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Research Letters

The South Brazilian grasslands – A South American tallgrass prairie? Parallels and implications of fire dependency

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ABSTRACT

Fire has long been recognized as an important driver of vegetation patterns, and is of particular importance for biodiversity maintenance in many grassland systems, including the North American tallgrass prairie. Here, it has been successfully used as a conservation and restoration tool. In southern Brazil, grasslands appear to present many similarities to tallgrass prairie in terms of composition and ecology, but the role of fire has been poorly studied and it is not usually used in conservation. Here, we compare plant genera and family composition of tallgrass prairie and South Brazilian grassland sites. We find striking similarities in terms of dominant families, genera, and functional types. The similarities between plant communities suggest similarities in ecological processes and should lead to a re-thinking of conservation strategies in South Brazilian grasslands. Research on the role of fire is needed, and comparative North–South studies on grasslands in the Americas likely will provide important insights for grassland ecology and management.

Introduction

Fire is one of the important ecological drivers of vegetation patterns globally and has shaped the emergence of the grass-dominated biomes (e.g. Bond and Keeley, 2005). The tallgrass prairie (TGP) ecosystem located in central North America (Figs. 1 and 2), for instance, is a mesic ecosystem that has been confirmed to be "fire-dependent" (Collins and Wallace, 1990). In the absence of this disturbance, the mesic TGP which receives 700–1100 mm of precipitation per year, will transition from grassland to woodland in as little as 40 years (Briggs et al., 2002). For conservation purposes, fire thus constitutes an important tool, not only for maintenance of typical native tallgrass prairie plant communities, but also other conservation components of these ecosystems, such as birds (Fuhlendorf et al., 2006). However, fire is not the only important ecological process shaping prairie communities. TGP plant species diversity is also influenced by the interaction between fire and grazing. Fire singularly in application or in complete exclusion decreases plant species richness, but when combined with grazing the abundances of the dominant grasses are reduced, allowing forbs to increase in abundance (Collins et al., 1998; Coppedge et al., 1998; Fuhlendorf et al., 2006).

Unfortunately, less than 2% of native TGP remains in North America, making TGP a "critically endangered ecosystem type" (Samson and Knopf, 1994; Noss et al., 1995). Given the recognized importance of fire and grazing for maintenance of the TGP, grassland remnants are increasingly placed under a burning regime or a combined burning-grazing regime for conservation purposes (Duchardt et al., 2016). This is especially the case where still large remnants exist, such as in Kansas or Oklahoma, and often in a combination of fire and grazing. Common recommendations are burns every 2–8 years, depending on moisture characteristics with recommendations for more frequent burns in wetter sites (Smith, 2010).

Some 7000 km further to the south, the South Brazilian Campos grasslands (SCG) are under subtropical humid climate, and form the dominating vegetation type both in the Brazilian Pampa biome and in the Highlands situated in the southern part of the Atlantic Forest biome (Figs. 1 and 2). The Pampa grasslands are part

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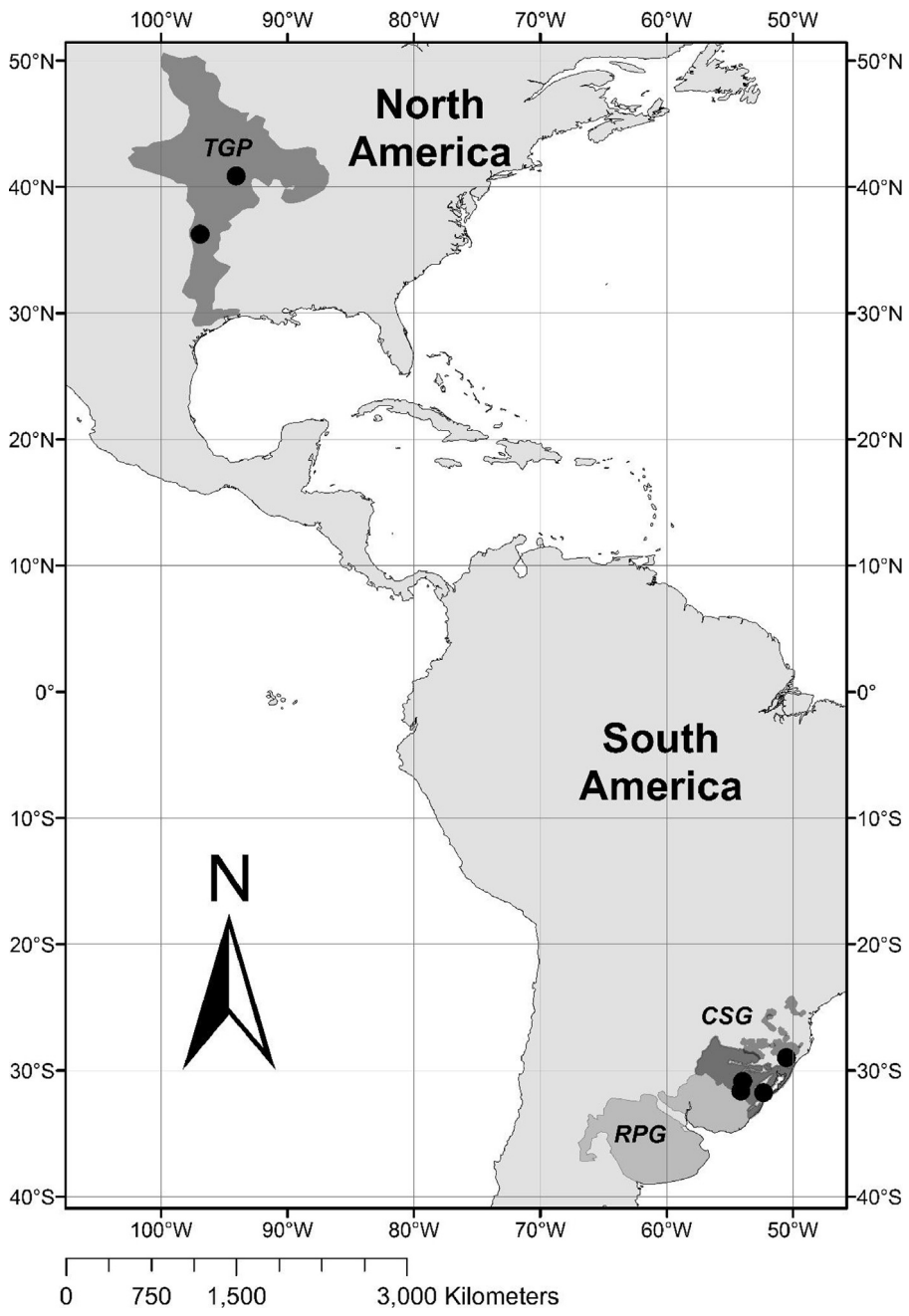

Fig. 1. Location of the tallgrass prairie (TGP) and the South Brazilian Campos grasslands (CSG) in North and South America. We also indicate the location of the Rio de la Plata Grasslands (RPG; see text for details) and study locations from which botanical data was collected. Overlapping points were removed for visibility.

of the so-called 'Pastizales del Rio de la Plata', the extended temperate grassland region that spans over southern Brazil, Uruguay and large parts of northeastern Argentina (Overbeck et al., 2007). Precipitation levels in the SCG are even higher than in the TGP, ranging from 1300 to 2200 mm/year (Table 1). Similar to the TGP, these grasslands depend on fire and/or grazing for their maintenance, and when these evolutionary processes are excluded, shrub encroachment and forest expansion take place (Oliveira and Pillar, 2004; Blanco et al., 2014). Thus, the conservation of SCG grasslands might likewise depend on the these disturbance regimes and on their restoration. The use of fire or grazing for conservation, however, is subject to a sometimes polarizing debate (see e.g. Pillar and Vélez-Martin, 2010; Luza et al., 2014; Overbeck et al., 2016). The "forest-bias" in conservation and restoration of the grass biomes is not unique to Brazil but is a common feature in tropical and subtropical regions around the world (e.g. Parr et al., 2014; Veldman et al., 2015). The source of such bias seems to be misunderstandings about the ecology of these systems, in particular the role of disturbances (Veldman et al., 2015). In the case of SCG, this is also evidenced by the use of terms such as 'steppe' or 'savanna' in Brazil's official vegetation classification, i.e. by problems of 'taxonomy' for SCG grasslands.

The consequences of this lack of understanding of the ecology of these systems and of the forest bias in conservation are readily visible on the landscape – grasslands are much more at risk to transformation into other land uses than forests. Where they are protected, management often is inadequate, as it excludes disturbances (Pillar and Vélez-Martin, 2010). In the South Brazilian

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