

Abstract

The trash from Tucson is a widespread issue and is overwhelming the Santa Cruz River. The Sonoran Institute Trash Study is designed to characterize trash in the river and has found that food packaging was the most frequently observed contributor of waste followed by plastic bags and clothing. These data are now going to be paired with a randomized assessment of the trash localization in the river to identify trash hot spots to better address trash at the source and through policy.

Santa Cruz River



The Santa Cruz River runs through the heart of Pima County. Its Arizona headwaters flow into Mexico then back into Arizona—it is the only river to cross the US/Mexico border twice. It is home to endangered wildlife

and is foundational to our local communities. The impact of trash in the river includes the risks to wildlife of growth retardation, habitat alteration, neurotoxicity, and behavioral effects—especially from petroleum-sourced products. Aesthetically, the pervasive trash is not appealing to the eye, and with The Loop being a highly recreated trail, it is critical to preserve its beauty.

Randomized Distribution

In order to get randomized data, locations must be selected without bias. The 12-mile stretch of the river being sampled spans from Silverlake to Ina Rd. One of the contributing factors to the sampling is limited access to the river areas, so the samples were randomized along the horse ramp access points, which introduces minor bias—but is the only practical way to effectively conduct the field work. A grid was overlaid across the river to allow for R systems to determine the locations with a uniform distribution function which correlates to the grid squares which translate to GPS coordinates to be investigated.

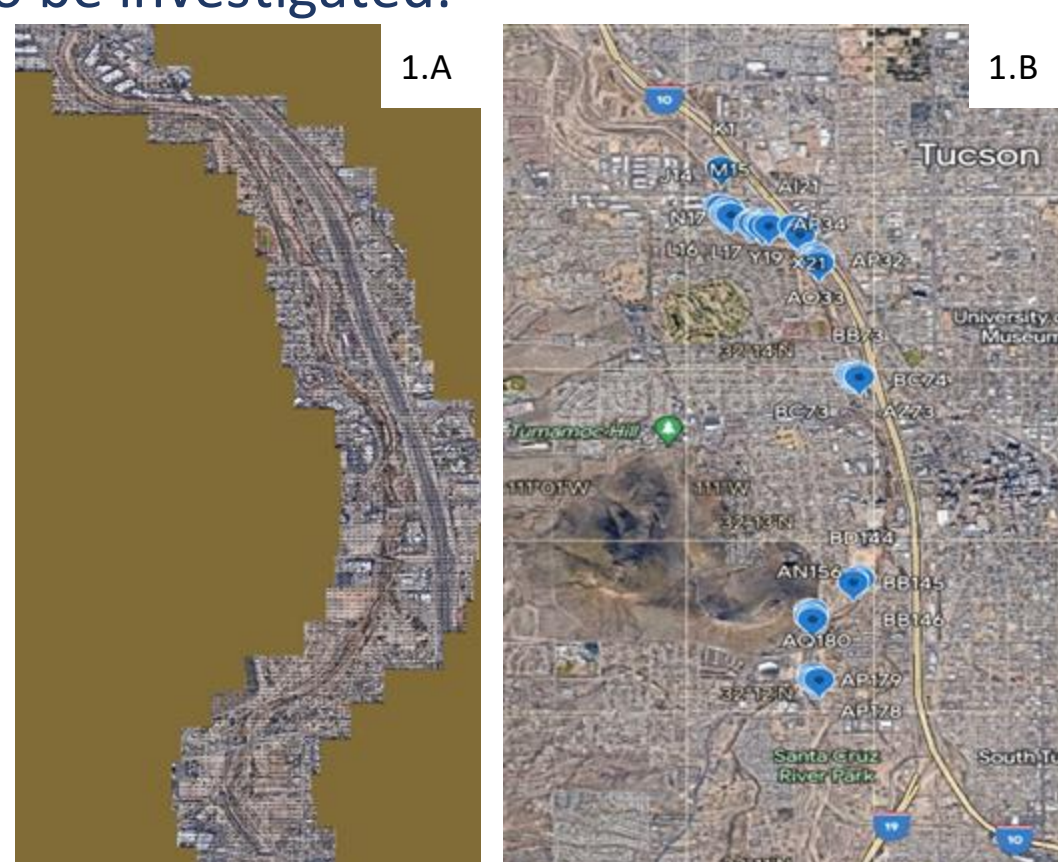


Fig. 1A-B Randomization Grid (A) Isolated section of the Santa Cruz spanning Silverlake Rd to Ina Rd. with a grid overlay. (B) The randomized points that were selected with the R randomization program along the grid from A.

Methodology

The Sonoran Institute Trash Study is a 3-year campaign with three distinct phases, yet the assessment methodology is consistent throughout.

Phase 1 was a characterization study where Earth Grant research scouted for and assesses pockets of trash. Phase 2 aims to assess the location and load of trash in the Santa Cruz, wherein researchers assess trash in randomly selected GPS locations.

For the current Phase 2 study, the GPS location pulled from the R randomization within the study area. In addition to trash data, site characterization data (e.g., date, flow conditions, vegetation cover) are collected to better understand the effect of site condition on trash (i.e., are bushes or trees acting as nets? Does the flow rate of the river mobilize the trash?).

For the randomized assessments 3 replicate 10m x 10m grids are laid out end-to-end spanning the width of the river to build statistical power in the assessment of the location.

Lastly, the researchers walk the 10m x 10m grid and count each piece of trash and mark it in a datasheet that includes 57 categories of trash. Analyses are conducted in a large database to be assessed used Python and Matlab.

Preliminary Data

Phase 1 of the Sonoran Institute Trash Study was performed by scouting out trash hotspots (i.e., not randomly selected). In analyzing these data, it was observed that plastic bags and food packaging are the primary contributors to trash in the river (by frequency of observation), followed by water bottles, cups, clothes, miscellaneous debris.

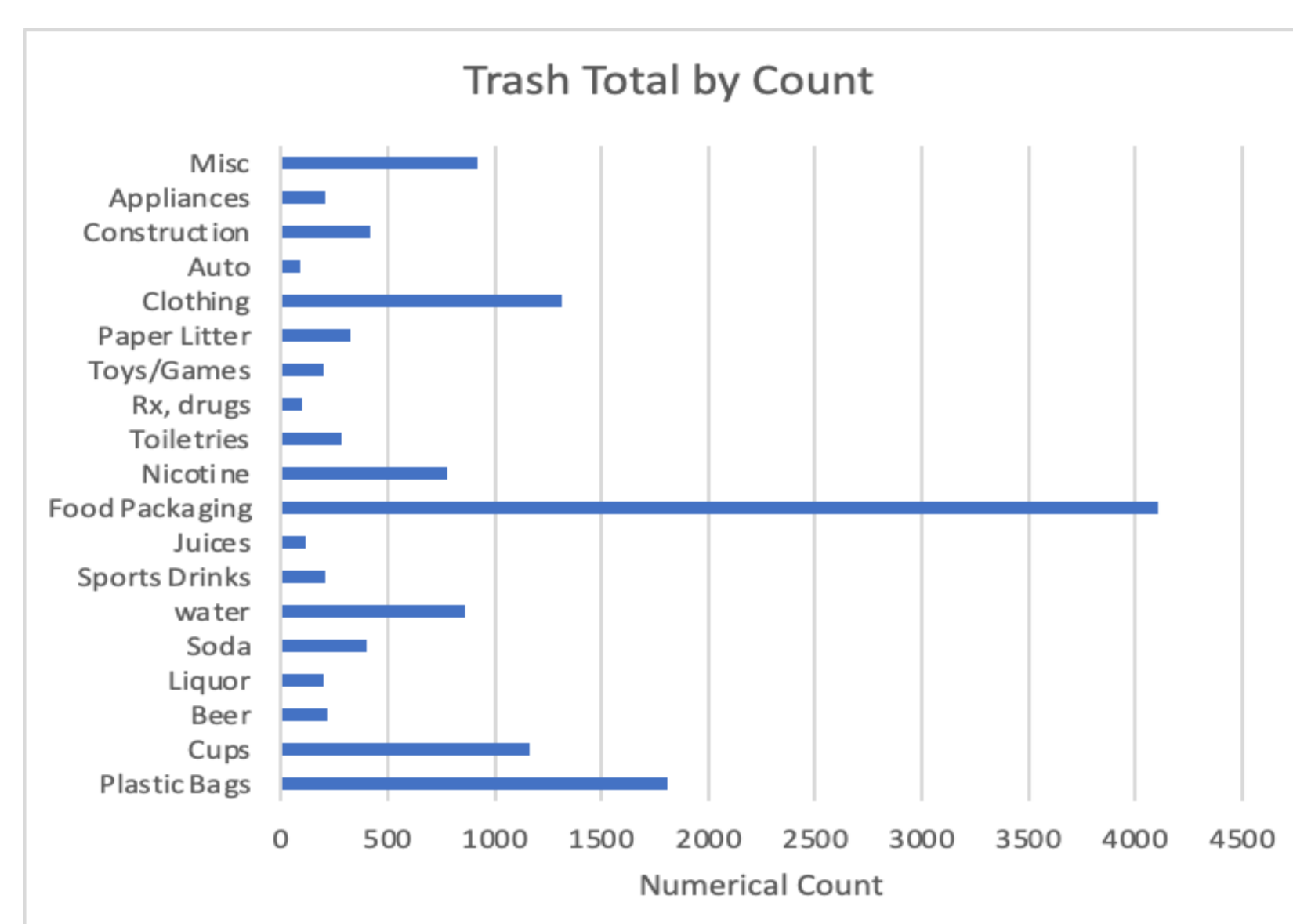


Fig. 2 Trash Distribution Illustrates the distribution of trash types that were found and visualized in field observations. These data include counts from the Sonoran Institute Trash Study data dating back to 2019.

Recyclable items such as beer containers, liquor containers, soda containers, etc. are important to note when presenting findings to municipal managers (e.g., Pima County Regional Flood Control District) to better assess ways to divert the trash. This categorization of the data can also extend to the floatability of items, which is useful to look at how far the plastic from one source can spread during high flow seasons of the river.

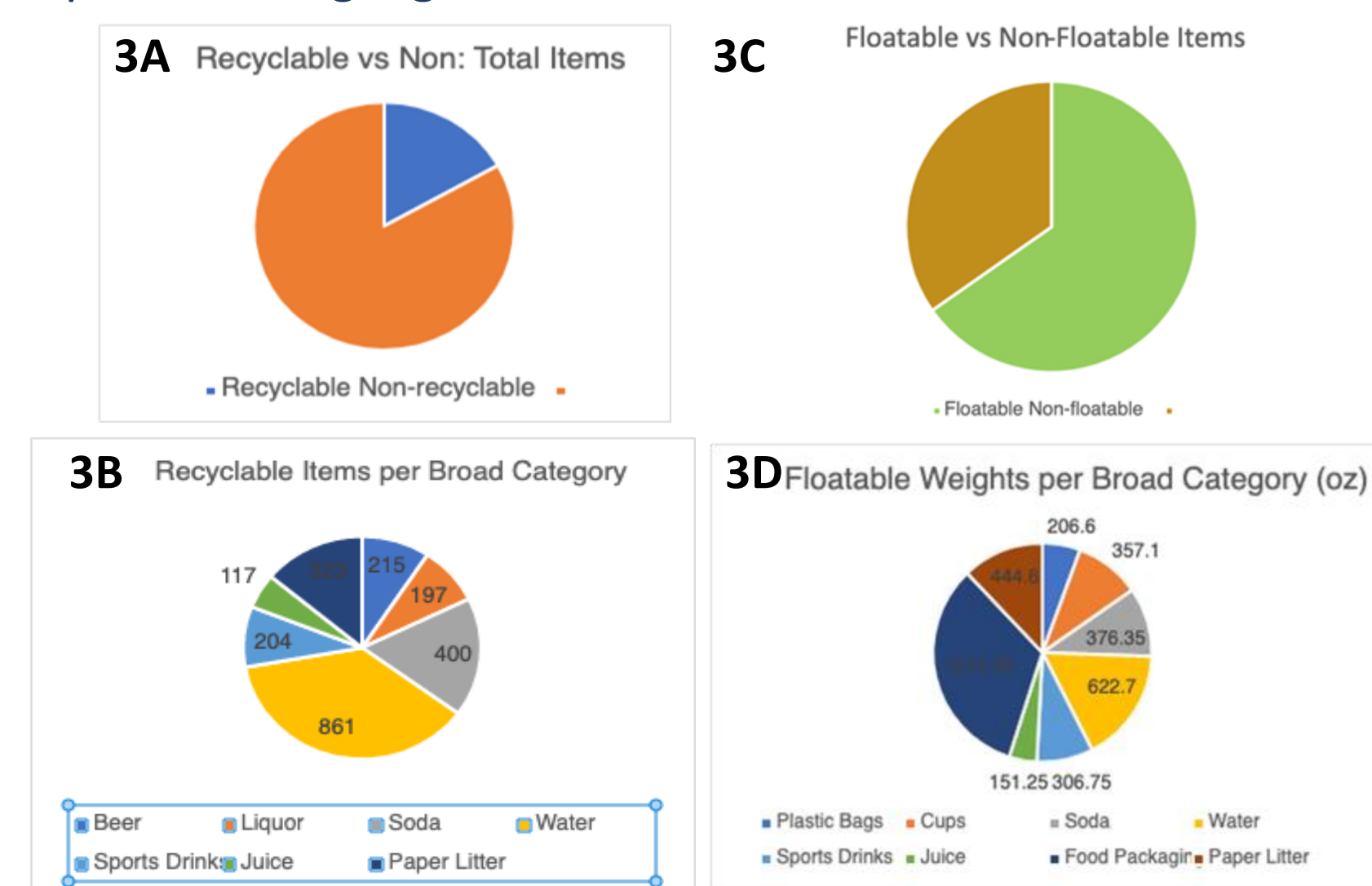


Fig. 3A-D Trash Categorization (A) Visualizes recyclable items by count from the total categorical values. (B) Breakdown of recyclables categorically. (C) Visualizes Floatable vs. Non-floatable Items from total categorical values (D) Breakdown of floatable item weights

Current Work

The current scope of this project (Phase 2) is assessing the trash along the river using a randomized distribution. The method removes any location bias and allows for a more robust analysis of trash load and distribution. The Phase 2 assessment is being conducted to: a) confirm that the previous data about the trash contents of the river are not only uniform amongst many locations and hotspot, and b) to better understand how the trash is ending up in the river and the best ways to address elimination and reduction of this waste.

Field work in Phase 2 is targeting at least 50 randomly chosen locations. Sampling events are occurring weekly, and the Earth Grant researchers are building additional capacity within the database to perform analyses automatically upon data entry.

As Phase 2 of the project continues throughout 2023, Earth Grant researchers will continue to showcase the project findings at scientific conferences, including Sonoran Institute's Santa Cruz River Research Days in April.

Further, the Earth Grant research team is showcasing the AIRE program during Santa Cruz River trash cleanups to demonstrate the impact of the Earth Grant program and the Sonoran Institute Trash Study.

Current Work



Fig. 4 Site Assessment This is a screengrab of part of the Santa Cruz River illustrating the way that the 10x10 meter grids in triplicate are placed. The area within these grids are surveyed for each randomized point.

The data from Phase 2 show that the values closer to the river bank are retaining a larger trash count, partially due to the amount of foliage coverage in these locations, acting as a net to trap the trash.

Points	Total Trash Count
AO31	248
AO32	208
AN31	331
AP33	259
AO33	305
AP32	268
AP33	131

Fig 5 Site Data Close up of figure 1B on a section where data have been collected. The accompanying table shows the corresponding total trash count per survey site.

Conclusion

- This randomized assessment is ongoing. There is a total of 50 points that are to be assessed, only of which 8 are completed thus far.
- Some of these assessments have yielded very little trash in the survey areas, while other are very large trash hotspots. This has the possibility of creating a heatmap of the hotspots of trash along the river to better aid with trash diversion.

Acknowledgement



References

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