Dzhanibek study site, Russia

Highlights of work carried out in the DESIRE Project
Based on work by Moscow State University

The study site

This area is a plain almost lacking in drainage and with soils prone to salinisation. Large state enterprises have exploited the land for agricultural crops and cattle-breeding, but productivity has declined, leading to unemployment and migration away from the area. Strategies may include ideas for ecosystem conservation, and diversification to provide a living for the remaining population.

The "Dzhanibek" study area is situated on the territory of Pallasovsky District, Volgograd Region and belongs to Elton Lake Province of steppe Zavolzhie and is classified as desertification province of dry steppe. Steppe Zavolzhie is positioned on the North-Western part of Caspian lowland territory. The Caspian lowland (2.9 million ha between Volga and Ural rivers) represents a unique territory in Europe with change from steppe to semidesert ecosystems. Semidesert in fact is a transitional zone to real deserts of Asia. Human-induced degradation and desertification were drastically accelerated in the last century under anthropogenic pressure. The North-Western part of it is an ideal plain slightly inclined toward the Caspian Sea with absolute heights less than 50 m asl. This territory is poorly drained and without any distinct water flow network, but with well-pronounced meso- and microrelief. The plain is composed of thick slightly saline heavy loams deposited as a result of the Caspian Sea Quaternary transgressions. The microelevations are occupied by solonchakous solonetz soils (>50 percent of the plain) under desert *Artemisia pauciflora* associations. The microslopes (about 25 percent of the plain) are occupied by light-chestnut solonetz face soils under dry-steppe vegetation (*Pyrethrum* associations). The microdepressions are occupied by meadow-chestnut soils developing under forb-grassy steppe vegetation with predomination of *Festuca sulcata*. Solonetz complexes are potential pasture grounds. In Volgograd oblast they occupy 3481.7 thousand ha or 40 percent of the total area of agricultural lands. The main desertification processes on the territory are weak manifestation of water erosion (26 percent of agricultural lands) and deflation (1 percent of agricultural lands, the latter is specific for light sediments), moderate and strong soil salinization (17 percent of agricultural lands).

Substantial increase of desertification in this region was before the 90s, the main human induced factors were plowing of marginal lands together with the growth of livestock number. Stocking level increase in favorable climatic years was twofold, in the years with mean climatic conditions – 4 times, in unfavorable years – 8.5 times. Even the threefold decrease of the total number of livestock observed in the past decade did not result in a considerable improvement of the state of pastures (with the exception of remote homesteads). Since 1991 there began a sharp decrease of the gross agricultural output in the oblast. Decrease of production output and incomes (more than twice as compared to 1990) resulted in a decrease of demand for agricultural machines, equipment, fertilizers, pesticides, etc., especially in the semidesert Zavolzhje steppe. In 1999-2000 the oblast's administration considered the expediency and possibility of moving population from the southern part of Pallasovsky region to regions with a more favorable natural situation. At present many former plowing lands are abandoned or set-aside.

Agricultural lands occupy 76.8 percent, the arable land 51.7 percent, the hayfields 1.8 percent, the pastures 23.2 percent, the forests 3.4 percent of the total area of the oblast.

Up to 80 percent of agricultural land undergoing of desertification. Density of the rural population is relatively low – 8.4 people per km^2, or 11.9 ha of agricultural lands are per 1 countryman, but due to the processes of desertification in reality this index is lower – only 6.4 ha. Average yield loss in cereal equivalent is about 1.03 t ha^{-1} per each countryman.

At the beginning of XXI century the area of eroded lands in the oblast made up 2220.5 thousand ha (26 percent of agricultural lands). Arable land occupies the major part of it – 1346 thousand ha. The area of deflated soils made up 87.3 thousand ha (1 percent), out of them 46.8 thousand ha on arable land. The area of saline lands had made 1436.5 thousand ha (17 percent) by the beginning of 2001, including 691.6 thousand ha on arable land. Very great damage was caused to pastures – ¾ of their area are at different stage of digression. Only 40 thousand ha are used for irrigation, 76 percent of the formerly irrigated lands were withdrawn because of land abandonment and secondary salinization with water table rise as the main consequences of irrigated agriculture. Erosion leads to soil organic matter losses, annual loss figures 2-3 times exceed accumulation.

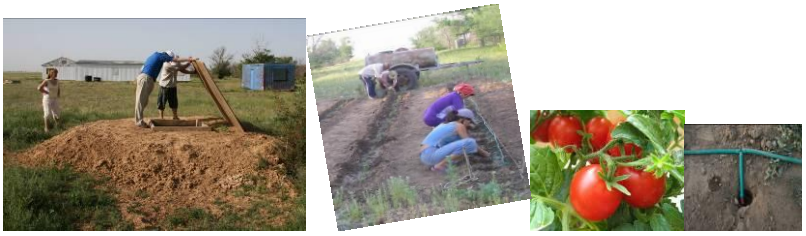
In semidesert Zavolzhje the use of intrazonal soils on brackish lagoons and depressions of the mesorelief as the best productivity areas was a long-term practice. Such system of land use is well combined with traditional meat-wool stockbreeding. Depressions occupy 10-15 percent of the study area. Brackish lagoons under cheap border irrigation were commonly used for haying as well for grazing on harvest-field and in 1970-80s provided 500 thousand tones of hay in Volgograd Oblast. Currently only one half from 58.6 thousand ha is used and hay yield usually not more than 2 t ha-1 instead of the expected 3.5-4 t ha^{-1}.

The ¾ of water resources for irrigation are provided by water supply channels and ¼ - by local water sources. Local irrigation system is composed of two systems. First is created by several hundreds km of water supply channels pumping water or from Volga River or from its tributaries. These ending in the artificial ponds and fields which had been abandoned after several years of irrigation, usually less than 10 due to yield dropping below those on dry land area. Second is presented by local water harvesting from melted snow and soil water conservation techniques. To accomplish this task hundreds of artificial ponds and hundred km of small wall-dam equipped by weir and surrounding agricultural areas were constructed in XVIII-XIX centuries. During last years soil is not frozen during winter time and melted from snow water infiltrates and reaches ground water without any significant surface flow to water harvesting and water storage reservoirs.

Novy Study site (51°82’ N, 47°03’ E) is located at Marksovsky District (29·103km2) of Saratov Region (Oblast) of Russian Federation. This region is situated in the southeast of the Eastern European plain named “Great Russian Plain” in the Lower part of Volga River, called Nighnee Povolzhie. (an area surrounding Volga downstream).

Dzhanibek Forestry Station

At the middle of tomato growing season an empty well of fresh water harvested from infiltrated snow melted water. Well was excavated at local mezo-depression to collect/use lens of fresh water in salty ground water for drip irrigation. Not enough water for drip irrigation – water volume capacity of well and tomato plot demand was estimated with error.



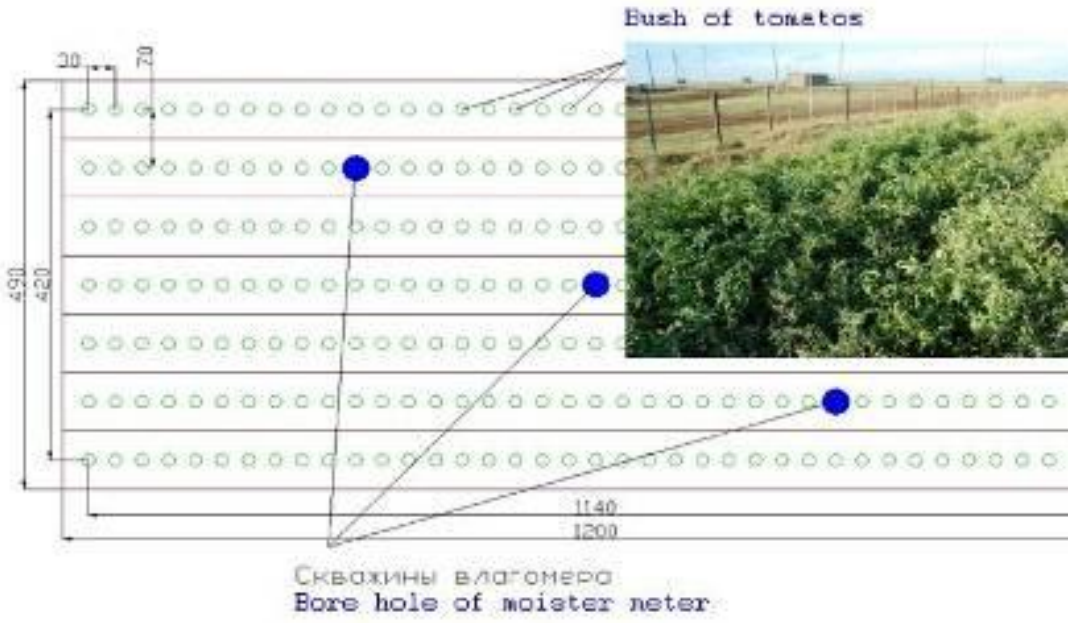
Romashky – Sobolev Family

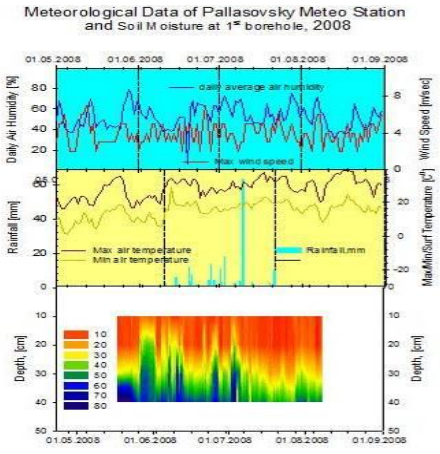
Three years (2007-2009) of successful drip irrigation implementation/application at backyard of SOBOLEV family. Romashky village in the middle of semi-desert territory with very scarce water resources, Pallasovsky District, Volgograd Region, Russia.

Dissemination of drip irrigation technology proceeded at Romashky village and at the southern more dry part (village Elton) of Pallasovsky District.


May of 2008


August of 2008


Bush of tometos
30
20
490
420
1140
1200
Скважины влагомера
Bore hole of moister meter


Meteorological Data of Pallasovsky Meteo Station
and Soil Moisture at 1st borehole, 2008
01.05.2008
01.06.2008
01.07.2008
01.08.2008
01.09.2008
Daily Air Humidity [%]
Wind Speed [m/sec]
daily average air humidity
Max wind speed
Rainfall [mm]
Max air temperature
Min air temperature
Rainfall,mm
Max/Min/Surf.Temperature [C°]
Depth, [cm]
10
20
30
40
50
60
70
80


June of 2009
Eltan - Misuina Family


August of 2009

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See: http://www.desire-his.eu/en/dzhanibek-russia for full details of DESIRE research