

Rainy Season Nitrogen Transport in Urban Residential Stormwater Runoff

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Background

Urbanization Causes More Runoff



Rainfall falls onto impervious surfaces
Runoff is carried via drains and gutters
Connected water bodies

Carries pollutants from urban land to water bodies

❖ Stormwater runoff is a leading contributor of N in urban waters.

❖ Excess N in urban waters causes eutrophication and algal blooms that leads to water quality degradation.

❖ Red tide outbreaks in Florida are common occurrences.

❖ Limited data are available on composition of N in urban waters over various storm events.



Objectives and Hypotheses

SPECIFIC OBJECTIVES:

1. Investigate the composition of N forms in stormwater runoff over various storm events.
2. Investigate the influence of runoff volumes on the composition of N forms.

HYPOTHESES:

H1: Organic N is the most dominant N forms in residential stormwater runoff.

H2: High volumes of stormwater runoff will cause more transport of inorganic N forms (i.e. $\text{NO}_x\text{-N}$, $\text{NH}_3\text{-N}$), and less amounts of stormwater runoff will cause more transport of organic N forms (i.e. DON)..

Materials and Methods

Study Site

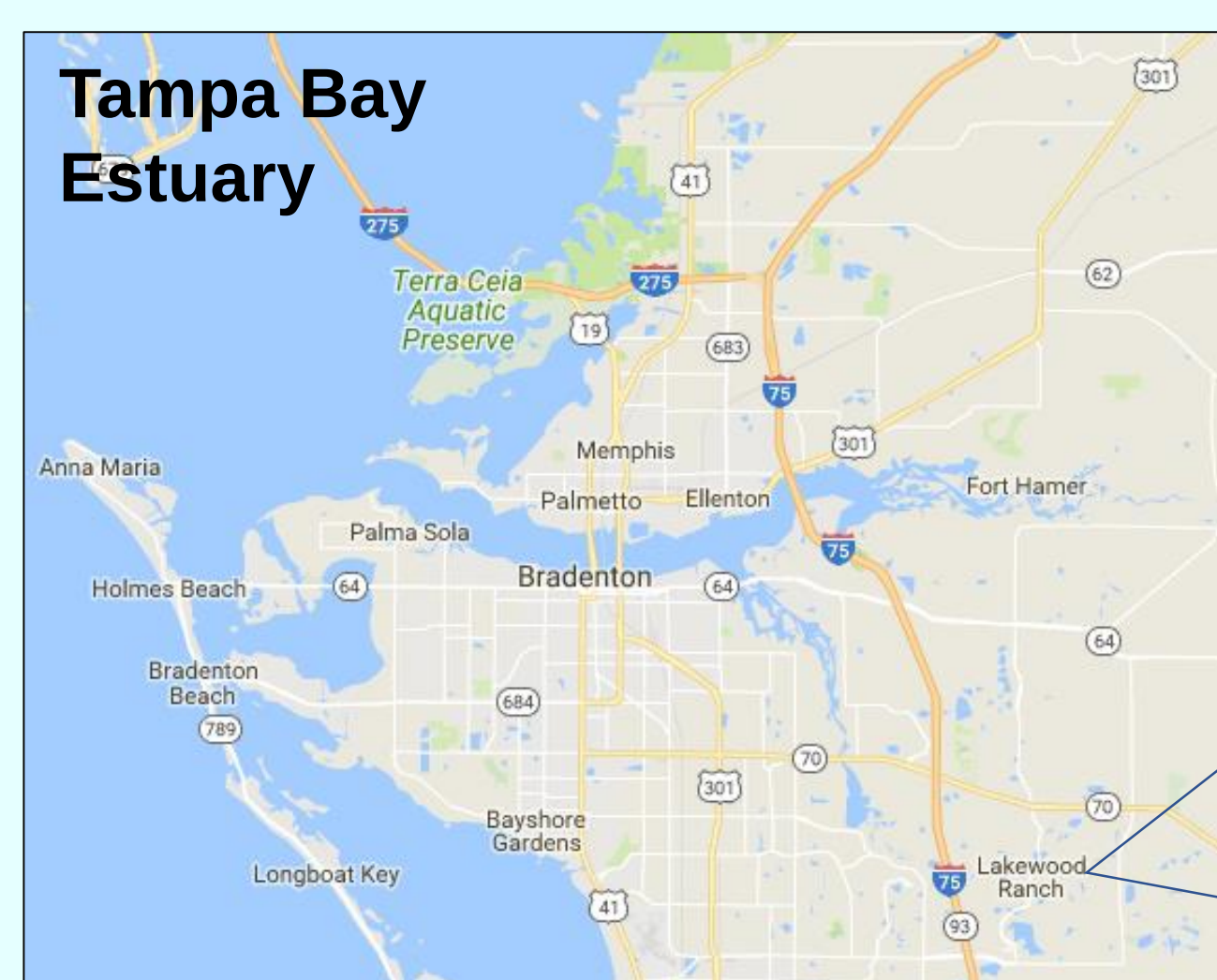


Figure 1. Runoff catchments located in Lakewood Ranch, Bradenton Florida.

Runoff catchment:
▪ Total area: 4.99 acres
▪ Pervious surface: 63%
▪ Impervious surface: 37%

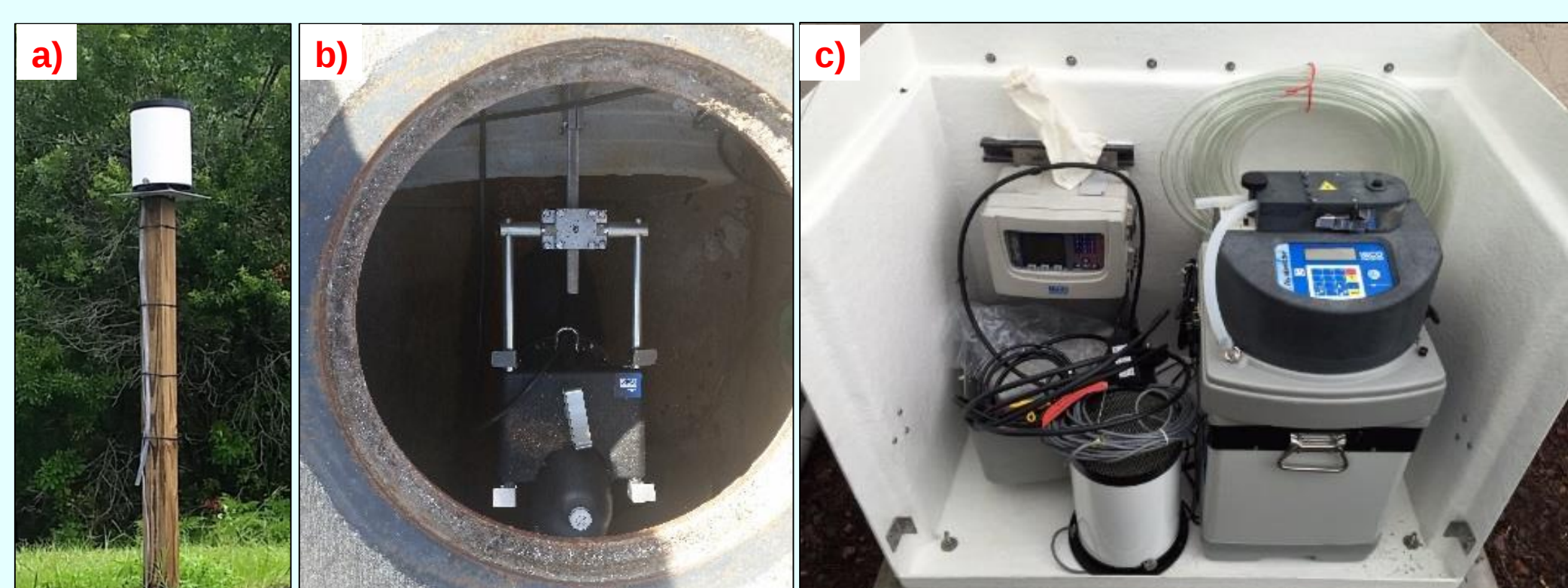
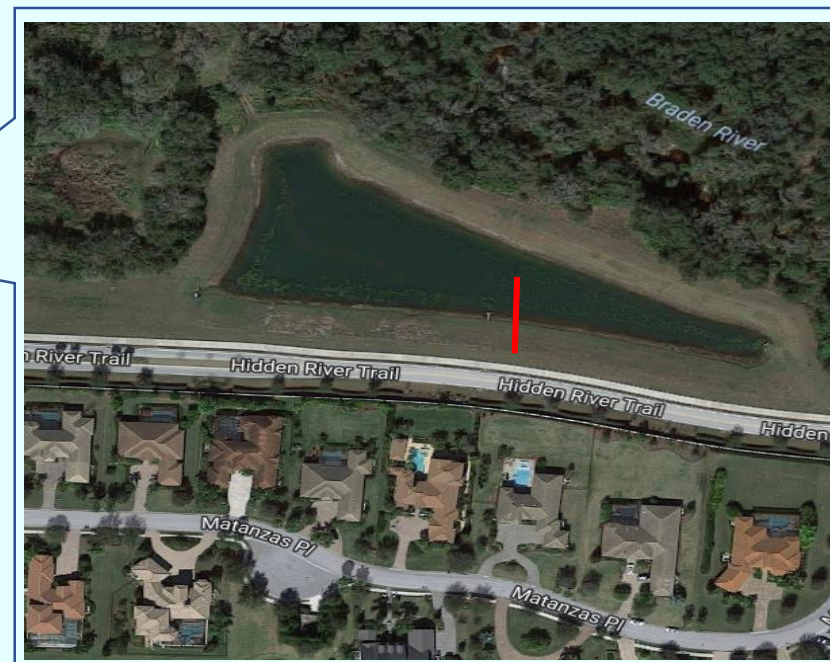
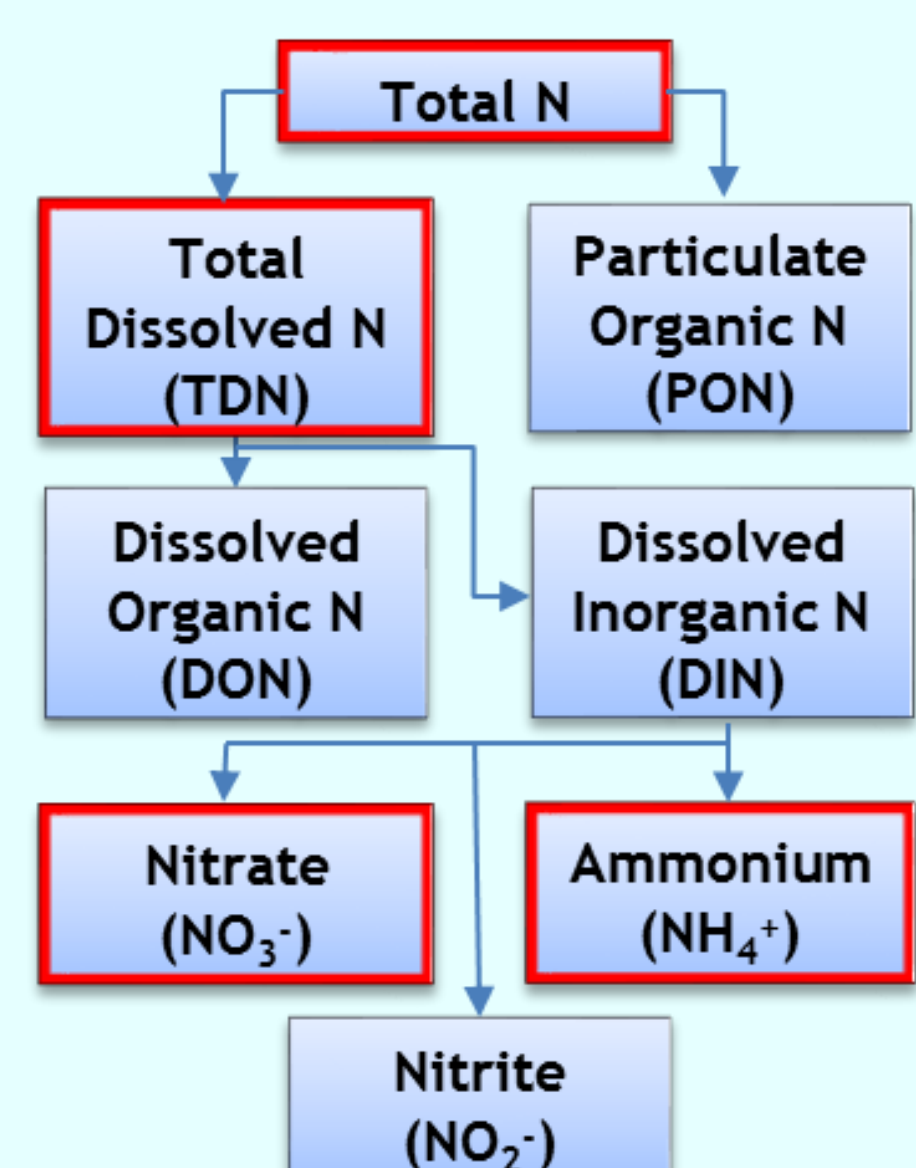


Figure 2. a) Rain gauge to determine rainfall, b) laser flow meter to measure flow, and c) autosampler with built in refrigerator.

Composition of N Forms: N Forms Analysis



Other N form were calculated as:

- $\text{PON} = \text{TN} - \text{TDN}$
- $\text{DON} = \text{TDN} - (\text{NO}_x\text{-N} + \text{NH}_3\text{-N})$

Results and Discussion

Rainfall and Flow

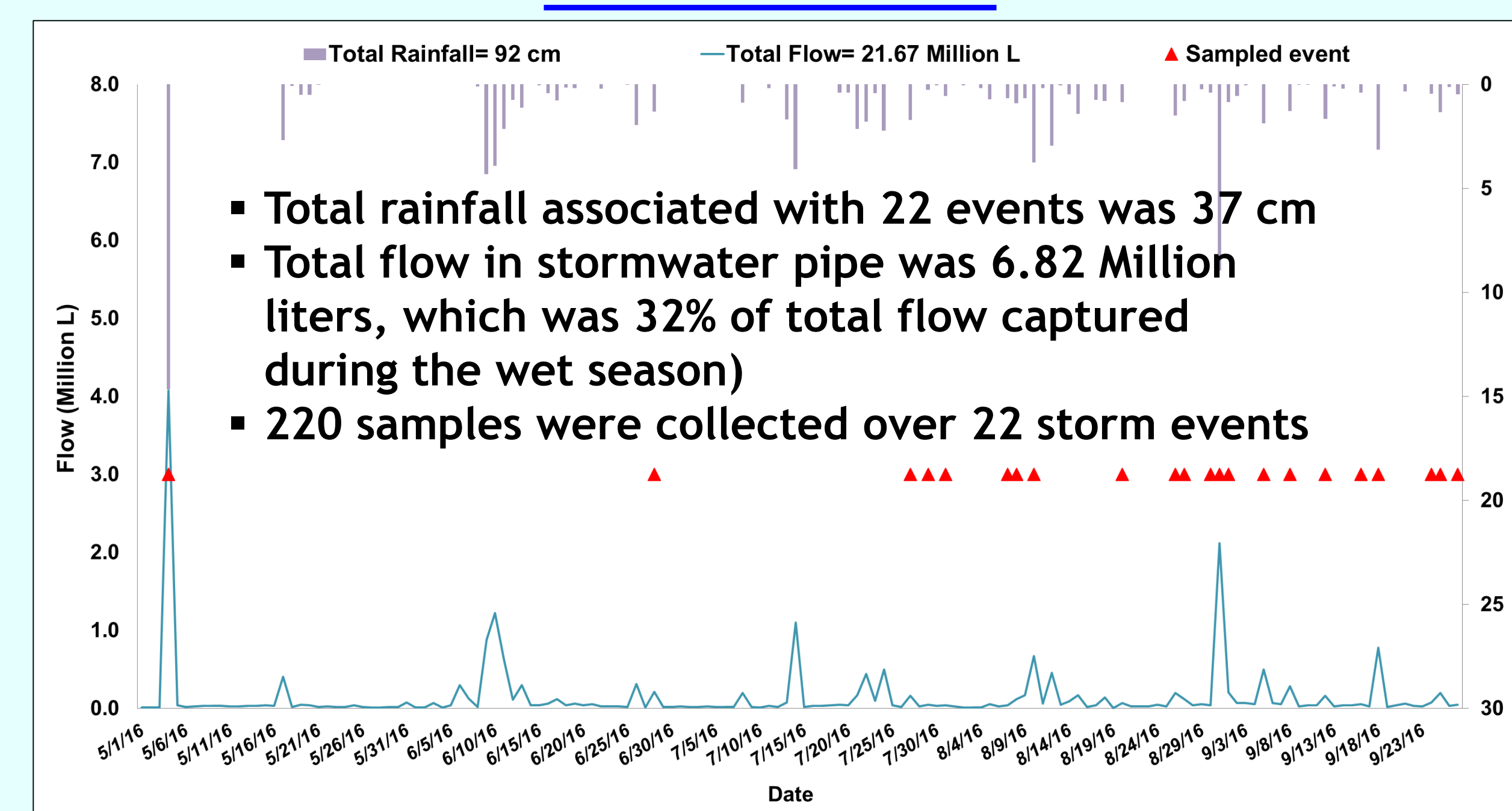


Figure 1. Daily rainfall (cm) and flow (Million L) data from May to October 2016.

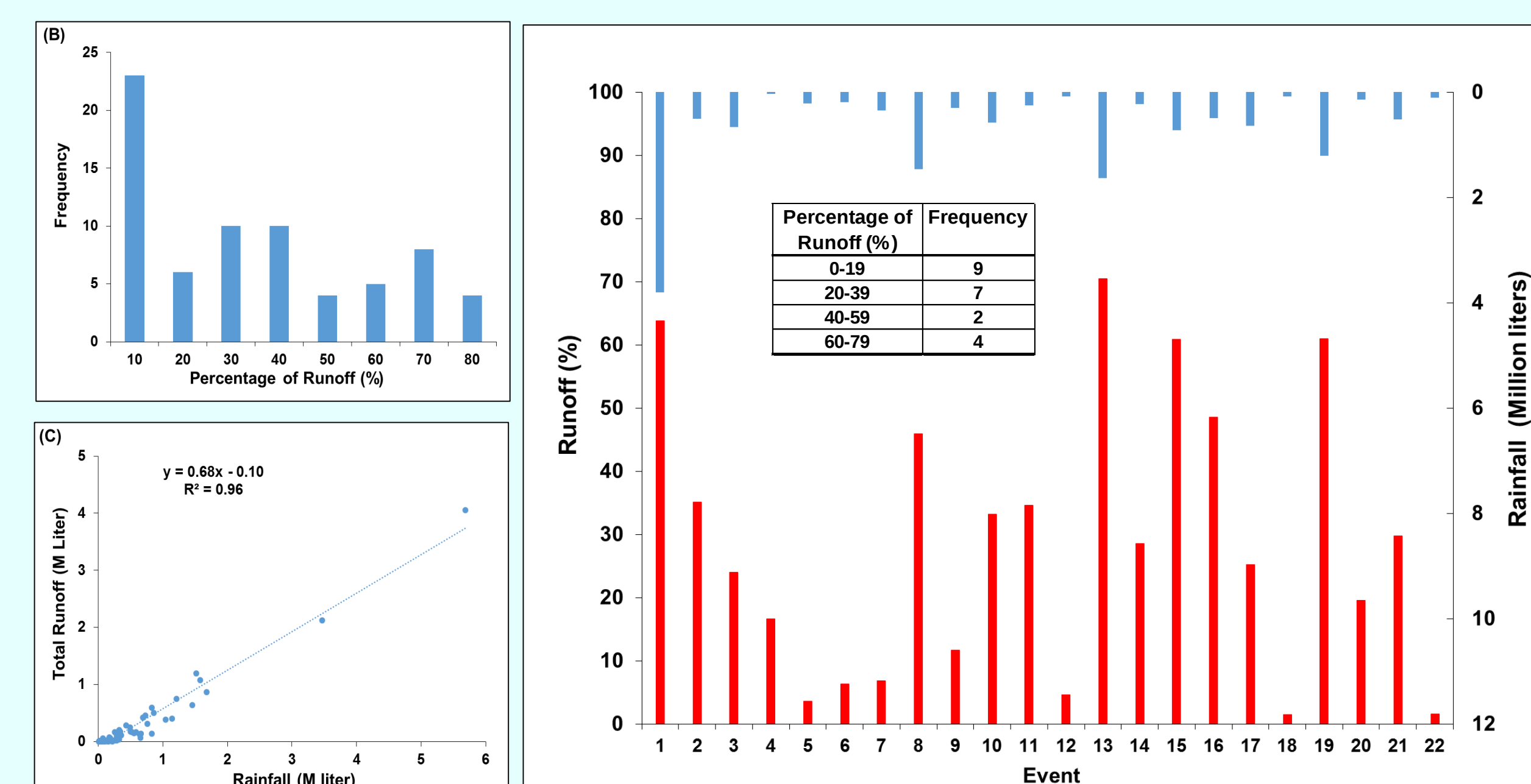
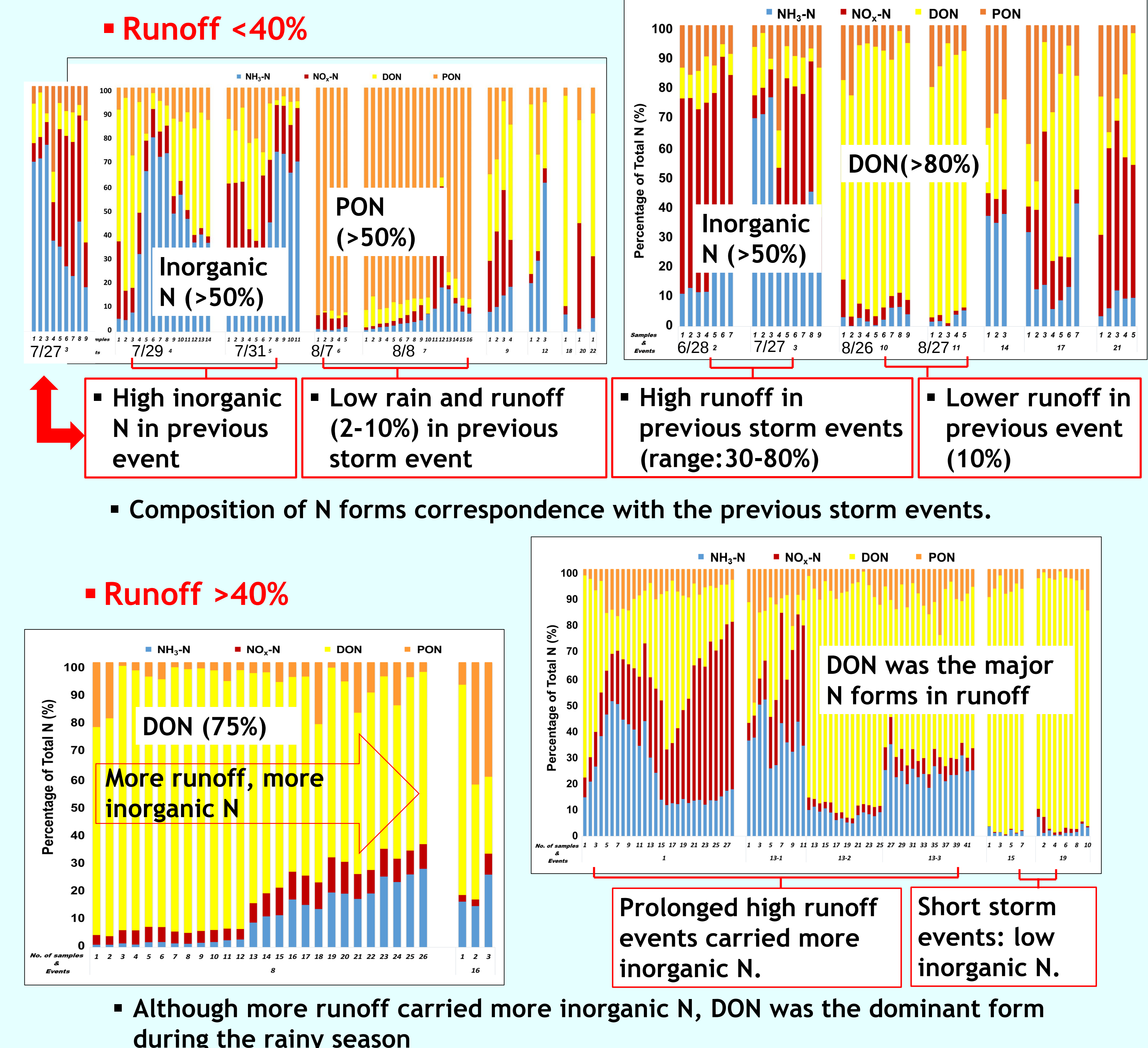


Figure 2. (A) Frequency of runoff percentage, (B) total runoff versus total rainfall (n=72), and (C) total rainfall and percentage of runoff for 22 collected storm events from May to October 2016.

Composition of N Forms in residential stormwater runoff



Conclusions

- Among all N forms, DON was the dominant form in residential stormwater runoff
- High volumes of stormwater runoff caused more transport of inorganic N forms (i.e. $\text{NO}_x\text{-N}$, $\text{NH}_3\text{-N}$), and less amounts of stormwater runoff caused more transport of organic N forms (i.e. DON).
- About 70% of stormwater events carried less than 40% runoff, which indicated that more DON will be carried from residential into the water bodies during Florida rainy season.
- Nitrogen management strategies must consider organic N sources to improve the quality of urban waters.

Reference

- ❖ Causse, J., Baurès, E., Mery, Y., Jung, A.-V., Thomas, O., 2015. Variability of N Export in Water: A Review. Crit. Rev. Environ. Sci. Technol. 45, 2245-2281. doi:10.1080/10643389.2015.1010432

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