

# Last chance for oasis in China's desert

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The Tarim basin in the Xinjiang region of northwestern China. Credit: TUM

Ten percent of the world's cotton is produced in the Xinjiang region in northwestern China. Irrigating the cotton fields, however, is causing ecological problems. After many years of research, a team of

international researchers headed by Prof. Markus Disse at the Technical University of Munich (TUM) has developed a set of recommendations aimed at preserving the local environment.

The Tarim basin in the Xinjiang region of northwestern China is unique. No other natural landscape is located as far from the ocean. It has an extremely dry climate with only around 50 millimeters of rain falling per square kilometer each year - and the majority of this evaporates. Despite these conditions, the Tarim river flows through this desert region, mainly fed by meltwater from high-altitude glaciers.

This water is a vital resource for a number of groups including:

- Around ten million people who live along the banks of the Tarim
- Local animal and plant species
- The land surrounding the river

Farmers, however, are diverting the lion's share of the water to irrigate their cotton fields. "The natural land and water resources in this unique landscape have been ruthlessly exploited over the past 50 years. This has severely damaged the soils and the quality of water in the region," explains Professor Markus Disse from the Chair of Hydrology and River Basin Management at TUM. As a result, the soils have become increasingly saline. And this is bad news for the farmers. Non-saline soils can support yields of up to eight tons of cotton per hectare whereas soils with medium to high levels of salt can only produce three to four tons per hectare.

Disse has headed the "Sustainable Management of River Oases along the Tarim River" (SuMaRiO) project since 2011. The initiative is funded by Germany's Federal Ministry of Education and Research (BMBF) and includes researchers from Germany and China.

## **Largest cotton producing region in China**

"Cotton is the lifeblood of most farmers who live in the Tarim basin," says Dr. Christian Rumbaur, employee at the Chair of Hydrology and River Basin Management and coordinator of the German/Chinese project. Forty percent of China's cotton is produced here. This corresponds to around ten percent of global production.

The lack of rain is what makes the region suitable for cultivating this valuable plant. The cotton fibers need a dry climate to mature properly; in a damper environment, they would be susceptible to fungus. Yet the plants also need a lot of water to grow, and the farmers take this from the river.

Under these conditions, groundwater supplies cannot be regenerated. This is proving a threat to the Euphrates Poplar, which draws water from a depth of up to ten meters. Sixty to seventy percent of the world's population of this rare tree species are located in the Tarim basin. The forests act as a barrier against the sands from the neighboring Taklamakan desert. Without them, whole roads and fields would disappear under the advancing desert. The forests also help keep down temperatures through evaporation.

Despite these benefits, farmers are cutting down more and more poplars in order to enlarge their fields. Climate change is one of the factors driving this expansion. Snow on the glaciers is melting, causing more water to flow into valley, and this means more water for irrigation.

## **The fight against desertification**

After years of measurements and investigation, the researchers will be presenting their findings at a conference in Xinjiang in September. They

will also be unveiling their recommendations for improving water and land management.

The most important points here include:

- Reforestation and renaturalization along a strip of land at least 50 to 100 meters wide along both banks of the river. This will allow the groundwater to be replenished during the annual summer flood and will also reduce erosion along the river banks.
- Sustainable land use that factors in the different types of soil and their degree of salination. Cultivating the plant *Apocynum pictum* (a member of the dogbane family) on salinated soils will enable farmers to earn an income from poor soils.
- Use of modeling tools to predict the impact of land use and climate scenarios. To this end, the SuMaRiO researchers developed a system that supports decision-making processes by enabling politicians to evaluate the consequences of different farming alternatives based on future changes in climate.

"We hope that this implementation workshop will herald a new era in sustainable land and [water](#) management in the region," adds Disse. "This is the only way that we can ensure long-term stability in this part of the world."

**More information:** Effects of Land Use and Climate Change on Groundwater and Ecosystems at the Middle Reaches of the Tarim River Using the MIKE SHE Integrated Hydrological Model, Patrick Keilholz, Markus Disse and Ümüt Halik, *Water* 2015, 7, 3040-3056; [DOI: 10.3390/w7063040](https://doi.org/10.3390/w7063040)

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