TPW Monitoring Method *Quick Start* Guide

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Overview

To understand whether the amount of Tobacco Product Waste (TPW) is decreasing, increasing, or remaining constant in a given location and across the state, the San Francisco Estuary Institute and the Southern California Coastal Water Resources Project co-developed a reliable, repeatable monitoring method for the California Department of Public Health (CDPH). This method is designed to yield field assessments of TPW in the environment. It is written to be accessible and understandable to those who might be occasional or rare monitoring practitioners. The method's target audience include CDPH-affiliated staff, volunteers, community scientists, researchers, and environmental advocates.

Practitioners are welcome to review the following demonstration:
https://sfei.org/tpw-method-demo



The video offers a tutorial on monitoring tobacco product waste (TPW). The goal of the methodology is to quantify tobacco product waste in local jurisdictions and to publicize the method in the California Trash Monitoring Playbook:
https://sfei.org/trash-playbook

Initial Summary of the Demonstration

Presenters

The host is Dr. Tony Hale, Program Director for Environmental Informatics at the San Francisco Estuary Institute. The team introduced includes:

- Shelley Moore: Veteran environmental scientist and co-founder of the Moore Institute.
- Alicia Gelbrath: Environmental scientist with a master's in environmental planning, who focuses on monitoring and modeling pollutant loads to the San Francisco Bay.
- Pete Kauhanen: GIS manager, environmental scientist, and licensed drone pilot.
- Lorenzo Flores: Software engineer with an MA in computer science and a BA in physics, who helped develop a machine learning algorithm for detecting TPW.
- Biruk Imagnu: Desktop support specialist and co-host.

Webinar Logistics and Resources

- The webinar is being recorded to serve as a resource and will be a companion to a printed tutorial document that will be sent to registered attendees, along with a link to the video.
- The chat function is for technical challenges or questions about things like sound.

- Attendees are encouraged to use the Q&A function for questions related to the webinar's substance, which will be addressed at the end.

The Problem: Tobacco Product Waste (TPW)

TPW, especially cigarette butts, poses several hazards to public health.

- The waste contains heavy metals and other toxic chemicals.
- Cigarette butts are a type of plastic that breaks down into microplastic, which can harm wildlife and reduce water quality.
- TPW negatively affects economic activity, aesthetics, and recreation.
- Globally, an estimated 4.5 trillion cigarette butts escape capture annually and enter waterways. The California Department of Public Health (CDPH) is interested in a more rigorous approach to measuring impacts in a scientifically defensible way, especially at a local level.

The Solution: Standardized Monitoring Methods

A standardized, practical TPW monitoring methods to allow for optimum spatial and temporal comparability.

- Spatial comparisons allow for questions such as how a neighborhood's TPW compares to other areas.
- Temporal comparisons allow for questions about whether TPW in a neighborhood is improving or worsening over time.

The team emphasized the importance of measuring load (the amount of TPW entering in a space in a given timeframe) to understand impacts, inform economic models, and generate standard data. The goal is to get consistency on load measurements.

TPW Monitoring Methods

SFEI explored innovative approaches to monitoring, including leveraging an unoccupied aerial system (UAS), also known as a drone, to collect imagery and tune a machine learning algorithm to detect cigarette butts.

The methodology has two parts:

1. On-the-Ground Method: This method is ready to roll out and has three interlocking variants. The choice of variant depends on available resources and the questions being asked.
2. In-the-Air Method (Drone): This method is considered a proof of concept, is promising but not yet operational, and currently only covers cigarette butts.

The Three Tiers of the On-the-Ground Method

The on-the-ground method is structured into three tiers that nest, meaning information from a lower tier can be grouped into the broader category of a higher tier. The tiers are:

- Tier 1 (General and Fastest): Capturing TPW in general, counting the total number of items.

    - Example Questions: How much TPW is in my neighborhood? How has the overall amount of TPW changed over time?
- Tier 2 (More Specific Classification): Distinguishing among the forms of TPW, such as cigarettes, cigarillos, wrappers, and e-cigarettes.
    - Example Questions: Is e-cigarette usage increasing around local restaurants? Are we spotting cigarillo-related TPW around our city's schools?
- Tier 3 (Brand Level and Most Time-Consuming): Tracking TPW back to the manufacturer, such as Marlboro or Newport.
    - Example Questions: Which brands are used most prevalently near gas stations? Are some types of e-cigarettes more prone to improper disposal?

Designating the Assessment Area

- Minimum Size: The minimum assessment area should be 100 square feet to prevent selection bias.
- Repeatability: The area must be repeatable and describable.
- Purpose: Proper sizing is crucial for calculating density (items per square foot), which is necessary for comparability over time or space and for determining impacts.
- Calculating Area: The presenters suggest using a rectilinear method (straight lines, ideally rectangles), where the area is calculated by multiplying the short side by the long side. For irregular areas with obstacles (like cars), the area can be broken down into multiple compound rectangles that are added together.

Field Demonstrations

Tier 1 Demonstration (Signal Hill, Southern California): Shelley Moore and her helper Hayden demonstrated a Tier 1 assessment on a hillside.

- They measured Hayden's stride length (five steps for 10 feet, or two feet per step).
- They measured the rectangular assessment area using steps: six steps for the short side (12 feet) and 11 steps for the long side (22 feet), totaling 264 square feet.
- Using the "snowplow method" (walking right through the middle of the area), Hayden counted 13 items of TPW using a simple counter app on an iPhone.
- This resulted in a calculated density of about 0.05 pieces of trash per square meter.
- Shelley also demonstrated using a free "Tally Counter" app for recording data and an interactive data sheet/spreadsheet that performs calculations for the assessor. The presenters prefer customizable tools like spreadsheets and simple apps over proprietary mobile apps.

Tier 2 and Tier 3 Demonstration (Park): Alicia Gilbraith and Nina Buzby demonstrated Tier 2 and Tier 3 assessments in a park.

- The assessment area was 10 feet by 20 feet, totaling 200 square feet.
- They used the "lawn mower pattern" for searching (walking straight up, making a turn,

and coming straight back, repeating until the area is covered).

- Tier 2 involved counting and classifying items into major categories: combustible waste, e-cigarette devices, and other. Nina called out the type of TPW, and Alicia recorded it on a hard-copy field sheet.
- Tier 3 involved calling out the brand names and the category of the item.
- The presenters emphasized that items outside the designated assessment area should not be recorded in the assessment.

Safety Protocol: Interacting with Waste

While the waste can be picked up during the assessment (extraction), it is not required. Concerns over the pandemic and the potential for discarded materials to be biologically infected, as well as the inherent toxicity of the materials, led the speaker to caution against collecting the waste. The speakers advise using chemically resistant gloves for anyone collecting the waste.