

## Ecology and utilization of salt-tolerant plants in the river basins of Central Asia

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**Summary.** In Central Asia soil salinization is a wide-spread concern. Biomass harvested from the moderate salt-tolerant species *Haloxylon aphyllum* and *Apocynum pictum* can be used as fodder as well as for textile fibers and medicinal purposes, respectively. These plants offer opportunities to generate income from saline soils.

**Key words:** *Haloxylon*, *Apocynum*, sustainable land use, biomass.

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### Introduction

Most river basins in Central Asia, like the Aral Sea Basin, the Ili Basin, and the Tarim Basin, are endorheic river basins. Therefore, salt lakes and saline soils with their associated salt-tolerant vegetation are a natural component of these river ecosystems. Starting with the 1950ties, the area under irrigation along the rivers in Central Asia, like Amu Darya, Syr Darya, Ili, Tarim, was massively increased. Today, the major crop grown along those rivers is cotton (*Gossypium* sp.). The irrigation seriously aggravated the soil salinization problems in Central Asian river basins so that agriculture had to be given up on large areas (Giese et al. 2004). Therefore, research about the utilization of salt-tolerant plants is of crucial importance, in order to provide economic benefit for the people whose fields are affected by soil salinization.

We propose that *Haloxylon aphyllum* and *Apocynum* species, as salt-tolerant native plants of the riparian vegetation, have a great potential for utilization. *H. aphyllum* can be used as fodder, energy source, and as biomass

or carbon accumulating plant. *H. aphyllum* is distributed along current and former river courses in Kazakhstan, Uzbekistan, and Turkmenistan on non-saline to moderate saline soils. It is a phreatophyte, i.e. it takes up water from the groundwater (Rachkovskaya et al. 2003). *Apocynum venetum* and *A. pictum* (<http://www.efloras.org>) can be used as medicinal or fiber plant. *A. venetum* is distributed in Kazakhstan, Uzbekistan, Northern Xinjiang, and Inner Mongolia. *A. pictum* is distributed on more saline and dry sites compared to *A. venetum* and is the major *Apocynum* species in the Tarim Basin. It is a phreatophyte, too (Zhang et al. 2006).

We investigated the standing biomass of *H. aphyllum* and *A. pictum* on representative sites in Turkmenistan, Kazakhstan, and Xinjiang, China, respectively.

### 2. Study area

*H. aphyllum* was investigated in Repetek, Turkmenistan, in the Ili Delta, and in Zana Darya, Kazakhstan. *A. pictum*

was investigated in Bachu, Shaya, and in Korla, i.e. the northern part of the Tarim Basin. The climate of all three study areas is arid and continental. The annual precipitation in Repetek, the Ili Delta, in Zhana Darya, and in the northern part of the Tarim Basin is 110, 140, 150, and 50 mm, respectively.

### 3. Research methods

At each site at least 3 representative sample points were chosen and 4 *H. aphyllum* shrubs were harvested. For the *A. pictum* measurement, at each site also at least 3 representative sample points were chosen. At each sample point 8 plots of 1 m<sup>2</sup> each were harvested.

### 4. Results

The standing above-ground biomass of the *H. aphyllum* and *A. pictum* sites are given in Table 1 and Table 2, respectively.

### 5. Discussion

The above-ground stand biomasses of *H. aphyllum* in Repetek and in the Ili Delta are comparable to the standing above-ground biomass of the most productive Artemisia-Deserts listed by Thevs et al. (submitted to Forestry). Thus, *H. aphyllum* dominated desert vegetation must be counted to the most productive desert ecosystems. Further research steps should focus on the net primary production, in order to provide guidelines for sustainable utilization of the *H. aphyllum* biomass.

The stem biomass of *A. pictum* in Shaya is significantly higher than on the two other sites. In contrast to the site in Korla and Bachu, the site in Shaya receives occasional floods so that the groundwater is replenished occasionally. One third of the stem biomass of *A. pictum* yields fibers, which properties are comparable with cotton (Wang et al. 2007). The leaves can be readily marketed as tea. The above-ground parts of *A. pictum* re-grow out of the rhizome. Still, further research steps should focus on monitoring of biomass and rhizome nutrient changes under harvest, in order to avoid degradation of *A. pictum* stands through over-utilization.

Table 1. Standing above-ground biomass of *Haloxylon aphyllum* in Repetek, in the Ili Delta, and in Zhana Darya. In brackets: number of sample points, a, b: different letters indicate significant differences at  $\alpha \leq 0.05$

Site	Standing above-ground biomass [t·ha <sup>-1</sup> ]
Repetek	8.3 ± 2.6 (3) b
Ili Delta	5.6 ± 5 (9) b
Zhana Darya	0.7 ± 0.3 (3) a

Table 2. Standing above-ground biomass of *Apocynum pictum* in Bachu, Shaya, and Korla: In brackets: number of sample points. a, b: different letters indicate significant differences at  $\alpha \leq 0.05$

Site	Standing stem biomass [kg·ha <sup>-1</sup> ]	Leaf biomass [kg·ha <sup>-1</sup> ]
Bachu	727 ± 102 (6) a	353 ± 113 (6) a
Shaya	2433 ± 834 (3) b	777 ± 365 (3) a
Korla	480 ± 264 (3) a	264 ± 119 (3) a

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