

REVIEWER'S REPORT

Manuscript No.: IJAR- 58667

Title: **Analyse de la productivité des terres dans la commune de Bouné (Niger) à partir d'un proxy de Google Earth Engine.**

Recommendation:

Accept as it is

Accept after Minor revision.....

Accept after major revision

Do not accept (*Reasons below*)

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

Reviewer Name: **ANAPANA GOPAL**

Reviewer's Comment for Publication.

General Comments

The manuscript addresses an important issue in the Sahel: the spatial and temporal dynamics of land productivity and land degradation in Bouné, Niger. The study uses Landsat-derived NDVI time series from **2002–2024**, Google Earth Engine processing, linear regression and the Mann–Kendall test, supplemented by land-use classification and field observations.

The manuscript has good potential and presents useful spatial information. However, several methodological details are insufficiently described, and some interpretations appear stronger than what the presented analysis can demonstrate. **Minor revision is recommended.**

Minor Comments

1. The title should be revised

The phrase “**à partir d'un proxy de Google Earth Engine**” is technically unclear. Google Earth Engine is the processing platform, whereas NDVI is the proxy/indicator used for land productivity.

A clearer title would be:

Analyse spatio-temporelle de la productivité des terres dans la commune de Bouné (Niger) à partir des séries temporelles NDVI de Landsat traitées sous Google Earth Engine

This better reflects the actual methodology described in the manuscript.

2. NDVI should not be presented as direct land productivity

The manuscript appropriately describes NDVI as a **proxy** for land productivity.

However, several statements later equate changes in NDVI directly with changes in biomass production or productivity.

The authors should consistently distinguish:

- NDVI trend;
- vegetation productivity proxy;

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- actual biomass/productivity.

A positive NDVI trend does not necessarily mean a proportional increase in actual agricultural or ecological productivity.

3. The Landsat time-series processing requires substantially more detail

The manuscript states that Landsat TM, ETM+ and OLI data from 2002–2024 were used and that images with cloud cover below 10% were retained.

However, important processing details are missing:

- exact Landsat collections/products used;
- surface reflectance versus top-of-atmosphere data;
- cloud and cloud-shadow masking method;
- treatment of Landsat 7 SLC-off data;
- harmonization between TM, ETM+ and OLI sensors;
- number of images retained per year;
- temporal compositing procedure for the NDVI series;
- treatment of missing observations.

These details are essential for reproducibility.

4. The temporal aggregation of NDVI is unclear

The manuscript says that the data constitute a time series of NDVI from 2002–2024, but it does not clearly explain whether the analysis used:

- annual mean NDVI;
- annual maximum NDVI;
- seasonal NDVI;
- monthly NDVI composites; or
- another statistic.

This is particularly important in a strongly seasonal Sahelian environment.

The authors should explicitly state the temporal aggregation method and justify why it is appropriate for measuring land productivity.

5. Rainfall effects need to be controlled or discussed more rigorously

This is a Minor issue.

The manuscript itself reports substantial changes in rainfall, including positive rainfall shifts in 1997 and 2016.

Yet NDVI is strongly influenced by precipitation in Sahelian environments.

The authors interpret the decline in productivity after 2013 as being increasingly driven by anthropogenic pressure.

This conclusion is plausible, but the current analysis does not demonstrate that anthropogenic pressure is the dominant cause.

At minimum, the authors should:

- analyse NDVI together with annual/seasonal rainfall;
- calculate the NDVI–rainfall relationship;
- discuss whether the observed NDVI trends remain after accounting for rainfall variability.

Otherwise, causal interpretations should be moderated.

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6. The Mann-Kendall methodology needs more information

The manuscript states that linear regression was applied and that the Mann-Kendall test was used to assess significance at $p \leq 0.05$.

However, the authors should specify:

- whether the test was applied pixel-by-pixel;
- the number of temporal observations per pixel;
- whether serial autocorrelation was tested;
- whether a modified Mann-Kendall test was used where autocorrelation existed;
- whether Sen's slope was calculated.

For long environmental time series, autocorrelation can affect the validity of the ordinary Mann-Kendall significance test.

7. The classification methodology is incomplete

The manuscript states that supervised classification was performed using the **maximum likelihood algorithm in ENVI 5.3** for 2002, 2013 and 2024.

However, the manuscript does not provide sufficient information on:

- training samples;
- number of training samples per class;
- source of training/reference data;
- validation samples;
- overall accuracy;
- producer's accuracy;
- user's accuracy;
- Kappa coefficient or another accuracy metric;
- confusion matrices.

Without classification accuracy assessment, the reliability of the reported changes in land-use classes cannot be adequately evaluated.

This should be added before publication.

8. Some land-use changes need reconciliation

The manuscript reports:

- pastoral areas: 41% → 46% → 32%;
- rain-fed crops: 31% → 30% → 43%;
- irrigated crops: 25% → 17% → 18%;
- active dunes: 3% → 7% → 7%.

These are useful results, but the authors should provide a **transition matrix** showing where the changes occurred.

For example, it would be particularly informative to quantify:

pastoral → rain-fed agriculture

rather than simply comparing class percentages at three dates.

This would substantially strengthen the land-use change analysis.

9. The statement that restoration caused higher productivity requires stronger evidence

The manuscript states that areas benefiting from restoration—including dune fixation and assisted natural regeneration—correspond largely to areas showing productivity improvement.

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This is an important observation, but spatial coincidence alone does not establish that restoration caused the NDVI improvement.

The authors should either:

- provide quantitative evidence comparing restored and non-restored areas; or
- change the wording to indicate **spatial association/correspondence rather than causal effect**.

10. Field validation is insufficiently described

The abstract states that the results were **validated by field observations**.

However, the Methods do not adequately describe:

- number of field verification sites;
- selection criteria;
- GPS coordinates;
- dates of field observations;
- variables recorded;
- how field observations were incorporated into validation.

The authors should provide a dedicated subsection describing the field-validation protocol.

11. The interpretation of "degradation" should be more cautious

The manuscript classifies statistically significant negative NDVI trends as potential degradation and non-significant trends as stable.

This is reasonable within the selected productivity framework, but **NDVI decline alone does not necessarily prove land degradation**.

The authors should acknowledge possible alternative explanations such as:

- rainfall variability;
- land-use conversion;
- seasonal differences;
- flooding;
- changes in cropping patterns;
- sensor-related differences.

The term "**potential degradation**" should be retained consistently.

12. The manuscript should distinguish land-use change from productivity change more systematically

One of the strongest aspects of the paper is the recognition that land-use change and ecological functioning do not necessarily follow the same trajectory.

This point should be developed quantitatively.

A cross-tabulation of:

Land-use class × productivity trajectory

for each period would significantly strengthen the manuscript.

13. The discussion sometimes moves from correlation to causation

For example, the manuscript attributes degradation to:

- agricultural expansion;
- cultivation of marginal land;
- sesame cultivation;
- anthropogenic pressure.

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These are reasonable hypotheses supported partly by field observations, but the remote-sensing analysis itself does not establish causality.

The language should therefore be changed from:

"is caused by"

to:

"may be associated with,"

"is consistent with," or

"may reflect."

14. The rainfall-productivity relationship should be integrated into the analysis

The study provides rainfall information in the study-area description but does not quantitatively integrate rainfall with NDVI trends.

Because the manuscript argues that productivity dynamics changed despite relatively favourable rainfall, a rainfall-NDVI analysis would be highly valuable.

A simple correlation or regression between seasonal/annual rainfall and NDVI could substantially strengthen the central argument.

15. The NDT framework is incomplete

The Introduction correctly notes that the UNCCD Land Degradation Neutrality framework considers:

1. land-cover/land-use change;
2. land productivity;
3. soil organic carbon.

However, the present study only analyses land cover and productivity.

The manuscript should explicitly state that **soil organic carbon was not assessed**, and therefore the study does not constitute a complete three-indicator NDT assessment.

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16. Abstract

The abstract is generally well structured and contains useful quantitative results.

However, it should mention:

- the spatial unit of analysis;
- the principal methodological approach;
- the limitation that NDVI is a proxy rather than direct productivity measurement.

17. Keywords

The keywords are currently:

Land productivity, Google Earth Engine, NDVI, Bouné, Niger.

Consider adding:

Land degradation; Remote sensing; Landsat; Sahel; Land Degradation Neutrality

18. Figure numbering is inconsistent

There is a clear numbering problem.

The land-use map is identified as **Figure 2**, while the productivity map is also identified as **Figure 2**.

The productivity figure should probably be **Figure 3**.

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All figure references should be checked throughout the manuscript.

19. Figure 2 needs clearer presentation

The land-use figure contains maps and a percentage table, but the visual presentation could be improved.

The authors should ensure:

- readable legends;
- consistent colours between years;
- clearly visible class labels;
- north arrow and scale bar;
- consistent map extent;
- high-resolution export.

20. The photographs are useful but need stronger integration

The photographs provide useful field evidence, including sesame cultivation, pastoral-area sand burial, irrigated cultivation and active dunes. Pages 6–8 visually document these conditions.

However, the text should explicitly explain what each photograph demonstrates and how it supports the remote-sensing findings.

21. Grammar and formatting require substantial proofreading

There are several typographical and formatting problems, including:

- inconsistent spacing;
- inconsistent use of punctuation;
- "Figure 2" duplication;
- "A. 3.2." formatting;
- inconsistent capitalization of section headings;
- occasional missing spaces after punctuation.

The manuscript should undergo careful French language editing before publication.

22. References need standardization

The reference list is generally relevant, but formatting is inconsistent. The authors should check:

- author formatting;
- journal names;
- volume and issue;
- page numbers;
- DOI presentation;
- consistency between citations and references.

For example, the reference list contains several recent 2026 references, which should be checked carefully for complete bibliographic information.

Strengths of the Manuscript

1. **Relevant environmental problem** in the Sahelian context.
2. Long temporal coverage (**2002–2024**) using Landsat imagery.
3. Use of **Google Earth Engine** provides an appropriate platform for processing large satellite datasets.

International Journal of Advanced Research

Publisher's Name: Jana Publication and Research LLP

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4. Combination of **land-use/land-cover analysis and NDVI productivity dynamics**.
5. Use of both **linear regression and Mann-Kendall testing**.
6. Inclusion of field observations and photographs.
7. The finding of a reversal from predominantly improving productivity during **2002-2013** to increased degradation during **2013-2024** is potentially significant.
8. The manuscript makes a useful distinction between changes in land use and changes in ecological functioning.

Final Recommendation

Decision: MINOR REVISION

The manuscript has a **good research topic, useful long-term satellite dataset, and potentially publishable results**, but the methodological description and statistical validation need strengthening.