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TREE RINGS PROVIDE SNAPSHOTS OF EARTH'S PAST CLIMATE

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ABSTRACT

Dendrochronology is the scientific discipline of determining the relationship between tree growth and climate, and is determined using the annual growth rings. This provides a potential method for monitoring climate change. Climate usually acts as a major factor influencing the tree growth. Here, the effects of climate of a conifer species was assessed in relation to measured climatic variables. Tree cores of Scots Pine *(Pinus sylvestris*) were sampled from a forestry plantation at Hordron Edge, Derbyshire to determine the relationship between annual growth increment and four climate variables (maximum temperature, minimum temperature, grass minimum temperature and rainfall). In this study there was no significant correlation between growth and climatic variables. There were no significant first-order relationships found between tree growth indices and any of the four climatic variables tested. This result suggests that climatic variables were not significant in controlling tree growth at this site.

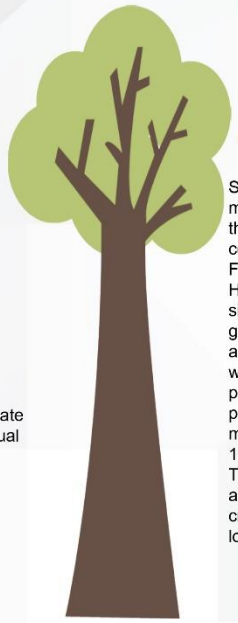
INTRODUCTION

Forest ecosystems have been recognized as an essential component of the biosphere. One of the most widely–distributed conifers tree in the world is Scots Pine (P. sylvestris) (Royal Forestry Society, 2014). It is found naturally in Great Britain mainly in the Scottish Highlands but is planted extensively throughout the country. During the early 20th century, the field of dendrochronology was born when it discovered that tree- ring width was dependent on climatic and environmental parameters (Fritts, 1976). Tree-rings are formed by the vascular cambium, a cell tis- sue located between the xylem and phloem, which produces new xylem (wood) to the inside and new phloem to the outside. Differential activity in the cambium layer in response to climate produces xylem rings of different thicknesses and is in effect a measure of response to climate.

NOVELTY

The novelty of the research is to provide the snapshots of earth past climate using tree's rings and the determination on the relationship between annual growth increment and four climate variables:

i) Maximum temperature
ii) Minimum temperature
iii) Grass minimum temperature
iv) rainfall



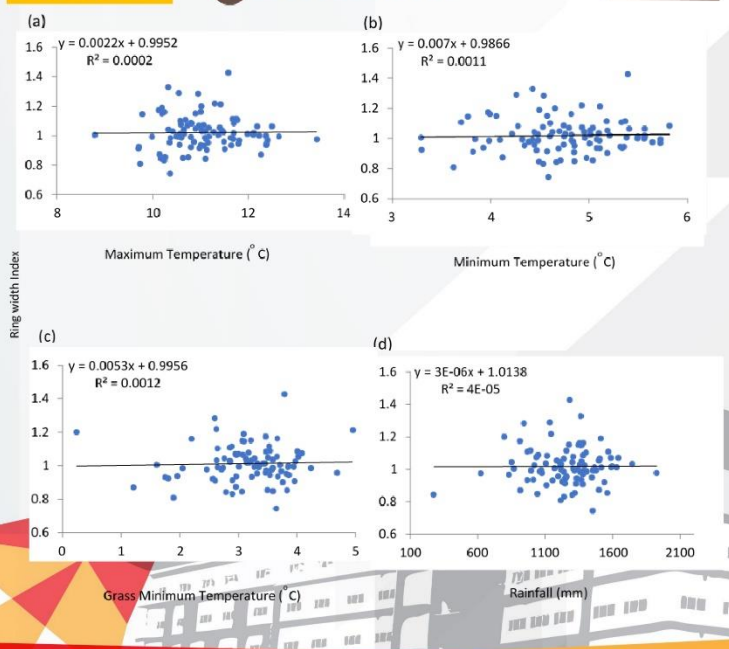
OBJECTIVES

To determine the relationship between tree growth and climate using the annual growth rings.

METHODOLOGY

Standard dendrochronological techniques were used to collect, prepare and measure tree–ring width increments. Tree-ring widths were as cross referenced to the climate data to enable growth dynamics to be investigated. Sampling was completed at the site using standard dendrochronological methods (Fritts, 1976). For each tree, height was recorded using a Haglof Vertex IV Ultrasonic Hypsometer (Krooks et al., 2014). Cores were always taken from the southern side of the tree to minimize differences due to aspect. Cores were labelled and glued into a wooden block until processed. The cores were left to dry overnight and then glued into the wooden core blocks with multipurpose white adhesive in a way that exposes the transverse cross-sectional surface. Cores were then progressively sanded and polished with successively different grades of emery paper (120, 240, and 320) until the wood cells were clearly visible under the microscope. Cores were then scanned using an Epson scanner (Expression 11000XL) at 1200 dpi resolution to provide a computerized image of the cores. The scanned images of the cores were then viewed using CoolDendro software and distances between annual rings counted. All samples of cores were visually cross–dated to avoid miscounting by missing or false rings which were either locally–absent or present as multiples rings.

FINDINGS



CONCLUSION

The research does not show any relationship between tree growth and climate relationships, as there were no significant first–order relationships found between tree growth indices and any of the four climatic variables tested. This suggested that *(P. sylvestris)* growth was not governed by climate variables at this site hence, our initial was rejected. Given this it was not possible to produce predictive relationships between tree *(P. sylvestris)* performance and climate at this site. As climate change is not static and is fluctuating continually, the dynamics of tree growth towards climate will likely depend on many factors comprising of water and nutrient availability, the timing of the warming, rising atmospheric CO2 and the ability of species to acclimate to new growing conditions (Way and Oren, 2010).

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