Speaker： Kenshi Sakai (Tokyo University of Agriculture and Technology)
Title： Nonlinear time series analysis on short noisy ensemble data

Most real world time series are too short and noisy to perform nonlinear time series analysis. However, in agriculture, it is not difficult to obtain ensemble time series data with a large cardinality, e.g. ten thousand. Utilizing this property, we developed the techniques to investigate the collective dynamics of seeds/fruits productions of trees in terms of determinism and synchrony. Perennial plants often show a highly synchronized fluctuation in their seed production called alternate bearing or masting. The alternate bearing of tree crops has been a central topic in agriculture and pomology. Citrus (e.g., oranges, lemons and mandarins), pistachios, and chestnuts are all crops that show pronounced alternate bearing (on-year followed by off-year). Masting of trees are also important for wildlife and mast effects cascade through ecosystems. The synchronization of ensembles of oscillators is known to be caused by mutual coupling and/or common noise. Many types of coupling, such as indirect local or global coupling and direct coupling, have been investigated. Common noise-induced synchrony is also a popular explanation of synchronization for certain types of plants. In this talk, I will demonstrate some typical collective dynamics modelled by globally coupled maps, coupled map lattice, diffusive coupling, asymmetric coupling, direct coupling and common noise-induced oscillators which we have used to explain the various types of synchronizations observed in fruits, nuts and acorns. I will show how the combination of chaos theory, synchronization theory and analytical phase analysis are useful in agricultural time series.