A SPECIAL IPC[1] WORKING PARTY ON COMMUNICATION AND OUTREACH (WP-COM) HIGHLIGHT SERIES:

'GLOBAL APPLICATIONS OF FAST-GROWING TREES IN AGROFORESTRY SYSTEMS'

Crop Water Consumption of Whole-Tree Windbreak Systems

June 2023: WP-ENV: #5D

Overview

Central Asia is one of the world's largest dryland regions. Consisting of Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan, the countries of the region are forest-poor and import most of the wood resources demanded by their domestic markets. At the same time, agriculture in the region largely depends on irrigation, which has resulted in the overexploitation of Central Asian water resources; the desiccation of the Aral Sea is the most vivid outcome of water extraction for irrigation. With climate change, water resources available for irrigation are expected to decrease, while the occurrence of heat waves is expected to increase.

Tree windbreaks composed of poplars (*Populus* L.) have long been implemented across Central Asia and are one option for reducing water consumption in irrigated agriculture and building resilience against climate change (Fig. 1). Tree windbreaks also provide wood resources, which make Central Asian countries less dependent on costly wood imports.

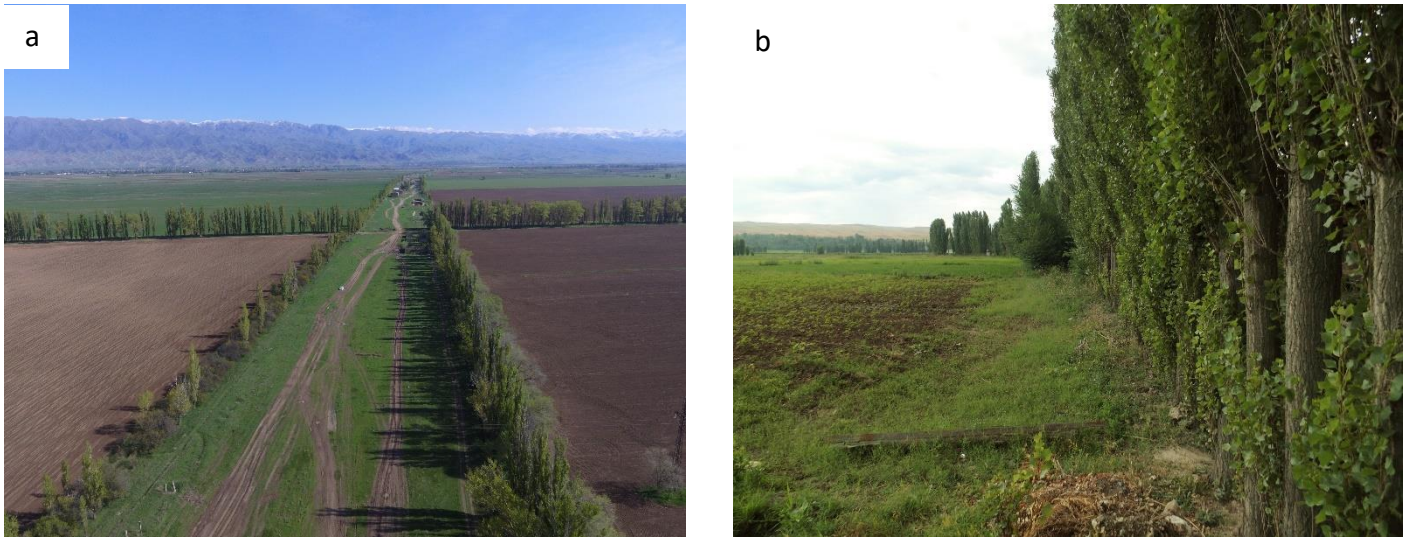

Figure 1. *Populus nigra* (local name Mirza Terek) tree windbreaks in: a) Chui Valley, Kyrgyzstan, and b) Chek Village, Bazarkorgon County, Kyrgyzstan.

[1]The International Commission on Poplars and Other Fast-Growing Trees Sustaining People and the Environment (IPC)

All photos by the authors.

Outcomes

In a case study on Central Asian agroforestry practices, poplar windbreak systems attained greater overall water efficiency than crops without tree windbreaks. Specifically, the water consumption of cotton (*Gossypium* L.) combined with that of single tree lines from poplar windbreak systems (200 m between tree lines) was 777 mm per growing season, while cotton without tree windbreaks consumed 904 mm per growing season (Fig. 2). This study also assessed the growth rates of 30 poplar cultivars unknown to the region to identify varieties that could increase the yields of wood products from tree windbreaks. Most of the new cultivars tested, particularly *Populus deltoides* Bartr. ex Marsh. × *P. nigra* L. hybrids, grew 2 to 3 times faster than the locally adapted *P. nigra* cultivars. Further, their water consumption was in the same range as that of the locally adapted cultivars.

In conclusion, newly developed poplar cultivars offer potential to increase the yield of wood resources

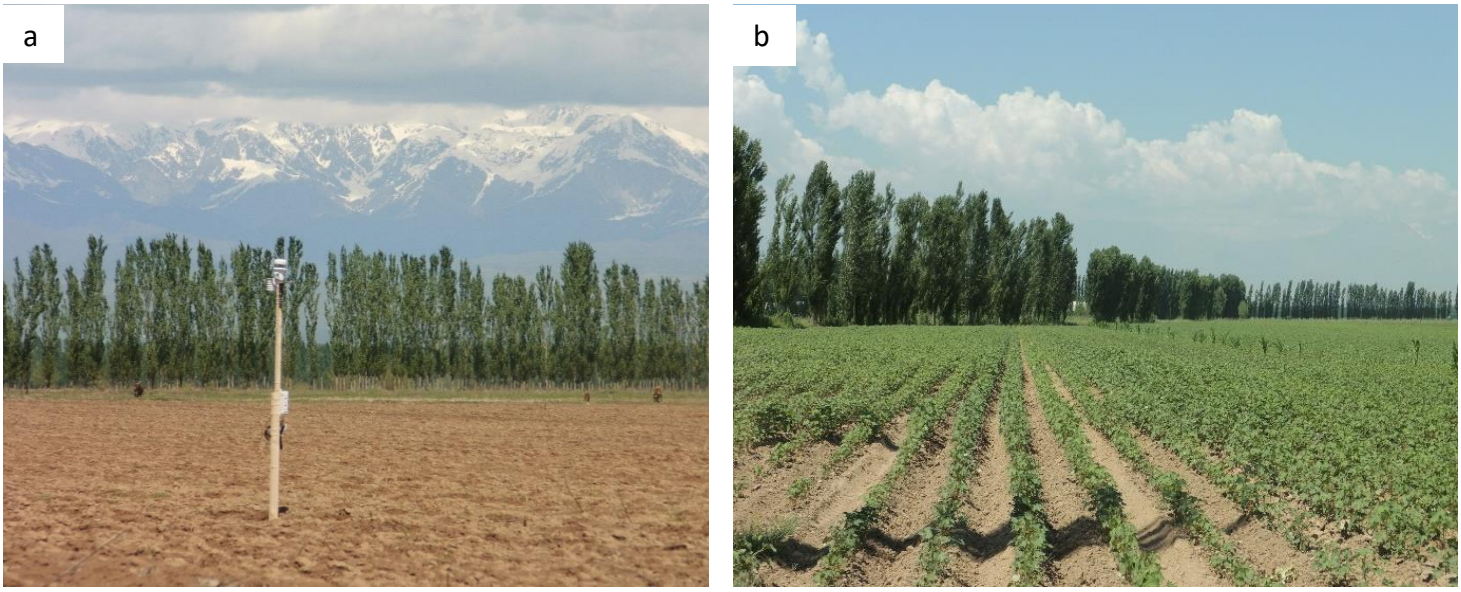

Figure 2. *P. nigra* (Mirza Terek) windbreak systems in Chek Village, Bazarkorgon County, Kyrgyzstan. The climate station in the foreground of a) was installed to record changes of the microclimate due to the windbreak for underplanted cotton seen in b).

to be harvested from tree windbreaks in Central Asia, while simultaneously helping to reduce water consumption of irrigated agriculture.

Keywords: Windbreak systems, water use, microclimate, cotton, *Populus*

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