Methodology of Climate Change Impact Assessment on Forests

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INTRODUCTION

Climate change is one of the main challenging issues in various countries (Jafari, 2013b) in current century. Climate change and climate variability and Global Warming and its' effects on natural resources, plants, animal and in general on human life are among subjects that received attention of scientists and politicians in recent years. Climate change challenges need to be considered in various dimensions (Jafari, 2013c). To both understand the present climate and to predict future climate change, it is necessary to have both theory and empirical observation. Any study of climate change involves the construction (or reconstruction) of time series of climate data. How these climate data vary across time provides a measure (either quantitative or qualitative) of climate change. Types of climate data include temperature, precipitation (rainfall), wind, humidity, evapotranspiration, pressure and solar irradiance (aric, 2008). Climate change assessments and evaluation should be done by using recorded observation data as well as prepared and provided proxy data (Jafari, 2010). Plant ecophysiological study has very important role to recognize climate changes (Jafari, 2007). Trees and also woods can be used as archive of past events. Climate change will strongly affect water resources, plant communities and wildlife in the arid and semi-arid regions (FAO, 2009). Water, environment humidity and temperature are main factors of plant growth. Majority of plant and forest ecosystems on the earth are formed under these two main factors. Whatever amount of humidity and required water are available and also favorable temperature for plant growth cause plant community reach higher plants and trees and forest ecosystems would develop. In fact plants are important climate indicators. Trees are not an exception. Plants, especially, trees are sensitive to their environmental changes, and tree-ring width is one of the reliable proxies of ambient environmental conditions. Climate and environmental changes affect natural ecosystems as well as planted forests (Kiaee and Jafari, 2014). Investigation of quantity and quality of these growths could help to consider past climatic conditions. Measuring and recording tree rings' widths and its' densities of early woods and late woods can provide valuable data resources to produce time series and consider its correlation with climate factors in the same time periods (Figure 1).

Seasonal changes in temperate climatic region effect on tree rings widths periodically. In spring and summer time plants grow better than unpleasant seasons like fall and winter. The outermost layer of a tree is composed of bark. Bark itself is composed of two tissues: an innermost layer of live phloem, and an outer layer of periderm (the bark 'proper'), which has an outermost layer of waterproofing cork (phellum) which protects the wood to some degree from insects, etc (Figure 2). The cork has its own cambium (phellogen) between the phloem and cork layer. Only the outermost layer of a tree is alive (essentially only the phellogen, phloem, cambium, and maturing xylem of the current year's growth). Consequently, the majority of the trunk does not require gaseous exchange. The bark is punctuated by lenticels, a sort of giant stoma, which allows the thin outermost living layers of the trunk to 'breathe' (Anonymous, 2008a),

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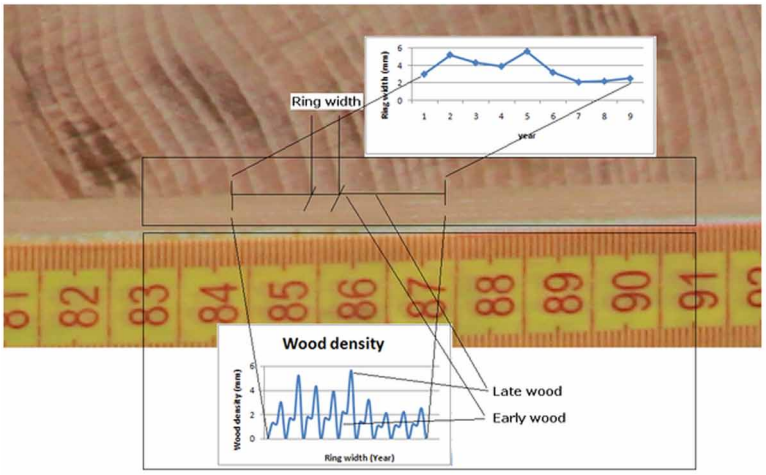
Figure 1. Tree ring width and densities, Fagus orientalis (beech tree), Mazandaran province mid-elevation forest (MA II F3)
(Author, 2010)



Growths of the vascular cambium tissue produce wood as secondary xylem production. Sapwood is xylem that conveys water and dissolved minerals from the roots to the rest of the tree. The darker heartwood is older xylem that has been infiltrated by gums and resins and has lost its ability to conduct water. Each growth layer is distinguished by early wood (springwood), composed of large thin-walled cells produced during the spring when water is usually abundant, and the denser latewood (summerwood), and composed of small cells with thick walls. Growth rings vary in

Figure 2. Anatomy of a tree trunk
(Encyclopedia Britannica, 2000)