TEMPORAL EFFECTS OF CLIMATE CHANGE ON THE GROWTH OF CHIR PINE (*PINUS ROXBURGHII*) IN TEHSIL MURREE, PUNJAB, PAKISTAN

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ABSTRACT

Tree rings have been used in various applications to reconstruct past climates as well as to assess the effects of climatic and environmental change on tree growth. The study focused on growth of *Pinus roxburghii* (Chir Pine) in Murree Tehsil forest. Meteorological data (maximum temperature, minimum temperature, mean annual temperature and precipitation) was analyzed during the period 1959-2015 to calibrate the effects of climate change on the growth of ring widths. The regime of maximum temperature, minimum temperature, mean annual temperature and precipitation were calculated 17.33±0.14 ^{o}C, 8.79±0.14 ^{o}C, 17.32±0.14 ^{o}C and 1648.75±48.8 mm/annum respectively. There is increase in minimum temperature (1.23 ^{o}C), maximum temperature (0.58 ^{o}C) and mean temperature (0.92 ^{o}C) (Bajwa et al., 2015) was observed during the period 1959-2015. Precipitation increased to 25% during the period 1959-2015. The mean ring-width, intra-ring early and late wood formation was 1.81 mm, 69.49 and 27.83%, respectively. The ring-width and intra-ring early wood formation decreased by 12.23% and 7.15%, respectively, while the intra-ring late wood formation increased by 11.38%. The impact of maximum temperature, mean temperature and precipitation was significant on the late wood formation. There is negative but significant correlation between ring width and temperature (minimum, maximum, mean) also ring width showed negative but significant ($p<0.05$) correlation with precipitation. The intra-ring early wood formation showed negative correlation with maximum temperature and precipitation, while intra-ring late wood formation showed positive correlation with mean temperature, maximum temperature and precipitation. Ring-width and intra-ring wood formation results revealed that climate change is effecting the growth of *Pinus roxburghii* in the Murree forest.

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ABBREVIATIONS

AMSL	Above Mean Sea Level
CPA	Cumulative Precipitation Anomaly
ET	Evapotranspiration
EWW	Early Wood Width
LST	Land Surface Temperature
LWW	Late Wood Width
MH	Maximum Humidity
MR	Maximum Rainfall
MT	Maximum Temperature
PMD	Pakistan Meteorological Department
SD	Standard Deviation
SPI	Standardized Precipitation Index
WMO	World Meteorological Organization
UNFCCC	United Nation Framework Convention on Climate Change
GHGs	Green House Gases
UNEP	United Nation Environment Programme
GIS	Global Information System
UNESCO	United Nations Educational, Scientific and Cultural Organization
PMD	Pakistan Meteorological Department

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