



## Non-stationary similarity in trends of monthly rainfall in the Tuscan Apennine Alps

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In 2009, the School of Geography and Environmental Science of Monash University (Australia) signed a research protocol with the “Corpo Forestale dello Stato, Uffici per la Tutela della Biodiversità” at Vallombrosa (province of Florence, Tuscany) and Pratovecchio (province of Arezzo, Tuscany). The aim of the research program is to investigate the relationships between recent and historical variability of climate, soil and site factors in the Tuscan Apennine Alps and the diffusion and severity of ‘butt rot’ in silver fir (*Abies alba* Mill.). Silver fir is susceptible to water stress and damage caused by drought or insufficient moisture availability. ‘Rot butt’ severely affects silver fir forests in the study area. How climate alterations may impact on the incidence and diffusion of this complex disease is very important for the conservation and management of the species, and for biodiversity. Therefore our primary objectives were to determine if a) trends in rainfall show alterations during the 20th century in the Tuscan Apennine Alps, b) master series of seasonal and/or monthly mean temperatures could be identified, and c) alterations are similar amongst sites in the study area. This paper reports on the first of these objectives.

Results show the need to detect variability in trends of monthly rainfall at the site level when effects of climate alterations on forests are investigated in Middle Italy. Although alterations in rainfall trends at the regional level may show a prevailing tendency (e.g. for reduced rainfall), potential effects on forest species may differ at the local level as similarity in trends of monthly rainfall amongst sites varies a great deal for some periods. For example,

- In the Tuscan Apennine Alps, similarity in trends of monthly rainfall among sites is non-stationary during the 20th century even between sites that differ little in elevation and at relatively short distance from each other.
- The level of correlation between series of monthly rainfall varies apparently irregularly from highly positive to negative over time.
- Monthly rainfall shows highest similarity amongst sites in winter, and lowest similarity in summer.
- Similarity in rainfall varies with season; subsequently, clustering of similar sites changes with season in the study area.

These results support the expressed need for more detailed information about variability in trends of climate variables as expressed by the I.P.C.C. (Solomon et al, 2007), and the critical need to approach and investigate the relationships between climate change and forest tree response at the local level.