Species prioritization for recovery potential estimation. Case of study: Seasonally dry tropical forest at an inter Andean valley of Cauca River, South America

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Abstract
Seasonally dry tropical forest (SDTF) at the Colombian inter-Andean valley of Cauca River (IVCR) has been under constant transformation. Following the current SDTF's global distribution, it has remained as small and sparse fragments embedded in an anthropogenic landscape. Information regarding the known species composition is a basic input in any modelling scheme. Environmental data is also needed to understand its influence as an explanatory variable for the species occurrences. Knowledge about the biomes and ecoregions where they have been registered may help to understand the way in which the multiple species have been distributed through environmental gradients. In such a way we could recognize the relevance that IVCR plays for the conservation of SDTF plant species in the long term. From multiple datasets, a database with 1725 plant species was built. After applying different criteria set (endangered, endemic, conservation status, at national and regional level), different species subsets were obtained. For a first subset with the species prioritized, Maxent Algorithm on R Studio has been applied to produce predictive habitat suitability models to support the detection of potential areas for restoration. Restoration scenarios will be built for each subset of prioritized species which can be used for landscape planning purposes.
Keywords: Biomes, ecoregion, restoration, species composition.

1. Introduction

Seasonally dry tropical forests (SDTF) have been considered as one of the most threatened ecosystems in the world, even more than tropical rain forests (Janzen 1986). Although encompassing 42% of the world's tropical forests (Brown y Lugo 1982), approximately 50% of its cover has been lost by deforestation (Miles et al. 2006). In South America, almost 60% has been transformed into agricultural lands (Portillo-Quintero y Sánchez-Azofeifa 2010, DRYFLOR et al. 2016). As a consequence of its highly fragmented and degraded state, knowledge about its species composition is incomplete. In the Neotropics, SDTF exhibits a fragmented distribution, supporting high levels of endemism and high β diversity as results of historical geological and climate events (DRYFLOR et al. 2016). Among the several neotropical SDTF distribution's nuclei identified, the inter-Andean valley of Cauca River (IVCR) stands out for its strong floristic relations with Central America and weak but not less important with the largest SDFT areas further south in South America (DRYFLOR et al. 2016). As a result, its species composition is not unique (Pizano and García 2014). Accounting for the IVCR highly degradation is urgent to recognize all the plant species found so far within it as a first step to understand the SDTF presence at the IVCR and to prioritize them for restoration purposes. Additionally, the biomes and ecoregions where the species have been registered in the Neotropics are also identified.

2. Material and Methods

***Study Area*.** The IVCR, with 7313 ha and an altitudinal range of 160 – 2042 m a.s.l, is in the southwestern portion of the Colombian Andes mountains (7°17' 41.49" N - 76°39'25.85" W, 3°0'4.083"N - 75°21'32.762" E) (Fig. 1). The ecoregion is characterized by a bimodal precipitation regime (annual average = 160 mm.y-1), with two peaks in the months of May (215 mm.y-1) and October (251 mm.y-1); and an average temperature of 23°C (min: 18 °C, max = 28 °C) (WorldClim V2, Fick and Hijmans 2017) The IVCR includes six administrative departments, Antioquia (29.16%), Caldas (10.26%), Cauca (8.13%), Quindío (0.19%), Risaralda (4.11%) and Valle del Cauca (48.15%).

***SDTF plant species*.** Using "tropical dry forest" as a keyword, a *total of 36 datasets were downloaded* from the Colombian's biodiversity platform administrated by SIB Colombia (Sistema de Información de la Biodiversidad, in Spanish, *https://sibcolombia.net/servicios/herramienta-de-publicacion/*). Only the datasets containing records falling into the administrative departments of the study area were considered. All records without geographical information, duplicates and those identified up to Genus level were left out for the subsequent analyses. With

this preliminary database, scientific names were verified in the GBIF platform (Global Biodiversity Information Facility, www.gbif.org). When doubtful accepted names were found, IPNI (The International Plant Names Index, http://www.ipni.org/) the Plant List (http://theplantlist.org/) and Tropicos (http://tropicos.org/) platforms were consulted.

Prioritization criteria. Species were prioritized for their national and regional relevance. At the national level: From the vascular plants prioritized (54 sp.), the threatened species recognized (96 sp.), endemics species identified (78 sp.), priority species for conservation (9 sp.). At the regional level: threatened species (231 sp.). A first subset was assembled with the species shared by at least two of the datasets listed above. A second subset was built after cross-checking all the lists against the final SDTF plant species database obtained for IVCR.

Ecological conditions. The map of the world's ecoregions was used to recognize the biomes and ecoregions where the occurrences records of the prioritized species have been recorded.

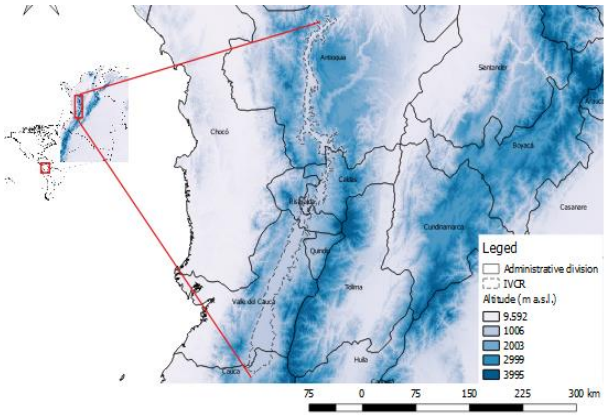

Figure 1. Location of the study area.

3. Results

SDTF plant species. After pre-filtering, data-cleaning and cross-checking, 17 datasets were selected as they reported plant species falling into the boundaries of the study area. A final database with 1725 species was consolidated, distributed in 7 classes, 58 orders, 167 families and 823 genera. In general terms, 70% of the species belong to the orders Fabales, Malphigiales, Lamiales, Gentianales, Asparagales, Myrtales, Poales, Rosales, Solanales, Malvales, Sapindales and Asterales. The 10 most abundant families are Fabaceae, Rubiaceae, Orchidaceae, Malvaceae, Asteraceae, Solanaceae, Melastomataceae, Araceae, Poaceae and Euphorbiaceae. Additionally, 30 families contain 70% of the species, while the remaining 30% are distributed in 137 families, where ~50% of these registers only one (33%) and two species (19%). In terms of genera, *Solanum L.* is the most abundant, followed by *Miconia* Ruiz & Pav., *Ficus* L, *Heliconia* L. and *Piper* L., all with more than 20 species. Of the total of genera, 63% registers a single species.

Prioritized species. The first subset of prioritized species consists of 45 sp., where 31% was reported in three of the listed criteria, 12 sp. have not been observed at IVCR and 15 sp. cannot be used in the following species distribution modelling approach to detect potential areas for restoration as the occurrences records are below the amount needed to run the algorithm. The final first subset consists of 16 prioritized species (*Anacardium excelsum*, *Astronium graveolens*, *Cedrela odorata*, *Ceiba pentandra*, *Comparettia falcata*, *Cratevia tapia*, *Guiacum officinale*, *Heliconia episcopalis*, *Lecythis minor*, *Nectandra turbacensis*, *Oxandra espintana*, *Pachira quinata*, *Passiflora sphaerocarpa*, *Sabal mauritiiformis*, *Syagrus sancona* and *Xilopia ligustrifolia*). The second subset is made up of 112 plant species.

Ecological conditions. **S**pecies' occurrences were observed along Central America, northern South America and further south in South America. Approximately 55% of them were recorded in the biome *Tropical and subtropical moist broadleaf forests*, and 26% at *Tropical and subtropical dry broadleaf forests*. Additionally, 70% of the occurrences fall within 31 ecoregions. Moreover, some of those ecoregions are part of another two biomes, the *deserts and xeric shrublands* and the *mangroves*.

4. Conclusion

The preliminary analyses undertaken highlights the importance that IVCR represents for the several SDTF species identified and prioritized in the present study. The results also agree with previous research related to the floristic relationships among the SDTF's core areas recognized in the Neotropics.

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