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LAND SURFACE TEMPERATURE AND FORESTED LAND COVERS: FASTIV REGION CASE STUDY

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Abstract

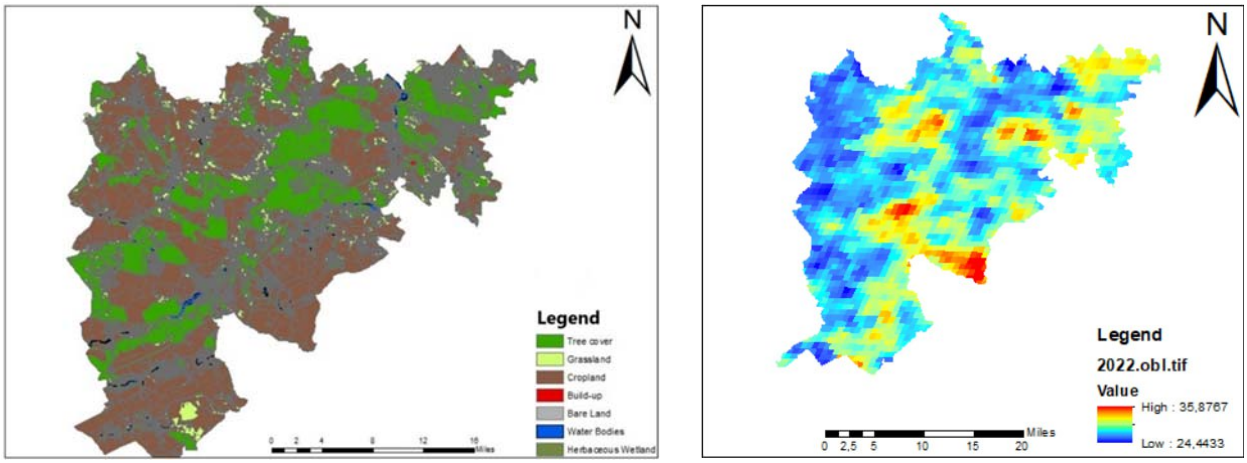
This study presents the characterization and classification of landscape cover using the example of Fastiv region of Kyiv oblast using Sentinel-5 images. The percentage of forest massif coverage of the territory of Fastiv region for the period 2016-2022 is shown. And the average air temperature for the summer period (July) on the territory of the same region, during 2016-2022. The graphs are interdependent, the smaller the area of forests, the higher the average temperature in summer. This deserves attention for the future management of the territories of the united territorial communities. This type of codependency should be done for each UTC in Ukraine, as it will help in managing their territories, assessing the impact on human health, and taking measures to preserve forest areas.

Keywords: *land surface temperature, landscape cover classification, united territorial community's management.*

The relationship between vegetation cover and the thermodynamics of the earth's surface is a critically important aspect, especially in the context of urbanization and climate change. Grass and forest cover play an important role in regulating Earth's surface temperature through processes such as shading, evaporation, and absorption and reflection of solar radiation. As urban areas expand, natural landscapes are often replaced by impervious surfaces, such as concrete and asphalt, that absorb and retain heat more effectively [1]. This transformation leads to the formation of urban heat islands (UHIs), where temperatures in urban areas are significantly higher than in rural areas.

Studying how grassy and forested areas influence surface heating and contribute to or mitigate the heat island effect is critical to developing strategies to improve urban sustainability and resilience. Vegetation not only provides shade, but also contributes to the cooling process through evaporation, when water is transferred from the soil and plants into the atmosphere. Forests, with their dense canopies, are particularly effective at reducing surface temperature, while grasslands, although less dense, still offer significant cooling advantages compared to built environments.

The Fastiv region will help us see the interdependence between the area covered by the forest and the average temperature in summer. Having a map of landscape cover classification for the Fastiv region, we can calculate the area of forests in this area during 2016-2022 [2].



(a) *(b)*

Fig. 1 Fastiv region: landscape cover classification *(a)* and surface temperature *(b)*

Also, with the temperature map, we can calculate the average summer temperature from 2016-2022 (table 1). Each pixel represents a different temperature indicator. Having received this data, we can convert it into a table of interdependence.

Table 1. The area covered by forest and the value of the average temperature

Years	2016	2017	2018	2019	2020	2021	2022
Temperatures	28.7	30.8	29.5	30.9	28.4	27.5	29.5
Trees	67394.81	60799.7	69619.39	63237.76	62396.66	63203.16	62460.69

At first glance, it is difficult to notice the co-dependence of the area covered by forests and the average temperature (Fig. 2 and 3).

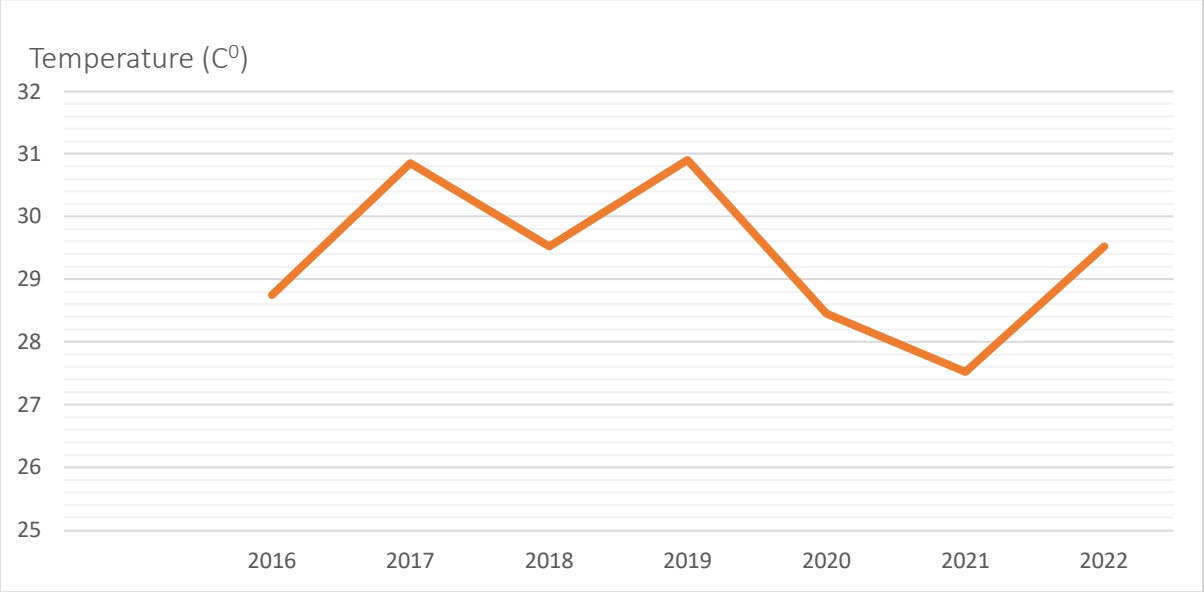


Fig. 2. Heating temperature of the earth's surface for the period 2016-2022

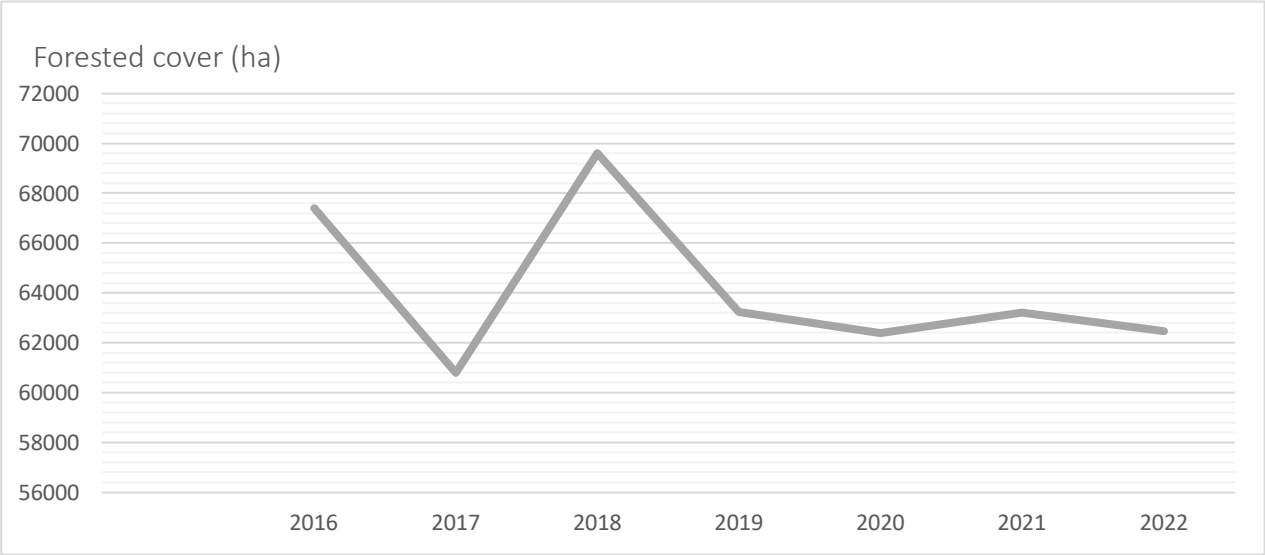


Fig. 3. Forest coverage area for the period 2016-2022

The interdependence between the two graphs becomes apparent when we compare the decrease in forest cover with the increase in summer temperatures. The inverse relationship indicates that average summer temperatures increase as forested areas decrease. This relationship can be explained by several key factors:

1. Loss of shading and cooling effects: forests provide significant shading and cooling through evaporation, when water is transferred from the soil and plants into the atmosphere, reducing surface temperatures. With fewer forests, there is less natural cooling, leading to higher temperatures.

2. Increased absorption of solar radiation: deforested areas are often inferior to surfaces that absorb more solar radiation, such as urban environments or agricultural fields, which do not reflect sunlight as effectively as forest canopies. This leads to better heat preservation and an increase in surface temperature.

3. Formation of heat islands: reduction of forest cover, especially in towns (settlements), contributes to the formation of urban heat islands (UHI). These are areas where the temperature is significantly higher than in the surrounding areas due to the concentration of buildings, roads and other heat-absorbing structures. The lack of cooling forest cover increases this effect.

In conclusion, analysis of the two graphs highlights a clear and troubling interdependence between declining forest cover and rising average summer temperatures. When forests disappear, the Earth's surface loses an important cooling mechanism, leading to higher temperatures and more intense heat waves. This highlights the importance of preserving and restoring forested areas as a strategy to mitigate rising temperatures and combat the negative effects of climate change. Reforestation and sustainable land management practices are essential to reversing these trends and ensuring a more stable and cooler climate in the future.

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ТЕМПЕРАТУРА ПОВЕРХНІ ЗЕМЛІ ТА ЛІСИСТІСТЬ ТЕРИТОРІЙ: ПРИКЛАД ФАСТІВЩИНИ

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Ключові слова*: температура поверхні землі, класифікація ландшафтних покривів, управляння територіями об'єднаних територіальних громад.*

Анотація
У даному дослідженні представлено характеристику та класифікацію ландшафтного покриву на прикладі Фастівського району Київської області за допомогою знімків Sentinel-5. Показано відсоток покриття лісними масивами територію Фастівського району за період 2016-2022 роки. Та середню температуру поверхні землі за літній період (липень) на території цього ж району, протягом 2016-2022 років. Помічено співзалежність графіків, чим менша площа лісів - тим вища середня температура влітку. Це заслуговує на увагу для майбутнього управління територіями об'єднаних територіальних громад. Цей тип співзалежності варто зробити для кожної ОТГ в Україні, оскільки це допоможе в управлінні їх територіями, оцінці впливу на людське здоров'я та прийняття заходів щодо збереження лісових масивів.