Julien Cappelle, Nicolas Gaidet, Sam Iverson, ; John Takekawa,; Scott Newman, ; Bouba Fofana, Marius Gilbert, :

Direct estimation of the dynamic of contact between poultry and wild ducks in African villages using distribution modeling based on satellite telemetry and remote sensing data.

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Abstract:

Understanding and modeling the wildlife-livestock interface is essential for controlling emerging infectious diseases (EIDs). The contact rate between hosts is a key parameter for mathematical modeling of EIDs dynamics. Because modifications of the contact rate can modify greatly the epidemiologic dynamic, it is important to take into account its seasonal variability. We developed a distribution model based on satellite telemetry and remote sensing data to directly evaluate the dynamic of contacts between wild birds and domestic poultry in African villages.

In the Inner Niger Delta of Mali, five Comb ducks (S*arkidiornis melanotos*), were tracked with satellite transmitters providing GPS data for seven months. We used 250-meter spatial resolution and 8-day temporal resolution remotely sensed environmental indicators to model the distribution of these wild birds with the MAXENT method. For each 8-day period, we estimated the potential contacts between wild and domestic birds by calculating the number of villages harbouring predicted suitable habitats for Comb ducks.

A period of increased potential contacts occurred at the end of the dry season when wild birds were looking for the last suitable habitats. Comb ducks subsequently performed regional movements to reach their breeding grounds during the rainy season.

We could directly estimate the seasonal variation of potential contacts between Comb ducks and domestic poultry. It allowed us to identify period of potential transmission and spread of pathogens by wild birds. The estimation of the dynamic of contacts between wild and domestic animals with our method could feed epidemiological models of the wildlife-livestock interface.