

Microplastics Contamination in Terrestrial Environments

California Bioresources Alliance Symposium
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California State Water Resources Control Board

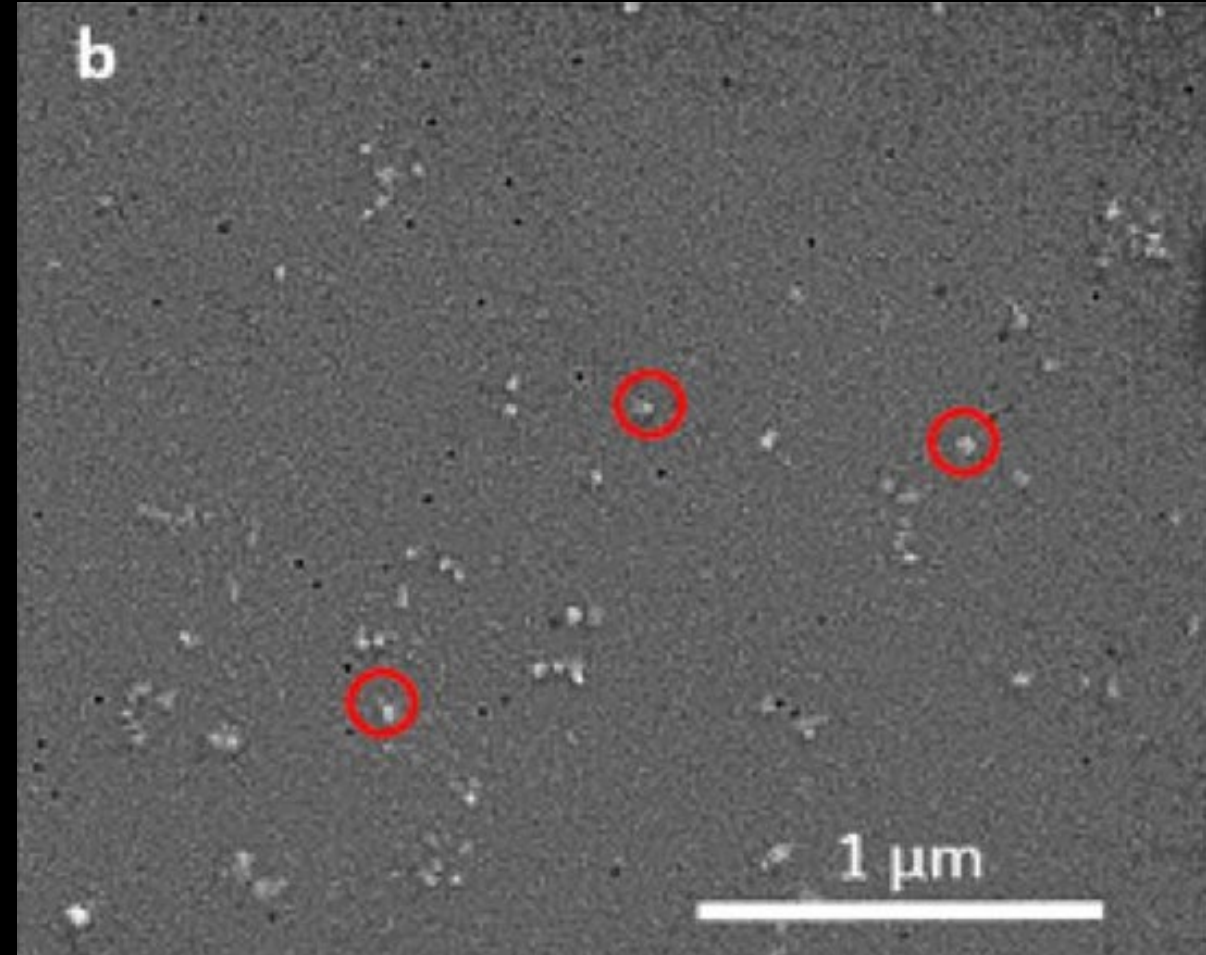
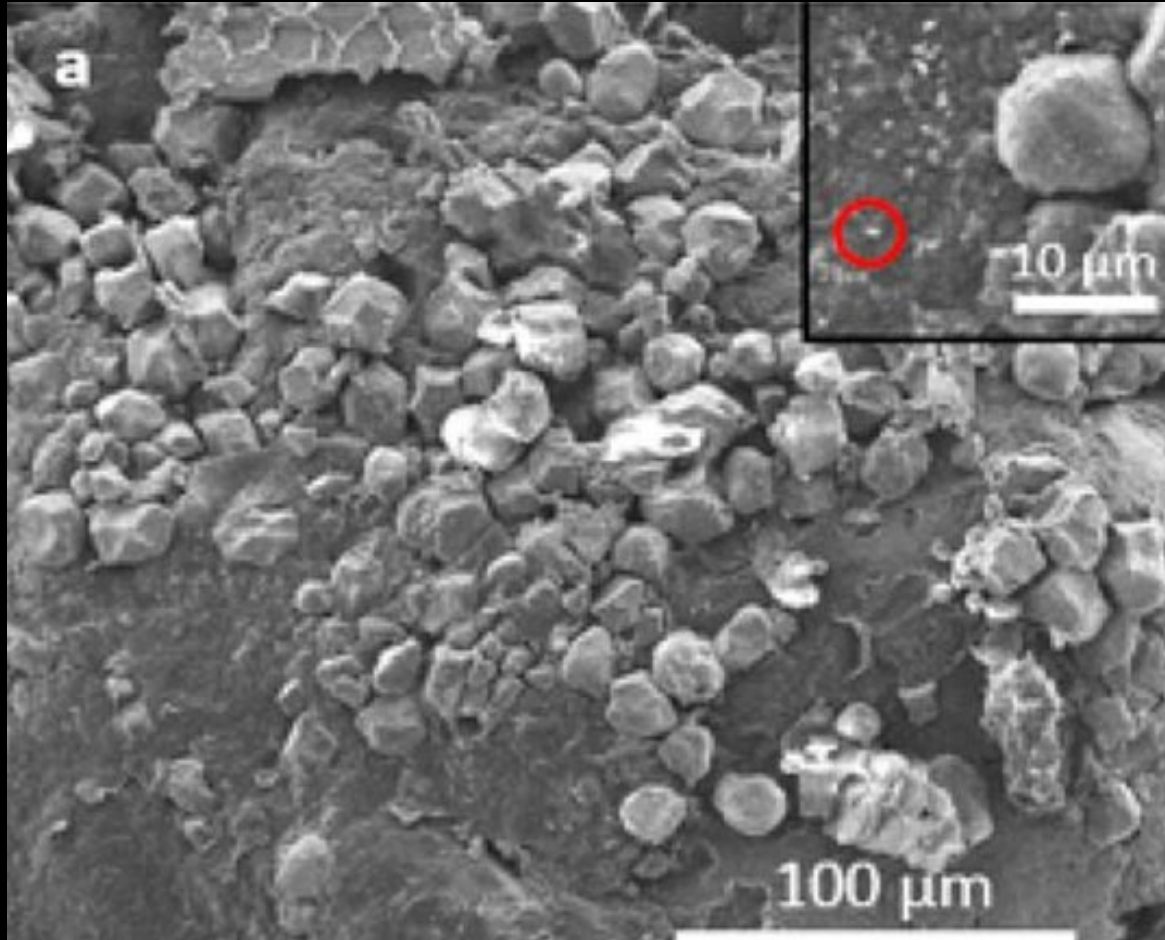


Photo: Mandy Barker



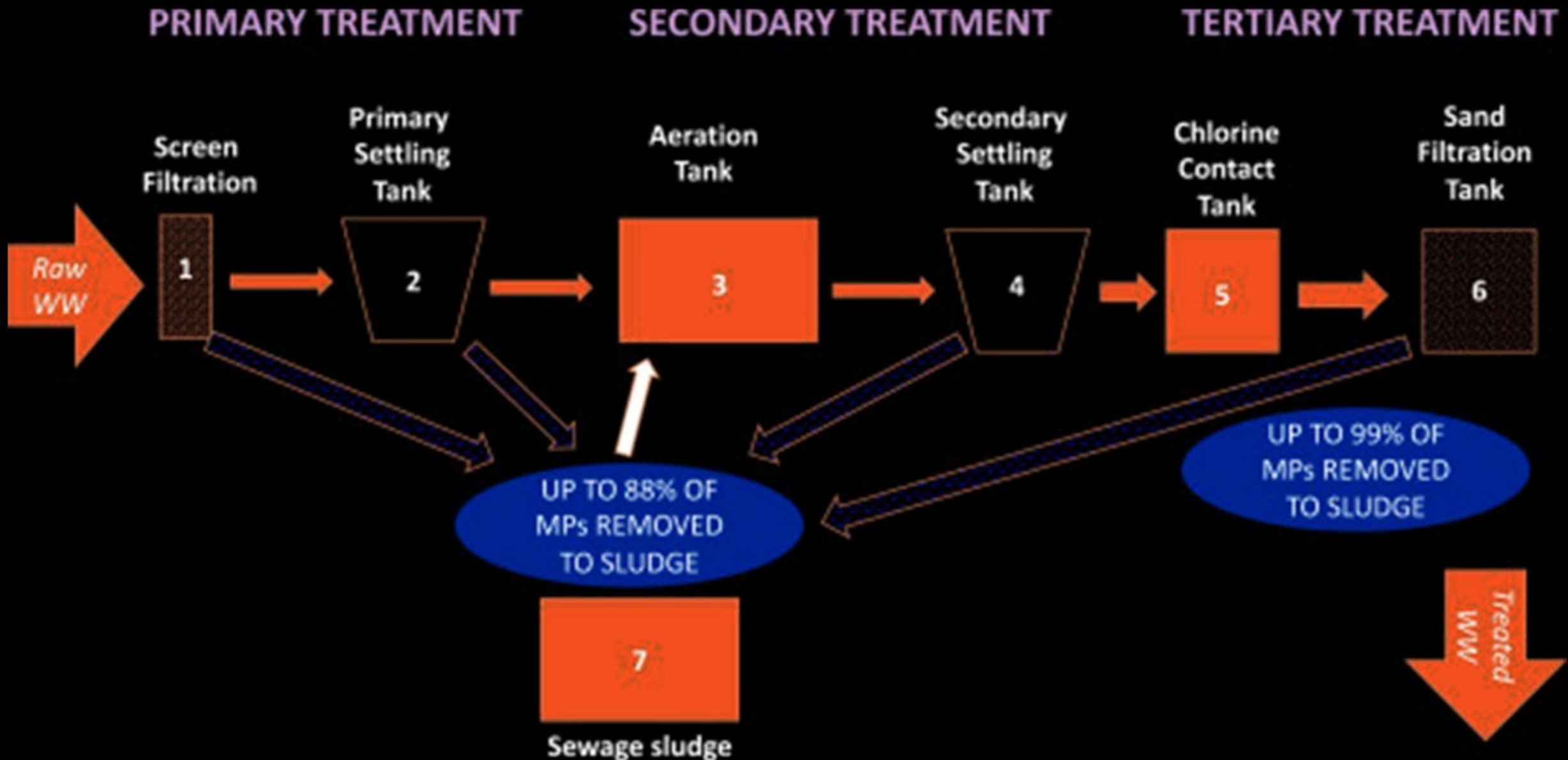
PHOTO BY GREG

Plastic Degrades into Micro/Nano-Particles

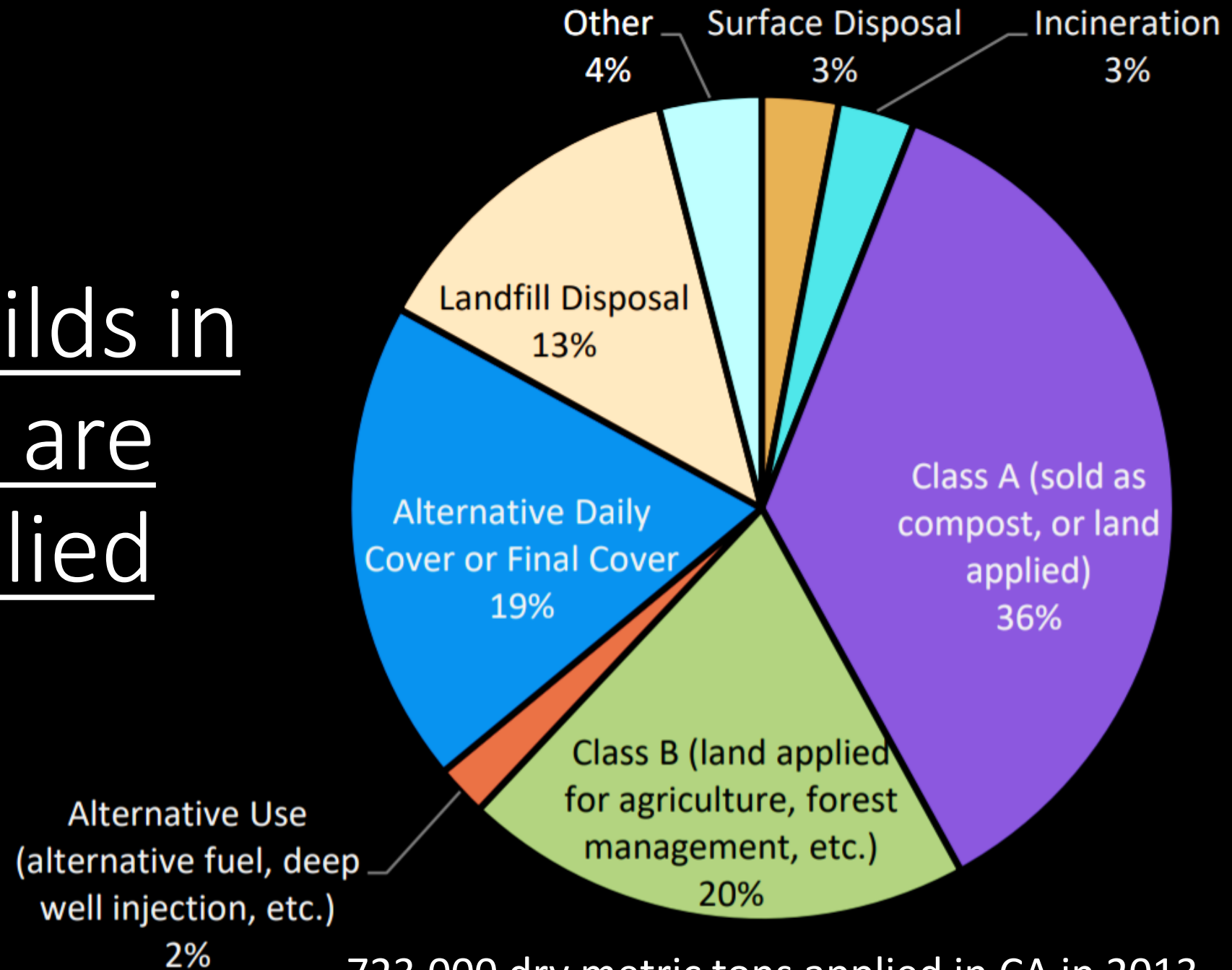


Scanning electron microscopy image of polyethylene facial scrub

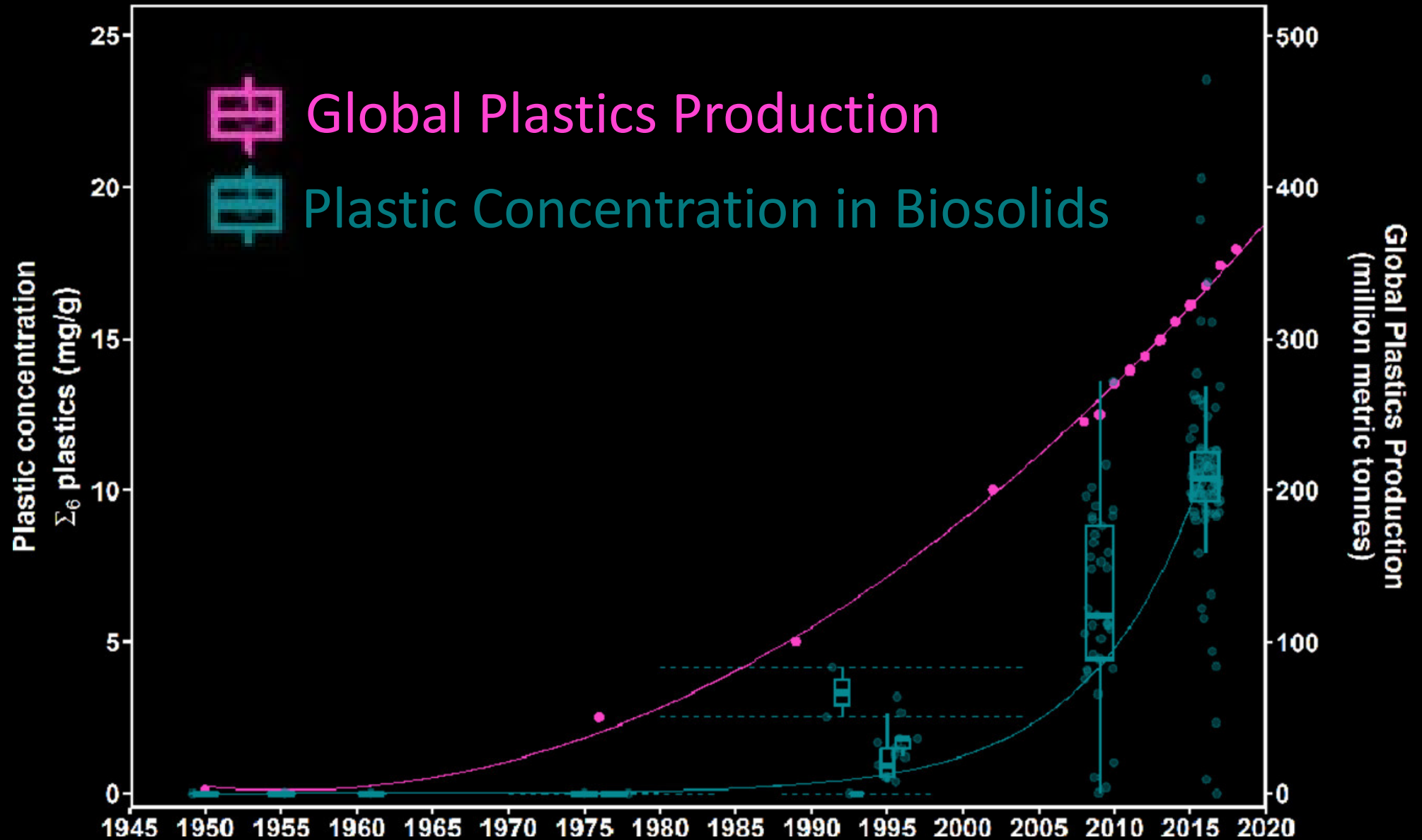
Wastewater Removes 88-99% of Microplastics



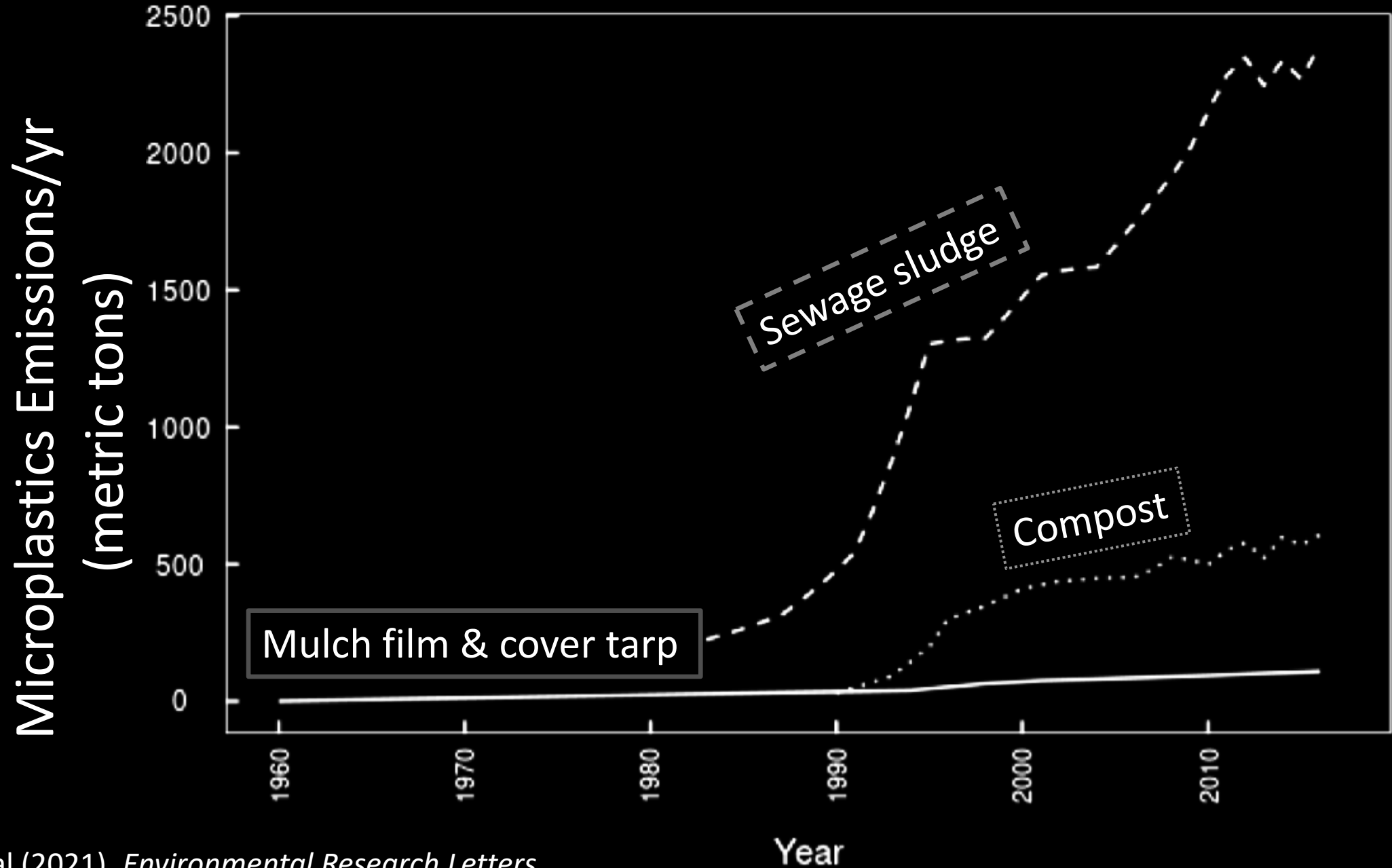
~75% Biosoils in
California are
Land-Applied



Plastics in Biosolids Correlates to Plastic Production

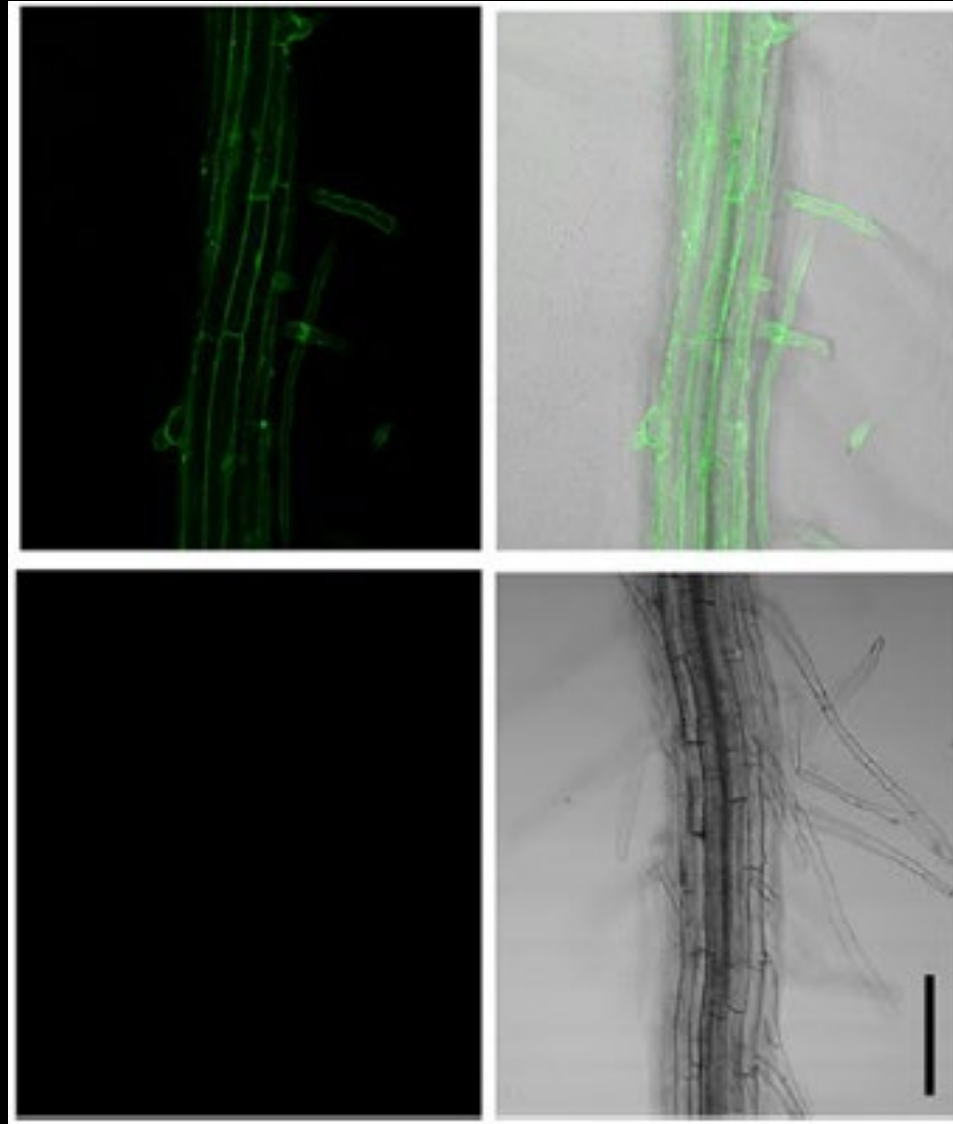


Plasticulture Input *Negligible* Compared to Biosolids



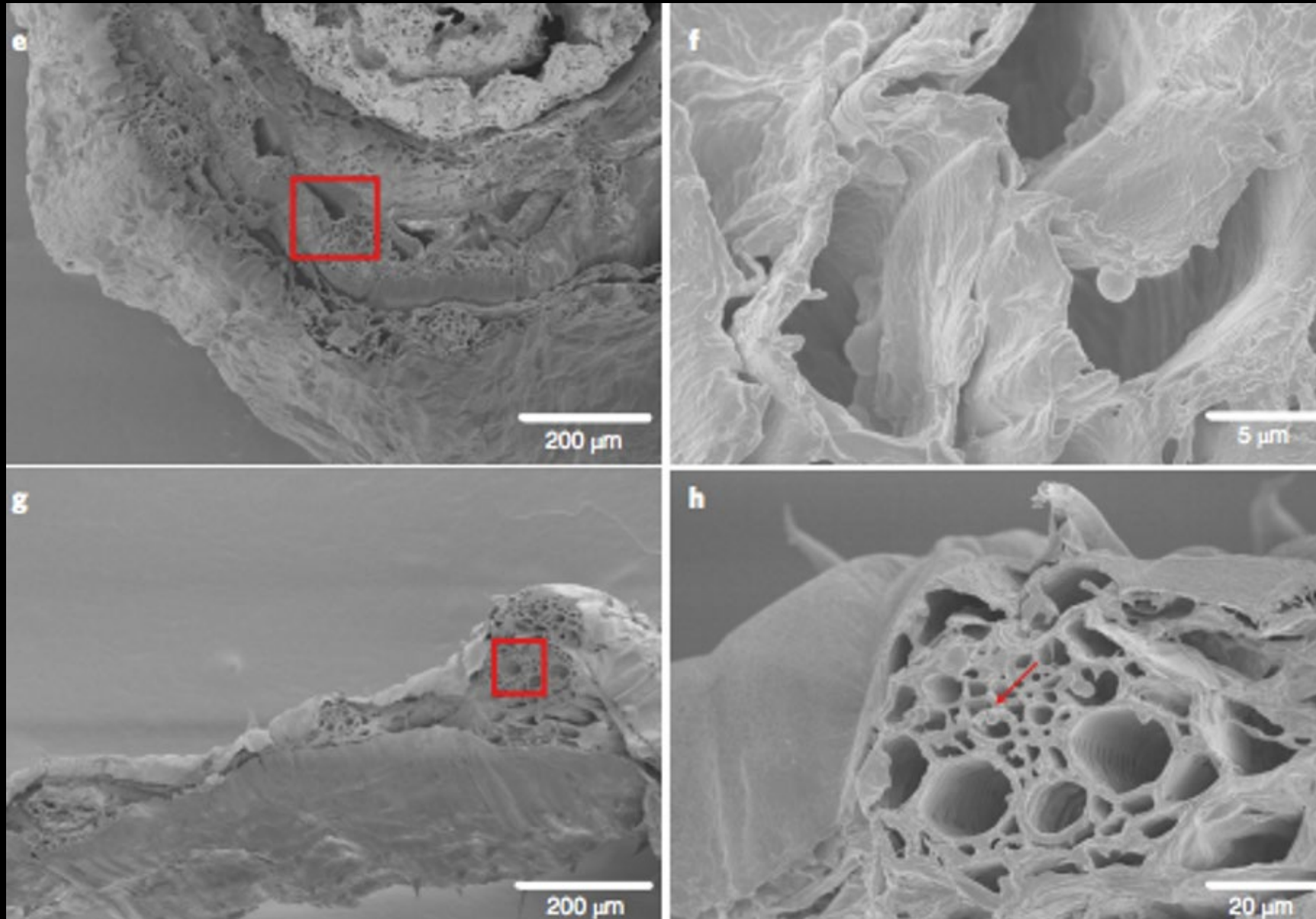
Plants Uptake and Accumulate Microplastics

Microplastics

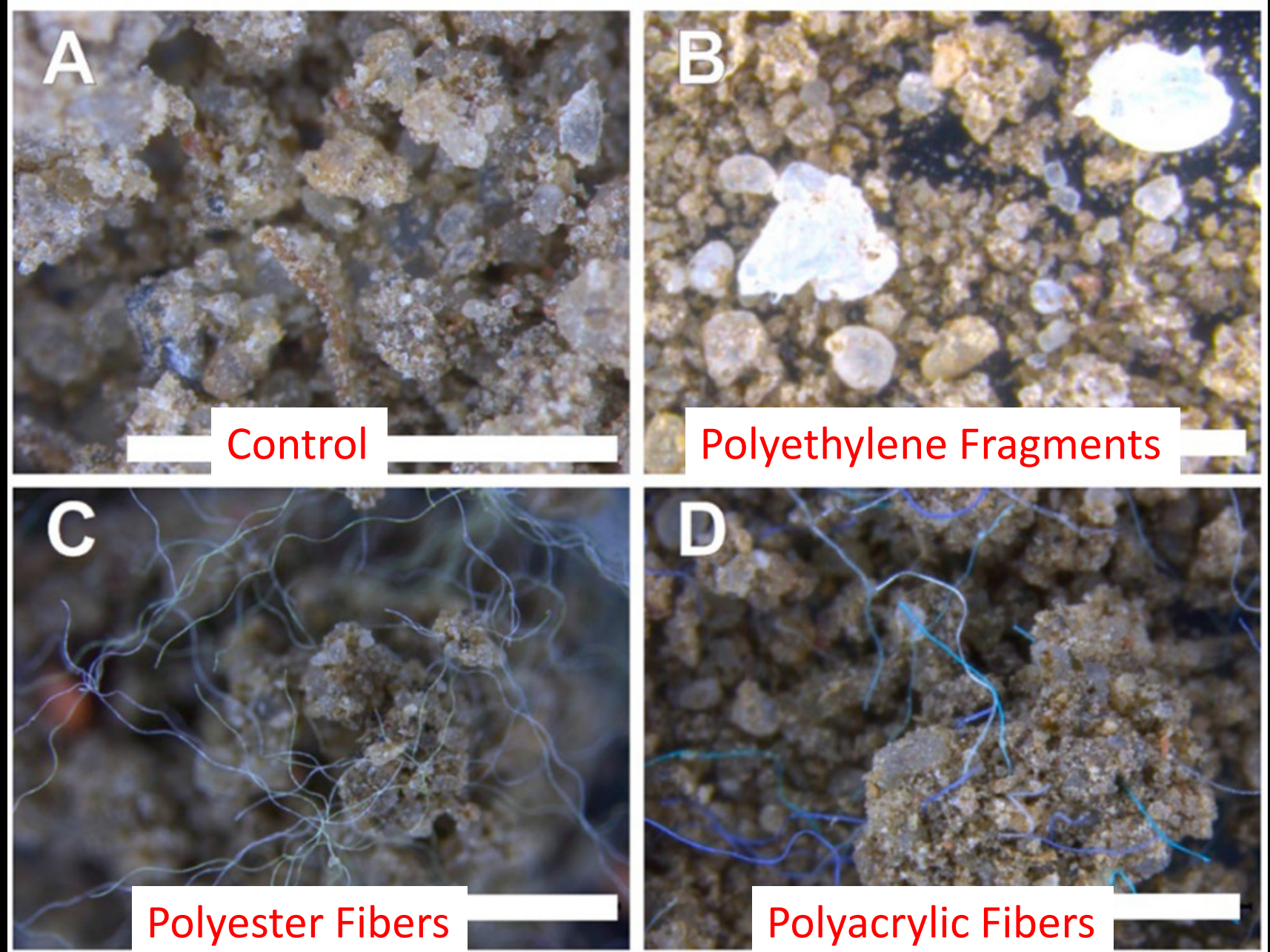


Control

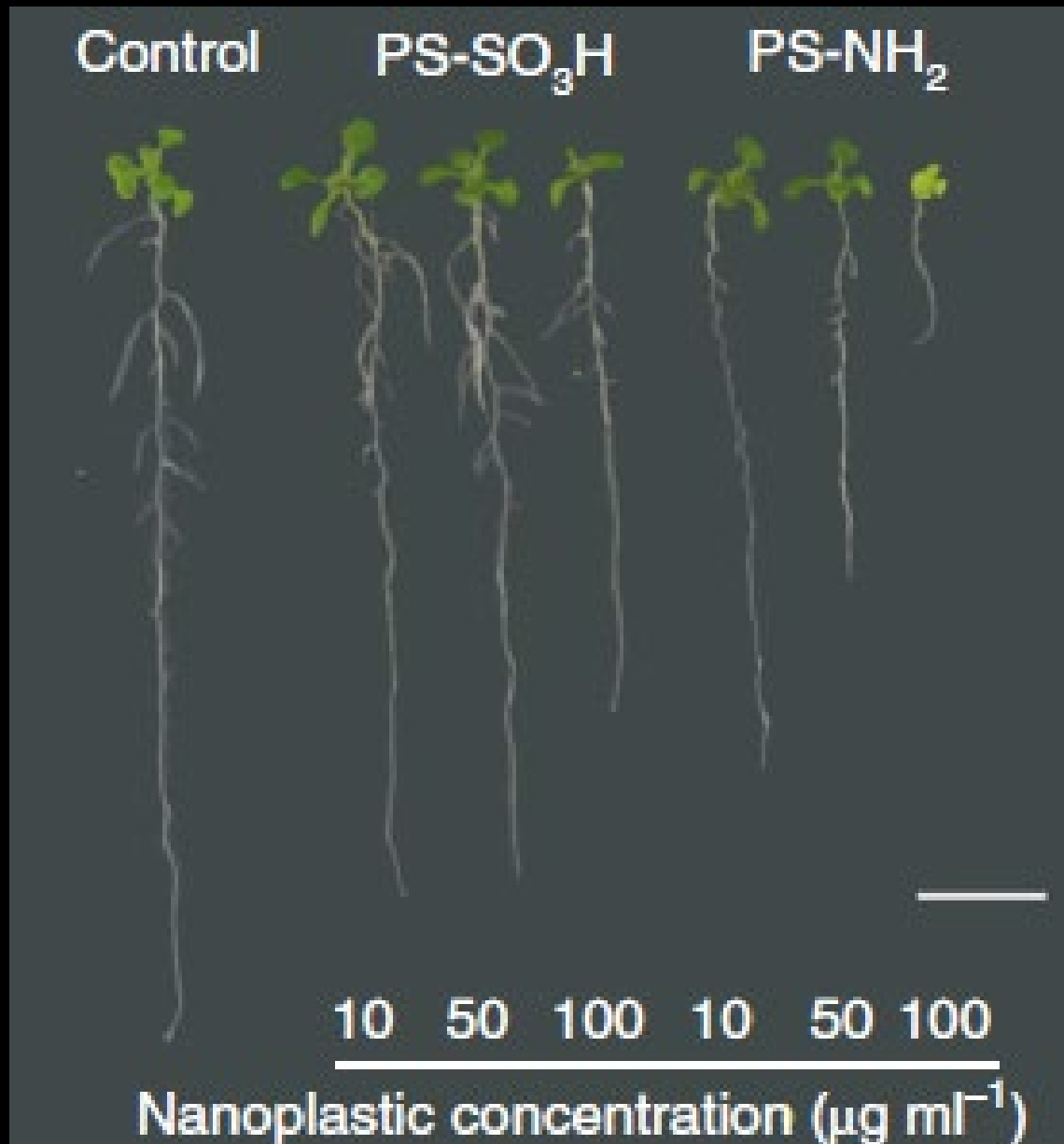
Crops Uptake Sub-Micron Plastics via Crack-Entry



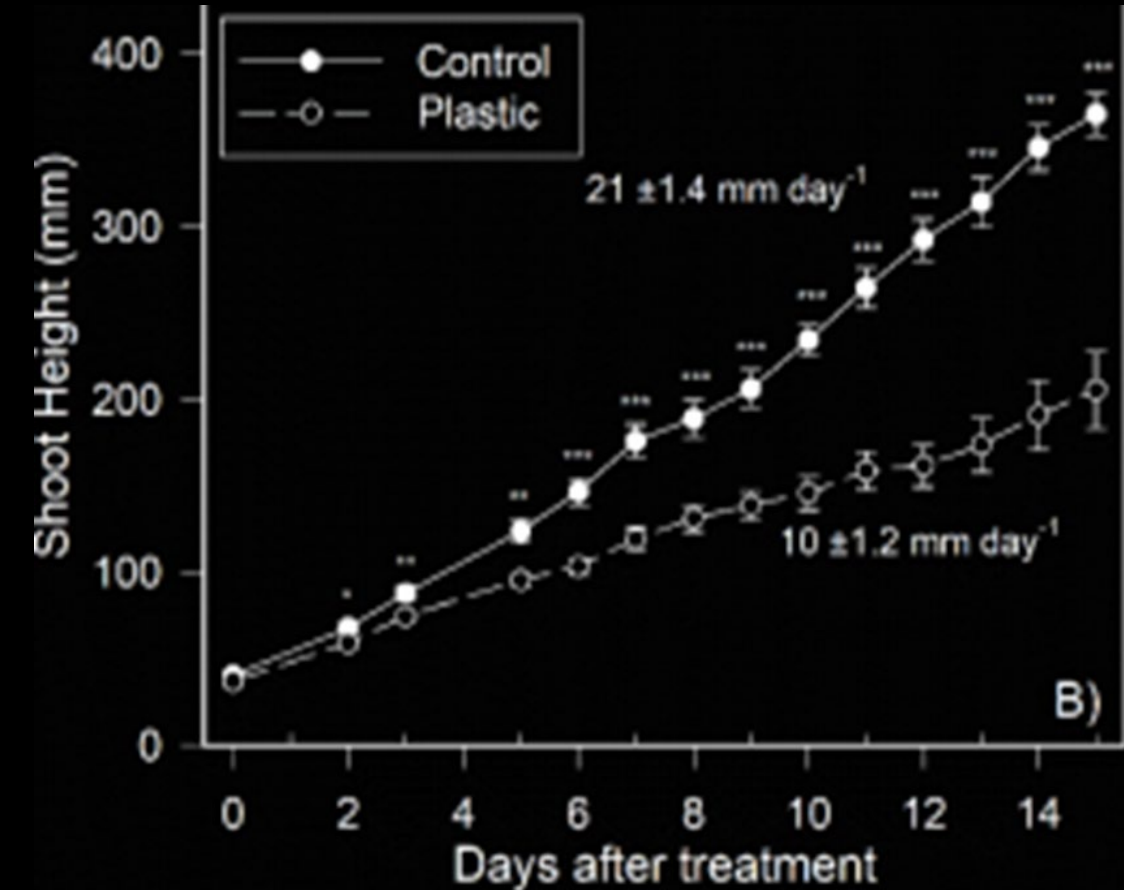
Microplastics Integrate in Soil Biophysical Environment



Microplastics Reduce Plant Growth



Plastic Bioaccumulation in Rhizosphere Decreases Growth Rate, Nutrient Uptake



Maize treated with PE (100 mg/L) decreased growth rate

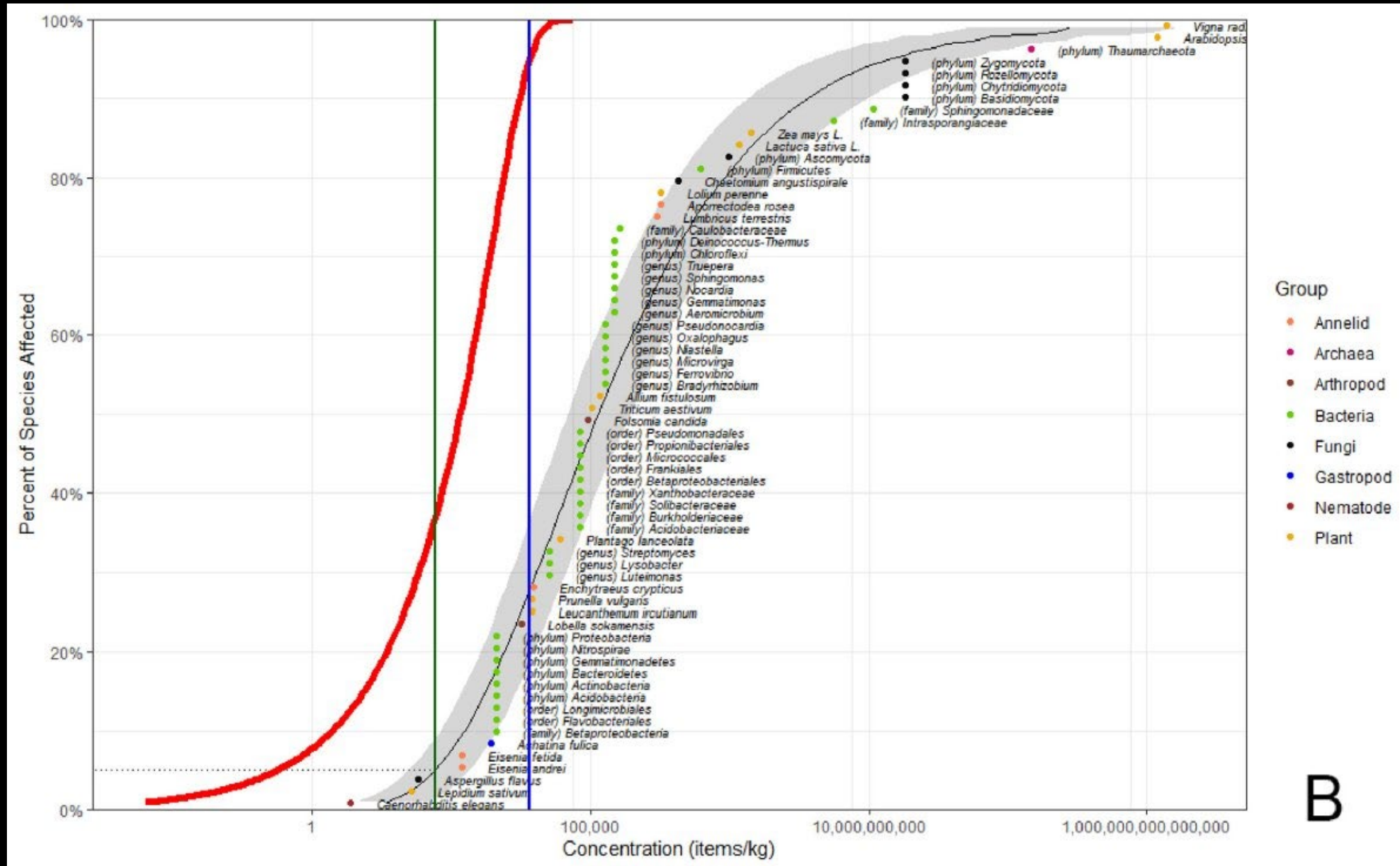


Maize treated with PE (100 mg/L) caused obvious morphological changes to roots

Microplastics Can Decrease Food Production

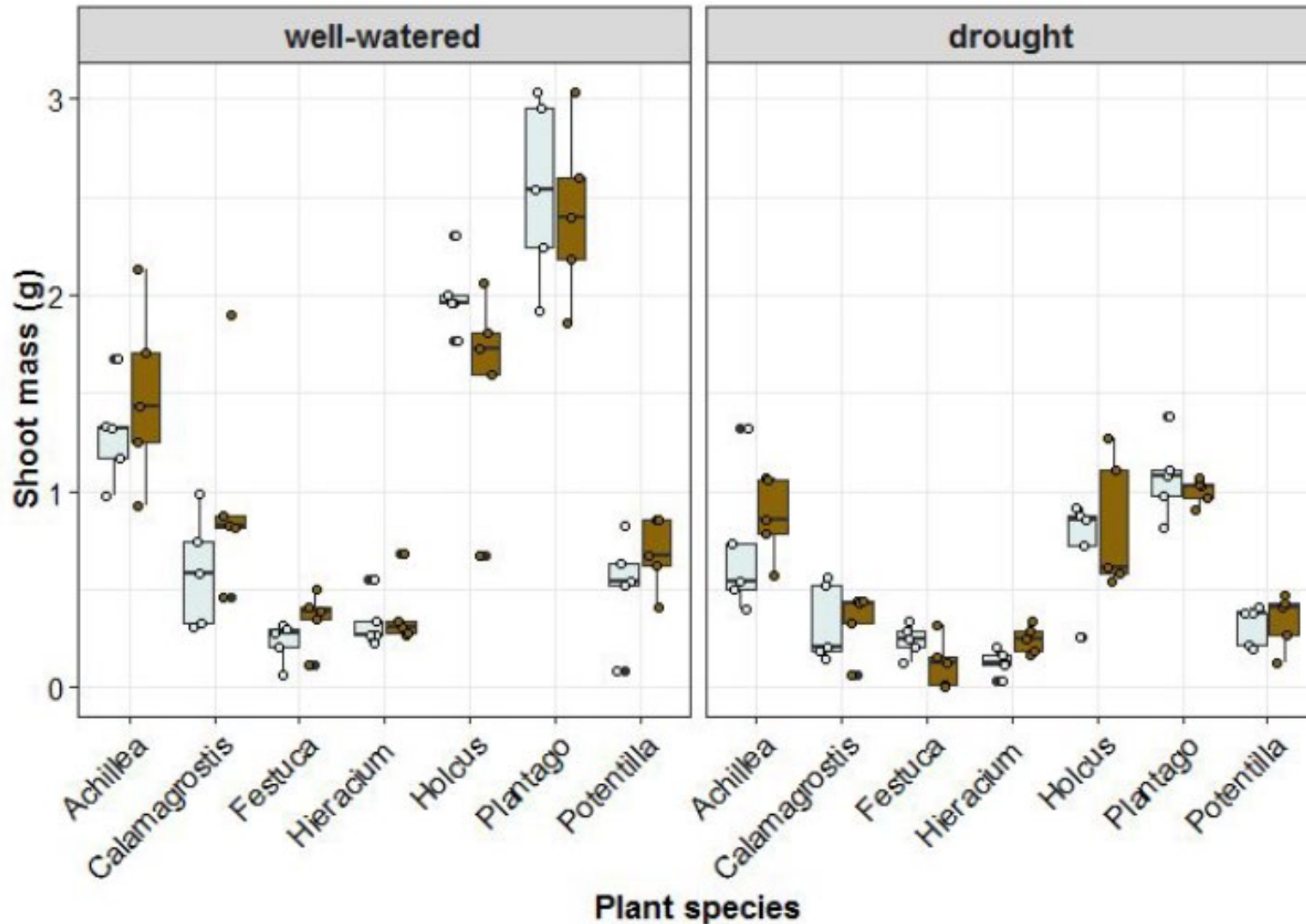


>5% of Species at Risk in 63% of Soil Samples Globally

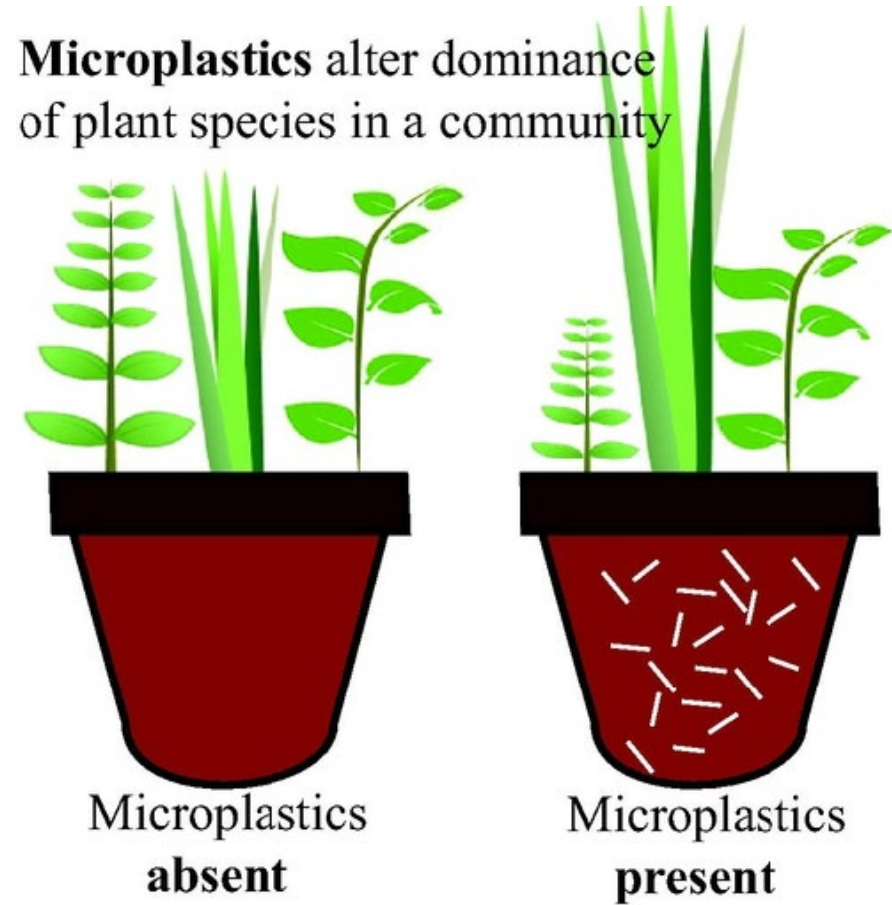


Microfibers Exacerbate Drought Impacts

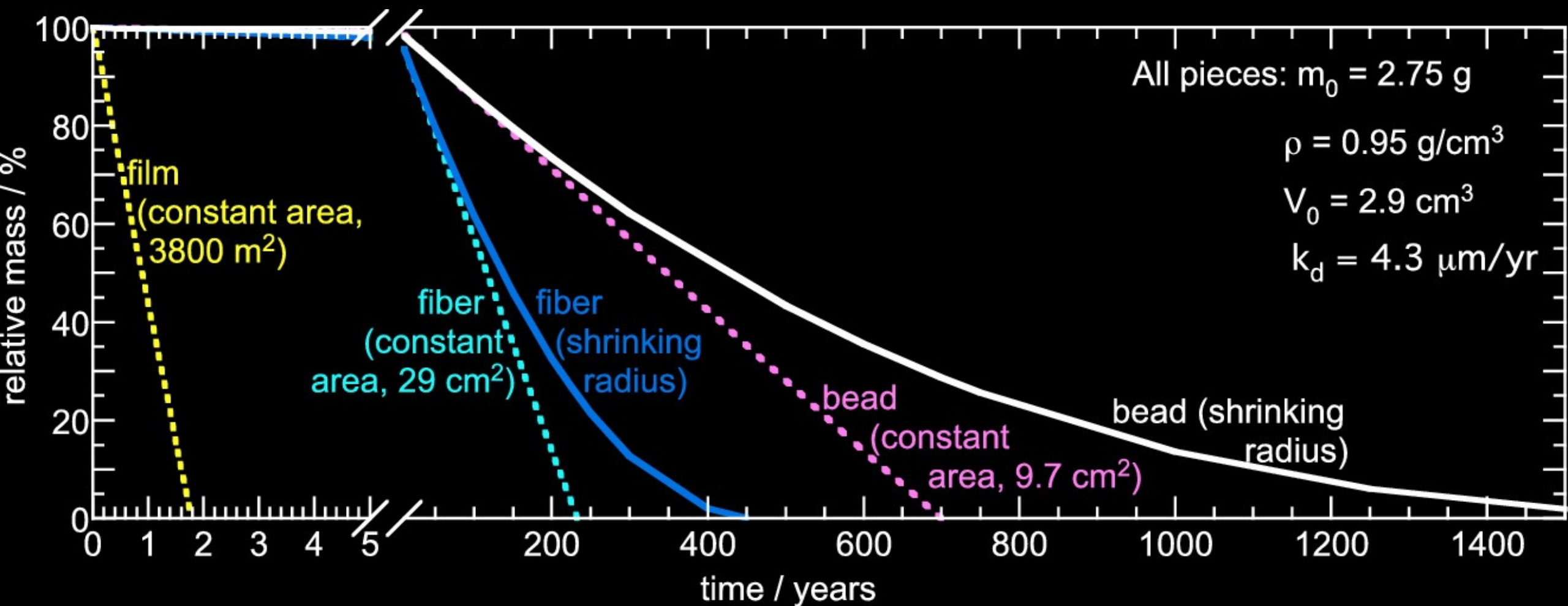
Microplastic fibers  absent  present



Microplastics alter dominance of plant species in a community



Plastic Degrades *Very Slowly*



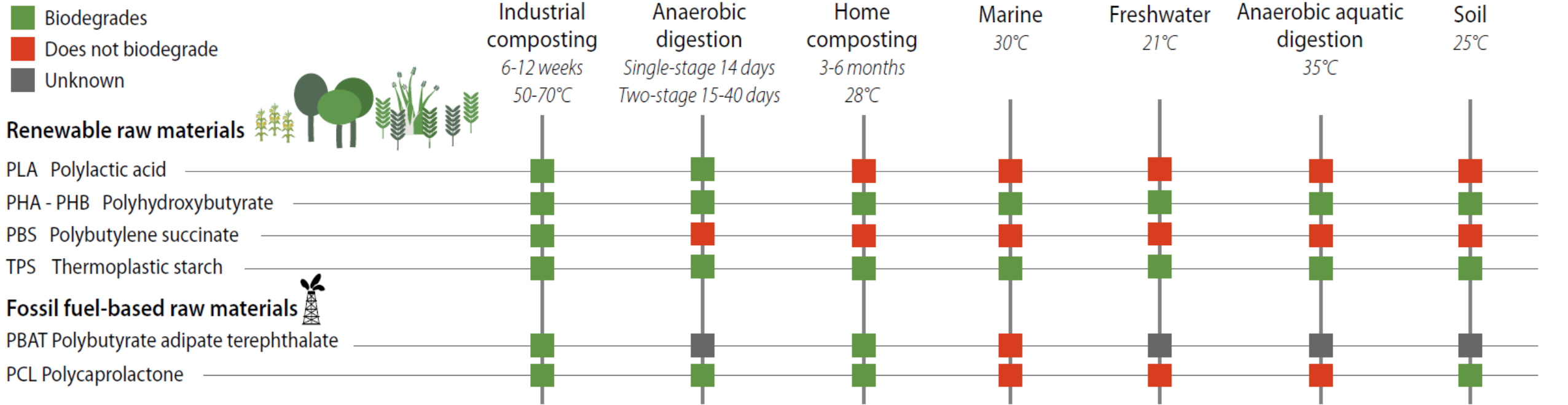
What's the deal with bioplastics?



Some degrade, some do not

Bio-based plastics and their biodegradation

Biodegradation according to ISO and ASTM standards

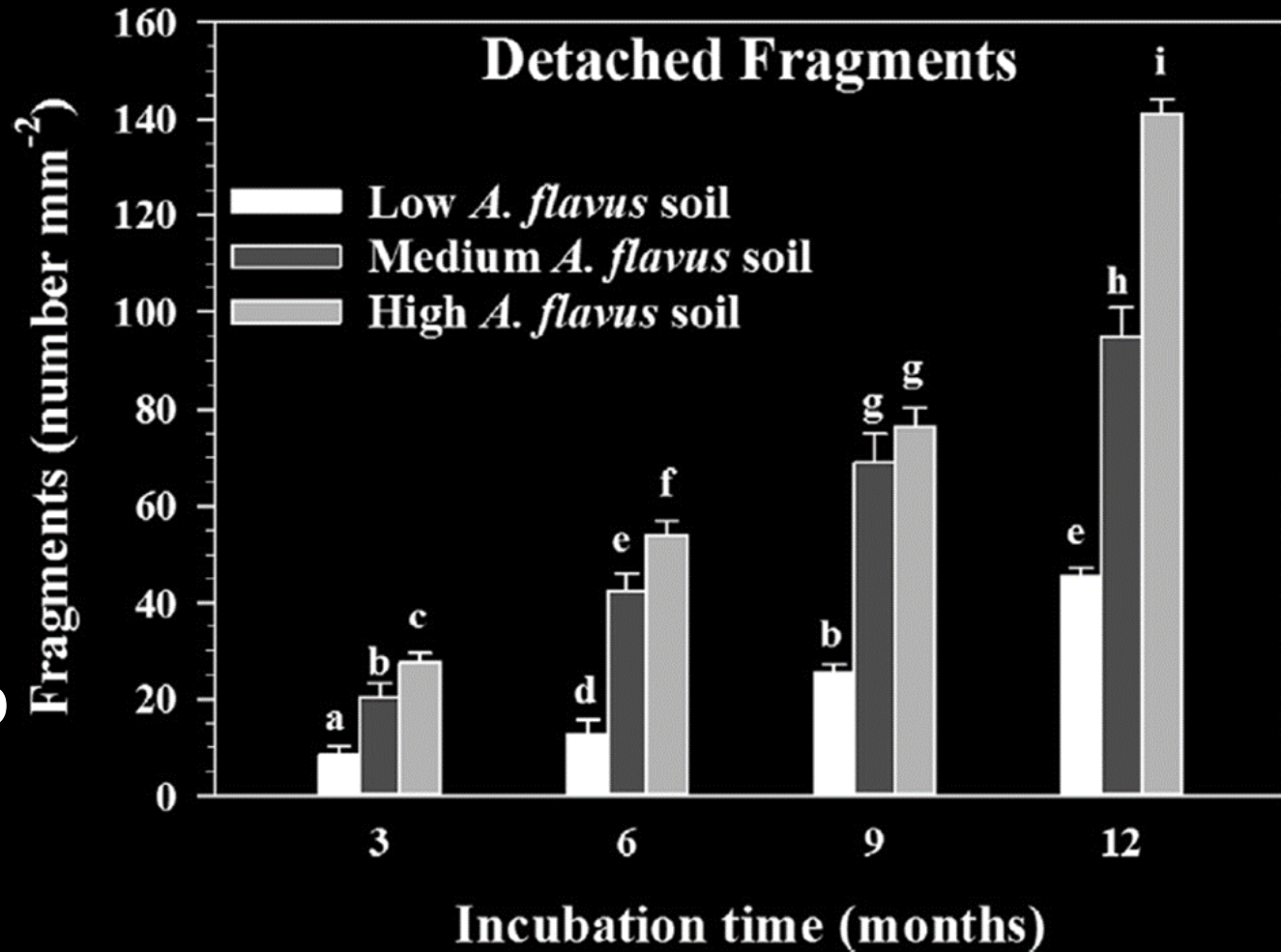


Source: UNEP 2021, adapted from Narancic et al. 2018.

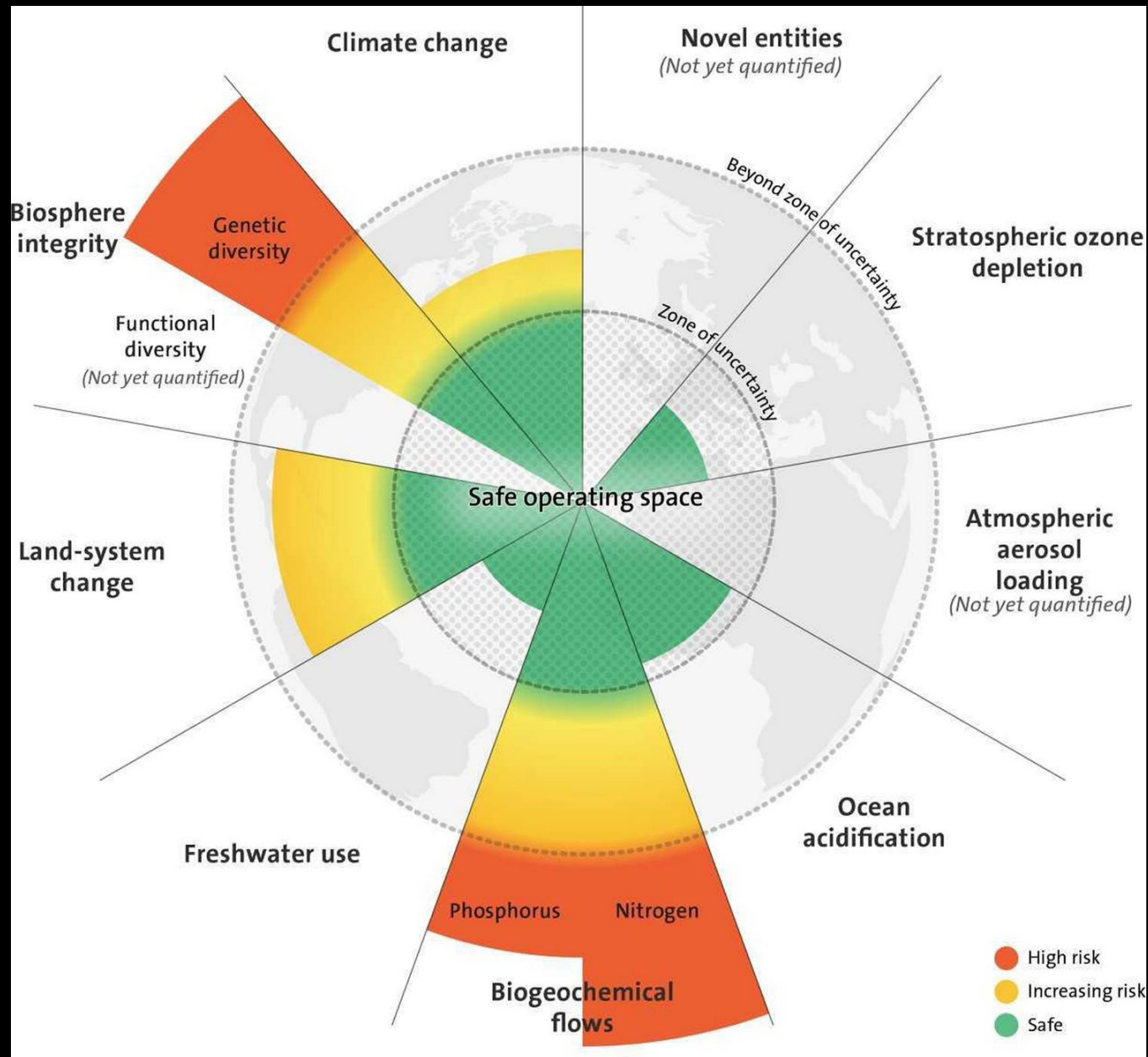
Illustrated by GRID-Arendal

Compostable Plastic Bags Increase Aflatoxin Content in Soil

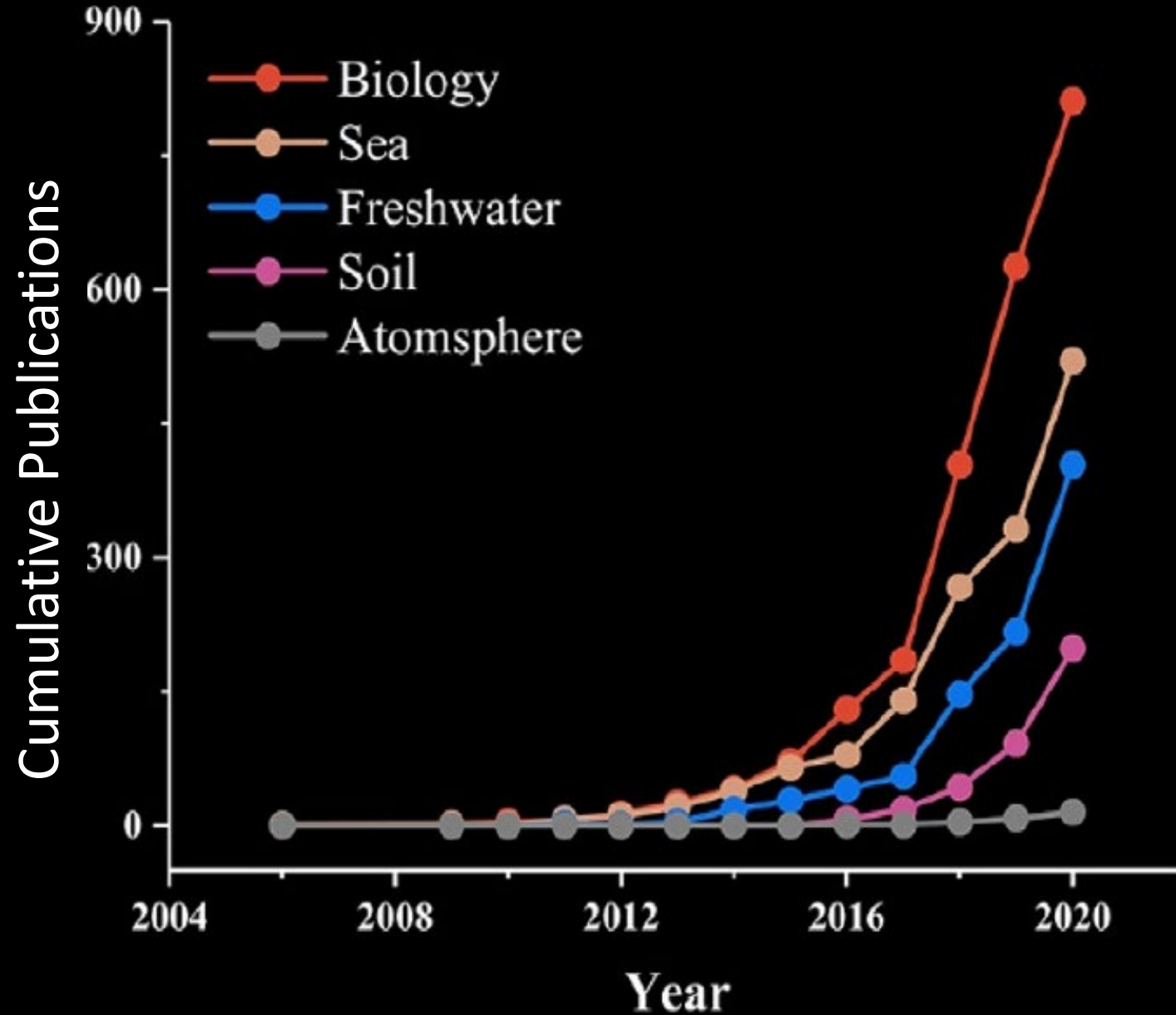
- *Aspergillus flavus* thrive on compostable microplastics particles, producing aflatoxins
- Burying compostable film in soil reduces soil quality, increases risk from aflatoxins to consumers



Planetary Boundary for Biosphere already at Risk

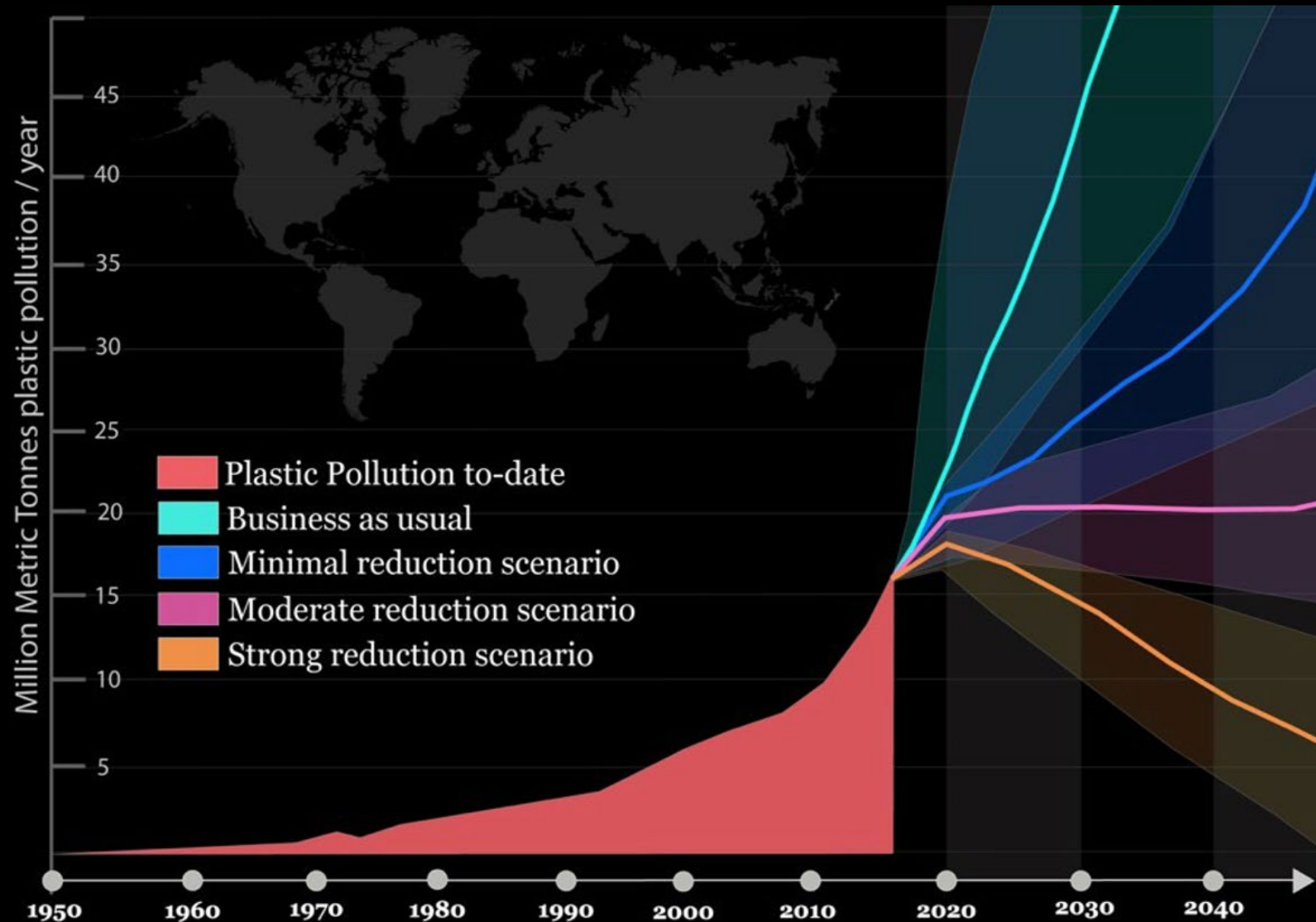


Evidence for Terrestrial Microplastics Impacts Rapidly Increasing



Yang et al,
*Science of the Total
Environment* (2021)

Business-As-Usual = Exponential Increasing Pollution



If it can't be
reduced, reused,
repaired, rebuilt,
refurbished,
refinished, resold,
recycled or
composted,
then it should
be restricted,
redesigned
or removed
from production.



- Pete Seeger