Gina Himes Boor
Montana State University
e-mail: gkhimesboor@montana.edu
Sharon Baruch-Mordo
Colorado State University
e-mail: sharonbm@warnercnr.colostate.edu

Using individual-based movement models to investigate mechanism of emergent herding behavior in African buffalo

Ungulate species worldwide have been observed to aggregate into variable-sized temporary or permanent herds. One important thread of research in ecology has been to try to understand why such aggregations occur, and what mechanisms control the dynamics of herding. Most research to date has focused on population-level herding dynamics, and evidence exists for both bottom-up control, wherein herds form as a result of patchy resource distribution, and top-down control, in which predator avoidance controls aggregation dynamics. In this study we used an individual-based model (IBM) to test whether population-level herding patterns emerge from individual-level movement decisions, and to examine the influence of bottom-up mechanisms on this emergent phenomenon. We used African buffalo (Syncerus caffer) in Kruger National Park, South Africa as our focal population, and simulated individual movement based on rules in which each buffalo attempts to meet its daily resource requirements. Our model did not incorporate birth or death processes but focused solely on spatial dynamics. To validate our model we compared herd size distribution observed in our IBM to herd size distributions observed in Kruger National Park between 1985 and 2001. Using IBM we found that herding behavior was an emergent property. We were able to emulate empirical herd size distributions when resources were available at low levels in large parts of the study area but abundant in small scattered areas. Our study demonstrates that empirically-based patterns of herding behavior can emerge from bottom-up mechanisms alone. Our continued research will attempt to elucidate whether predator avoidance behavior can produce similar empirically-validated herding patterns and how a combination of top-down and bottom-up mechanisms might change population-level herding dynamics.