

Developing Geospatial Indicators to Assess and Monitor Food Security in West Africa



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Objective

Geospatial indicators have been historically used to identify potential food insecurity; however in West Africa, these indicators have been based on unreliable and difficult to obtain ground reports due to extreme weather conditions. Additionally, only climatic factors have been assessed, not taking consideration of social and governmental factors. **The goal of this analysis is to create a meaningful set of indicators through GIS that can be used by analysts to effectively determine the location of food insecurity and instability in West Africa.**

A Geospatial Indicator is an observable trait, trend or characteristic that can be seen from satellites and can identify a situation or crisis.

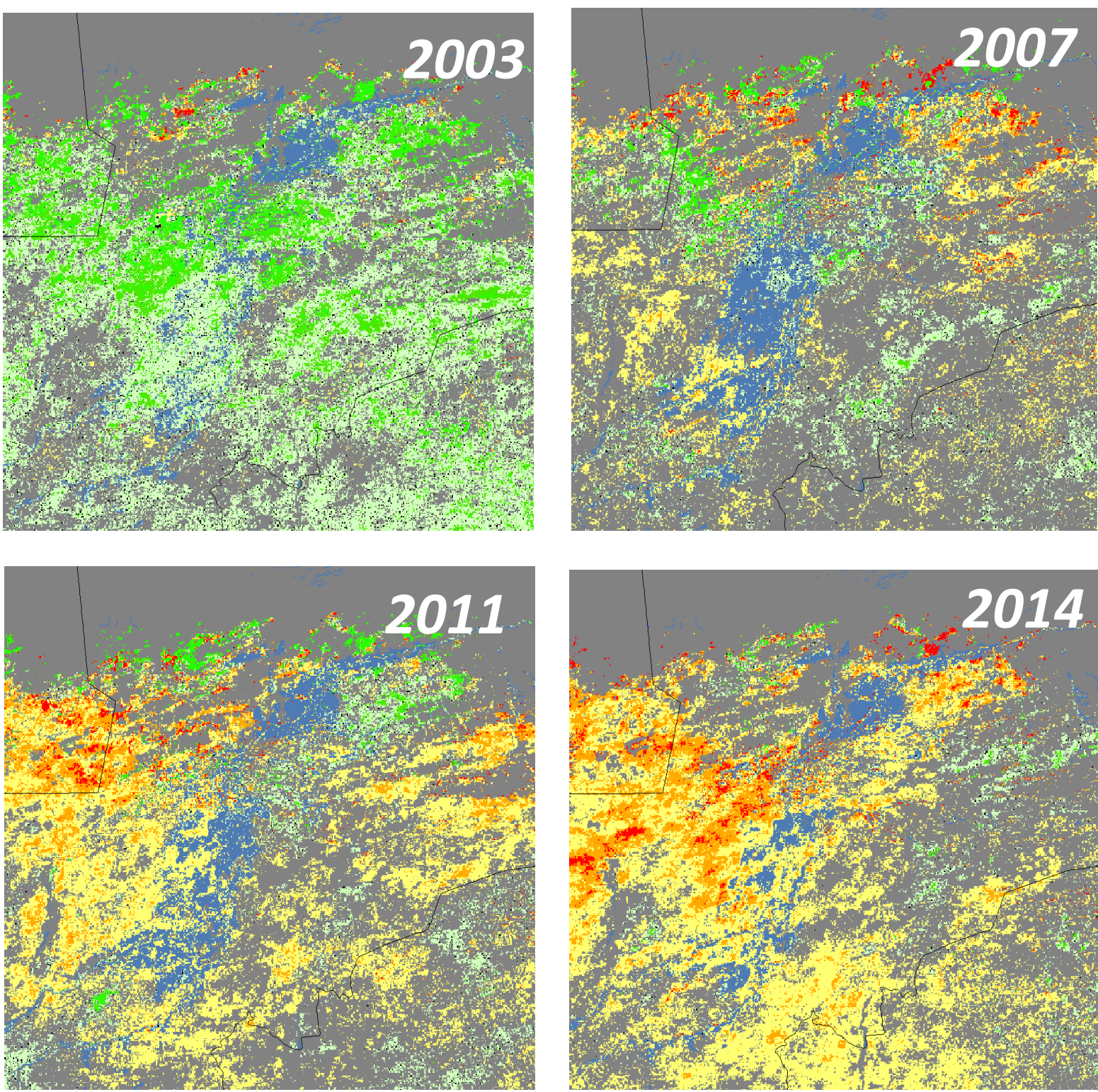
Study Area

The Inner Niger Delta, Mali will be used as the study area as it is the most agriculturally productive region in West Africa; it is a seasonal lifeline to millions, acting as a strategic asset to West Africa food security and stability. However, food insecurity still persists. Recent environmental changes and human activities have caused a drastic rise in food security. **After studying this ongoing crisis, 7 indicators have been developed that can be identified through satellites that allow analysts to project food security crises in West Africa.**

Methods

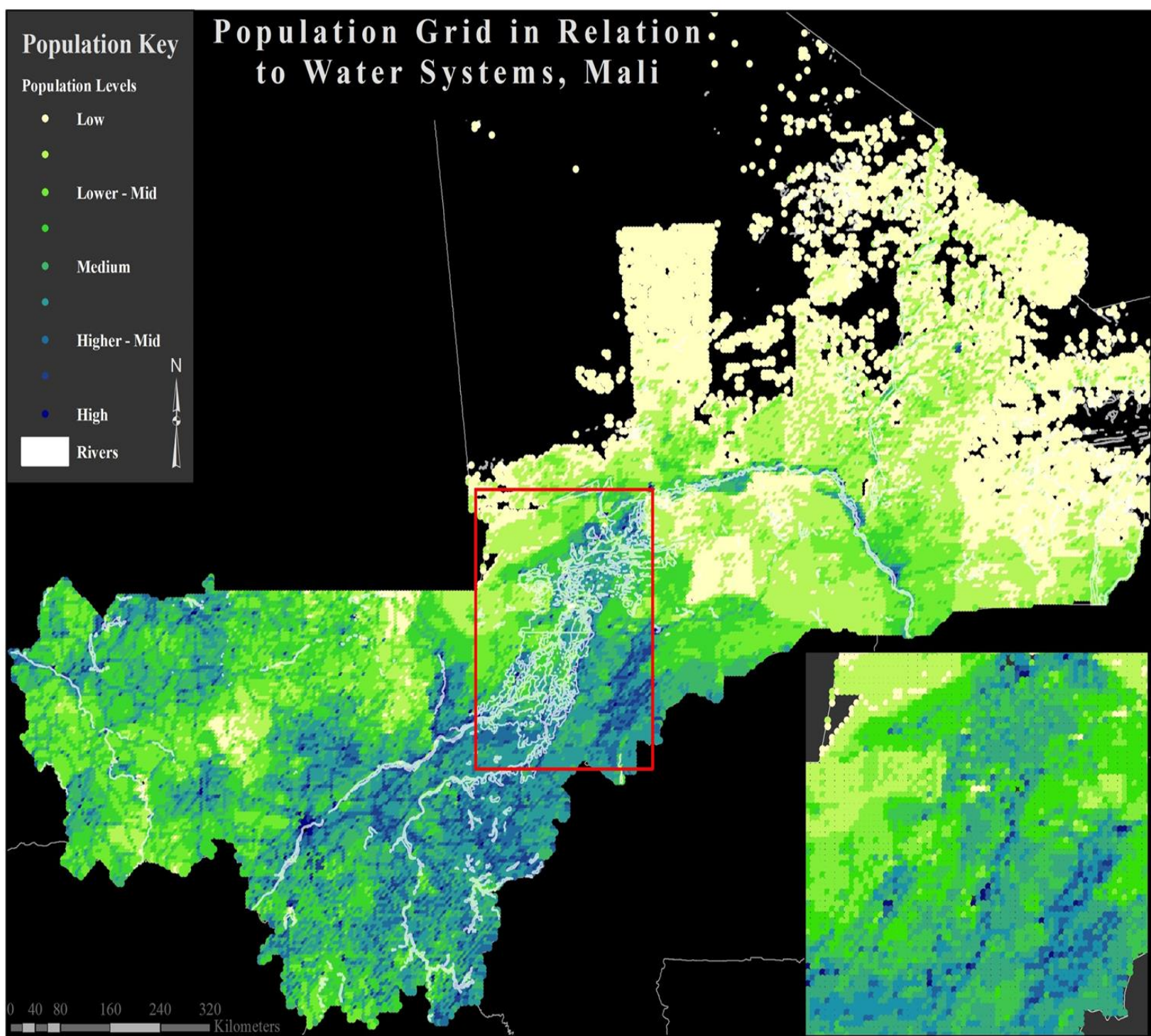
Indicator	Method
Indicator 1 and 2: Identify areas displaying significant changes in vegetation health (NDVI) and water absorption (ET)	Normalized Difference Vegetation Index (NDVI) or Evapotranspiration (ET)
Indicator 3: Identify high populations dependent on areas showing lowering vegetation health and water absorption.	Population Dynamics
Indicator 4: Identify areas being used for food production and potentially productive land covers being underutilized.	Land Use – Land Cover Classification

Indicator 1 and 2: What areas are showing significant seasonal changes in vegetation health or water absorption?



Results from water absorption levels indicate that the Inner Niger Delta has seen significant water absorption changes over the course of 11 years. Vegetation health results were similar to this, indicating that this area has a general potential for a food security crisis. However, more indicators are needed to accurately make this assessment.

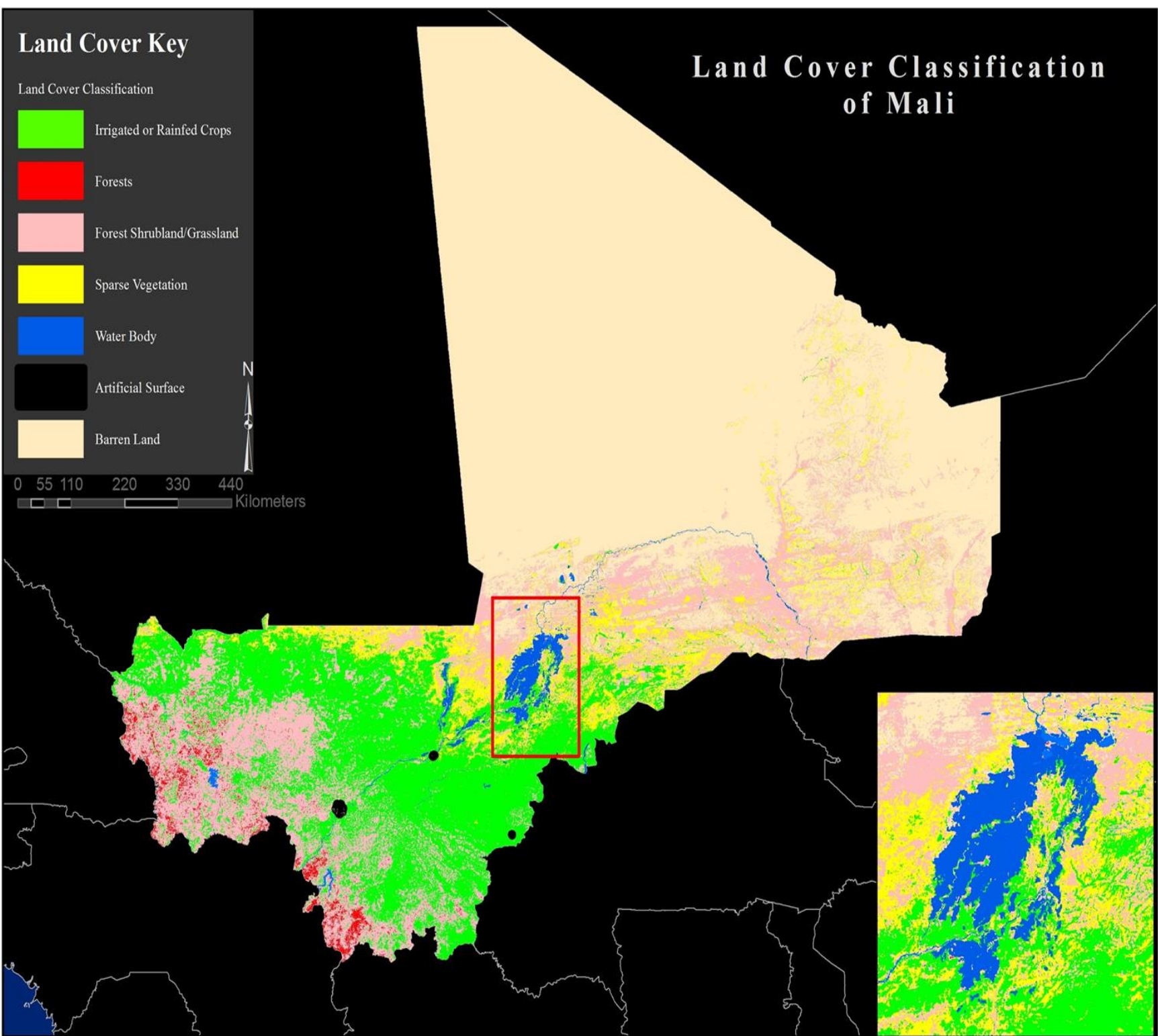
Indicator 3: What areas have a high population that are dependent on areas with lowering vegetation and water absorption measurements? (from indicator 1 and 2)



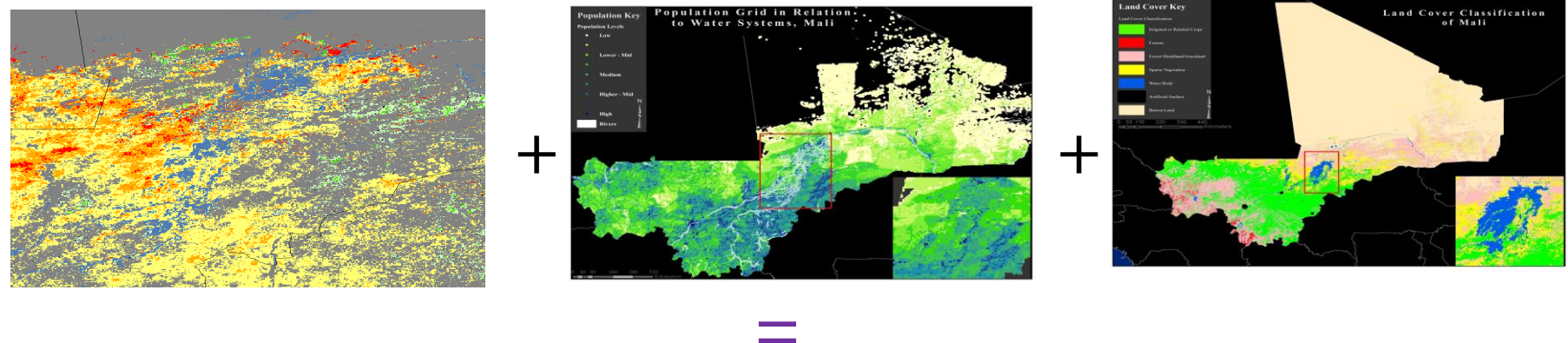
Results

Results from assessing where the population lives in correlation to grown agriculture indicate that a significant amount of people live around the Inner Niger Delta. This is extremely problematic as these areas of highly agriculturally dependent populations are overlaid by the same area showing significant negative changes in water absorption and vegetation health measurements. From this, a more accurate assessment can be made that this area is prone to a food security crisis. However, one last geospatial indicator is needed to make this judgement.

Indicator 4: What areas are currently being used for food production and are they being underutilized or mismanaged?



Land Cover Land Use Classifications classify the physical earth's surface, helping to distinguish between agriculturally productive and non productive land. Results showed a significant amount of non-productive sparse vegetation (shown in yellow in the map above) around the Inner Niger Delta. Given that large amounts of people are living in these non-productive area, the population is not able to effectively utilize and manage the land properly. Given these four different indicators, analysts can have a clear picture that the Inner Niger Delta has a strong potential for a food security crisis.

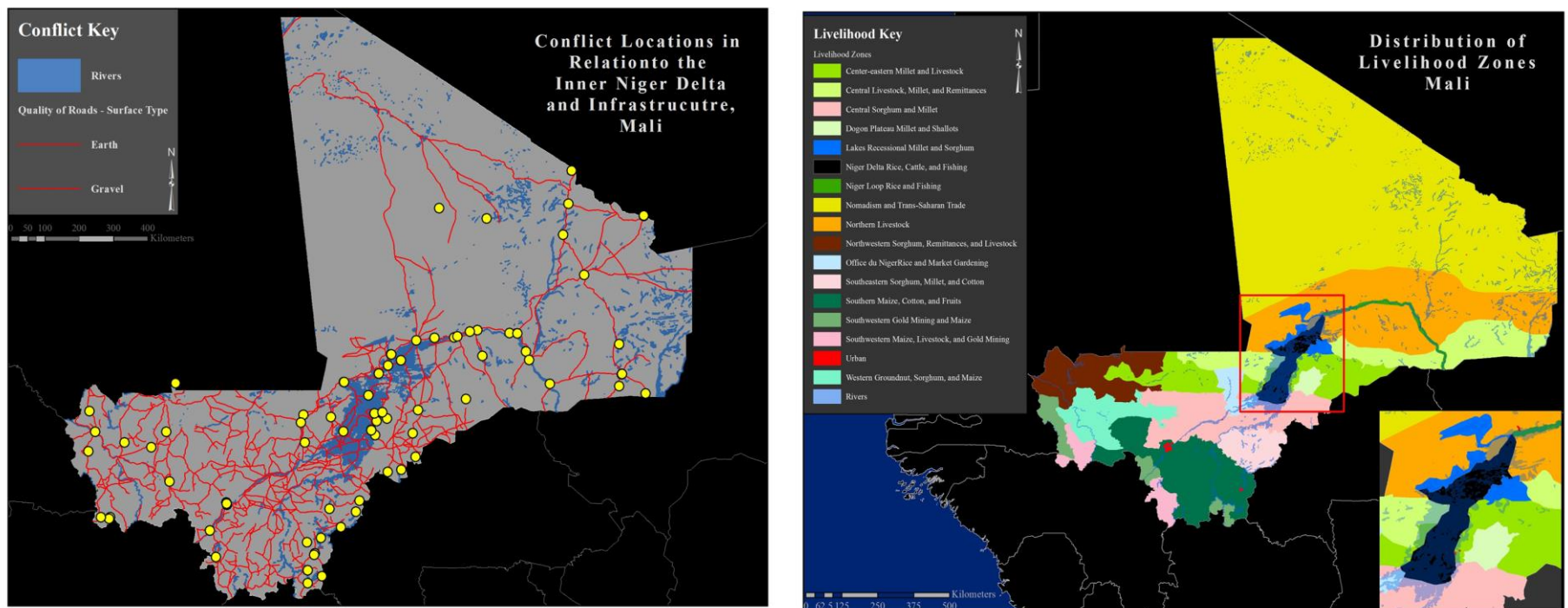


Strong potential for food security crisis

But what if an analyst wants to look into a situation more in depth?

Indicator 5: What are the current food sources under threat from disruptive forces?

Indicator 6 and 7: Where is there ineffectual ingestion and distribution of vital food sources due to infrastructure? Is conflict in close proximity to key infrastructure, food production or population sites?

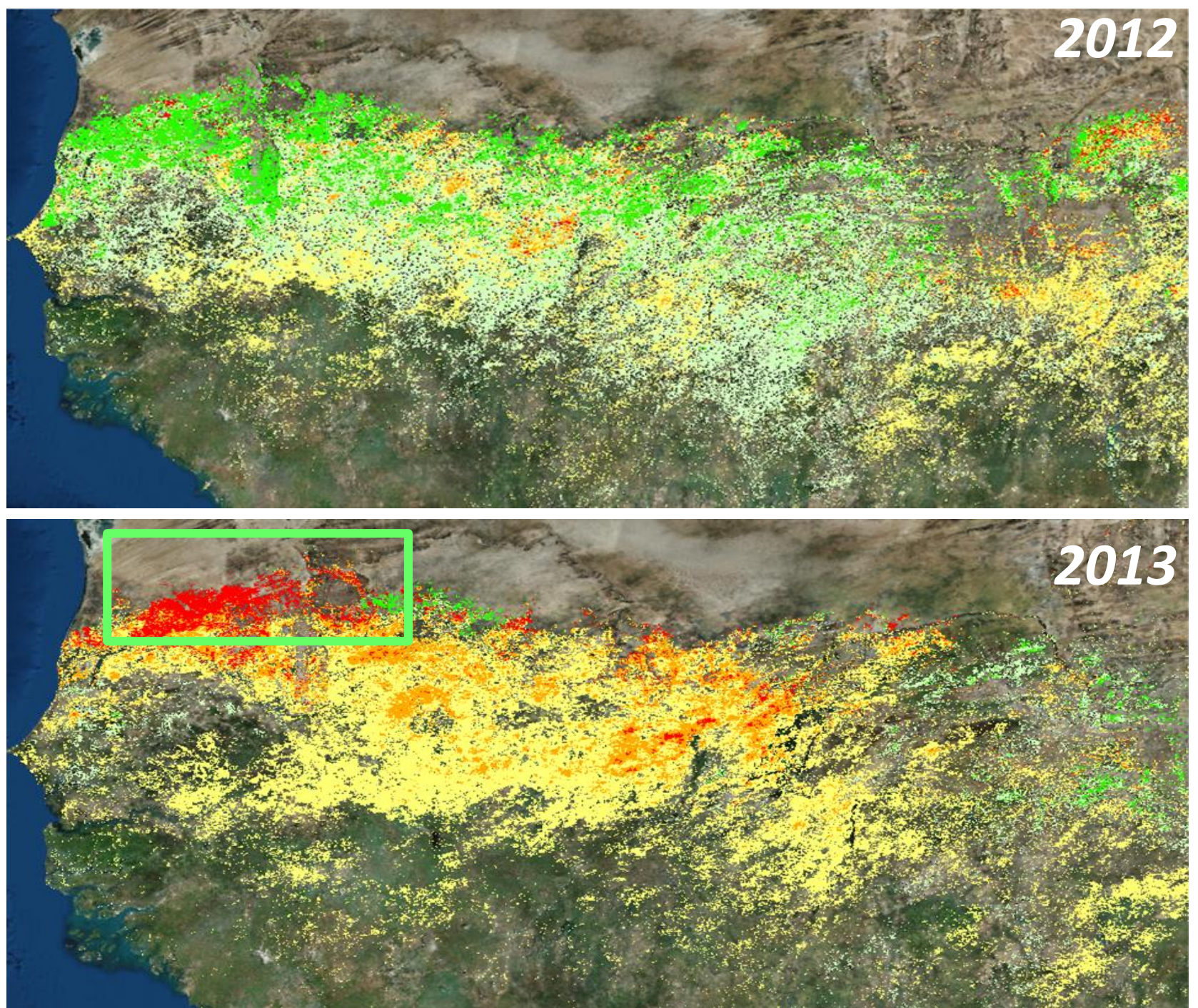


Indicators 5 - 7 do not have to be utilized by an analyst, however its usage may be useful as it provides a more in-depth assessment of what makes a particular location unique to food security. If a more clear and accurate assessment is needed, identifying these three additional indicators are crucial:

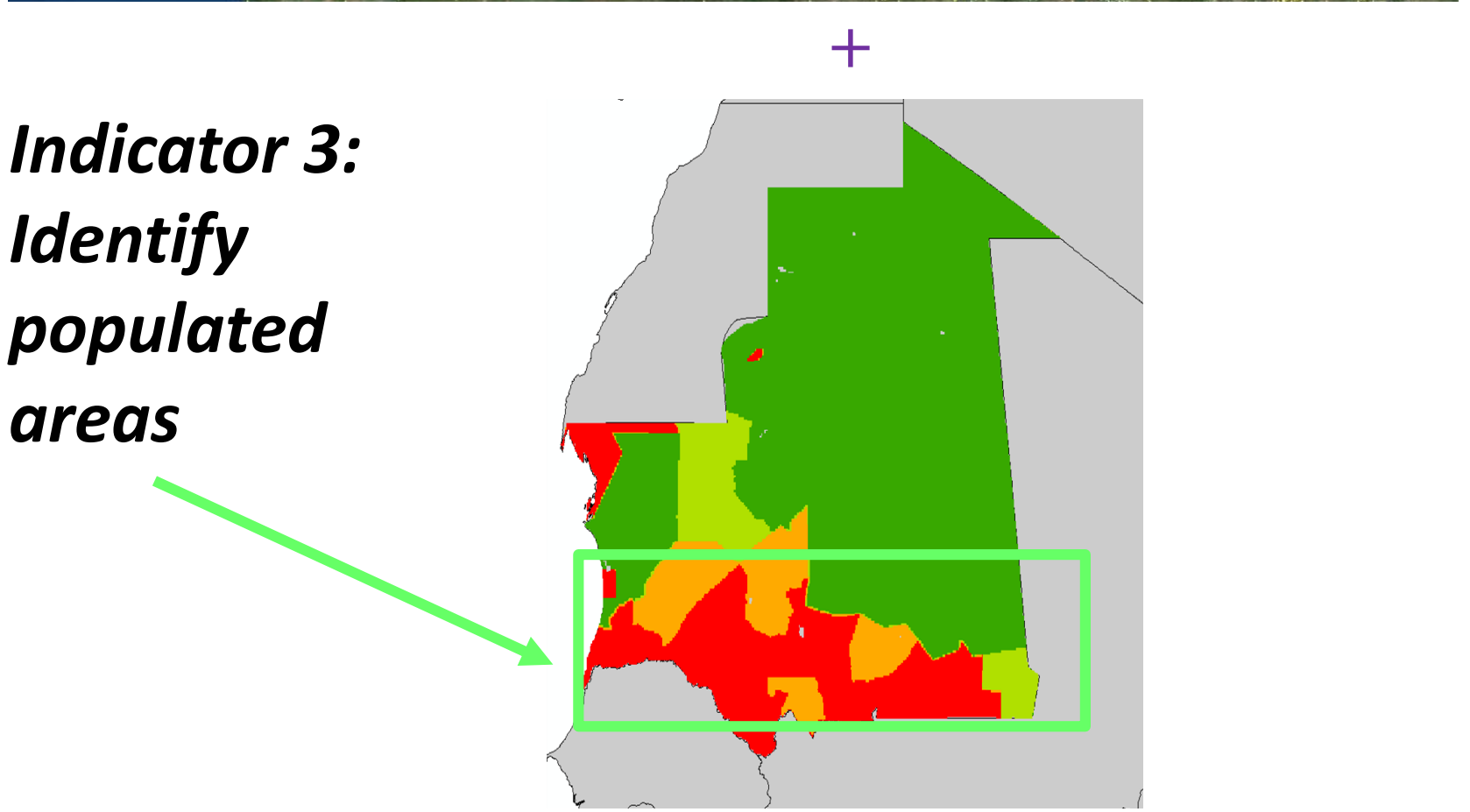
- 1) By analyzing Livelihood Zones, analysts can have a better sense of what food sources are currently available and how they survive given these resources.
- 2) Analyzing infrastructure will determine if current roads are able to move and distribute food to where it is needed. Poor quality roads are great indicators that this area will not be able to distribute and ingest food produced from the Inner Niger Delta.
- 3) By identifying where conflict is located in proximity to infrastructure, food production or population sites, analysts can have a better understanding of the distribution and ingestion of food sources. Conflict can close down roads and cut off main food distribution paths to the proper and necessary locations.

Conclusion: Can This Be Applied to West Africa?

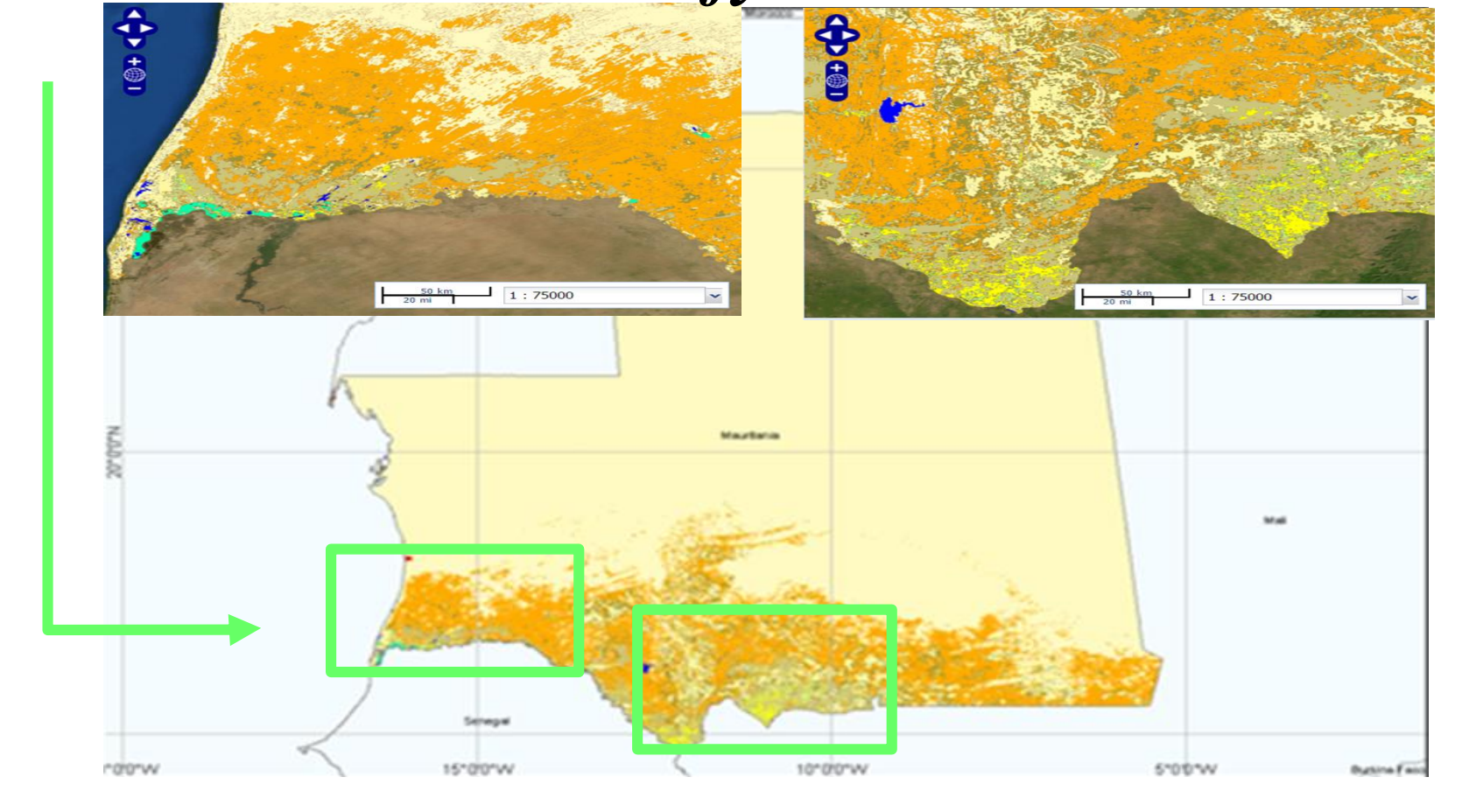
Indicator 1/2: Identify changes in vegetation health or water absorption levels



Indicator 3: Identify populated areas



Indicator 4: Identify Land Cover Trends



Area of Interest: Mauritania/Senegal Border

General research was then done to see if the Mauritania/Senegal border is food insecure. Results showed that this area has seen significant human-environment changes and food security has become a rising concern. **These indicators were successfully able to identify where food insecurity persists in West Africa. The use of these food indicators can be applied to assess anywhere across the world.**