Evaluating the Importance of Region-Specific Bioclimatic Datasets in Projecting the Future Distribution of *Lissachatina fulica* in Complex Landscapes

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The invasive African giant snail (*Lissachatina fulica*) poses a significant threat in tropical and subtropical regions, necessitating accurate distribution models for effective management. This study used the Maxent algorithm and both global (WorldClim, CHELSA) and high-resolution regional (BICI-ULL) bioclimatic datasets to project the future distribution of *L. fulica* in the topographically complex Canary Islands under CMIP5 RCP4.5 and RCP8.5 scenarios for mid- and end-century. Results using the BICI-ULL dataset indicate a future shrinkage of suitable habitat to a small area in northern La Palma, contrasting with the overestimation of suitable zones across the archipelago predicted by global datasets. This highlights the crucial role of incorporating region-specific, high-resolution data like BICI-ULL for accurate invasive species distribution modeling, particularly in areas with complex environmental gradients.

● Objectives:

- To estimate the potential presence areas of the invasive species *Lissachatina fulica* under different future scenarios
- To assess the capability of the BICI-ULL dataset to make reliable local projections.

● Materials & methods:

- **Global Occurrence Data** of *L. fulica* from 1970 to 2024 were downloaded from the GBIF database.
- **Species Distribution Model (SDM):** The Maxent code (Phillips et al., 2006), a machine learning technique effective for presence-only data, was used to model the snail's distribution.
- **Environmental Data (WorldClim & CHELSA)** at a high spatial resolution (30 arc-seconds).
- **Future Climate Scenarios:** SSP1-2.6 (low emissions) and SSP5-8.5 scenarios (high emissions).
- **Variable Selection:** A Pearson correlation (0.8) on the 19 bioclimatic variables (8 selected).
- **Model Projections & Comparison:** Trained models using global datasets → projected onto future in a similar high emission scenario (CMIP RCP 8.5) and compared with regional projections generated using BICI-ULL (Sosa-Guillén et al., 2024) dataset specific to the Canary Islands.

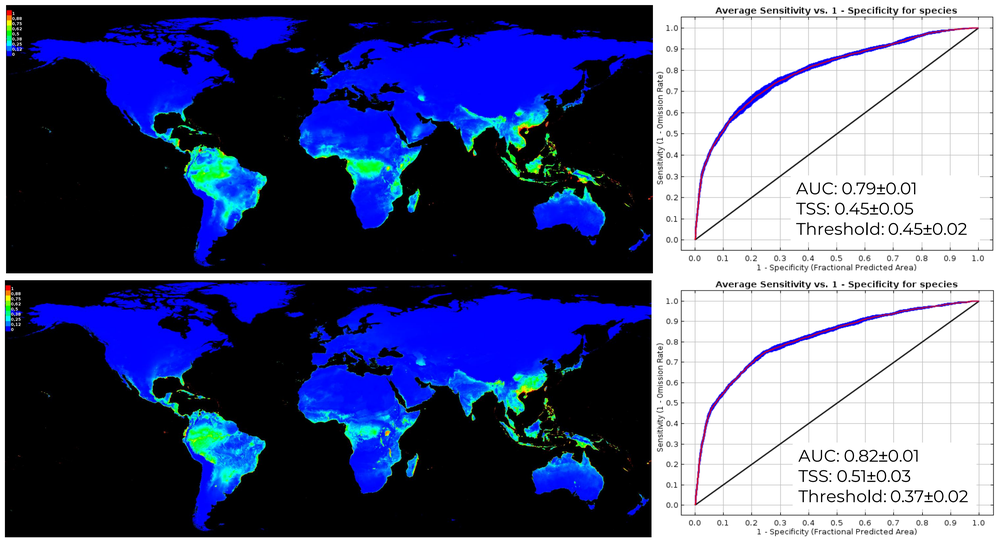

Fig. 1: Probability of occurrences at historical period and ROC curves estimated by Maxent for WorldClim (top) and CHELSA (bottom) datasets. Cool colors symbolize low probability while warm colors stand for high probability.

● Conclusions

- BICI-ULL has demonstrated its ability to estimate potential habitats in Maxent, one of the most widely used SDMs in the scientific community.
- BICI-ULL is a dataset composed of 53 biovariables compared to 19 in WorldClim and CHELSA → exclusive use of regional datasets can shed light on the variations observed in response curves.
- Global models can provide a general overview, but their accuracy is limited in regions with complex environmental conditions like the Canary Islands. This highlights the critical need for and potential of regional bioclimatic datasets to provide more reliable and nuanced predictions for invasive species distribution.

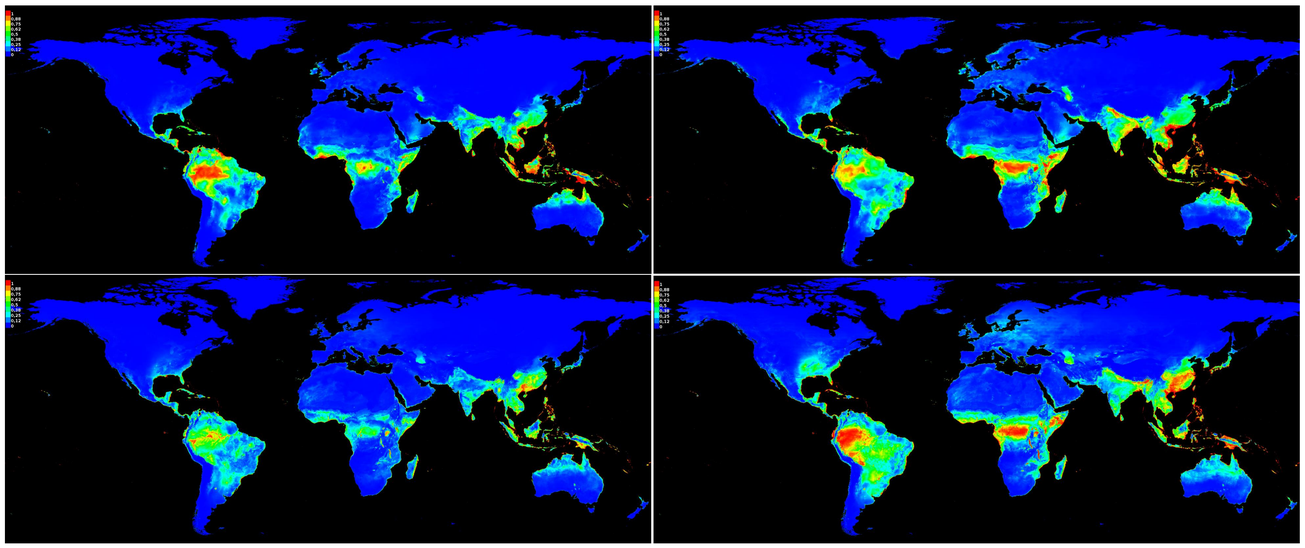

Fig. 2: Probability of occurrences estimated by Maxent for the WorldClim (top row) and CHELSA (bottom row) at 2 different time periods for the SSP5-8.5 climate scenario: mid-century (left column) and late-century (right column).

● Results & discussion:

- Global Training Data (**Fig. 1**):
  - Similar data for WorldClim & CHELSA
  - Total potential habitat area of *L.fulica*: ≈ 22 million km² (consistent with Wu et al., 2023)
- Future Projections (SSP5-8.5, **Fig. 2**):
  - Similar pattern in both models
  - Highest environmental suitability in same regions: Equatorial Africa, Amazon, India, Indonesia and Philippines
- Regional Scale (Canary Islands, **Fig. 3**):
  - Significant discrepancies due to bioclimatic variable construction: 1) CHELSA: Overestimation of suitable area vs. WorldClim. 2) Concentric distribution: Suitable climatic regions in Tenerife & Gran Canaria (CHELSA)
  - **Contradiction in Lanzarote**:
    - ➢ **WorldClim**: Probability **< 0.2** (late-century)
    - ➢ **CHELSA**: Probability **> 0.8** (late-century)
    - ➢ Cause: CHELSA response curves generally have wider tolerance ranges than WorldClim.
- WorldClim & CHELSA: Widely used, but regional differences create uncertainty → Need: Region-specific bioclimatic dataset (**BICI-ULL**) to reduce uncertainty (as suggested by Tsiftsis et al., 2024).
- BICI-ULL uses equivalent emissions scenarios to SSP as CMIP RCP 4.5 and RCPP 8.5

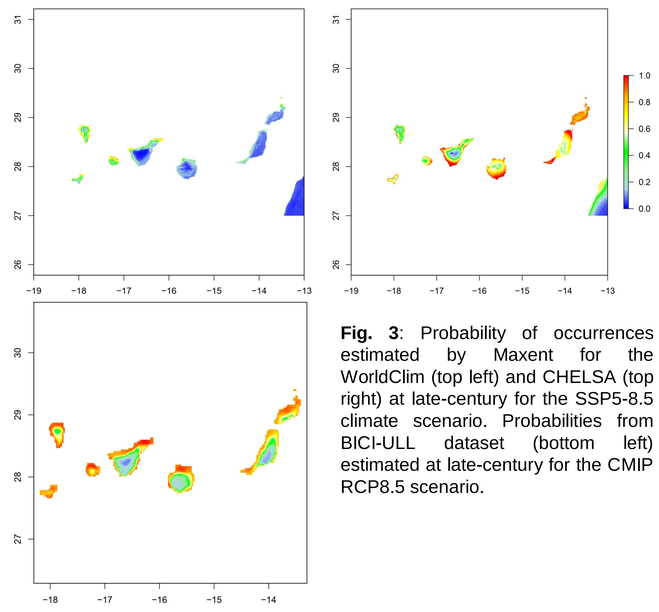

Fig. 3: Probability of occurrences estimated by Maxent for the WorldClim (top left) and CHELSA (top right) at late-century for the SSP5-8.5 climate scenario. Probabilities from BICI-ULL dataset (bottom left) estimated at late-century for the CMIP RCP8.5 scenario.

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