

Marie Skłodowska Curie Action –Postdoctoral Fellowship 2024
(MSCA-PF-2024)

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Department /Institute /Centre	Name	Department of Applied Mathematics. E.T.S. de Ingeniería Agronómica, Alimentaria y de Biosistemas.
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	Province	Madrid
Research Area		Environment and Geoscience (ENV) Mathematics (MAT) Information Science and Engineering (ENG)
Brief description of the Centre/Research Group		<p>The GSC (Complex System Research Group) is a multidisciplinary team of 20 researchers, belonging to different UPM Schools, with extensive research and teaching experience in Physics, Mathematics, Statistics, Chemistry and various branches of Engineering. Their training allows them to carry out high-quality research work, internationally recognized, in the interdisciplinary area of Complex Systems. GSC collaborates with similar groups in the US, South America and Europe. Within the UPM, it occupies the global position 11/184 of the research groups according to the latest Results Report of the UPM Quality Plan of 2019, highlighting position 3/184 in the dissemination of research results and position 5/184 in the recognition of merits.</p> <p>One of the research lines in the GSC is Biocomplexity in Agrarian Systems. The behaviour of agricultural systems is nonlinear, because it refers to feedback loops that can explain and predict the behaviour of each element, which, when affected, has an impact on the others, like an interconnected network of information. In our group we have focused on: scale laws that relate different levels of aggregation, predictive models based on machine learning, and patterns recurrence detection in agricultural systems.</p> <p>We are applying these tools to various topics such as: analysis of porous soil structures, mapping of vegetation indices and soil properties, dynamics analysis in grasslands, semi-arid zones, and deforestation.</p> <p>http://www.gsc.upm.es/gsc3/</p>

<p>Project description</p>	<p style="text-align: center;">Recurrence and Patterns of Agro-Complex Systems REPROCESS</p>  <p>Ecosystems are considered complex systems with non-linear dynamics in space and time for more than three decades. However, only recent research focuses on tackling the complexity of ecosystem temporal dynamics with non-linear methodologies. As an eco-social system, rangelands comprise 30–40% of the Earth’s landmass, supporting approximately 1 billion people; this makes them suitable land types to study ecosystem dynamics with significant human activity effects. This type of land is heavily affected by land degradation which reduces biological productivity, ecosystem functions, and complexity.</p> <p>The Normalized Differentiated Vegetation Index (NDVI), obtained from Remote Sensing, is widely used to monitor rangelands. The NDVI series are non-linear, non-stationary and seasonal. NDVI and its relationship with meteorological variables (temperature and precipitation) have reported different results depending on the analysed spatial scale, the heterogeneity of the soil properties and topography of the terrain. However, these relationships are essential to forecast drought situations that specially affect Mediterranean areas as it is in Spain.</p> <p>In this line, recurrence plots (RP) is a rigorous, multidisciplinary and visually appealing methodology to detect temporal pattern in complex dynamical systems. Furthermore, pattern structures at small or great scale can be quantified thorough a recurrence quantification analysis to attain a complete characterization of a ecological system. The main objective of this project is to forecast the responses of the rangeland NDVI to temporal dynamics of temperature and precipitation for an arid environment. Several methods will be applied in time and space, beginning with RP and Joint RP (JRP).</p>
<p>Applications: documents to be submitted and deadlines</p>	<p>CV, letter of motivation, PhD diploma Deadline: 30th April 2024</p>