

Lecture Notes Outline: Predicting the Effects of Climate Change on Soil Loss

By the end of this unit, you will be able to:

1. Explain how rainfall and runoff erosivity, soil properties, landscape characteristics, and agricultural practices contribute to soil erosion.
2. Differentiate between natural and human influences on soil sustainability.
3. Analyze how changes in precipitation predicted in climate change models will impact erosion rates.

Estimating soil loss using the Revised Universal Soil Loss Equation (RUSLE)

RUSLE Factors

- R = rainfall and runoff erosivity

Definition:

Key Components:

- K = soil erodibility

Definition:

Key Components:

- LS = length slope (landscape)

Definition:

Key Components:

- CP = cover management and support practices

Definition:

Key Components:

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The RUSLE:

$$\text{Estimated average soil loss} = R * K * LS * C * P$$

Practice problems:

1. Keeping all other factors the same, if a farmer changes crop rotations such that contribution of the C factor decreases by one third, what would that do to the erosion rate (average soil loss)?
2. If soil organic matter decreases such that K doubles, what could be done (besides adding more organic matter) to keep the erosion rate the same?

Influences on soil erosion: human activity vs. natural processes

Each component of the RUSLE that impacts soil erosion is influenced itself by one or more natural processes and/ or human activities. What influences each of these?

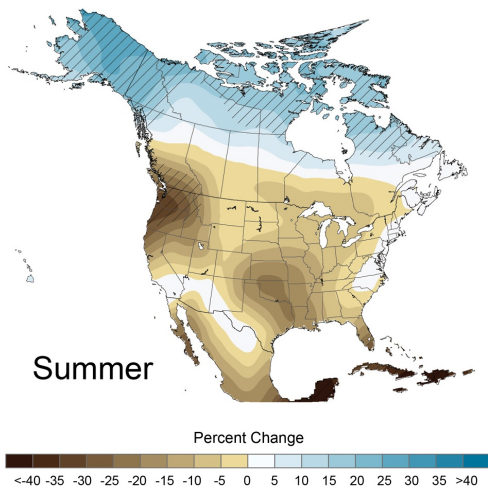
- Support practices
- Soil porosity
- Slope steepness
- Surface cover
- Rainfall intensity

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Climate change: impacts on agriculture

Key points from the video:

Climate change will impact precipitation during the summer growing season:



The map shows projected changes during summer, the primary growing season, precipitation relative to the recent past as simulated by 15 climate models. The simulations are for late this century, showing changes that are expected to happen by 2080-2099. Confidence in the projected changes is highest in the hatched areas.

What are the predicted changes for *your* region?

Image source: Kenneth Kunkel, NOAA NCDC/
Cooperative Institute for Climate and Satellites-NC

Soil erosion as a system

Examples of other systems:

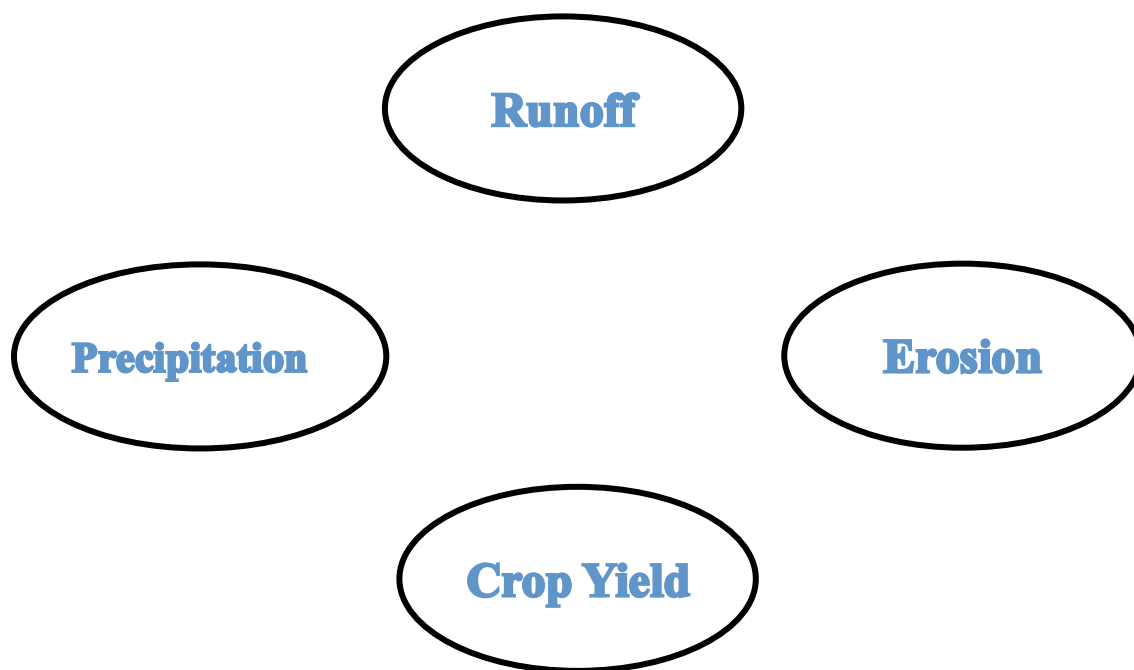
Benefits of taking a systems thinking approach:

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Relationships between factors that influence erosion in agricultural systems

Explanation of symbols:

- Direction of arrows
- + = positive relationship
- - = negative relationship



(diagram modified from Pruski and Nearing, 2002)

Practice problems:

Models for Syracuse, Nebraska, predict that precipitation will decrease overall for the region.

1. Erosion is also expected to decrease for wheat. Which pathway is most likely to be dominant for wheat?
2. The same models predict that, while precipitation decreases overall for the region, erosion is expected to increase for cornfields. Which pathway is most likely to be dominant for corn?
3. Based on these pathways, which crop do you think is more severely impacted by the decrease in precipitation?