Role of MODIS Vegetation Phenology Products in the ForWarn System for Monitoring of Forest Disturbances in the Conterminous United States

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This presentation discusses MODIS vegetation phenology products used in the ForWarn Early Warning System (EWS) tool for near real time regional forest disturbance detection and surveillance at regional to national scales. The ForWarn EWS is being developed by the USDA Forest Service NASA, ORNL, and USGS to aid federal and state forest health management activities. ForWarn employs multiple historical land surface phenology products that are derived from MODIS MOD13 Normalized Difference Vegetation Index (NDVI) data. The latter is temporally processed into phenology products with the Time Series Product Tool (TSPT) and the Phenological Parameter Estimation Tool (PPET) software produced at NASA Stennis Space Center. TSPT is used to effectively noise reduce, fuse, and void interpolate MODIS NDVI data.   PPET employs TSPT-processed NDVI time series data as an input, outputting multiple vegetation phenology products at a 232 meter resolution for 2000 to 2011, including NDVI magnitude and day of year products for seven key points along the growing season (peak of growing season and the minima, 20%, and 80% of the peak NDVI for both the left and right side of growing season), cumulative NDVI integral products for the most active part of the growing season and sequentially across the growing season at 8 day intervals, and maximum value NDVI products composited at 24 day intervals in which each product date has 8 days of overlap between the previous and following product dates. MODIS NDVI phenology products are also used to compute nationwide NRT forest change products refreshed every 8 days. These include percent change in forest NDVI products that compare the current NDVI from USGS eMODIS products to historical MODIS MOD13 NDVI. For each date, three forest change products are produced using three different maximum value NDVI baselines (from the previous year, three previous years, and all previous years). All change products are output with a rainbow color table in which forests with the most severe NDVI decreases are assigned hot colors (yellow to red) and forests with prominent NDVI increases are assigned cold colors (blue tones). All mentioned products have been integrated as data layers into ForWarn's geospatial data viewer known as the U.S. Forest Change Assessment Viewer (FCAV). The latter is used to view and assess the context of the mentioned forest change products with respect to ancillary data layers, such as land cover, elevation, hydrologic features, climatic data, storm data, aerial disturbance surveys, fire data, and land ownership.   The FCAV also includes a temporal NDVI profiler for viewing phenological change in multi-year NDVI associated with known or suspected regionally apparent forest disturbances (e.g., from fire and insects). ForWarn forest change products have been used to detect, track, and assess several biotic and abiotic regional forest disturbance events across the country, including ephemeral and longer lasting damage from storms, drought, and insects. Such change products are most effective for viewing severe disturbances affecting multiple MODIS pixels. MODIS vegetation phenology products contribute vital current information on forest conditions to the ForWarn system and this role is expected to grow as these products are refined and derivative products are added.