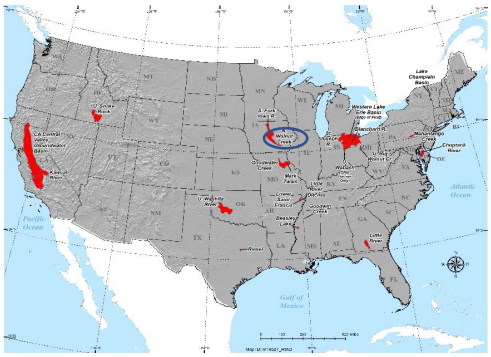
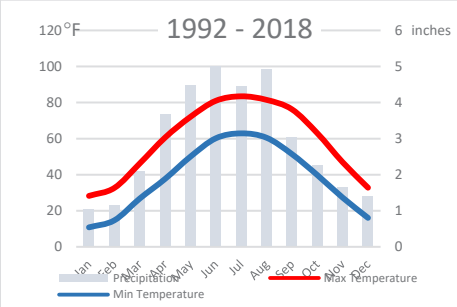
# Walnut Creek Watershed



## Location

The slightly under 51.3-km$^2$ Walnut Creek Watershed is located on the Des Moines Lobe region of central Iowa. Walnut Creek flows into the South Skunk River just south of Ames, IA.

## Temperature and Precipitation




## Major land uses

**Cropland:** Corn & Soybean production occurs on about 90% of the watershed. **Pasture, Farmsteads, Woodlands, Roadways and Towns** comprise the remainder.

## Data collection

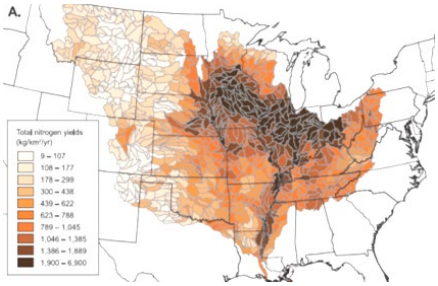
Stream monitoring began in 1991. Continuous discharge data are aggregated on 5-minute intervals. Automated samplers collect water samples during storm events with additional samples collected every week. Water quality sensors have been in place since 2014 to collect continuous turbidity data and since 2016 to collect continuous nitrate concentration data. Two meteorological stations measure precipitation, temperature, relative humidity, and solar radiation.

**A Conservation Effects Assessment Project (CEAP) Watershed Assessment Study: A collaboration between the Agricultural Research Service and the Natural Resources Conservation Service**

## Concerns

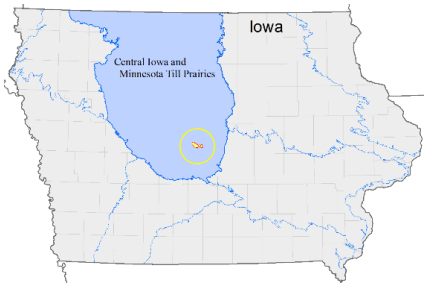
Soils in the watershed are deep, with high organic matter content formed over post-glacial deposits (till). The till forms a layer restricting deep percolation of water. This poor drainage is overcome by installing subsurface drains (tiles), which represent the main pathway for water in the watershed. These tiles eventually discharge into ditches or streams.

The corn-soybean cropping system covers most of the agricultural land. There are relatively few confined animal feeding operations (CAFO). Water quality issues include high nitrate loads from subsurface drainage, and to a lesser extent pesticides. Walnut Creek exports N loads to the Mississippi River, which drives up hypoxia in the Gulf of Mexico.




## Main conservation practices used

Conservation practices used in the watershed include conservation tillage and nutrient management, with minor amounts of cover crops, no-till, and erosion control practices. Several practices have been identified that could reduce nitrate losses and provide other benefits. These include N fertilizer management, cover crops, wood-chip denitrification bioreactors, and saturated riparian buffers.



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## Outcomes/Findings

### Plot and field scale

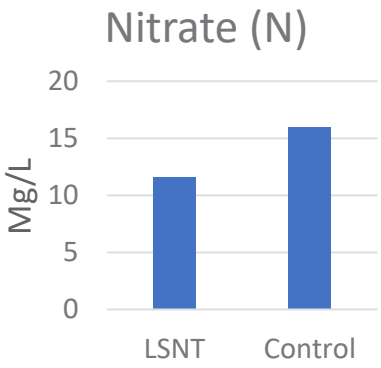
- Wood-chip bioreactors were evaluated on plots with individual tile drains. Bioreactors removed an average of over 25 kg N/ha/yr over 9 years of testing.
- At the same site, direct $N_2O$ emissions were not reduced by the rye cover crop. However, the rye did reduce indirect emissions through reduction in nitrate leaching.
- Over 4 years under field conditions, corn-soybean nitrate-N losses ranged from 34 to 81 kg N/ha/yr compared to 11to 34 kg N/ha/yr losses from the corn-soybean with a winter rye cover crop system.
- Modeling studies showed that controlled drainage using water level control gates could reduce nitrate-N losses by 39% compared to the loss from free drained fields.
- Saturated buffers were identified as another tool for nitrate removal from tile drainage. Tile lines are intercepted and drainage water is redistributed laterally into riparian buffers. See photo of installation below. As the water seeps through the buffer, soil microorganisms remove the nitrate by denitrification. Nitrate removal by buffers ranged from 8 to 84% of nitrate leaving the field. Study used 6 different riparian buffers in central Iowa.

Lower Walnut Creek (left) and upper Walnut Creek (right). Upper Walnut Creek is sourced from tile discharge into ditches that join more natural stream channels.

### Watershed scale

The Late Spring Nitrate Test (LSNT) predicts available N when corn most needs it. The test is usually done in late May and requires soil sampling, nitrate analysis, and application equipment. N management by LSNT was applied on one sub-basin in Walnut Creek on farmer fields and compared to sub-basins where farmers made their own N fertilizer decisions.

- LSNT-based management reduced nitrate loss by 30% without affecting corn yield.




Nitrate concentrations in Walnut Creek sub-basins with late spring N applications after LSNT or conventional N application.

## Collaborators and Stakeholders

USGS science for a changing world

IOWA SOYBEAN Association

IOWA STATE UNIVERSITY

IOWA DEPARTMENT OF AGRICULTURE & LAND STEWARDSHIP

## More Information

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