STARS in Bangladesh

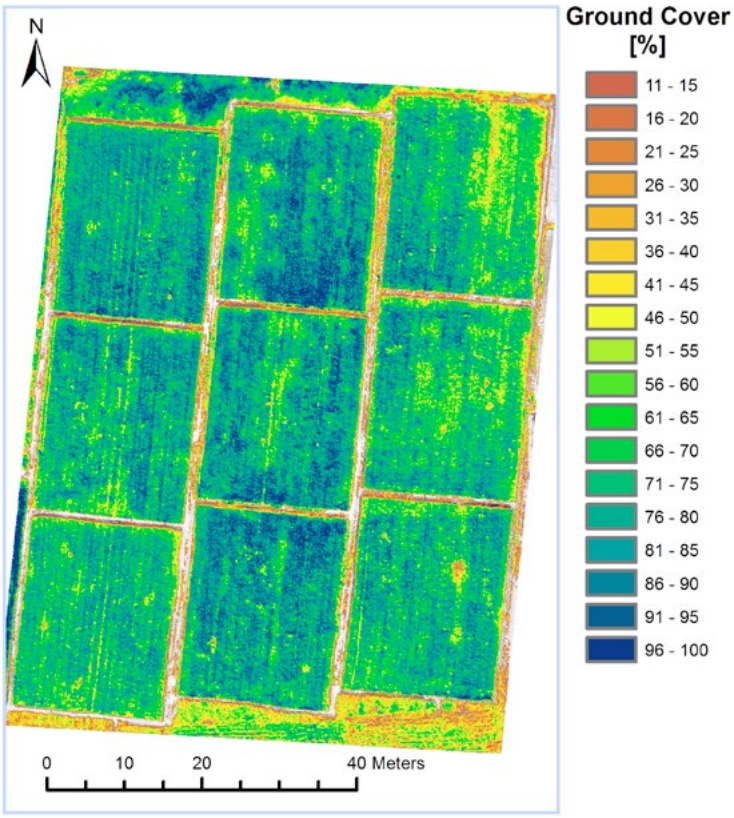
Sustainably intensifying crop productivity in the Southern Delta region

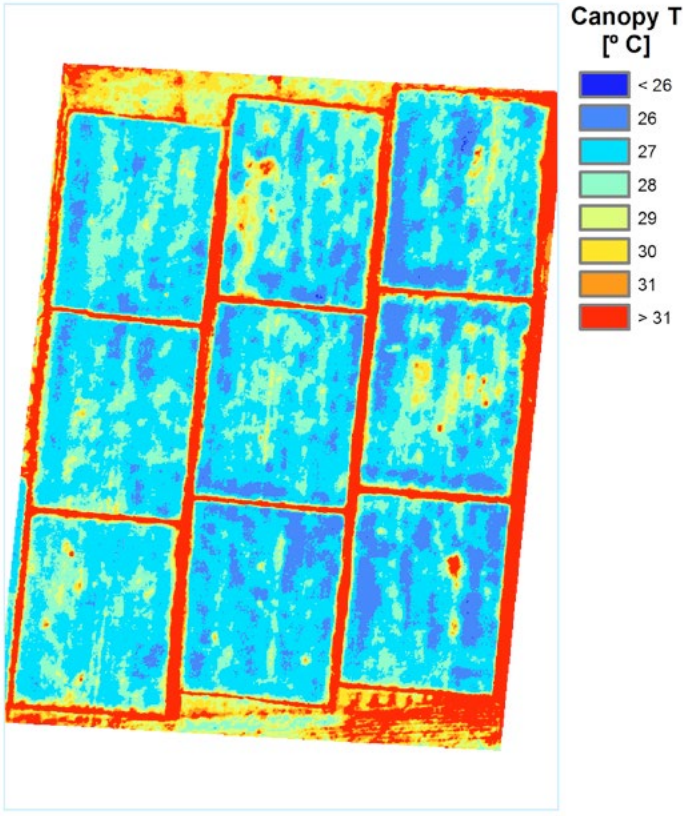
Many farmers in the coastal zone of Bangladesh typically fallow their land in the dry season, or grow low-input and -output legumes such as grass pea (Lathyrus sativus), lentil (Lens culinaris), and mungbean (Vigna radiata). These crops do not necessarily require irrigation and other inputs, such as fertilizer or pesticides. Risk is low, but so are yield and profitability. Unlike in other parts of the country, ground water in the extreme South is not suitable for irrigation, due to generally high salinity levels. But surface water, carried into the region by the Padma river and its distributaries, might be a suitable source for irrigation. Increased use of surface water is one of the core pillars of sustainable intensification efforts supported by the Government of Bangladesh. A study conducted by CIMMYT showed that in the South Central hydrological region of Bangladesh, 54'000 ha are fallow and 261'000 ha are grown with legumes. In order to accelerate intensification of crop production and make smart use of surface water to improve farmers' livelihoods, the USAID funded Cereal Systems Initiative for South Asia – Mechanization and Irrigation (CSISA-MI) project is facilitating the deployment of energy efficient low-lift pumps through partnerships with the private sector. But farmers in this region generally do not have much experience with irrigation. Preliminary studies indicated that it might be possible to grow a crop with one or two irrigations only, because these soils have a high water holding capacity and the water table is close to the surface. In the coastal zones, however, salinity levels of surface and ground water increase in the winter months, due to the intrusion of saline sea water into the Delta region, and an irrigation may do more harm than good under certain circumstances. Use of surface water for irrigation at a large scale may also disturb water flow dynamics in the river system and it is important to conduct an ex-ante analysis in order to determine the safe operating space.

Objectives of STARS

For these reasons, STARS aims at:

- Development of a field specific irrigation scheduling algorithm that takes into account salinity and potential contribution of the water table to crop growth
- Assessment of the impact of the withdrawal of surface water for irrigation at a large scale in the Delta region on water quality and quantity. It will also take into account climate change and sea level rise.





Research activities:

The Institute for Water Modeling (IWM) is conducting a detailed survey of all rivers and canals in 5 study areas within the South Central hydrological zone, in order to refine a river flow model used to determine how much water can be safely extracted for irrigation. The model will simulate the long-term effects of water withdrawal considering different climate change scenarios and mixes of crops irrigated with surface water. It will also generate a set of recommendations to bring surface water to as many crop fields as possible. The results will be made available on an interactive web map server being developed by the Center for Environmental and Geographic Information Services (CEGIS).

The irrigation scheduling algorithm will take into account field specific conditions. Studies conducted elsewhere have shown that remote sensing can be used to accurately estimate crop water use. CIMMYT is therefore using an unmanned aerial vehicle (UAV) to monitor crop growth with a similar sensor as satellites do. Estimated crop water use will be fed into a model that simulates a soil water balance that takes into account salinity, water holding capacity, and contribution of the water table to the root zone. Using forecasted weather data, the model can then predict the field specific irrigation water requirements up to one week in advance. Working with the Bangladesh Institute of ICT in Development (BIID), CIMMYT is developing a prototype of an app for smart phones, that will inform farmers and irrigation service providers on a weekly basis whether and on which day specific fields need to be irrigated.

In order to ensure that this project fits well into the general context of agricultural research activities being conducted in Bangladesh, STARS is closely collaborating with the Bangladesh Agricultural Research Council (BARC) and Bangladesh Agricultural Research Institute (BARI).

Our remote sensing system uses three types of cameras:

- A red-green-blue (RGB) camera in order to visualize the field location, boundaries, and percentage of green pixels (which correlate with percent ground cover)
- A multi-spectral camera, similar to the ones used on satellites, that can measure ground cover, leaf area index, and stress factors
- A thermal camera that can measure canopy temperature, and thus water stress.