Groundwater based nutrient loading in Fagaalu Watershed, American Samoa

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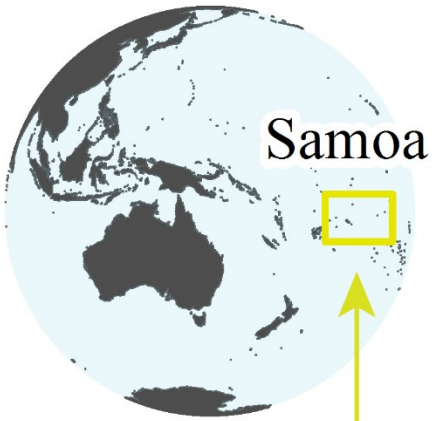
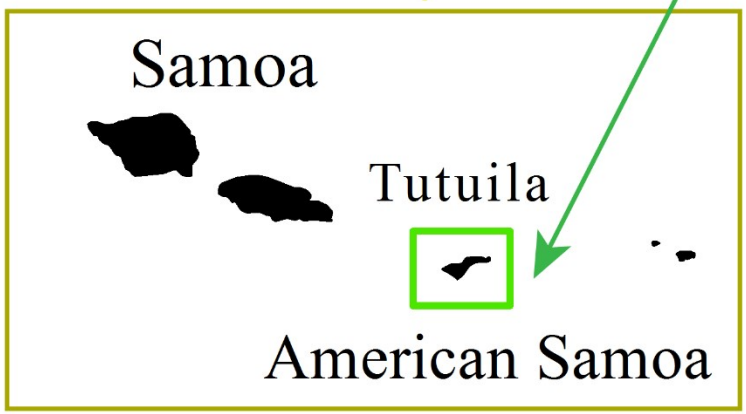
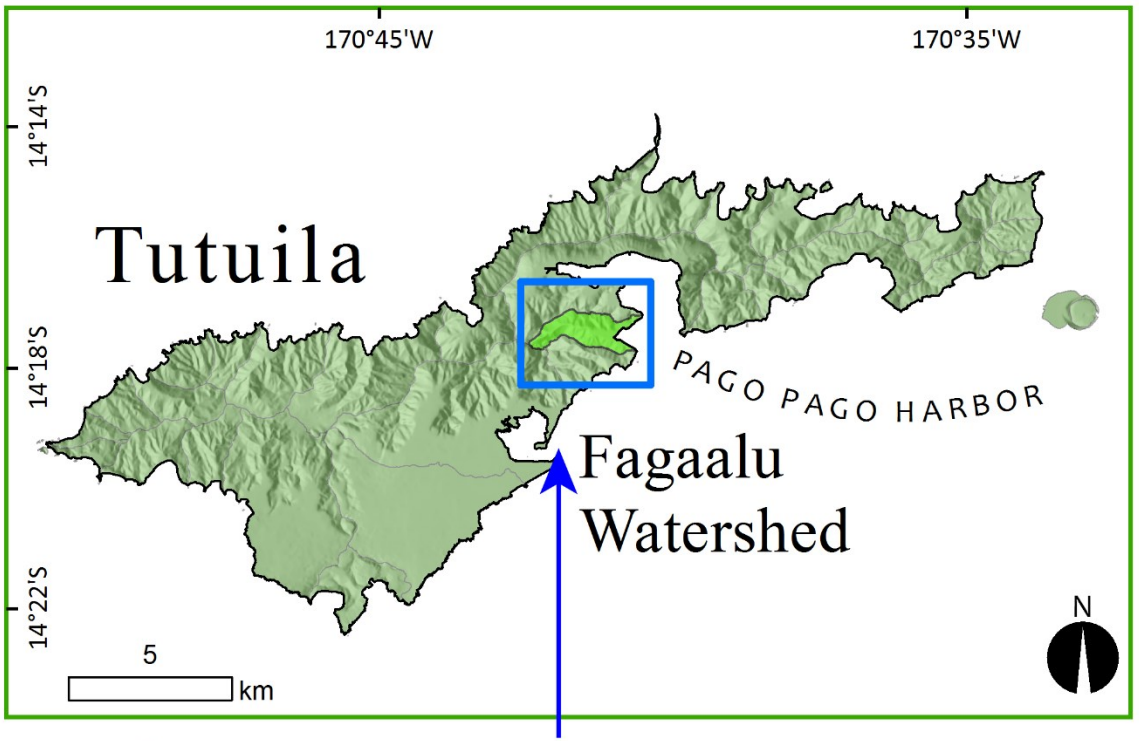
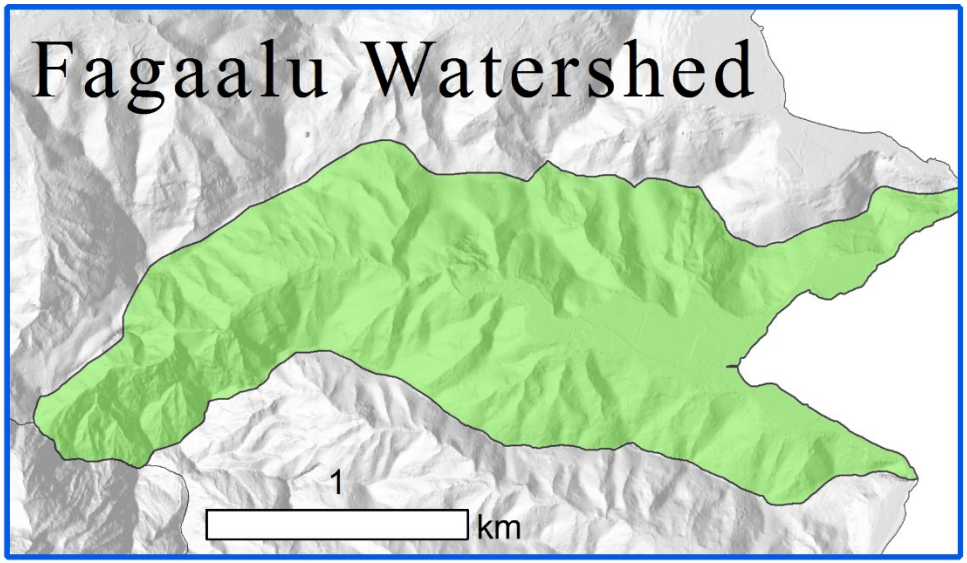
Study area


Samoa


Samoa
Tutuila
American Samoa


170°45'W
170°35'W
14°14'S
14°18'S
14°22'S
Tutuila
PAGO PAGO HARBOR
Fagaalu
Watershed
5
km
N


Fagaalu Watershed
1
km

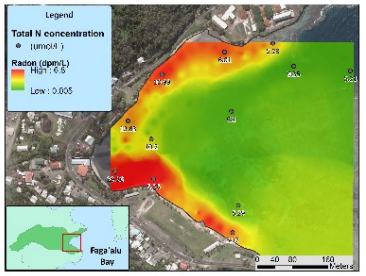
Study motivation

- Declining reef health, and is priority a watershed (CRTF)
- Stream water quality is impaired (AS-EPA)
- Groundwater's nutrient loading is unknown/unmeasured
- No prior SGD studies in American Samoa

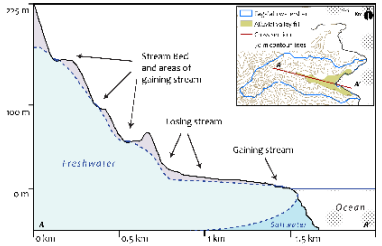
Study objective

Determine the importance of groundwater in coastal nutrient loading

1) Quantify total dissolved nitrogen (N) flux via Submarine Groundwater Discharge (SGD)

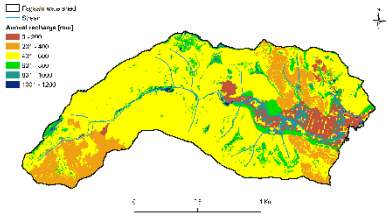


2) Quantify (GW) - surface water (SW) interaction and nutrient flux at baseflow

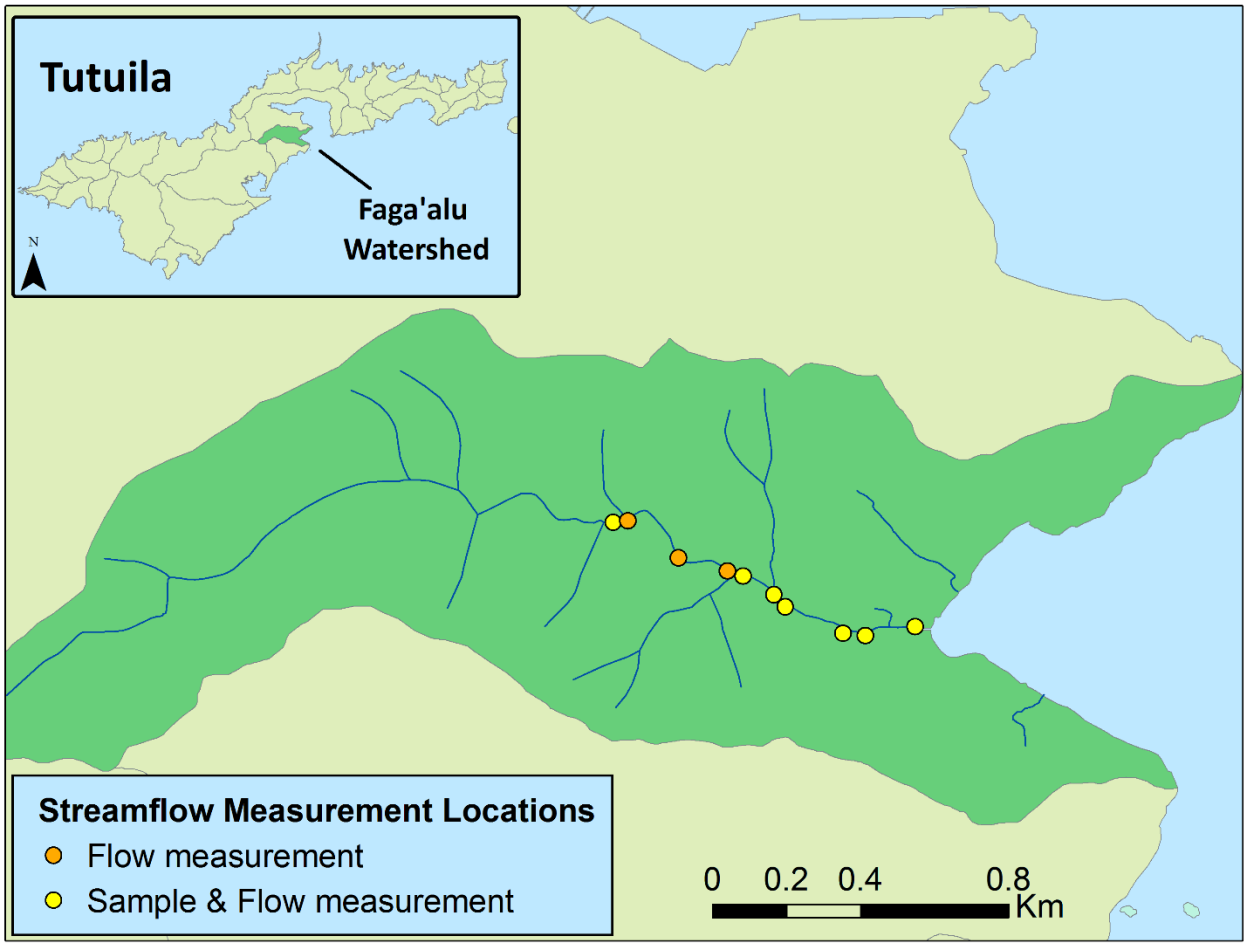


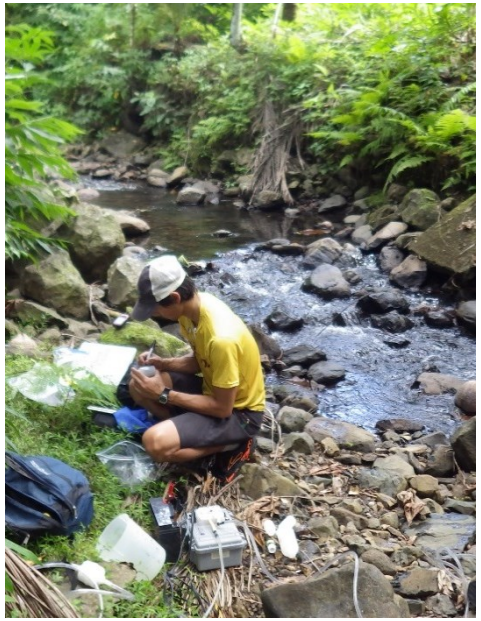
3) Model N loading with SWAT to assess

- Importance of different sources
- Estimate N-loading at high-flows

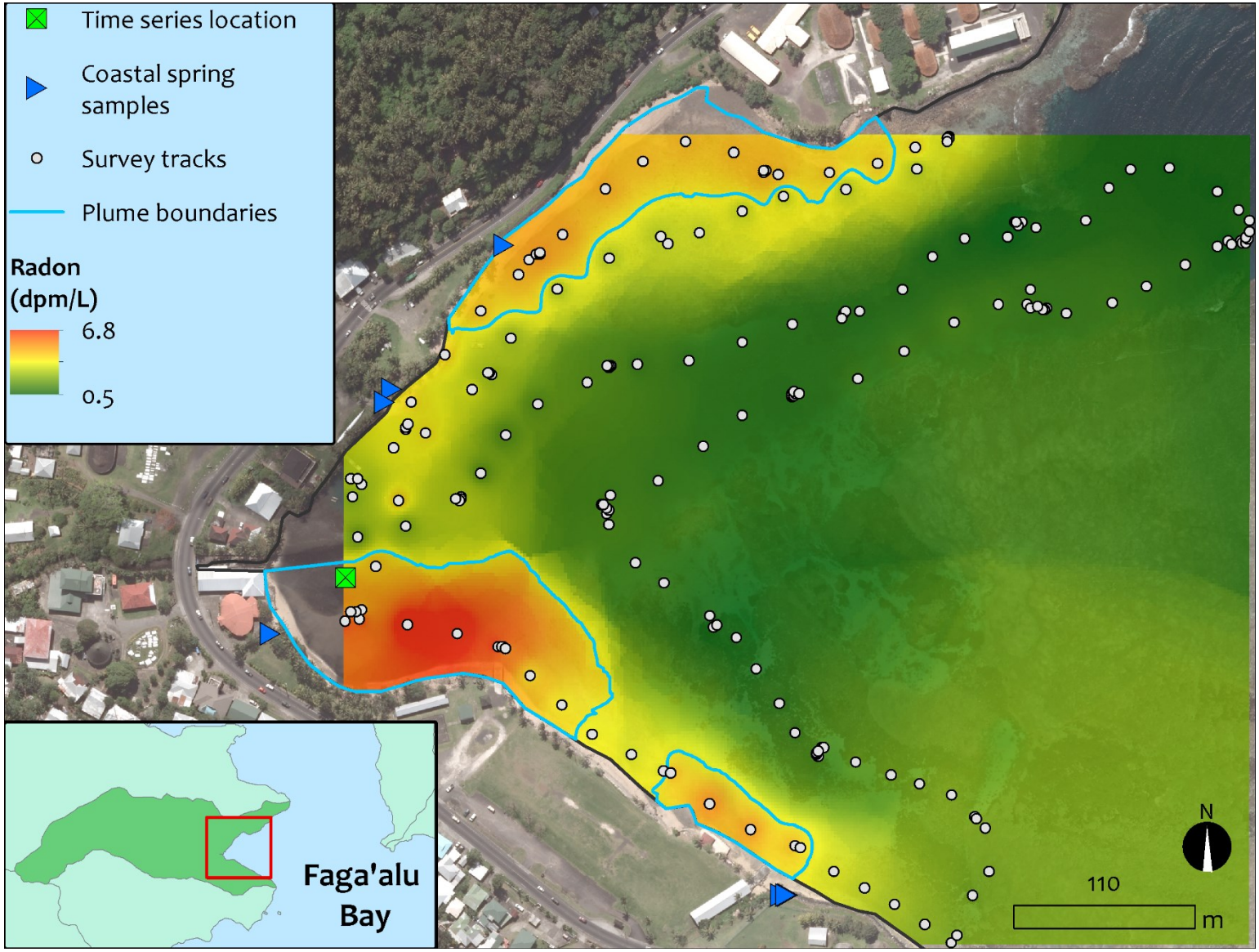


Methods: Quantifying nitrogen and water fluxes between GW and SW

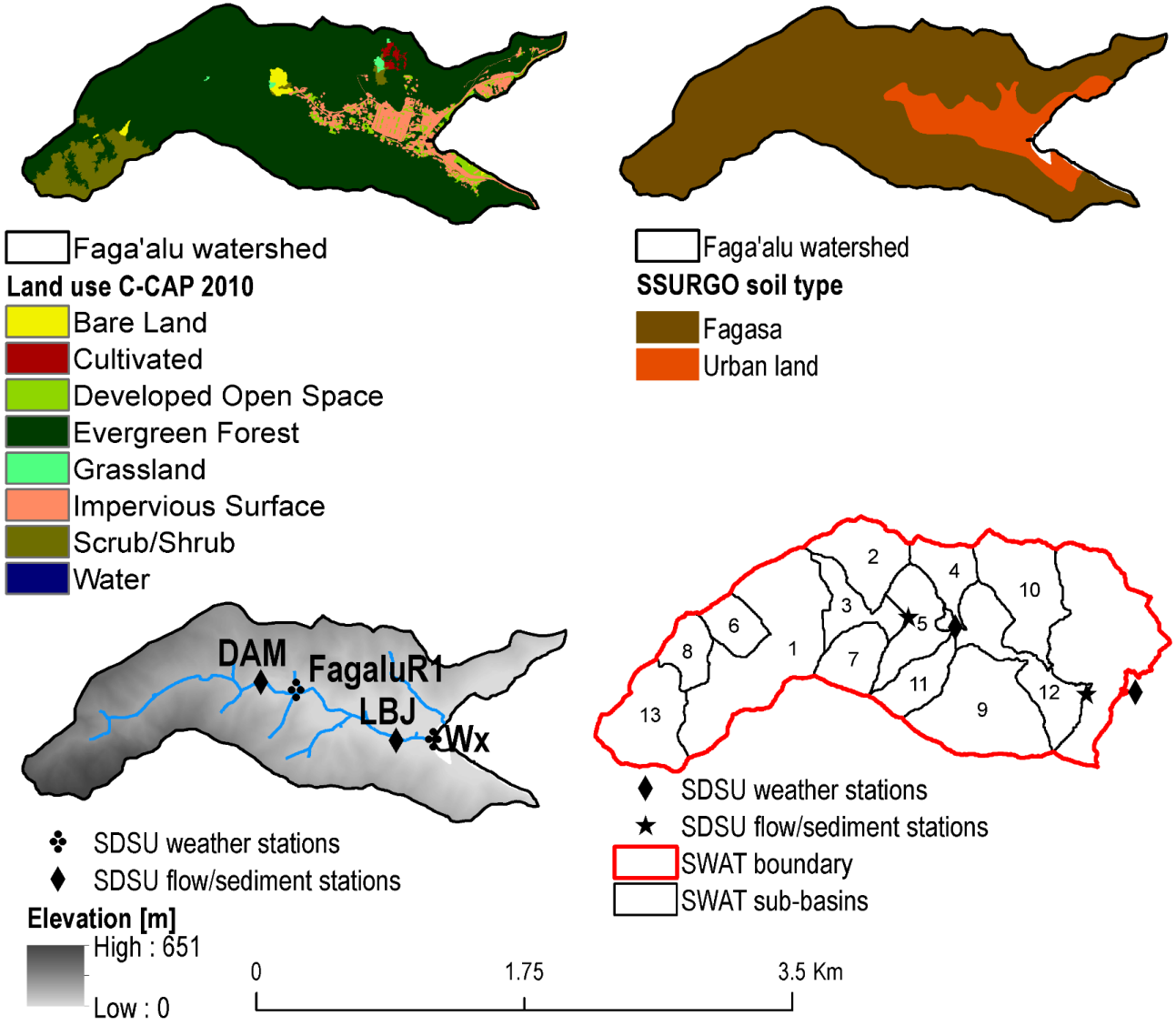




Methods: Quantifying SGD and associated coastal nitrogen fluxes



Methods: Watershed modeling (SWAT) for water budget nitrogen loading estimates



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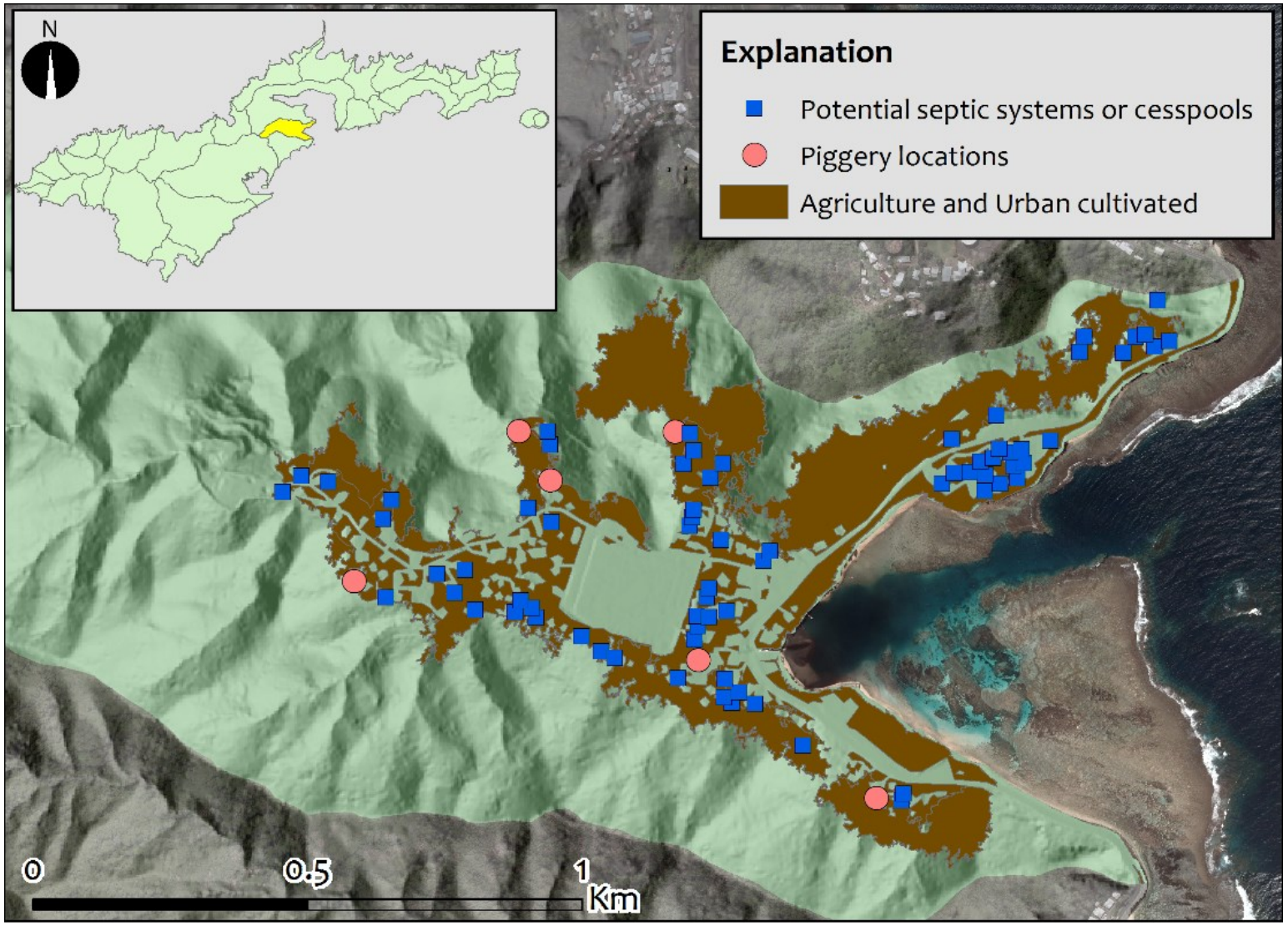
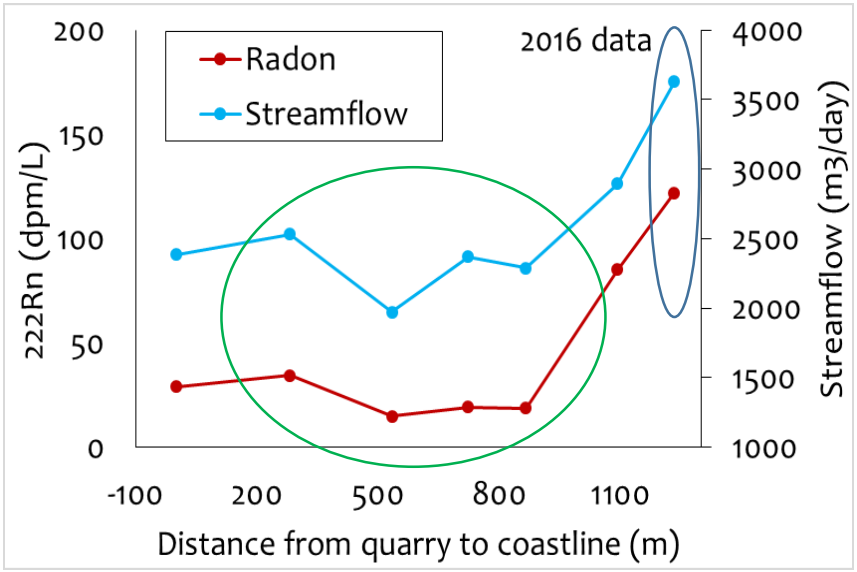
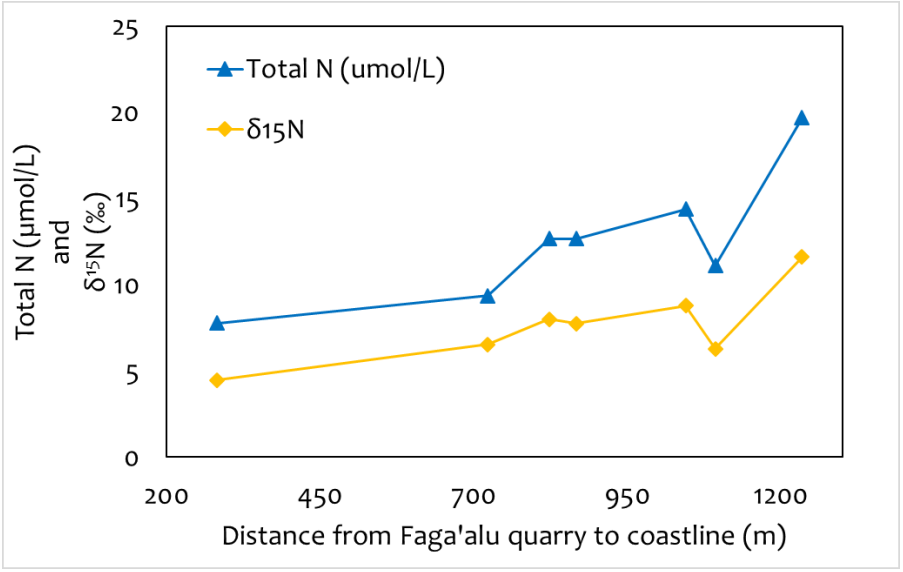


Results: Quantifying coastal nitrogen fluxes via SGD and streamflow

Streamflow and ^{222}Rn measurements

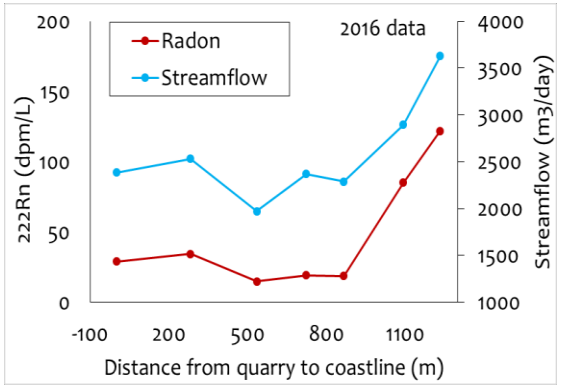


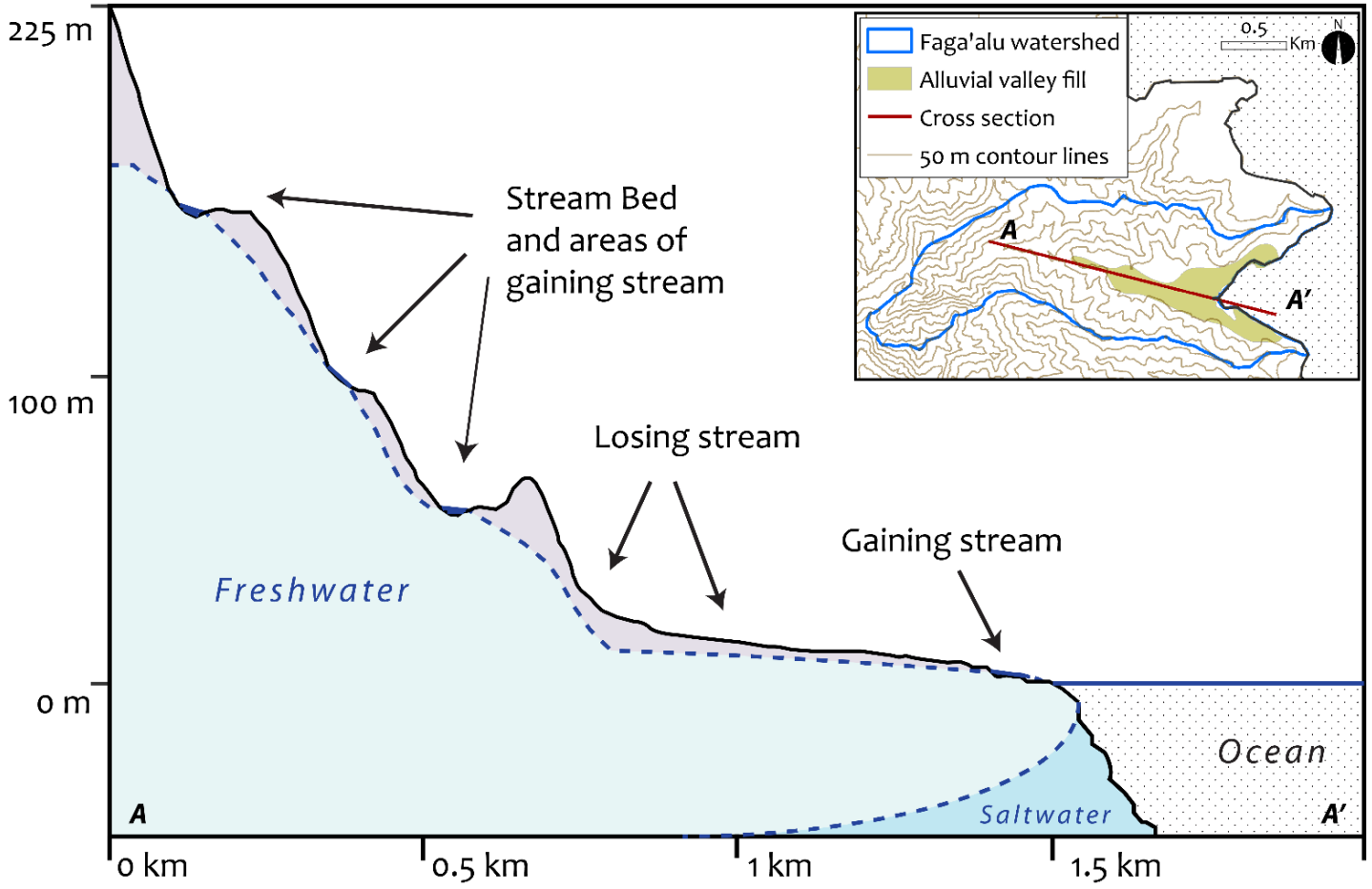
Water sample data



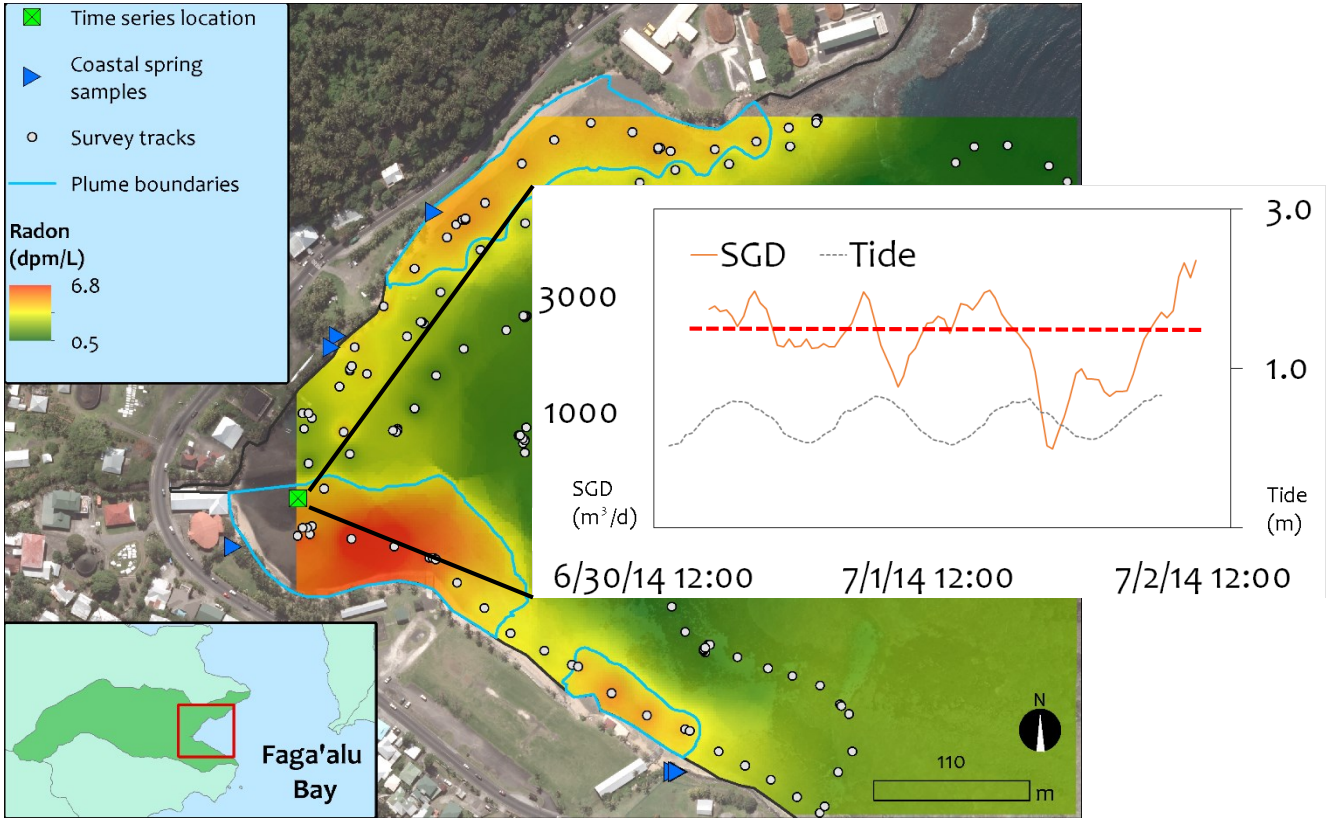
Source	Flow (m^3/d)	N load (kg-N/yr)
SGD (fresh fraction)	2274 ± 685	537 ± 278
Baseflow "GW" fraction	1155 ± 238	218 ± 22
Baseflow "Stream" fraction	2368 ± 238	137 ± 14

Results: Conceptual model of GW-SW interaction





Results: Quantifying coastal nitrogen fluxes via SGD and streamflow



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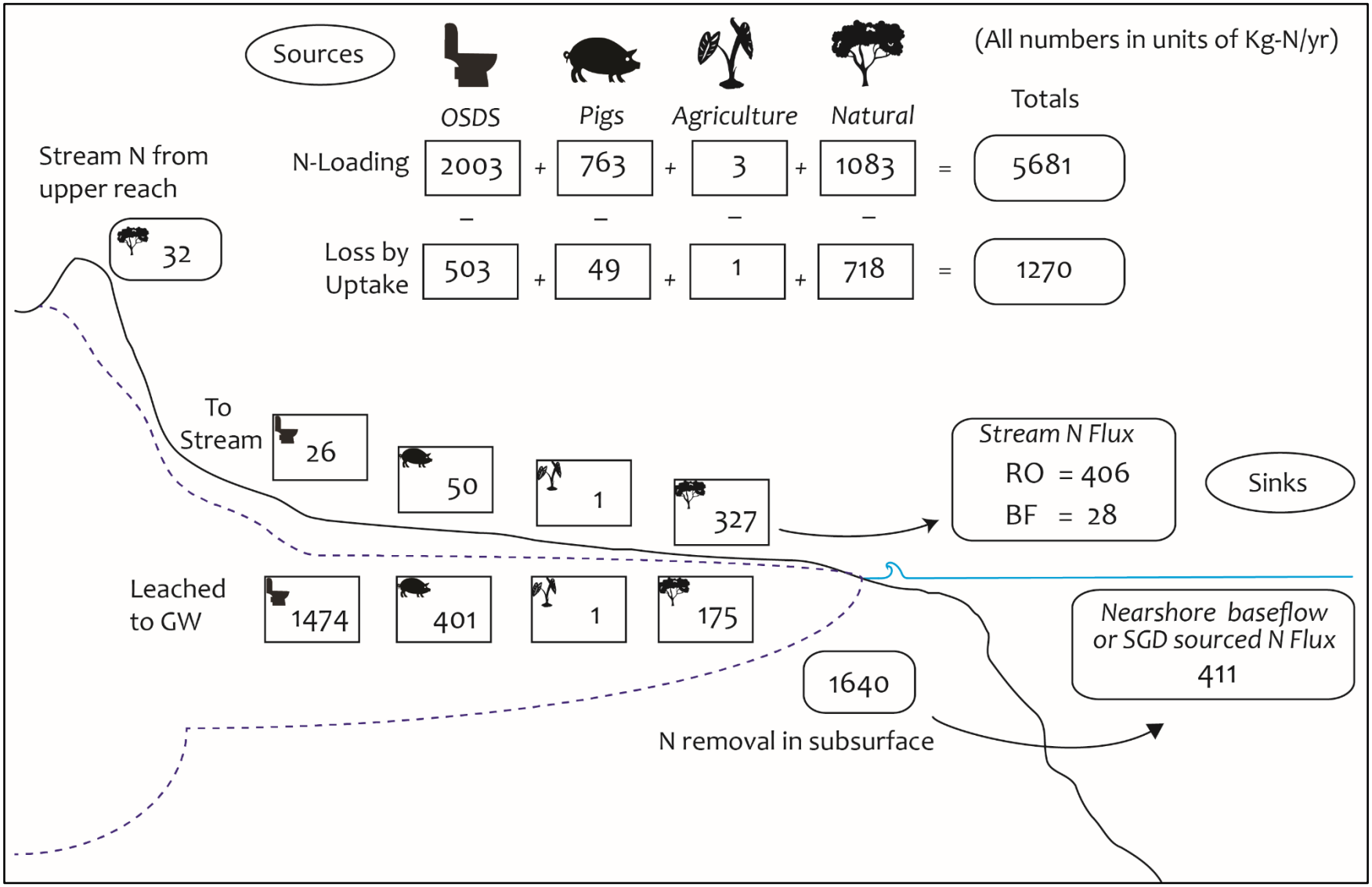
Results: Water & nitrogen budget from SWAT



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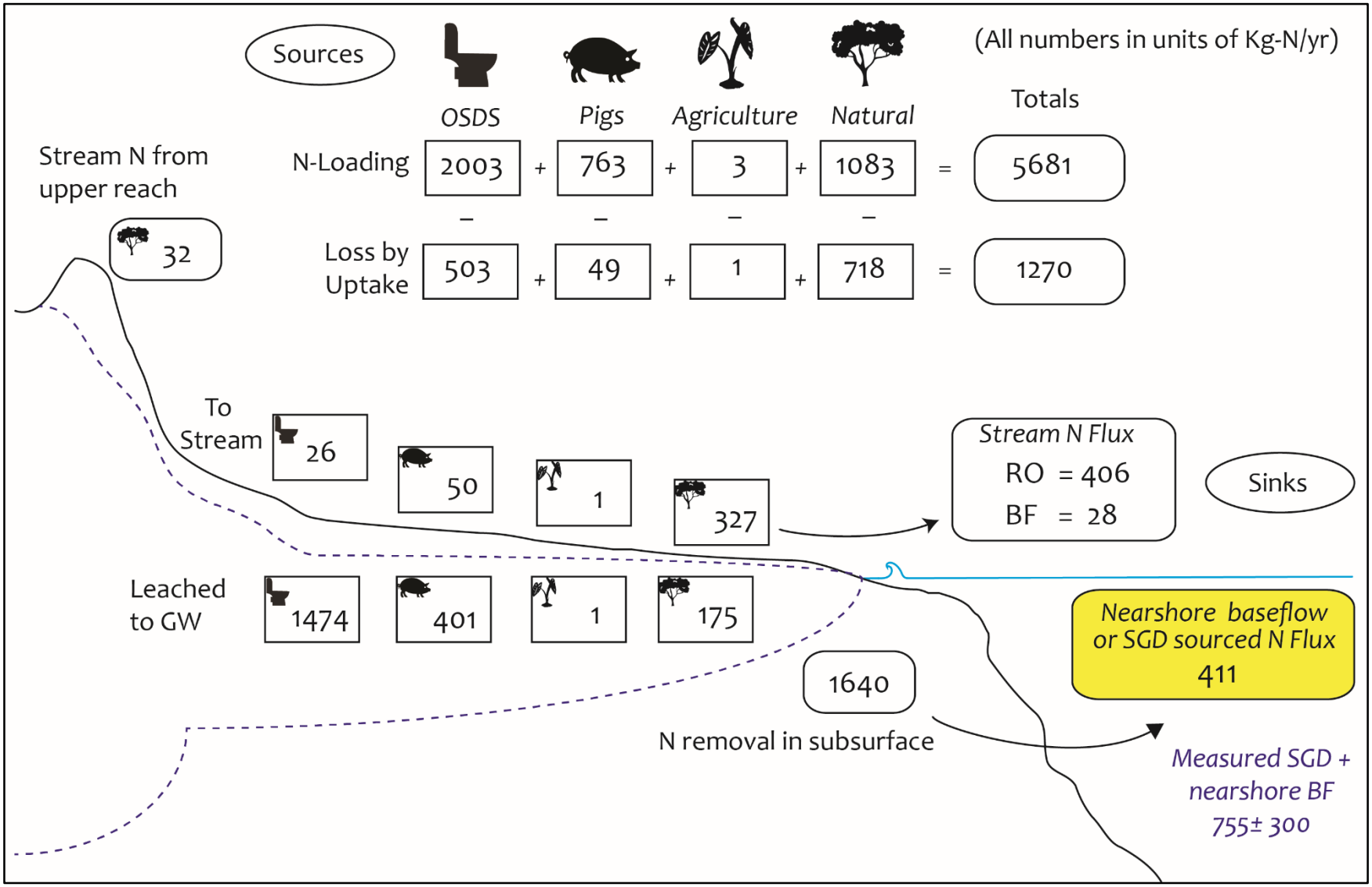

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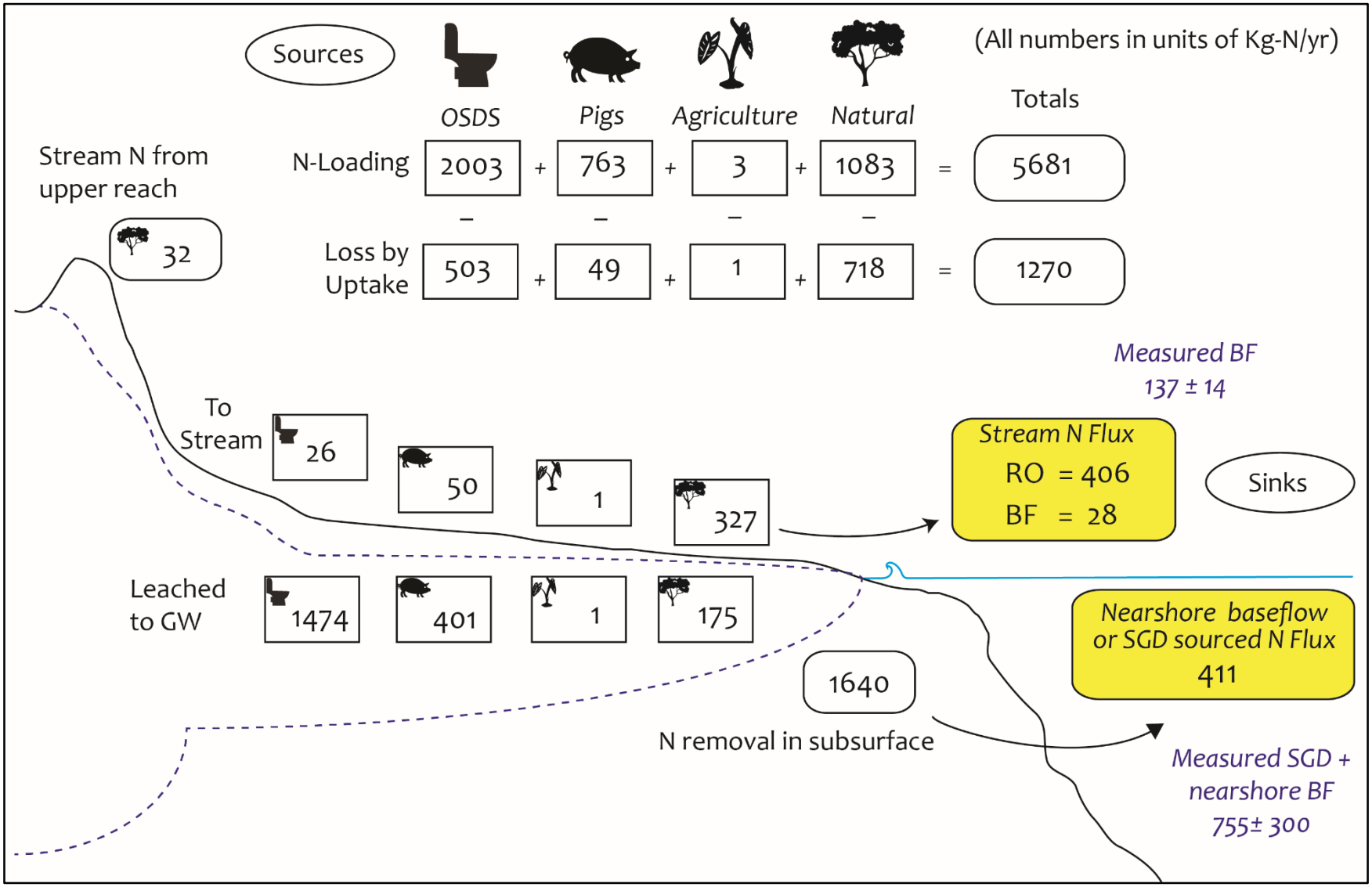
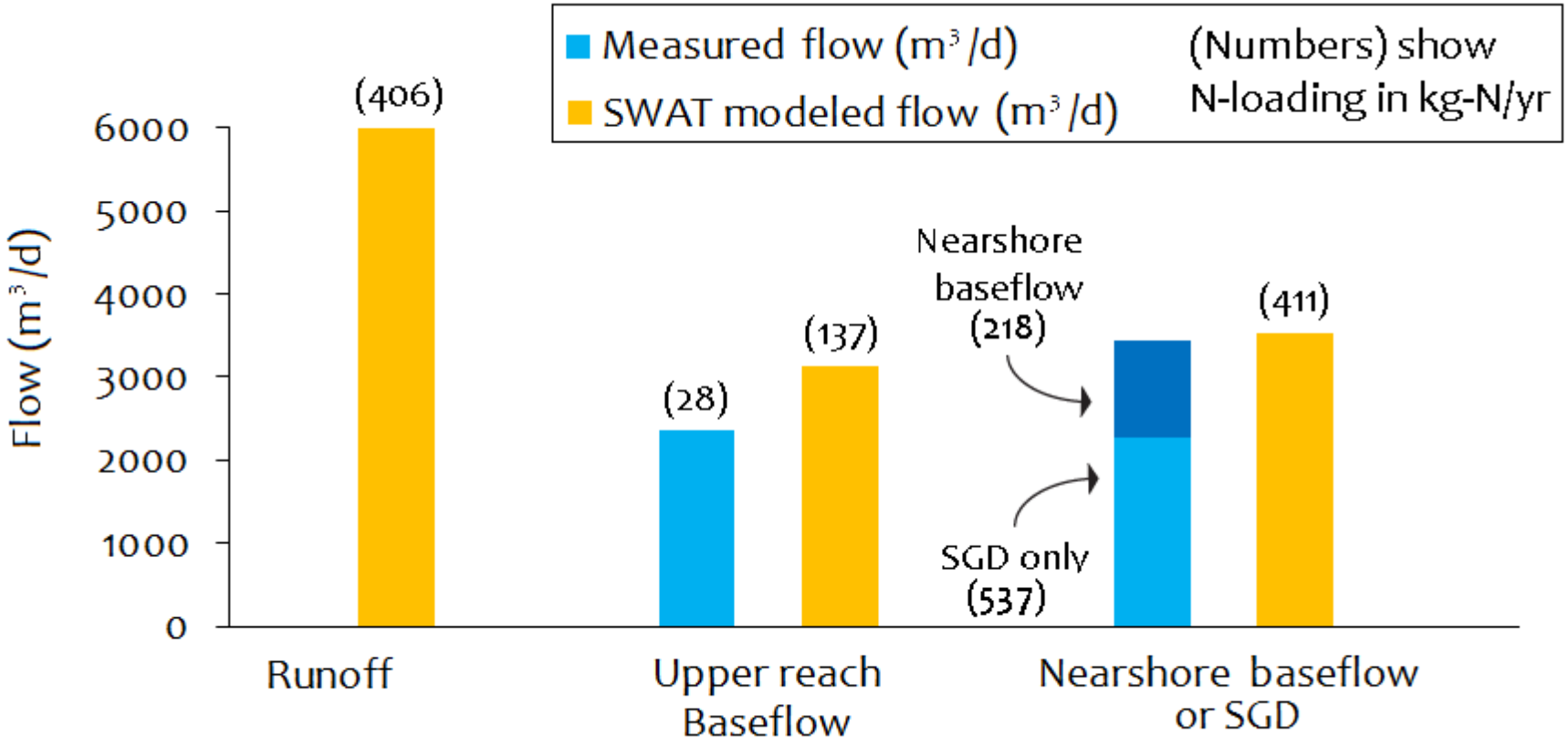
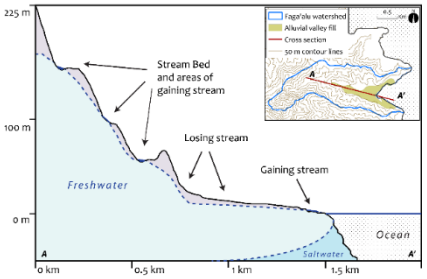


Results: Water and nitrogen budget measured vs. modeled

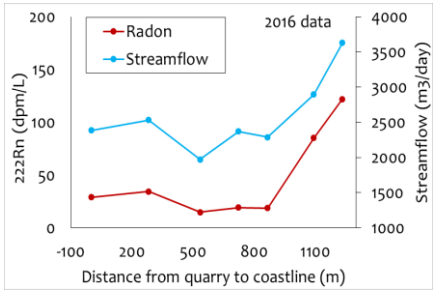


Conclusions

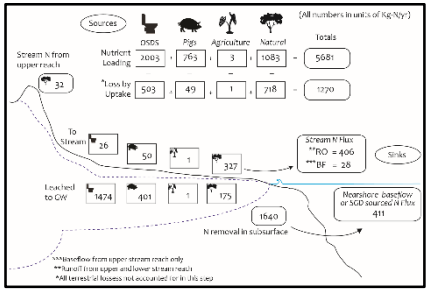
- Stream is gaining up high, losing in alluvium, gaining again near coast



- Nearshore groundwater contributes 30% of water but 60% N to total stream flux



- **Groundwater is important - contributes at least 50% of annual N to Fagaalu bay**



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