



The imprint of urbanization on plant phenology

Enrico Tomelleri (1), Albin Hammerle (2), and Georg Wohlfahrt (2)

(1) Faculty of Science and Technology, Free University of Bozen/Bolzano, Bozen, Italy, (2) Institute of Ecology, University of Innsbruck, Innsbruck, Austria

The modification of the surface radiation and energy balance in urban areas causes their temperatures to typically exceed those of the surrounding countryside, an effect termed the urban heat island. It has been suggested that urban areas may thus serve as field laboratories for studying the effects of global warming on biota and their interactions. We investigated changes in the timing of plant phenological phases and temperature across spatial gradients from natural to fully urbanized using publicly available European data sets on multi-species phenology, air temperature and degree of urbanization for the period 1981-2010. By controlling for confounding factors we show with a multiple linear regression that across the gradient from natural to fully urbanized there is a significant advancement in leaf development, flowering and fruiting phenological phases, while a significant delay is observed for leaf senescence phenological phases. Along with these phenological changes we observed, again by controlling for confounding factors in a multiple linear regression, that air temperature increased along the gradient from natural to fully urbanized. The increase was largest during the periods of leaf development, flowering and fruiting (i.e. spring to summer) and smallest during the period of leaf senescence (i.e. autumn). By combining the results of the two previous analyses we show that the temperature sensitivity of phenological phases is either significantly dampened (leaf development, flowering and fruiting) or reversed (leaf senescence) compared to the temperature sensitivity inferred from temporal changes in phenology and temperature. We conclude that urbanization gradients, despite the observed increase in temperature, represent poor analogs for the temporal changes in plant phenology, apparently due to confounding factors associated with urbanization.