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## **Are drought-related crashes in pastoral cattle herds predictable ? —More evidence of equilibrium dynamics from the doughtern Ethiopian rangelands**

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**Key words :** Equilibrial/non-equilibrial ecosystems, Boran, risk management, livestock early warning

**Introduction** Drought routinely ravages the Greater Horn of Africa, especially rangelands. Drought leads to massive reductions in livestock productivity and increased risk of famine and poverty for people. Traditional pastoral systems were better able to cope with drought, but restoring traditional pastoralism is nearly impossible in many cases. Other strategies focus on helping people deal with drought using market development and opportunities for livelihood diversification. Livestock remain the core economic engine for pastoralism and understanding how risks and returns to livestock vary over time is important to devise tactics to improve the situation. Ellis and Swift (1988) proposed that some East African pastoral systems are non-equilibrial, meaning that vegetation and herbivore dynamics are controlled by precipitation; carrying capacity and livestock-induced ecological degradation lose relevance. Livestock death losses would be unpredictable and vary with rainfall. For the semi-arid Borana Plateau we posit a different theory based on dynamic equilibrium concepts (Desta and Coppock 2002). In this situation, drought impacts on livestock production are predictable due to interactions between stocking rates and precipitation. When stocking rates are high the regional herd is more likely to crash if annual precipitation is low. Cattle crashes in 1983-5, 1991-3, and in 1998-9 lead to the hypothesis that periodicity of crashes is related to time needed for the regional herd to grow to a vulnerable size. Desta and Coppock (2002; p. 450) predicted that the next cattle crash would occur by 2005. The purpose of this paper is to verify the cattle prediction and illustrate whether ecological change has occurred as a result of pastoral activity (Mesele, 2006).

**Materials and methods** Herd dynamics during 1999 to 2007 were assessed using reviews of secondary information, results from focus group discussions with pastoralists, and analysis of rainfall records. Ecological trends in one 400-km<sup>2</sup> district were assessed using standard soil surveys and analysis of three satellite images collected at 15-year intervals between 1973 and 2003.

**Results** A major cattle crash indeed occurred during 2005-2006. Herd losses were 40-70%, consistent with losses in previous crashes. Losses were associated with a regional drought. For Yabelo District, soil surveys indicated losses of topsoil fertility and increased compaction in heavily grazed sites compared to lightly grazed sites. Analysis of land-cover change indicated that large portions of the original grasslands were lost to bush encroachment and maize cultivation over 30 years.

**Conclusions** We accurately predicted the most recent cattle crash several years in advance. Ecological analyses confirmed that pastoralism has directly and indirectly changed the environment in several detrimental ways. These results indicate that this ecosystem is dynamic yet equilibrial and that interaction among vegetation and livestock components is important in understanding ecological change. Such findings can better inform pastoral development and relief strategies for this region.

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