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## **Title page**

### *1. Title*

On the difference between "exclosures" and "enclosures" in ecology and the environment

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Rehabilitation of degraded land in arid and semiarid environments often involves excluding livestock from degraded sites. The main objective of such “exclosures” is to allow native vegetation to regenerate as a way to reduce soil erosion, increase rain water infiltration and provide fodder and woody biomass (e.g. Mekuria et al., 2007; Pei et al., 2008; Yayneshet et al., 2008). Some alternative names for this practice that are increasingly used in the literature, including “enclosure” (Angassa and Oba, 2008a; Bogale et al., 2006; Girmay et al., 2008; Mengistu et al., 2005; Verdoodt et al., 2009), “area enclosure” (Abebe et al., 2006; Asefa et al., 2003), “range enclosure” (Angassa and Oba, 2008b) and “grazing reserve enclosure” (Tefera et al., 2007), may lead to confusion and misunderstanding, because exclosures and enclosures are not synonyms. Here we aim to illustrate the difference using recent ecological and environmental literature and provide guidance for their proper use.

Enclosures are "*areas surrounded by walls, objects or other structures*" and serve to keep objects, usually animals, inside a given area. In experimental research, enclosures are units or plots in which living beings are confined, for instance to reveal competitive relationships between different animal species (Manor and Saltz, 2008) or to create a controlled environment for plant pollination studies (Jauker and Wolters, 2008). In aquatic community studies, they are used to manipulate environmental conditions or communities in ponds (e.g. Cottennie and De Meester, 2004; Louette et al., 2006).

Oppositely, exclosures are "*areas from which unwanted animals, etc., are excluded*" and their main purpose is to keep things (animals) out of a given area. Experimental exclosures (Wagg, 1964) have been widely used as

treatments to exclude (or statistically control for) the effects of predation or herbivory on species richness and recruitment in plant and animal communities (e.g. Isaksson et al., 2007; Torre et al., 2007; Fraser and Madson, 2008; Jacobs and Naiman, 2008; Levick and Rogers, 2008), and on processes such as sediment deposition or woody plant invasions (e.g. Descheemaeker et al., 2006; Yanoff and Muldavin, 2008). Typical examples of exclosures feature fences that prevent animals from entering, and to increase experimental control, it is possible to only exclude targeted species from the fenced area while allowing other animals to move freely (Vercauteren et al., 2007). Fencing off areas in this way is a common practice in forest management throughout the world because high tree seedling mortality is often related to high browsing pressure by large or small herbivores (Tremblay et al., 2007; Negussie et al., 2008; Coop and Givnish, 2008).

Some pastoralist and agropastoralist communities, such as the Gogo and Maasai in Tanzania, the Himba in Namibia, and the Borana in Ethiopia, traditionally set aside some of their grazing land during the rainy season so that it can be grazed during the dry season. These temporary range exclosures, where recovery of palatable species is the primary goal, are also known as (communal) feed, fodder or forage reserves (Müller et al., 2007; Tefera et al., 2007; Mwilawa et al., 2008). Some other common terms are related to the concept of "exclosure" but not with that of "enclosure". The term "*closed area*" is primarily used in marine and freshwater biology where it usually refers to areas where fishing is forbidden or suspended (e.g. Hunter et al., 2006; Moustakas et al., 2006). "*Protected area*" has a similar, but broader meaning, and usually refers to more formal conservation areas (e.g. Grech

and Marsh, 2008; Jachmann, 2008). Nevertheless, in a well-defined context both can be used as a synonym for enclosure – i.e. closed to cattle (Tilahun et al., 2007) and protected by guards and bylaws against grazing and cutting (Aerts et al. 2004; Mekuria et al., 2007). Similarly, "*area closure*" (Chadhokar, 1992) can be used for describing the act of establishing an enclosure, but not as a synonym for it.

Thus areas where, for management or research purpose, certain animals are excluded or biomass harvesting is controlled, should never be described as enclosures but as exclosures. For reasons of uniformity, clarity and increased indexing performance, we strongly recommend the terminology "exclosure" for any area or activity that involves excluding unwanted species or practices from (degraded) sites.

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