

# Determining the sensitivity of airborne eDNA data

## Using micrometeorological techniques

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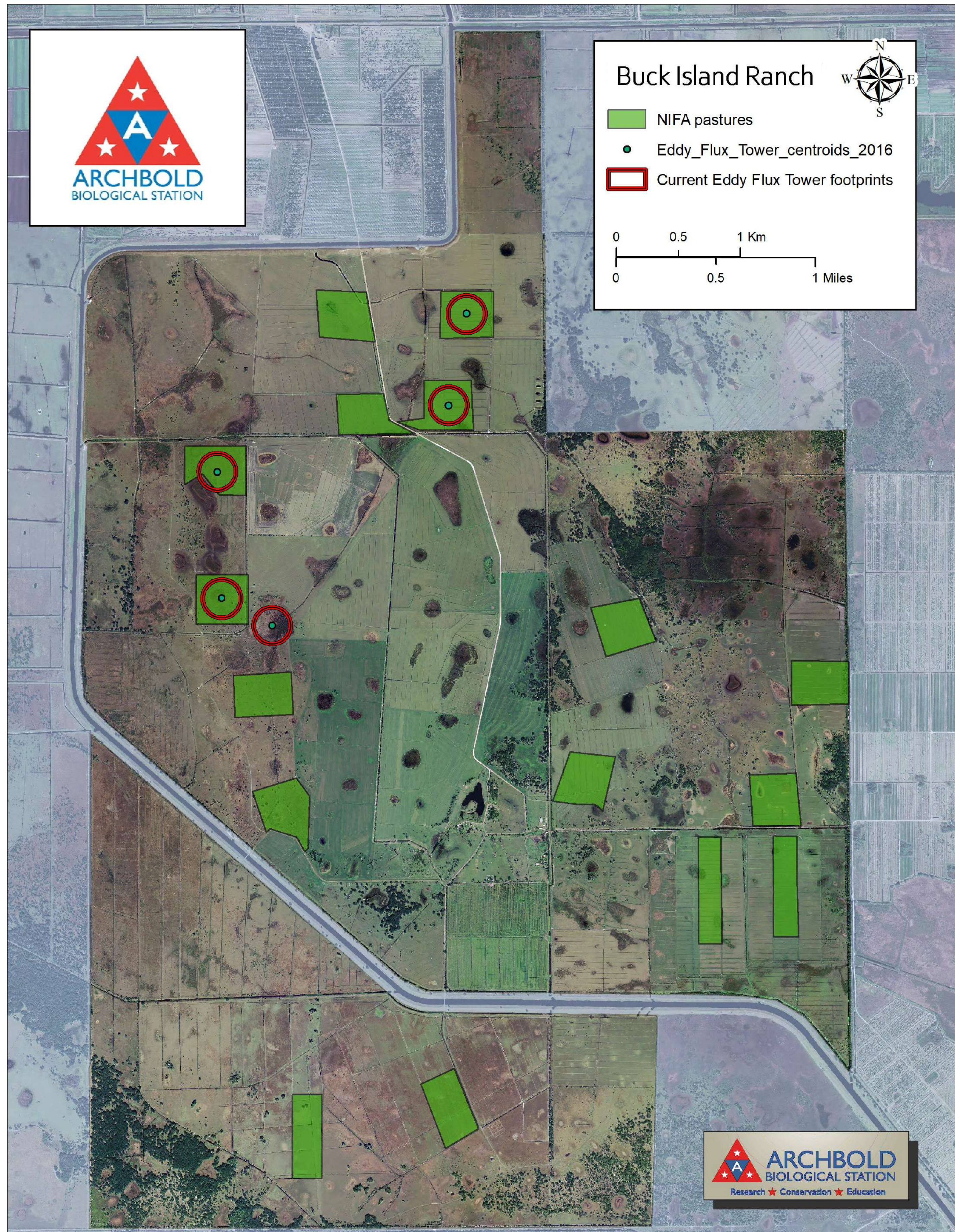


Fig. 1: Map of Archbold's Buck Island Ranch, showing locations of 5 eddy flux towers and 2 met towers



Fig.2 Eddy covariance flux towers capture micro-meteorological data such as: air temperature, humidity, wind velocity, net incoming radiation and more

Current literature suggests airborne eDNA can be used to survey organisms in an area up to ½ km radius effectively<sup>1</sup>. Some studies cite plant eDNA on dust particles travelling vast distances with the wind, with analysis that shows dispersion areas up to 600 km<sup>2</sup>. In order to inform biodiversity monitoring protocols, we use a combination of 3 approaches to uncover some of the factors underpinning the spatial sensitivity of air eDNA surveying methods:

- 1) Distance decay analysis
- 2) Tracer experiments
- 3) Simulation modelling

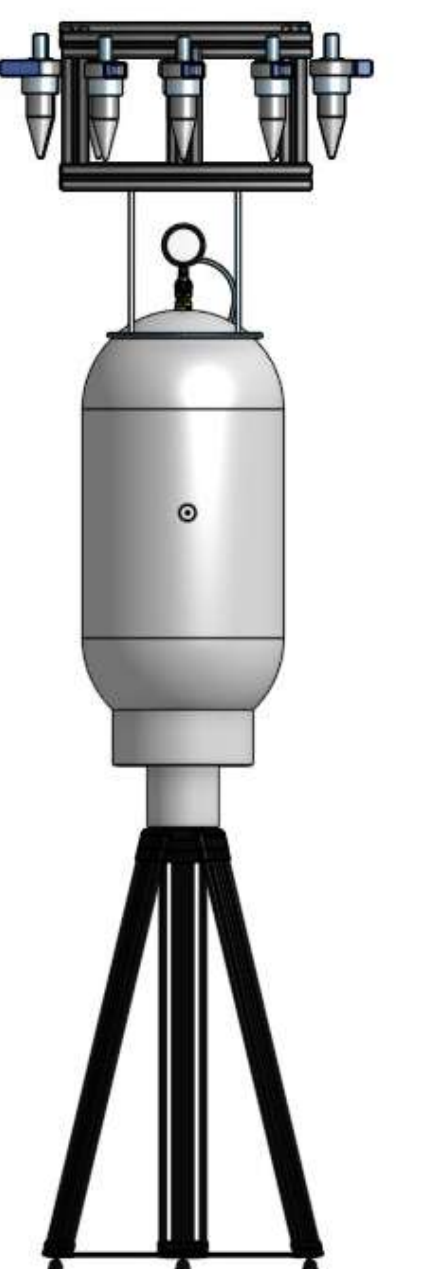
With the goal of gaining insight into boundary layer dynamics, meteorological variables that influence optimal sampling height, time of day and sampler designs that can help surveyors maximize eDNA sequence data generated per flow cell.

This research is carried out at a 10,500 acre operational ranch in the headwaters of the Everglades in South Florida, USA. Archbold Biological Station's Buck Island Ranch serves as a well instrumented agro-ecological laboratory with long-term field research that has compiled thorough species lists of the plants and animals occupying the area. It has a mosaic of habitats including cultivated pastures, semi-natural grasslands, woodlands, and over 600 seasonal wetlands<sup>4</sup>. It is also surrounded by citrus groves and a threatened endemic scrub habitat.

It's place in the USDA's Long-term Agroecosystem Research network, along with being in the Florida wildlife corridor make it well suited to pilot an eDNA biomonitoring program. The ranch currently has 5 active eddy covariance towers and two meteorological towers, lending to dynamic measurements of micrometeorological phenomena.

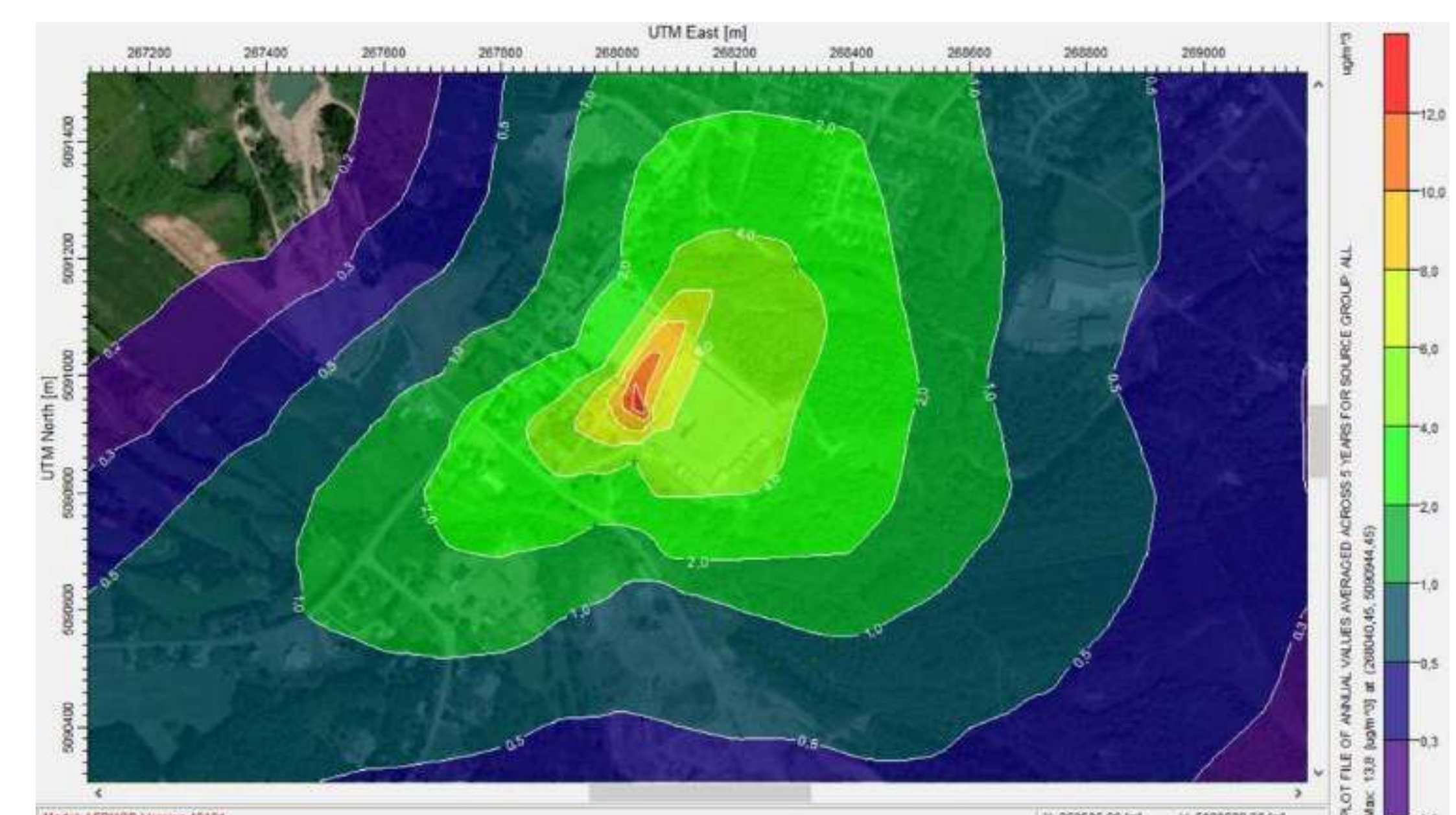
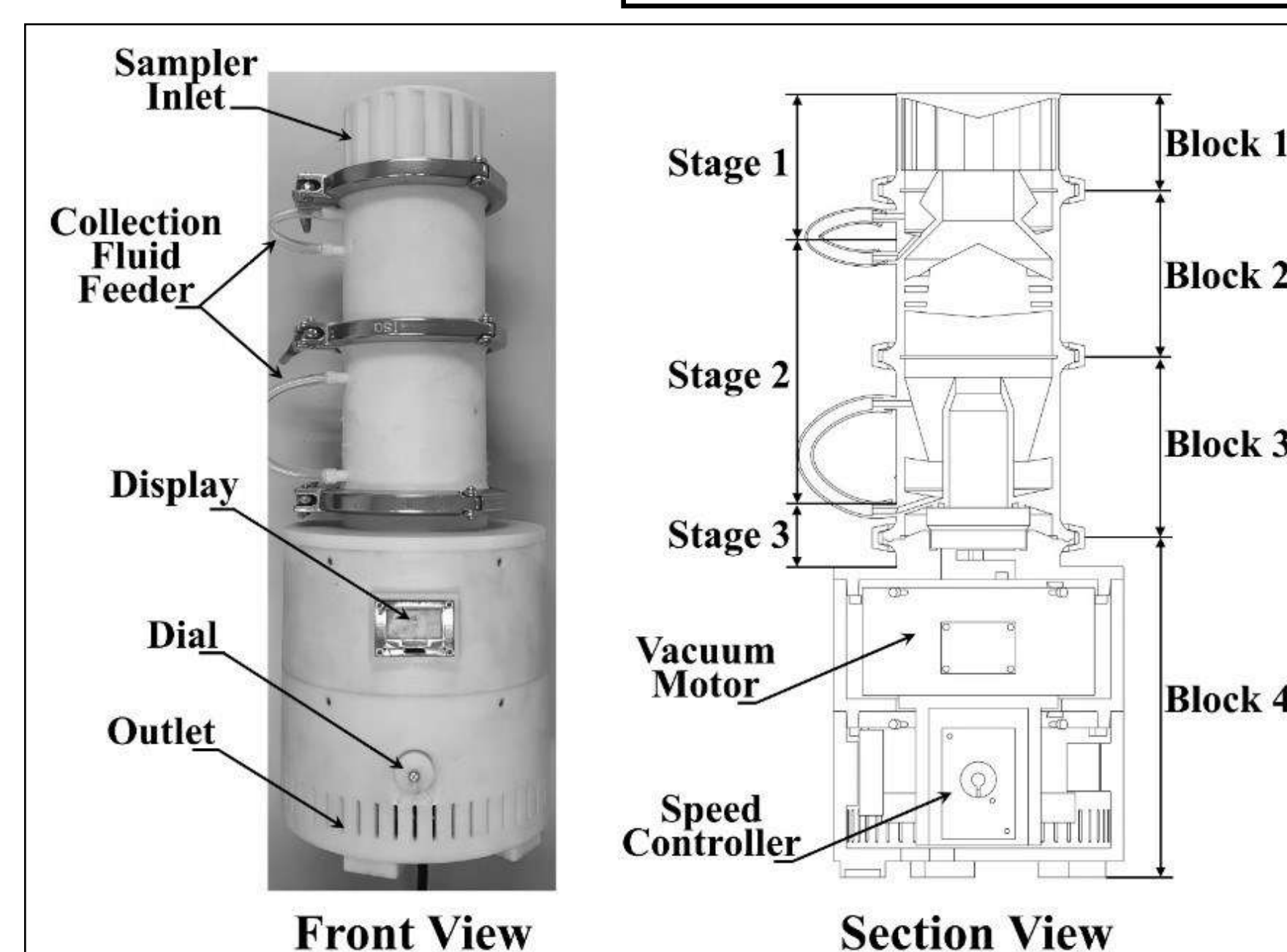
### Open-source time-series eDNA cyclonic sampler:

For use in tracer experiments. Using a nebulizer, aerosolize fluorescently labeled DNA from a non-environmental source using a, such as a plasmid or virus, to avoid any interference with the eDNA of interest. Sample in different locations simultaneously, in time intervals to better understand spatio-temporal aspects of dispersion.



High volume air samplers<sup>3</sup>: 1000 L/min

AEROMOD dispersion model



### References:

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2. Lennartz C, Kurucar J, Coppola S, Crager J, Bobrow J, Bortolin L, Comolli J. Geographic source estimation using airborne plant environmental DNA in dust. *Sci Rep*. 2021 Aug 10;11(1):16238. doi: 10.1038/s41598-021-95702-3. PMID: 34376726; PMCID: PMC8355115.
3. High-volume sampler for size-selective sampling of bioaerosols including viruses. *Atmos Environ* (1994). 2021 Nov 15;265:118720. doi: 10.1016/j.atmosenv.2021.118720. Epub 2021 Sep 12. PMID: 34539212; PMCID: PMC8435071.
4. Hilary M. Swain, Elizabeth H. Boughton, Patrick J. Bohlen, Laurent O'Gene Lollis "Trade-Offs Among Ecosystem Services and Disservices on a Florida Ranch," *Rangelands*, 35(5), 75-87, (1 October 2013)