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Individual based, long term monitoring of acacia trees in hyper arid zone: Integration of a field survey and a remote sensing approach

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Vegetation in hyper arid zones is very sparse as is. Monitoring vegetation changes in hyper arid zones is important because any reduction in the vegetation cover in these areas can lead to a considerable reduction in the carrying capacity of the ecological system. This study focuses on the impact of climate fluctuations on the acacia population in the southern Arava valley, Israel. The period of this survey includes a sequence of dry years with no flashfloods in most of the plots that ended in two years with vast floods.

Arid zone acacia trees play a significant role in the desert ecosystem by moderating the extreme environmental conditions including radiation, temperature, humidity and precipitation. The trees also provide nutrients for the desert dwellers. Therefore, acacia trees in arid zones are considered to be 'keystone species', because they have major influence over both plants and animal species, i.e. biodiversity. Long term monitoring of the acacia tree population in this area can provide insights into long term impacts of climate fluctuations on ecosystems in arid zones.

Since 2000, a continuous yearly based survey on the three species of acacia population in seven different plots is conducted in the southern Arava (established by Shalmon, ecologist of the Israel nature and parks authority). The seven plots representing different ecosystems and hydrological regimes. A yearly based population monitoring enabled us to determine the mortality and recruitment rate of the acacia populations as well as growing rates of individual trees. This survey provides a unique database of the acacia population dynamics during a sequence of dry years that ended in a vast flood event during the winter of 2010.

A lack of quantitative, nondestructive methods to estimate and monitor stress status of the acacia trees, led us to integrate remote sensing tools (ground and air-based) along with conventional field measurements in order to develop a long term monitoring of acacia trees in hyper arid zones. This study includes further work on the development of ground based remote sensing as a new tool to monitor stress indicators as part of long term ecological research.
Since acacia trees are long lived, we were able to identify individual trees in satellite images from 1968 (corona) and expand our monitoring "into the past". Remote sensing expands the spatial and temporal database and is thus a powerful tool for long term monitoring in arid zones, where access is limited and long-term ground data are rare.