

REVIEWER'S REPORT

Manuscript No.: IJAR- 59101

Title: *Drought dynamics, vulnerability and adaptation priorities in Sierra Leone: an integrated assessment for climate resilience and sustainable development.*

Recommendation:

Accept as it is

Accept after Major revision.....

Accept after Minor to moderate revision

Do not accept (*Reasons below*)

Rating	Excel.	Good	Fair	Poor
Originality		✓		
Techn. Quality		✓		
Clarity			✓	
Significance			✓	

Reviewer Name: **Dr. ANAPANA GOPAL**

Reviewer's Comment for Publication.

General Comments

The manuscript addresses an important and policy-relevant topic concerning drought dynamics, vulnerability, adaptation, food security, water resources, and climate resilience in Sierra Leone. The attempt to integrate climatic, agricultural, environmental, socio-economic, and institutional dimensions of drought is potentially valuable. The manuscript also provides a broad synthesis of existing information and proposes a national drought monitoring and early-warning framework.

However, in its present form, the manuscript has **moderate methodological and scientific limitations**. Although it is presented as an “integrated assessment,” much of the manuscript is a literature/policy synthesis rather than an original empirical assessment. The Materials and Methods section repeatedly describes datasets and analytical procedures that *could* or *should* be used, rather than clearly demonstrating that these analyses were actually performed. For example, the manuscript states that the recommended dataset for a full empirical implementation includes CHIRPS, CRU, ERA5 and national observations, while the subsequent methods describe procedures for calculating SPI and constructing a vulnerability index without providing the actual datasets, observation period, processing details, weights, or computed outputs.

Therefore, substantial revision is required to clarify the study type, establish a reproducible methodology, distinguish original analysis from literature-derived evidence, and provide quantitative results supporting the conclusions.

1. Originality and Scientific Contribution

The manuscript has a potentially useful contribution because it attempts to connect drought hazard with exposure, vulnerability, adaptive capacity, sectoral impacts, and policy responses.

The conceptual framework:

Drought Risk = Hazard × Exposure × Vulnerability

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is clearly presented, and five dimensions are proposed: climatic conditions, environmental conditions, agricultural exposure, socio-economic vulnerability, and adaptive capacity.

However, the manuscript needs to establish **what is genuinely new** compared with existing Sierra Leone drought studies.

The authors cite previous studies on rainfall variability and drought, including Amara and Ullah, Fayiah et al., Funk et al., and Wadsworth et al.

Recommendation:

The authors should explicitly state:

- What new dataset or analysis is presented.
- Which results were generated by the authors.
- Which results are obtained from previously published studies.
- What distinguishes this assessment from previous drought studies in Sierra Leone.
- Whether the paper is intended as an **original research article, systematic/narrative review, policy assessment, or conceptual framework paper.**

At present, the article appears to combine all four approaches without clearly defining its research design.

2. Moderate Concern: Materials and Methods Do Not Match the Results

This is the most important issue in the manuscript.

The Methods section says:

"The recommended dataset for a full empirical implementation of this study includes..."

and subsequently lists CHIRPS, CRU, ERA5 and national observations.

Similarly, the trend-analysis section states that long-term trends **"should be evaluated"** using Mann-Kendall and Sen's slope methods.

This wording strongly suggests that the analyses are proposed rather than actually performed.

Likewise, the Drought Vulnerability Index section states:

"A composite Drought Vulnerability Index **can be developed...**"

and says that the resulting index *can* be classified into vulnerability categories.

However, the Results section does not provide an actual calculated vulnerability index, district-level scores, weighting scheme, uncertainty estimates, or vulnerability map.

Recommendation:

The authors must either:

A. Conduct the proposed empirical analyses and present the results, or

B. Reframe the manuscript explicitly as a review/conceptual/policy assessment, removing language that implies that quantitative analyses were performed.

The present mixture of proposed methodology and literature-derived results makes the scientific basis of the manuscript difficult to evaluate.

3. Drought Analysis Requires Actual Quantitative Results

The manuscript describes SPI calculation, drought thresholds, severity and intensity equations.

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However, the Results section mainly discusses previously reported drought characteristics rather than presenting the authors' own SPI results.

For example, the manuscript states that previous studies found considerable temporal variability and that drought characteristics differ according to temporal scale.

There are no:

- SPI time-series figures;
- SPI-1, SPI-3, SPI-6 and SPI-12 maps;
- drought-event tables;
- event frequencies;
- duration statistics;
- severity distributions;
- intensity statistics;
- district-level comparisons;
- statistical significance values.

Recommendation:

If SPI is claimed as part of the study methodology, the authors should provide the actual calculations and results.

At minimum, the revised manuscript should include:

1. SPI time-series plots;
2. spatial distribution maps;
3. drought frequency;
4. drought duration;
5. drought severity;
6. drought intensity;
7. temporal trends;
8. statistical significance;
9. regional/district comparisons.

4. Vulnerability Index Is Not Actually Implemented

The manuscript provides a potentially useful vulnerability framework based on exposure, sensitivity and adaptive capacity.

However, the manuscript does not provide:

- the actual indicator dataset;
- indicator values;
- normalization results;
- indicator weights;
- justification for equal versus weighted approaches;
- sensitivity analysis;
- composite vulnerability scores;
- district-level vulnerability classes;
- a final vulnerability map.

The statement that a composite index **“can then be calculated using weighted or equal-weight approaches”** is insufficient for an empirical paper.

Recommendation:

The authors should select and justify one methodology and actually calculate the index.

If no index was calculated, this section should be presented as a **proposed conceptual framework**, rather than as a completed vulnerability assessment.

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5. Results Are Heavily Dependent on Previous Literature

A considerable proportion of the Results and Discussion section reports findings from previous studies and institutional documents.

For example, the projected drought exposure values of 0.07% of land area and 0.05% of population under approximately 1°C warming, increasing to 0.24% and 0.1% under 2°C warming, are attributed to Lange et al. (2020).

Similarly, vulnerability categories under RCP4.5 and RCP8.5 are attributed to the International Center for Biosaline Agriculture.

These are useful contextual findings, but they should not be presented as if they were generated by the present study.

Recommendation:

Clearly distinguish between:

“Our analysis shows...”

and

“Previous studies have reported...”

A separate subsection such as **“Evidence synthesized from previous studies”** may improve transparency.

6. Methodological Reproducibility

The methodology requires considerably more detail.

For SPI, the manuscript states that an “appropriate probability distribution” was fitted to precipitation data.

The authors should specify:

- probability distribution used;
- parameter-estimation method;
- treatment of zero precipitation;
- baseline/reference period;
- missing-data treatment;
- quality-control procedure;
- software/package used;
- spatial aggregation method.

For the Mann–Kendall analysis, the manuscript mentions the test and Sen's slope but provides no actual implementation details.

The revised paper should report:

- test statistic;
- p-value;
- Sen's slope;
- confidence interval;
- significance threshold;
- treatment of serial correlation.

7. Data Sources Need Clarification

The manuscript lists several possible data sources:

- CHIRPS;
- CRU;
- ERA5;
- national meteorological observations;

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- environmental datasets;
- socio-economic datasets.

However, it is unclear which datasets were **actually used**.

This is particularly important because the paper presents itself as an assessment rather than merely a research proposal.

Recommendation:

Provide a comprehensive data table containing:

Dataset	Variable	Period	Spatial resolution	Source	Actual use
CHIRPS	Precipitation	—	—	—	Clarify
CRU	Climate variables	—	—	—	Clarify
ERA5	Temperature	—	—	—	Clarify
Socio-economic data	Vulnerability indicators	—	—	—	Clarify

The Data Availability section currently states that datasets “**used in a full empirical implementation**” may be obtained from CHIRPS, CRU and national institutions. This wording further indicates that a full empirical analysis may not have been conducted.

8. Need Stronger Distinction Between Hazard, Exposure and Vulnerability

The conceptual framework is appropriate, but the manuscript sometimes moves directly from climatic exposure to vulnerability without demonstrating the intermediate relationships.

For example, the northern and north-eastern regions are described as requiring particular attention because of comparatively lower rainfall, rain-fed agriculture, seasonal water scarcity, limited irrigation, environmental degradation and limited household resources.

These are plausible factors, but the manuscript should demonstrate whether they were quantitatively assessed or simply synthesized from previous evidence.

Recommendation:

Provide an explicit analytical framework:

Hazard → Exposure → Sensitivity → Adaptive Capacity → Risk

and identify the actual indicators used at each stage.

9. Agricultural Vulnerability Section

The agricultural discussion is relevant and provides a useful description of how drought can affect germination, crop establishment, vegetative growth, flowering, livestock water availability and pasture productivity.

However, the statement that:

“Agriculture represents the most vulnerable sector to drought impacts”

should be supported by a defined comparative vulnerability assessment rather than presented as an unsupported overall conclusion.

The manuscript also states that more than two-thirds of the population is directly involved in subsistence farming.

The source and definition of this statistic should be carefully verified and clearly described.

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10. Water-Resource Analysis

The water-security section contains potentially valuable information concerning Guma Valley Water Company, water supply, infrastructure and previous adaptation projects. However, the section is largely descriptive.

There is no quantitative analysis of:

- river discharge;
- groundwater levels;
- reservoir storage;
- groundwater recharge;
- water demand;
- drought-related changes in water availability.

Therefore, the terminology **“water-resource assessment”** should be used cautiously unless actual hydrological data are incorporated.

11. Public Health, Transport and Energy

The manuscript appropriately recognizes that drought may have cascading effects on public health, transport and energy.

Nevertheless, these sections rely heavily on institutional statements and do not present primary evidence.

For example, claims concerning heat stress, PM2.5, waterborne diseases, reduced hydropower generation and transport disruption should either be:

- supported with quantitative evidence; or
- explicitly presented as documented/potential impacts based on cited sources.

12. Policy Analysis Needs a More Systematic Approach

The manuscript provides extensive discussion of:

- NDC 3.0;
- Feed Salone;
- Climate Resilient Water Investment Programme;
- climate finance;
- World Bank projects;
- community-level adaptation.

This is one of the stronger components of the manuscript, but the policy analysis remains mainly descriptive.

A systematic policy-assessment table would substantially improve the paper.

For example:

Policy/Programme	Drought-related objective	Target sector	Geographic focus	Implementation status	Identified gap
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This would make the policy synthesis more analytical rather than simply narrative.

13. Adaptation Recommendations Are Too General

The manuscript recommends drought-tolerant crops, irrigation, rainwater harvesting, watershed protection, groundwater monitoring, early-warning systems, improved climate data, institutional coordination and climate-finance readiness.

These recommendations are relevant, but many are already widely recognized adaptation measures.

The authors should explain:

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- Why each intervention is appropriate for Sierra Leone;
- Which regions should receive priority;
- Which sectors should be prioritized;
- Who should implement each intervention;
- What data are required;
- How effectiveness should be monitored;
- What constraints may prevent implementation.

A **priority matrix** would strengthen the practical contribution.

14. Proposed Drought Early-Warning Framework

The proposed framework is potentially useful and integrates meteorological, agricultural, hydrological, socio-economic and early-warning indicators.

However, it remains conceptual.

The authors should provide a clearer operational framework showing:

Data collection → indicator generation → drought classification → impact assessment → alert generation → communication → response → evaluation

The responsible institution, temporal frequency, spatial scale, trigger thresholds and communication mechanism should also be specified.

15. Figures, Maps and Tables

For a manuscript with the stated objectives, the absence of substantive quantitative figures/maps is a moderate weakness.

The revised manuscript should ideally include:

1. **Map of Sierra Leone study area and administrative districts**
2. **Spatial rainfall distribution**
3. **Historical precipitation trends**
4. **SPI drought maps**
5. **Drought frequency map**
6. **Drought severity/duration map**
7. **Vulnerability index map**
8. **Agricultural exposure map**
9. **Water-resource vulnerability map**
10. **Integrated drought-risk map**
11. **Conceptual framework diagram**
12. **Operational drought early-warning framework**

The present Table 2 is useful conceptually, but additional quantitative tables are required if the paper is to remain an empirical assessment.

16. Internal Consistency and Repetition

The objectives are stated twice in the Introduction, first as five objectives and later as six objectives.

The manuscript should retain **one definitive set of research objectives**.

There is also substantial repetition between:

- Introduction;
- Results and Discussion;
- Adaptation priorities;
- Conclusion.

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For example, the importance of northern/north-eastern regions, rain-fed agriculture, water insecurity, and adaptive capacity is repeated several times.

The manuscript should be streamlined to avoid repetition.

17. Conclusion Needs Revision

The conclusion summarizes several important points, including drought exposure, agricultural vulnerability, water insecurity, policy development and institutional constraints.

However, some statements are stronger than the evidence presented.

For example:

“These projections likely underestimate actual risk...”

This is an interpretive claim that requires stronger evidence.

The conclusion should focus primarily on findings directly demonstrated by the study and distinguish them from implications derived from the literature.

18. References and Citation Quality

The reference list requires careful editorial and bibliographic checking. Several references are institutional documents, websites or reports rather than conventional peer-reviewed literature. This is acceptable for policy analysis, but the manuscript should distinguish between:

- peer-reviewed scientific literature;
- government reports;
- institutional reports;
- project documents;
- web-based information.

There are also citation inconsistencies. For example, the manuscript uses “**IMF eLibrary**” in the text but the reference list contains several separate IMF references.

The authors should verify every in-text citation against the reference list.

The citation to Funk et al. (2015) should also be used carefully because the cited paper concerns the CHIRPS precipitation record, whereas several statements in the manuscript appear to use it as evidence for broader drought characteristics.

19. Language and Editorial Issues

The manuscript requires professional English-language editing.

Examples include:

- “Key words:-” should be standardized to **Keywords**
- Heading punctuation such as “Introduction:-”, “Results and discussions:-” should be removed or standardized.
- “The SPI were calculated” should be “**SPI was calculated**”.
- “4. Results and discussions” should preferably be “**4. Results and Discussion.**”
- Repeated statements should be consolidated.
- Long sentences should be divided for readability.
- Terminology should be standardized throughout the manuscript.

The manuscript would benefit from thorough grammatical and stylistic editing before publication.

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Strengths of the Manuscript

- The topic is highly relevant to climate resilience and sustainable development.
- The manuscript considers drought as a **multi-dimensional risk** rather than simply a precipitation deficit.
- The integration of hazard, exposure, vulnerability and adaptive capacity is conceptually appropriate.
- Agricultural and water-security implications are discussed in considerable detail.
- The manuscript attempts to connect scientific evidence with national policy and adaptation planning.
- The proposed national drought monitoring framework has potential practical relevance.
- The limitations section appropriately acknowledges uncertainties associated with global-model projections and the available evidence base.

Overall Recommendation

The manuscript addresses an important and under-integrated aspect of climate risk in Sierra Leone and contains potentially useful conceptual and policy material. However, **the current version does not yet provide sufficient original quantitative analysis to support its presentation as an integrated empirical assessment.**

The central issue is the mismatch between the proposed methodology and the evidence actually presented. The authors should either undertake and report the quantitative analyses described in the Methods section or substantially reframe the manuscript as a systematic/narrative evidence synthesis and policy assessment.

Recommendation: Moderate Revision

Final Decision: Minor to Moderate Revision

The manuscript may become suitable for publication after substantial revision addressing the methodological transparency, empirical evidence, distinction between original and secondary findings, quantitative analysis, figures/maps, and overall presentation.