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Ice-wedge polygons distribution, morphometry and state in the Tombstone Territorial Park, Central Yukon, Canada

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Ice wedge (IW) polygons form through thermal contraction induced by winter cooling of ice-rich permafrost which results in the formation of cracks. Hoar frost develops in the cracks in winter and meltwater infills the cracks during spring and freezes. As the cracking and infilling occurs repeatedly, IWs grow, leading to characteristic surface morphology with depressions or troughs aligned on the axis of the IW and raised rims or ridges on either side. Surface expression of IW is either characterized as low-centered polygons or high-centered polygons, the former being associated with the first stages of IW development, and the latter with IW degradation. Because IWs represent important excess ice close to the surface, considerable local subsidence and related effects on landscape parameters, such as vegetation and moisture, are likely to occur upon degradation.

IW polygons distribution, morphometry and state were characterized in the Tombstone Territorial Park (Central Yukon, Canada) using semi-automated remote sensing techniques, field observations and laboratory analyses. The data is used to define determining landscape factors for IW polygons occurrence, to characterise the stages of the IWs development and/or degradation and to estimate the volume of buried ice in the region. Results show that elevation, slope and material are important elements defining IW polygons distribution. The relationship between landscape factors and stages of development is not as clear, and, despite climate changes being homogenous in the area, IW development and degradation is very heterogenous, as shown by the differing moisture, greenness and brightness signals across the polygonal terrain.