Tanzania Food Security Monitor

Every crop has its own water requirement in order to achieve its yield potential given that there are no other constraints such as field preparation, weeding, pests, diseases or nutrient stress. The amount of daily water requirement is highly influenced by crop stage and environmental factors such as rainfall, radiation, wind and temperature. The Water Requirement Satisfaction Index (WRSI) is an indicator that was developed by FAO and provides insight on how much the water requirements of a crop have been satisfied in a cumulative way at any development stage of the crop. In this application, the food security monitor for Tanzania applies the WRSI to maize.

WRSI values range between 0 and 100 percent. The higher the value of WRSI, the lower the expected water stress and in consequence the better are crop growth conditions and yield. In many areas of sub-Saharan Africa, water is the most limiting factor for agricultural production because of high dependence on unreliable seasonal rainfall. Furthermore, rainfall is a very good indicator of food security in sub-Saharan Africa since the livelihoods of more than 80% of its population depend on rainfed agriculture, which is also their main employer.

In computing WRSI, which is directly interpreted as food security indicator in this case, the following datasets are used: crop coefficient, soil water holding capacity, crop cycle, dekadal rainfall, and dekadal evapotranspiration. The crop coefficient reflects the ratio of the effective crop evapotranspiration to reference crop evapotranspiration. Due to variations in crop characteristics throughout its growing season, it changes from sowing to harvest. Soil water holding capacity, also referred to as available water holding capacity or crop extractable moisture, is defined as the volume of water retained between field capacity and permanent wilting point. The amount of available water in a given soil has a profound effect on the productivity of the soil for agricultural use.

The WRSI is extensively used in many countries and organizations as reflected in the literature. The main advantage of this tool is its embedding in a webGIS platform that automatically calculates and displays WRSI for Tanzania only. The crop coefficient used in this case is the one of maize, since it is the main staple crop grown in the country and at the same time a good performance indicator for other cereal crops such as rainfed rice, sorghum and millet. The crop coefficient were adapted to the different growing season lengths in various agro-ecological zones.

The data source of dekadal rainfall and evapotranspiration is the USGS FEWS NET Data Portal (http://earlywarning.usgs.gov/fews). Figure 1 shows WRSI results by USGS FEWS NET Portal (a & b) and our tool (c). In the case of USGS FEWS NET WRSI is computed for Eastern Africa and Southern Africa separately while our computation combines both. A difference occurs with respect to the color code; in our tool blue replaces green. The northern part of the Tanzania has a bimodal rainfall distribution and its main rainfall starts in March to May while the remaining part of the country has unimodal rains and nowadays starts in December to April.

Comparison of the two images in the Figure 1(a & b) and Figure 1(c) shows very close resemblance with the Northern part (bimodal areas) showing very poor maize yields for the 2015/16 season. With exception of the eastern part of Lake Victoria, the rest of the areas showed possibility of crop failure. In

the unimodal areas, the central zone of Tanzania moving to North-Eastern direction shows the crop condition being between average and mediocre. The rest of the areas have experienced between good and very good growth conditions. Therefore, we conclude that the tool can be used as a monitor to estimate the food production security based on the water requirement satisfaction index for maize.

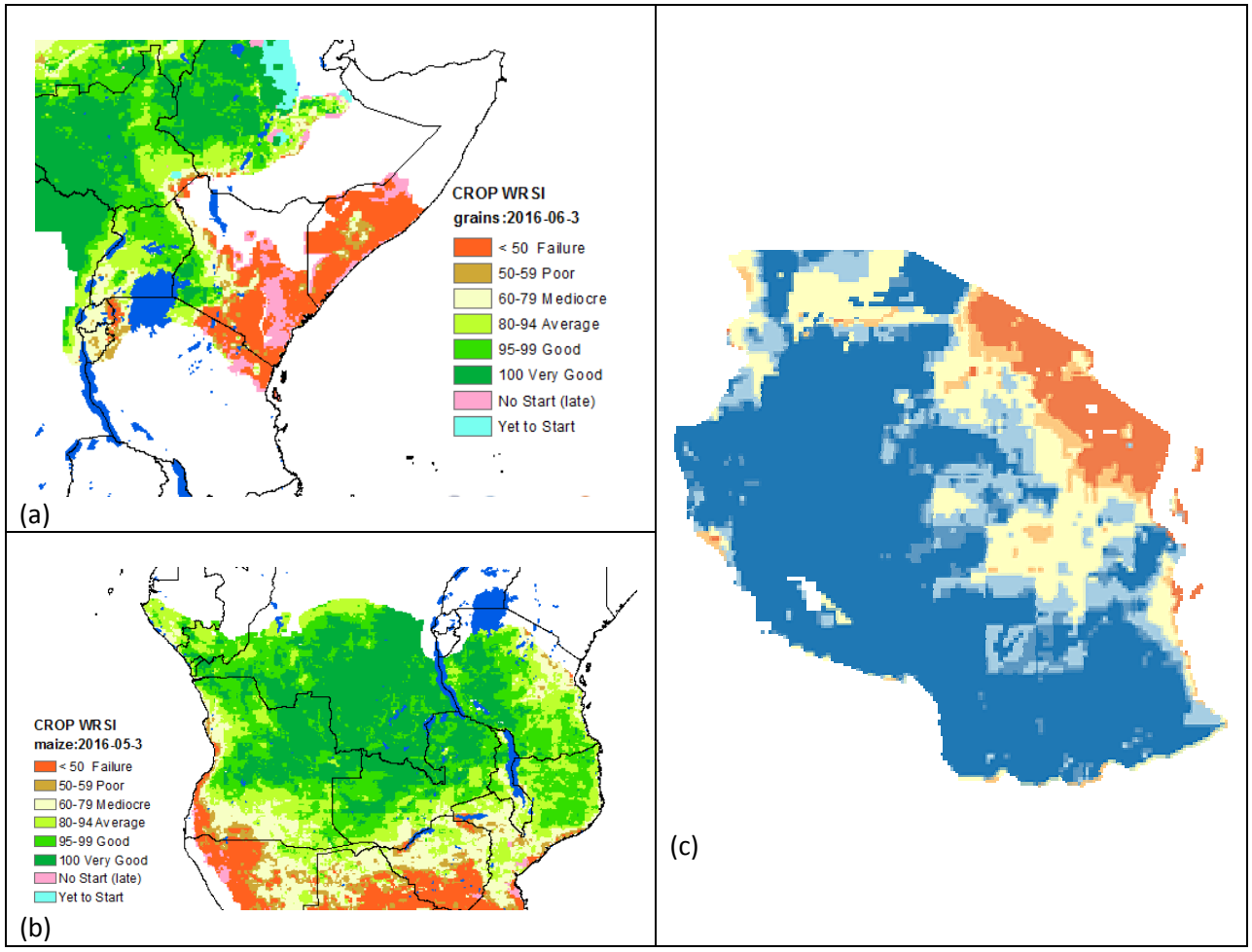

Figure 1. Water requirement satisfaction index (WRSI) for maize for Eastern Africa (a), Southern Africa (b) source: http://earlywarning.usgs.gov/fews, and Tanzania (c) source: this project.