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A build-up of nutrients in the soil and groundwater over time

Diagram illustrating a single neuron structure:

- INPUT**: Represented by a dashed line entering the neuron.
- OUTPUT**: Represented by a solid line exiting the neuron.
- ACCUMULATION**: Represented by a yellow rectangular area where the input and output lines meet.

INPUTS - OUTPUTS = ACCUMULATION

Anthropogenic landscapes are in excess of nitrogen through agricultural, industrial, and urban activities

Current focus: Nitrogen

This work can be extended for phosphorus

- ◆ Cover crops can be effective for preventing nitrate leaching at the farm scale

- ◆ Cover crop implementation is currently opportunistic rather than strategic about placement in the watershed

Cover Crops

Protect

Hotel



Does not need

fertilizer

Groundwater Pathways and Travel Times

Nitrate in groundwater travel with the flow towards streams

Nutrient input into landscape

When more nutrients are put into the land than taken out via crop uptake, **nitrogen accumulates**. Best management practices like **cover crops start to deplete the accumulated nitrogen**.

Velocity of water flowing in the subsurface is affected by **soil properties, slope, and presence of tile drains**

management time lag

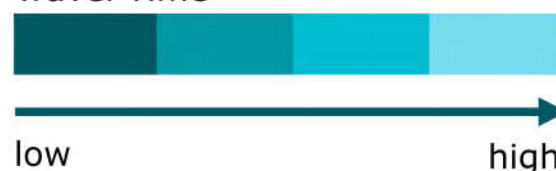
Output Measurement

Decreased nutrient loading from management change
will take time to be seen at the outlet due to long **groundwater travel times**.

now

later

Travel Time



- Cover crop placement

For example, cover crops could be placed in areas with the shortest travel times and largest legacy accumulations.

What is the **increased water quality improvement** for strategic vs ad hoc placement of BMPs?

Current
(ad hoc, not strategic placement)

BMPs placed in regions with short travel time

Average time lag

Shortest time lag