Letters to the Editor

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Scale matters: differences between local, regional, and global analyses

To the Editor:

In their commentary on our recent article, "Where have all the people gone? Enhancing global conservation using night lights and social media" (Levin et al. 2015), Tortato and Izzo (2016) agree with the manuscript's approach and major conclusions. However, Tortato and Izzo (2016) state that some of the areas identified by Levin et al. (2015) as "unprotected visitation hotspots" (page 2162) are actually located "in and around protected areas of the Pantanal." Tortato and Izzo (2016) suggest that this mismatch may result from incompleteness of the version of the World Database on Protected Areas (WDPA) that was used in our global analysis (from August 2013). While we are aware that remotely sensed imagery, GIS datasets, and social media data applied at the global scale may have limitations due to issues of spatial resolution, accuracy, and completeness (Goodchild and Quattrochi 1997, Kerr and Ostrovsky 2003, Goodchild and Li 2012), we disagree with Tortato and Izzo's observation. We show below in a detailed local-scale analysis that the visitation hotpots in Brazil's Pantanal region, as identified in our global analysis (Levin et al. 2015), are indeed unprotected, supporting our original paper. This finding is important since the Pantanal is one of the world's largest wetland ecosystems and holds vast biodiversity that is very vulnerable to predicted changes in climate and to human-induced changes related to the dependence of this ecosystem on flood pulses (Junk et al. 2006). Wetlands are some of the most threatened and degraded ecosystems on the planet and require urgent protection, as reflected in the Ramsar and other global and regional efforts (Erwin 2009).

Following the commentary of Tortato and Izzo (2016), we examined in depth and in detail the spatial location of protected areas within the Brazilian part of the Pantanal (Junk and de Cunha 2005; Fig. 1), comparing the May 2016 version of the WDPA database with respect to the original visitation hotspots that we mapped in Levin et al. (2015). Brazil's system of protected areas includes a wide variety of protection categories and types, which can be classified based on their hierarchical level (e.g., federal, state, or municipal), their type (e.g., strictly protected areas or sustainable use areas) and other categories, such as land ownership and tenure (e.g., private natural heritage reserves [RPPNs] and indigenous reserves; Rylands and Brandon 2005).

According to the 2014 United Nations List of Protected areas of Brazil (http://blog.protectedplanet.net/), there are 1,810 protected areas in Brazil (39.1% of them being indigenous reserves), covering a total area of 3,991,235 km^2 (32% being UNESCO-MAB Biosphere Reserves and 27% being indigenous reserves). In order to examine the comprehensiveness of the WDPA database for the Pantanal, we downloaded the May 2016 version of the WDPA and complemented it with spatial datasets of protected areas from the following Brazilian sources: i3GEO (Unidades de conservação, under Áreas Especiais, as well as Zon. Ecológico Econ./Estados; http://mapas.mma.gov.br/i3geo/datadownload.htm) and ICMBio (Reservas Particulares do Patrimônio Natural–RPPN; http://sistemas.icmbio.gov.br/simrppn/publico/). Comparing these latter two Brazilian sources (both hosted on government websites) with the May 2016 WDPA map of protected areas, we found that at least within the Pantanal, many of the private natural heritage reserves (RPPNs) were not included in the global WDPA dataset (see Fig. 1). Nevertheless, this does not change the findings of Levin et al. (2015) for the Pantanal.

The map of the Pantanal that we present in Fig. 1, based on a compilation of protected areas from both the most recent version of the WDPA and also from Brazilian sources, offers a more complete and detailed presentation of protected areas within the Pantanal (Fig. 1), including the two areas mentioned by Tortato and Izzo (2016) in their commentary, namely the Private Reserve of Natural Heritage "SESC Pantanal" (one in Fig. 1) and "Encontro das Águas" State Park (six in Fig. 1). When overlaying this map (Fig. 1) of the Pantanal's protected areas with the full set of unprotected visitation hotspots as quantified and mapped in our recent paper (Levin et al. 2015), it is clear that the vast majority (>90%) of the unprotected visitation hotspots that we identified based on the numbers of Flickr photographers were located outside of existing protected areas, supporting our original findings (Fig. 1). Many of these unprotected visitation hotspots coincide with the Transpantaneira road (State Highway 60). This road is one of the major routes for ecotourism in the Pantanal, starting in the town of Poconé (Fig. 1), along which many eco-lodges have been established over the years, often taking advantage of the facilities of existing local ranches that are currently located within unprotected areas (fazendas; Maruyama et al. 2005). Indeed, as we and others have shown, accessibility is one of the major factors positively correlated with visitation of protected areas (Balmford et al. 2015, Levin et al. 2015).

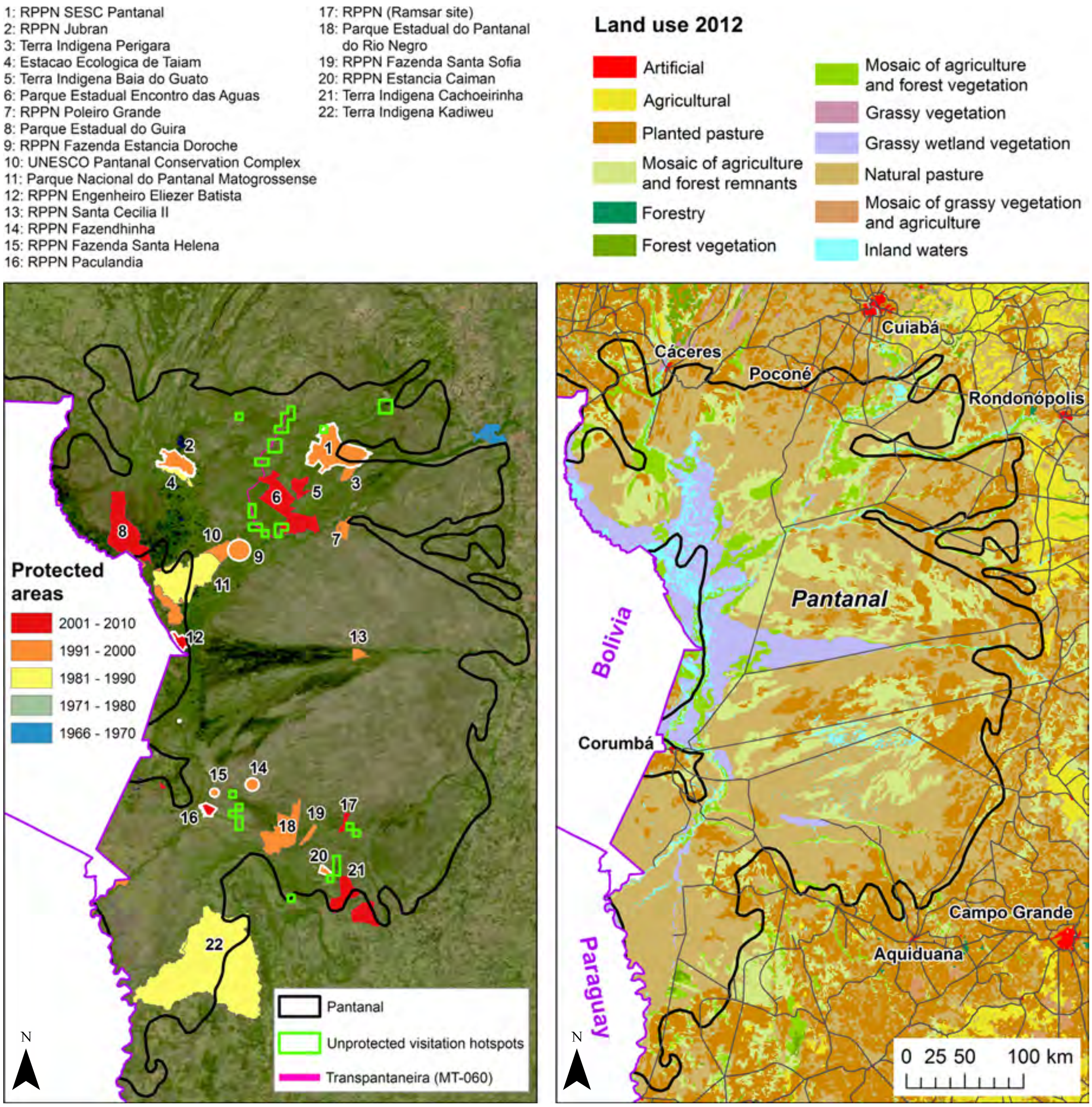

Fig. 1. Land use as of 2012 and protected areas within the Pantanal. Protected areas marked with a bold white outline indicate private natural heritage reserves (RPPNs) in the Pantanal that are not included in the WDPA dataset of May 2016. The map also shows unprotected visitation hotspots based on Flickr photos (in green rectangles) and the Transpantaneira (State Highway 60), which is one of the main routes for ecotourism in the Pantanal region. In this map of the Pantanal, we present all unprotected visitation hotspots identified by Levin et al. (2015), whereas in Levin et al.'s (2015) original paper, we only showed the larger unprotected visitation hotspots. Map source for land use data: http://downloads.ibge.gov.br/downloads_geociencias.htm.

The vast majority of land in the Pantanal is privately owned and is used for extensively managed cattle ranches (Seidl et al. 2001). However, both ecotourism and sustainable recreational fishing (Shrestha et al. 2002) can form an incentive for further enhancing the network of protected areas within the Pantanal, either as public or as privately owned protected areas. Various plans and scenarios for enhancing the Pantanal's protected areas have been published in both a range of Brazilian publications in Portuguese, such as the zoning of the State of Mato Grosso (Governo do Estado de Mato Grosso 2004), and the wider scientific literature (e.g., Lourival et al. 2009, 2011).

Interestingly, the analysis in our original global-scale paper (Levin et al. 2015) has thus succeeded in capturing unprotected visitation hotspots at the local and regional scale (of the Pantanal). Indeed, we agree that there are various limitations of using global-scale databases for conservation planning, which often requires local- and regional-scale data. Some relevant examples for variation between global and regional spatial patterns of conservation related datasets can be seen by the differences in the Human Footprint Index at the global and at the ecoregional scales (Woolmer et al. 2008), by comparing the vegetation assets, states and transitions (VAST) framework done by Thackway and Lesslie (2008) at national and regional scales, and in the quality and availability of datasets for biodiversity conservation in the Mediterranean Sea (Levin et al. 2014). We suggest that applying the methodology we develop in Levin et al. (2015) at regional and local scales using finer and up-to-date spatial datasets of protected areas that are not available globally can indeed refine the identification of sites where benefits from the establishment of protected areas might be highest. Spatial analyses at local and regional scales can differ from analyses done at the global scale. As far as we are aware, the World Database of Protected Areas (WDPA; IUCN and UNEP-WCMC 2016) is currently the most comprehensive global database of terrestrial and marine protected areas. However, being a global-scale dataset, it has limitations and it is difficult to maintain its comprehensiveness and its real-time accuracy.

While datasets required for studying conservation planning in the face of biodiversity loss rates are increasing in their scope and availability, many are not up-to-date, freely available, of sufficient resolution, or assessed for accuracy (Joppa et al. 2016). The WDPA also has the limitations of many other global datasets that rely on data sourced from many countries and organizations rather than on one global uniform source. We suggest adding to the WDPA website (http://www.protectedplanet.net) some interactive digitizing and data sharing capabilities, so that users who identify areas where protected areas are missing will be able to add information in real time (as done in OpenStreetMap; http://www.openstreetmap.org; Haklay and Weber 2008) or to notify the managers of the database, who could check for accuracy and update the data accordingly. These interactive capabilities will enhance the accuracy and timeliness of the WDPA dataset, which is a valuable resource for conservation science and practice.

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