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SHORT ARTICLE ON PRELIMINARY RESEARCH

Suitability of the native woody species of the Chaco region, Argentina, for use in dendroecological studies of fire regimes

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Abstract

The Chaco region is one of the most extensive areas of dry forests and savannas in South America and fire plays a major role in its ecology. We studied the types of wounds caused by fire on the native woody species of Chaco and evaluated their suitability for fire dendroecological studies. The selected species were "quebracho colorado santiagueño" (*Schinopsis lorentzii* (Griseb). Engl.), "quebracho blanco" (*Aspidosperma quebracho-blanco* Schlecht), "algarrobo blanco" (*Prosopis alba* Griseb), "algarrobo negro" (*Prosopis nigra* (Griseb.) Hieron), "tusca" (*Acacia aroma* Gill. Ex Hook. et Arn.) and "*garabato*" (*Acacia furcatispina* Burkart). Sampling sites were spread across different locations in the Province of Santiago del Estero, Argentina. A selection was made of individual trees with external signs of fire. Cross-sections of boles and branches were taken from each tree at heights of 0.3 and 1.3 m from the ground. The types of wounds were classified according to the percentage of damaged bole perimeter and the patterns of growth interruption. Species suitability for dendroecological studies was based on longevity, patterns of annual ring growth, type of wound, bark thickness and difficulty in dating the fire event. Two types of wound were studied: fire scars and fire marks. It was determined that *S. lorentzii*, *A. quebracho-blanco, P. alba* and *P. nigra* are the most suitable for dendroecological studies since their longevity and thicker bark development enable them to survive in moderate to high intensity fires. *Prosopis* and *Acacia* species have better tree ring demarcation and therefore provide more certainty in fire event dating. Despite the lower longevity and higher susceptibility to fire damage of the *Acacia* species, they are suitable for dendroecological studies that require analysis over a few decades in environments with lower intensity fire regimes. The distribution areas of the studied species means that they can be used for dendroecological studies of fire in the Western, Eastern and Mountain Chaco areas and the phytogeography provinces of Monte and Espinal.

Keywords: *Aspidosperma*; Chaco; Dendroecology; Fire; *Schinopsis*

Introduction

Fire is a major factor modelling landscape of most biomes where it affects the vegetative and animal community dynamics, and different components of

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ecosystems functioning (Hungerford et al., 1991; Dansereau and Bergeron, 1993; Taylor, 1993; Skinner and Chang, 1996; Pausas et al., 2004). Tropical and subtropical dry forests and savannas are among the ecosystems more influenced by fire (Hueck, 1978, Cutter and Guyette, 1994; Kunst et al., 2003; Boletta et al., 2006).

The Chaco region lies between the counties of Argentina, Paraguay, Bolivia and a small part of Brazil. In Argentina, the Chaco region covers approximately 600,000 km^2 and includes the provinces of Salta, Tucumán, Jujuy, Catamarca, Santiago del Estero, Córdoba, Chaco, Santa Fe and Formosa (Hueck, 1978; de la Balze, 2004). It is the largest continuous dry-forest biome in South America, and the largest extratropical biome reservoir in the Southern Hemisphere. Fire is assumed to play a major role in Chaco dynamics (Martínez Carretero, 1995; Naumann and Madariaga, 2003). In the region, fire is used for brush control, grassland maintenance, and land clearing for agriculture expansion (Bordón, 1993; Kunst et al., 2003; Tálamo and Caziani, 2003; Grau et al., 2005).

Fire regime alterations caused by climatic or anthropogenic factors have important effects on species survival (Skinner and Chang, 1996; Swetnam and Baisan, 1996; Grau and Veblen, 2000; Pausas et al., 2004). Dendroecological techniques have contributed to studying the effects of fire and other disturbances on forest dynamics (Villalba, 1995; Kitzberger et al., 2000; Medina et al., 2000; Grau et al., 2003). Owing to the importance of fire as disturbance in Chaco region there is a lack of studies to assess dendroecological potential of woody native species.

Dendroecological techniques analyse fire scars in species with annual growth rings. Fire scars are identified as discrete marks embedded inside dendrochronological series allowing fire dating even in dead material. Even when there are no chronologies of growth width rings, the year of the fire event can be pinpointed by counting the rings between the scars in the direction of the bark. Live material must be used for this technique and can be controlled by means of marker years or skeletons plots (Kitzberger et al., 2000).

The objectives of this work were to determine types of lesions generated by fire in the woody native species of the Chaco Region and to evaluate their suitability as material to be used for dendroecological studies of fire regimes.

Materials and methods

Study area and species

Five sampling sites were established in the Province of Santiago del Estero, located in the Western sector of the Chaco region of Argentina (Fig. 1). This region is characterised by a strongly seasonal climate with a mean precipitation is approximately 550 mm. Rainfall occurs mainly in summer, and the dry season extends from April to October. Mean temperature is 26.9 °C for the hottest month and 12.4 °C for the coldest month. Extreme temperatures range between 42 and 45 °C in summer and −7 and −8 °C in winter (Boletta et al., 2006). In the sites, six species were sampled: *Schinopsis lorentzii*, *Aspidosperma quebracho blanco*, *Prosopis alba*, *Prosopis nigra*, *Acacia aroma* and *Acacia furcatispina*. *S. lorentzii* and *A. quebracho blanco* species are the dominant species of the upper stratum of Chaco forests (>12 m height); *P. nigra* is well represented in the intermediate canopy layer (8–10 m), *P. alba* is characteristic of river floodplains and moister areas, *A. aroma* and *A. furcatispina* are abundant in lower canopy layer (>8 m) (Brassiolo et al., 1993; López de Casenave et al.,1995). The origin samples sites correspond to areas of good conservation state with scarce signals of anthropic activities. At each sampling site, we selected individuals with external fire signs as charred bark or fire scars. Because selected species produce hardwoods, samples consisted on 5 cm wide wedges taken with a chainsaw from bole and branch, at 0.30 and 1.30 m height. The maximum age of sampled species ranged from 41 to 102 years old (Table 1). Several samples were discarded due to rotten or insect galleries that prevented their use, resulting in an uneven number of samples per species.

The surfaces of samples were sanded with a band sander and an orbital manual sander with 100–600 grains until a clear surface was obtained for best observation of wood.

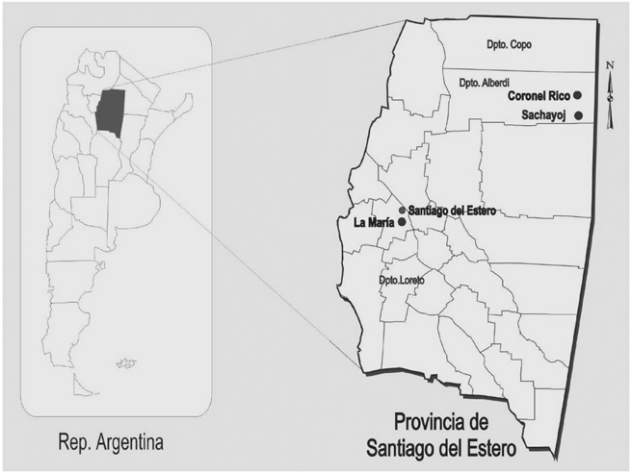

Fig. 1. Localisation of sampling sites of woody native species of the Western Chaco, province of Santiago del Estero, Argentina.