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LAND MANAGEMENT, ENVIRONMENT & SOLID-WASTE: INSIDE EDUCATION AND BUSINESS IN CENTRAL ASIA
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MICRO-CREDENTIAL

CLIMATE CHANGE FOR SUSTAINABLE LAND MANAGEMENT IN CENTRAL ASIA

6.- Agriculture, Food Security and Rural Livelihoods

Data mini-lab

Simple dataset of yield vs rainfall for a key crop

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Objective

The objective of this mini-lab is to help students explore how rainfall variability can influence crop yield in semi-arid agricultural systems. Students will use a simple dataset to identify trends, interpret climate sensitivity and discuss the limitations of rainfall-yield analysis.

The dataset is designed for teaching purposes and does not represent official observed data from a specific district.

Dataset

The table shows seasonal rainfall and wheat yield for a hypothetical semi-arid district over 12 years.

Year	Seasonal rainfall during growing season (mm)	Wheat yield (t/ha)
1	210	1.2
2	245	1.5
3	280	1.8
4	310	2.1
5	335	2.4
6	360	2.6
7	390	2.9
8	420	3.1
9	455	3.2
10	480	3.3
11	520	3.2
12	560	3.1

Instructions for students

Step 1. Inspect the data

Look at the rainfall and yield values.

Answer:

1. Which year had the lowest rainfall?
2. Which year had the highest rainfall?
3. Which year had the lowest yield?
4. Which year had the highest yield?

Step 2. Plot the data

Create a simple scatter plot:

- X-axis: seasonal rainfall.
- Y-axis: wheat yield.

Students may use Excel, Google Sheets, R, Python or a hand-drawn graph.

Step 3. Identify the relationship

Describe the relationship between rainfall and yield.

Questions:

1. Does yield generally increase with rainfall?
2. Does the relationship remain linear at high rainfall values?
3. Is there evidence of a yield plateau?
4. Why might yield decrease slightly at very high rainfall?

Step 4. Estimate simple rainfall sensitivity

Calculate the approximate increase in yield between:

- 210 mm and 360 mm.
- 360 mm and 480 mm.
- 480 mm and 560 mm.

Discuss whether each additional millimetre of rainfall produces the same yield benefit.

Step 5. Interpret agronomic meaning

Discuss possible explanations for the observed pattern.

Possible explanations include:

- Water limitation at low rainfall.
- Improved soil moisture at intermediate rainfall.
- Yield plateau when another factor becomes limiting.
- Nutrient limitation.
- Heat stress.
- Soil salinity.
- Waterlogging after excessive rainfall.

- Pest or disease pressure.
- Poor timing of rainfall.
- Differences in crop variety or management.

Step 6. Identify missing variables

Rainfall alone does not explain crop yield fully.

List at least five additional variables that would improve the analysis.

Examples:

- Temperature.
- Rainfall distribution during the season.
- Soil moisture.
- Soil type.
- Irrigation.
- Fertiliser use.
- Crop variety.
- Planting date.
- Pest and disease occurrence.
- Soil organic matter.
- Salinity.
- Extreme heat events.
- Farmer management practices.

Questions for interpretation

1. Why is total seasonal rainfall an incomplete indicator of water availability for crops?
2. Why is the timing of rainfall important?
3. How could climate change affect this rainfall-yield relationship?
4. Which climate-smart practices could reduce yield losses in dry years?
5. How could irrigation, mulching or drought-tolerant varieties modify the relationship?
6. Why should farmers avoid relying only on historical averages?
7. What type of early warning information would help farmers before the growing season?

Expected output

Students should submit:

1. A scatter plot of rainfall vs wheat yield.
2. A short interpretation of the relationship.
3. A list of missing variables.
4. Two climate-smart recommendations for reducing yield risk.

Recommended length: 1 page.

Suggested interpretation

The dataset shows that wheat yield generally increases as rainfall increases from 210 mm to around 480 mm. However, after this point, the yield response becomes weaker and may even decline slightly. This suggests that rainfall is important, but it is not the only factor controlling yield. At higher rainfall levels, other limitations may become more important, such as nutrients, diseases, waterlogging, poor drainage or temperature stress.

A climate-smart cropping system should therefore not focus only on increasing water availability. It should also improve soil health, crop varieties, nutrient management, drainage, pest control and climate information.