Journal of Applied Remote Sensing

Spectral index to improve the extraction of built-up area from WorldView-2 imagery

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https://doi.org/10.1117/1.JRS.15.024510

Abstract

Globally, the unprecedented increase in population in many cities has led to rapid changes in urban landscape, which requires timely assessments and monitoring. Accurate determination of built-up information is vital for urban planning and environmental management. Often, the determination of the built-up area information has been dependent on field surveys, which is laborious and time-consuming. Remote sensing data are the only option for deriving spatially explicit and timely built-up area information. There are few spectral indices for built-up areas and often not accurate as they are specific to impervious material, age, colour, and thickness, especially using higher resolution images. The objective of this study is to test the utility of a new built-up extraction index (NBEI) using WorldView-2 (WV-2) to improve built-up material mapping irrespective of material type, age, and color. The new index was derived from spectral bands such as green, red edge, NIR1, and NIR2 bands that profoundly explain the variation in built-up areas on WV-2 image. The result showed that NBEI improves the extraction of built-up areas with high accuracy [area under the receiver operating characteristic curve, (AUROC) = ~ 0.82] compared to the existing indices such as built-up area index (AUROC = ~ 0.73), built-up spectral index (AUROC = ~ 0.78), red edge/green index (AUROC = ~ 0.71) and WorldView-Built-up Index (WV-BI) (AUROC = ~ 0.67). The study demonstrated that the new built-up index could extract built-up areas using high-resolution images. The performance of NBEI could be attributed to the fact that it is not material-specific and would be necessary for urban area mapping.