Julien Cappelle, Olivier girard, Bouba Fofana, Nicolas Gaidet, Marius Gilbert

Identification of key areas for wildlife surveillance by combining spatial distribution of wild birds and an epidemiological indicator of Avian Influenza Virus circulation

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Abstract:

Predicting areas of disease emergence when no epidemiological data is available is essential for the implementation of efficient surveillance programs. The Inner Niger Delta (IND) in Mali is a major African wetland where >1 million Palearctic and African waterbirds congregate. Waterbirds are the main reservoir of Avian Influenza Viruses (AIV). Our objective was to model their spatial distribution in order to predict where these viruses would be more likely to circulate.

We developed a generalized linear model and a boosted regression trees (BRT) model based on total aerial bird counts taken in winter over six years. We used remotely sensed environmental variables with a high temporal resolution (10 days) to predict the spatial distribution of four waterbird groups. The predicted waterbird abundances were weighted with an epidemiological indicator based on the prevalence of low pathogenic AIV reported in the literature.

The BRT model had the best predictive power and allowed prediction of the high variability of waterbird distribution. Years with low flood levels showed areas with a higher risk of circulation and had better spatial distribution predictions. Each year, the model identified a few areas with a higher risk of AIV circulation.

This model can be applied every 10 days to evaluate the risk of AIV emergence in wild waterbirds. By taking into account the IND's ecological variability, it allows better targeting of areas considered for surveillance. This could enhance the control of emerging diseases at a local and regional scale, especially when resources available for surveillance programs are scarce.