

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

Raf Aerts^{a*}, Jan Nyssen^b and Mitiku Haile^c

^aDivision Forest, Nature and Landscape, Katholieke Universiteit Leuven, Celestijnenlaan 200E-2411, BE-3001 Leuven, Belgium

^bDepartment of Geography, Ghent University, Krijgslaan 281-S8, BE-9000 Gent, Belgium

^cLand Resources and Environmental Protection Department, Mekelle University, P.O.Box 231, Mekelle, Ethiopia

*Corresponding author: raf.aerts@ees.kuleuven.be (R. Aerts)

Rehabilitation of degraded land in arid and semiarid environments often involves excluding livestock from degraded sites, creating what are usually but unfortunately not consistently, called "exclosures" (e.g. Mekuria et al., 2007). Their main objective is to allow native vegetation to regenerate as a means of providing fodder and woody biomass, to reduce soil erosion and to increase rain water infiltration. We are concerned that some of the alternative names for this practice that are reported in the international literature, including "closed area", "area closure" and "enclosure" (e.g. Mengistu et al., 2005), may lead to confusion and misunderstanding, especially when these are used as synonyms (as in Girmay et al., 2008). Here we aim to illustrate the difference between exclosures and enclosures using recent ecological and environmental literature and provide guidance for their proper use.

Enclosure is "*the action of surrounding or marking off land with a fence or boundary, or the action of thus converting pieces of common land into private property*" (Oxford English Dictionary, 2008). Enclosure appeared in England and Wales in the thirteenth century, and took place throughout the medieval and modern periods as a means to end certain traditional land use rights in shared land, such as livestock grazing. In a broader sense, enclosures are "enclosed" areas: "*areas surrounded by walls, objects or [other] structures*" (Cambridge Dictionary, 2008). Exclosures are "*areas from which unwanted animals, etc., are excluded*" (Oxford English Dictionary, 2008). Exclosures and enclosures are related terms, but can not be used as synonyms. The word enclosure comes from latin *in* "in" and *cludere*, "closing, confining, restricting": keeping objects, usually animals, inside a given area. Exclosure, a more recent word, was later formed

as an analogy to enclosure, and has the opposite meaning: keeping things (animals) out.

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). Enclosures are a powerful tool in aquatic community studies, where they are used to manipulate environmental conditions or communities in ponds (e.g. Cottennie and De Meester, 2004; Louette et al., 2006). Except for etymology, ecological enclosures have nothing in common with the socioeconomic term 'enclosure', defined as "*increasing commodification and individualization of access to land and water, [...] with increasing disadvantage for the poor*" (Woodhouse, 2003).

Experimental enclosures (*sensu* Wagg, 1964) have been widely used as treatments to exclude (or statistically control for) the effects of predators, large herbivores, livestock, small mammals or birds on the species richness and recruitment in plant communities (Fraser and Madson, 2008; Jacobs and Naiman, 2008; Levick and Rogers, 2008; Negussie et al., 2008; Olofsson et al., 2008; Shitzer et al., 2008), on the abundance of other animals (Isaksson et al., 2007; Torre et al., 2007; Aerts et al., 2008; Huntzinger et al., 2008) and on processes such as sediment deposition, litter production, soil carbon sequestration and woody plant invasions (Descheemaeker et al., 2006a; 2006b; Pei et al., 2008; Shrestha and Stahl, 2008; Yanoff and Muldavin, 2008).

Typical examples of enclosures feature fences that prevent animals from entering, and 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; Coop and Givnish, 2008). Enclosures are also known traditionally by pastoralist and agropastoralist communities, such as the Gogo and Maasai in Tanzania, the Himba in Namibia, and the Borana in Ethiopia. These communities set aside some of their grazing land during the rainy season so that it can be grazed during the dry season. These temporary grazing enclosures, where recovery of palatable species is the primary goal, are more appropriately called (traditional) (communal) feed, fodder or forage reserves (Müller et al., 2007; Tefera et al., 2007; Mwilawa et al., 2008).

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; Salas et

al., 2007). "*Protected area*" has a similar, but broader meaning, and usually refers to more formal conservation areas (e.g. Grech and Marsh, 2008; Jachmann, 2008; Linkie et al., 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; 2006; Mekuria et al., 2007). Similarly, "*area closure*" (Chadhokar, 1992; Aerts et al., 2004) 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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