Comparing camera traps and sound recorders as data sources for assessing bird occupancy in the Dry Chaco

Laura Gonzalez, Master's Thesis

Abstract

In Latin America, tropical dry forests face various threats, including deforestation, rapid urbanization, and agricultural expansion. Habitat fragmentation, a principal effect of agricultural expansion and the main driver of biodiversity loss, has uncertain effects on biodiversity, as some species may benefit while others are negatively affected. Birds, as indicators of habitat quality, are tightly linked to landscape trends, making monitoring methods such as camera traps, sound recorders, and occupancy models meaningful in this understudied environment. I compared community-level diversity metrics across camera trap and audio recorder data, then the variation in occupancy for four focal species using a) camera traps, b) sound recorders, and c) both datasets combined, across methods performance and along a deforestation gradient. Camera-trap and audio-recorder data showed biased results in diversity metrics, suggesting that each method was limited to the sampling extent and species features such as vocalizations or size. Occupancy probability for each species varied and was method-dependent. Forest cover had a significant positive effect on the occupancy probability of Black-legged Seriema and a negative effect on the occupancy probability of Greater Rhea. In contrast, cropland cover had mixed effects on the occupancy probability of Brushland Tinamou, Chaco Chachalaca, and Greater Rhea. Audio-only models performed better in holdout cross-validation, contradicting the hypothesis that integrated models improve accuracy and highlighting the need for better model design. These results proved that these generalist species benefit from and adapt to an environment modified by humans. Although the majority of integrated models were uncertain, the integration of cameras and audio recorders across a wider area, over the long term, and with clearer objectives, remains valuable and useful for conservation strategies, not only for species that thrive in a fragmented landscape, but also for the specialized species that are declining and inhabit the remaining forest fragments.

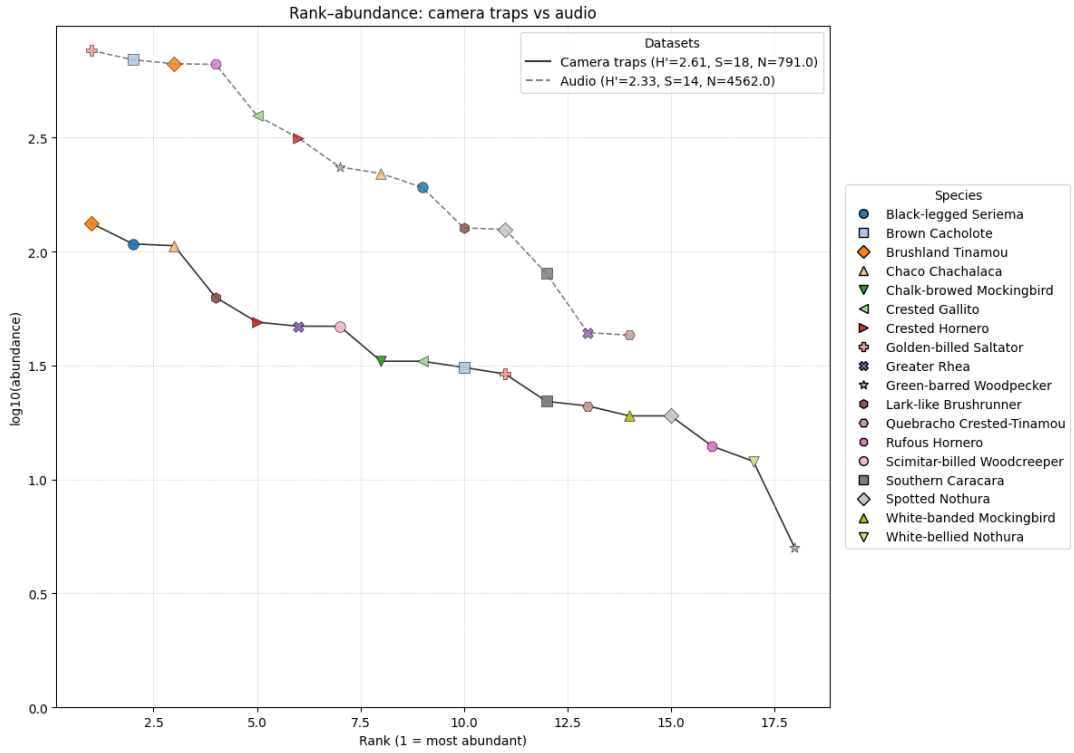


Figure 1. Rank-abundance curve from camera traps vs. audio data across all areas. This graph illustrates the relative abundance distribution of bird species observed in all audio recorders and cameras deployed across the four areas.

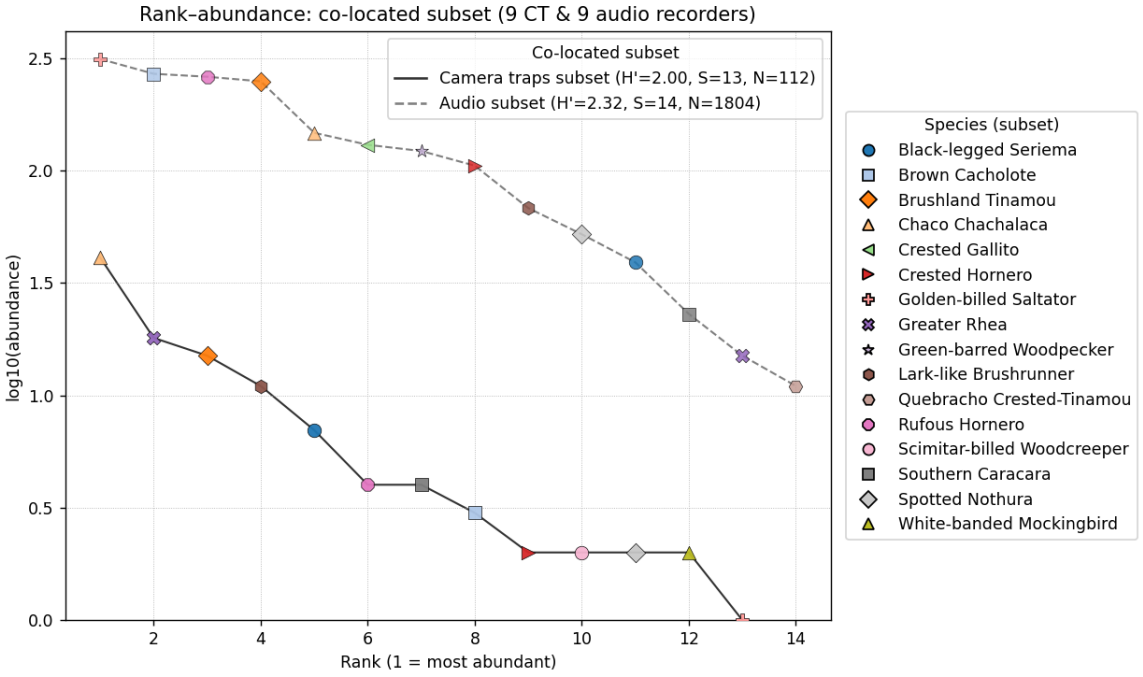


Figure 2. Rank-abundance curve from camera traps vs. audio data at collocated sites. This graph illustrates the relative abundance distribution of bird species observed in audio recorders and cameras deployed at the same coordinates (9 camera traps and 9 audio recorders).

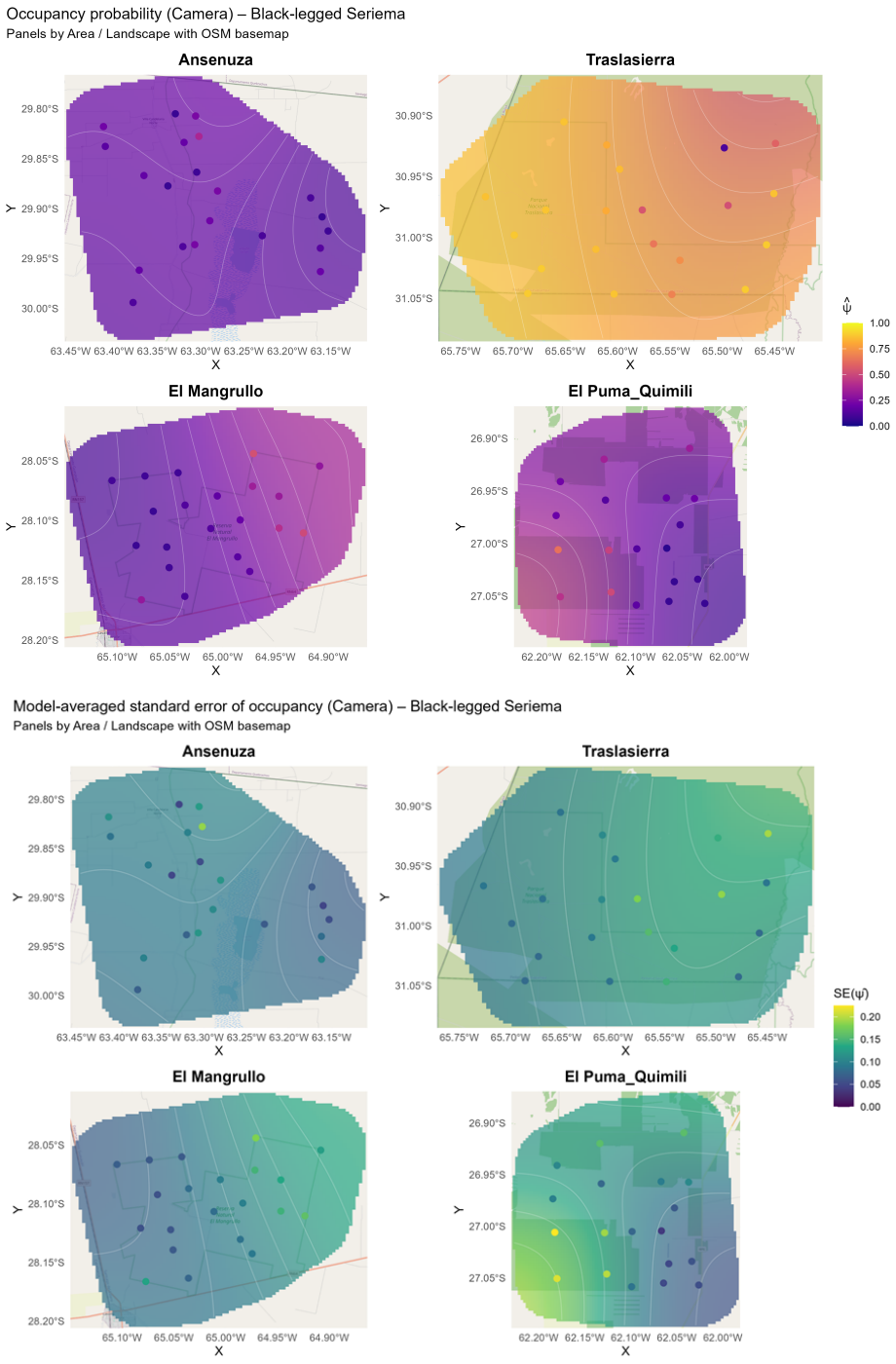


Figure 3. Model-averaged occupancy probability maps for Black-legged Seriema across the four study areas. The upper map shows occupancy probability, and the lower map shows the corresponding standard error.

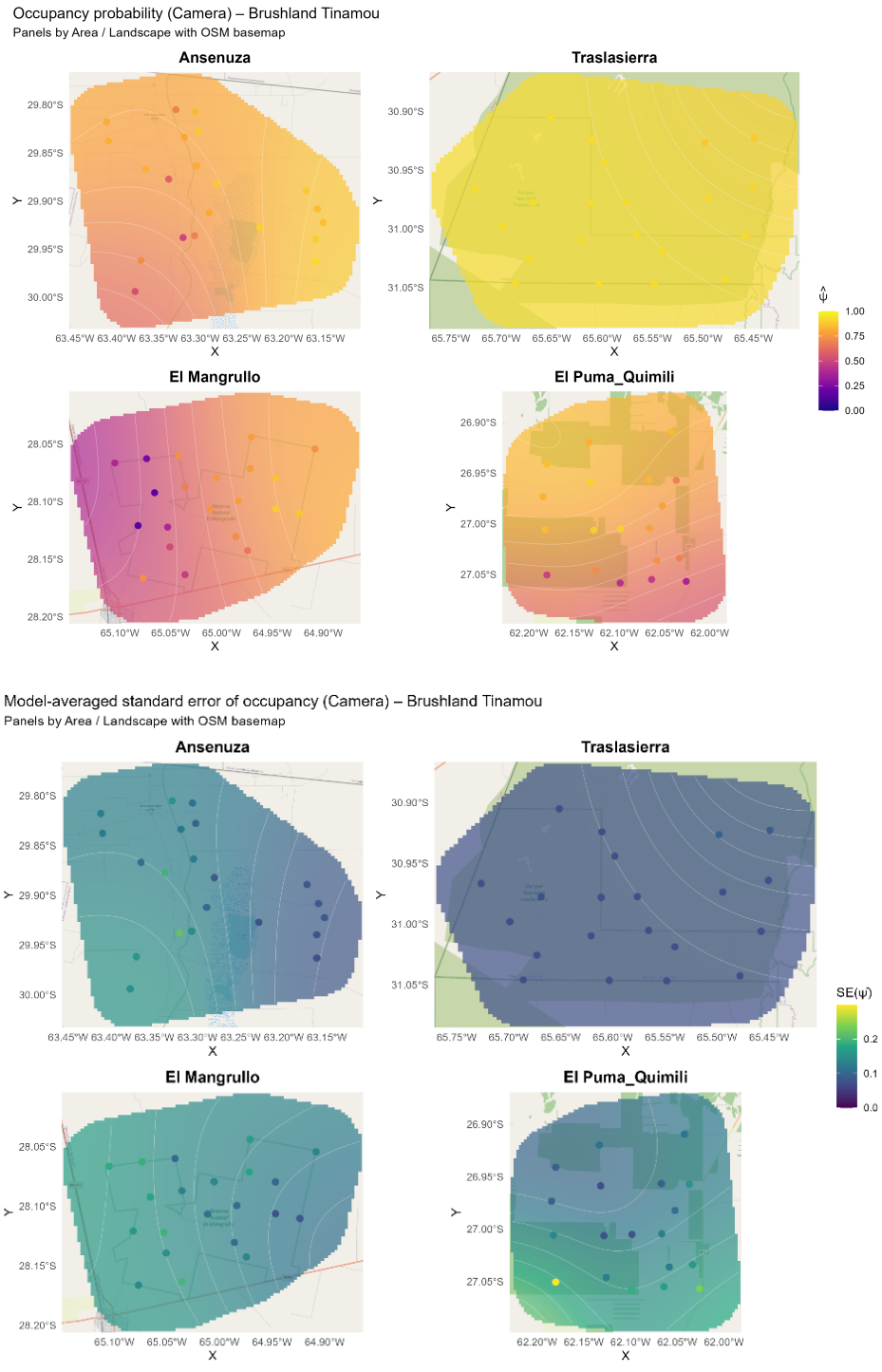
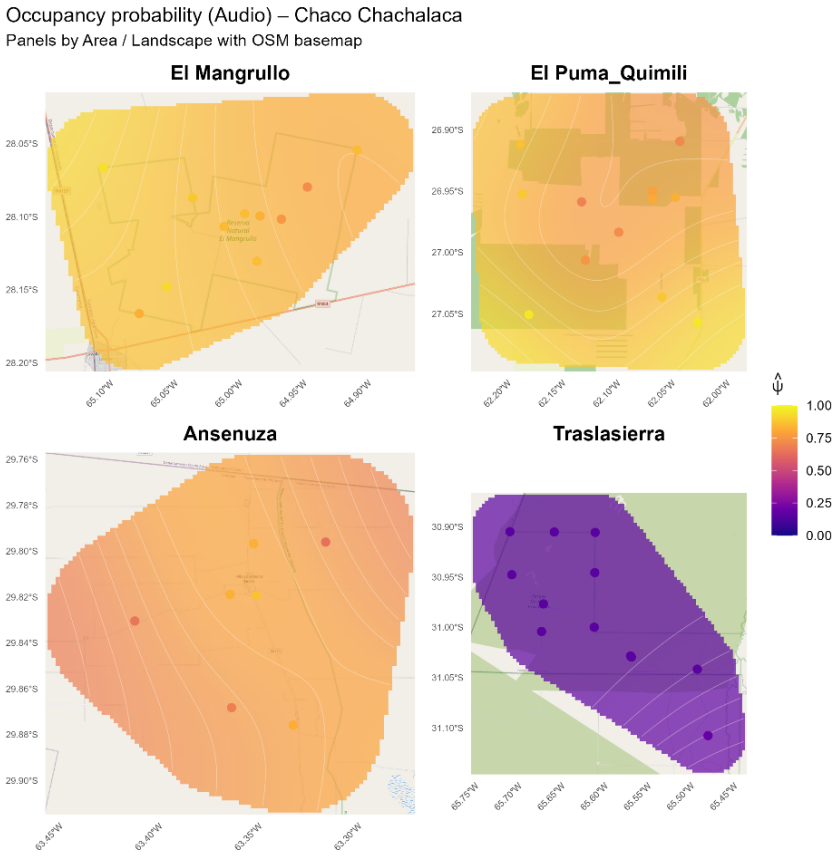


Figure 4. Model-averaged occupancy probability maps for Brushland Tinamou across the four study areas. The upper map shows occupancy probability, and the lower map shows the corresponding standard error.



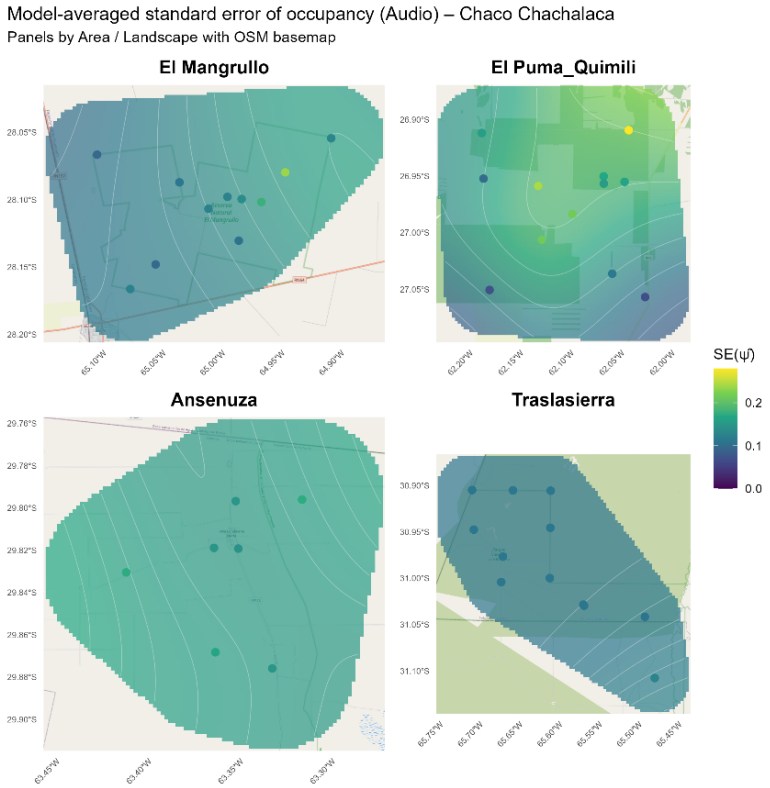


Figure 5. Model-averaged occupancy probability maps for Chaco Chachalaca across the four study areas. The upper map shows occupancy probability, and the lower map shows the corresponding standard error.

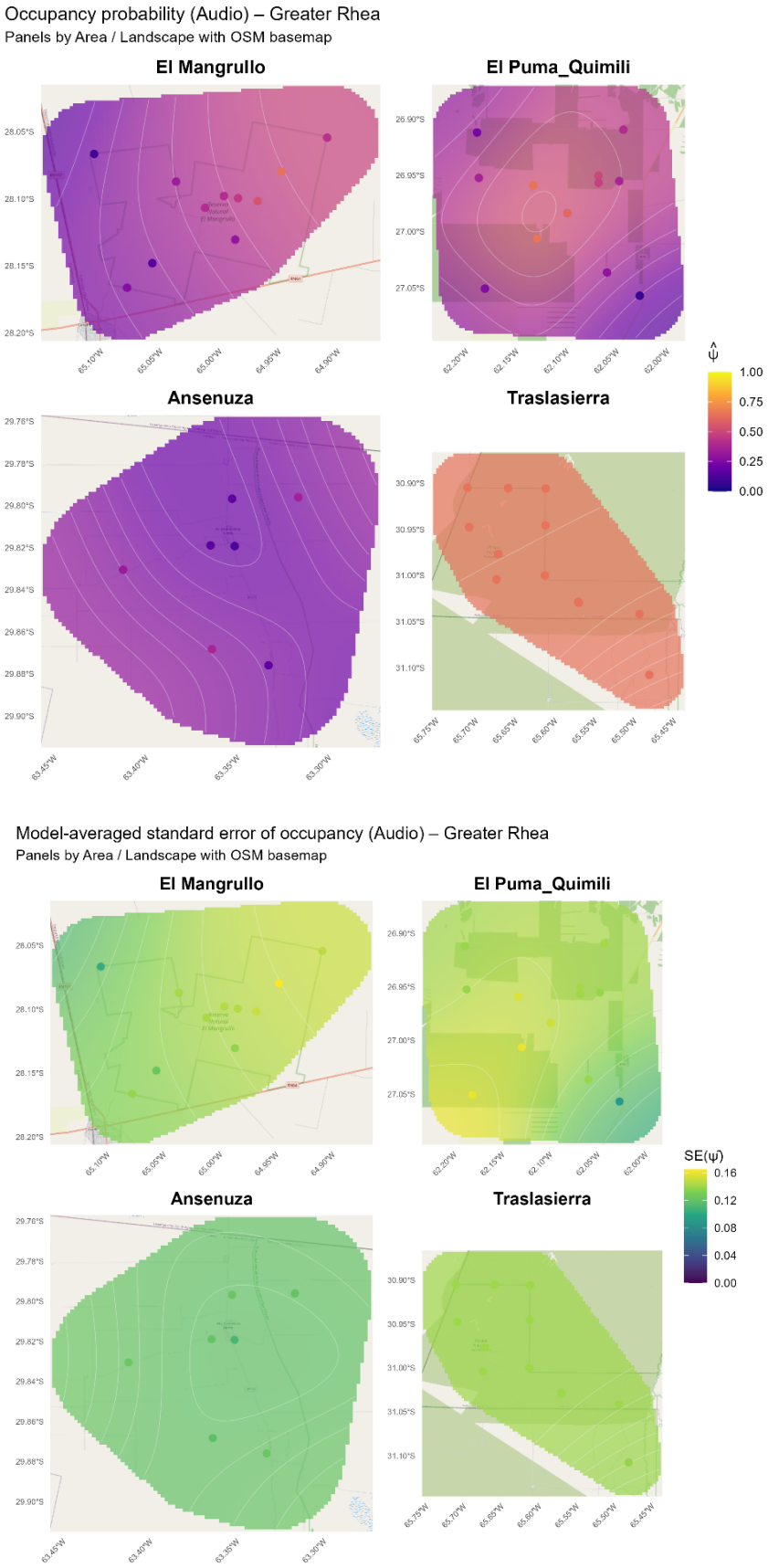


Figure 6. Model-averaged occupancy probability maps for Greater Rhea across the four study areas. The upper map shows occupancy probability, and the lower map shows the corresponding standard error.