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First passage time: insights into animal movement

Movement plays a role in structuring the interactions between individuals, their environment, and other species. First passage time is a novel way of understanding the effect of the landscape on animal movement and search time. In the context of animal movement, first passage time is the time taken for an animal to reach a specified site for the first time. We derive a general first passage time equation for animal movement that can be connected with empirical data. This equation is related to the Fokker–Planck equation, which is used to describe the distribution of animals in the landscape. Drawing on examples of red fox movement within a home range and wolf movement in response to linear features, we use first passage time analysis to demonstrate the effect of spatial heterogeneity on the time required for a predator to locate prey. In addition, we discuss the effect of two different searching modes on the functional response and show that random searching leads to a Holling type III functional response. First passage time analysis provides a new tool for studying the influence of animal movement on ecological processes.