CBGP Centre de Biologie pour la Gestion des Populations

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SOUTENANCE DE THÈSE

THE EFFECTS OF PAST AND FUTURE CLIMATE CHANGE ON DESERT LOCUST POPULATION DYNAMICS

par

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- Climate change is creating major challenges for ecosystems worldwide, endangering fragile species while creating favorable conditions for invasive species and agricultural pests. This dual threat compromises biodiversity and food security, highlighting the urgent need to understand and predict the adaptation mechanisms of these species to mitigate the effects of climate change. This thesis uses the desert locust (*Schistocerca gregaria*), one of the most destructive agricultural pests, as a study model to investigate the influence of climate change on pest population dynamics.
- In response to high population densities, desert locusts become gregarious, forming swarms that can cause major damage to crops and pastures, threatening the food security of human populations from West Africa to India. This transition from a solitarious to a gregarious population is highly dependent on favorable weather conditions. Climate change is therefore likely to have a significant impact on spatial distribution and the risk of gregarization. However, the desert locust is intensively managed on a large scale, which could compensate for the increased risk of invasion due to a more favorable climate.
- The aim of the first part of this thesis was to assess whether changes in climatic conditions have altered locust population dynamics in the past. To do this, we carried out a statistical analysis at different spatial scales, combining historical locust observation and treatment effort data with past climate variables. The results show that while climate change has created favorable conditions for locust outbreaks in some regions, preventive management efforts have significantly mitigated these risks. However, regional disparities in management effectiveness highlight the need for coordinated strategies to ensure overall success.
- The second phase explores climate change scenarios using a locust population dynamics simulator to assess how locust populations might respond in the future. To do this, we first developed an agent-based model (ABM) capable of simulating desert locust population dynamics, integrating known biological and ecological processes, and depending on climatic variables. We then used projected climate data to predict future population dynamics. Simulations of the different future climate scenarios tested revealed two critical trends: an increase in gregarisation events and a northward expansion of gregarisation areas. These results are in line with broader ecological theories concerning range shifts in response to global warming and reinforce the importance of adaptive management strategies to address emerging vulnerabilities.