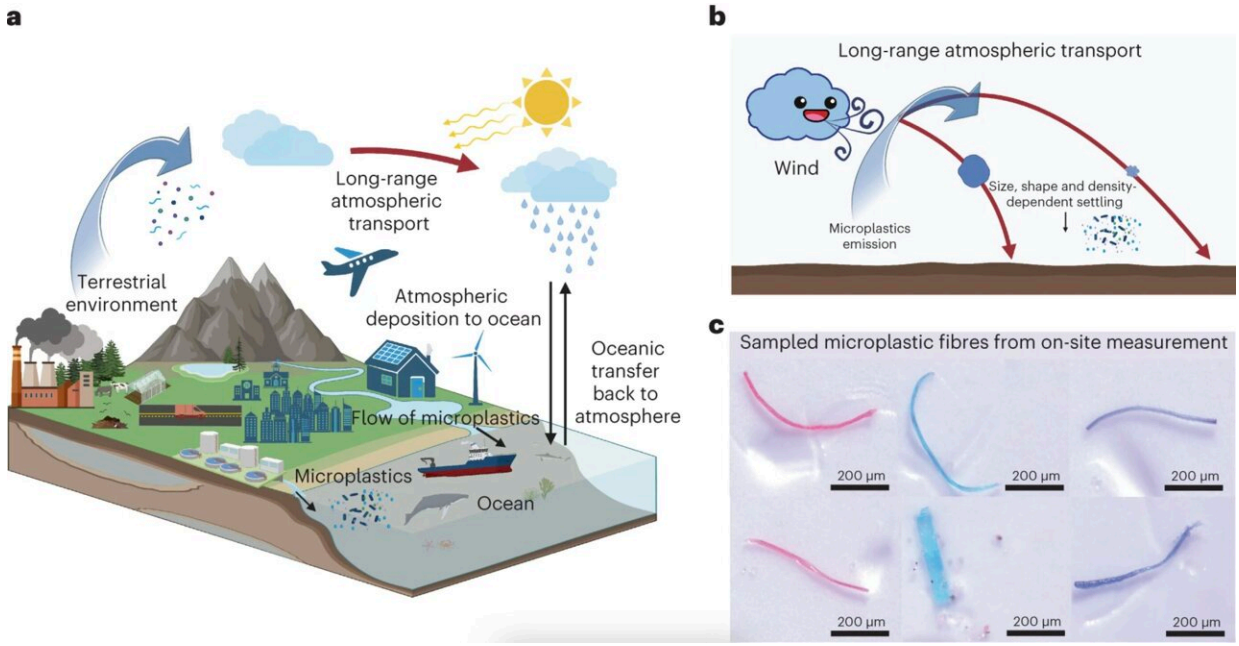
Atmospheric microplastic transport predominantly derived from oceans, study finds

October 3 2023, by Hannah Bird



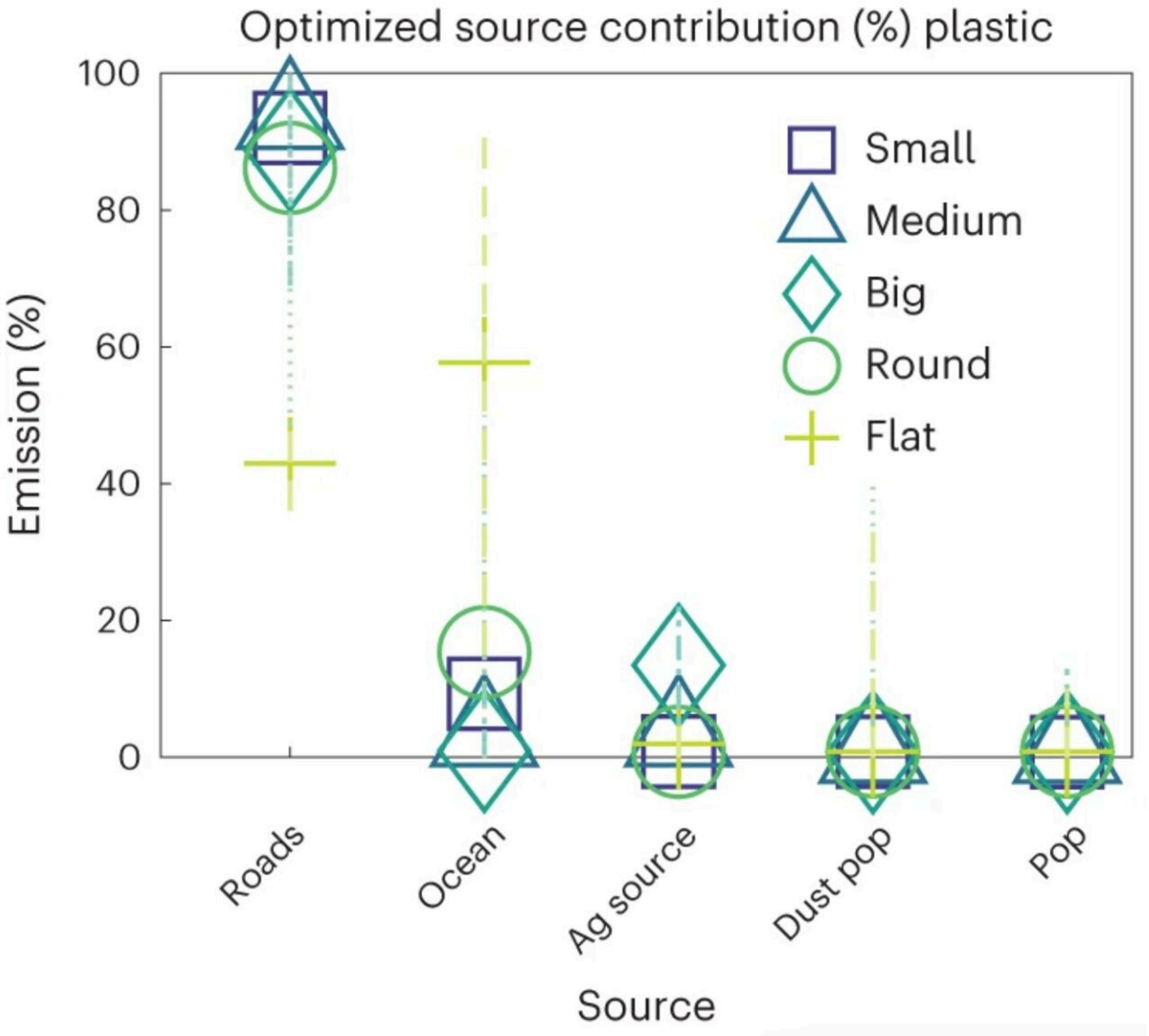
a) Illustration of the global microplastic cycle with sources in the built environment dispersing them through rivers and oceans via aquatic or airborne wind transport before deposition by gravity and precipitation. b) Illustration of microplastics deposition depending upon size and shape, with smaller spherical particles transported further. c) Images of microplastic fibers used in this study. Credit: *Nature Geoscience* (2023). DOI: 10.1038/s41561-023-01264-6

Microplastics in our natural environments are of increasing concern as

these tiny particles (450%. Consequently, this research highlights that microplastics are likely to travel farther than previously thought through atmospheric wind regimes, and therefore deposit over a much larger area. However, by modeling their atmospheric transport it may be possible to determine source locations to aid management plans and reduce further dispersal.

The research team used experimental data on the settling of nylon fibers alongside the model and concluded that very thin and long microplastic fibers would be particularly abundant in both natural and urban environments, being deposited sooner and closer to the source and have greater longevity in ecosystems than spherical particles. The irregularity of air turbulence was found to impact elongated microplastic fibers more than spherical ones as it alters transport orientations and therefore settling velocity due to its weight and air resistance.

This model validates previous work published in *Science* by Dr. Janice Brahney, Associate Professor at Utah State University, and collaborators who had collected microplastic samples from national parks across the United States. Evaluating a total of 1,260 length and width measurements alongside microplastic fiber shapes, the team determined that these fibers, predominantly derived from clothing, contributed to more than 1,000 metric tons of microplastics deposited by wind and rain within the south and central western United States alone annually.



Estimates of the percentage contribution of key microplastic fiber sources of atmospheric transport: from tires, those entrained from the ocean surface, agricultural and anthropogenic dust, plus general population sources in daily use. Credit: *Nature Geoscience* (2023). DOI: 10.1038/s41561-023-01264-6

With this knowledge, the research team then considered a number of key sources of microplastics carried by atmospheric transport: particles from roads and tires, particles picked up by wind from the surface of the

ocean, dust from agricultural practices (likely from the application of wastewater that contains microbeads from cosmetic and cleaning products) and urban activities, and the vast array derived from the population globally.

Based on the model, deposition of flat fibers from tires were reduced compared to previous models, while those derived from the ocean had increased. Dust from agriculture and urban activities as well as the overall anthropogenic sources in daily use was found to be less impactful. The exact mechanism by which microplastics in the ocean become airborne does however require further investigation, particularly as this appears to be a dominant source.

While some remote areas of the planet may be considered "pristine" and protected from direct human interaction, this research highlights that our fingerprints can still be found in far-reaching locations, and the toll of plastic consumption now will continue to be felt over generations to come if high-risk forms are not sufficiently managed.

More information: Shuolin Xiao et al, Long-distance atmospheric transport of microplastic fibres influenced by their shapes, *Nature Geoscience* (2023). DOI: 10.1038/s41561-023-01264-6