



Reducing Plastic Debris in the Los Angeles and San Gabriel River Watersheds

Students: Jessica Midbust, Michael Mori, Paula Richter, Bill Vosti | Faculty Advisor: Derek Booth | Client: Algalita Marine Research Institute



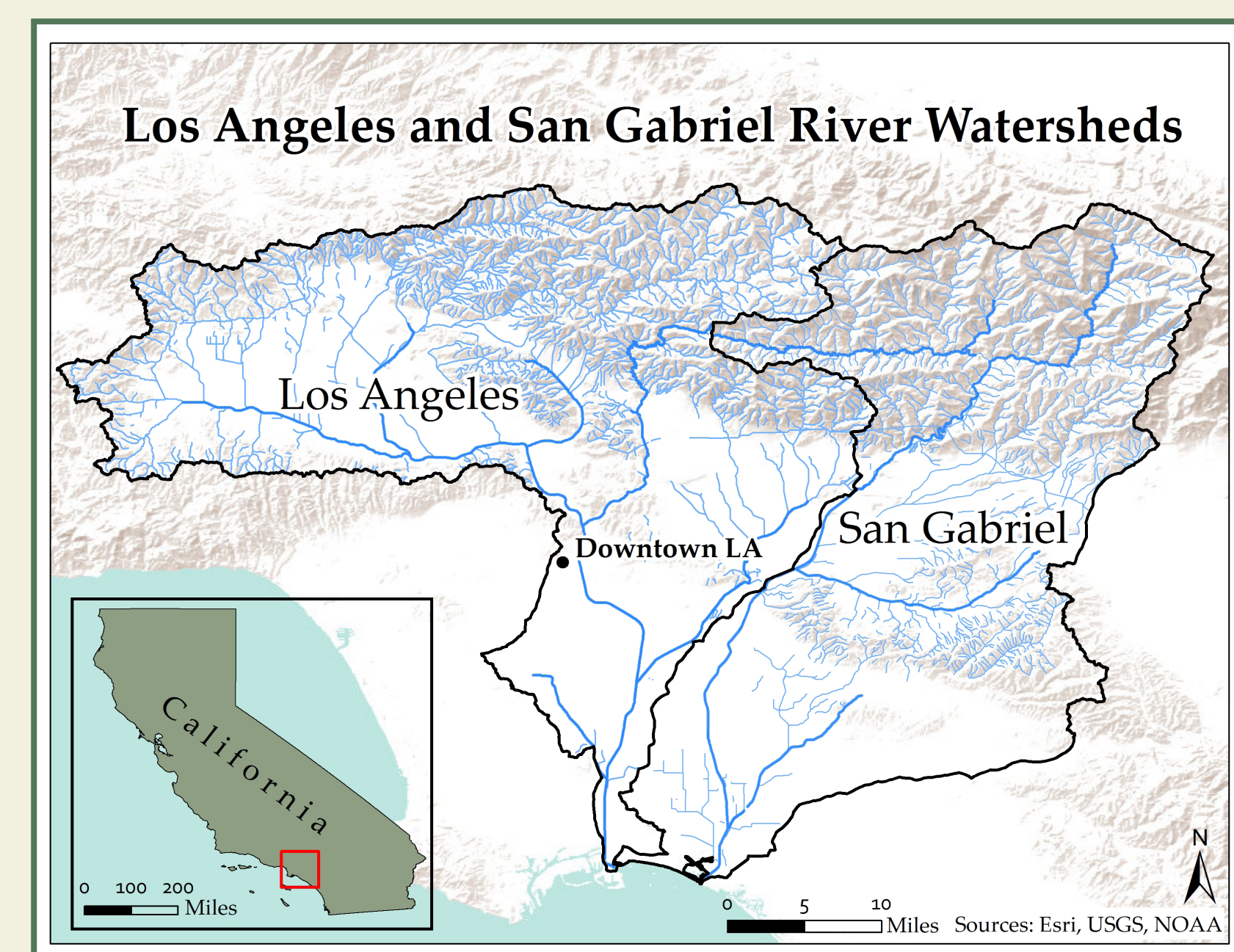
Background

Purpose

The overarching purpose of this project was to conduct an analysis of the sources and movement of plastic debris in the Los Angeles and San Gabriel River Watersheds, and to examine and recommend policies to reduce their ultimate delivery to the Pacific Ocean.

To our knowledge, this is the first project of this type to focus locally on the source, impacts, and transport of plastic debris in a highly urbanized region.

Watersheds



Los Angeles River (Photo: Michael Mori)



San Gabriel River Storm Drain (Photo: Michael Mori)

Surrounded by the San Gabriel Mountains to the north and the Santa Monica Mountains to the west, the Los Angeles and San Gabriel River Watersheds have high urban densities that help to increase runoff that contains littered trash, including plastic debris. This runoff may be water from storms or from general use during the dry season, such as landscape irrigation, street cleaning, and car washing. Both types of runoff can pick up litter that has accumulated on city streets, and then transport it to catch basins and eventually to the waterways.

Large winter storms, common to the Mediterranean climate of the region, are likely to transport litter in much greater quantities than from general use. Plastic debris can also reach the waterways via wind and direct dumping. Since both watersheds empty into the Pacific Ocean near Long Beach, plastic debris that enters the waterways are likely to reach the ocean.

Methods

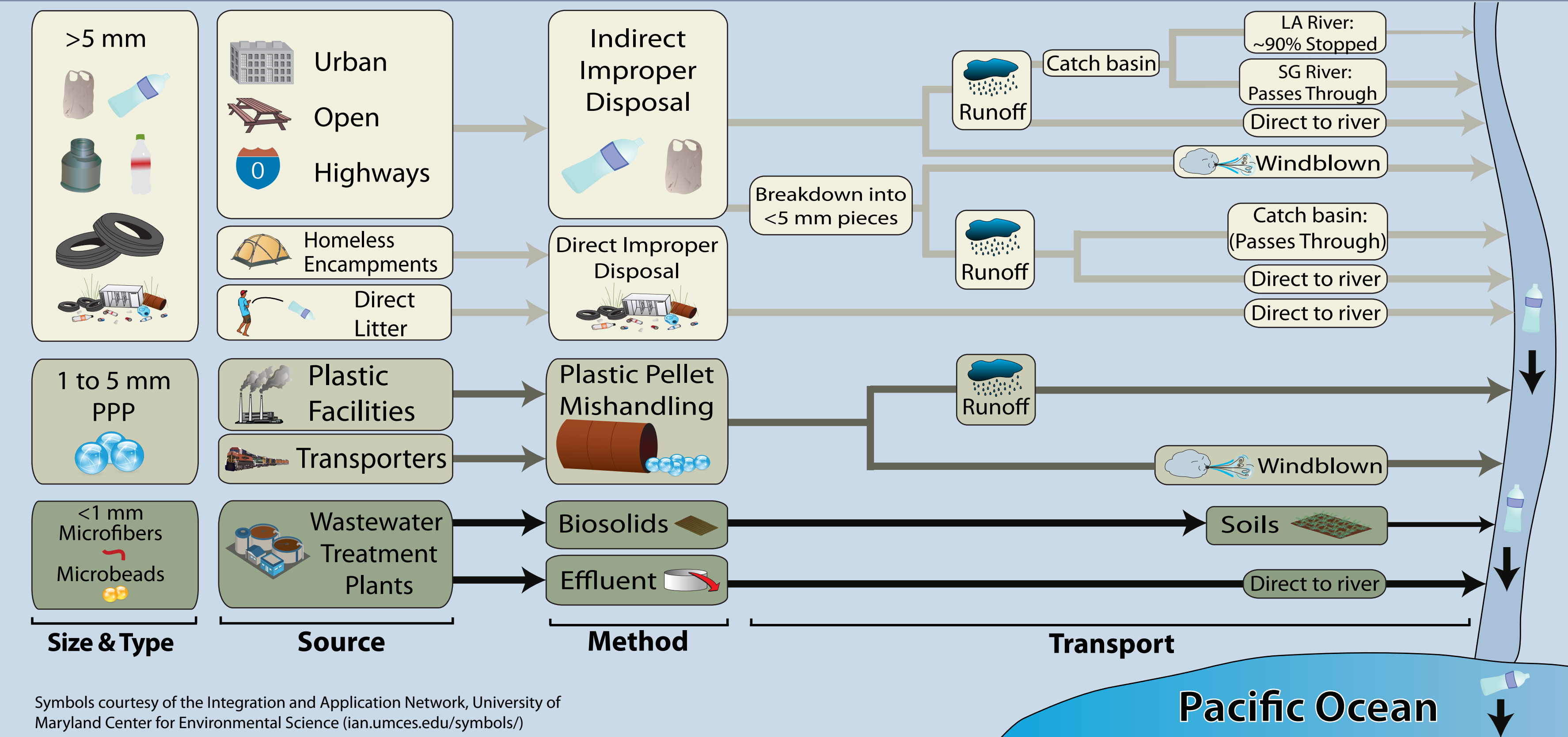
Given the broad scope of the project, multiple methods were used to collect and analyze information and data related to plastic debris.

Interviews with more than 60 professionals with knowledge of plastic debris and/or policy were conducted, and an extensive literature review (over 300 articles and reports) related to the current knowledge of the issue was completed. To complement this information, visits to both watersheds and a plastic production facility were used to enhance our understanding of plastic debris in the region.

Data on plastic debris quantity and characterization was collected from government and nongovernment agencies. The data were then analyzed using various statistical methods and by compilation. Finally, all of the previous research and findings were synthesized into policy recommendations, ranked by feasibility and effectiveness.

Findings

Plastic Debris Conceptual Model



Symbols courtesy of the Integration and Application Network, University of Maryland Center for Environmental Science (ian.umces.edu/symbols/)

The impact, sources, method of litter, and transport of plastic debris in the Los Angeles and San Gabriel River Watersheds ("PPP" stands for preproduction plastic).

General Findings

Magnitude of Plastic

- Plastic is ubiquitous on beaches, in rivers, on streets, and in the ocean
- Plastic is transported by wind and water to the environment
- Plastic production has increased ~5% per year for the past two decades
- The supply of new plastic products maintains a steady stream of debris
- Population density is positively correlated with increased plastic debris levels

Impacts of Plastic

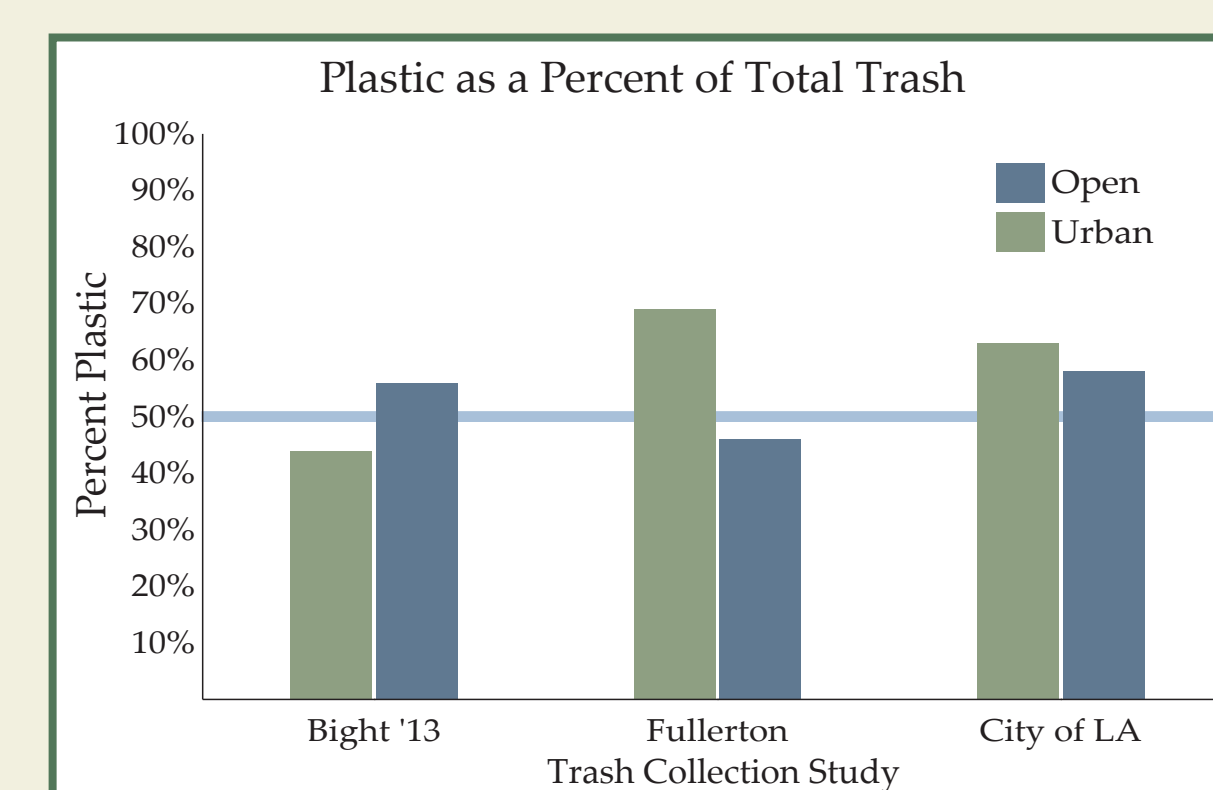
- Plastic debris impacts wildlife through ingestion and entanglement
- Plastic debris persists in the environment for tens to hundreds of years
- Plastic debris transports invasive species
- Plastic pollution poses risks to human health
- Plastic pollution cleanup efforts have significant economic impacts

Sources of Plastic

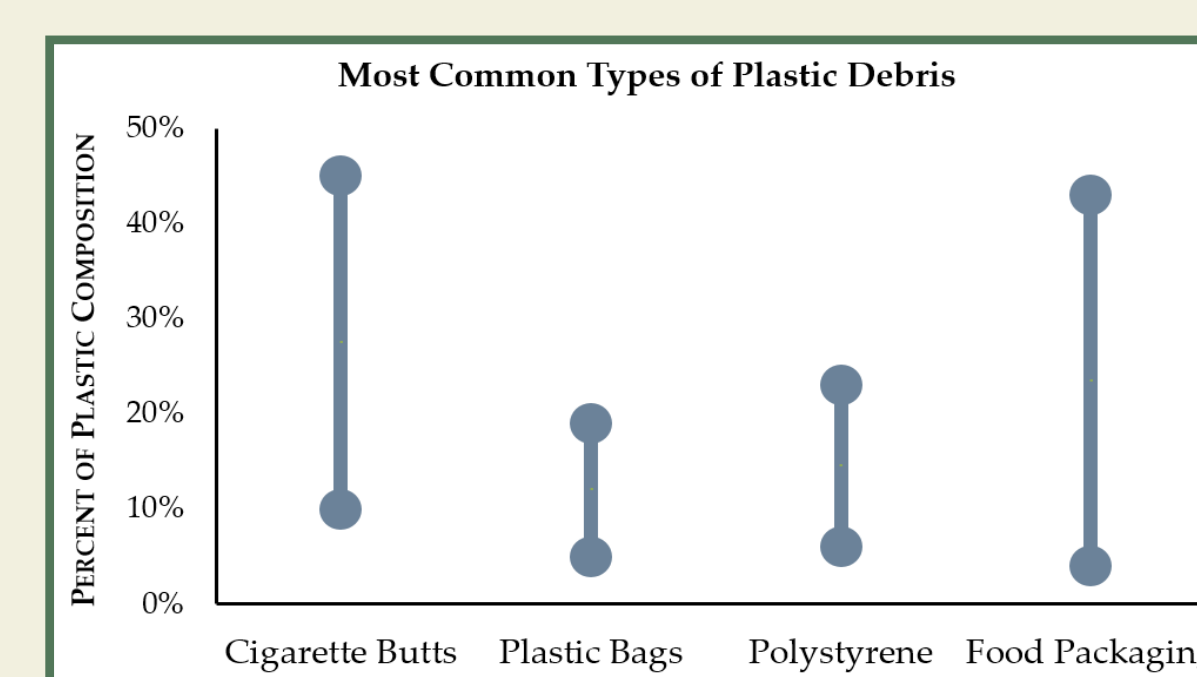
- ~50% of the trash entering the ocean is from land-based sources
- ~50% of that trash is plastic debris
- ~50% of trash found in beach and river cleanups is plastic debris
- ~50% of all plastic debris is single-use packaging items
- Single-use plastics, such as takeout containers, plastic bags, wrappers, and cigarette butts, are commonly littered

Los Angeles and San Gabriel River Watersheds Findings

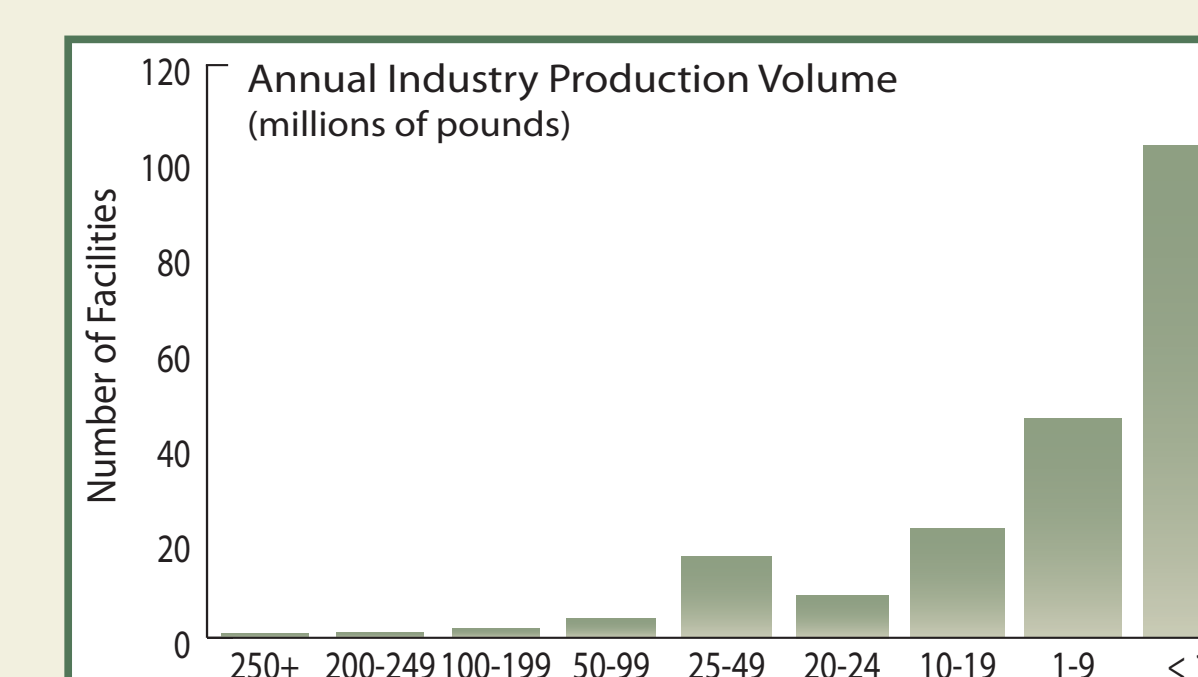
Plastic debris makes up ~50% of all littered trash in the watersheds ...



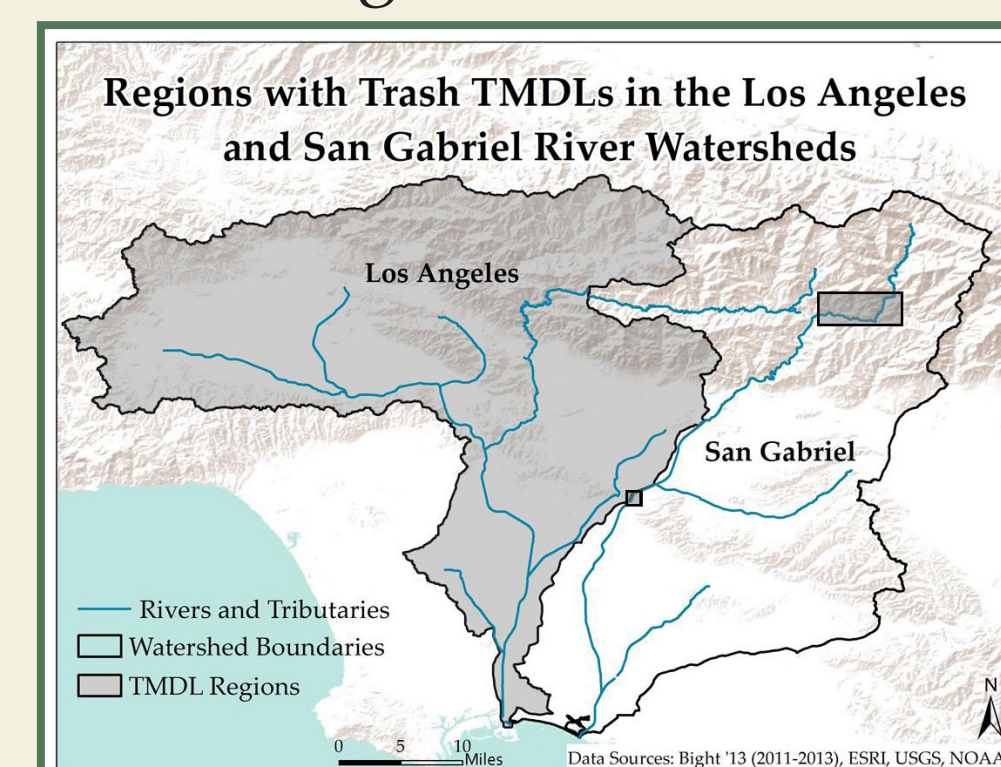
... The most common types of plastic debris are single-use items, which are frequently littered ...



... Preproduction plastic spills are common; the high volume of small producers makes enforcement costly...



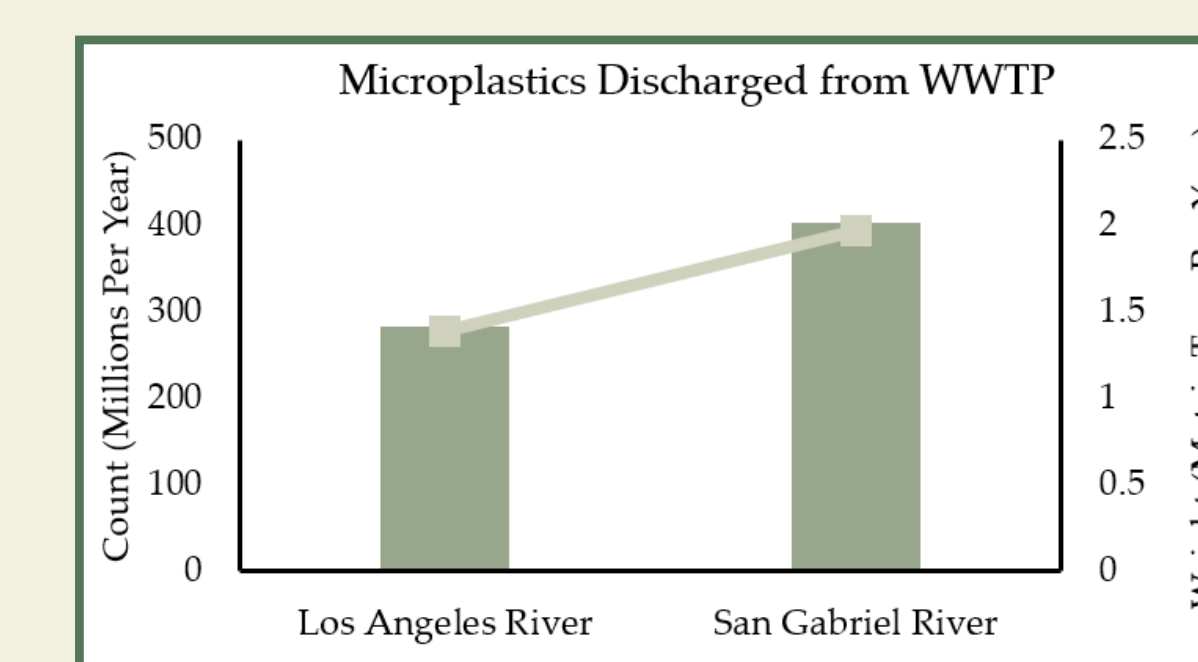
... The Los Angeles region addresses the debris problem through a broad Trash Total Maximum Daily Load; the San Gabriel region does not.



... Littering is one of the largest sources of plastic debris. While millions of littering events occur every year in the Los Angeles region, only ~7,000 citations are issued ...

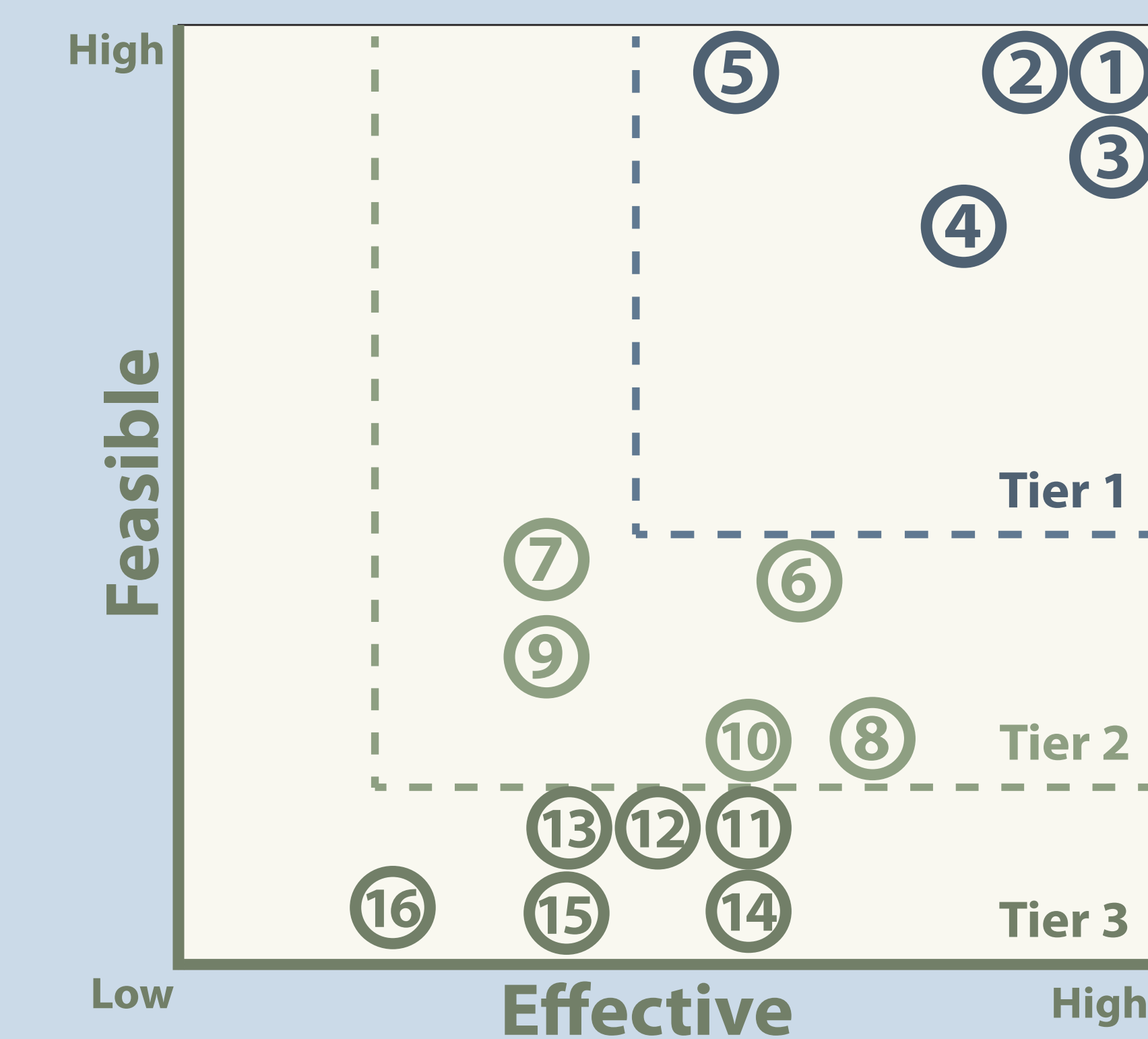


... Microplastics are an emerging issue with an estimated half a billion pieces being discharged from wastewater treatment plants each year ...



Recommendations

Action Item Rankings

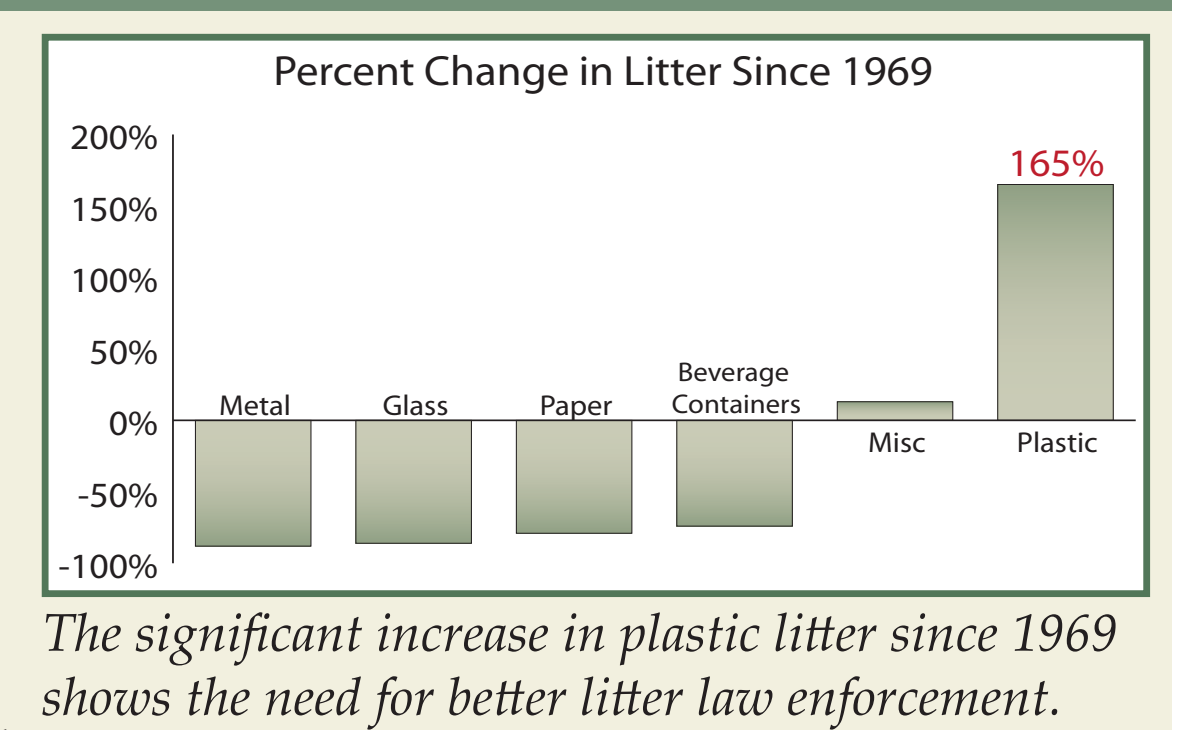


This project culminated in a suite of 16 recommended action items, ranked through a qualitative assessment of feasibility and effectiveness based on our findings. For feasibility, political and economic criteria were used. Effectiveness was based on an assessment of the likely impact on reducing plastic debris.

The recommendations were then placed into three action tiers. If resources are limited, Tier 1 Action Items should have the highest priority for implementation.

Tier 1 Action Items

- Increase litter law enforcement, outreach, and education using a civil administrative approach, continuance of the "Erase the Waste" campaign to reinforce anti-littering messaging, and expansion of K-12 littering education
- Ban single-use plastic grocery bags and polystyrene containers (e.g., Styrofoam™), which are common litter items. Bans have been enacted in many California cities
- Implement a comprehensive San Gabriel River Watershed Trash Total Maximum Daily Load that addresses trash that is smaller than 5 mm in size, open space recreational areas, and mandatory monitoring
- Reduce single-use plastic items through point-of-sale fees, expansion of the California Redemption Value program, and container exchange programs
- Collect information to better track plastic facilities by adding a checkbox on business license forms to identify preproduction plastic facilities and create a database to track these facilities



The significant increase in plastic litter since 1969 shows the need for better litter law enforcement.

Tier 2 Action Items

- Amend the Los Angeles River Watershed Trash Total Maximum Daily Load
- Collect better data and standardize protocols
- Advance extended producer responsibility programs
- Increase recycling efforts
- Improve participation and establish metrics for the Operation Clean Sweep voluntary industry program



By increasing participation in Operation Clean Sweep, preproduction plastic spills may be reduced (Photo: State Water Board)

Tier 3 Action Items

- Incentivize plastic packaging innovations
- Address litter from homeless encampments through data collection and outreach
- Enact comprehensive statewide plastic debris legislation
- Improve the Long Beach trash boom and add additional trash booms
- Declare plastic as a hazardous substance
- Develop marine biodegradable plastic materials

Acknowledgements

Our sincerest gratitude to Dr. Derek Booth, our faculty advisor; Drs. Patricia Holden and Mark Anthony Browne, our external advisors; Algalita Marine Research Institute, our client; and the individuals and organizations that provided us with data: Adam Furman – California State University, Fullerton; Kirsten James – Heal the Bay; Sherry Lippiatt – National Oceanic and Atmospheric Administration; Alfredo Magallanes – City of Los Angeles, Bureau of Sanitation; Shelly Moore – Southern California Coastal Water Research Project; Dylan Seidner – California Water Board; Ted Von Bitner – AMEC Environment and Infrastructure, Inc.; and John "Alan" Walz – Surfrider Foundation