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1. Background

- Explosion and fire at Chernobyl Nuclear Power Plant in 1986 released ~5,000 PBq of radioisotopes (incl. 137-Cs, 90-Sr)
- 2,400 tons of lead dropped by air to shield the reactor
- Mass killing of abandoned animals after evacuation, but some escaped destruction leading to several hundred semi-feral dogs living in the exclusion zone today
- Areas within the exclusion zone remain heavily contaminated with radioisotopes, toxins, and heavy metals (**Fig. 1**)

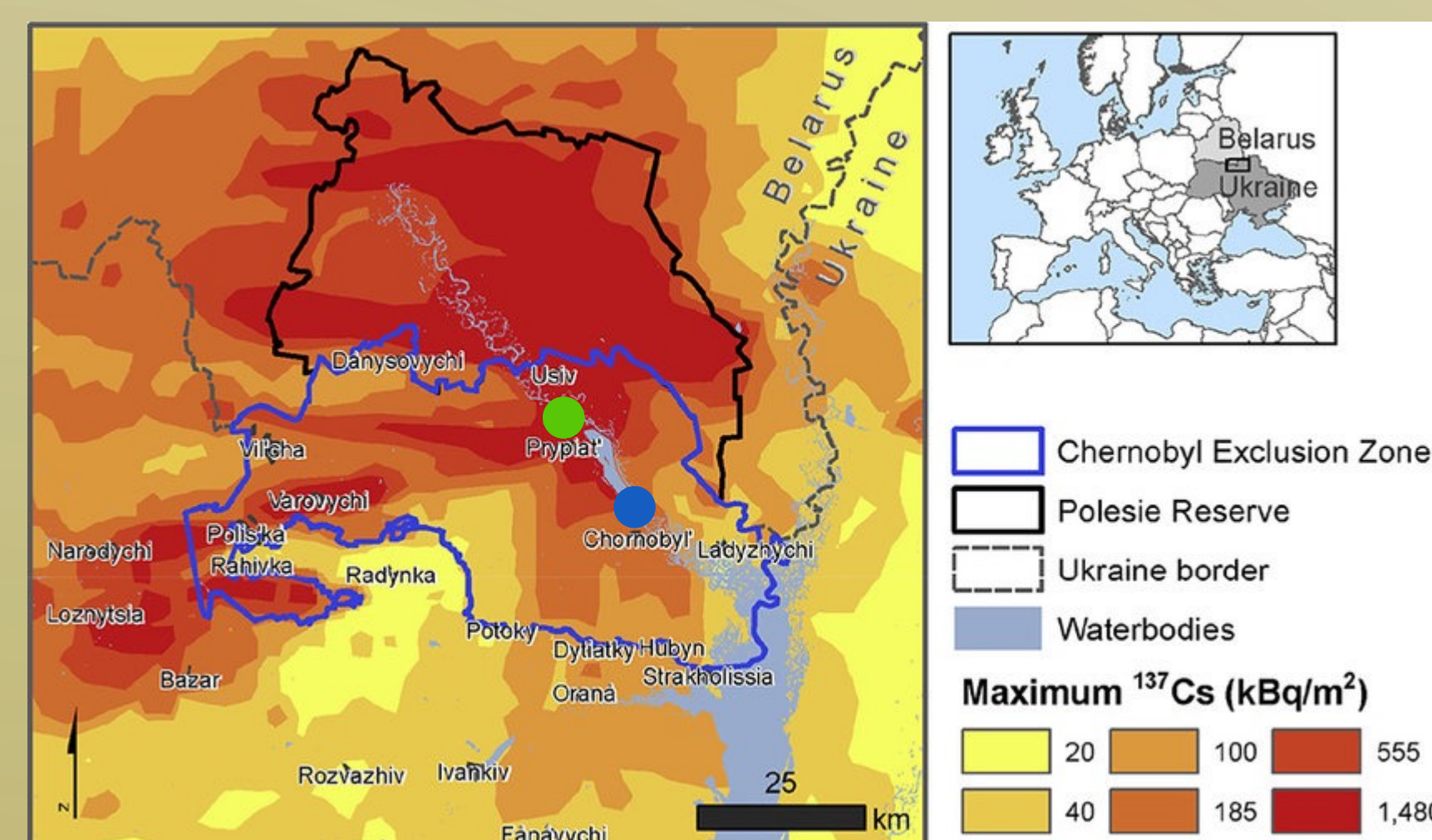


Figure 1. Map of cesium-137 deposition in Ukraine with the Chernobyl Nuclear Power Plant (green) and Chernobyl City (blue) marked, adapted from Ager et al. 2019.

2. Methods

- Sampled dogs from the Chernobyl Nuclear Power Plant (**PP**) and Chernobyl City (**CC**; 16.5 km away)
- 712,000 SNPs genotyped for 119 dogs
- Identify candidate loci and potential genes under selection in **PP** using an F_{ST} outlier method



Photos by Solo East and Edward Neyburg

Developing a model for human health effects arising from chronic exposure to radiation, heavy metals, and other environmental toxins



Dr. Jen Betz providing veterinary health care with the assistance of Drs. Tim Mousseau and Norman Kleiman



Photo by Sam Berkhead

3. Results

- Significant genetic differentiation between **PP** and **CC** populations, despite possibility of gene flow (**Fig. 2**)
- Higher genetic diversity within **PP** population than within **CC**
- Found 405 significant outlier loci indicating genomic regions under directional selection between populations

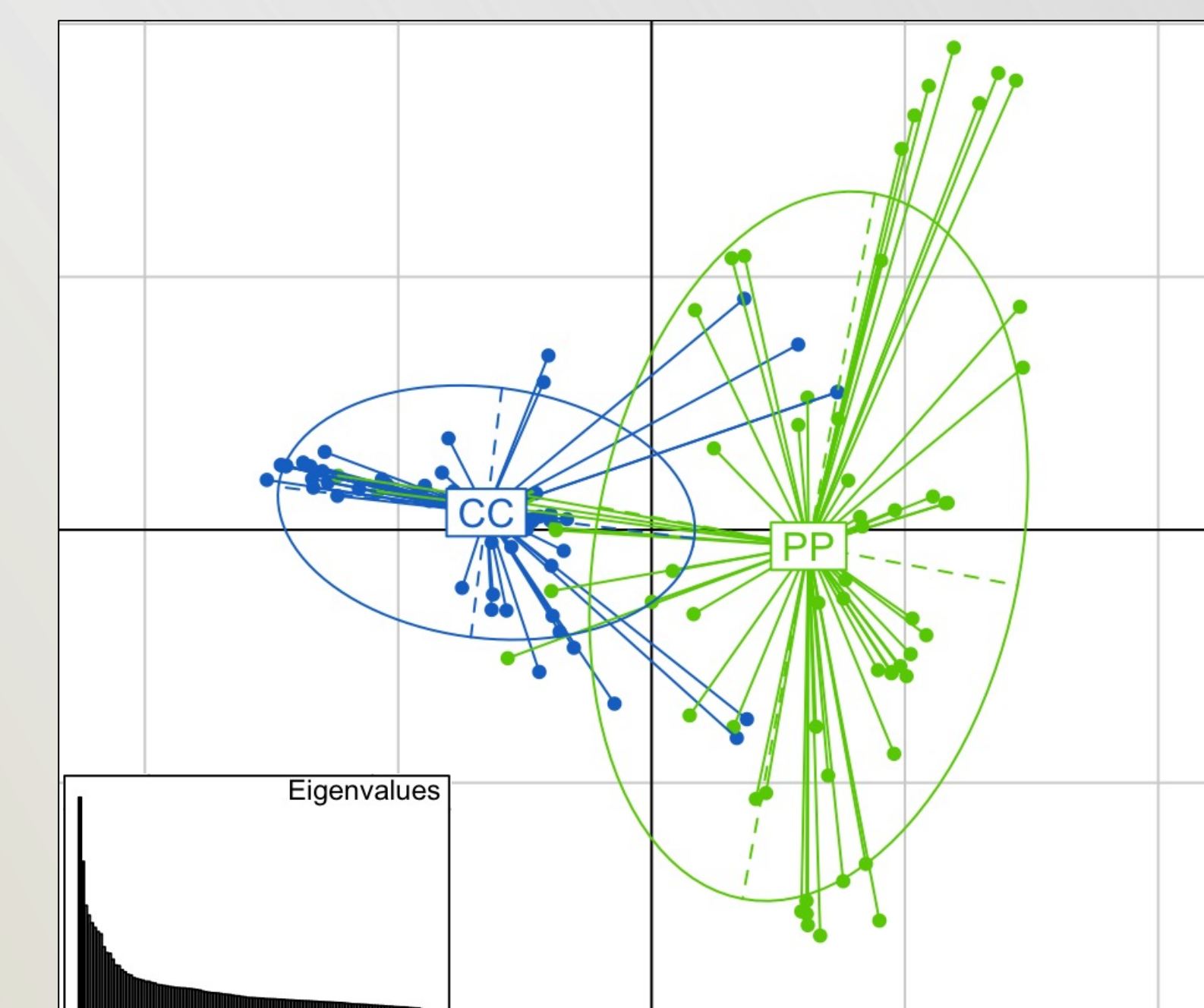


Figure 2. Principle Component Analysis based on 279,009 markers. PC1 highlights genetic differentiation between **PP** (green) and **CC** (blue) dogs, while PC2 emphasizes variation within the **PP** dogs. N = 61 (**PP**), 58 (**CC**).

4. Next Steps

- Identify signatures of local adaptation associated with radiation and heavy metal exposure
- Relate genetic and epigenetic impacts of these long-term exposures to health
- Quantify how multi-generational exposure to these environmental toxins affects the genome and genetic health



The CleanFuturesFund and SPCAi Team



Photo by Sergiy Romanyuk



Questions?
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