Majalah Pusat Pengajian Biologi UiTMCNS JANUARI 2023| Bilangan 7 / 2023

EON

Epitome of Nature

TS DR NOR'AISHAH HASAN

SRIKANDI TEKNOLOGI

OMEGA-3

PERANAN IKAN

MAKMAL MEGA

PERANAN DALAM BIOLOGI MOLEKUL

CANVA

MAKMAL KOMPUTER MAYA?

TEKNOLOGI PLASTIK

APAKAH KESANNYA?

RISK MANAGEMENT IN MICROBIOLOGY LABORATORY

KENALI PENYAKIT IKAN DALAM MAKMAL

PLOGGING: A NEW TREND IN ENVIRONMENT?

ISSN 2773-5869

9 772773 586005

Rencana Antarabangsa

TREE – RING RESEARCH MAY UNDERSTAND CLIMATE CHANGE

By

NUR IDZHAINEE HASHIM[1] AND ROB MARRS[2]

[1]Centre of Studies for Park and Amenity Management, College of Built Environment, UiTM Shah Alam, Selangor, Malaysia

[2]School of Environmental Sciences, University of Liverpool, United Kingdom

idzhainee@uitm.edu.my

EDITOR: MOHD SYAHRIL MOHD ZAN

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, Derbyshir. Standard dendrochronological techniques were used to collect, prepare and measure tree – ring width increments. Forest ecosystems have been recognized as an essential component of the biosphere (Hooper et. al., 2005). 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. It is evergreen, reaching heights of 25 m to 45 m when mature, and is classified as softwood which makes it easy to extract tree cores.

Therefore, *(P. sylvestris)* is considered to have a wider geographical distribution than many other pine species. The ecology of *(P. sylvestris)* may lead to biological responses in tree growth which may reflect in the wood structure by stress tolerance, allowing it to occupy habitats that are unfavorable to other species as a result of climatic or soil conditions, including low temperatures, extremes of acidity and alkalinity waterlogging and drought (Kelly and Connolly, 2000). Therefore, to achieve greater benefits from trees, it is essential to recognize the growth, forest management, environmental effect of the utilization through the global climate change of the earth.

Global Climate Change

The earth's climate is a dynamic system. Yet, concern about climate change is increasing due to many uncertainties which exist as regards to possible changes on the ecosystems in the current century. Bluemle (1999), stated the recent compilation of proxy data revealed that the global mean annual temperatures of the earth have experienced a global average increase by approximately 0.98 (°C) from 1866 to 1998.

Moreover, data obtained from NASA's Goddard Institute for Space Studies (GISS) revealed the Earth was the warmest from 134 records in the year 2014. A major challenge in climate research has been the attribution of cause for this temperature trend. Globally, the earth's temperatures are expected to continue rising to at least the end of the present century (IPCC, 2013) and it is expected that human influence has been detected in the warming of the atmosphere and the oceans since the mid– 20th century. This may alter the current growth dynamics for tree species at different scales from the species to the community.

Relationship between climate and tree growth

Trees are recognized to be very sensitive to climate changes, where changes in the ecosystem can disturb the metabolism and physiological process of the trees and affect the wood structure.

Extreme changes of environmental conditions form tree– rings that are either much wider or narrower compared to neighboring tree-ring widths (Kaennel Schweingruber, 1995). One example is drought conditions which can exaggerate the concentrations of contaminates in groundwater and results in increased mortality or decreased tree radial growth.

Tree–ring width chronologies can, therefore, provide a retrospective record of the past tree growth, which allows scientists to surmise the history of environmental change. It is thought that the dynamics of the tree–line are very sensitive to a change in climate (Holtmeier, 2009), because tree–line eco-tones are sensitive to climate change with increases in temperature being associated in tree density and tree–line position. Accordingly, in this study, tree–ring increment data of *(P. sylvestris*) from the Peak District National Park had been collected and compared to climate data collected from a nearby weather station.

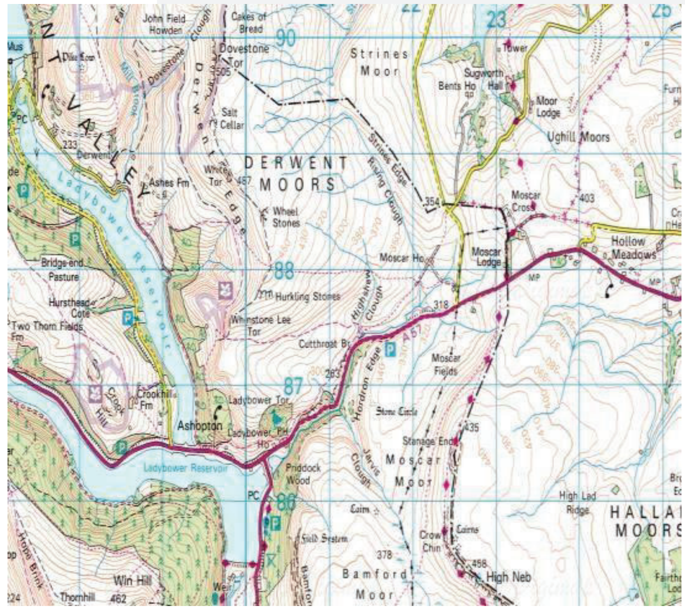

Figure 1. Peak District National Park, Sheffield

DENDROCHRONOLOGICAL SAMPLING

This study was conducted at Hordron Edge site in the Peak District, Derbyshire. Sampling was completed at the site using standard dendrochronological methods. Twenty tree cores were extracted (5mm diameter) using a Haglof manual increment borer. For each tree, height was recorded using a Haglof Vertex IV Ultrasonic Hypsometer along with girth at breast height (1.3 m above the ground). Cores were always taken from the southern side of the tree to minimize differences between each core. 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 while 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 (Stokes and Smiley, 1968). Core 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 multiple rings.

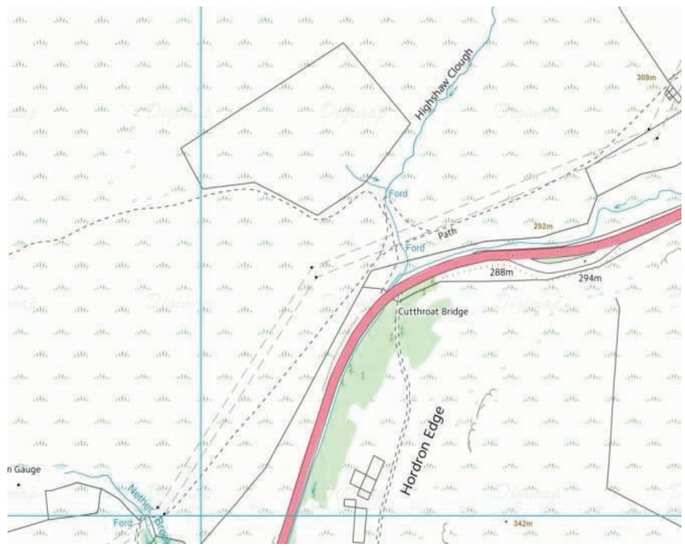

Figure 2. Hordron Edge site in Peak District, Derbyshire

The growth–index data in (Figure 3) indicated considerable fluctuations through the study period. A steady increase in annual growth was found between 1921 and 1928 followed by peaks in growth in 1927, 1935, 1975, 1982, 2011 and troughs in 1931, 1949, 1968 and 1987.

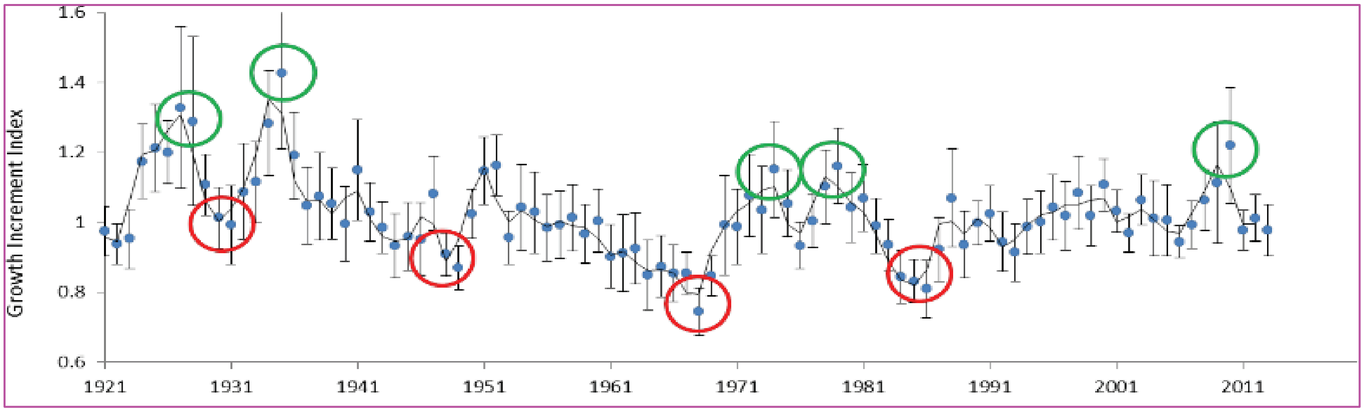

Figure 3. Mean Growth Index with Standard Error; a 2–period moving average line

DESCRIPTION OF TREES HEIGHT AND GROWTH

Twenty cores of *(P. sylvestris)* from Hordron Edge in a Derbyshire forestry plantation were analyzed. In this study the annual growth increments of the trees were investigated.

Conclusion

Dendroclimatology is the science of measuring annual tree growth – ring widths to infer environmental, usually that of climate and the reconstruction of past climate changes and monitoring current one (Fritts, 1976). Such studies can provide indicators of environmental conditions which can be important for the evaluation of long-term impacts on forest health.

Table 1. Field data recorded for the sampled trees

Tree Number	Basal Area (m^2)	Height (m)	Girth (cm)
1	0.5	19.8	102
2	0.4	16.0	136
3	0.3	17.6	149
4	0.3	13.1	157
5	0.4	11.4	117
6	0.2	20.4	108
7	0.3	30.5	153
8	0.1	42.7	158
9	0.2	28.5	161
10	0.3	14.6	162
11	0.3	12.8	126
12	0.2	18.7	160
13	0.2	15.2	141
14	0.2	14.1	161
15	0.2	20.7	195
16	0.4	11.6	199
17	0.1	16.1	132
18	0.3	19.8	113
19	0.3	17.5	125
20	0.2	18.5	178

Figure 4. Doing the field work

Using samples data from 20 *(P. sylvestris)* trees, the results show that the tree ring index growth prediction models could not be developed for annual radial growth in Derbyshire. The research does not show any relationship between tree growth and climate relationships, as there were no significant first–order relation- ships found between tree growth indices and any of the four climatic variables tested. 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 CO_2 and the ability of species to acclimate to new growing. The variability of environmental drivers between years may have had different effects on tree growth performance. Therefore, the ability to predict the impact of climate change on tree growth.