Evaluating Seasonal and Annual Imagery for Enhanced Wetland Classification Using Remote Sensing

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Wetlands are crucial to Earth, improving water quality, protecting against floods, and providing homes to hundreds of species. Wetland loss has increased by more than 50% in the US since 2009, making monitoring essential to conservation efforts. Satellite imagery has become a widespread source of spatial-temporal information to monitor wetlands. Wetlands can be seasonal, causing variations in satellite imagery from month to month. Existing studies show that certain months are better for classification, but are limited to small-scale field studies. However, the impact of using imagery with varying spatial-temporal resolutions from different seasons over a larger geographic area for wetland classification remains unexplored. This study analyzed the effectiveness of Sentinel-2 and Landsat 9 imagery across seasonal and annual time frames in wetland classification, focusing on the midwestern and southern United States. A supervised classification approach was used to build a machine learning model, incorporating standard variables used to identify wetlands such as computed texture, indices, and elevation. Composited images from four time periods (Spring, Summer, Fall, Annual) within 2022 were assessed for wetland classification using multiple accuracy metrics. Notably, the composited spring images of both satellites achieved the highest accuracies, with Sentinel-2 imagery exhibiting a 5-10% increase in overall accuracy across all time periods compared to Landsat 9. This study reveals the novel potential of using spring imagery to enhance wetland classification and underscores the value of Sentinel-2 for improving accuracy, which can further guide scientists into selecting optimal data for monitoring wetlands.

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