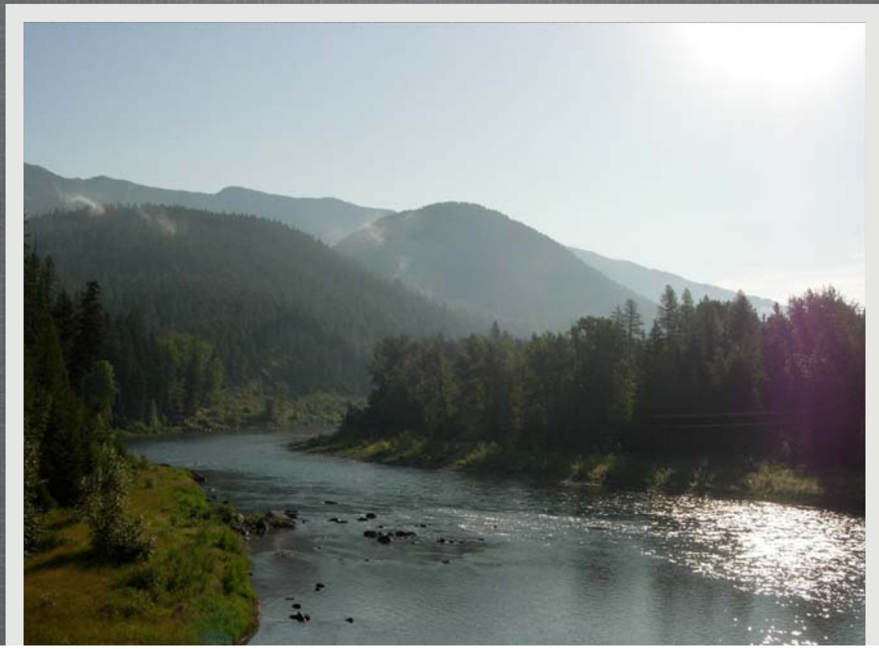
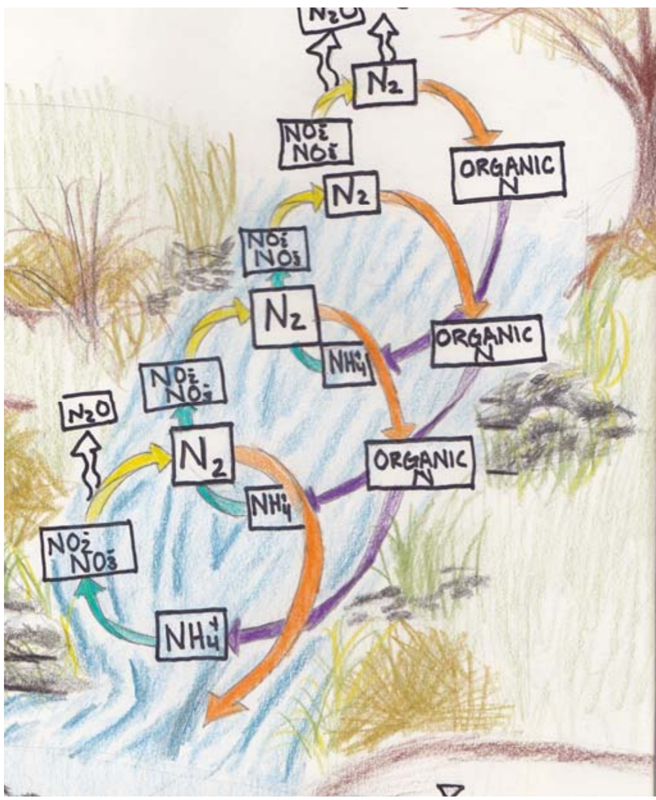
stream restoration projects

Angela Gardner



Top Goals of Restoration

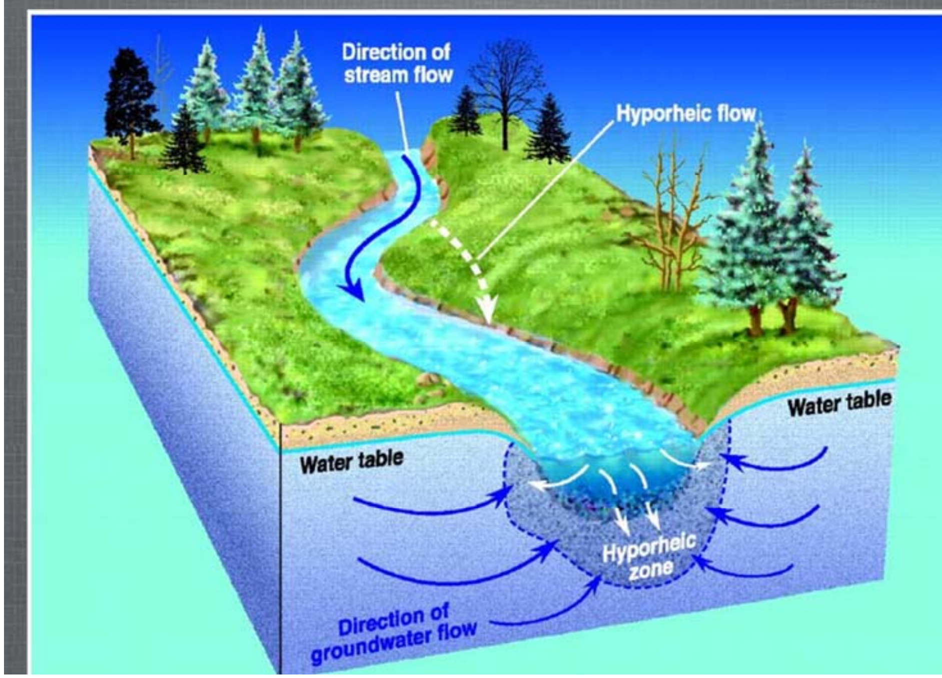
Stabilizing Stream Banks
Developing and enhancing riparian zones
Creating/improving instream habitat
Aquatic organism passage



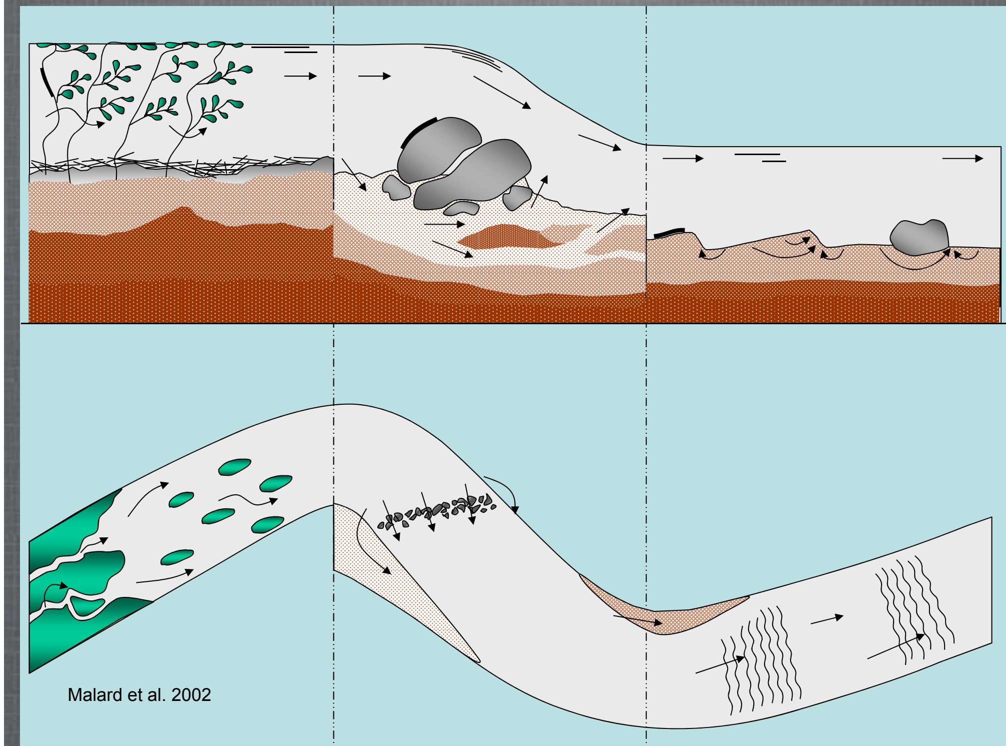
Nutrient cyclin
important to a l
ecosystem’s ov
health and func

It is a dynamic pr
in a constant sta
flux

ater, materials, and biota between groundwater an
stream water as it flows downstream.



the potential to enhance hyporheic exchanges.

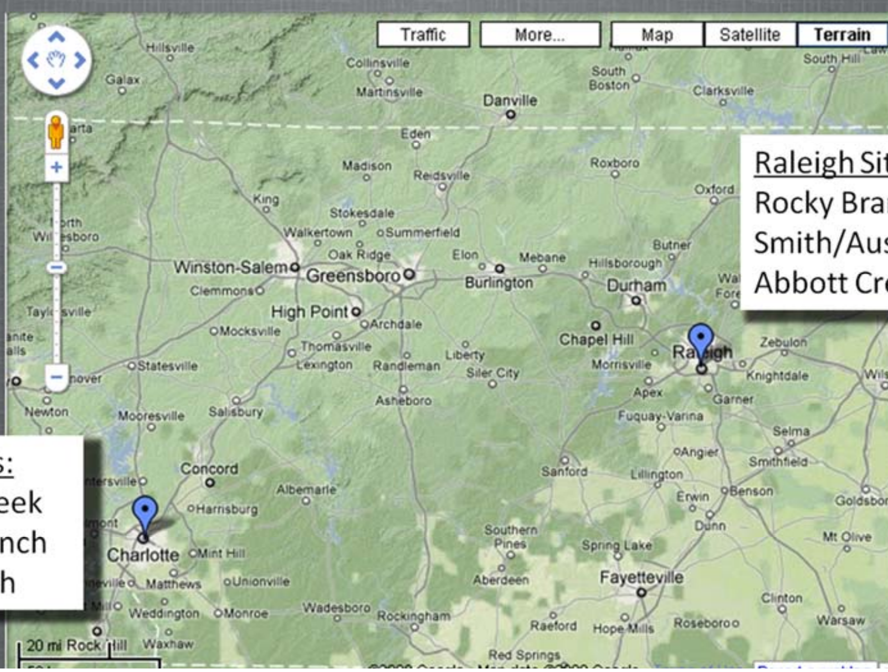


differences in reach scale nitrogen uptake between restored and degraded reaches in low-order urban streams

pothesis 1: restored reaches greater capacity for nutr retention compared to un-restored streams in the sa watershed.

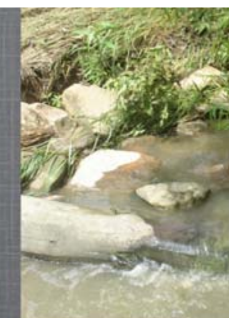
ypothesis 2: Timescale required for reestablishment c retention can be short and impacted by restoratio design strategy

both restored and un-restored sections.



Raleigh Sites
Rocky Branc
Smith/Austir
Abbott Creel

te Sites:
ugar Creek
ark Branch
s Branch



Abbot Creek
Raleigh, 2001

Rocky Branch
Raleigh, 2002

Little Sugar
Charlotte,

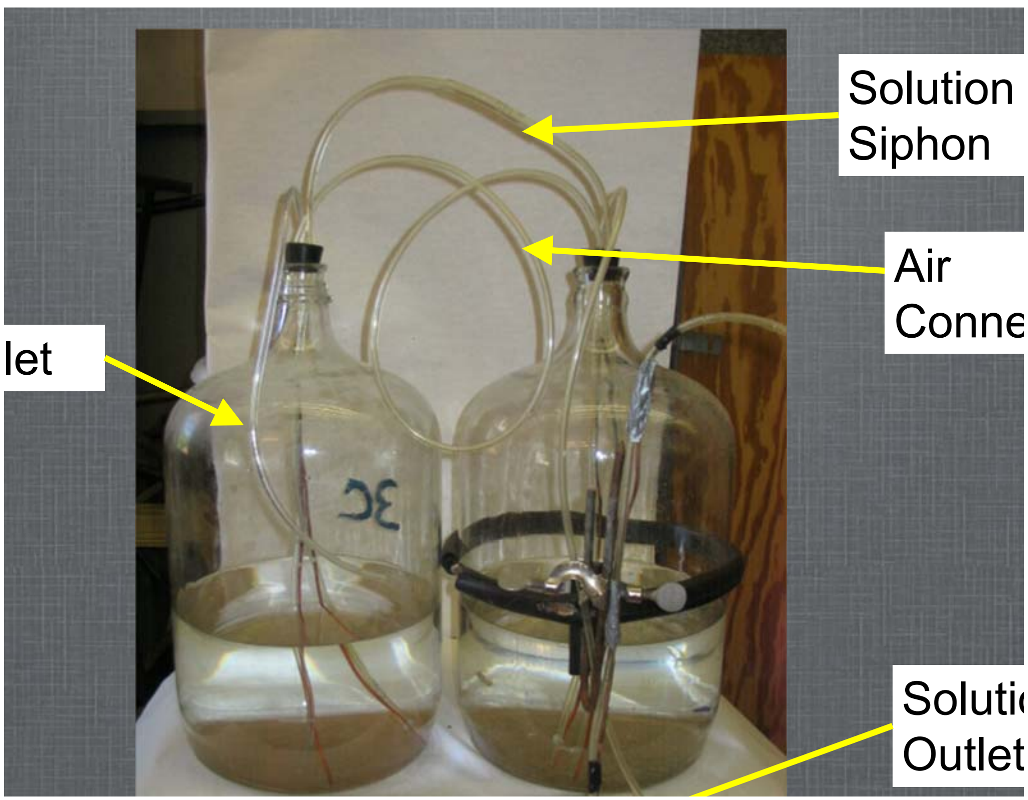
of NO_3 and PO_4 with a salt solutior
several hours

YSI So
Locati

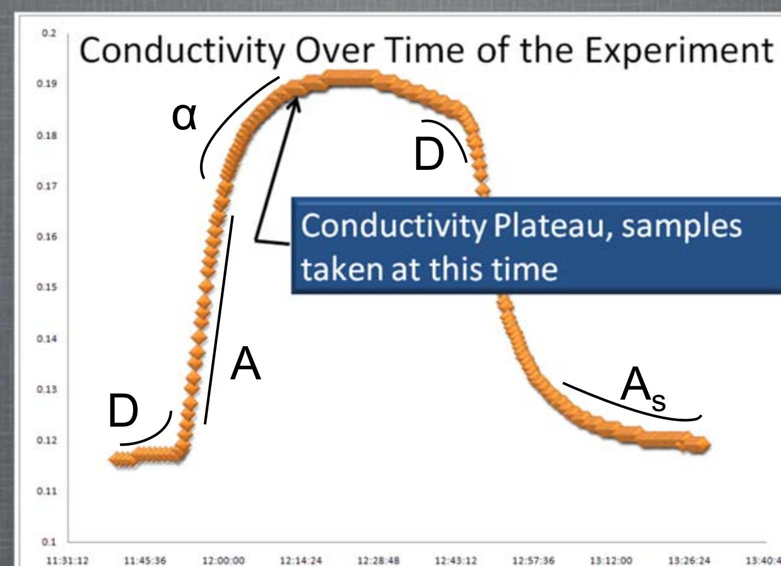
ction
t

mportant to control whatever variables you ca

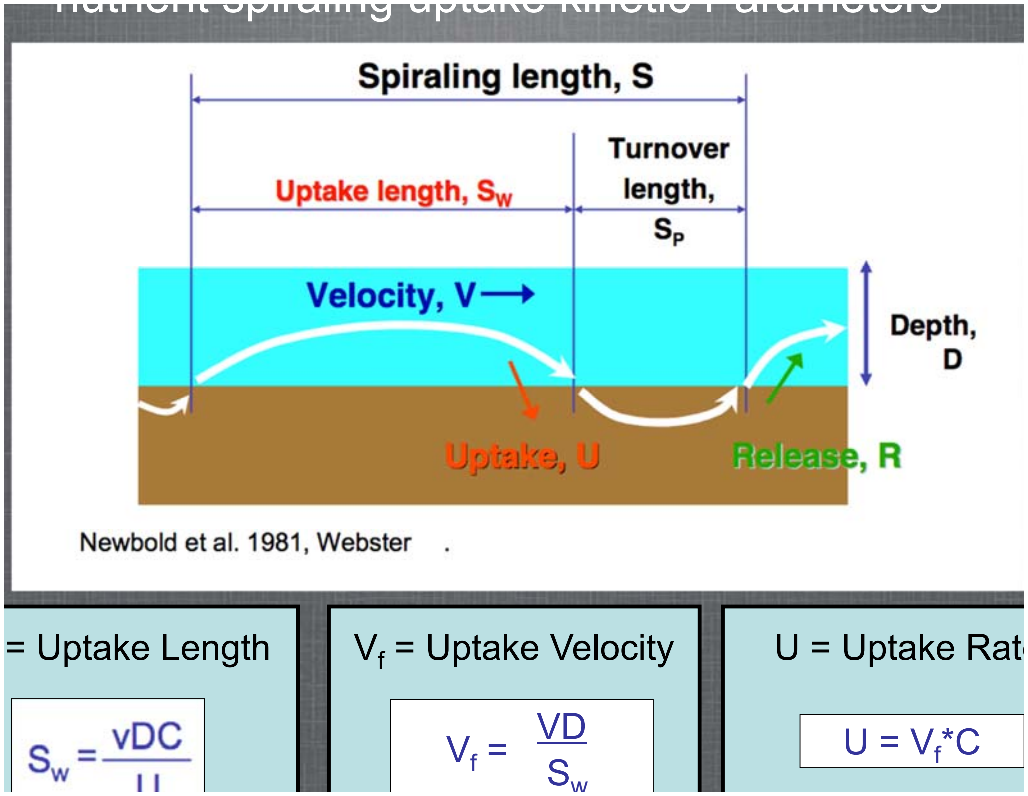
- Site Selection !!
- Flow conditions
- Injection time – diurnal fluctuations
- Disruption to the stream bed/banks
- Proper mixing

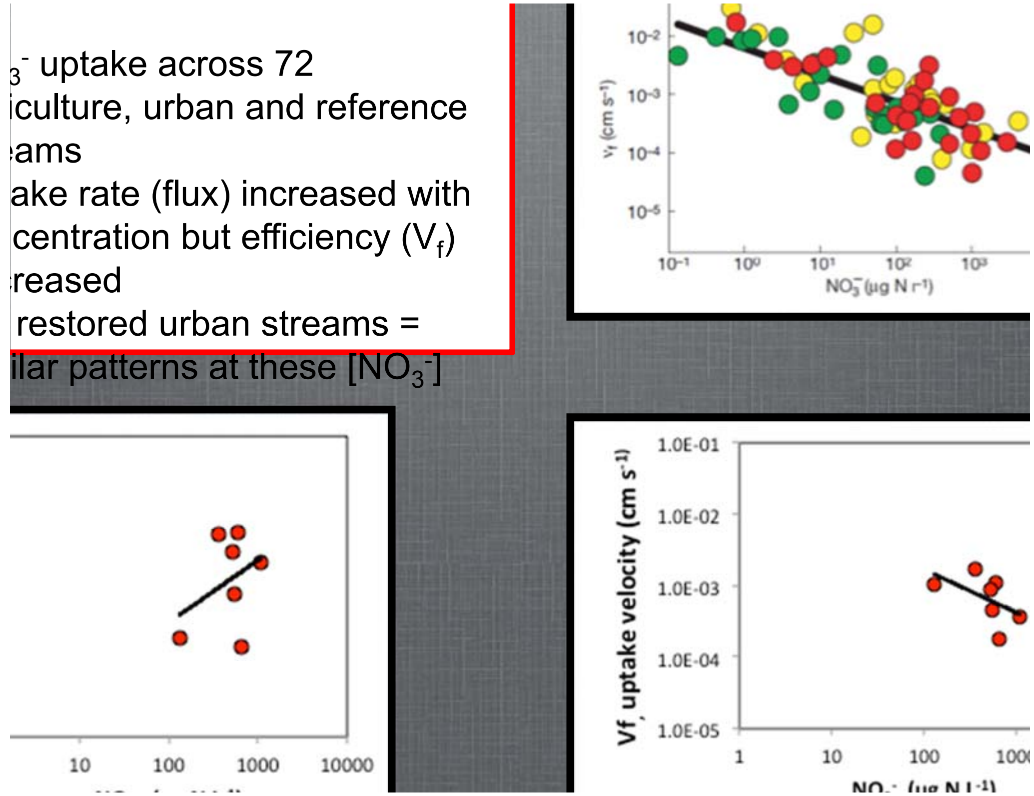


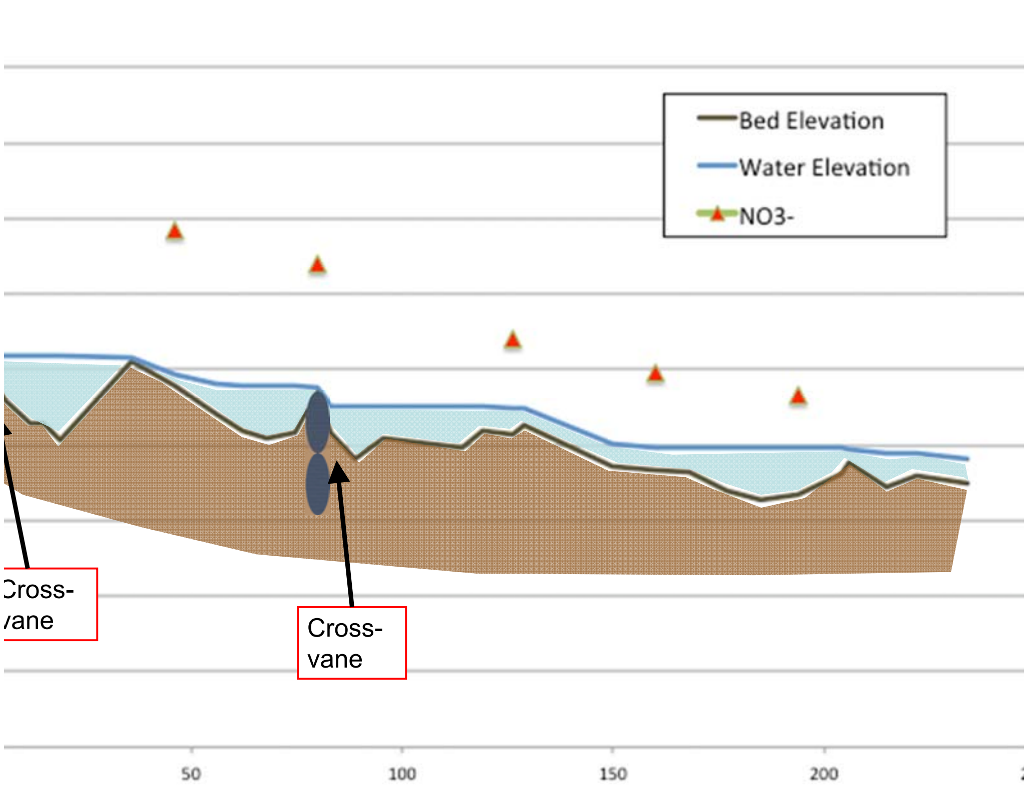
in OTIS to calculate effects of stream storage zon

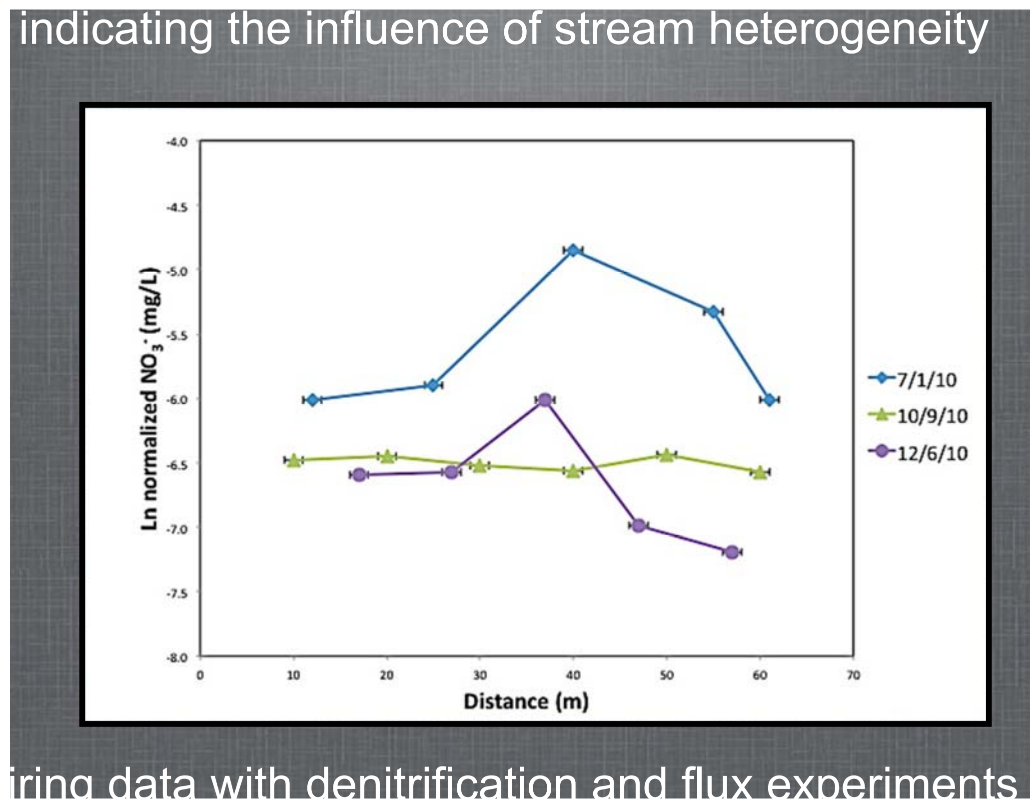


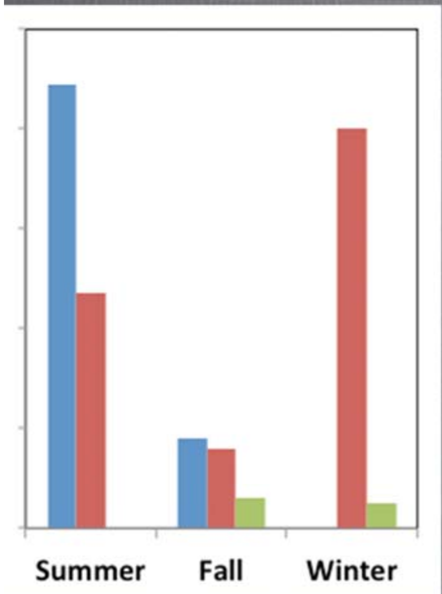
A = stream cross-sectional area
As = Storage zone cross-sectional area

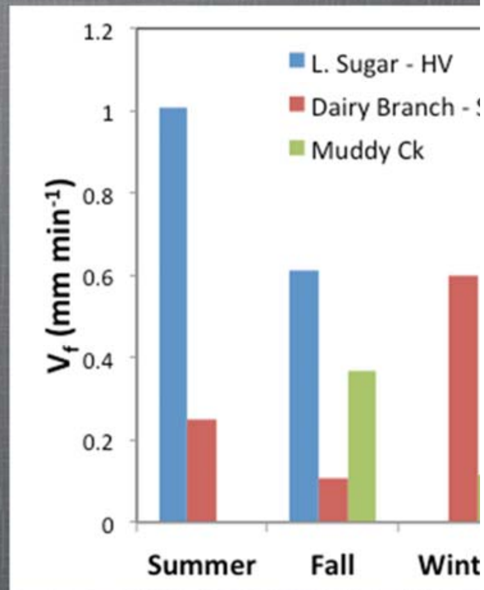

Spiraling length, S
Uptake length, S_W
Turnover length, S_P
Velocity, V
Depth, D
Uptake, U
Release, R
Newbold et al. 1981, Webster .
= Uptake Length
V_f = Uptake Velocity
U = Uptake Rat
$S_w = \frac{vDC}{U}$
$V_f = \frac{VD}{S_w}$
$U = V_f{*}C$


$_3^-$ uptake across 72
iculture, urban and reference
eams
ake rate (flux) increased with
centration but efficiency (V_f)
reased
restored urban streams =
ilar patterns at these $[NO_3^-]$
v_f (cm s^{-1})
NO_3^- (µg N l^{-1})
10
100
1000
10000
Vf, uptake velocity (cm s-1)
1.0E-01
1.0E-02
1.0E-03
1.0E-04
1.0E-05
1
10
100
100


Bed Elevation
Water Elevation
NO3-
Cross-
vane
Cross-
vane
50
100
150
200


indicating the influence of stream heterogeneity
Ln normalized NO_3^- (mg/L)
-4.0
-4.5
-5.0
-5.5
-6.0
-6.5
-7.0
-7.5
-8.0
0
10
20
30
40
50
60
70
Distance (m)
7/1/10
10/9/10
12/6/10
iring data with denitrification and flux experiments





Age of restoration *may* have an effect (Muddy Creek, 201
However, Muddy Creek also had lowest [NO_3^-]

understanding restored urban stream ecosystems

Influence of carbon and seasonality

Influence of restoration age

Relationship between denitrification, flux rates and graphs of V_f

Thank You To:

The Brains:
Dr. Greg Jennings
Dr. Sara McMillan
Dr. François Birgand
Alea Tuttle

The Brawn
Wesley Kimbrell
Bre Long
Emily Darr