

Impact of differences in land cover on the urban heat island in villages – case studies from Northern, Middle and Southern Europe

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The urbanization of an area alters the landscape, implying a gradual replacement of vegetation and bare soil by buildings and paved surfaces. Since the newly introduced structure and materials amplify warming, an urban heat island (UHI) originates, referring to the cooler temperatures in the rural surroundings. This phenomenon has been studied in various great cities throughout the world, whereas there is limited work on small urban settlements like villages. In order to address this issue, our study focusses on the impact of land cover on urban temperatures in three similar sized European villages (Spain, Germany, Sweden). Temperature loggers were installed in representative locations throughout the villages and the rural surroundings to assess spatial differences for one year. Since several studies proved land cover to be important for local temperatures within a 1000m radius, digitization was performed for each measurement spot in accordance to that distance. In all three villages, the highest values could be assessed for locations with the most buildings and paved surfaces in its vicinity in summer, especially if minimum temperatures were regarded. In that case, the UHI intensity in the centre exceeds 1°C in comparison to a rural reference. Significantly lower temperatures could be observed if the amount of vegetation was increased. A separation in low and high vegetation seemed necessary since open fields tended to show higher maximum but lower minimum temperatures in comparison to forested areas. A very prominent cooling effect could be found when taking into account the sensor data from the dense vegetation near the river in the Spanish village during the summer heat at night (approx. 5°C cooler than centre). Even though the rivers in the German as well as in the Swedish village are by far bigger than the Spanish counterpart, less cooling could be observed, suggesting either the vegetation to be a more important factor than water bodies or an amplification of cooling in accordance with very high insolation and temperatures. Ultimately, the study showed a very similar impact of land cover on urban temperatures in all three European villages and pointed out the summer minimum temperatures to be most important with regard to the UHI intensity.