Silvicultural treatments of exotic and native tree monocultures and influence on biodiversity facilitation in southern Ecuador. Preliminary Results

Darío Veintimilla[1,2]; Baltazar Calvas[2]; Reinhard Mosandl[2]; Bernd Stimm[2]; Patrick Hildebrandt[2]; Sven Günter[3]

1. Universidad Técnica Particular de Loja, Dept. de Ciencias Naturales, Área de Ecología, Ecuador
2. Technical University of Munich, Dept. of Ecology and Ecosystems Management, Germany
3. Thünen Institute of International Forestry and Forest Economics, Germany

INTRODUCTION

Forests plantations with exotic species in southern Ecuador have been characterized mostly by having negative externalities in both ecological and economic aspects (Hofstede *et al* 2002). Despite of this externalities, exotic plantations can have facilitating effects for regeneration of native species (Cavalier &Tobler 1998) and could be used to foster the establishment of mixed forests (Aguirre *et al*. 2006).

GOAL

Testing suitable shelter conditions for enrichment plantings of selected native tree species in *Pinus patula* plantations and *Alnus acuminata* natural stands.

STUDY AREA

Location: Loja canton, Loja province, Southern Ecuador (Fig 1).
Altitud: 2000-2400 m asl
Sample sites: Five *Pinus patula* plantations and three *Alnus acuminata* natural stands (2.8 ha total sampling area).
Precipitation: 600-900 mm annual average
Temperature: 16°C annual average
Soils: Cambisols
Vegetation: Lower montane forest

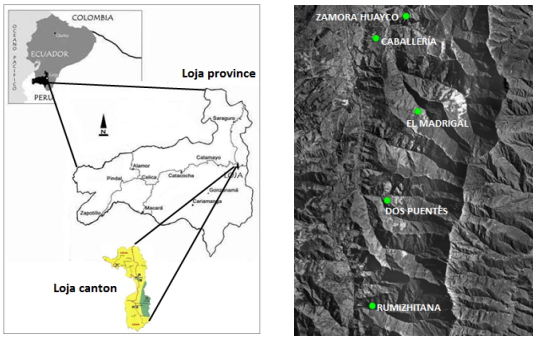

Fig 1. Study area and experimental sites of *Pinus patula* plantations and *Alnus acuminata* natural stands in Loja province, Southern Ecuador.

METHODOLOGY

Sampling

49 sample plots 24 x 24m (33 in *Pinus patula* plantations and 16 in *Alnus acuminata* stands) were installed. Each sample plot was divided into 16 (6 x 6m) sub sample plots.

Sample plots were arranged in a randomized block design. Eleven blocks were placed in *Pinus* plantations and eight blocks in *Alnus* naturalstands.

Stem diameter at breast height (dbh, 1.30 m), total and commercial height was measured for all trees.

Light conditions, canopy opening , soil properties (pH, CEC, N, Mn, Ca, K, P, Zn, Cu, C) and microclimatic variables (temperature and relative humidity) were measured before and after silvicultural treatments.

Silvicultural treatments

Three different tree thinning intensities were applied for *Pinus* plantations (control, strong and slight intervention), and two for *Alnus* natural stands (control and strong intervention) (Fig 2).

Plantation of native tree seedlings

Planting tree seedlings was carried out during rainy season of 2015, immediatly after silvicultural treatments were developed. Nine native tree species were planted separately and randomly arranged in sub-sample plots with spacing of 2x2m (two species were tested with two different provenances) (Fig 3).
The age of seedlings from each specie was different at the time of plantation (8 to 24 months).
Root collar diameter (RCD), height and phytosanitary status was registered for each seedling at 6 months and 1 year after plantation.

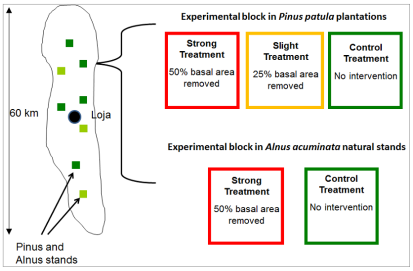

Fig 2. Block arrangement and silvicultural treatments in *Pinus* plantations and *Alnus* natural stands

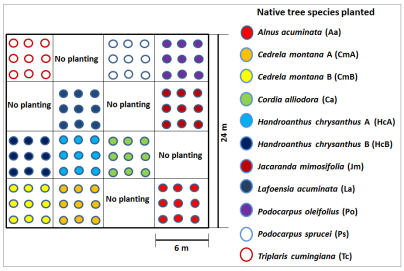

Fig 3. Scheme of reforestation and list of nine native tree species tested

RESULTS

Percentage of survival was high in both *Pinus* and *Alnus* stands (up to 85%). Control plots in *Alnus* stands showed the higher mortality rate after one year (15%) (Fig 4). Tree seedlings report higher damage by insects in *Pinus* plots under strong treatment (20%) (Fig 5).
Height and root collar diameter was significantly different of almost all species in response to silvicultural treatments under *Pinus* plantations (Fig. 6 a,b). This tendency was different under *Alnus* natural stands, in which only three species showed significant differences in response to silvicultural treatments(Fig. 6 c,d).

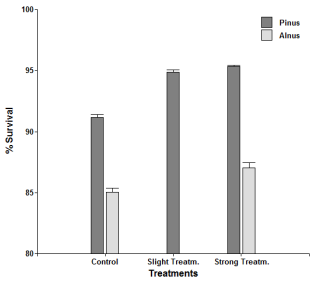

Fig 4. Mean (%) of survival of tree seedlings in *Pinus* and *Alnus* stands one year after planting

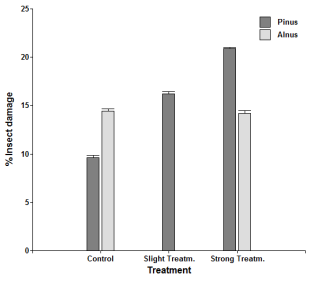

Fig 5. Mean (%) of insect damage on each seedling of tree seedlings in *Pinus* and *Alnus* stands one year after planting

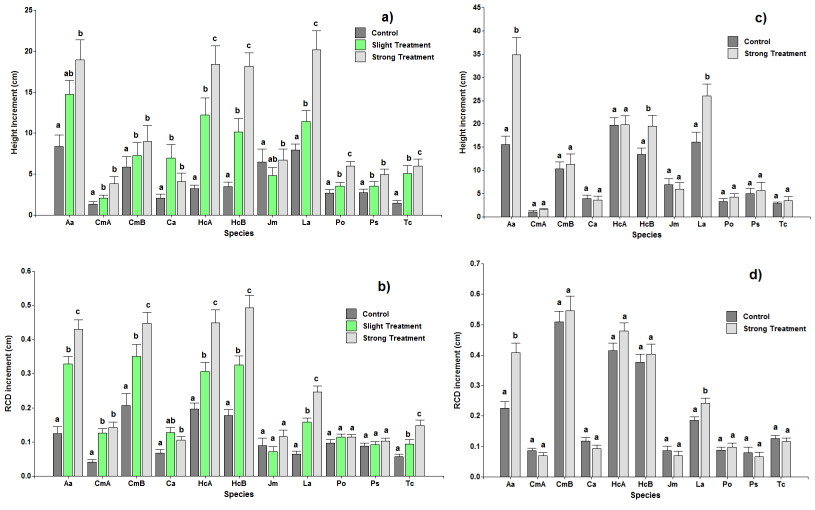

Fig 6. Means and standard error of height and root collar diameter (RCD) increment of native tree seedlings in *Pinus* plantations (a,b) and *Alnus* natural stands (c,d) in six months period. Different letters indicate significant differences between treatments (*LSD Fischer* α=0.05).

CONCLUSIONS

- Seedlings development in enrichment plantings seems strongly influenced by canopy openness in *Pinus* plantations, but not in *Alnus* natural stands.
- Higher thinning intensities (up to 50% of basal area) showed the best results for almost all tested species in *Pinus* plantations.
- Additional comparisons between treatments regarding light, soil and microclimatic variables will be developed in order to know the better way to foster the establishment of mixed forests.

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