PIEF-GA-2009-237097 DISLOOP

PUBLISHABLE SUMMARY

The **decline or extinction of native species** involved in **biotic interactions** (i.e., the disruption of interactions) can cause significant changes in ecosystem processes (Bronstein, 1994). Ecosystem structure and functioning is most likely to be affected in habitats that already have lost functional redundancy, and or those which limited functionality at the regional species pool level (e.g., islands where few species can interact there naturally; Rejmánek 1996). The case of the Mediterranean basin is quite paradoxical: despite being one of the global biodiversity hotspots (Myers et al 2000), human activities have extensively impacted its ecosystems for more than 8,000 years which is significantly longer than any other hotspot (Delanoë et al. 1996). For such reason, Mediterranean islands are extremely vulnerable as their small size increases the effects of loss of biodiversity and ecosystem functioning. The project *DISLOOP* was proposed to improve our understanding of the **direct and indirect consequences of the disruption of plant-disperser interactions** within the context of the **spatial-explicit population dynamics**. This project is focussed on a well-know plant-disperser interaction between the endangered shrub *Daphne rodriguezii* Teixidor (Thymelaeaceae) and its only seed disperser, the frugivorous lizard *Podarcis lilfordi* Gunter (Lacertidae), both endemic to the Balearic Islands (Western Mediterranean). Plant populations are under two extreme ecological conditions (in which **the disperser is present and absent**), which is a rare and essential requisite in the study of the disruption of plant-animal interactions and especially useful for model validation (see below).

The main approach of this project requires a combination of advanced modeling techniques and profound knowledge of the natural history of the species of interest. The model is rooted in a valuable and interdisciplinary dataset, comprising the data analysis of plant and animal demography, animal movement and spatial distribution of plants. In consequence, the main challenge of this project is to integrate heterogeneous field information into the general framework of spatially-explicit and individual-based models (IBM).

A first major achievement of the project was the description and analysis of observed patterns which were based on two methodologies. First, we developed *habitat quality models* to define the landscapes from the perspective of the plant and the lizard, both in the plant populations with and without seed disperser. We hypothesize that the activity patterns of the frugivorous lizard directly influence the spatial distribution of the plant species. To evaluate this hypothesis, we first analysed lizard activity and identified its main determinants at several spatial scales of habitat aggregation. In a second step, the most important determinants of lizard activity plus those describing habitat structure were used to predict the presence of adult and juvenile plants. The main result was that the interplay between lizard activity and local habitat features determines the spatial patterns of juvenile-plant presence and leaves a lasting signature on adult-plant distribution (Rodríguez-Pérez et al. in press).

Second, we used *spatial point-pattern analyses* (SPPA, hereafter) to describe the observed spatial structure of the plant populations. We weighted the relative importance of seed dispersal as a process structuring the plant spatial distribution. For such purpose, it was necessary to develop habitat suitability maps of the plant and the lizard (see previous task) which were used to generate null hypotheses testing the plant spatial distribution. The results derived from this analysis suggest that the presence of the seed disperser created broad-scales heterogeneties in plant distribution (blurred by stochastic processes under the disperser absence), whereas the plant aggregation could even more tight at local scales after the disperser loss, which may lead into an increase of interspecific competition at early stages of plant recruitment (Rodríguez-Pérez et al. in prep).

Third, we have started to develop the *spatial-explicit population model* based on both describing the movement activity of the seed disperser and the plant population dynamics. We planned to create two submodels of (i) lizard activity and (ii) plant demography. Concurrently to the analyses described above, this task has been delayed from the planned schedule. One reason for the delay is that we were able to extract more information than initially thought directly from the statistical analysis of the data (i.e, the two archivements described above). This involved some additional effort but greatly simplifies the analysis of the spatial-explicit population model (because much less unknown parameters and processes need to be determined indirectly). The SPPA contributed greatly to optimize the structure of the simulation model and to indirectly determine unknown parameter processes useful to quantify and implement discrepancy measures between model output and the observed patterns of the spatial distribution. The simulation model will test how the fine and broad activity responses of the frugivorous lizard could affect the plant demography. Moreover, it is also possible that the model could also test the sensitivity of the plant population dynamics in front to a loss the seed-dispersal connectivity.

References

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