Root and functionality relationship in trees for Ecological Restoration of critical environments in the Colombian Andes

[1]Rodríguez Nathaly., [2]Melo Omar., [3]Ochoa Alexandra. & [4]Rojas Ferney.

[1]Research Group in Biodiversity and Tropical Ecosystems Dynamic, University of Tolima, nrodriguez@ut.edu.co. [2]Department of Forest Sciences, University of Tolima, omelo@ut.edu.co. [3]Fundacion Natura, aochoa@natura.org.co. [4]Corporacion Ambiental Empresarial, Camara de Comercio de Bogotá, hojasverdescaem@ccb.org.co

KEY WORDS

Forest biomass, rooth architecture, plant functionality, ecological restoration, global climate change

STUDY AREA

La Poma Ecologic Park is located in the far southwest of the Sabana de Bogota, town of Soacha, department of Cundinamarca, Colombia South America. The extension is 140 hectares and the geographical coordinates of the park are: X: 993300 – 990659; Y: 967900 - 977900 .

The average annual temperature is between 4 and 12 degrees Celsius, with occasional freezes and winds in the months from January to December and with less intensity in July and august . The areas are distributed between the 2500 and 2700 meters above sea level. The average annual precipitation does not exceed 600 millimeters per year. According to the classification of life zones proposed by Holdridge, climate belongs to the type of Lower Montane dry forest (Bs-MB) with vegetation of the Andean forests of the eastern mountain range.

LOCATION

STUDY AREA

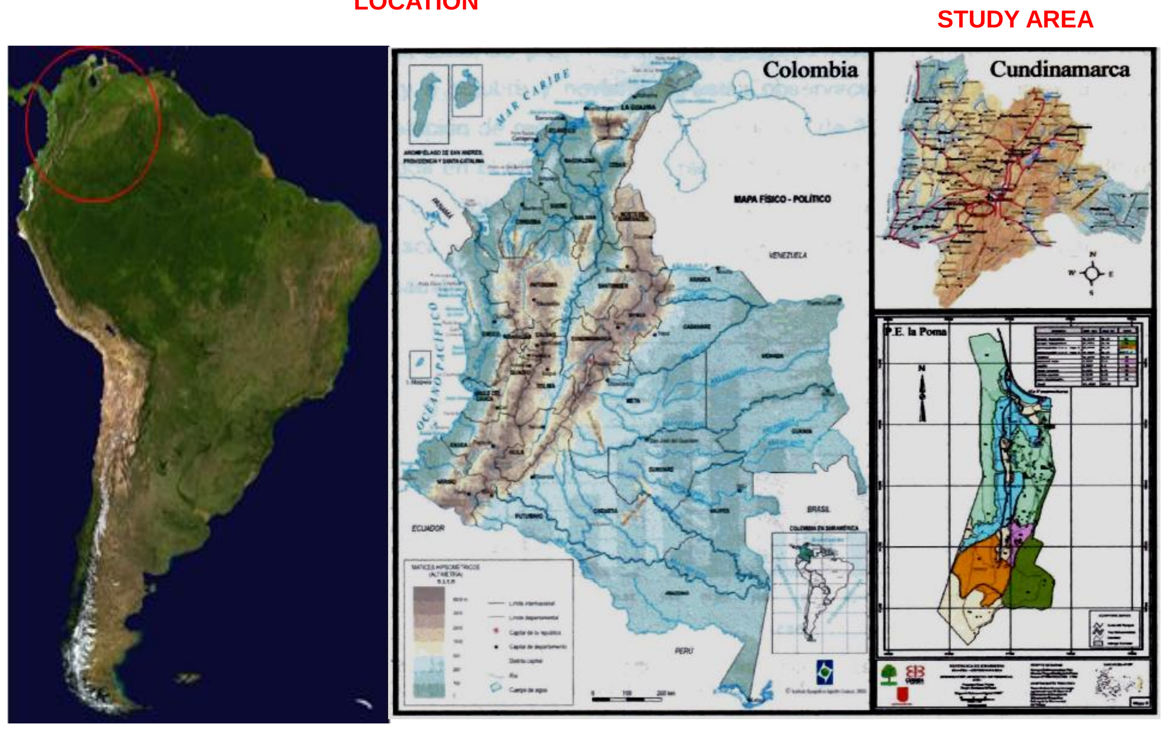

FIG 1. Location of the study area in the South American, regional and local context.

METHODS

The relationship between the plan functionality and the root architecture like adaptation factor to critical environments was evaluated for the species *Lafoencia acuminata* (La), *Cedrela montana* (Cm), *Alnus acuminata* (Aa), *Myrcianthes leucoxila* (Ml) and *Xilosma espiculiferum* (Xe). Trees with ages between 2 and 18 years were evaluated. The specific leaf area (SLA), the overground biomass (OB), the underground biomass (UB), the root/shoot ratio (R/S), the proportion of roots (length stem/deep main root) (Lüttge, 2008, Pallardy, 2008), growth rate (G%) and mortality rate (M%) were determined (Weiskittel et al. 2011).

RESULTS

Specie with high values of AFE (La= 180,6; Cm=67,1 and Aa=61,7), showed low relation R/S (<0,31), high values in the roots proportion (0,26 – 0,32), low relative growht (<19%) and low mortality rates (less than 2,3%). Specie with AFE low (Ml=109,1 and Xe=90,9) showed high R/S (0,65 y 0,53), les proportion of roots (0,24 y 0,23), hight growht (26 y 28%) but with hight mortality . (7,5 y 8,3%).

TABLE 2 Parámetros funcionales para la caracterización de la arquitectura de raíces para cinco especies leñosas de boques altoandinos secos, utilizadas en restauración ecológica en la Sabana de Bogotá. Lafoencia acuminata (La), Cedrela montana (Cm), Alnus acuminata (Aa), Myrcianthes leucoxila (Ml) y Xilosma espiculiferum (Xe). SLA= specific leaf área, O-B= overground biomass. U-B= underground biomass. R/S= root-shoot relation. SL/RL= Root proportion. RGR= relative growth rate. Mortality rate.

SPECIE	CODIGO	SLA	O-B	U-B	R/S	SL/RL	RGR	M%
Lafoencia acuminata	La	180,6	77,275	22,725	0,303	0,262	18,7	1,93
Cedrela montana	Cm	167,1	77,648	22,352	0,298	0,297	16.6	2,17
Alnus acuminata	Aa	161,7	78,367	21,633	0,288	0,325	15.9	2,25
Myrcianthes leucoxila	Ml	109,1	52,875	47,125	0,655	0,24	25,98	7,5
Xilosma espiculiferum	Xe	90,3	61,725	38,275	0,537	0,23	28,03	8,3

TABLE 2 Acummulation of biomass models of roots for five specie of Fores forest andean dry used in ecological restoration in the Sabana de Bogotá. Lafoencia acuminata (La), Cedrela montana (Cm), Alnus acuminata (Aa), Myrcianthes leucoxila (Ml) and Xilosma espiculiferum (Xe). RB = Root Biomass.

SPECIE	MODEL	R2	ESTANDAR ERROR
Bm	RB_{La} = exp(1,69771 - 7,83048/age)	91,17	0,1336
Ep	RB_{Cm} = exp(2,08531 - 8,68949/ age)	89,12	0,2802
Ap	RB_{Aa} = exp(2,06857 - 6,34102/ age)	85,54	0,2166
Dv	RB_{Ml} = exp(2,68024 - 7,75818/ age)	85,60	0,3471
Qh	RB_{Xe} = exp(3,26406 - 10,056/ age)	90,11	0,2768

CONCLUSIONS

The research concluded that species with deep roots have low mortality but reduce growth, it use more lighting resources in contrast with species with surface roots that use the soil resources more in order to produce more coverage in less time, which generate competition that increase mortality. Shrub species have lower yields than tree species; however, they can more efficiently handle environmental changes and be an alternative for use in ecological restoration and the mitigation of global climate change. And this information can be used to optimize the process of ecological restoration of critical environments.

REFERENCES

Carson, w. and Schnitzer, S. 2008. Tropical forest community ecology. Wiley – Blacwell. 517 P.

Lüttge, U. 2008. Physiological ecology of tropical plants. Second edition. Springer. Berlin. 458 P.

Pallardy S.G. 2008. Physiology of woody plants. Third edition. Academic Press. Elsevier. San Diego. 454 P.

Weiskittel, A. R. Hann, D. W. Kershaw. J. A. and Vanclay, J. K. 2011. Forest growth and yield modeling. Wiley – Blacwell. 415 P.