Growth of Scots Pine under dry and wet conditions

Introduction:

This was an investigation into the effect of water logging upon Scots Pine (*Pinus sylvestris*) saplings. By comparing data for waterlogged saplings against saplings grown in drier conditions it was possible to deduce the trees' average growth performance.

Discussion:

The method was to collate growth related data, a list of which is available in Appendix 'A'. The measurements collated were recorded in centimetres using a 30cm ruler and a defective vernier. This resulted in data being no more accurate than ± 3 mm. As some of the measurements were only one or two centimetres this must have caused a credible amount of inaccuracy. The use of a piece of string to measure height, and a micrometer for the smaller measurements, would have definitely improved accuracy.

Also the wide age range of the saplings could have adversely affected the results and the establishment of saplings being from wet or dry environments was vague. Were these saplings plucked from areas that had been continuously monitored for such factors as field capacity, precipitation, temperature and humidity (for at least the age of the saplings)? These factors can vary greatly, both seasonally and annually; hence it is possible that a twelve-year-old sapling spent the first half of its life in dry conditions and the second half in waterlogged conditions. It is likewise conceivable that certain saplings only experienced occasionally waterlogged conditions for short periods of certain years.

This notion, combined with the age variance, could significantly 'contaminate' the data for each group. The comparison of data between wet and dry saplings of comparable age (across the age range) would lessen the potential for inaccuracy. Likewise, ascertaining the level of environmental stability experienced by the saplings throughout their lives would also lessen the potential for inaccuracy

Conclusion:

The 't-tests' conducted upon the results (Appendix 'B') proved very conclusive: only one of the twelve features tested scored a significance less than '$P < 0.0001$', and that was the 'annual diameter increment', which was '$P < 0.001$'. These results confirmed that waterlogged saplings grow at a lesser rate than drier soil saplings. When one examines the physiological effects of water logging the results are further substantiated.

Waterlogged soils are typically O_2 deficient. This restricts the amounts of O_2 that the roots can absorb for respiration. Unlike other plant life, such as the Swamp Cypress (*Taxodium distichum*), the Scots Pine has not evolved compensatory measures like aerenchyma (air conducting tissues used by many swamp plants). Consequently the growth rate of Scots Pine in waterlogged soils is restricted by the inability of the roots to absorb enough oxygen.

To compound the problem waterlogged soils are an ideal habitat for many anaerobic microorganisms involved in decomposition. These microorganisms produce hydrogen sulphide, methane and ethylene; these further inhibit the ability of the roots to function adequately. Furthermore, waterlogged soil has a detrimental effect on the osmotic pressure of the saplings. This in turn reduces its osmotic potential and so inhibits its capability to absorb minerals and nutrients in solute form.

So, waterlogged soils cause several factors that are inhibitory upon the growth of Scots Pines. This investigation dealt only with the overall effect of waterlogged soils upon saplings. Further investigation would be needed to determine exactly which properties of waterlogged soils had the most inhibiting effects upon growth.

Bibliography

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