Submitted Abstract

ID IMC22-FSAbstr- 600

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Country	Brazil
Region	South America
Title	South-East Brazilian Mountain Grasslands – Are They An Alternative Stable State?
Keywords	Alternative Stable State, Grassland, Fire, Climate, Land Use
Type	List Of Focus Session
Focus Session ID	39

Abstract

Treeless vegetation in mountains is associated either with land use in the montane zone or with climate limitation (temperature at the alpine treeline, or precipitation in dry climates). Removal of grazing in European anthropogenic montane grasslands is usually followed by secondary forest regrowth. In many parts of the world the existence of open grassy-shrublands has been attributed to top-down regulation either by herbivore consumers or by fire, leading to an alternative stable state. In the south-eastern Brazilian mountain range where climatically determined treeline is by far above the elevation of the mountains, there are extensive mosaics of vegetation formed by tropical montane rain forest and open grassy shrubby formation (locally called ‘campo’). The various hypotheses proposed regarding their origin and maintenance include fires naturally lit by lightening, climate change (retarded response by trees to colonise open areas since the last maximum [LGM] extension of glaciation), soil (shallow skeletal soil with insufficient water-holding capacity for tree growth) and man-made fires to clear and maintain pastureland. We undertook a landscape-scale modelling of soil water availability to test the hypothesis that shallow soil would store insufficient plant available water to support tree growth. After a recent survey of recent fire history (1984-2020) in the Parque Estadual de Campos do Jordão, we ran a landscape scale water availability model under current mean and minimum annual precipitation years, future IPCC scenarios and LGM and mid-Holocene optimum scenarios. We found that in an average year, there is no month with water shortage in the areas currently occupied by open vegetation. We further discuss to what extent, if at all, the permanence of these ‘mountain grasslands’ may be attributable to extreme precipitation years.