

Radiotrophs and Where to Find Them



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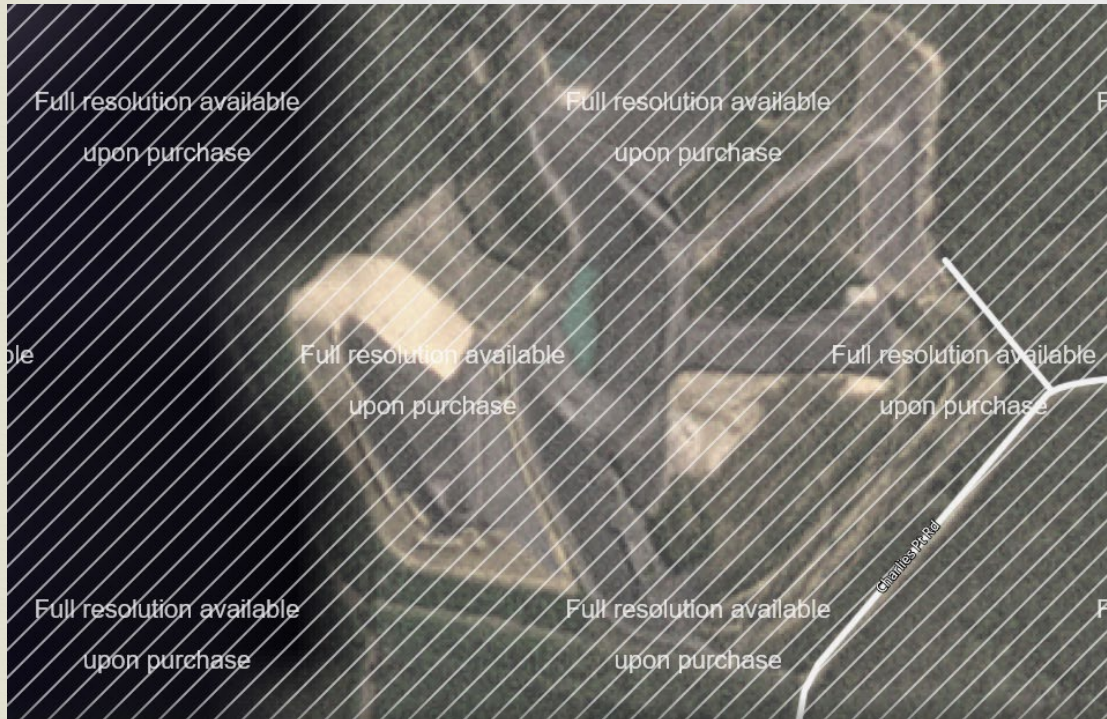
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High Definitions



This subject prioritises remote sensing technology for holistic spatial understanding – yet relies on regulated satellite imagery, itself restrained by resolution. Recent developments add novel dimensions to the palms of our hands.



Every Frame a Painting



Photogrammetry and 3D reconstruction underwent a radical shift from meshes to Gaussian splats; we'll explore how these changes techniques extend existing remote sensors with a focus on semi-autonomous robots.

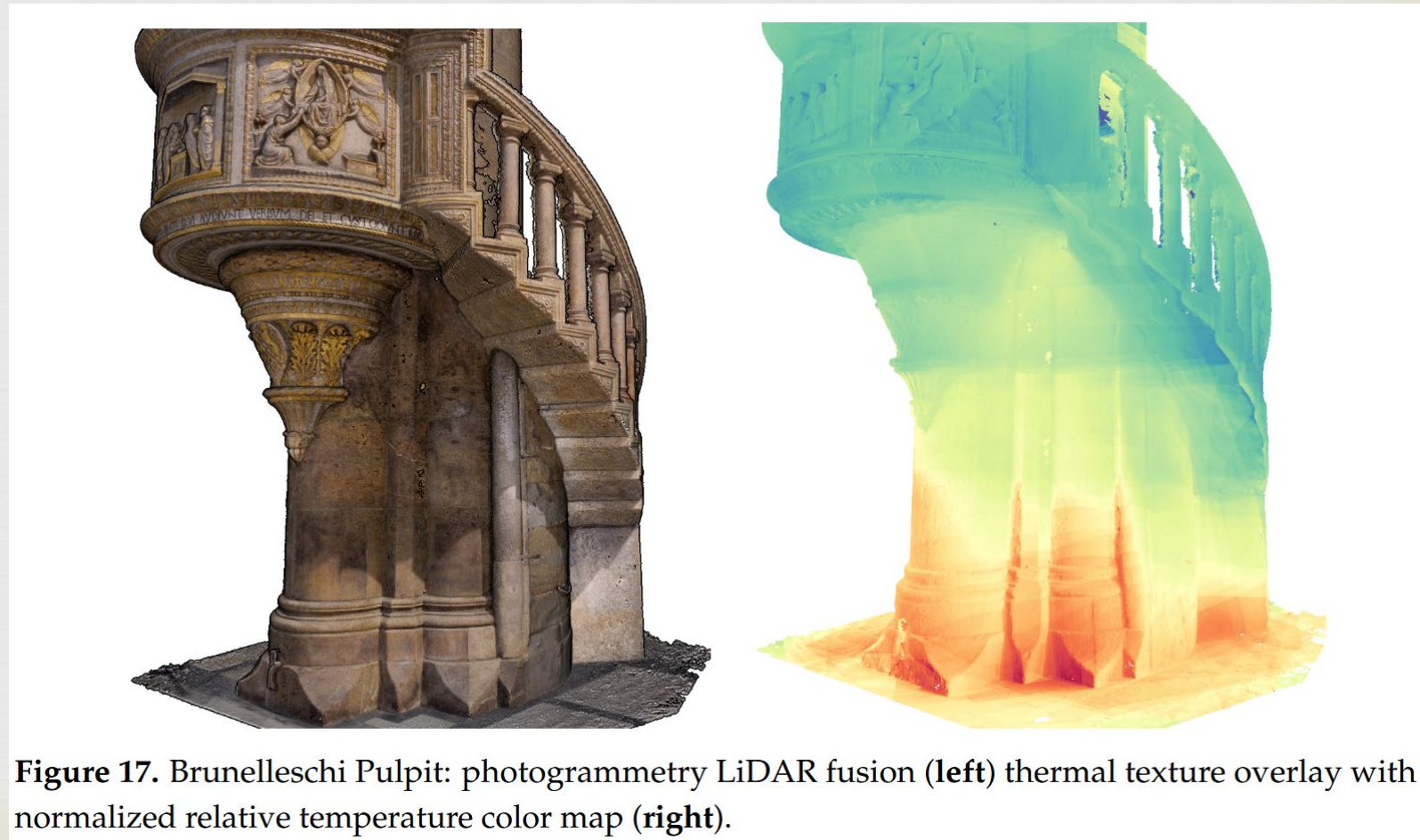


Figure 17. Brunelleschi Pulpit: photogrammetry LiDAR fusion (**left**) thermal texture overlay with normalized relative temperature color map (**right**).

Cheap Robots



As demonstrated by Younger 2026 and Ibrayev 2026, commercial off-the-shelf (COTS) products like smart vacuums and personal dosimeters (Accurad or [Radiacode 103](#)) can be repurposed for cost-effective spatial analysis



Figure 1. The Dreame L10s Ultra smart vacuum used in this study.



(a)



(b)

Figure 3. The mechanical integration of (a) the Dreame L10s Ultra smart vacuum, (b) an AccuRad detector and a Raspberry Pi.

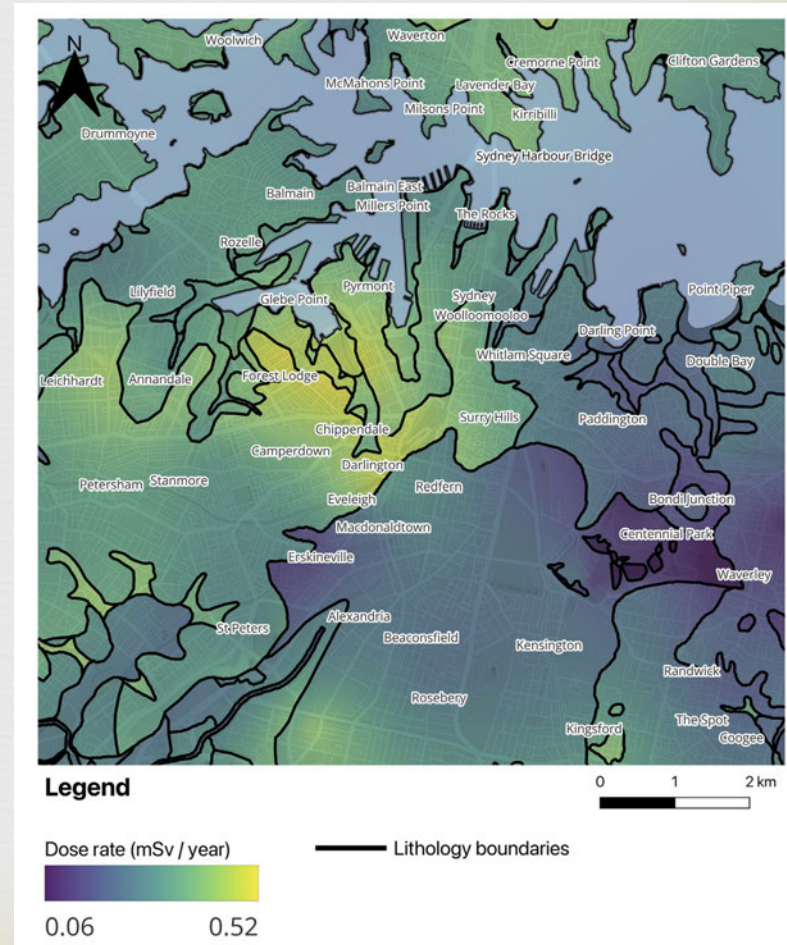
Handheld Detectors



USyD's Ibrayev et al 2026, specifically, walked various suburbs holding Radiacode 103 units to synthesise Sydney's first terrestrial gamma-radiation map. Results matched regional geologies.



Dr Laura Manenti holding one of the simple gamma radiation detectors used in the study. Photo: Stefanie Zingsheim



Cheap Flying Robots (with Detectors)



These previous instances required human direction – its time to introduce semi-autonomy. Since Chernobyl fearless automatons braved hazard zones. Today cheap, modular, miniature networked drone platforms are processing vast stretches across all areas.

MRS UAV Platforms are compatible with:

- Rangefinders
- LiDAR
- GNSS/GPS
- UltraViolet Direction And Ranging (UVDAR)
- Cameras
 - Infrared
 - Thermal
 - RGB
 - Compton
- Pixhawk sensors
 - Gyroscopes
 - Barometers
 - Accelerometers



Fig. 1: MRS UAV platforms used for a diverse range of real-world applications (a)-(c), (g)-(i) and their simulated variants (d)-(f), (j)-(l), respectively. The numerous applications, ranging from aerial indoor inspection to multi-robot wall building, is enabled thanks to the high modularity of the MRS drone.

Drones at Scale



Although photorealistic, large-scale studies will outstretch computational capacity. However, Mei 2025, is pioneering layered optimisations to increase quality whilst lowering overhead.

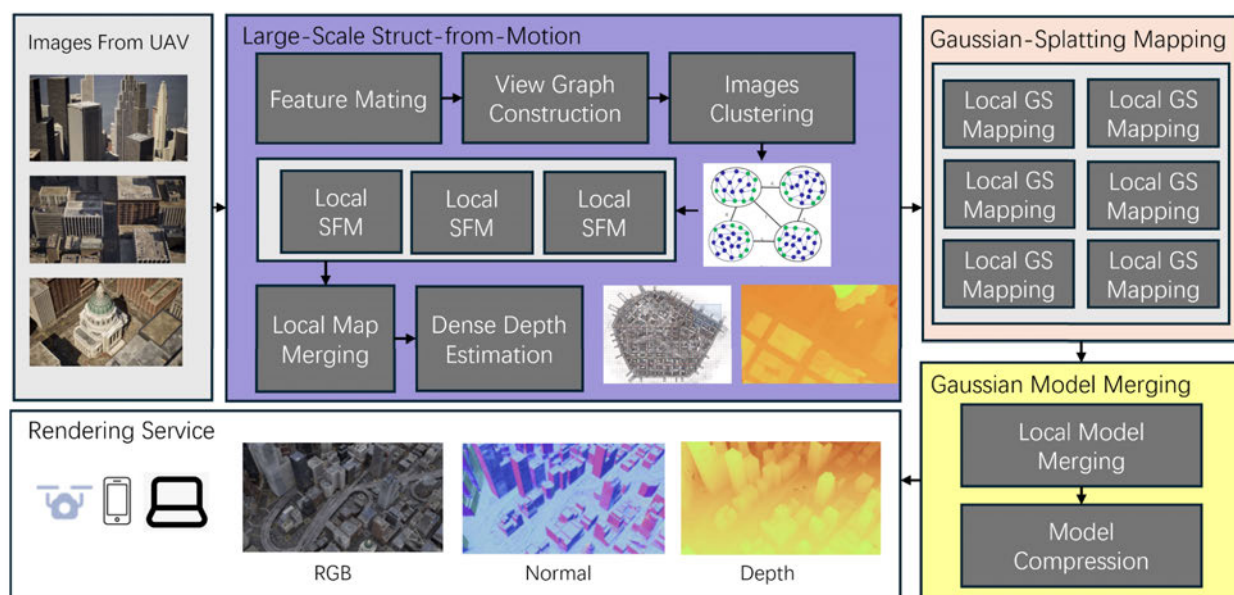


FIGURE 2. The proposed 3D reconstruction system comprises three core components: (1) parallelized camera pose estimation and dense depth reconstruction, (2) parallelized Gaussian-Splatting based dense reconstruction, (3) partition mapping result fusion, and model compression.

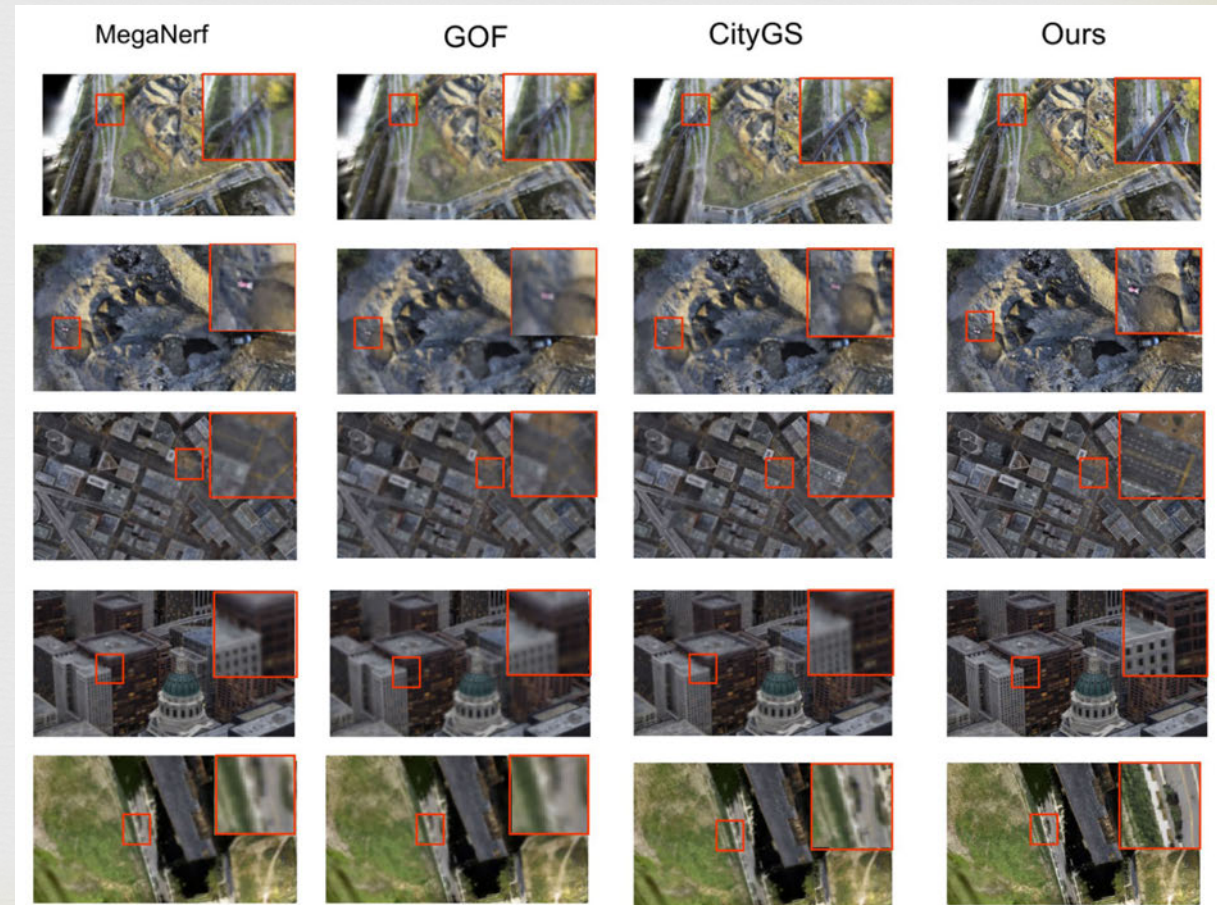
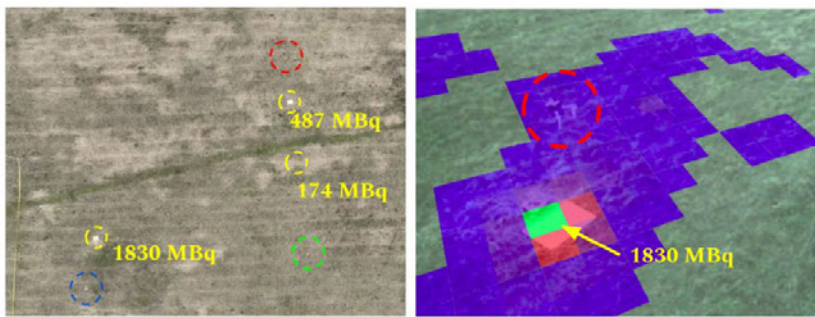


FIGURE 3. Qualitative comparison with SOTA methods on MatrixCity and Mill-19 dataset.

Radioactive Applications



Fukushima and several other radioactive sites have experimented with real-time UAV radiometry and 3D reconstruction. Here, we focus on the Czech Technical MRS group.

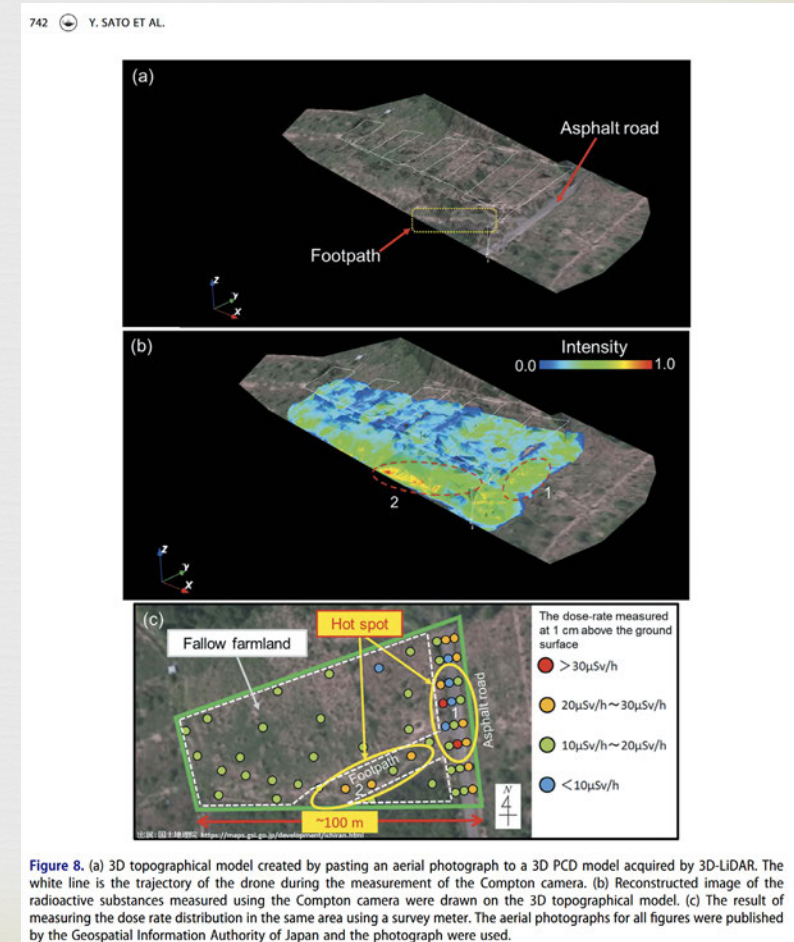


(a) The UAVs (red/green/blue) and (b) Estimated radiation intensity radiation sources (yellow) during the around the 1830 MBq radiation experiment ($t = 32$ s).

Fig. 8: The real-world experiment with Cs-137 radiation sources.



Fig. 9. Photograph of the experimental setup used during the measurements at El Cabril.



**recorded data
from real-world experiment**

4 drones



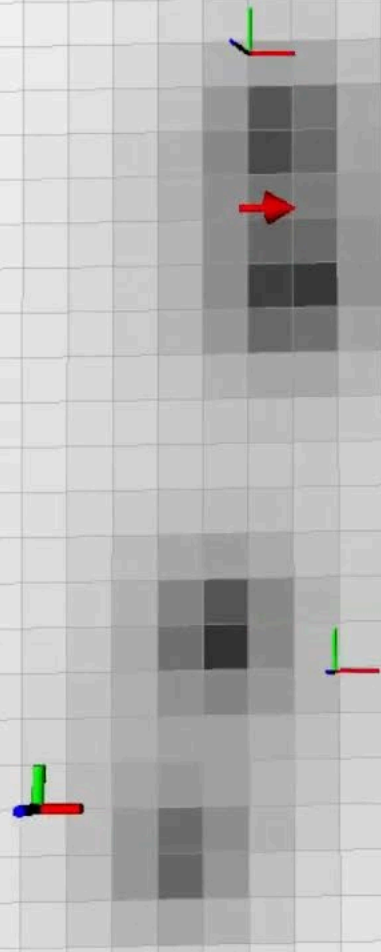
180 MBq

1900 MBq

500 MBq

55 MBq

Cesium-137 sources



180 MBq

1900 MBq

500 MBq

55 MBq

one drone with camera

180 MBq

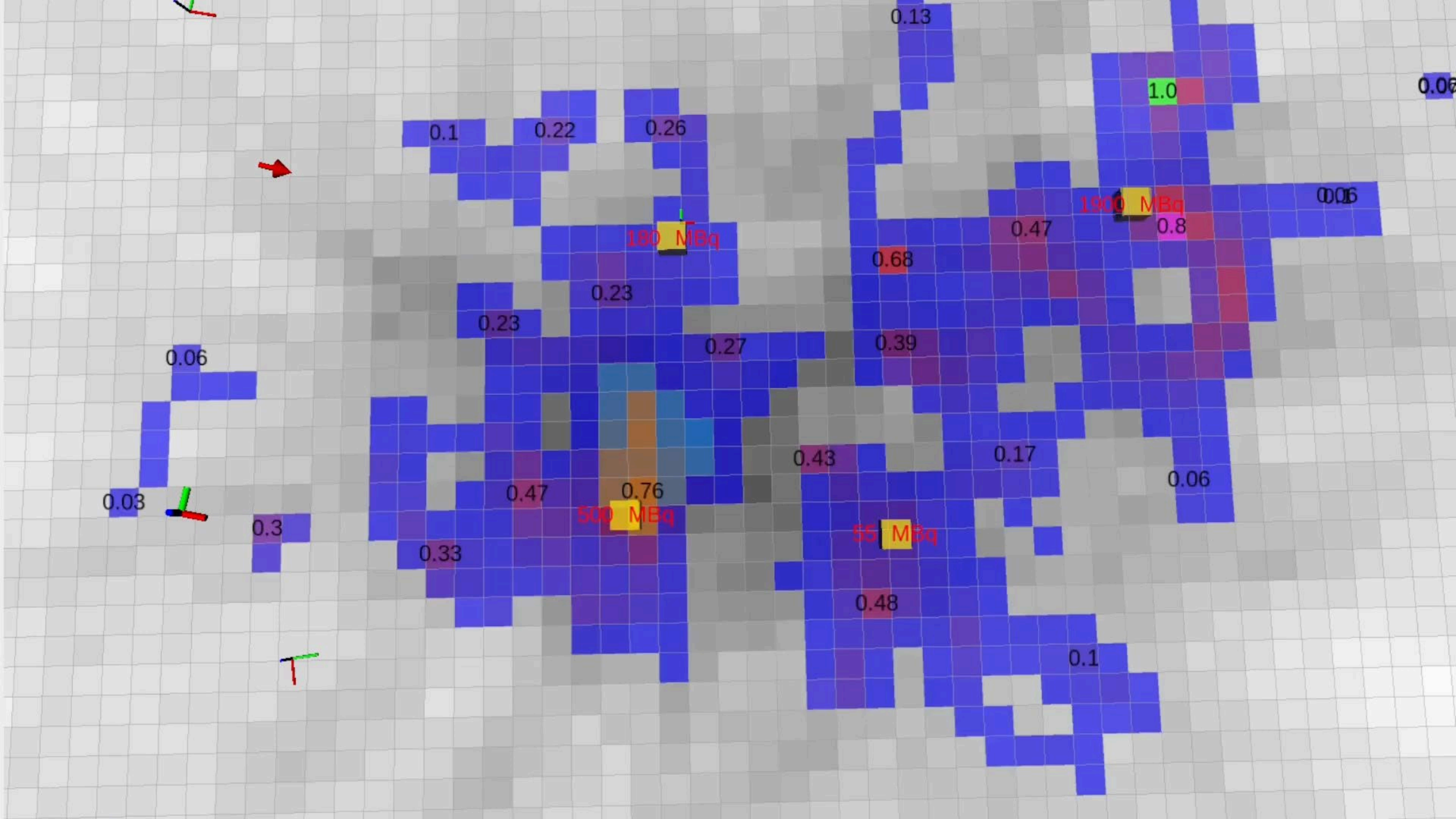
1900 MBq

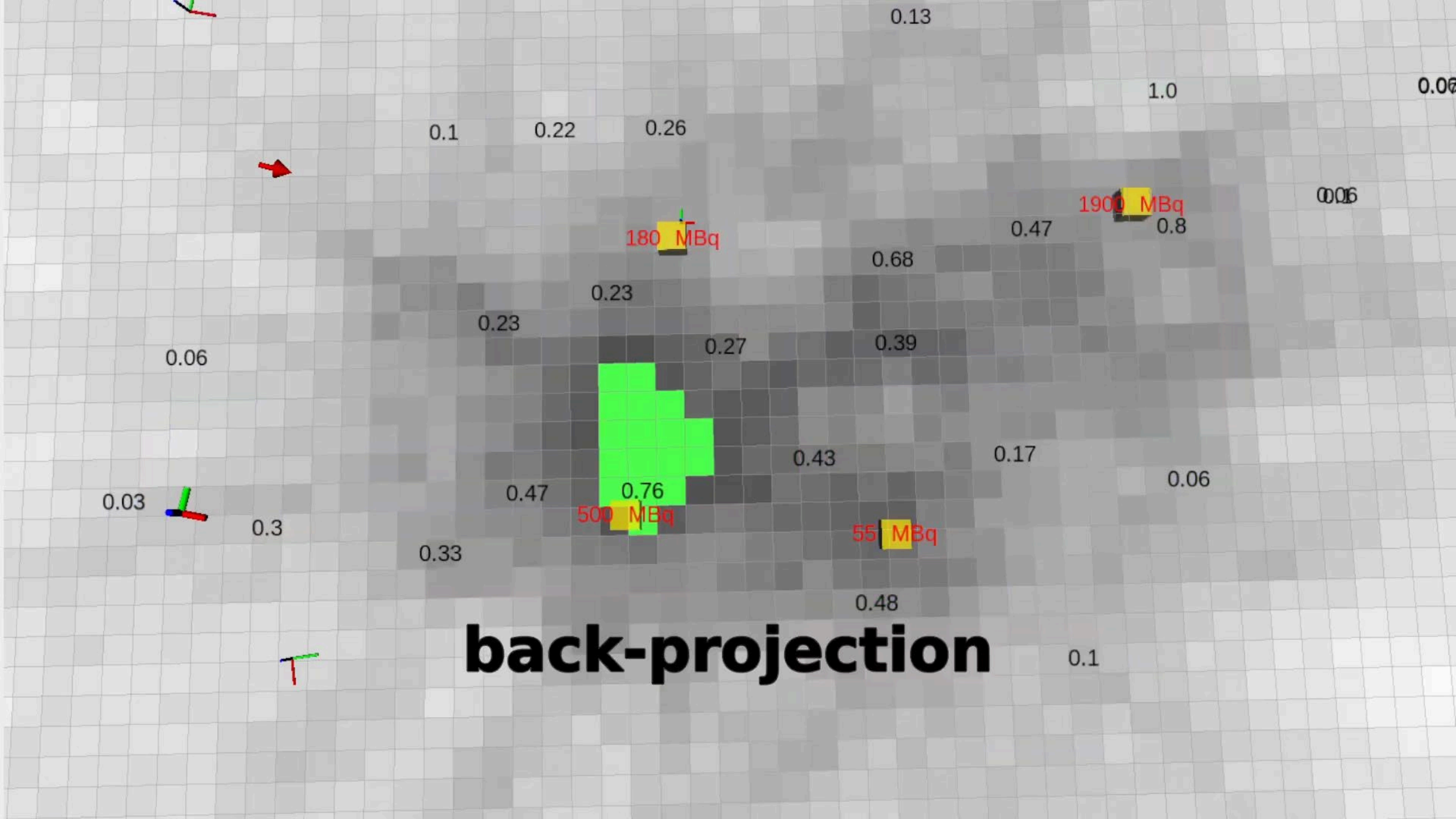
500 MBq

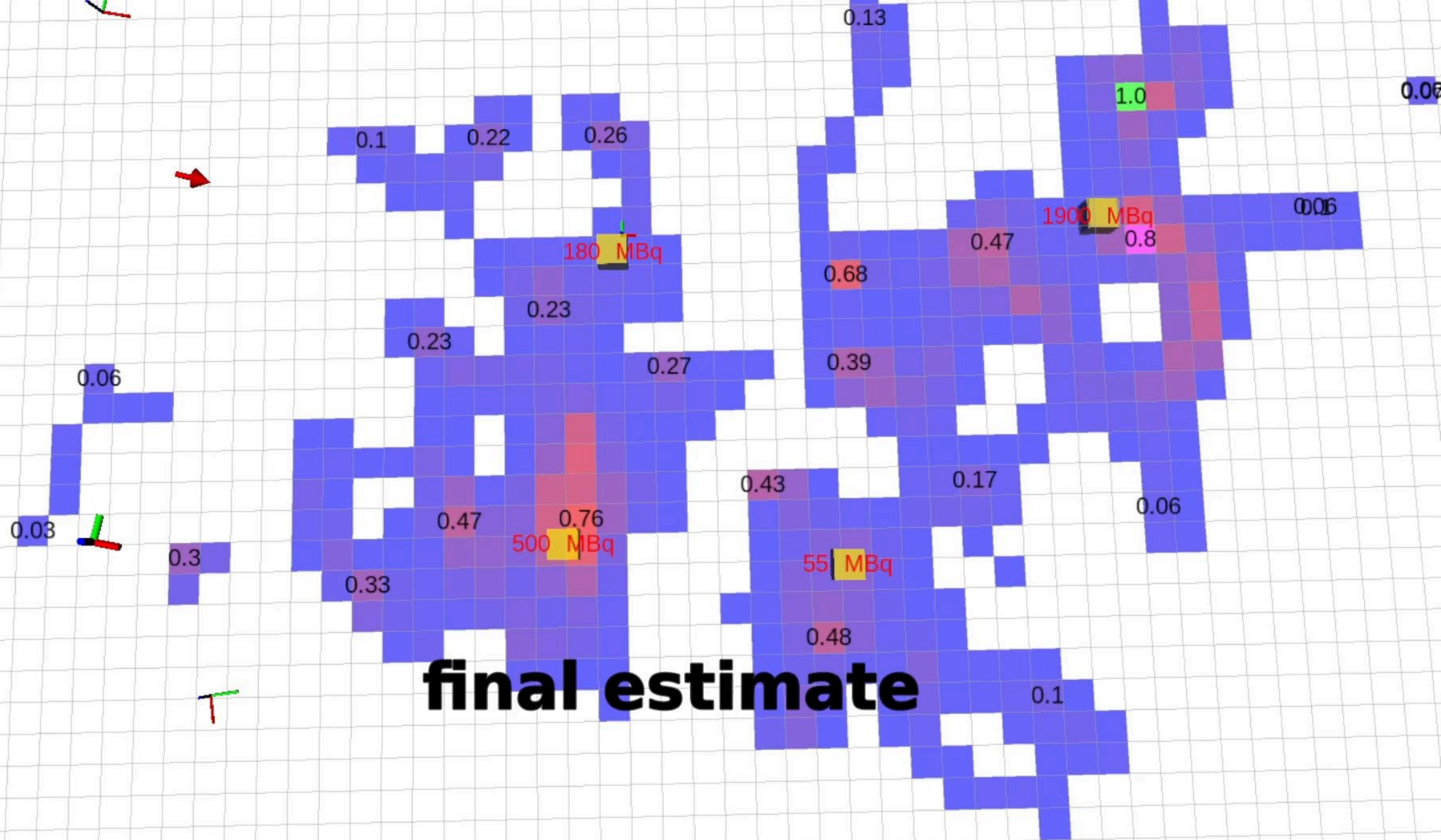
55 MBq







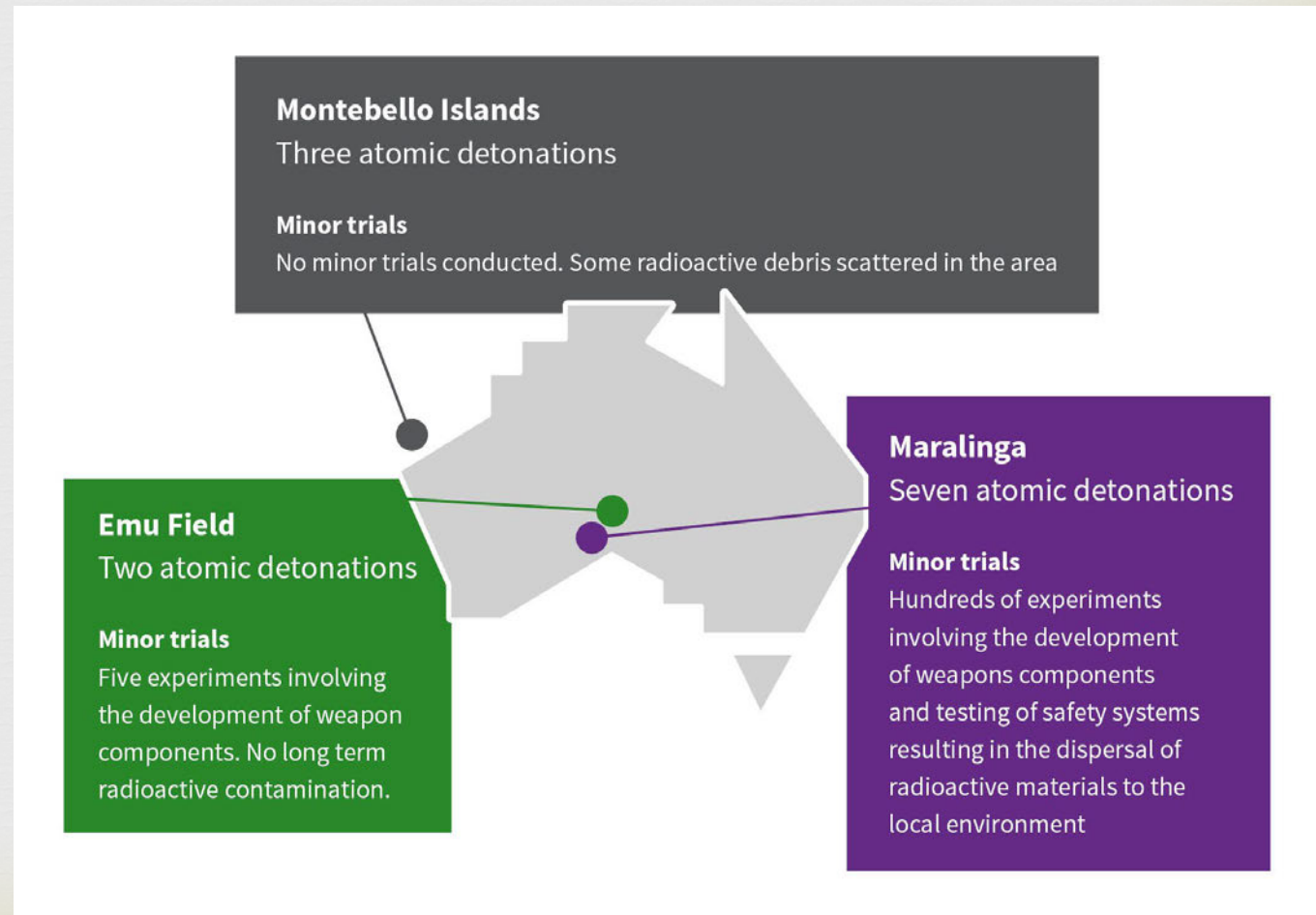




(Our) Radioactive Applications



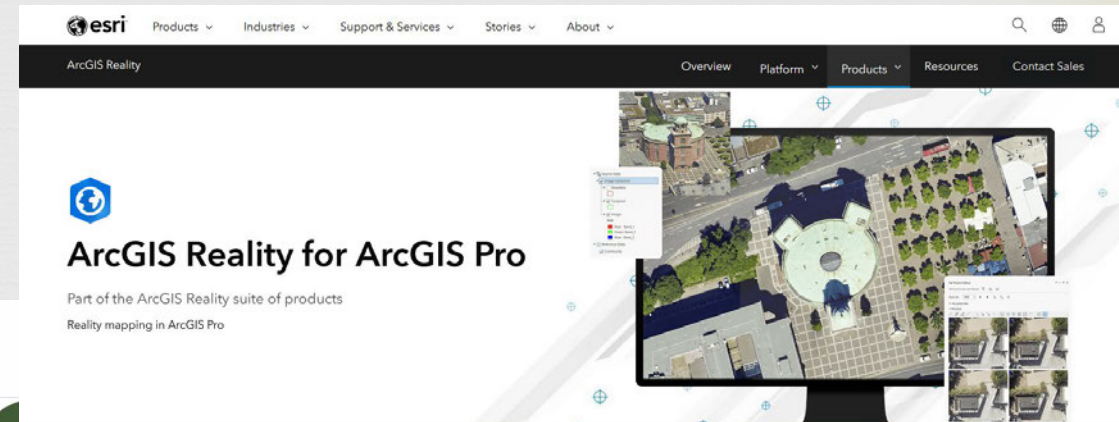
This Czech autonomous exploration with Compton cameras should be the next aerial radiometric survey over decommissioned Maralinga and Emu Fields.



ArcGIS Pro Compatibility



Ersi continues developing industrial avenues with ecosystems designed for topographic photogrammetry, pointclouds and Gaussian splatting.



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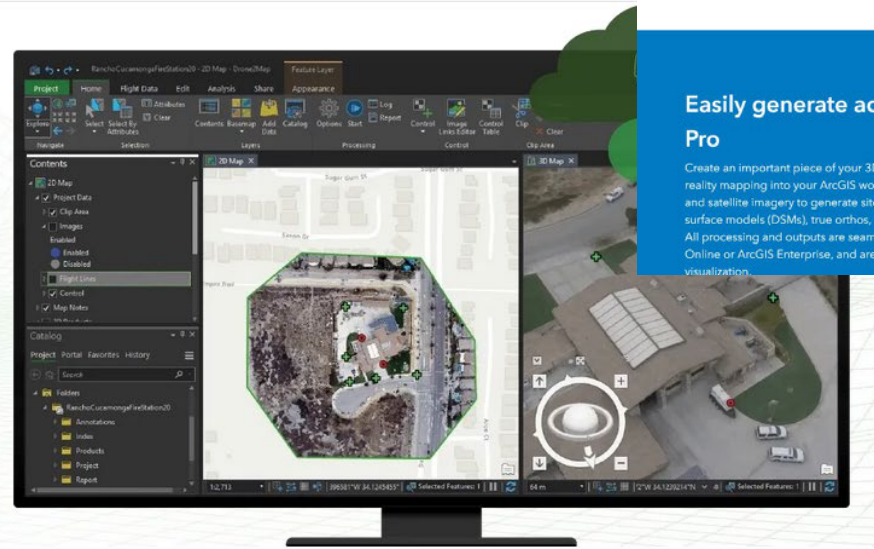
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ArcGIS Drone2Map

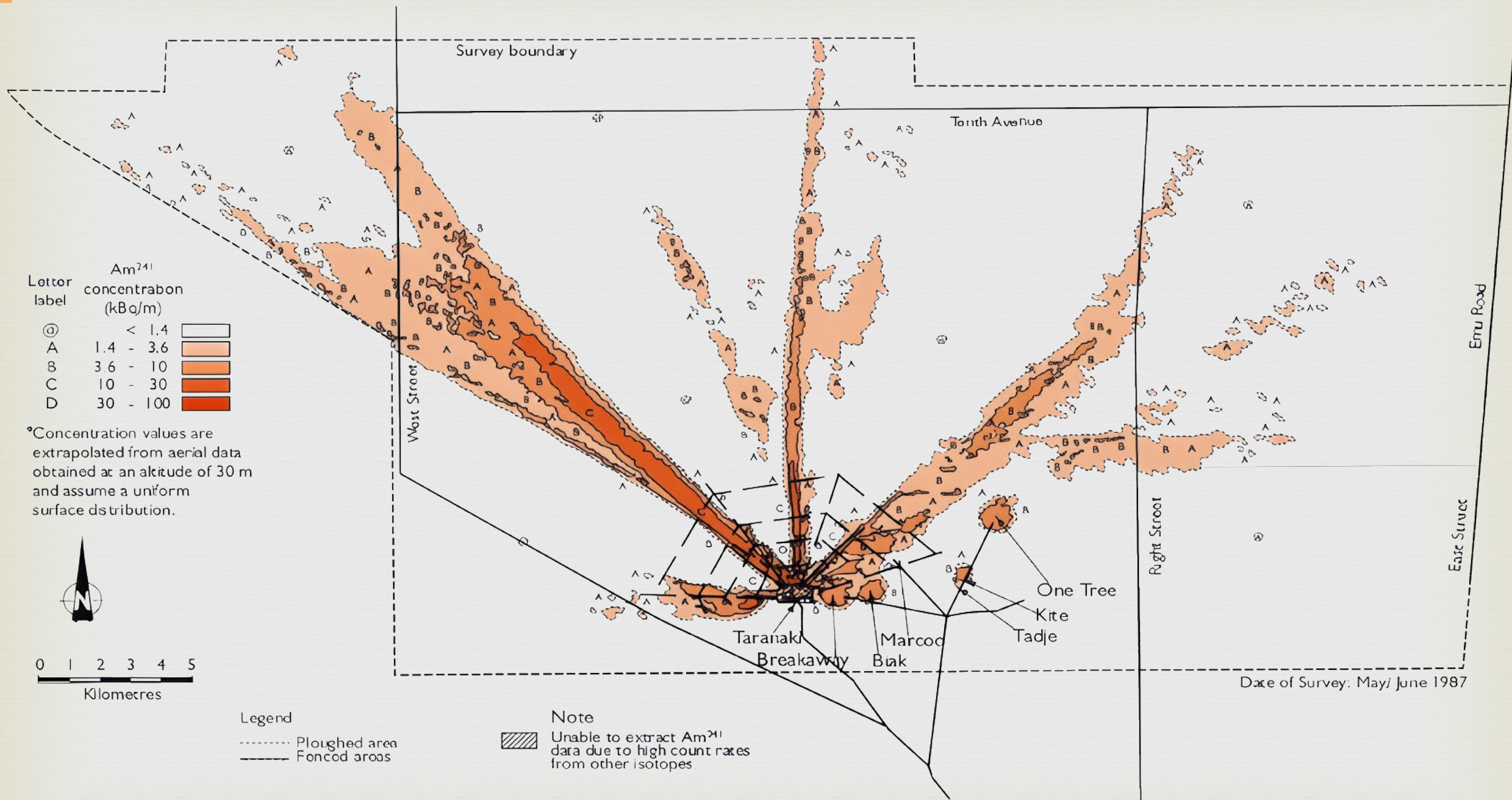
Turn drone imagery into valuable GIS data

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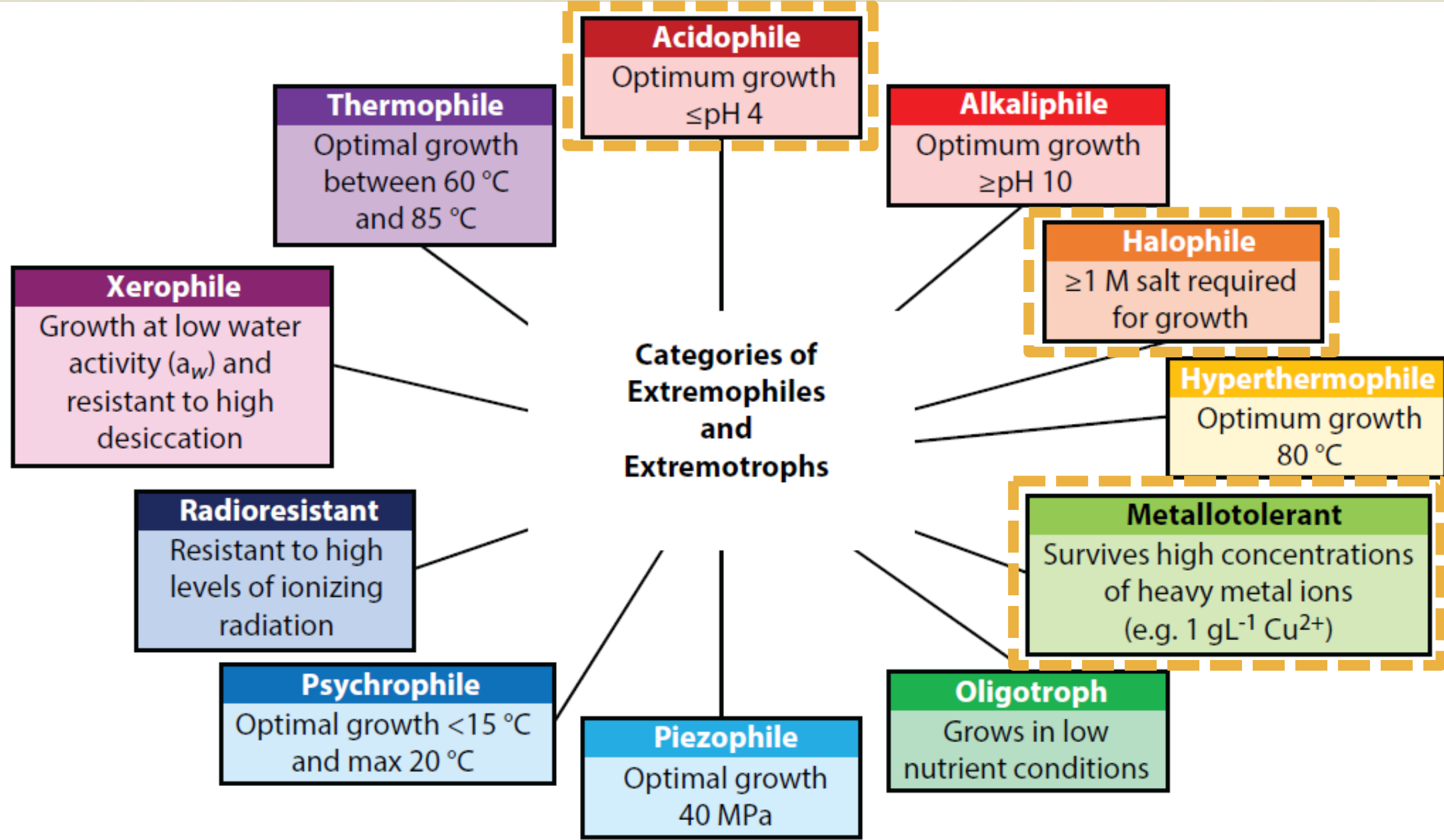


Figure 6.1 Extremophiles and Extremotrophs by category. Characterizing the parameters for life at extremes [6.38] [6.50] [6.90]. (Image credit: the authors).

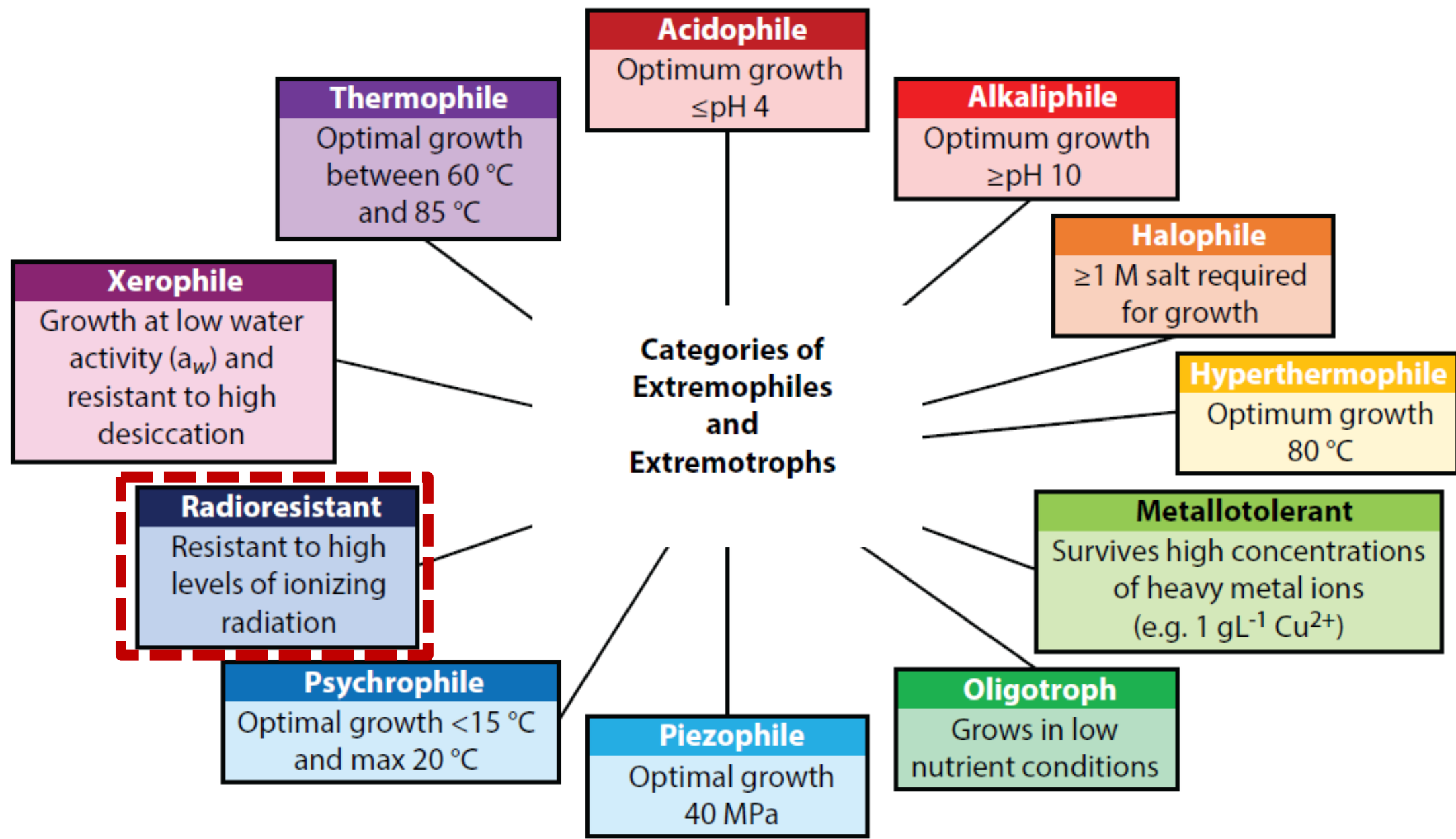


Figure 6.1 Extremophiles and Extremotrophs by category. Characterizing the parameters for life at extremes [6.38] [6.50] [6.90]. (Image credit: the authors).

Melaninised Extremophiles



Ionizing radiation may influence melanin production, from Antarctica to Nevada and Reactor No. 4, organisms protect themselves from exposure with distinct melanisation profiles.



Fig 5. Example of melanized fungal culture (Zhandanova 2000)

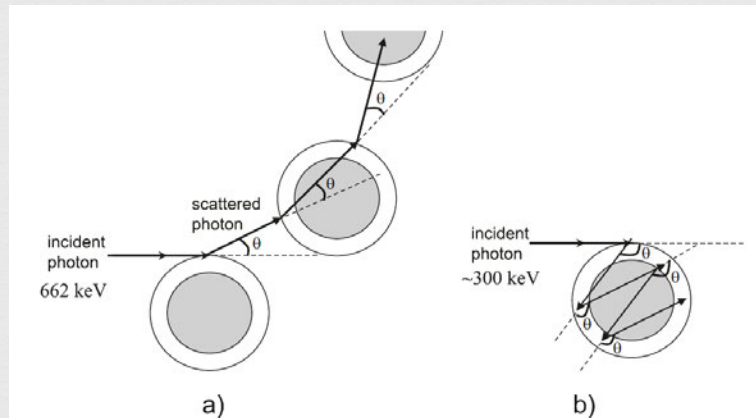
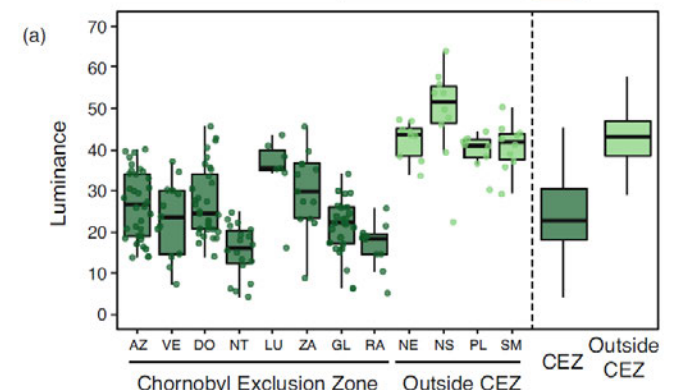


Fig. 10.1 Proposed model of scatter of ionizing radiation by melanin spheres: (a) forward scatter of initial high-energy photons incoming at arbitrary angle θ when forward scatter predominates; (b) oscillation within melanin spheres of secondary scattered photons which energies fall below 300 keV and both forward and backward scatters take place with backward scatter starting to predominate. *Source* Dadachova et al. (2008). Copyright @ Pigment Cells and Melanoma Research (John Wiley and Sons). Reproduced with permission

BURRACO AND ORIZAOLA

FIGURE 2 (a) Dorsal skin luminance in eastern tree frog (*Hyla orientalis*) males inhabiting across a gradient of radiation inside (CEZ) or outside the Chornobyl exclusion zone (outside CEZ). (b) Range of dorsal skin luminance in *H. orientalis* males (from left to right: Luminance values of 5, 20, 30, 40 and 60).



What if?



In conclusion, I leave you all with a speculation.
Could we use drone swarms to hunt hot spots and potentially where strange radioresilient creatures grow? (Like Rum Jungle's Uranium mine)



Fig. 1. A layout of the Ranger Uranium Mine. Approximate boundaries of different Land Application Areas (LAAs) have been shaded (Akber et al., 2011a).

Thank You



Any questions?

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Problems

(Industrial examples)

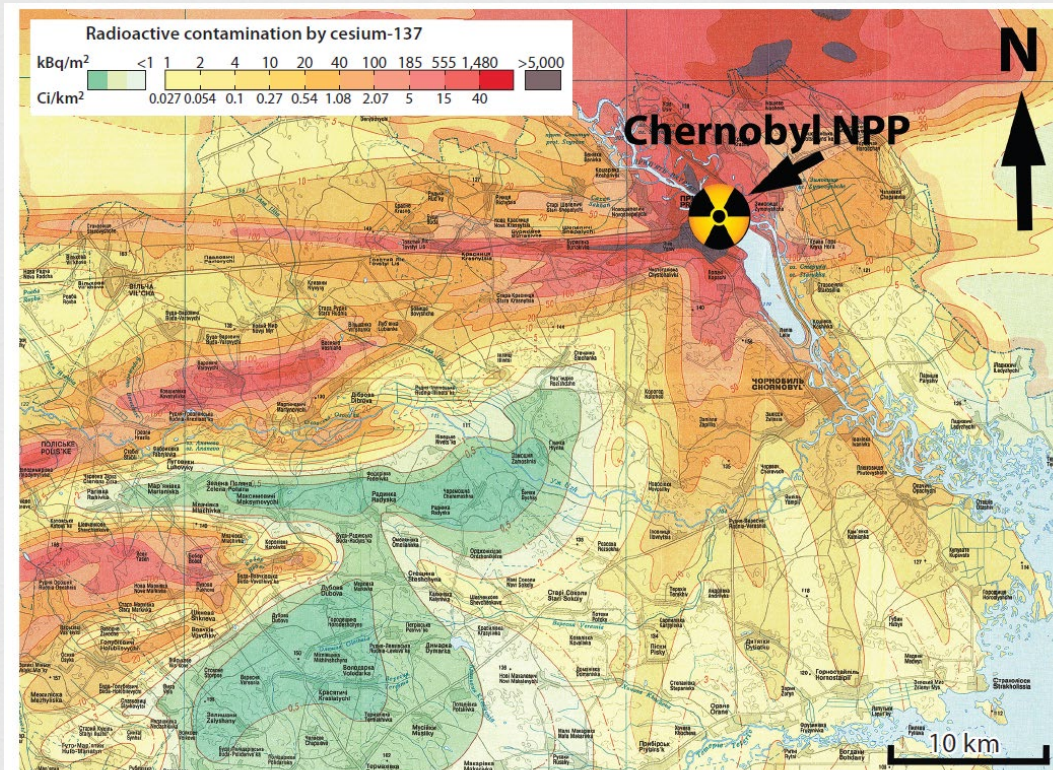


Figure 2

A map of radioactive contamination within the Chernobyl Exclusion Zone of Ukraine. Note the highly heterogeneous deposition patterns across the zone. The patchiness stems from variable wind and precipitation at the time of the accident. This map is based on estimates and measurements of cesium-137 deposition, but the region is also contaminated with strontium-90, various plutonium isotopes, and increasing amounts of americium-241. The areas in green are less than 1 kBq/m² while areas in brown are greater than 5000 kBq/m². Adapted from Shestopalov (1996). Abbreviation: NPP, nuclear power plant.

