Tropentag, October 7-9, 2008, Hohenheim

"Competition for Resources in a Changing World:
New Drive for Rural Development"

Afforestation for Improving Productivity of Degraded Agricultural Land and Rural Livelihoods in the Amu Darya Lowlands of Uzbekistan

Asia Khamzina, John Lamers, Paul L. G. Vlek

University of Bonn, Center for Development Research (ZEF), Germany

Abstract

Land degradation in the Aral Sea Basin is a major concern because of its adverse impact on the environment and rural livelihoods. In the Khorezm region of Uzbekistan, one of the most densely populated areas affected by the Aral Sea desiccation, 15–20 % of arable land became unsuitable for agricultural practices and some can be considered for afforestation with appropriate tree species.

Physiological characteristics and socio-economic importance suggested *Elaeagnus angustifolia*, *Ulmus pumila* and *Populus euphratica* as most promising for afforestation. Under deficit irrigation of 80–160 mm yr^{-1}, these species successfully established on highly saline soils with a root-zone electrical conductivity (EC) of over 20 dS m^{-1}, underlain by shallow (0.9–2.0 m) groundwater with EC ranging within 1.2–4.8 dS m^{-1}. Following the cessation of irrigation after two years, the trees effectively used the groundwater producing 10–60 t ha^{-1} yr^{-1} of shoot biomass.

Besides increasing productivity of land abandoned from cropping, afforestation can improve livelihoods by providing useful products. Fuelwood, as an alternative energy source, would offer some relief to over 50 % of the rural population which has no or reduced access to gas supplies. Four years after planting, the energy value of 1 ha plantation (2,300 stems ha^{-1}) averaged 6.4–10.3 tonne of oil equivalent which could satisfy the annual energy need of 55–89 persons.

The production of supplementary fodder would enrich the roughage-based diets fed to the livestock during winter. The foliar crude protein content in trees ranged within 90–150 g kg^{-1}, by far superior to that of the commonly used feed. The nutritive value relative to barley (100) varied from 62 (*P. euphratica*) to 97 (*E. angustifolia*) and ranked between molasses and moist barley.

Additionally to these direct benefits, planting N-fixing *E. angustifolia* on degraded land can contribute to soil fertility. Depending on the plantation age, the amount of biologically fixed nitrogen varied from 59 to 475 kg ha^{-1} yr^{-1}, characterising *E. angustifolia* as an important source of renewable bio-fertiliser.

These observed services supported by positive returns from capital investments in plantations, estimated in an accompanying financial valuation, reveal afforestation is an effective means to mitigate land degradation while improving rural livelihoods.

Keywords: land degradation, nitrogen fixation, rural livelihoods, salinity, tree fodder

Contact Address: Asia Khamzina, University of Bonn, Center for Development Research (ZEF), Walter Flex Str. 3, 53113 Bonn, Germany, e-mail: asia.khamzina@uni-bonn.de