Outline: This project will collect and organize into uniform platform existing information of local authorities (e.g. Cyprus Veterinary services (CYVS)) comprising results from several analyses. Information will target different diseases that will be investigated, including bluetongue, west Nile fever, Newcastle disease, Brucellosis, paratuberculosis or any other disease for which records exist in the different pilot locations of the participating countries. The focus of the diseases will be on direct (animal-animal) and indirect transmission by vectors (animal-vector/vehicle-animal). Generally, many pathogens spend time to the environment exposed to the weather in order to get from one host to another. Therefore, climate can affect pathogen survival, persistence, generation times and seasonality. Our main objective will be to develop a model which will explain how the risk of an outbreak of each of the animal diseases in the monitored areas changes under different climate conditions. The attempt will be to examine the effect of past climate on the risk of the animal diseases over the past years (as back as we can go, 20-40 years would be ideal) to understand the specific triggers for disease outbreak over time and throughout geographical regions of interest. We can then drive the model forwards in time, using predictive climate models (20-40 years ahead accordingly) to show how the diseases may react to future climate change. For some we would expect to find significant differences while other may not be affected so much.

The core of the proposal will be a computerized system which will host the data organized in a layered form so as to accommodate their demonstration on a GIS module which will be integrated with the main system (MS). The MS will serve two purposes: (i) It will form the basis for digitizing information that is already available, as well as provide the means for collecting and storing further data in the future. (ii) It will utilize models based on data mining and computational intelligence to describe the possible dynamics behind the effect that climate changes may have on the birth and spread of various animal diseases in the selected areas of interest. The first purpose will be facilitated by the development of a modern software system which will offer web and mobile software services to users that wish to enter new or view existing data. The former will be based on a client-server architecture that will enable the gradual enrollment of groups of users in the data recording activities, with the type of users ranging from national authorities, to vets, breeders etc. The second purpose forms a data analysis axon, which will incorporate visual

presentation of the available data in a spatio- temporal manner with GIS serving as the medium for organizing information in layers of interest and displaying this information on maps ranging from satellite images to specific land zooming. Innovative classification algorithms will be applied to satellite images for mapping the diachronic land use /land cover regime of significant pasturages in terms of flora and fauna. The most significant part of this axon, though, will be the construction of models based on novel computational intelligence approaches like Fuzzy Cognitive Maps, Artificial Neural Networks and Evolutionary Algorithms, as well as more conventional approached, like statistical data analysis methods, that will enable the study of the evolution of diseases through the years and their association with climate change factors and with the condition of significant pasturages in terms of type of flora and excess use. The models will enable scenario analysis and projection of the course of undesired situations in the future, as well as reveal those factors that are considered more important so as to revert their negative effects on the situation under modeling.

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