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Biological Invasion by wild pig (*Sus scrofa* Linnaeus, 1758) in an Atlantic Rainforest protected area

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ABSTRACT
This is the first record of the biological invasion by wild pigs (*Sus scrofa* Linnaeus, 1758) in the Mata dos Godoy State Park (PEMG), an important protected area in the State of Paraná, Brazil. The PEMG landscape is identified as a priority for the conservation of the Atlantic Forest by sustaining a high richness of native species. Using camera traps, we report 21 records of wild pigs with groups of up to 26 individuals within the limits of this park. We highlight the need for quick action to contain the invasion, and thus reduce the potential negative effect on the region's natural and agricultural ecosystems. Early detection of biological invasion events is essential to guide managers to use suitable management practices and thus avoid damage to both biodiversity and local economies.

Key words: Atlantic rainforest biodiversity, conservation units, ecological impact, feral pigs, invasive species.

RESUMO – Invasão biológica por porcos selvagens (*Sus scrofa* linnaeus, 1758) em uma área protegida da Mata Atlântica
Este é o primeiro registro da invasão biológica por porcos selvagens (*Sus scrofa* Linnaeus, 1758) no Parque Estadual Mata dos Godoy (PEMG), uma importante área protegida do Estado do Paraná, no Brasil. A paisagem do PEMG é apontada como prioritária para a conservação da Mata Atlântica ao sustentar uma alta riqueza de espécies nativas. Através de armadilhas fotográficas, reportamos 21 registros de porcos selvagens com grupos de até 26 indivíduos dentro dos limites deste parque. Evidenciamos a necessidade de ações rápidas para conter a invasão e assim reduzir o potencial efeito negativo sobre os ecossistemas naturais e agrícolas da região. A detecção rápida dos eventos de invasão biológica é imprescindível para orientar os gestores no uso de práticas de manejo apropriadas e assim evitar prejuízos tanto para a biodiversidade como também para as economias locais.

Palavras–chave: biodiversidade da Mata Atlântica, espécies invasoras, impactos ecológicos, unidades de conservação, porcos asselvajados.

Invasive alien species are widely considered one of the main drivers of biodiversity loss and species extinction (Butchart et al. 2010; Bellard et al. 2016; Brondizio et

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al. 2019). Biological invasion events are attracting considerable interest due to the negative effects they can have on the environment and economy (Simberloff et al. 2013). This global phenomenon also affects human health (Bayliss et al. 2017), and the delivery of ecosystem services (Walsh et al. 2016). However, the damage caused to ecosystems is among the most commonly investigated types of losses attributed to the spread of alien species (Scalera et al. 2012).

Due to its destructive feeding behavior and high ecological plasticity, wild pigs are considered as one of the top 100 invasive species in the world (Lowe *et al.* 2000, 2004; Barrios-Garcia & Ballari 2012). Some studies suggest that wild pigs have successfully hybridized with the conspecific domestic pigs (*S. s. domestica* Linnaeus, 1758) in some areas where it was introduced (Grossi et al. 2006; Keiter et al. 2016; Melletti & Meijaard 2017; Acosta et al. 2019). The wild pig was introduced in southern Brazil for game meat, and over the last two decades has expanded its presence mainly in the southern and southeastern regions (Pedrosa et al. 2015; Salvador & Fernandez 2017).

The report of the presence of wild pig is important for the development of control and eradication plans, mitigating the impacts in protected areas (Heger & Trepl 2003). Controlling wild pig invasion is a major challenge to be faced when great care is required with the techniques to be employed, and which past culling projects in the Atlantic forest have failed or have difficulty reporting successes (Brasil 2017; Rosa et al. 2018; Salvador et al. 2019).

Here we report the recent occurrence of wild pigs at Parque Estadual Mata dos Godoy (PEMG), an important protected area in southern Brazil. The PEMG protects 690 hectares of semi-deciduous seasonal forest, one of the most threatened vegetation type in the Brazilian Atlantic Rainforest biome (Fig. 1). The PEMG is located in Londrina city, North of Paraná State, in a forest-fragmented landscape with an agriculture matrix, and considered by the Brazilian Environment Ministry as a conservation priority area (MMA 2018).

We recorded the presence of wild pigs with two camera traps (Bushnell 8MP Trophy Cam HD Hybrid), equipped to record 15 seconds of video each time they were triggered, distributed in two trails across the PEMG. During the sampling period from October 20, 2019 to January 31, 2020 wild pigs were recorded 21 times. The largest group recorded had 26 wild pigs, with 18 of them not fully mature individuals. There were no records during the morning and afternoon. Wild pig groups were recorded during twilight (62%) and solitary individuals were recorded at night (38%), suggesting greater night activity patterns.

This is the first occurrence reported for this important protected area, although the presence of wild pigs in this region has been recognized since 2008. In this context, it is possible to infer that the landscape connections allowed this biological invasion, despite presenting low connectivity for bird communities (Anjos et al. 2004).

Our findings suggest that the PEMG is going through the initial stages of a wild pig invasion. However, we highlight that our study was conducted in the short-term within a relatively low sample effort. Therefore, the problem could be potentially

higher than reported. Beyond the ecological impacts, we believe that the presence of wild pigs in the PEMG could threaten visitors and researchers due to the lack of safe infrastructure in this park. In this way, we strongly recommend that park authorities implement measures to control wild pigs before the consequences become irreversible, as in other areas in the Atlantic Forest biome (Deberdt & Scherer 2007; Hegel & Marini 2013).

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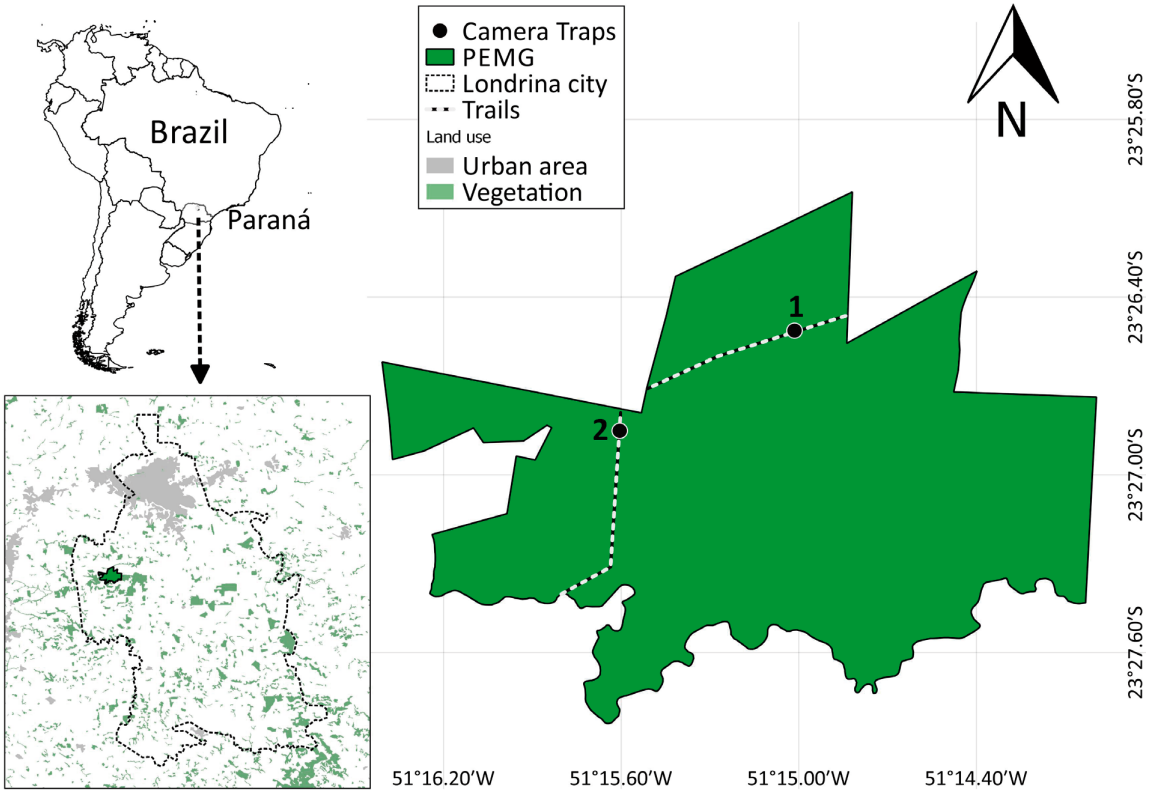

Figure 1. Map showing the Parque Estadual Mata dos Godoy (PEMG) area in Londrina city, Paraná State, Brazil. Number 1 is the wild pig record point at Catetos Trail (-23.443138; -51.250335) and number 2 is the wild pig record point at Peter trail (latitud -42,901355; longitud -71,303148).

Figure 2. Photographs from CT video records of solitary (left images) and wild pig groups (right images) including adults and piglets at Parque Estadual Mata dos Godoy, Londrina city, Paraná State, Brazil.

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