3rd INTERNATIONAL CONFERENCE ON CLIMATE CHANGE IN WEST AFRICA AND SAHEL

Rainfall aggressiveness in the Sudano-Sahelian zone of Mali: case of Djindjila in Meguetan municipality.

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OUTLINE

1. RESEARCH FRAMEWORK AND OBJECTIVE
2. MATERIAL AND METHODS
3. RESULTS AND DISCUSSION
4. ACTION TO BE TAKEN
5. CONCLUSION AND SUGGESTIONS

1 RESEARCH FRAMEWORK AND OBJECTIVES

RESEARCH HYPOTHESIS

Increase in the intensity and frequency of aggressive rainfall event, leads to greater risks of soil erosion and agricultural disruption.

The rainfall erosivity index (R) is highly variable across years but follows a recognizable trend, which can be used to predict future soil erosion patterns.

The max 30-minute rainfall intensity (I30) significantly influences (R), suggesting that short bursts of heavy rain are the primary drivers of soil erosion.

OBJECTIVES

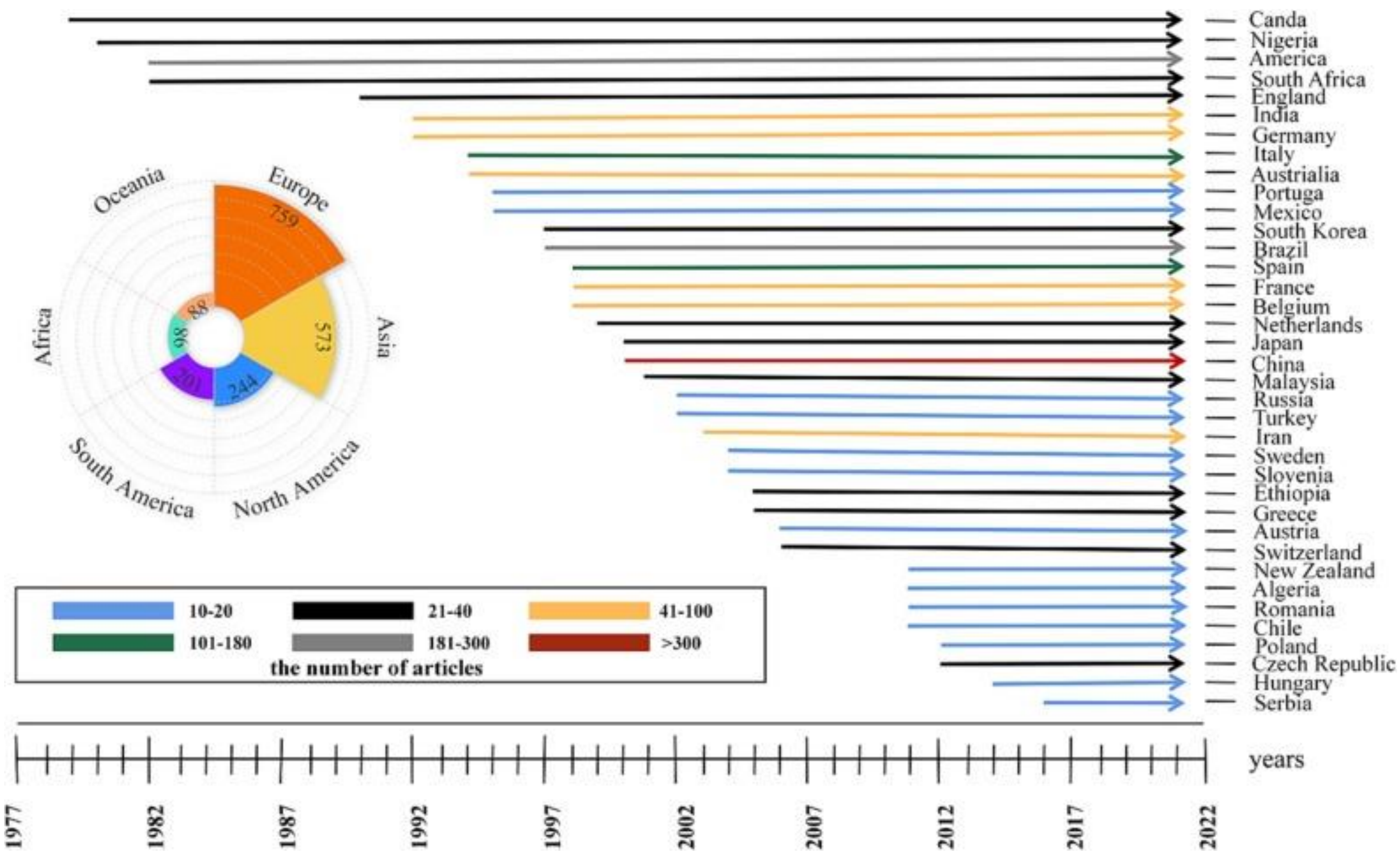
Assess rainfall aggressiveness; Provide data for improving agricultural practices; and Contribute to characterizing the rainfall regime.

PROCESSES

- In situ rainfall measurements during 2022 cropping season.
- Rainfall erosivity factor (R) calculated using E.I30 index.
- Data collection: rain gauge, microphone and SW, Katibougou station.
- Data analysis Mann-Kendall test and Pearson correlation

1 RESEARCH FRAMEWORK AND OBJECTIVES

STATE OF KNOWLEDGE



>1,900 research papers

2 MATERIAL AND METHODS (1/2)

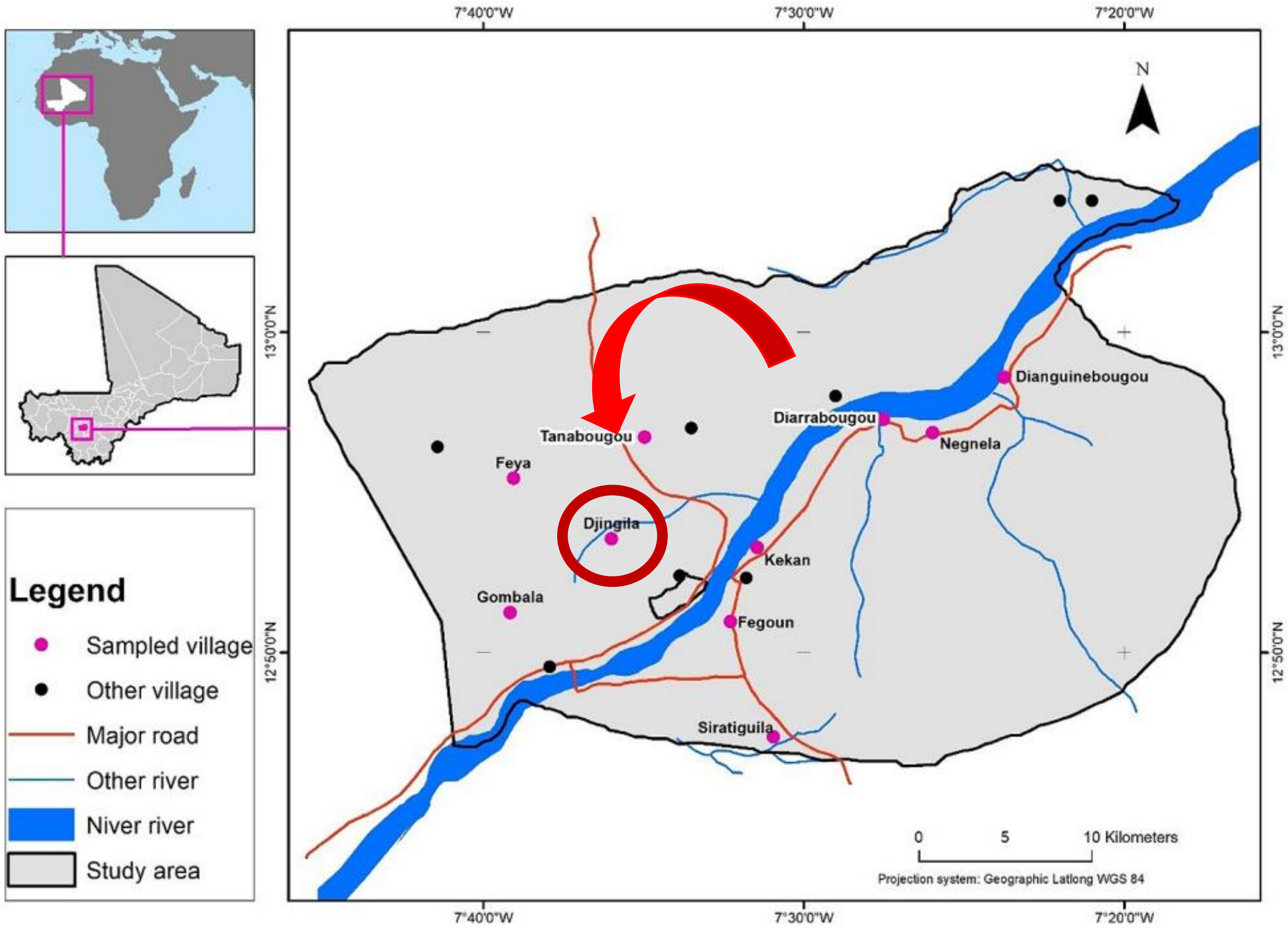


Figure 1. Rural municipality of Méguétan

The study was conducted during the 2022 rainy season in the village of Djindjila.

T = 17 and 45° C, Rainfall from 700 to 900 mm/year (Keita et al., 2023).

The main crops grown include cowpeas, sorghum, millet, maize and groundnuts.

2 MATERIAL AND METHODS (2/2)

The rainfall erosivity factor (R)

Equation 1: $R = \frac{E \times I_{30}}{685}$

Avec E = energy in joules per m^2 per mm of rain.

I_{30} = maximum rain intensity in 30 minutes.

Equation 2: $I_1 = \frac{Pi}{ti}$

With I: Rain intensity (mm/h); P: Rain quantity (mm); t: Time (h).

Equation 3: $E = \sum Eh$

With Eh: homogeneous energy of the slice.

Equation 4: $Eh = Eu \times$ amounts of rain.

With Eu: unit energy.

Equation 5: $Eu = 8{,}73 \log_{10} I + 11{,}9$

③ RESULTS AND DISCUSSION (1/5)

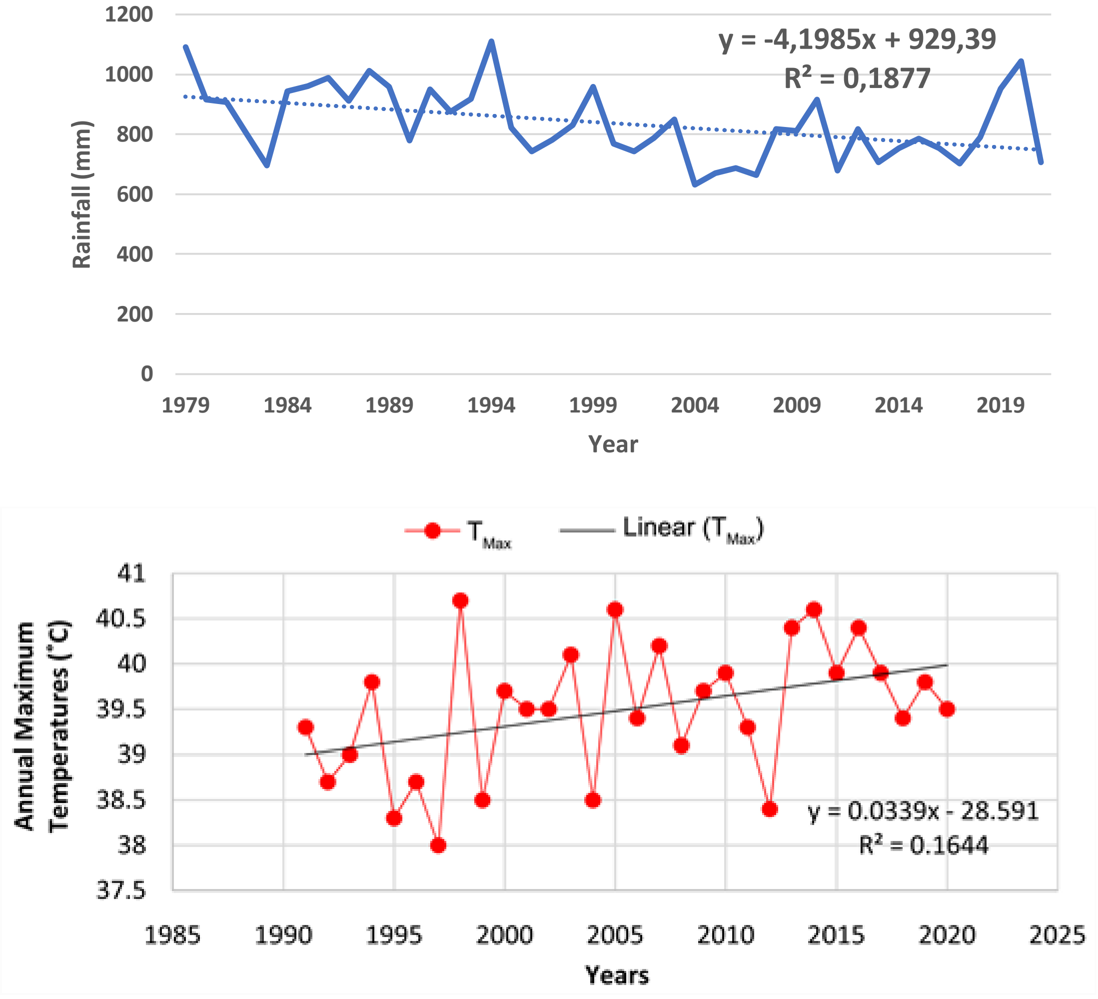


Figure 2. Annual max rainfall and temperature.

Rainfall fluctuates from year to year. This highlights the complexity of the rainfall pattern in the region (Traoré et al., 2023). The trend in annual maximum rainfalls is decreasing (0.68 mm/year) (Sanogo et al., 2023)

3 RESULTS AND DISCUSSION (2/5)

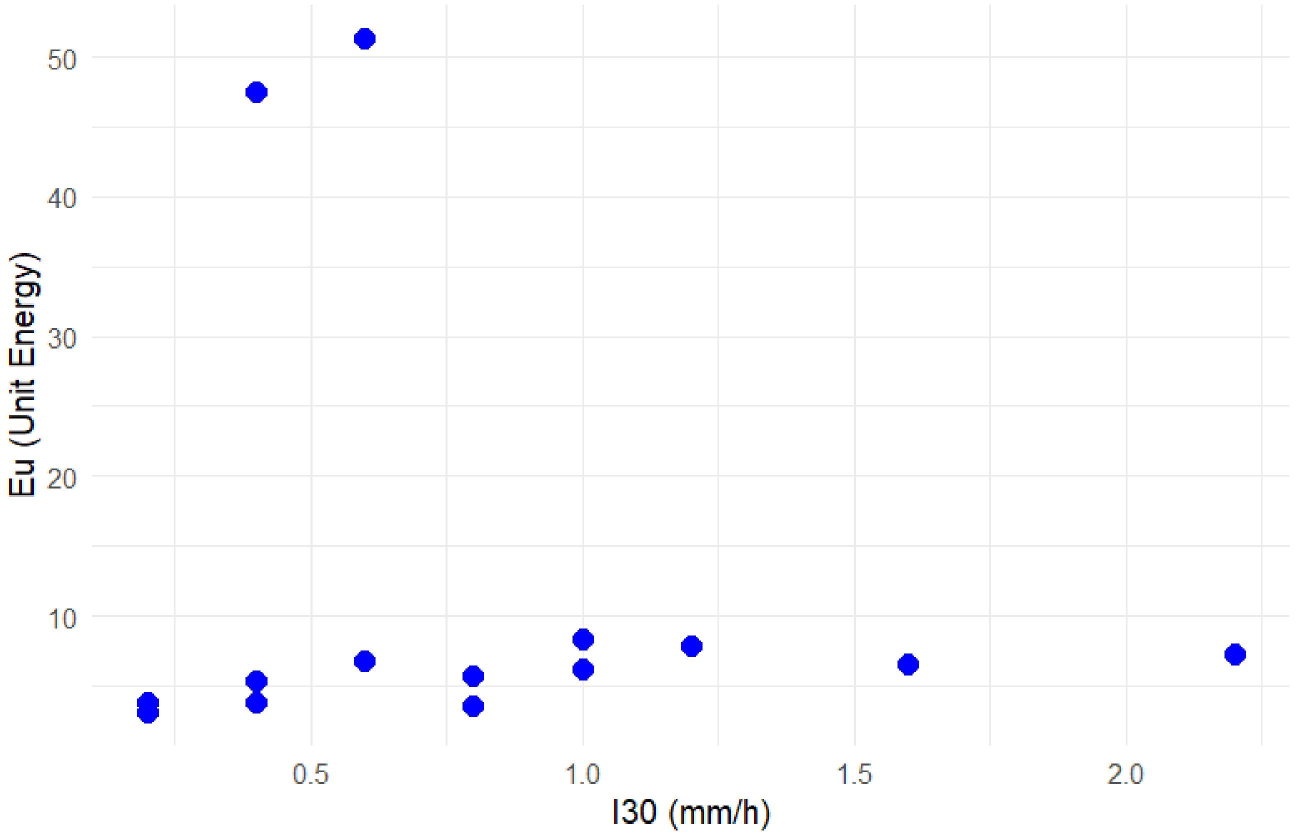


Figure 3. Scatter plot of Eu and I_{30}.

No strong correlation between Eu and I30. This indicates that high total rainfall is not necessarily associated with high short-term intensity (Kader & Franklin, 2008).

RESULTS AND DISCUSSION (3/5)

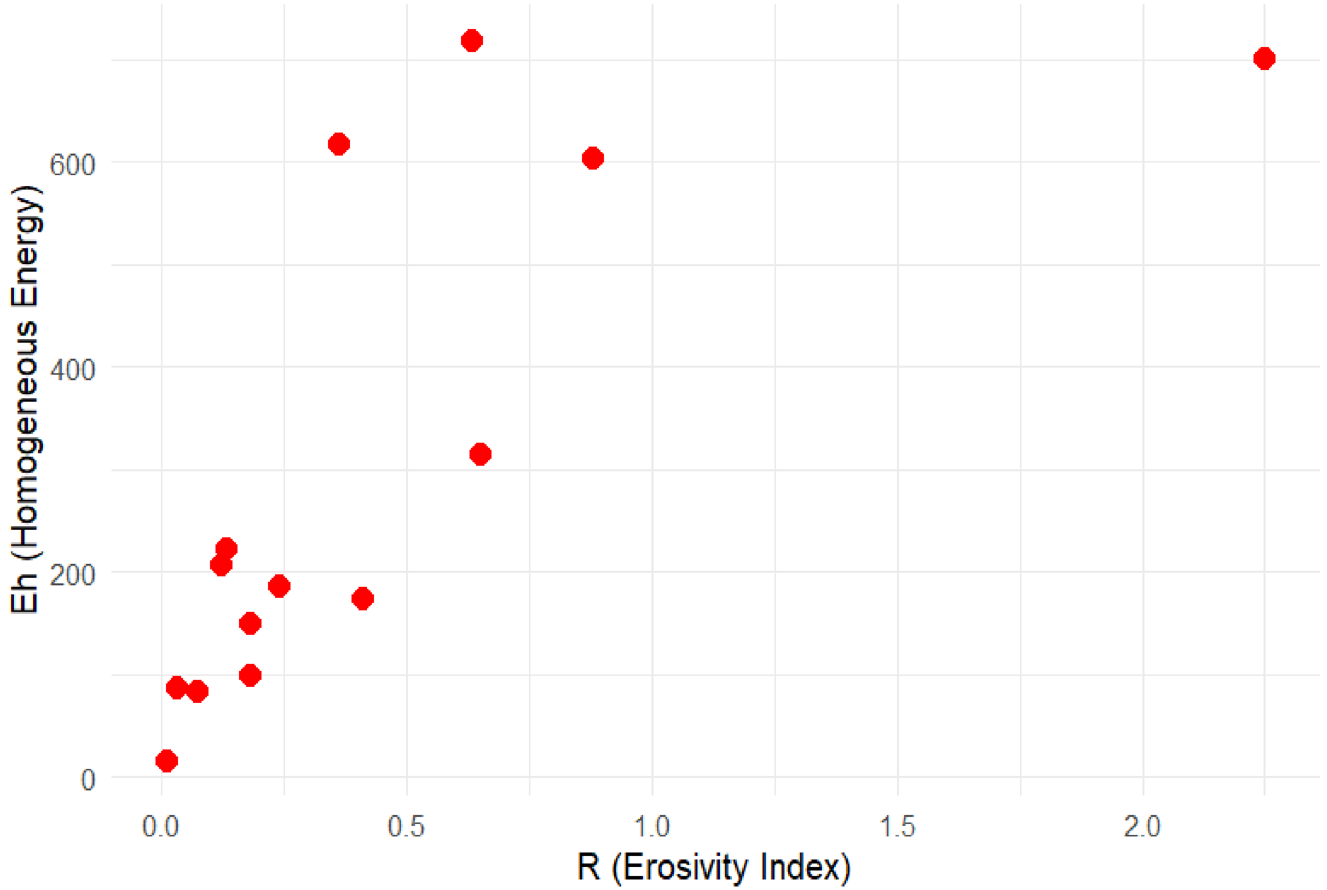


Figure 4. Scatter plot of Eh and R.

Figure 4 indicates a positive relationship between Eh and R, where higher Eh generally leads to higher R, reflecting more aggressive rainfall conditions (Wang et al.,2024).

3 RESULTS AND DISCUSSION (4/5)

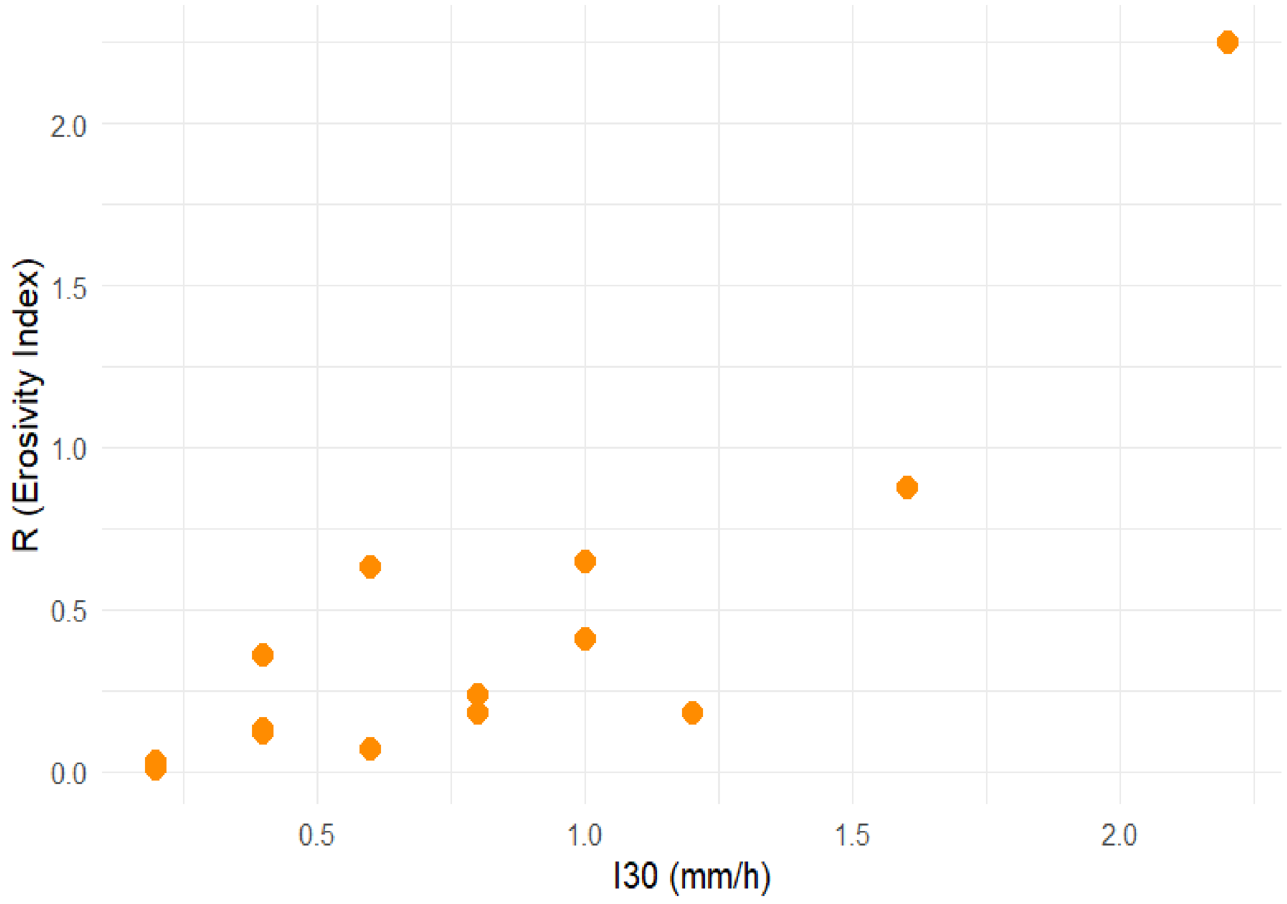


Figure 5. Relationship between rain intensity and erosivity index.

Max (I30)= 2.20 mm.h-1 ; Max (R) = 2.25

Strong corelation between (R) and (I30) indicates that increased rainfall intensity over 30 minutes is associated with higher rainfall erosivity, highlighting the impact of intense precipitation on soil erosion (Yan et al., 2024).

3 RESULTS AND DISCUSSION (5/5)

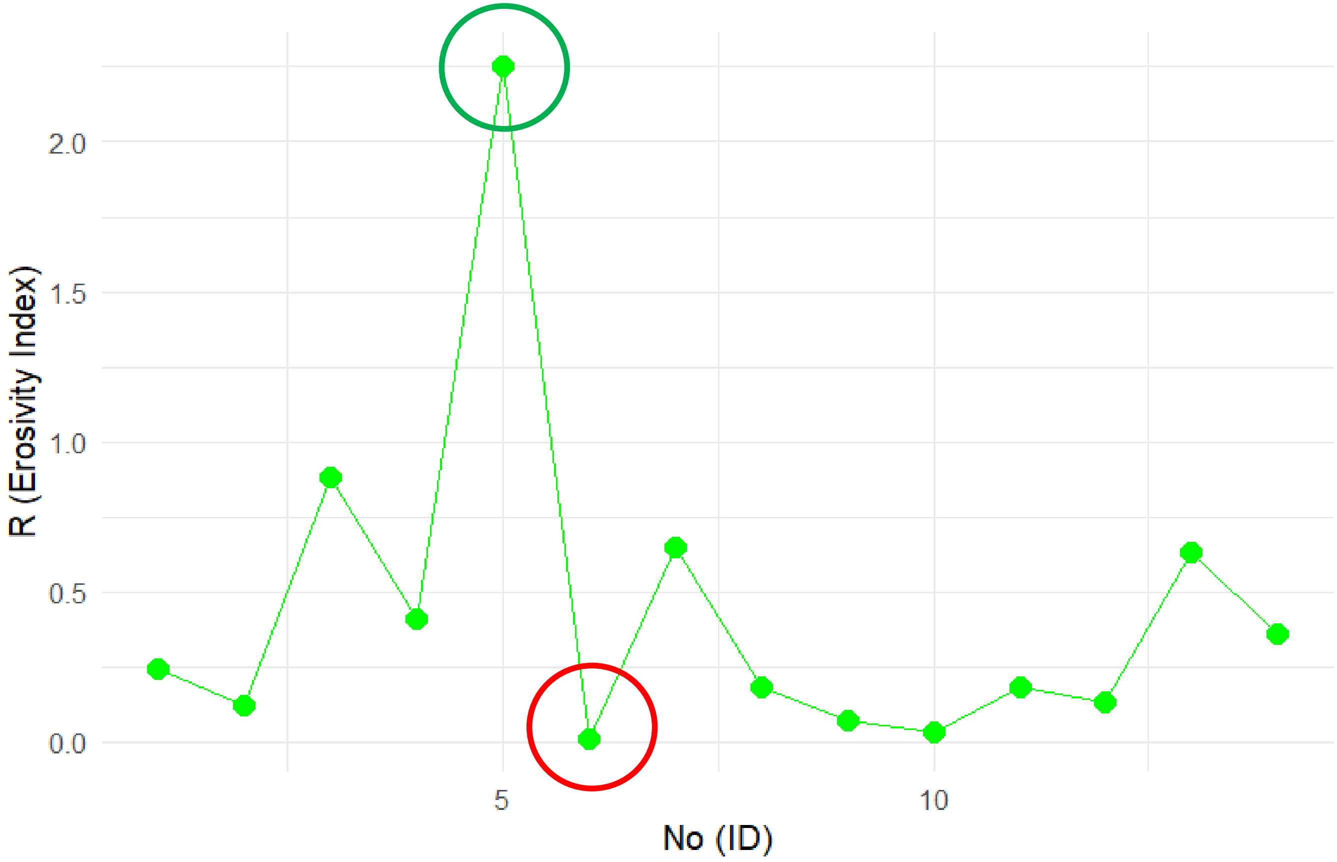
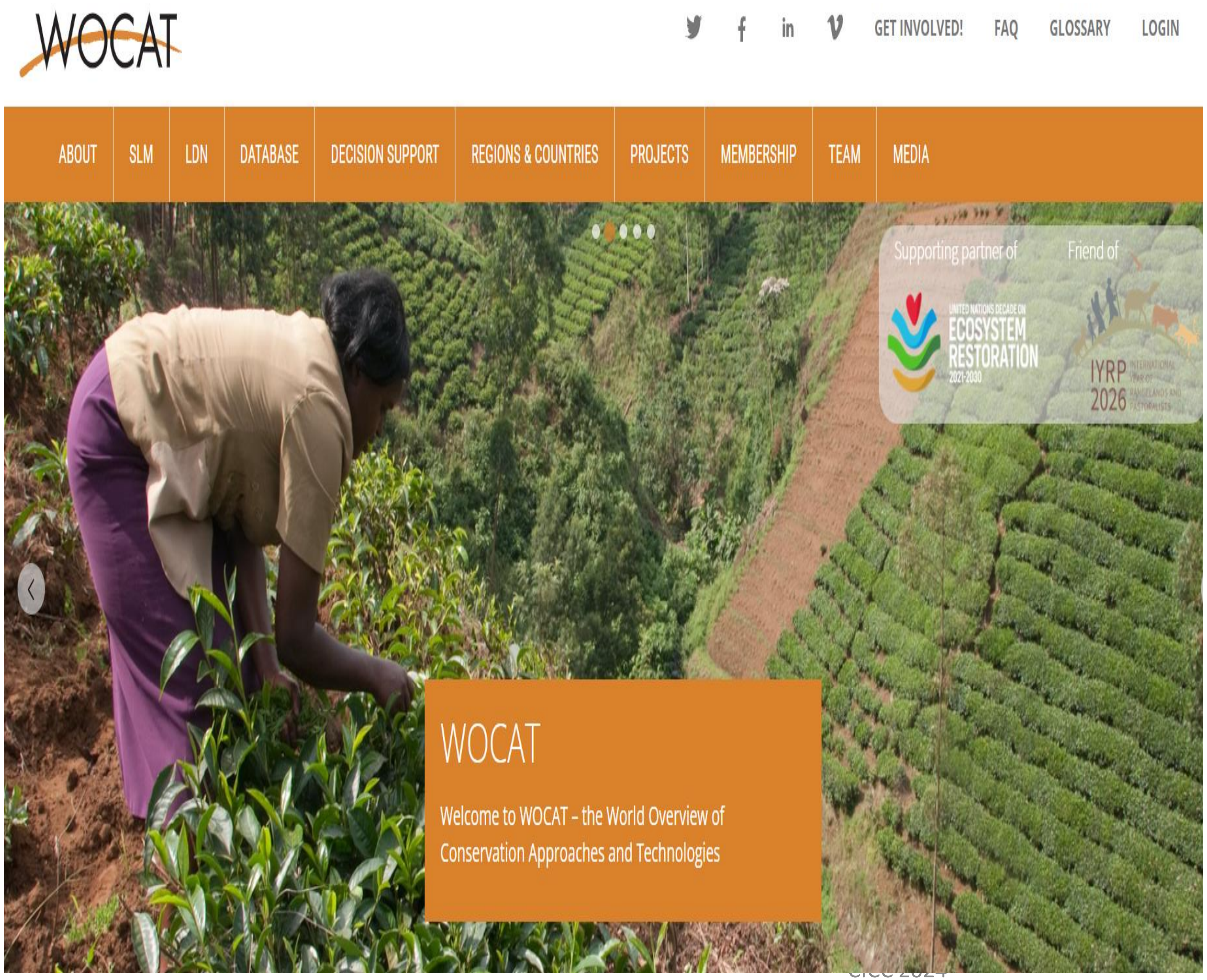


Figure 6. Trend in the erosivity index.

There is a significant variability in the rainfall erosivity. The erosivity index R calculated on the basis of recorded rainfall was 0.44. (Dicko et al., 2022 ; Roose & Noni, 2004).

4 ACTION TO BE TAKEN



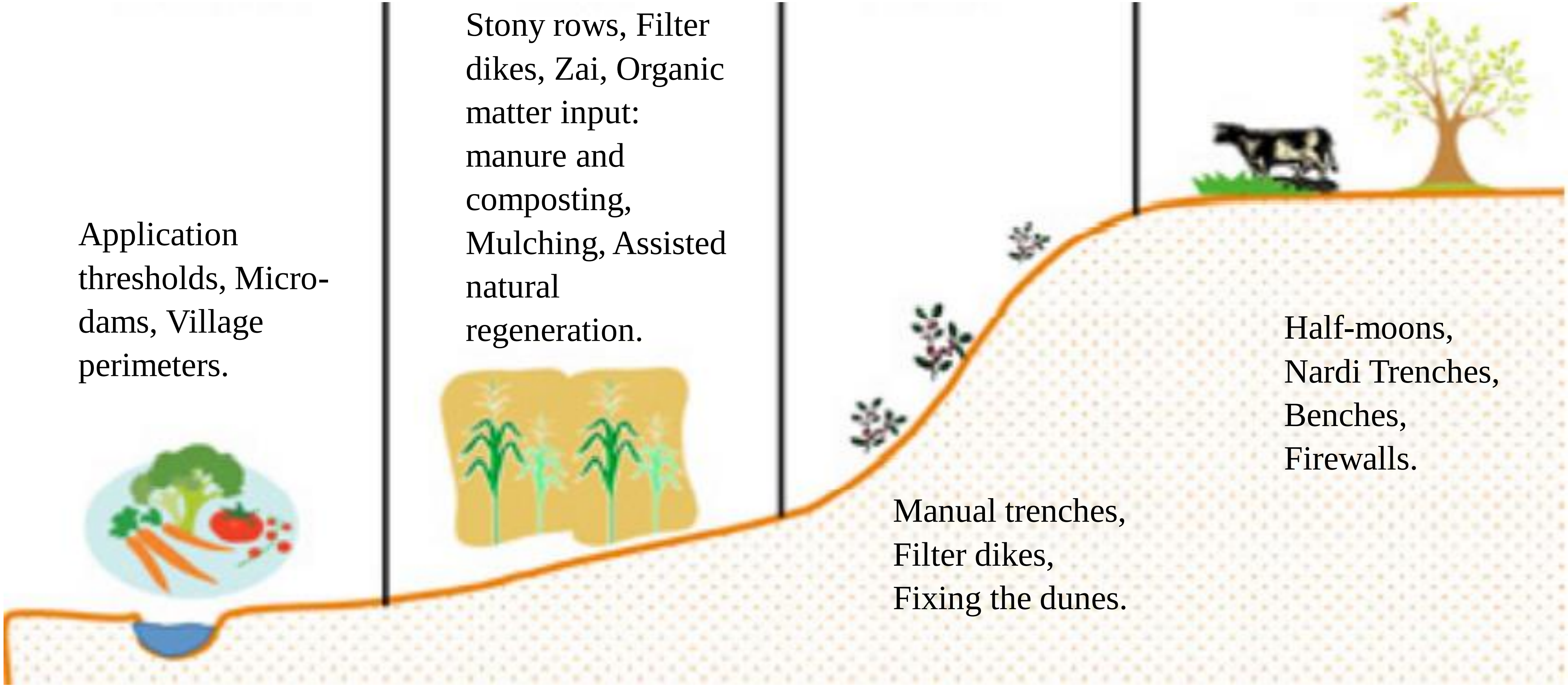
World Overview of Conservation Approaches and Technologies.

2442 SLM Practices

https://wocat.net/en/global-slm-database/

4 ACTION TO BE TAKEN

Site-specific conservation and restoration measures.



Lowland development

Application thresholds, Micro-dams, Village perimeters.

Glacis layout

Stony rows, Filter dikes, Zai, Organic matter input: manure and composting, Mulching, Assisted natural regeneration.

Slope development

Manual trenches, Filter dikes, Fixing the dunes.

Layout of the plateaus

Half-moons, Nardi Trenches, Benches, Firewalls.

5 CONCLUSION AND SUGGESSTIONS

- The measured erosivity index (R) aligns with regional trends, reinforcing the importance of understanding local rainfall dynamics to better predict and manage the effects of extreme precipitation.
- The findings may be applied to improve agricultural methods and utilized as a database to describe the Sudano-Sahelian zone's rainfall regime.

We suggest to:

- Carry out long-term research to monitor variations in the erosivity and intensity of rainfall over several decades.
- Expand the study to include multiple locations across the Sudano-Sahelian zone to capture regional variability in rainfall intensity and erosivity.

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Thank you

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