The thesis deals with the tree energetic balance closely related to the phenomenon of plant transpiration. Living systems have a unique ability to equilibrate gradients in the nature. Storing energy of the incoming solar radiation into a latent heat of water evaporation is an example of such tree feature. It dissipates energy and simultaneously recycles nutrients and water in the ecosystem.
There are few possible ways of energy balance detection shown in this work. The thermal imagining can be used as a method for an indirect indication of transpiration - transpiring plants have lower leaf surface temperature. An alternative method for determining the rate of transpiration is a direct measurement of transpiration on leaves or transpiration flow in a tree trunk. However, extrapolation of the above mentioned methods to entire stands can encounter some difficulties.
The first part of the thesis presents a description of a physical background of energetic processes and the ways in which plants operate with water, the biotic pump theory is being discussed. The practical part begins with experiments on single leaves. These experiments are carried out to test the usability of the methods for the following experiments, which are performed on the entire living trees. They are focused on the relationship of the transpiration flow in the stem and leaf transpiration, as well as on their dependence on ambient conditions. The energetic costs are calculated from the measured transpiration values and consequently are compared with the incoming solar energy. When extrapolated to the whole tree the methods (leaves transpiration vs. sap flow measurements vs. transpiration calculated from the leaves temperature) give different values. It is assumed that full connection of the different approaches and levels of measurement will never be possible. Still, it is good to find out as much as possible about each level, hoping that it will provide better insight into the whole phenomenon.