Financial and Nutrient Reduction Tool (Finrt)

Objective: Estimate the total costs and expected nitrogen reduction of various conservation scenarios at field scales and at the HUC12 watershed-scale.

Task: Perform various scenario-oriented financial analyses such as total cost for conservation planning, comparative cost-effectiveness, and budget or N-reduction goal optimization.

# Datasets

**Cost outcomes.** Comprehensive enterprise budgets for ACPF-supported BMPs were assessed and updated (adapted from Christianson et al. (2013) and Tyndall and Bowman (2016)) for use with the Iowa Nutrient Reduction Strategy. Costs are accounted for using standard discounted cash flow techniques across designated time horizons and annualized to allow for comparative analysis with other farm-level production costs (Tyndall and Roesch 2014). All Financial data is in 2021$ value and will be updated on an annual basis.

**Direct Cost.** Partial budget, field-scale data for establishing and managing a BMP or set of BMPs over a specific period of time.

**Opportunity Cost.** Spatially explicit, long-term opportunity cost of land use for practices that remove cropland from production.

**Total Cost.** Calculated on a per acre per year unit and based on scale of application and duration of use.

# Methods

## Opportunity Costs

Calculated based on the cropland or permanent pasture land conversion to BMP (e.g., riparian buffers, contour buffer strips, nutrient removal wetlands, and farm ponds), and accounts for long-term cost of land by calculating area-weighted land rent loss as a proxy opportunity costs (Zimmerman et al. 2019).

**Cropland Conversion:**

Longterm Cost = foregone cropland rent

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MLRA = rental rate per index point averaged across MLRA

**Improved Permanent Pasture:**

Longterm Cost = foregone cropland rent

area weighted average adjusted productivity index

MLRA = Rental rate per index point averaged across MLRA

Weights:

1. State-specific crop productivity indices
   * Illinois: (currently acquiring)
   * Indiana: (currently acquiring)
   * Iowa: CSR2
   * Minnesota: (currently acquiring)
   * Nebraska: (currently acquiring)
   * Ohio:
   * Wisconsin:
2. Major Land Resource Area (MLRA) scale rent data (USDA SCS 1981). Area-weighted averages for county-data were aggregated at MLRA-levels to calculate an average MLRA-level per acre rent.
   * Iowa: Cash rental rates were gathered from Iowa State University Extension and Outreach AgDecision Maker. Typical rental rates for high, medium, and low cropland in all Iowa counties, and for pasture, hay and oat production land are reported annually by ISU Extension & Outreach (Plastina et al. 2021).
3. In situations where permanent pasture is being improved the productivity index was adjusted and multiplied by 0.35 (35%). The state average 2021 cash rental rate in Iowa for improved permanent pasture is $195 per hectare and the state average 2021 cash rental rate for corn and soybeans is $537 per hectare. The tool then calculates the area-weighted average productivity index and the per-productivity index point $ amount to get the per hectare rental rate.

## Nitrogen Reduction Estimate

Mean percent nitrate reduction efficiencies from the Iowa Nutrient Reduction Strategy allows for N load, N load reduction potential from BMPs, and cost per pound of N reduced per BMP to be estimated.

## Developing Conservation Scenarios

1. **Estimate field Nitrogen requirements.** Estimates the potential nitrogen load at the field and watershed level. Field nitrogen requirements and potential nitrogen load are generated.
2. **Analyze Conservation Scenario N load.** Quantifies the expected nitrogen load reduction and financial costs associated with the user-selected sitings generated while using the ACPF GIS toolset.

# Appendix A: Definitions

Annualized

Corn Suitability Rating (CSR2) – an index of the inherent soil productivity of each soil series relative to corn production in Iowa and is scale from 5 to 100 for the least to most productive soils (Burras & Miller 2015). The data is used to measure soils’ capacity to grow corn and estimate relative average yields

Direct Costs

Discounted Cash Flow

Discount Rate

Enterprise Budgets

National Commodity Crop Productivity Index (NCCPI)

Opportunity Costs

Partial Budget

Total Cost

# Appendix B: Read List

* Iowa Nutrient Reduction Strategy
* Ellen Audia
* Emma Bravard
* Tyndall & Bowman 2016
* Tyndall & Roesch 2014
* Christianson et al. 2013
* Zimmerman et al. 2019
* Iowa State University Extension and Outreach AgDecision Maker

# Appendix C: Enterprise Budgets

2% discount rate