Halophytes as useful tools for rehabilitation of saline ecosystem– the Aral Sea case

Breckle, S.W.[1], Veste, M.[2], Wucherer, W.I.[3]

[1] Department of Ecology, Wasserfuhr 24-26, D-33615 Bielefeld, Germany, sbreckle@gmx.de
[2] Brandenburg University of Technology, Research Center Landscape Development, 03046 Cottbus, Germany, maikveste@yahoo.no
[3] Institute of Botany, University of Greifswald

Keywords: Aralkum, salt desert, Chenopodiaceae, rehabilitation, phytomelioration

Before 1960 the Aral Sea was the fourth largest inland lake on the globe. Inefficient water use for irrigation led to an imbalance of the regional water budget. As a result of this drastic changes water level dropped by about 30 m during the last 50 years. The remnant water bodies today are the Northern (Small) Aral Sea, and the Western Basin of the Southern (Great) Aral Sea. A new man-made desert has developed on the dry seafloor: the Aralkum [1]. The total area of the Aralkum is more than 60.000 km^2. About 70% of the area are salt deserts with saline and alkaline soil surface. In this environment the excess of soluble salts in the puffy soil crust (NaCl, $NaHCO_3$ etc.) have a large influence on the ecosystems and plant growth and reduce the productivity in vast areas. Halophytes may serve to improve the ecosystem production and to minimize dust storms. Halophytes are model plants for the understanding of the adaptation strategies in such habitats. Aim of the presented studies were to identify suitable plants on the basis of their morphological and ecosphysiological strategies for the phytomelioration on saline soils of the Aral Sea.
The fast increase of the salt desert area has caused a dominance of halophytes on the dry sea floor. This results in a rich halophytic flora of the dry sea floor which, on the one hand, is affected by salinity to various degrees and, on the other has evolved adaptations for survival on those saline stands. From the halophytes about 20% belong to the halo-succulent group of eu-halophytes. Within the salt tolerant plants the Chenopodiaceae form the largest group (with 84 species).
The enhancement of vegetation cover by means of phytomelioration is a realistic way to reduce the salt dust output from the dry seafloor. This will support the natural spreading of plants through vegetative propagation and seed dissemination. Huge experimental plantings with plots up to 200 ha have shown [2], that only very few species are suitable for this purpose: *Haloxylon aphyllum* and to a lesser extent *Halocnemum strobilaceum*. Evaluation of various experimental sets reveal that special techniques to plant saplings have to be applied and have to be adjusted to the relevant soil situation [3]. Plantations on sandy deserts of the Aralkum are almost always successful (more than 90%), but not necessary, since nature will cover those areas in a few years spontaneously. Plantations on saline soils are the big challenge; huge areas (about 3 million ha) would needs special techniques of soil improvement of the soil surface or by adding sand in furrows or pits. By planting small portions like islands, saxaul will spread in a few years. In this cases the successful establishment of the saxaul shrub can be increased.

[1] Breckle S-W, Veste M, Wucherer W (eds.), 2001. Sustainable Land-Use in Deserts, Springer, Heidelberg, 465 pp.
[2] Wucherer W, Breckle SW, 2005. Desertifikationsbekämpfung und Sanierung der Salzwüsten am Aralsee. Sukzession und Phytomelioration, Naturschutz und nachhlatige Entwicklung. Bielefelder Ökologische Beiträge 19, 94pp.
[3] Breckle SW, Wucherer W, 2007. What will be the future of the Aral Sea? in Lozan et al: Global Change: Enough water for all? Wiss Auswertungen GEO/Hamburg, pp.310-314.

First Meeting COST Action FA0901

Putting Halophytes to Work - From Genes to Ecosystems

March 12-13, 2010. *Conference Centre University of Naples Federico II*
Via Partenope, 36 – Naples – ITALY

Department of Agricultural Engineering and Agronomy (DIAAT)
University of Naples Federico II Italy

Department of Agriculture and Forest Systems Management
"Mediterranea" University of Reggio Calabria Italy

BOOK OF ABSTRACTS