

Mapping and measuring the intensity of mining activities in southwestern Ghana

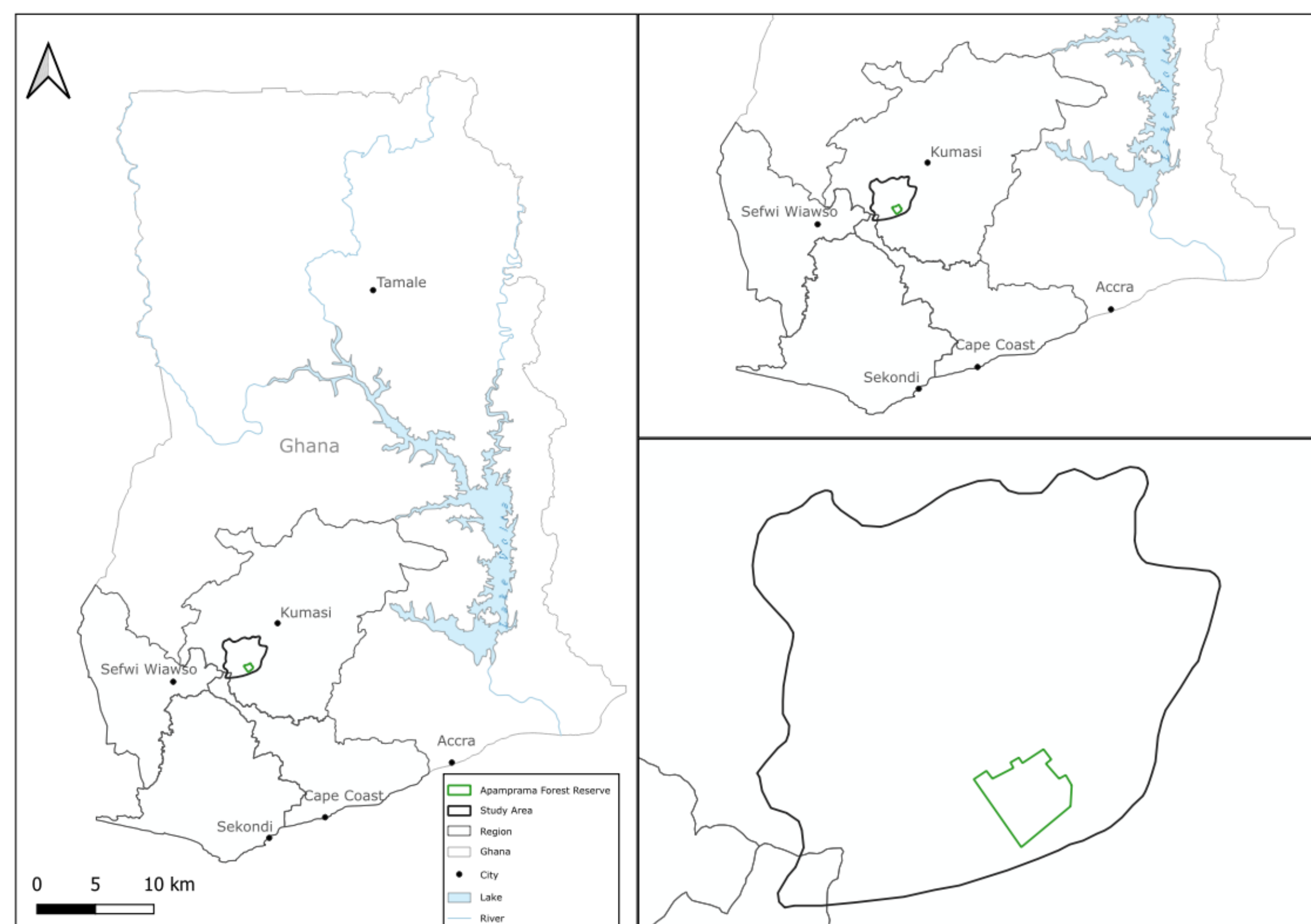
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Abstract

This poster presents data and generalizable methods to quantify the spatial distribution of gold mining along the Pra River in southwestern Ghana. The data are land cover maps for 2015, 2017, 2019, and 2021 with three land cover categories: Illegal Artisanal-small scale mining (ASM), Vegetation, and Other. We used intensity analysis at the interval, categorical, and transitional levels to assess the relationship between ASM and the other two land cover categories, thus providing an opportunity to link patterns to the processes of change. The interval level change intensity shows that change is fastest during 2015-2017 and slowest during 2017-2019. Categorical intensity analysis reveals that the gain of ASM is active from 2015-2017 and 2019-2021 but dormant during 2017-2019. In addition, the categorical level intensities showed that most of ASM's gains derive from Exchange during 2015-2017 and Quantity during 2019-2021. The transitional level intensity showed that although ASM gained from both Vegetation and the Other category during all time intervals, it targeted the Other category. The poster provides methods to create data and measure the change concerning ASM in a way that can facilitate informed discussions concerning the devastating effects of ASM on the environment.

Study Area



Impacts of Artisanal-small scale mining on vegetation and water bodies in the study area. Image Source: 2023 CNES / Airbus

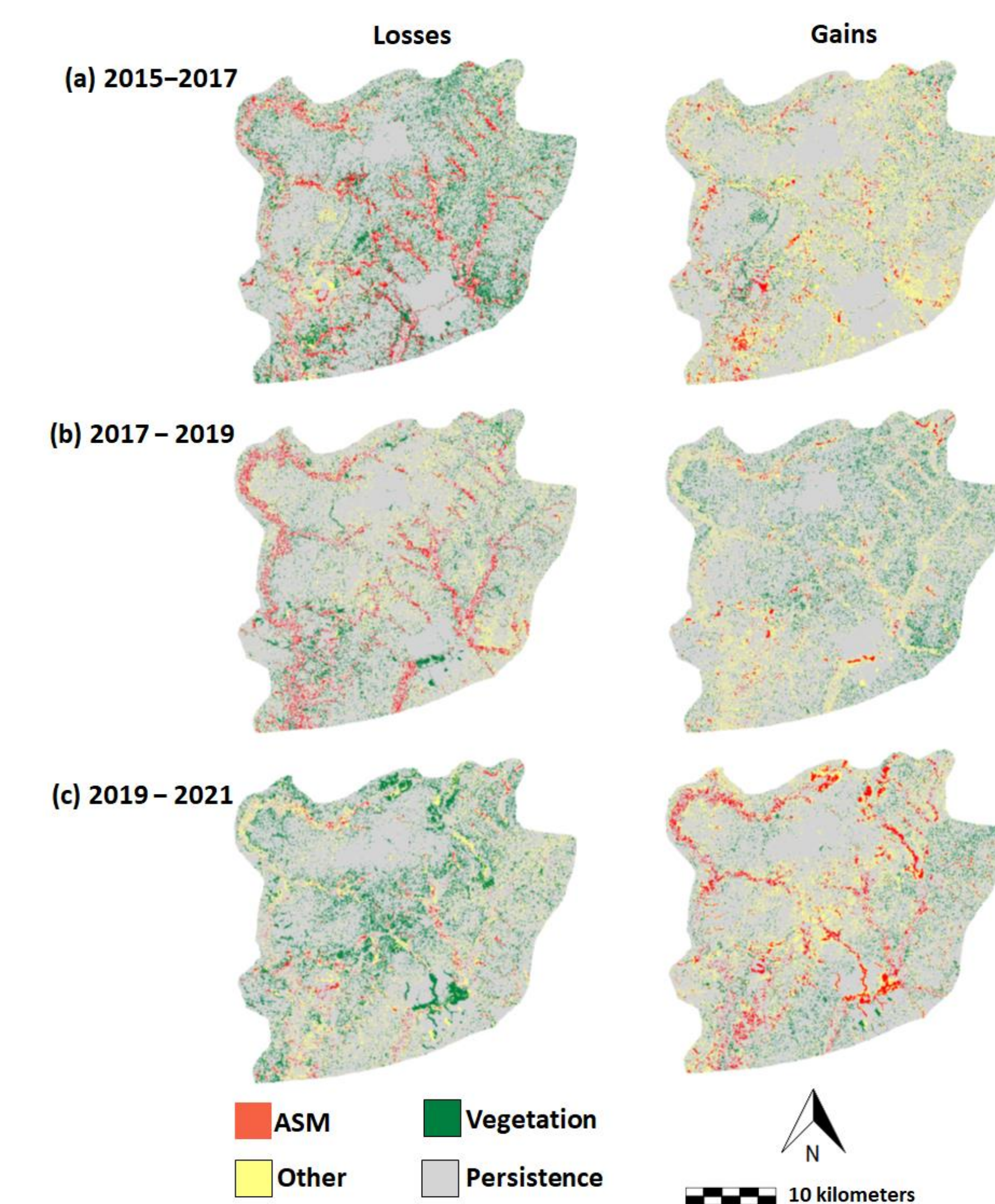


Data and Results

We selected 2015, 2017, 2019, and 2021 to reflect varying stages of ASM activities in the study area. We harmonize the Landsat data so that it is comparable to sentinel data. The accuracy assessment shows that our classification model finds it challenging to differentiate ASM from water puddles.

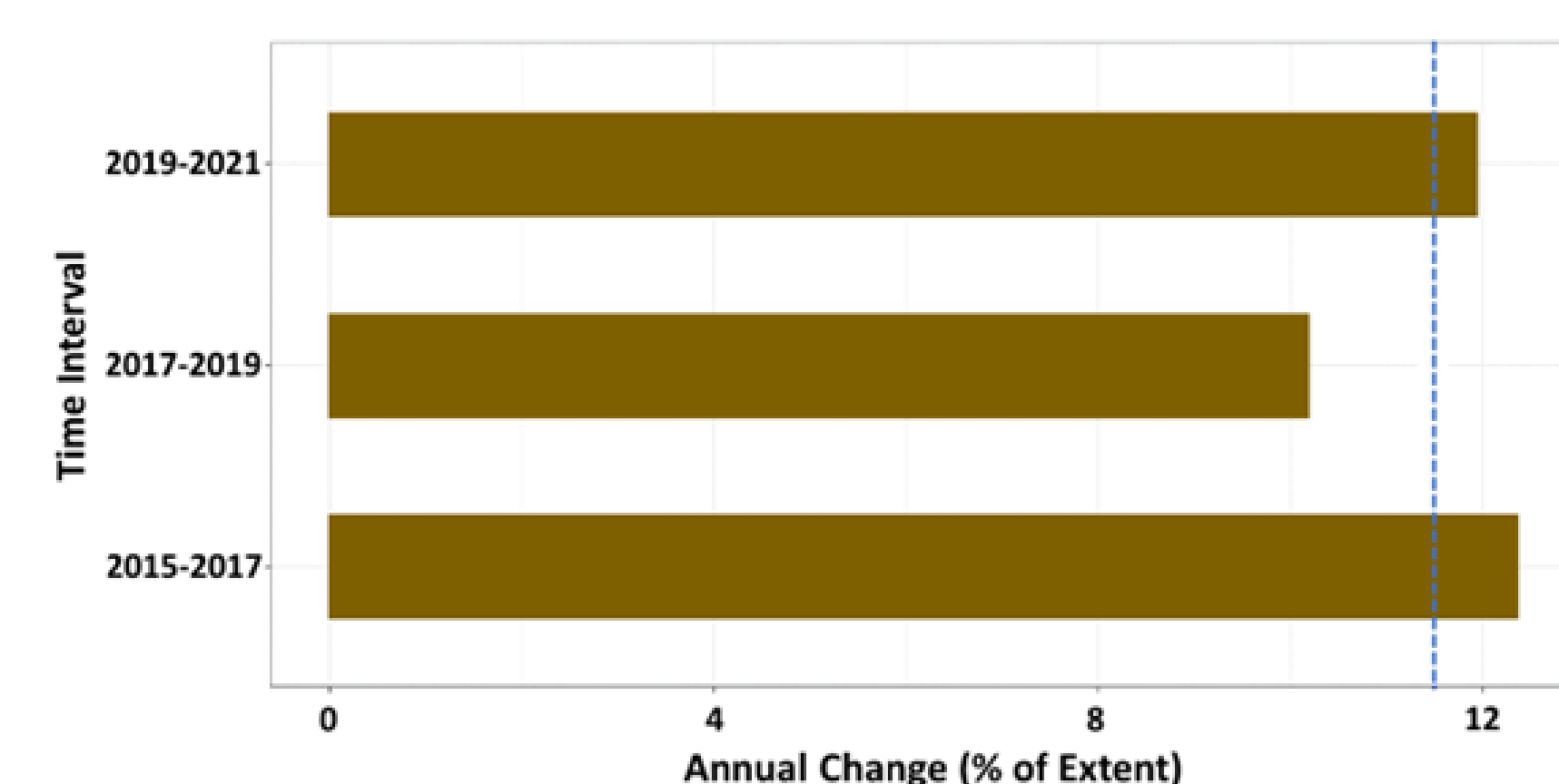
Source	Acquisition Year	Acquisition Date	Sensor	Cloud Cover Percentage
Landsat 8	2015	29-December	Operational Land Imager	9
Sentinel 2	2017	23-December	Multispectral Instrument	47
Sentinel 2	2019	2-January	Multispectral Instrument	2
Sentinel 2	2021	26-January	Multispectral Instrument	0

Gain and losses of land cover categories during 2015–2017, 2017–2019, and 2019–2021.



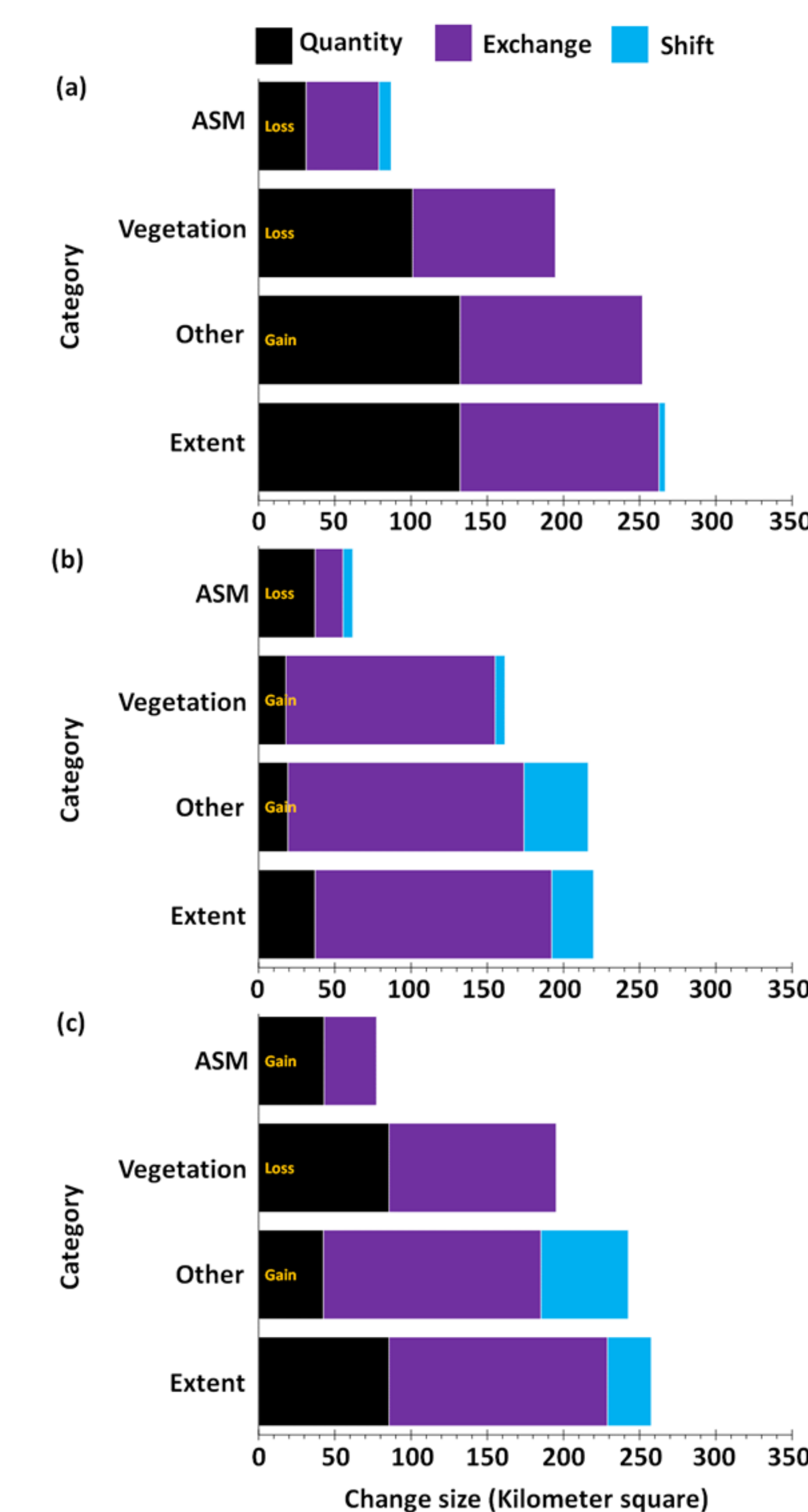
Interval level change intensity

The blue dash line indicates the uniform change across the three time intervals. Change is fastest during 2015-2017 and slowest during 2017-2019.



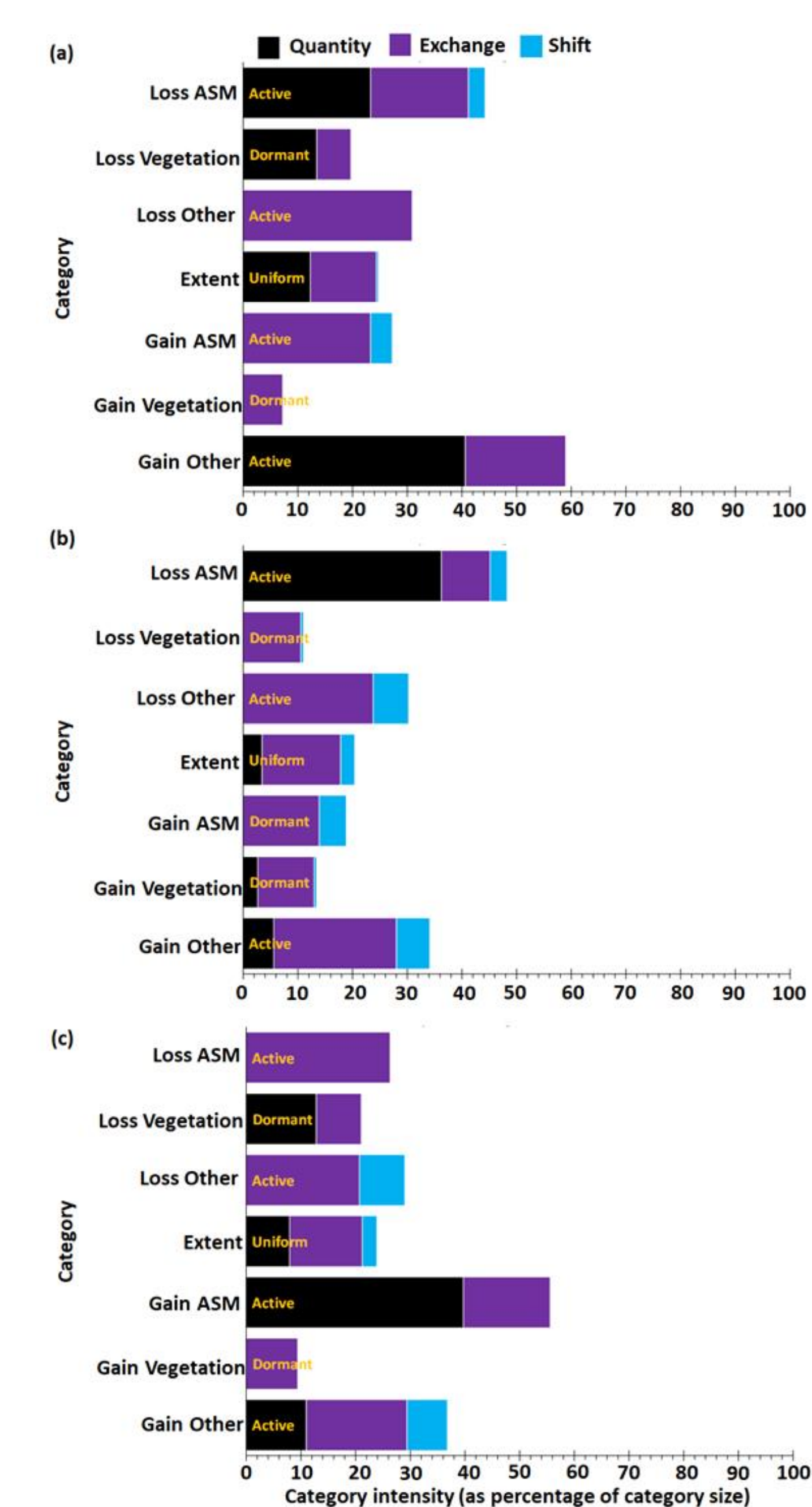
Components of change

1. ASM experiences quantity loss in the first and second time interval, and quantity gain in the third.
2. Vegetation experiences alternations of loss and gains during the three time intervals.
3. ASM experiences all the components of change during the first and second time interval.



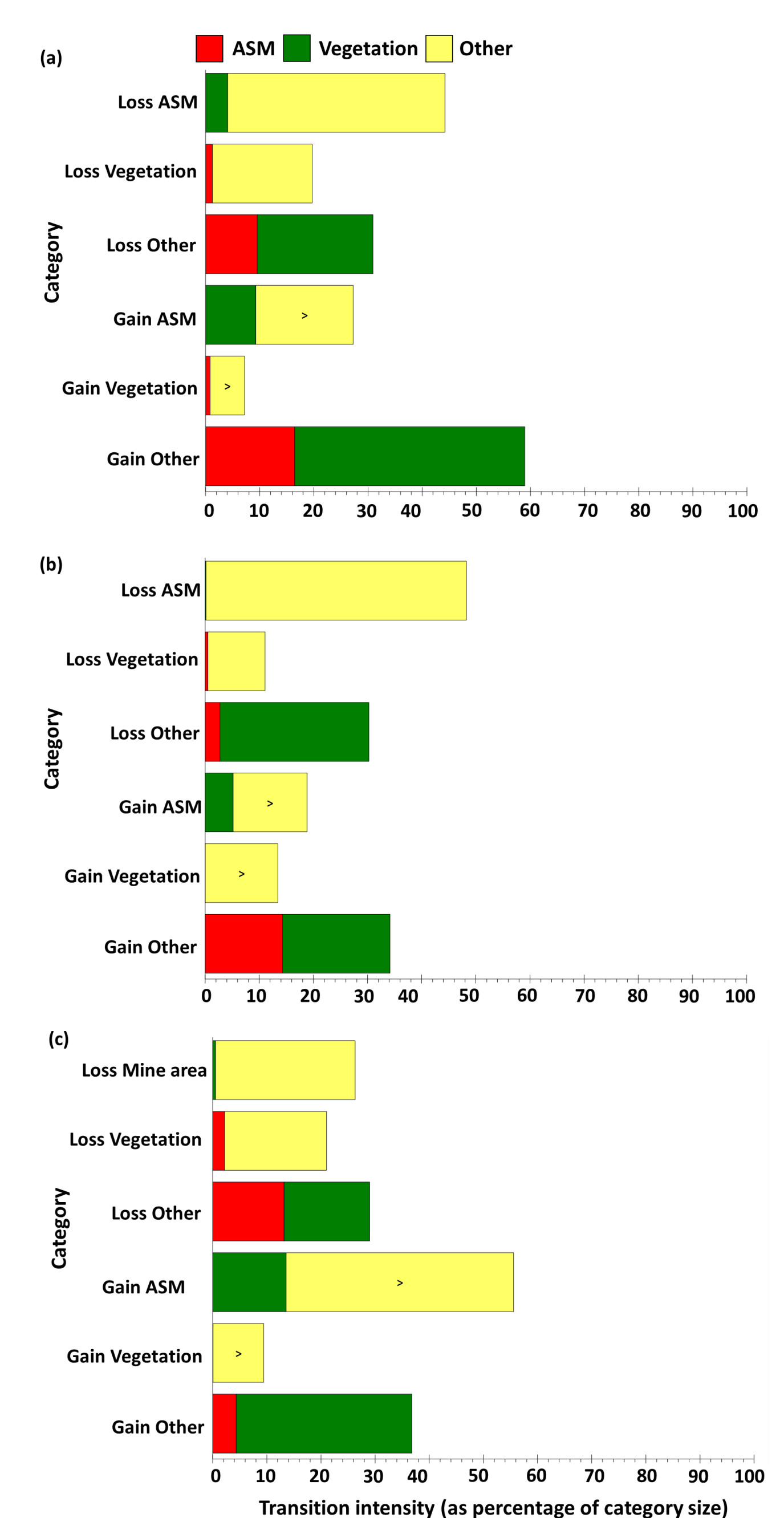
Categorical level intensity

1. ASM's losses actively during all time intervals but with a dormant gain during the second time interval..
2. This can be attributed to the policy interventions in 2017 to clamp down on illegal mining.
3. ASM's experiences active gross gains during the first and third time interval.



Transitional level intensity

1. ASM gains from both Vegetation and the Other category during each time interval.
2. Vegetation gains from the Other category in both second and third intervals.
3. The gains of ASM and Vegetation targeted the Other category.



Conclusion

Looking at ASM change at all levels of intensity analysis is paramount for understanding the complexity of the interactions between ASM and other land cover classes. First, it is crucial to analyze ASM at the interval level because the interval level provides insights into how the overall change in the landscape compares temporally. It is important to analyze ASM at the categorical level because categorical level intensity analysis provides insights into how much ASM's initial or end size changes during a specific time interval. Finally, transitional level intensity analysis provides information about which land cover categories ASM targets or avoids during a specific time interval.

Acknowledgements

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