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Efficiency of Ground Cover Types under *Samanea saman* on Reducing Outdoor Thermal Environment in Urban Parks of Bangkok, Thailand

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Abstract

This research was investigated outdoor thermal environment under *Samanea saman* based on 2 types of ground covers during January 2015 in 2 urban parks of Bangkok, Thailand. Outdoor temperature was evaluated during 10 am to 2 pm under *Samanea saman* which were representative of asphalt and grass covering. Average temperature was evaluated at 2 meters far from the stem in north south east west directions, and at 0 and 100 centimeters above the ground. The results revealed that, grass covering at 0 centimeter was the highest ground cover type which can be reduced air temperature by 1.23% compared with other types of ground covers whereas the results were not difference statistically in both different types of ground cover and height. Additionally, *Samanea saman* were recommended as the suitable tree for planting in urban environment as this species can be reduced outdoor temperature for all types of ground covers.

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Keywords: urban parks; outdoor temperature; ground cover; *Samanea saman*

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1. Introduction

Nowadays, a well-known effect of urbanization is the warming of the local climate relative to surround rural area. Factors that contribute to the temperature include the thermal properties, height, and spacing of building, the production of waste heat, air pollution, and differences in land cover and albedo. To reduce the effect of environmental degradation is an important issue for natural forest conservation [1]. In addition, vegetation also has a important role to play in contributing to the overall temperature regulation to the cities. Trees and green infrastructure can cool the air by between 2°C and 8°C [2], [3], [4]. Vegetation can be very effective as it delivers several mechanisms of cooling simultaneously such as evaporative cooling and evaportranspiration, reflectance, and shading. Magnitude of cooling form a shade tree depends upon crown shape and density. It was found that, dense trees block more incoming solar radiation, reducing solar warming, reduce light and infiltration. Magnitude of cooling also depends on tree growth rate and longevity.

Moreover, for urban park, the role of greenspace size by cooled area is influenced by the type and composition of vegetation. In suburban park, mature canopies indicated daytime air temperature 1.7-3.3°C lower than in the areas with no trees [3]. Potcher et al. [5] studied that high and wide canopy trees and higher tree/ shrub coverage resulted in cooler parks compared to the surroundings. Therefore, tree selection is very important for urban park as not all tree species have the same cooling effect. The lower the foliage temperature the greater the cooling, and canopy size, structure and density also influence the extent of shading. Leaf temperature depends on various factors which are anatomical (leaf mass, size, shape, angle, reflectance), physical (incoming energy, air temperature, wind), and physiological (transpiration, stomata conductance [6].

Generally, small-leafed species tended to be more effective at cooling by maintaining lower crown temperature than those of larger-leafed species [7]. Levermore et al studied impact of vegetation types on air and surface temperatures and found that even in suburban areas in temperate cities at 5% increase in mature deciduous trees can reduce mean hourly surface temperatures by 1°C over the summer's day. In contrast, the extreme worst case scenario of replacing all green space with asphalt was found to increase surface temperatures by up to 4.7°C and air temperatures by up to 3.2°C [8].

In Bangkok, Thailand, *Samanea saman* is one of the prominent species which are selected from the policy makers and government to plant in many urban parks with many reasons. This research was investigated efficiency of ground cover types under *Samanea saman* by evaluated outdoor thermal environment under *Samanea saman* based on 2 types of ground covers in 2 urban parks of Bangkok, Thailand. Outdoor temperature was evaluated under *Samanea saman* which were representative of asphalt and grass covering.

2. Materials and Methods

This research was investigated outdoor thermal environment under *Samanea saman* based on 2 types of ground covers during January 2015 in 2 urban parks of Bangkok, Thailand which are Lumpini Park in Patumwan District with the area 360 Rai (°13.730631N,°100.539064E) and Vachirabenchatas Park in Chatuchak District with the area 375 Rai (13.817034°N, 100.555838°E).

Outdoor temperature was evaluated during 10 am to 2 pm under *Samanea saman* which were representative of 10 asphalt and 10 grass covering.

In addition, average temperature was evaluated at 2 meters far from the stem in north south east west directions, and at 0 and 100 centimeters above the ground.

Calculate efficiency of reducing outdoor temperature by equation:

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