SUPPLEMENTARY MATERIAL 1 - BOX S1

The evolution of the concept of disturbance and its impact on Ecology

The concept of disturbance has changed through time, and we still can find many definitions across the literature (see reviews from Rykiel 1985; Laska 2001; White and Jenks 2001; Johnson and Miyanikshi 2021). Disturbance was originally defined in terms of major catastrophic events originating in the physical environment and, thus, its focus was on short-term natural abiotic disturbances (Cooper 1926; White 1979; Rykiel 1985; Burton et al. 2020) (Figure 1a). With this focus, a disturbance was tightly linked to the ideas of primary and secondary succession as an orderly unidirectional process. Although at present, the dynamics of ecosystems have been proved to be much less orderly than previously thought, the image of directional succession still permeates the present literature (Johnson and Miyanishi 2021). Later, the concept was revised, and biotic factors, such as browsing and grazing operating in the long term, became core components of the analysis of disturbance and its relationship with gap dynamics and mechanisms of species coexistence (Figure 1b), sometimes seen as representing microscale succession (White and Jentsch 2001; Rykiel 1985; Picket et al. 1989; Johnson and Miyanishi 2021). This revision also implied a reconsideration of the main role of changes in the disturbance regime (i.e. disturbance intensity, frequency, and extension) as a major driver of ecosystems trajectory (Figure 1c), which revived the link between disturbance and resilience (van der Maarel 1993; Anand 2000; Laska 2001; Turner 2010), its applicability in state and transitions models (Bertiller and Bisigato 1998; Westoby et al. 1989; Stringham et al. 2003; Johnstone et al. 2016; Peri et al. 2017), and in restoration ecology (Palmer et al. 1997; Sudding et al. 2004; Conway et al. 2010; Jones et al. 2018). It is in the context of the consequences of changes in disturbance regimes that anthropogenic disturbances became particularly relevant (Turner 2010, Newman 2019, Keely and Pausas 2019). At present, some of the more frequently used meanings of disturbance refer to the type of event that causes the disturbance as defined by Pickett and White (1985) "... a discrete event in time that disrupts ecosystem, community, or population structure or changes resources, substrate availability, or the physical environment". Another widely used definition of disturbance refers to the type of effect that can be caused by the disturbance on the vegetation or to the different variables to detect a perturbation, as in by Grime (1977) "… mechanisms which limit the plant biomass by causing its destruction". Across all its history, although it has been clear that the effects of changes in vegetation as a consequence of disturbance may lead to changes in ecosystem function, the functioning itself has been much less explored than the vegetation dynamics.

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Figure 1. Diagrammatic representation of the evolution of the concept of disturbance and its impact in different areas of Ecology; a) classic conceptualisation as a major catastrophic event originated in the physical environment, and linked to succession ecology; b) inclusion of biotic drivers of disturbance, such as browsing and grazing operating in the long term, linked to the development of gap dynamics ecology and the exploration of mechanisms of species coexistence; and c) focus on changes in the disturbance regime as a driver of ecosystems trajectory, linked to the ecology of resilience and its applicability in state and transitions models and restoration ecology.

Figura 1. Representación gráfica de la evolución del concepto de disturbio y su impacto en diferentes áreas de la Ecología. a) conceptualización clásica, como un gran evento catastrófico originado en el ambiente físico y vinculado a la ecología de la sucesión; b) incluyendo factores bióticos de disturbio, como el ramoneo y el pastoreo que operan a largo plazo, vinculados al desarrollo de la ecología de la dinámica de parches y la exploración de mecanismos de coexistencia de especies; y c) conceptualización centrada en los cambios en el régimen de disturbios como impulsor de la trayectoria de los ecosistemas y vinculado a la ecología de la resiliencia y su aplicabilidad en modelos de estados y transiciones y a la ecología de la restauración.