Spatial Variation of Microclimate in Shelterbelts on Newly Reclaimed Land in Jiya Township, Hotan, Xinjiang: Postprint

Authors: Mao Donglei, Cai Fuyan, Xu Dan, Lei Jiaqiang, Lai Fengbing, Xue Jie

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Abstract

From June 13 to August 3, 2011, this study analyzed the diurnal variation differences of wind speed, temperature, atmospheric relative humidity (RH), solar radiation energy, and photosynthetically active radiation (PAR) under four site types inside and outside shelterbelts on newly reclaimed land in Jiya Township. It compared the differential impacts of sunny and sand-dust weather conditions on various meteorological elements across the four underlying surfaces, and conducted a comparative analysis of spatial variations in microclimate elements using methods including field observation and correlation statistics. The results demonstrated that, compared with shifting sand land, the daily average wind speed at 1 m height within poplar, Calligonum, and Tamarix forests decreased by 76.43%, 95.85%, and 78.74%, respectively; at 0.5 m height, the corresponding decreases were 78.07%, 97.80%, and 93.82%. The vegetation coverage of Xinjiang poplar, Calligonum, and Tamarix shelterbelts was 12%, 80%, and 40%, respectively, indicating that higher vegetation coverage produces superior windbreak and sand fixation benefits, and that wind speed decreases with proximity to the ground surface. Compared with shifting sand land, air temperature within poplar, Calligonum, and Tamarix forests decreased by 0.93°C, 1.31°C, and 0.82°C, respectively, while RH decreased by 18.96%, 23.34%, and 14.78%, respectively, demonstrating that vegetation exerts a cooling and humidifying effect during summer. The variation trends of solar radiation energy and photosynthetically active radiation were broadly similar; daily average solar radiation energy was highest in shifting sand land, whereas daily average PAR values were highest in Calligonum forest and lowest in poplar forest. Temperature trends under sunny and sand-dust weather conditions were broadly similar. On sunny days, atmospheric relative humidity exhibited substantial variation during the morning hours, whereas under sand-dust weather conditions, atmospheric relative humidity gradually decreased from sunrise. In summer, variations in tree

species, height, vegetation coverage, porosity, and observation distances before and after shelterbelts can all induce spatial differences in the microclimate of shelterbelts on newly reclaimed land.

Full Text

Spatial Differences of Microclimate in the Shelterbelt Forests in New Reclaimed Land of Jiya Countryside in Xinjiang

Mao Donglei[1,3], , **Cai Fuyan**[2], **Xu Dan**[1], **Lei Jiaqiang**[3], , **Lai Fengbing**[1], **Xue Jie**[3],

[1]College of Geography Science and Tourism, Xinjiang Normal University / The Key Laboratory "Xinjiang Laboratory of Lake Environment and Resources in Arid Zone" , Urumqi 830054, Xinjiang
[2]College of Application Engineering, Urumqi Vocational University, Urumqi, Xinjiang 830002
[3]Xinjiang Institute of Ecology and Geography, Chinese Academy of Sciences, Urumqi 830011, Xinjiang
Cele National Station of Observation and Research for Desert-Grassland Ecosystem in Xinjiang, Cele 848300

Abstract: The temporal-spatial differences of daily wind velocity, air temperature, relative humidity, photosynthetically active radiation (PAR), and solar radiation were analyzed across four site types in shelterbelt forests and outside shelterbelts in newly reclaimed land of Jiya countryside from July 13, 2011 to August 3, 2011. Meanwhile, the differences of diurnal meteorological factors in four landscape types were compared between a fine day and a blown-sand day. After field observation, correlational statistics were used to analyze the data. The results showed that the daily wind velocity at 1 m height in *Populus alba*, *Calligonum mongolicum*, and *Tamarix ramosissima* shelterbelt forests was 76.43%, 95.85%, and 78.74% less than that in shifting sandy land, respectively. The wind velocity at 0.5 m height was 78.07%, 97.80%, and 93.82% less than that in shifting sandy land, respectively. The vegetation cover of shelterbelt forests of *P. alba*, *C. mongolicum*, and *T. ramosissima* was 12%, 80%, and 40%, respectively, which shows that the wind prevention effects would be better with increased vegetation cover. The wind speed was smaller at heights closer to the surface. The daily air temperature in the *P. alba*, *C. mongolicum*, and *T. ramosissima* shelterbelt forests was 0.93°C, 1.31°C, and 0.82°C less than that in shifting sandy land, respectively, and the daily relative humidity was reduced by 18.96%, 23.34%, and 14.78% compared with that in shifting sandy land, which shows that air temperature can be lowered and air humidity would be increased by plants. The changing trends for photosynthetically active radiation (PAR) and solar radiation were roughly the same. The value of daily solar radiation is maximum in shifting sandy land, and the value of daily PAR is maximum in *C. mongolicum* shelterbelt forest. The daily values are both smallest in the *P. alba*

shelterbelt. The changing trends for air temperature in a fine day and a blown-sand day were roughly the same, which shows larger relative humidity variation at forenoon in a fine day, and the relative humidity decreases from the sunset in a blown-sand day. In summer, the spatial differences of microclimate in the new reclaimed land were all affected by tree species, plant height, vegetation coverage, porosity, and the distances from shelterbelt forests.

Keywords: microclimate; spatial differences; air temperature; relative humidity; shelterbelt forest; Jiya countryside; Xinjiang

[Figure 5: see original paper] Changes of averaged daily solar radiation (a) and PAR (b) at different site types

[Figure 6: see original paper] The daily changes of air temperature, humidity, solar radiation and PAR at different site types during a blowing sand day and a sunny day

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Note: Figure translations are in progress. See original paper for figures.