Augmenting Water Deficit Index as a tool to estimate forest plantation water availability.

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Summary

Water availability is the largest limitation for trees to grow in several parts of the world. With climatic patterns varying over the last two decades, characterizing water available to the crop trees, becomes an important task as it relates to stand growth. Several authors have tried to integrate rainfall into growth and yield equations with varying levels of success. From the very simple yearly rainfall to more complex full water balance models, determining an index of water availability remains a task that needs to be taken into account when projecting forest grow.

With this objective in mind, a water deficit index was derived for the forest plantation region in Chile. This area is characterized by a Mediterranean climate, with a rains exceeding four folds the potential evapotranspirations in the winter, and the opposite in the summer. In this area, the index serves as a simple indicator of site drought allowing comparison between different sites around the world independently of yearly rainfall distribution.

In order to calculate the index, we used a 90m digital elevation model to estimate potential radiation, this was combined with interpolated maximum and minimum mean monthly temperature to estimate potential evapotranspiration using Hargreaves equation.

Water deficit was calculated as the summation of all negative values for a given year. Finally, soil water storage capacity, derived out of soil maps and pedotransferfunctions, was discounted from the water deficit to account for differences in storage under sites with equal water deficit.

The index was compared against other widely used water indices, highlighting the importance of seasonality in the final outcome. When used as a comparison tool, the index was able to accommodate differences between areas with same total rainfall but different yearly distribution, making it a rapid method to assess the magnitude of water limitations under any given environment.

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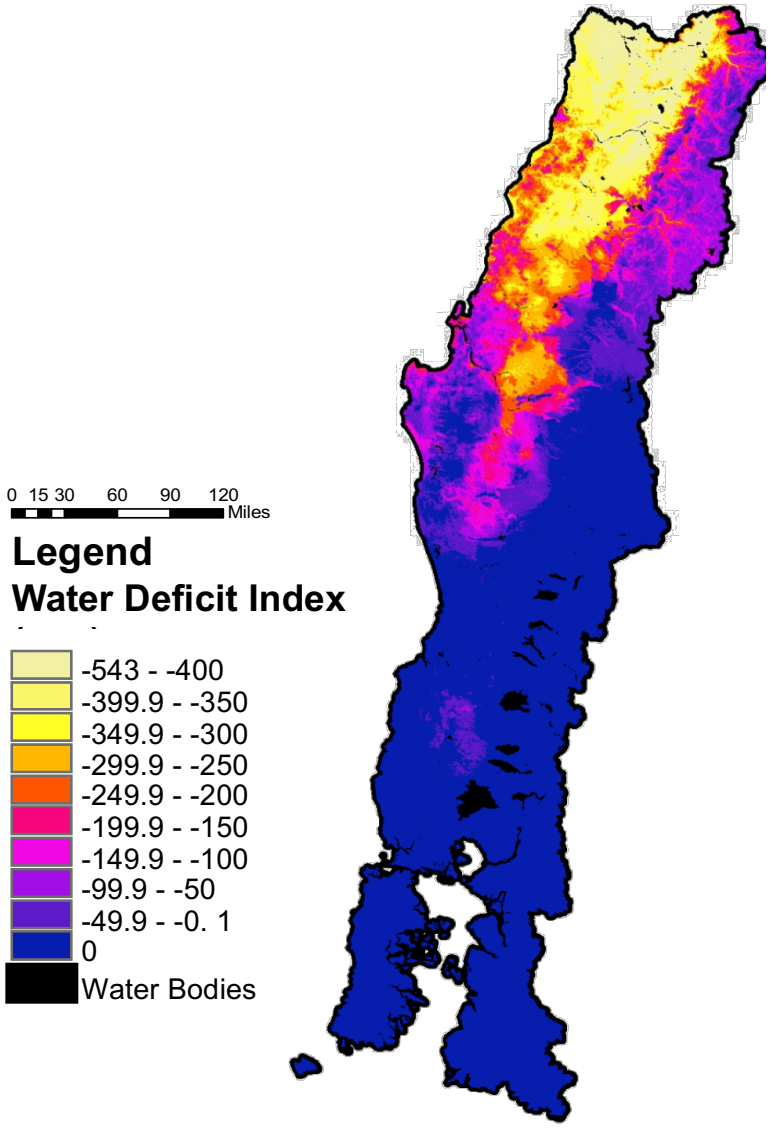

Figure 1 Water Deficit Index for the plantation area in Chile. More negative values correspond to dryer summer conditions. Values closer to zero correspond to areas where water might not be a limitation.

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