

Understanding Stream Litter Loading through Watershed Characteristics

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Introduction

MARINE DEBRIS

VS.

AQUATIC TRASH



Introduction Cont.

ENVIRONMENTAL IMPACTS

- Entanglement/ ingestion
- Bioaccumulation
- Transportation of non-native or invasive species



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Introduction Cont.



ECONOMIC IMPACTS

- Commercial fishing
- Tourism industry
- Cost of cleanups
 - \$11.5 billion on litter cleanups across the country
- Blocked or damaged storm drain systems
 - \$140 per storm drain per year

Introduction Cont.

Most studies focus on marine debris with relatively few in-depth discussions on aquatic trash



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Why focus on aquatic litter?

- Rivers are a primary litter source for marine environments
- Closer to the source
 - Prevention
 - Removal

Introduction Cont.



Santa Clara Valley Urban Runoff Pollution Prevention Program

Introduction Cont.

WATERSHED DYNAMICS

- Hydrological flow
- Rainfall
- Land use/ cover
- Vegetative Buffers

DEMOGRAPHIC + SOCIOECONOMIC FACTORS

- Population Density
- Income
- Education
- Age
- Gender

Research Objective

The focus of this project is to address the current knowledge gaps by analyzing data from litter collection devices in the Southeastern United States and comparing it to a range of watershed characteristics.

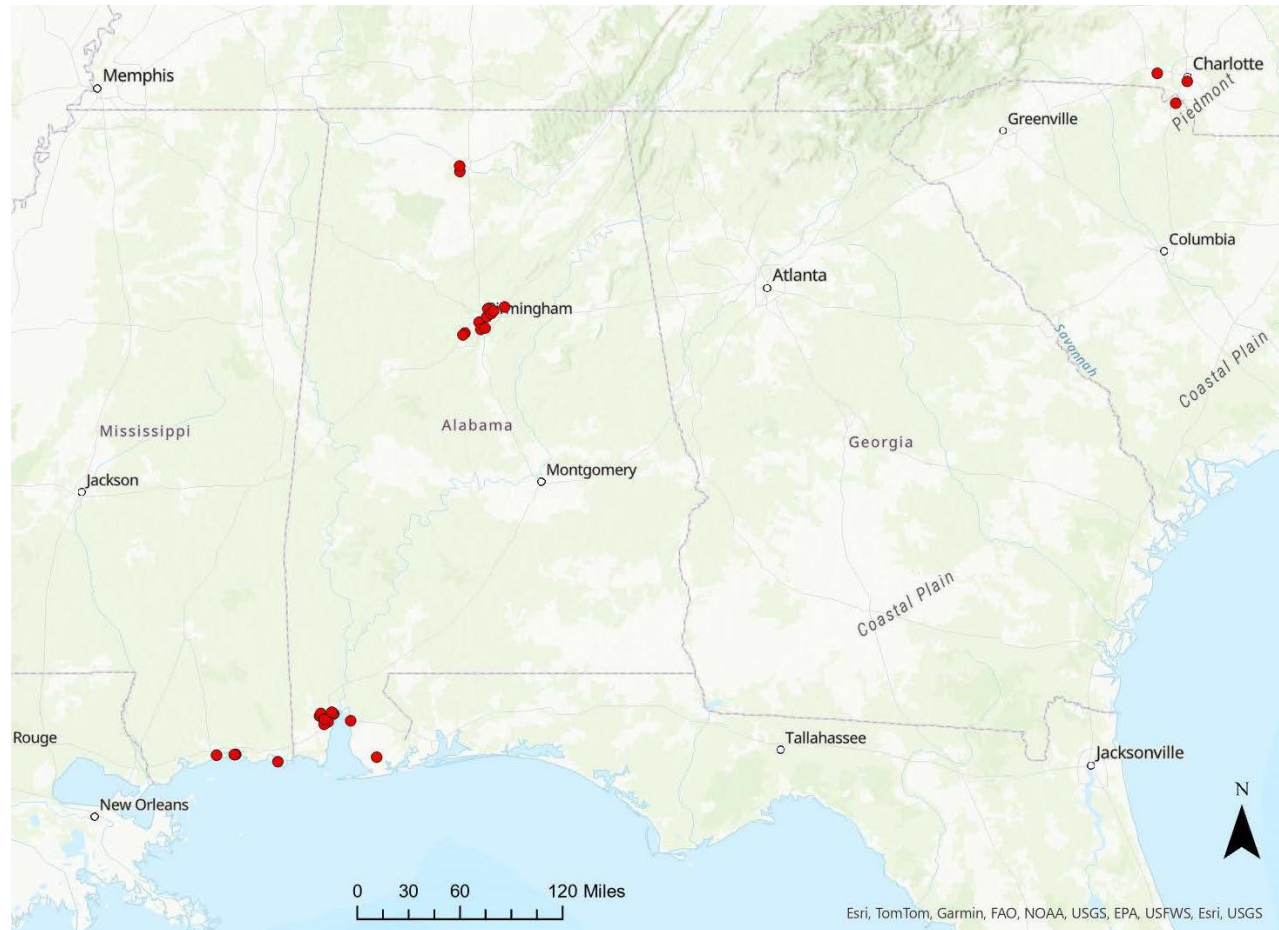


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Research Question

How do watershed characteristics impact floating litter loading rates in urban waterways?

Study Sites



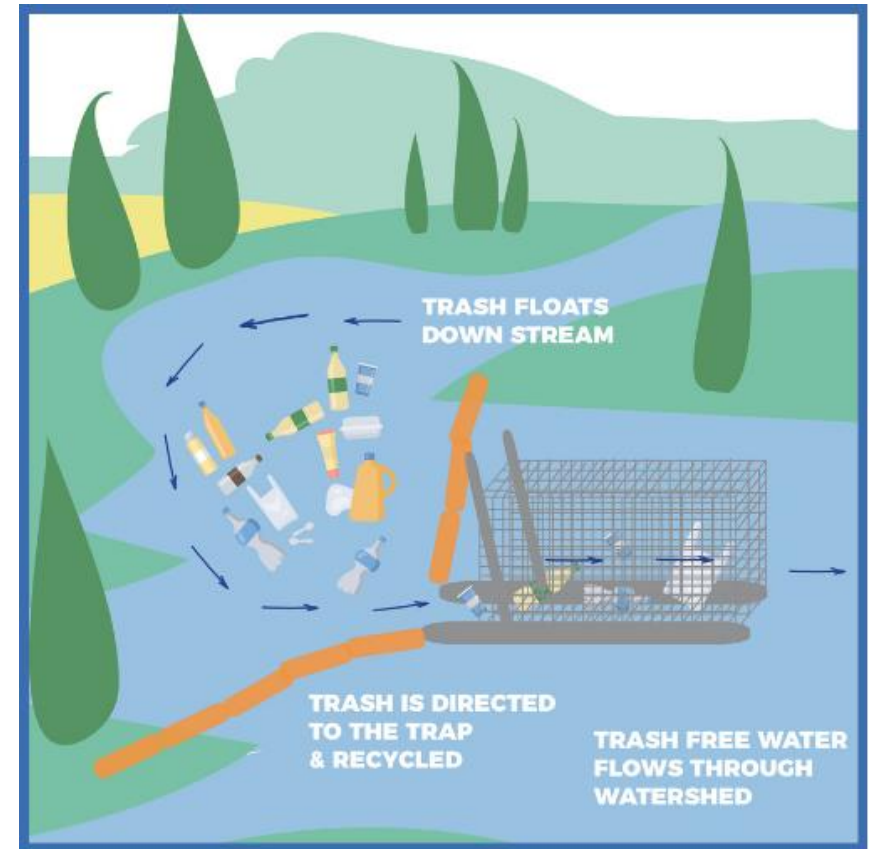
Site Number	Osprey Litter Gitter Site Name	State
1	TwelveMileCreek_LanganPark	AL
2	TwelveMileCreek_University	AL
3	OneMileCreek_Lawrence	AL
4	ThreeMileCreek_LanganPark	AL
5	MapleStreetTributary	AL
6	ToulminsSpring_Whitney	AL
7	AugusteBayou_BradfordSt	MS
8	KeeganBayou_I-110	MS
9	JohnsonBayou_BeatlineRd	MS
10	UTBS_Cedar	AL
11	FivemileCreek_CHPark	AL
12	ValleyCreek_7thSt	AL
13	ValleyCreek_BRCemetery	AL
14	ValleyCreek_I20	AL
15	VillageCreek_Airport	AL
16	VillageCreek_EastLake	AL
17	VillageCreek_Roebuck	AL
18	GriffinBrook_Broadway	AL
19	PinchgutCreek_CedarLn	AL
20	ShadesCreek_Brookwood	AL
21	D'OliveCreek_US98	AL
22	BoltonBranch_Navco	AL
23	MontlimarCanal_MichaelBlvd	AL
24	MooreCreek_HallsMillRd	AL
25	MooreCreek_MichaelBlvd	AL
26	ChicotBayou_IngallsAve	MS
27	ClarkSpringBranch_WilsonMorgan	AL
28	DryBranch_1stSt	AL
29	DuhartsCreek_LowellBethesdaRd	NC
30	SteeleCreek_DairyBarnLn	SC

Litter Collection Device

What is a Litter Gitter?



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Litter Data Collection

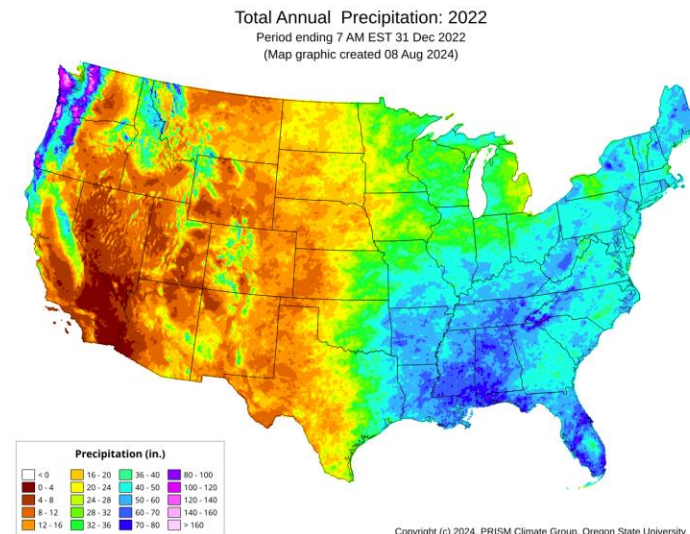
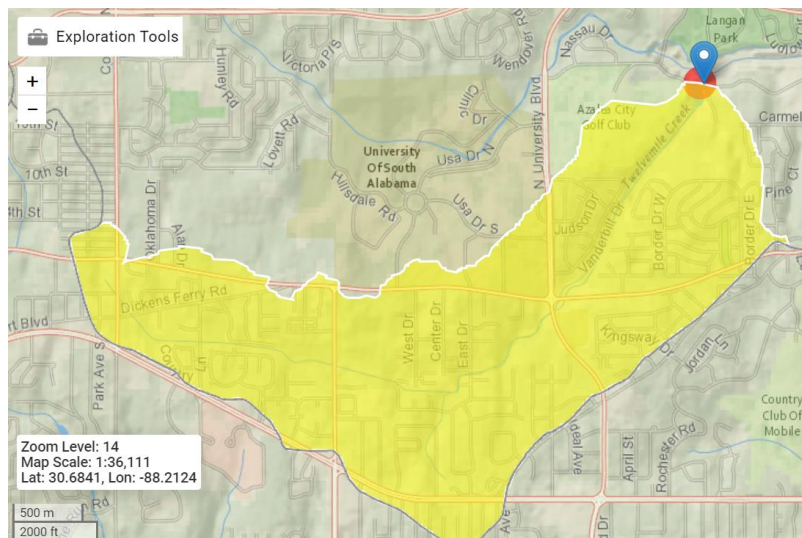
- Monthly average total weight (kg.)
- Escaped Trash Assessment Protocol
 - o Plastic, Styrofoam, Glass, Paper, Metal, and Other – Monthly average count



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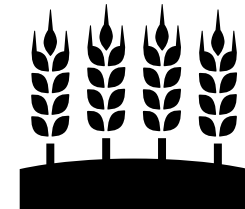
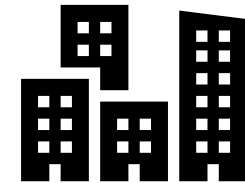
Watershed Characteristics

Metric	Unit	Source
Catchment Size	km ²	USGS StreatState Application Version 4
Annual Rainfall	cm	Oregon State University PRISM Climate Group



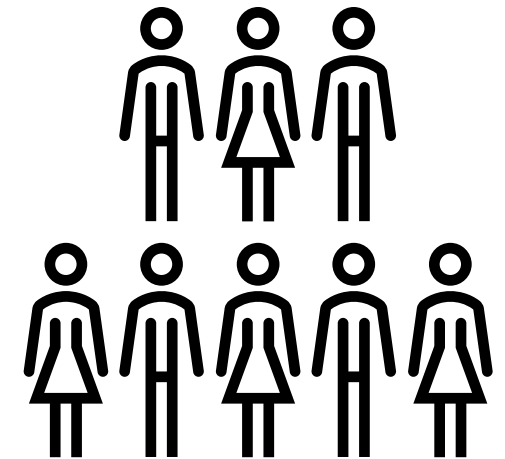
Watershed Characteristics Cont.

Metric	Unit	Source
Land Cover - Developed - Open Space	Percent	2016 National Land Cover Database (NLCD) U.S. Geological Survey
Land Cover - Developed - Low Intensity	Percent	
Land Cover - Developed - Medium Intensity	Percent	
Land Cover - Developed - High Intensity	Percent	
Land Cover - Developed	Percent	
Land Cover - Agriculture	Percent	
Land Cover - Open Land	Percent	



Watershed Characteristics Cont.

Metric	Unit	Source
Population	Count	American Community Survey (ACS) - U.S. Census Bureau
Population Density	Persons per square km	
Median Household Income	U.S. Dollar	
Median Age	Years	

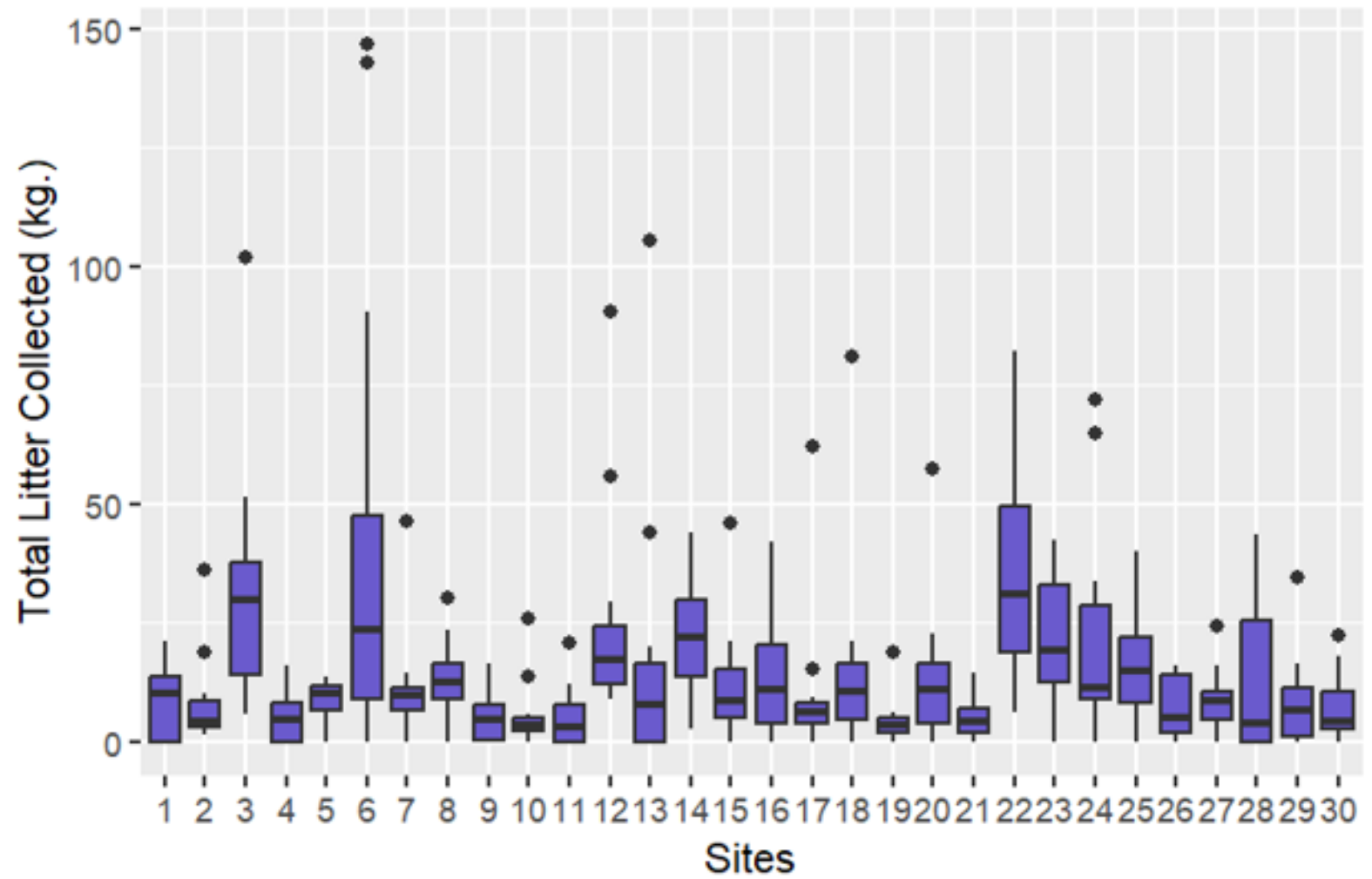


Hypothesis

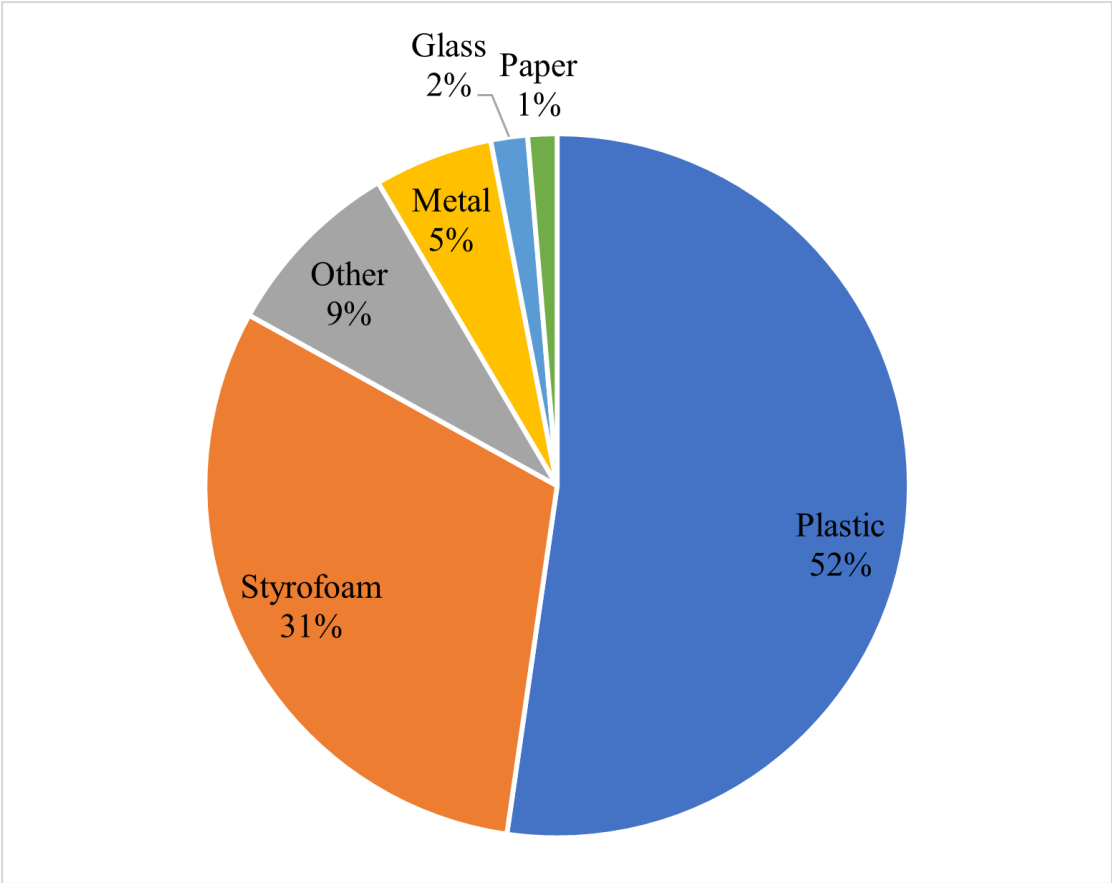
- Research Question - How do watershed characteristics impact floating litter loading rates in urban waterways?
- Hypothesis - Population density, rainfall, or land cover will be the primary driver.

Results

Total Litter
Collected -
Distribution by
Site

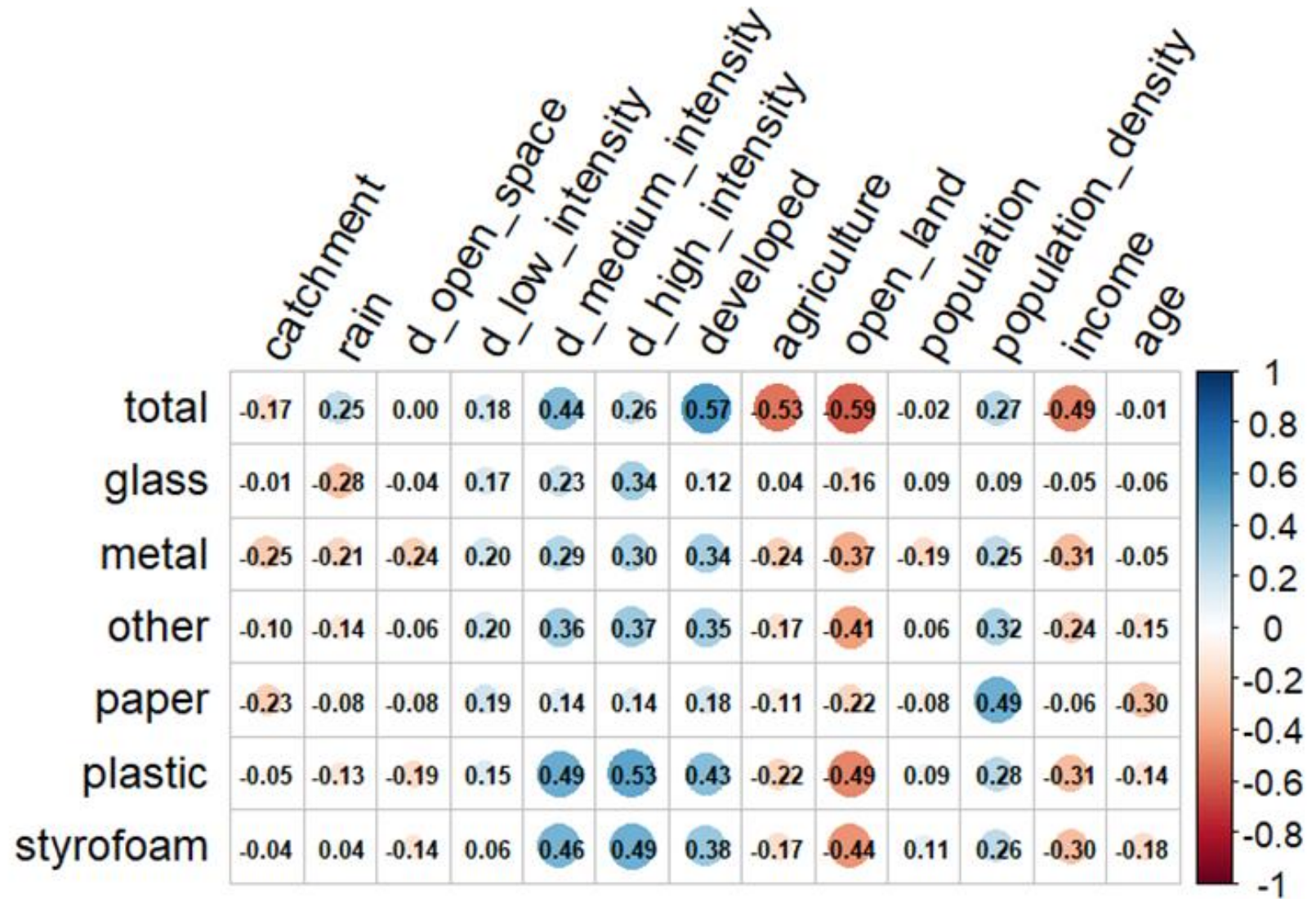


Results Cont. – Litter Breakdown

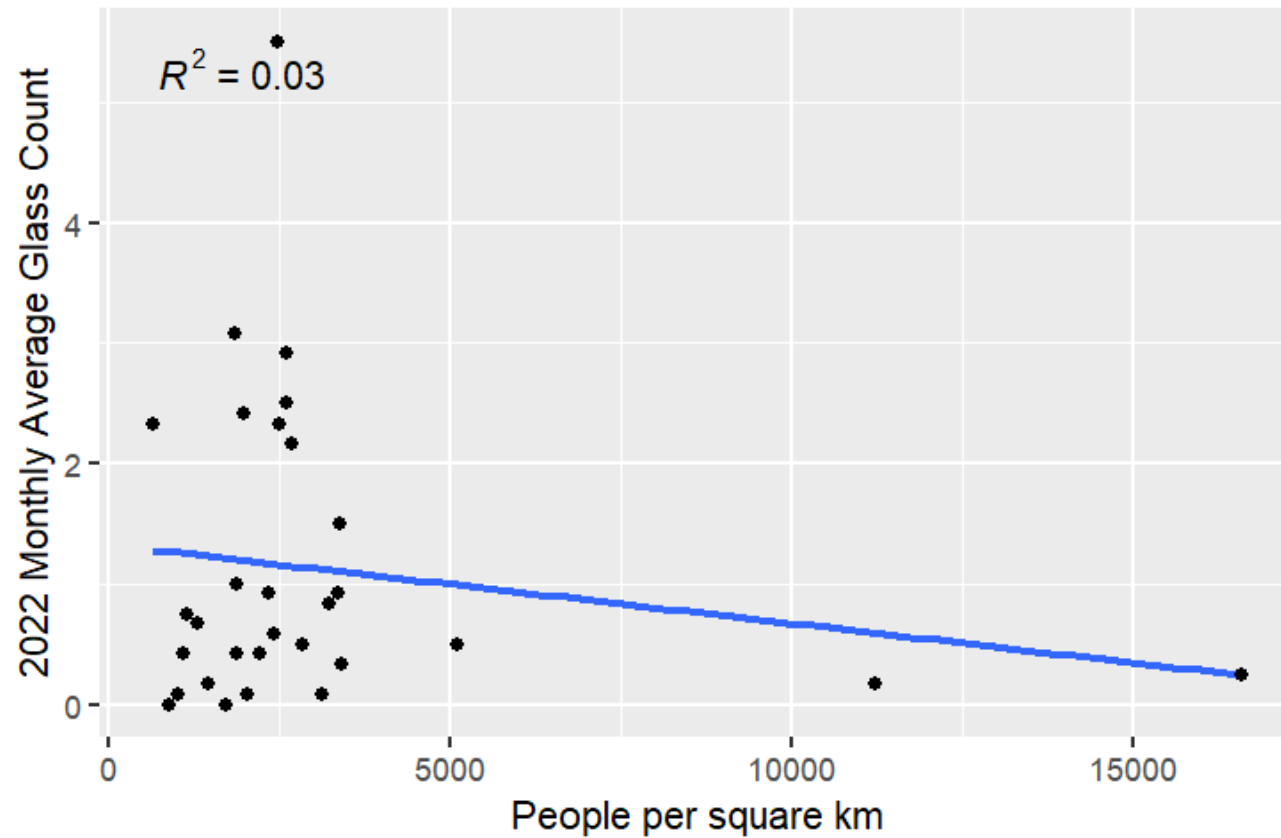


Results Cont.

Spearman's Rank Correlation Matrix



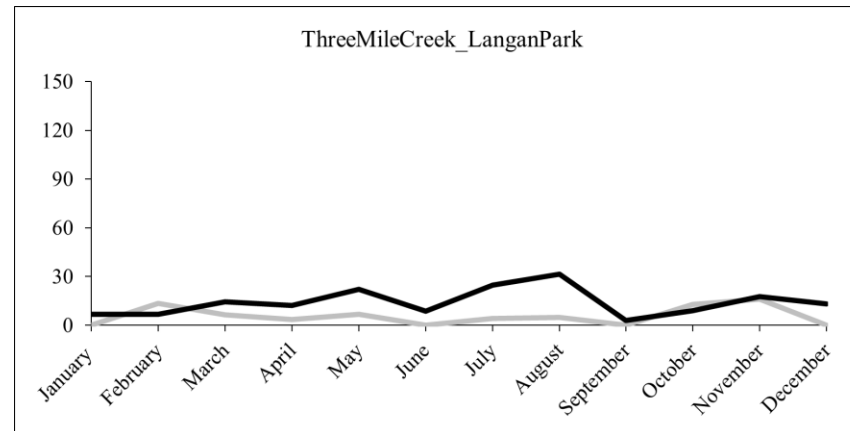
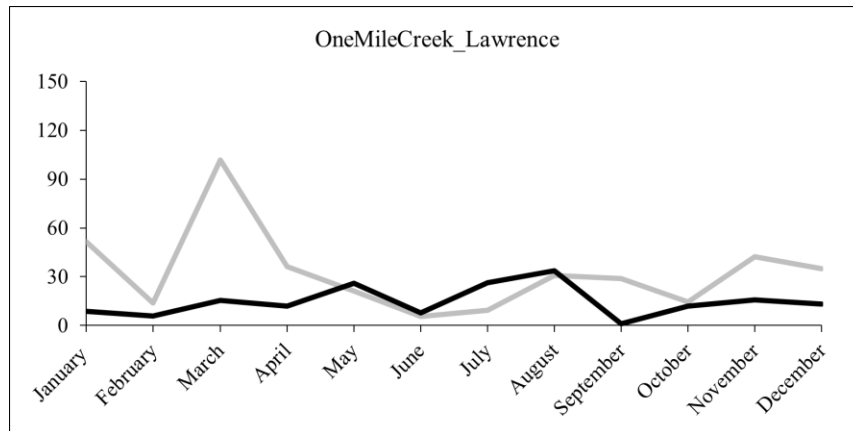
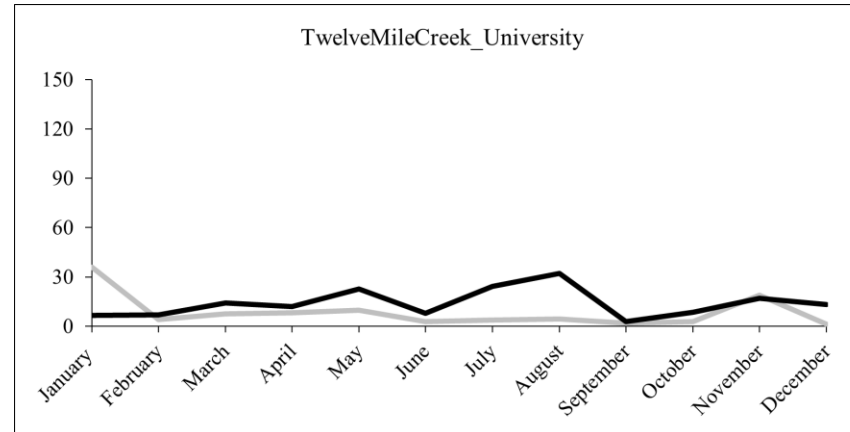
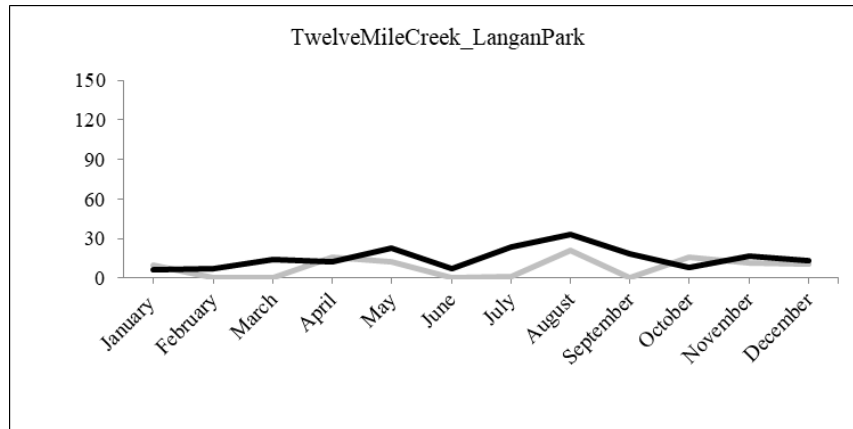
Results - Population Density



	<i>p-value</i>
Total	0.515
Glass	0.409
Metal	0.565
Other	0.261
Paper	0.11
Plastic	0.917
Styrofoam	0.969

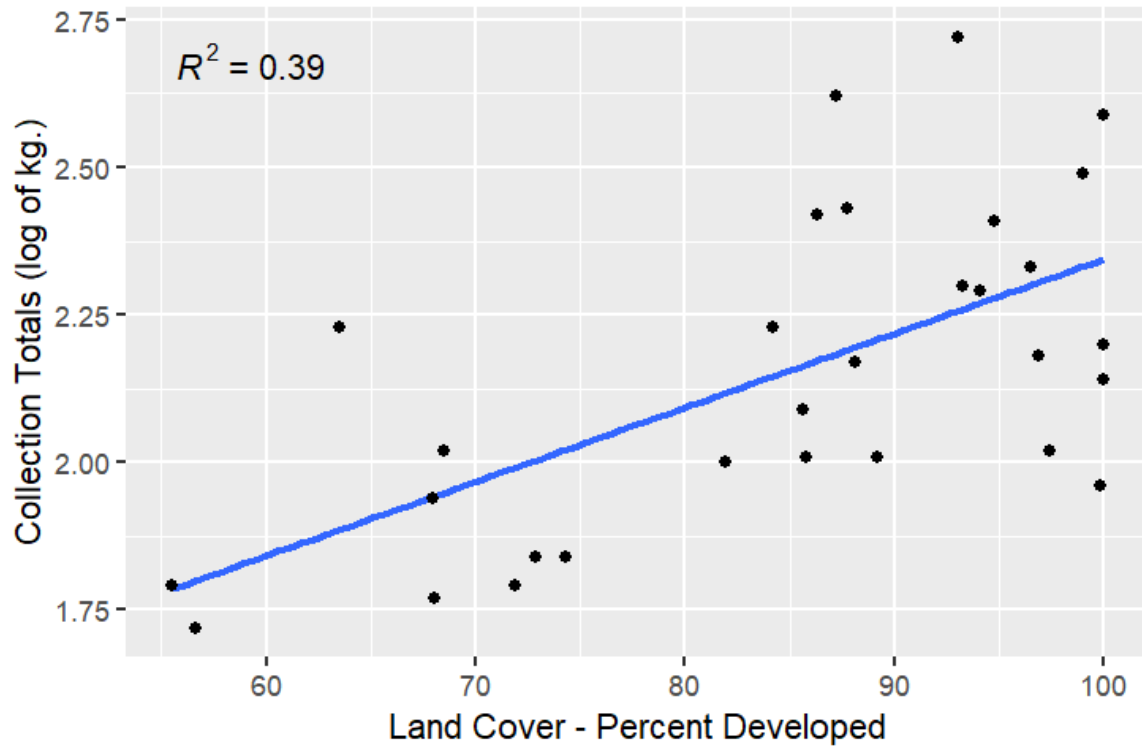
Results – Rainfall

— Total Litter Collected (kg.) — Rainfall (cm)

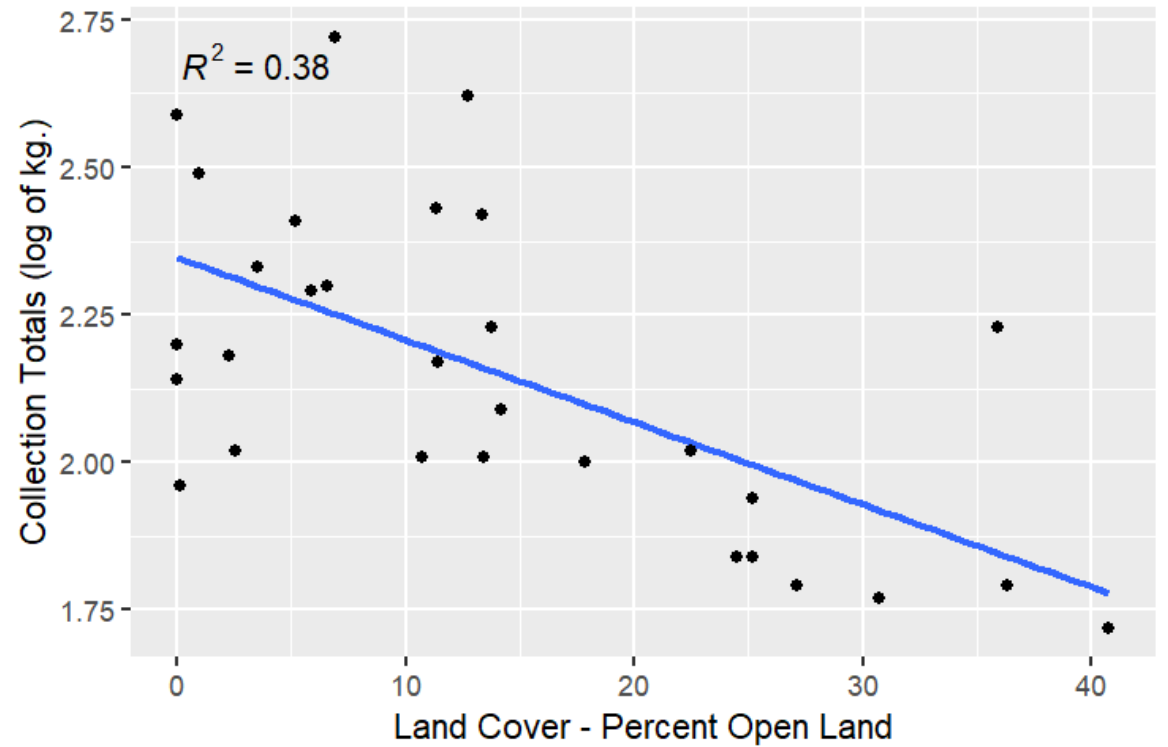


	<i>p-value</i>
Total	0.315
Glass	0.075
Metal	0.227
Other	0.48
Paper	0.488
Plastic	0.348
Styrofoam	0.988

Results – Land Cover

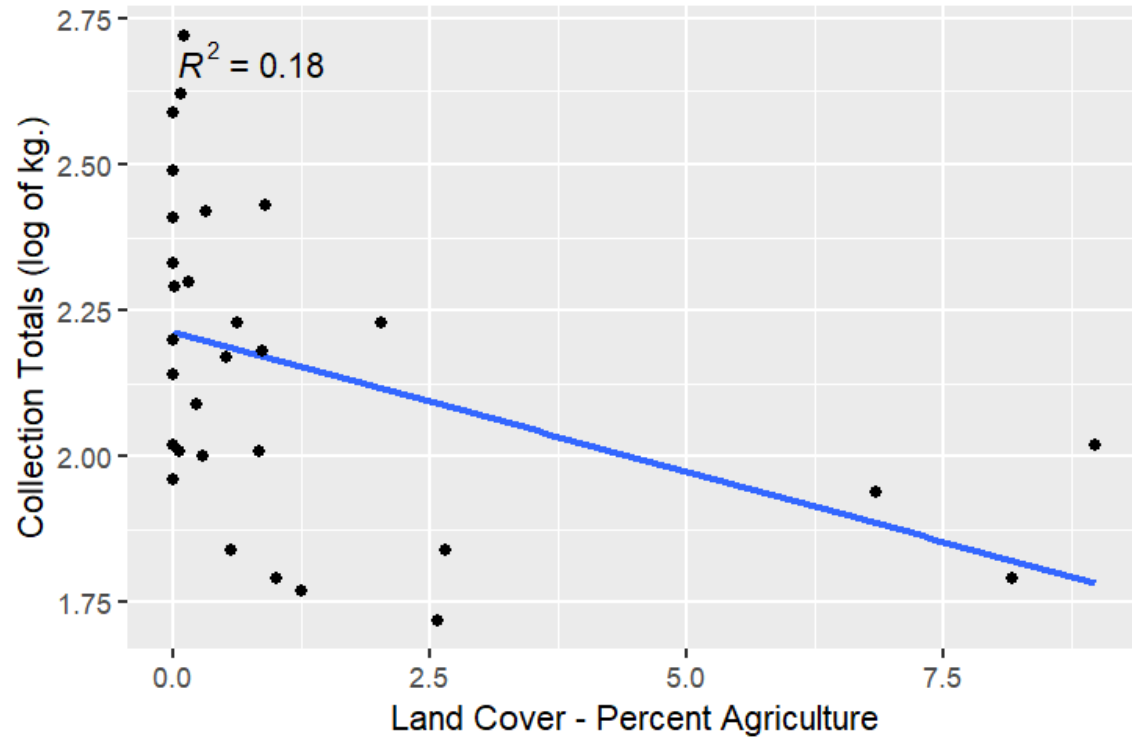


***p-value* ≤ 0.001**

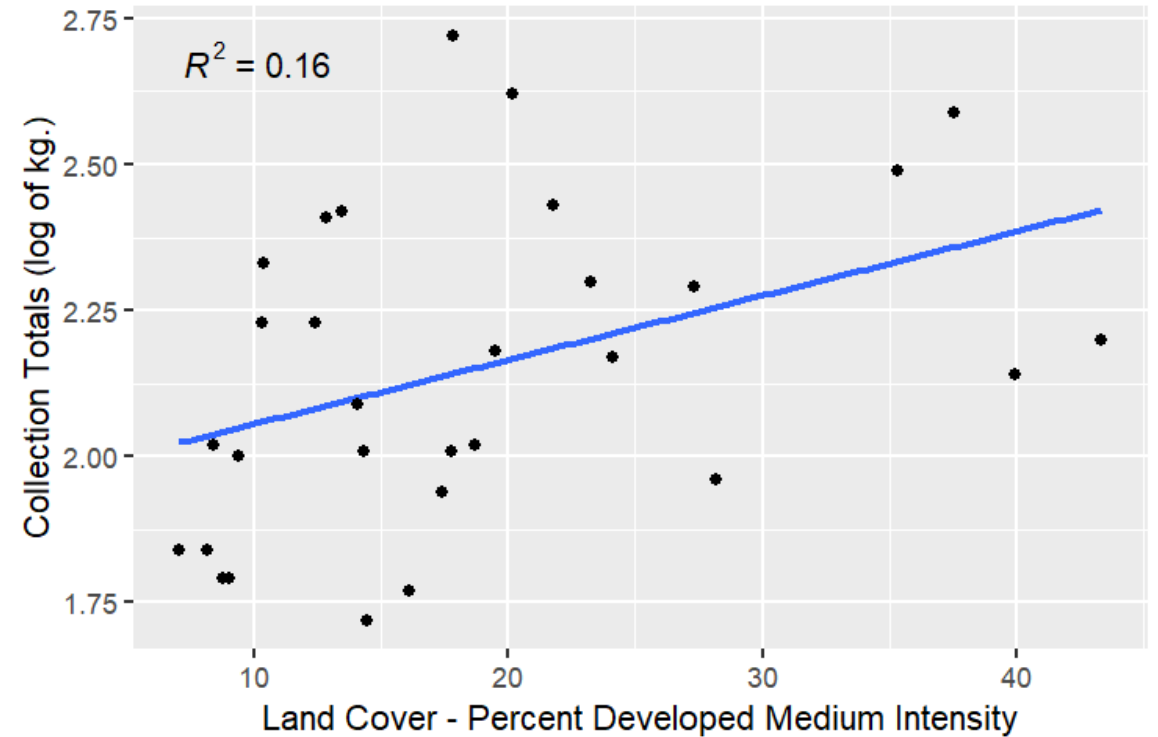


***p-value* ≤ 0.001**

Results – Land Cover Cont.



p-value = 0.019

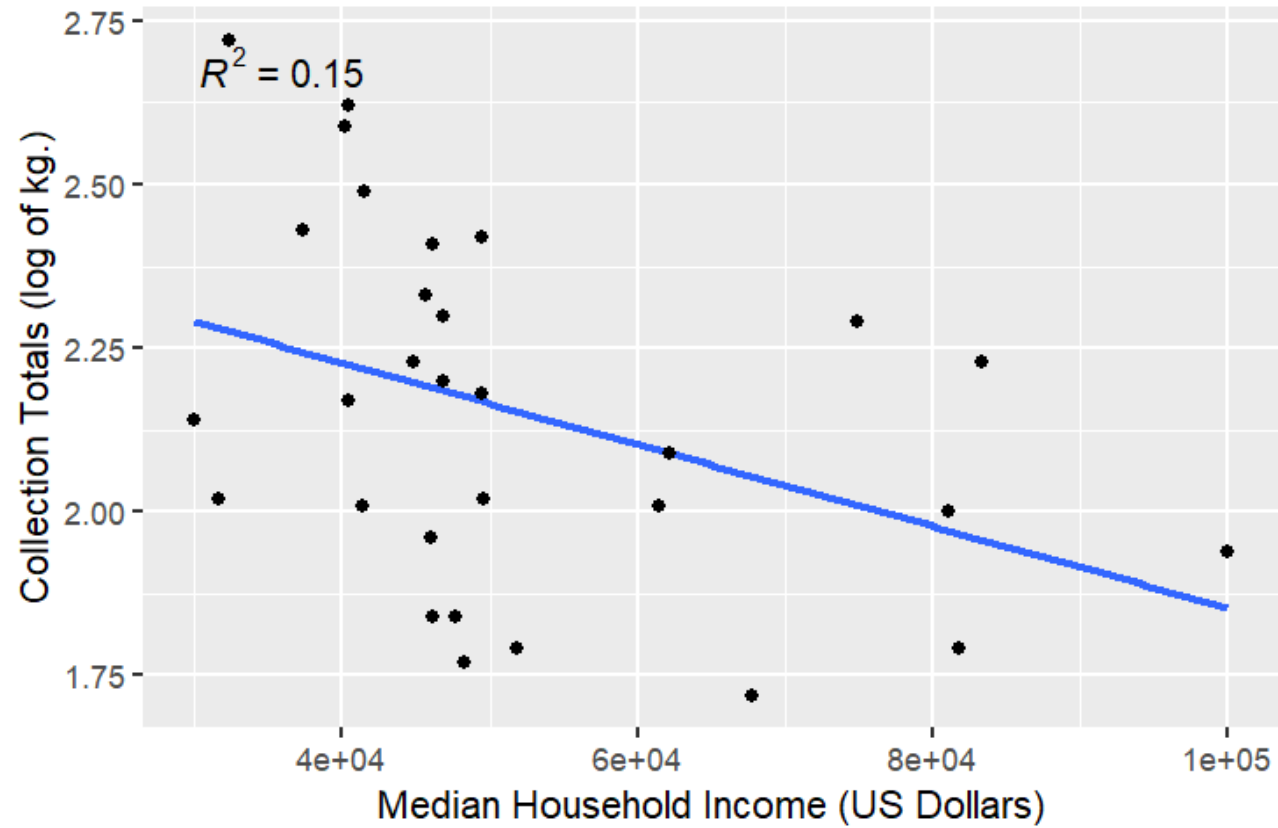


p-value = 0.027

Results – Land Cover Cont.

- Land Cover – significant
 - Developed – Other and Plastic
 - Developed Medium Intensity – Plastic
 - Developed High Intensity – Plastic
 - Open Land – Metal, Other and Plastic

Results – Median Household Income



p-value = 0.032

Hypotheses Review

- Rainfall – not significant
- Population Density - not significant
- Land Cover – significant
- Median Household Income – significant



Discussion

MONTHLY AVERAGE RAINFALL

- Not significant
- Contradictory to findings in various other studies
- narrow geographic range and therefore a narrow climate range
 - Annual rainfall range – 120 cm to 191 cm

POPULATION DENSITY

- Not significant
- Mixed support from other studies
- not a good indicator because of the non-uniform distribution of litter

Discussion Cont.

LAND COVER

- Significant
- Supported by various other studies
- Pathway for litter to reach local waterways
 - Impervious surfaces

MEDIAN HOUSEHOLD INCOME

- Significant
- Positive Correlation
 - Regular city or community-supported services
 - Less illegal dumping
 - Community pride

Limitations & Future Research



- Larger sample size
- Wider range of site locations
- Additional watershed characteristics
 - Education attainment
 - Types of households
 - Creek flow/discharge rates
- More consistent data collection

Conclusion

- Land cover classification had the most impact on the amount of litter collected from the Litter Gitters.
- Information gathered is beneficial for numerous reasons
 - Placement of litter collection devices
 - Litter education programs



Thank you!

Questions?

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