Percent Agriculture in Areas of High Water Accumulation

This EnviroAtlas national map uses a wetness index to estimate the percent of land within each 12-digit hydrologic unit (HUC) that is is managed for agriculture and is frequently or periodically wet. Agriculture includes all land dedicated to the production of crops, but excludes land managed for pasture.

Why is agriculture on wet areas important?

A wetness index, or modified Compound Topographic Index (CTI), based on watershed contributing area, slope, and overland flow, was used to generate this EnviroAtlas data layer. The national map of agriculture on wet areas shows high concentrations of farmed wet areas in the Midwest. In drier regions, such as the Columbia Plateau in eastern Washington state and the southern Central Valley of California, high CTI index values indicate the potential for wet areas based on index attributes, but wet areas may be ephemeral or nonexistent because of low annual precipitation. Wet areas are typically created by runoff from natural land cover when rain falls on saturated soil. Surface and rill (or small channel) runoff carries excess water to lowland depressions.

The wet areas data layers cover areas that may or may not be defined as wetlands. The three main components used to define wetlands are the presence of wetland hydrology, hydric soils, and hydrophytic (water-adapted) vegetation. A depression that carries water during wet periods may be temporary and may not possess one or more of the required wetland components. An agricultural wet area may be drained and tiled to be brought into full production or it may be planted later in the season after drying.

A major increase in farm acreage, yield, and income during the century between 1885 and 1985 occurred partly by expanding farming into wet areas through ditching, subsurface tiling, and drainage. While the expansion of agriculture into wet areas increased crop yields, it also reduced the residence time of water on the landscape, sending precipitation and polluted overland flow directly through drains and tiles to streams and rivers and bypassing previously existing vegetation filtering services.[1] Remaining wet areas, surrounded by agriculture, experienced degradation through changes in hydrology, water pollution, and increases in non-native and tolerant species.

Depending on its position in the landscape and local needs for various ecosystem services, a persistent agricultural wet area

may provide more benefit by being taken out of crop production. By filtering surface runoff, wet areas can serve as buffers to prevent sediment, nutrients, and harmful bacteria from entering waterbodies and degrading water quality.[2] Wet area vegetative cover also helps regulate the flow of surface water into nearby waterbodies by slowing runoff and recharging ground water.

The Conservation Reserve Program (CRP) offers incentives to farmers to take wet areas out of production and plant permanent natural cover to serve as filtration buffers for sediment and nutrients or as groundwater recharge areas. A recent study found that exports of sediment and nutrients fell to 0 from marginal cropland planted with CRP natural cover.[3] Another study on the High Plains Aquifer in Oklahoma found that CRP parcels significantly increased groundwater recharge in areas where irrigation had seriously reduced groundwater levels.[4]

Knowing the distribution of agriculture on wet areas is important for locating and prioritizing candidate areas for sediment capture, nutrient filtration, and groundwater recharge. Multiple functions may be ranked by local needs for water quality improvement, wildlife habitat, or flood protection.

How can I use this information?

This national map uses a wetness index to estimate the percent land area of 12-digit HUCs covered by agriculture in areas of high water accumulation. It is a companion map to Percent Agriculture on Hydric Soils and one of a series of national-

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scale maps displaying land cover on wet areas using a CTI wetness index. For conservation efforts, this map may be used with other metrics such as ecoregions, protected lands (PADUS) data, National Wetland Inventory (NWI) wetlands, or other national EnviroAtlas data layers such as Potentially Restorable Wetlands on Agricultural Land.

Knowing potential runoff contributing areas can help target implementation of best management practices (BMPs) to improve water quality.[5] Wet areas maps may be compared with EnviroAtlas impaired waters data to assist in planning to maximize filtration capabilities when implementing Total Maximum Daily Loads in streams. Wet areas restored alongside or upstream of impaired stream segments may help reduce sediment and nutrient loads to streams.

How were the data for this map created?

This map of percent agricultural land cover on wet areas for each 12-digit hydrological unit (HUC) is based on a hybrid of the 2011 National Land Cover Database (NLCD) and the USDA's 2011 Crop Data Layer (CDL). A wetness index—a modified Compound Topographic Index (CTI)—was developed to identify areas wet enough to collect water. The wetness index grid, calculated from National Elevation Data (NED), relates upstream contributing area and slope to overland flow. Results from our analysis suggested that CTI values ≥900 captured the majority of wet areas. Percentages of agricultural land cover on wet areas within 12-digit HUCs were calculated by raster cell counts with a cell size of 30m x 30m and an area of 900 m^2 per raster cell.

What are the limitations of these data?

EnviroAtlas uses the best data available, but there are still limitations associated with these data. The landcover classes found in NLCD and CDL are created through the classification of satellite imagery. Human classification of different landcover types that have a similar spectral signature can result in classification errors.

The wetness index, CTI, tends to overestimate wet areas, in part because it does not consider precipitation and evaporation water balances. It will also overestimate wetness in areas with highly permeable soils that do not retain water. Finally, CTI indicates wet areas based entirely on topography and surface water flow and will miss wet areas created by other factors such as heavy precipitation or irrigation outflow.

How can I access these data?

EnviroAtlas data can be viewed in the interactive map, accessed through web services, or downloaded. Land cover, crop, and elevation data are available on their respective websites.

Where can I get more information?

A selection of references relating to agriculture, managed wet areas, and ecosystem services is listed below. Information about the base data layers can be found at the websites linked throughout the text. For additional information on data creation, access the metadata for the data layer from the drop down menu on the interactive map and click again on metadata at the bottom of the metadata summary page for more details. To ask specific questions about this data layer, please contact the EnviroAtlas Team.

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Selected Publications

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3. Food and Agricultural Policy Research Institute (FAPRI). 2007. Estimating water quality, air quality, and soil carbon benefits of the Conservation Reserve Program. FAPRI-UMC Report No. 01-07. University of Missouri-Columbia, Columbia, Missouri.

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