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The role of aspects on the temperature and moisture distribution in the mountain areas of Uzbekistan

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Introduction

Thanks to the geographical location, Uzbekistan is rich in thermic sun energy. The overall potential of sunny energy of Uzbekistan is evaluated to 50,978 mil. tons of oil-fired equivalent, i. e. accounting for 99.7% of all exploitable thermic and hydroelectric energies. In present days, out of this potential is exploited 0.6 mil. tons of oil-fired equivalent, i. e. 0.3% of technical potential.

More than 20% of the Uzbekistan territory is a mountainous terrain. With respect to the orientation to the sun, steep or mild slopes get different amount of heat energy. In this contribution, the results of microclimatic observations across slopes of different orientations within Naratin Mountains are evaluated.

Affect of Southern and Northern slopes to heat and moisture distribution in mountains of central Asia have been studed by more investigators, e. g. Ščukin and Ščukina (1959), Gvozdeckij (1963), Murzaev (1964), Stepanov (1964) and others.

Soils of South and North facing slopes are more detailed described in the paper of Stepanov (1964). The author (ined.) carried out mapping and soil investigation throughout Southern and Northern slopes in the valley of the Sukoch river (Western Tan Shan) in the altitude 800–2,000m a.s.l. The differences in soil temperatures between North and South facing slopes in the altitude of 800–1,700m a.s.l. were 3-5%, in upper altitudes 8-27% (Stepanov 1964). Dissimilarity in soil surface temperatures between North and South facing slopes in lower levels was 8-11O˚ C, in alpine levels more. Middle cover in Northern slopes was 70-90%, middle cover in Southern slopes was 30-70%. In literature sources, the information on ecological differences between North and South facing slopes so far are lacking.

Material and Methods

In order to explain ecological environment across Northern, Southern, Westerns and Eastern slopes within Naratin Mountains in the Kadaksaja Basin, we have carried out microclimatological measuring at the altitudes of 1,000 - 1,100m a.s.l. - air temperature 1.5m above soil surface and soil temperature in the depth of 5, 10, 20 and 30 cm.

To determine soil wetness, the soil sampling was carried out to the depth of 30, cm every 5cm. The sampling sites were selected with regard to get the same altitude (1,098m a.s.l.) and the same slope inclination (18˚).

Air temperature was recorded from 7.00 to 17.00 o´ clock every two hours. Air temperature was measured by the thermometer of aspiration psychrometer, the temperature of soil surface by quick read soil thermometer, soil temperature in the depth 5 and 10 cm by soil thermometer „Savinova“, soil temperature in the depth 20-30cm by soil in-depth thermometer. Soil wetness was determined by soil sample desiccation in thermostat and weighing out.

Results and Discussion

More remarkable differences in air temperature in Northern and Southern slopes we have recorded between 9.00-17.30 o´ clock (Fig. 1).

More important differences in soil surface temperatures in Northern and Southern slopes we have found between 9.00-18.00 o´ clock (Fig. 2).

At that time, the peak difference in air temperature was 2.2O˚ C and maximum difference in soil surface temperarature was 8.6O˚ C. During summer months, in morning time, the North facing slopes are illuminated by sunrays and getting warmed. This is why the air temperature and the temperature of soil surface of North facing slopes were 0.2–0.3˚ C higher against opposite slopes.

We have recorded greater differences in soil temperatures between North facing slope and South facing slope in the depth of 5 cm (8.1 ˚ C) and 10cm (7.8˚ C) (Fig. 3, 4).

The differences in soil temperature between North facing slope and South facing slope in the depth of 20-30 cm were 2-3 times lesser than in the surface layers. Soil wetness North facing slopes compared to South facing slopes was 2-2.5 times higher.

Related to microclimatic differences are another components of the nature. North facing slopes have a weathering zone in the thickness up to 2m with developed gray soils. Vegetation comes to 70-90% cover in average. The opposite rocky slope have a stonish-sandy layer in the thickness up to 0.5 m with stonish-sandy soils, vegetation comes to 30-50% cover in average.

Under certain conditions have Western and Eastern slopes distinct dissimilarities. Under equal slopes, West facing slopes are better covered by vegetation than East facing slopes. This is well

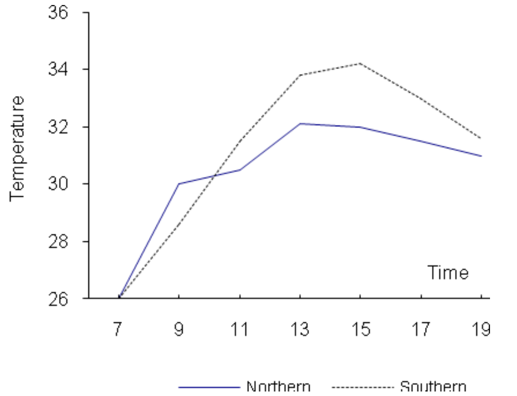

Fig. 1. Air temperature changes, 1,5 m above soil surface, Northern and Southern aspects.

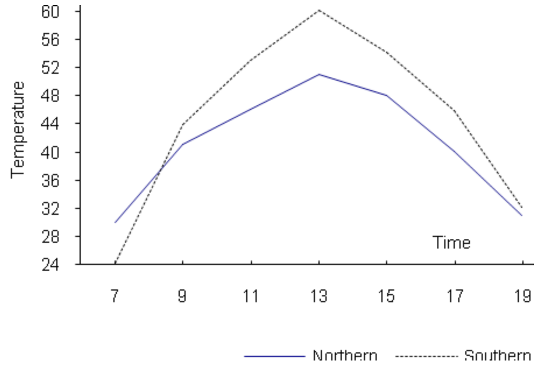

Fig. 2. Soil surface temperature changes, Northern and Southern aspects.

observable for the slopes steeper than 12-13˚, for milder slopes differences are minor.

Forenoon, Eastern slopes apparently get far more warmness than opposite slopes. The greatest differences were recorded at 9.00 o´clock. At that time the air temperature in Eastern slopes comes to 25.4˚C (Fig. 5).

Soil surface temperature at that time was 44˚C (Fig. 6).

The air temperature difference of opposite slope was 1.8˚C and soil surface 17.8˚C. Afternoon, more warmness get West facing slopes. The greatest air temperature differences were recorded at 15.00 o´clock - 1.3˚C, soil surface at 17.00 o´clock - 14.9˚C. The temperature differences between West facing slopes and East facing slopes afternoon were lesser than in the morning, because the East facing slopes are forenoon warming up by direct sunny rays. Afternoon, all the air filling the valley is warm enough, this is why East facing slopes getting additional warmness. The greater differences in soil temperatures between West facing slopes and East facing slopes are recorded in the depth of 5 and 10cm (Fig. 7, 8).

In the depth of 5cm, maximal temperature difference 7.5˚C was recorded at 19.00 o´clock. In the depth of 10cm, maximal temperature difference 5.6˚C was recorded between 12-13.00 o´clock.

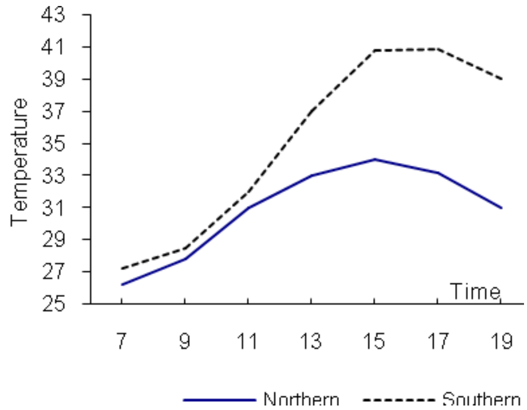

Fig. 3. Soil temperature changes, depth 5cm, Northern and Southern aspects.

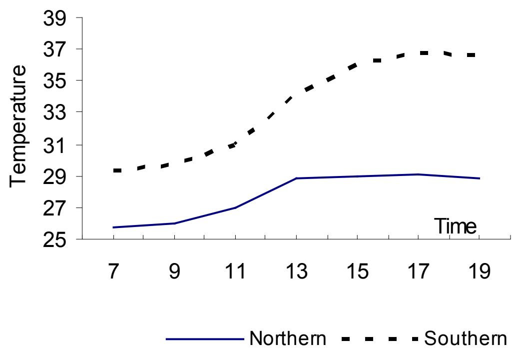

Fig. 4. Soil temperature changes, depth 10cm, Northern and Southern aspects.

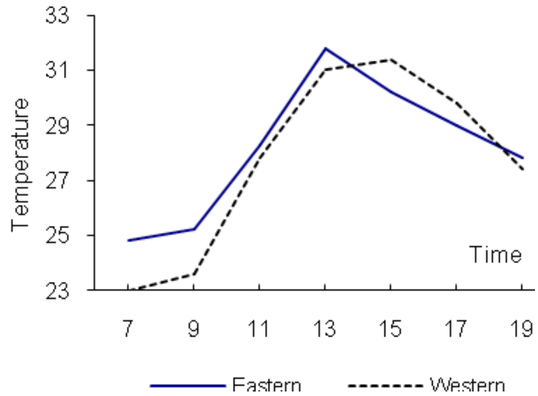

Fig. 5. Air temperature changes, 1.5m above soil surface, Eastern and Western aspects.

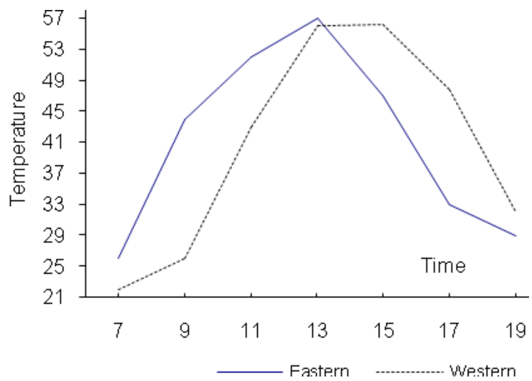

Fig. 6. Soil surface temperature changes, Eastern and Western aspects.

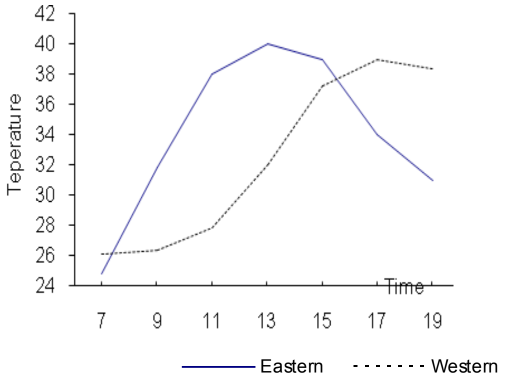

Fig. 7. Soil temperature changes, depth 5 cm, Eastern and Western aspects.

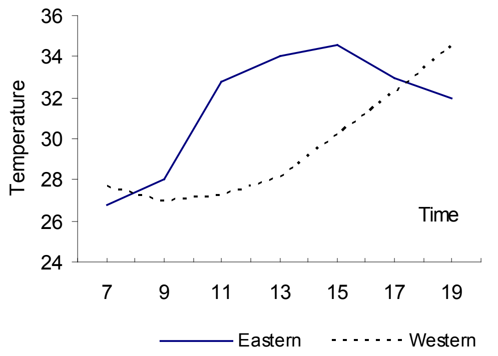

Fig. 8. Soil temperature changes, depth 10 cm, Eastern and Western aspects.

The second temperature difference occurs after 19.00 o´ clock. The temperature differences influence all the nature of the slopes. In East facing slopes, the snow was melting 2-3 days sooner than in West facing slopes. This causes more intense soil drying up and this is why during summer, in East facing slopes sooner appears soil aridness.

In the environment of Middle Asia, dew have an important ecological role during shiny days. In East facing slopes, the dew is quickly vaporized due to morning sunrays, in opposite slopes dew remains up to 9.00 o´ clock.

Since the slopes are warmed in different levels, different is the soil moistness as well. The moistness in all the measured depths in West facing slopes is somewhat greater than in opposite slopes. Soils and vegetation cover of slopes reflect these differences. Under identical conditions (inclination, altitude, bedrock), soils in West facing slopes are always deeper and more humic than soils in East facing slopes. Naturally, vegetation cover mirrors these differences.

The results of our observations may be commercialized for acquirement of thermic and electric energies by means of solar cells.

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