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| **High Accuracy Mapping of Peatland Typologies, Distribution and C Stocks via Dense Time Series of Optical and Radar Imagery** |
| Peatlands represent a strategic belowground carbon pool that occurs on merely 3-5% of the land surface, but represents the largest C store of the terrestrial biosphere. Since peatlands represent a C storage and sequestration pool that can most readily be conserved and restored, the United Nations recently completed a Global Peatland Assessment for increasing awareness of preserving and restoring peatlands as a strategy to help mitigate climate change. However, there is a data gap in our current knowledge of the geospatial distribution, type and extent of C rich peatlands across the globe. The ability to accurately map peatland types and monitor their extent, impacts and condition has been a focus of study by several researchers and governments. Using a combination of optical and microwave sensors from multiple seasons within a given subregion has been shown to allow for the characterization of peatland typologies from boreal, temperate, and tropical ecoregions. There are limitations in accuracy for mapping at global scales using a single approach due to the rich diversity of forested and non-forested peatland typologies that occur across the globe. Therefore, the approach needs to be tuned to the region of interest. Challenges of peatland mapping include limited field data, high cloud cover in many regions of interest, and radiometric differences between adjacent mosaicked images due to variable environmental conditions. These issues can be overcome to a great degree with the increasing availability of dense temporal datasets from Sentinel-1, Sentinel-2, Landsat, NISAR, etc. These datasets combined with cloud computing is allowing for broader areas to be mapped with limited field datasets. Cloud computing and dense temporal data allows for temporal normalization, and in the case of SAR temporal speckle filtering, for improved mapping capability. We have examples of high accuracy peatland maps and in situ soil C measures that have allowed for improved accounting of C-storage estimates from the Peruvian Amazon, Andean mountains, and boreal Northwest Territories. Cloud based approaches and new tools utilizing the dense time series data are demonstrated in de novo mapping of the western United States Rocky Mountains, where sparse networks of mountain fens occur, and in coastal mangrove and inland areas of the Democratic Republic of Congo.  Accurate mapping of peatland typologies and extent with high resolution (<30 m) sensors linked with field data are necessary to reduce uncertainties in estimates of the distribution of C stocks, but also to allow for decisions to prevent and mitigate threats from land use and climate change. The most efficient way to move forward with mapping and monitoring at regional and global scales is using dense time series datasets in cloud environments. Further, remote sensing based on a combination of microwave and optical sensors has been shown to aid in monitoring peatland degradation, C flux and soil C emissions from wildfire. Knowledge of where peatlands are on the landscape and understanding their role in global C cycling, and thereby their importance to climate mitigation, gives decision makers tools and information to implement policy for peatland protection, conservation, restoration and sustainable use. |