

SUPPORTING INFORMATION I

IMPACT FACTORS ON RESTINGA AND DUNE ECOSYSTEMS OF PAURÁ LAGOON

The *restinga* is a sandbank formed by sand deposits parallel to the shoreline, generally elongated in shape, produced by sedimentation processes, with different biota communities having generally marine, or estuarial, influence. The term *restinga* is commonly used in Brazil to describe both the coastal landscape and the associated vegetation (Silva *et al.*, 2010). The *restinga* vegetation, according to the Brazilian National Council for the Environment (CONAMA, 1996), includes all the plant communities, physiognomically distinct under marine and fluvial-marine influence. These communities, distributed in mosaics, are characterized by herbaceous, shrubby and arboreal plants and also by areas naturally devoid of vegetation. Such vegetation occurs in regions of great ecological diversity, being considered edaphic communities more dependent on the soil nature and their water content than on the climate (Magnago *et al.*, 2012). The *restinga* vegetation plays a fundamental role in the stabilization of sediments and maintenance of natural drainage, as well as in the preservation of resident and migratory fauna associated with the sandbank (CONAMA, 1999). The dunes are also protected by the legislation. Fixed or semi-fixed dunes have a greater pedological development associated with the settlement and increase of a vegetation cover, which provide an environmental stability by mitigating the influence of winds and, therefore, fixing it in the landscape (Pinheiro *et al.*, 2013). Along the Middle Coast of Rio Grande do Sul State, *Pinus* forestry has been established since the 1970's. However, this woody invasive species spreads easily from the forestry plots, invading *restinga* and dune ecosystems, where it can damage the biota, when not properly handled. In the study area, *Pinus* spp specimens from the nearby forestry plots are invading the borders of the remnant *restinga* forest (Figures SI-I.1 and SI-I.2) and also expanding over the dunes and Paurá lagoon margins (Figure SI-I.3).



Figure SI-I 1) Proximity between *Pinus* trees dispersed from forestry plots and the native *restinga* forest. P – *Pinus*, MR – *restinga* forest.

Figura SI-I 1) Proximidade entre as árvores de *Pinus* dispersas do talhão de silvicultura e a mata de restinga. P – *Pinus*, MR – mata de restinga.



Figure SI-I 2) *Pinus* trees invading the native *restinga* forest. P – *Pinus*, MR – *restinga* forest.

Figure SI-I 2) Exemplos de *Pinus* invadindo a mata de *restinga*. P – *Pinus*, MR – mata de *restinga*.

Highlighting the ecological importance of the *Paurá* lagoon area, a report from Bugin *et al.* (2015) related 21 plant species belonging to 14 families, mostly from *restinga* forest, but also from fields and dunes, classified into the 2014 national official lists of species endangered of extinction. Regarding endangered fauna species, the same report cites four species of annual fish (*Austrolebias minuano*, *Austrolebias wolterstorffi*, *Cynopocilus fulgens*, *Rivulus riograndensis*), three of felids (*Leopardus geoffroyi*, *Leopardus guttulus*, *Puma yagouaroundi*), two of rodents (*Ctenomys flamarioni*, *Ctenomys minutes*, *Dasyprocta azarae*), one of big-eared brown bat (*Histiotus velatus*), and one of mustelids (*Lontra longicaudis*) occurring in the study area.



Figure SI-I.3 Natural dispersion of new pine trees (DP) and old pine forestry planting (OP) in permanent preservation areas of margin and dunes of *Paurá* Lagoon.

Figura SI-I.3 Dispersão natural de novas árvores de *Pinus* (DP) e plantio antigo de silvicultura de *Pinus* (OP) em áreas de preservação permanente de margem e dunas da Lagoa do Paurá.

Another impact factor on the study area is the presence of cattle grazing in the dry and wet fields and borders of the *restinga* forest (Figure SI-I.4). Besides cattle trampling, which affects mostly the development of herbaceous and shrubby plants in the field, the animals can cause various injuries to the trees, for example, by eating branches, leaves and reproductive parts, rubbing, lowering and breaking trunks or canopies to reach their apex for food.



Figure SI-I.4 - Cattle grazing on field adjacent to *Paurá* Lagoon (foreground). Sequence towards the back: wet grassland/swamp, *Pinus* invaders and range of natural dunes.

Figura SI-I.4 - Presença de gado em campo de pastagem adjacente à Lagoa do Paurá. Na sequência da frente para o fundo: campo úmido/banhado, Pinus invasores e faixa de dunas naturais.

Knowledge of the impacts, characterization and mapping of the different thematic classes in the study area may assist environmental agencies decision making towards sustainable land use and measures for conservation of these priority coastal ecosystems.

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