



Response of African Elephants (*Loxodonta africana*) to Seasonal Changes in Rainfall

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Abstract

The factors that trigger sudden, seasonal movements of elephants are uncertain. We hypothesized that savannah elephant movements at the end of the dry season may be a response to their detection of distant thunderstorms. Nine elephants carrying Global Positioning System (GPS) receivers were tracked over seven years in the extremely dry and rugged region of northwestern Namibia. The transition date from dry to wet season conditions was determined annually from surface- and satellite-derived rainfall. The distance, location, and timing of rain events relative to the elephants were determined using the Tropical Rainfall Measurement Mission (TRMM) satellite precipitation observations. Behavioral Change Point Analysis (BCPA) was applied to four of these seven years demonstrating a response in movement of these elephants to intra- and inter-seasonal occurrences of rainfall. Statistically significant changes in movement were found prior to or near the time of onset of the wet season and before the occurrence of wet episodes within the dry season, although the characteristics of the movement changes are not consistent between elephants and years. Elephants in overlapping ranges, but following separate tracks, exhibited statistically valid non-random near-simultaneous changes in movements when rainfall was occurring more than 100 km from their location. While the environmental trigger that causes these excursions remains uncertain, rain-system generated infrasound, which can travel such distances and be detected by elephants, is a possible trigger for such changes in movement.

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Introduction

Conservation of elephant populations, particularly in areas where poaching has been prevalent, is a pressing ecological issue. The management of elephant populations in both protected and unprotected areas requires an understanding of the predominant historical movement patterns of family groups [1–2]. Beyond the mapping of past elephant movements, it is important to understand what environmental cues might trigger the movement of elephants from one area to another. In dry areas, one such environmental trigger could be rainfall, particularly when it occurs at the end of a prolonged dry season. It is likely that any change in movement from dry to wet season conditions—ranging from distant migration-like excursions to localized movement—may be influenced by the habitat of the region (water, vegetation, and terrain) and dictated by topographically confined seasonal food and water sources [3–4].

The relationship between elephants and rainfall is embedded in the mythology and legends of people living for centuries in close contact with these animals. Turkana legend in northern Kenya holds that sighting an elephant at the end of the dry season is a sign that rain is imminent [1]. The Samburu people, further south

in Kenya, have a similar belief, where the sudden appearance of an elephant, after months of no rain, signals the coming of the rains [1]. In India, the elephant is believed to bring the monsoon rain and is considered to be allied to cumulus clouds [1].

Surprisingly little research has been conducted on how elephants that populate arid environments might respond to rainfall triggers. Lindeque and Lindeque [5] reported a response of elephants in the eastern end of the Etosha National Park and Damaraland (Namibia) to rainfall well removed from where the herds were and well in advance of the rains. Leggett [6] observed elephants in the Kunene region of Namibia changing their movements within 24 hours of distant rainfall, heralding the start of the wet season. Neither study provided a possible cause for the observed change in elephant movement, however.

Loarie et al. [7] attempted to determine whether there was an underlying order in the effects imposed by climate, water and vegetation upon elephant movement. They examined these relationships over an extended transect from Namibia to Mozambique (2500 km) over multiple years (2000–2006). Tracking was not conducted simultaneously over the entire transect but in separate areas for different years. They found that elephants