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An investigation into some of the aspects of the stand structure of *Araucaria araucana* (Mol.) Koch. in areas of Chile and Argentina.

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Araucaria araucana (Mol) Koch (araucaria or pehuen) is a unique tree that grows in areas located in the South Central Andes and in two small populations near the West Coast of Central Chile. It is an important tree not only because of its ecological value as an endemic species to South America but because of the place it holds in the Mapuche (Indian) culture. This has not stopped it from being logged in the past centuries and the numbers of araucaria have declined making it an endangered species. A ban has already been placed on the felling of the araucaria, however there is still much to be done to ensure its conservation.

Understanding the ecology of the araucaria can help in its preservation by ensuring that its habitat is kept as natural as possible and aiding in possible restoration projects. The dynamics of araucaria stands have been studied in detail, however there are still some aspects that have not been dealt with. One of these is the level of competition, which take place between the regenerating plants. Part of the investigation conducted probed this problem by looking at the different degrees of clumpiness as an indicative of the level of intraspecific competition. This was done by using Morisita's index, I_δ (Taylor and Halpen, 1991 and Sakai and Oden, 1983):

$$I_\delta = \frac{q \sum_{i=1}^{q} a_i (a_i - 1)}{N (N - 1)}$$

Where q = number of 5 x 5 meter quadrats, a_i = the number of individuals in the i^{th} quadrat and N is the total number of individuals in all the quadrats. If Morisita's index equals one then the population is randomly distributed, if it is more than one then the population is clumped and if it is less than one the population is dispersed or regularly distributed. Effects of regeneration density and canopy cover were also included into the investigation.

Fragmentation of populations is another consequence of overexploitation of a resource and the araucaria is no exception. The isolated populations found in the Argentinean side of the Andes evidence this. The way in which this will alter the processes of growth and reproduction of the araucaria is also a question yet to be investigated in depth. In an attempt to get closer to the answer, a fragmented stand was located and measurements of dbh (diameter at breast height) and number of

cones were made for trees at different distances from the larger, central patch. In this way, it was possible to determine whether the degree of isolation had an effect on cone production and size. This was possible by taking GPS readings of different patches from the main fragment. These readings were then entered into a Map Maker a computer package which plotted out all the areas and made it possible to measure the distance in kilometres between them. It was then possible to look at the relationship between distance from the main fragment and the number of cones and dbh.

The results obtained from the first experiment conducted in Chile showed that in all the cases studied the seedlings and saplings showed a clumped distribution where as in the case of the adult trees this varied from plot to plot. Correlations were done to see if there was any direct affect of the structure of the canopy on the distribution of seedlings and saplings and in both cases there was no correlation. The effect of the density and the clumpiness on the health was tested and in both cases there was no significant result. It is likely that the reason why there was such an insignificant effect of the structure of the stand on the seedlings could be due to the understory having a more direct effect. *Chusquea coleou* (bamboo) has an effect on the understory (Donoso and Schmidt, 1991 and Finck, 1995) and this was found in a number of plots. In others *C. coleou* was not found but in these cases there was evidence of fire, which would certainly have a grater effect on the regeneration.

Perhaps the most interesting result was the fact that the density and spatial structure of the saplings does not effect the health of the saplings. This is surprising as in most cases it was noticed that the adult trees were dispersed. This would give the idea that there must be some form of intraspecific competition between the trees at the early stages leaving only the fittest behind to thrive and become adults. However, even in very densely packed stands of saplings (up to 10 per meter squared) (fig.1) there was no effect on the health. One possibility could be that there is a reduction in the growth rate of the saplings instead of a visible decrease in health, but it is not possible to investigate this aspect in a short-term study. A reason for this could be due to the protection this gives to the individuals located in the centre of the patch from grazers or even low intensity fires.

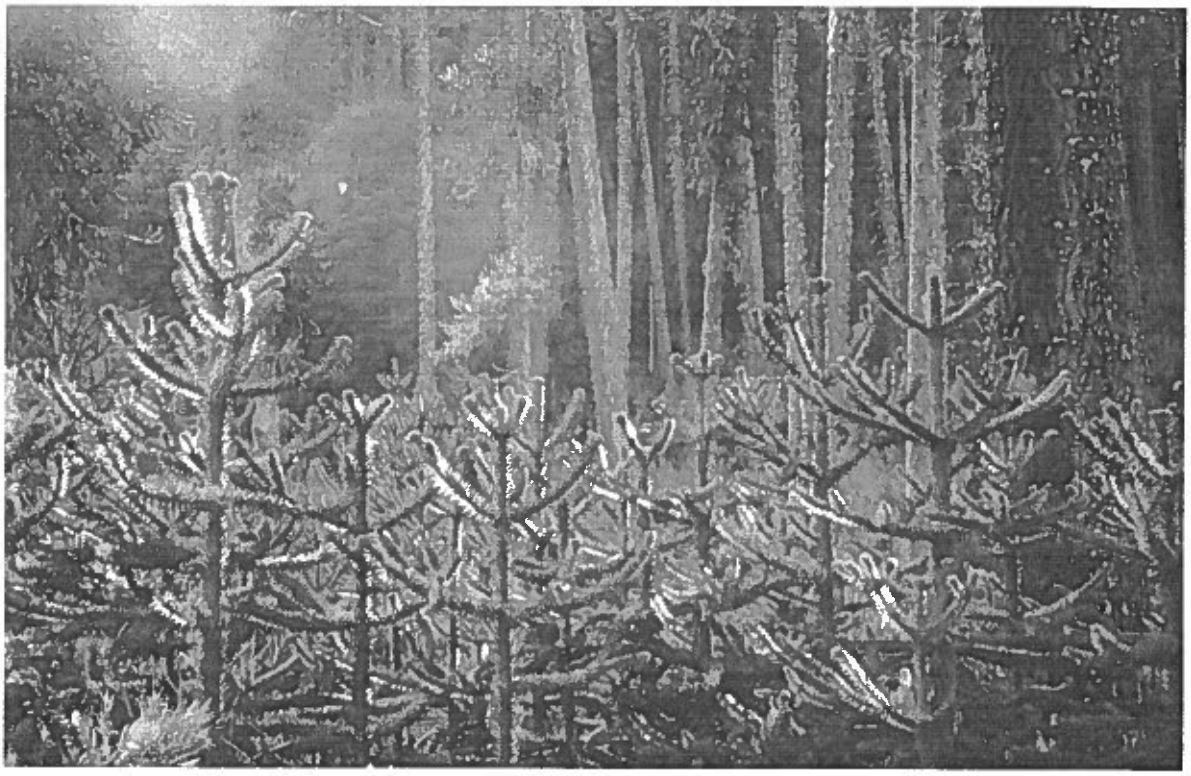

Figure 1. This plot in Icalma (Chile) is a good example of the density at which saplings can grow without any noticeable negative effects.

The results obtained from the second part of the experiment conducted in Argentina gave insignificant results to all the tests used on the data suggesting that the fragmentation of the stands had no effect on the cone production or the dbh of the individuals. This could have been due to the site chosen as it was hard to find isolated patches with further fragmentation that were small enough to study all the trees within them. In this case it could mean that on a bigger scale things could be different. It is interesting to note that if the furthest tree from the central patch was removed in both cases there was a significant negative correlation. This could suggest that the central patch out trees is expanding and colonising areas around it, as the trees are younger as you go out of the patch. This would be interesting for further investigation into the powers of regeneration and expansion of the fragments.

In both cases further investigation and a longer term study would be necessary to further the understanding of these aspects of the stand dynamics of *Araucaria araucana.* However I believe that the study I conducted in Chile and Argentina was not in vain as it inspires further questions and gives yet another point of view into the investigations of stand dynamics.

References

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