BIOGEOCHEMICAL DRIVERS OF AQUATIC ECOSYSTEM METABOLISM UNDER AN ALTERED FLOW REGIME IN AN EVERGLADES MARSH

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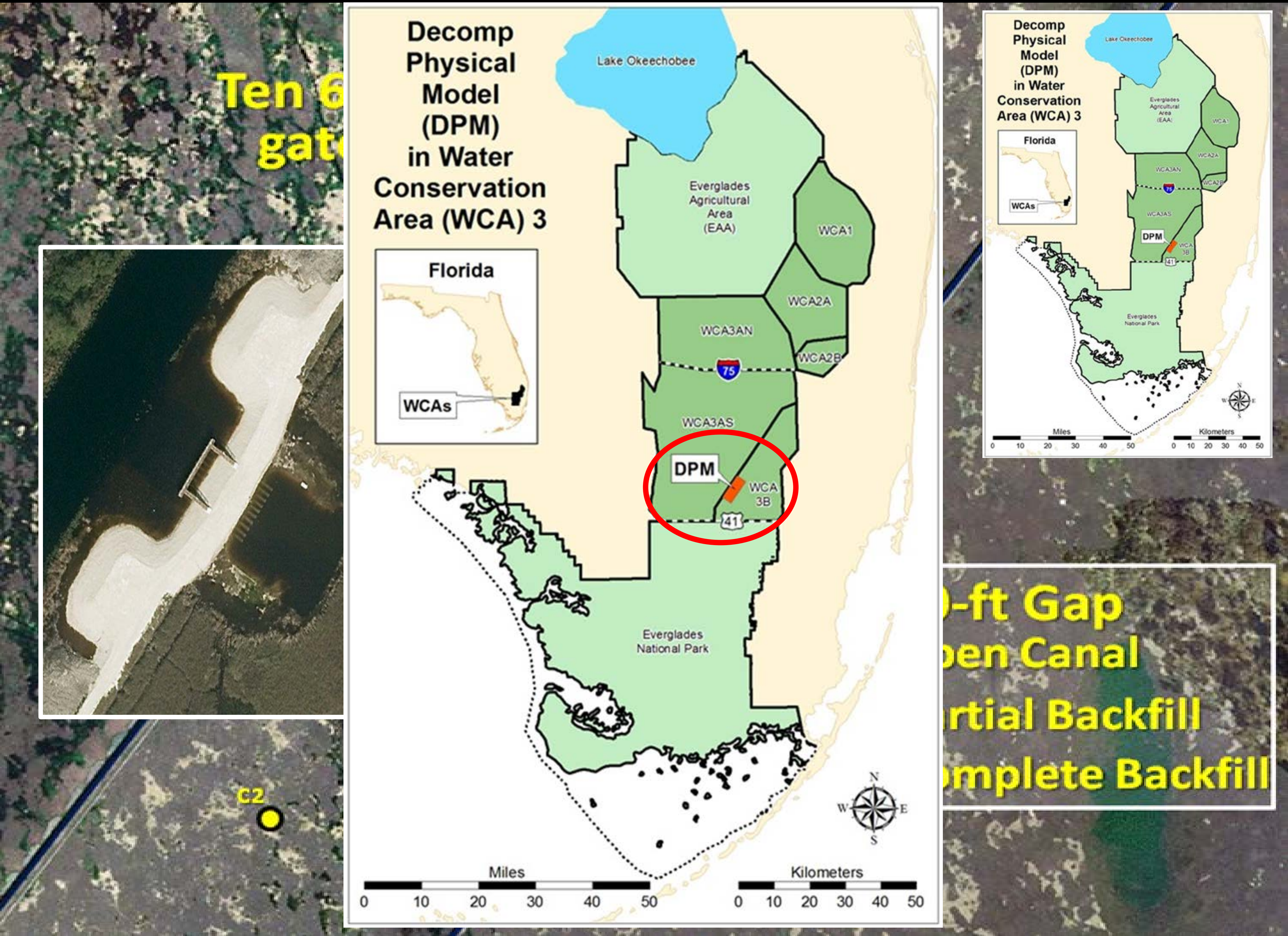
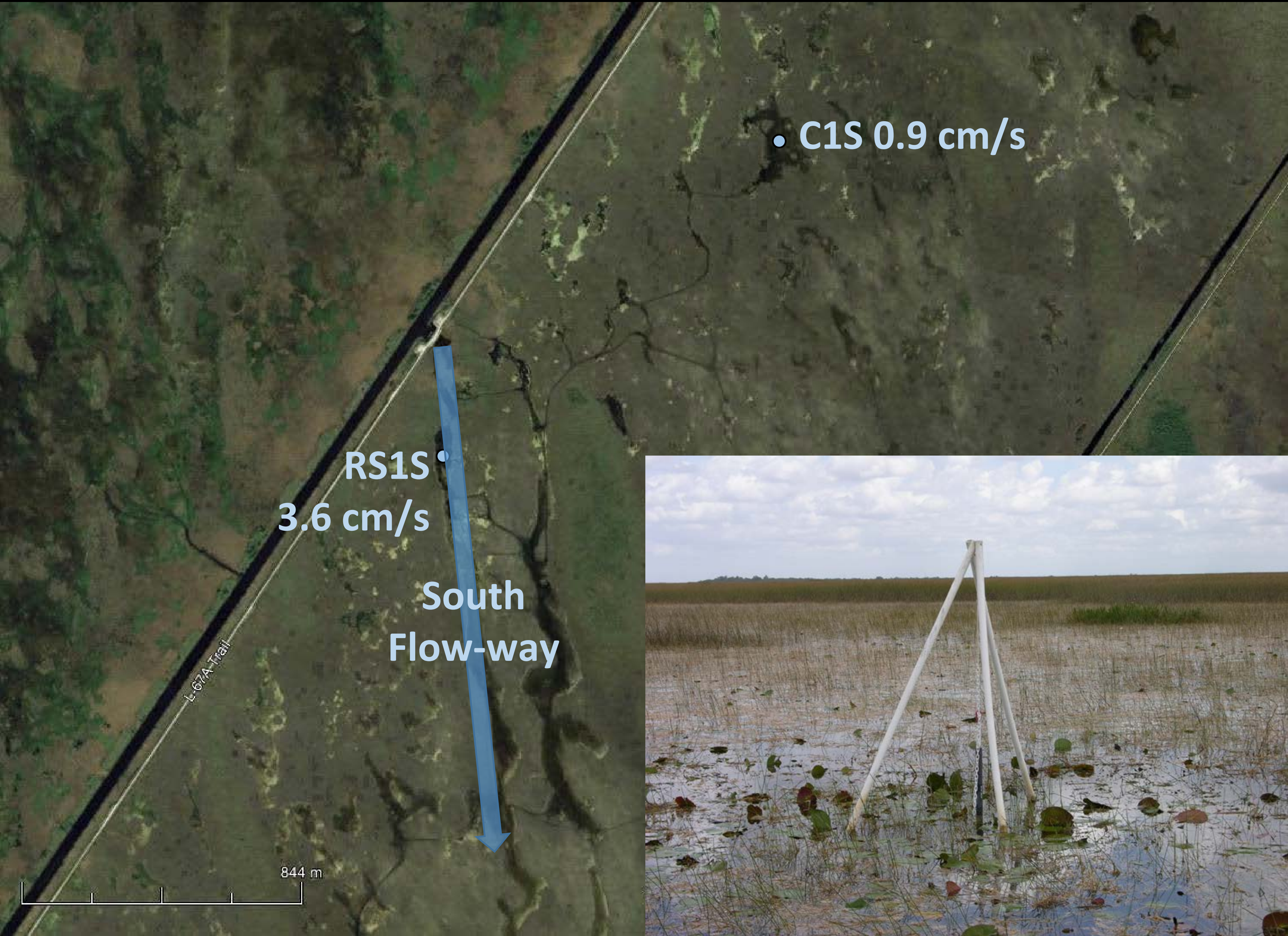
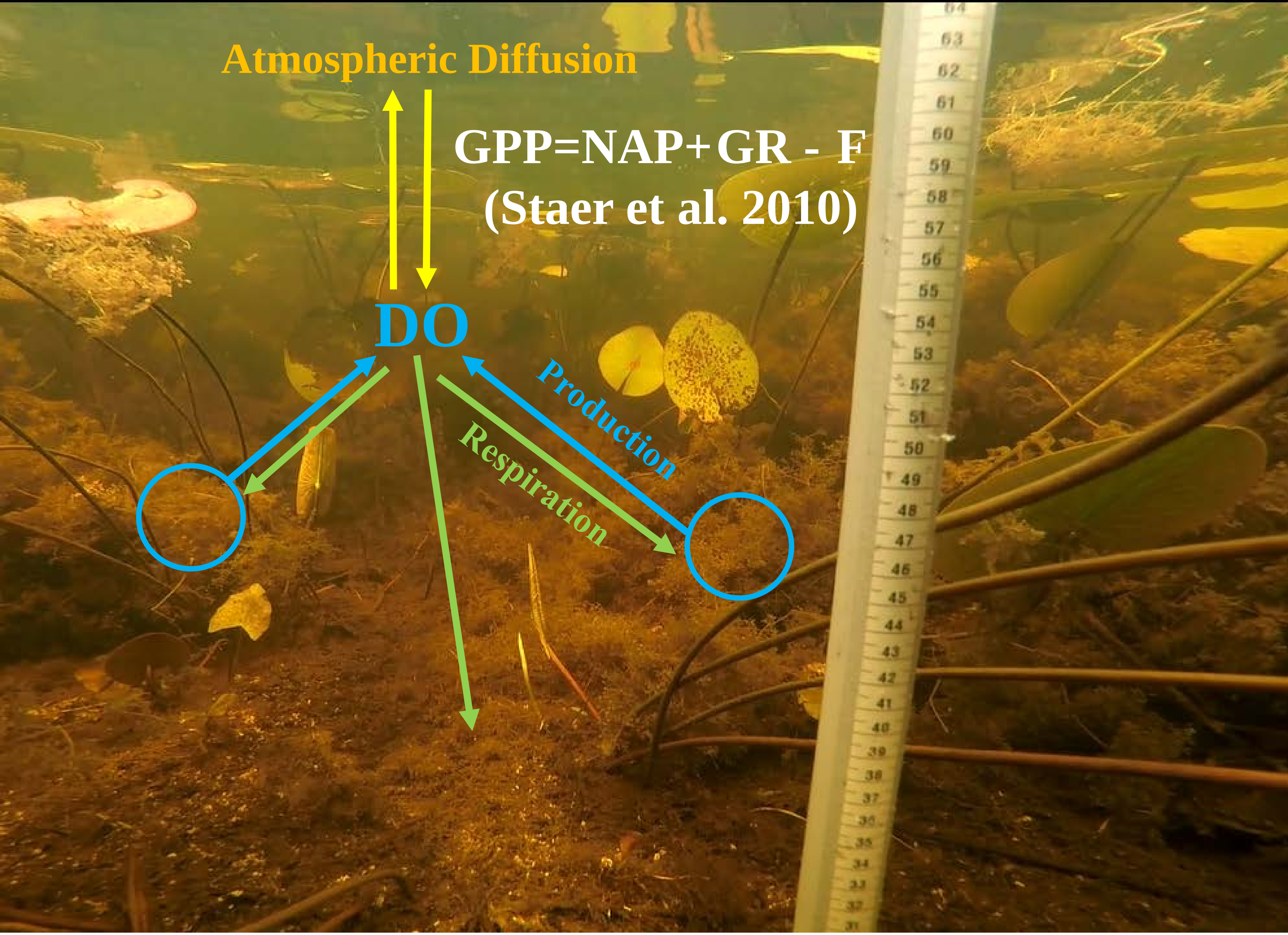
I. Decompartmentalization Physical Model (DPM)
II. Flow as an ecosystem driver:
  I. Dissolved Oxygen
  II. Aquatic Metabolism
III. Sudden Changes in Flow
IV. Discussion of models


Ten 6
gat
Decomp Physical Model (DPM) in Water Conservation Area (WCA) 3
Florida
WCAs
Lake Okeechobee
Everglades Agricultural Area (EAA)
WCA1
WCA2A
WCA2B
WCA3AN
75
WCA3AS
DPM
WCA 3B
41
Everglades National Park
N
W
E
S
Miles
0 10 20 30 40 50
Kilometers
0 10 20 30 40 50
C2
-ft Gap
pen Canal
rtial Backfill
mplete Backfill


C1S 0.9 cm/s
RS1S
3.6 cm/s
South
Flow-way
L-67A Trail
844 m


Atmospheric Diffusion
GPP=NAP+GR - F
(Staer et al. 2010)
DO
Production
Respiration

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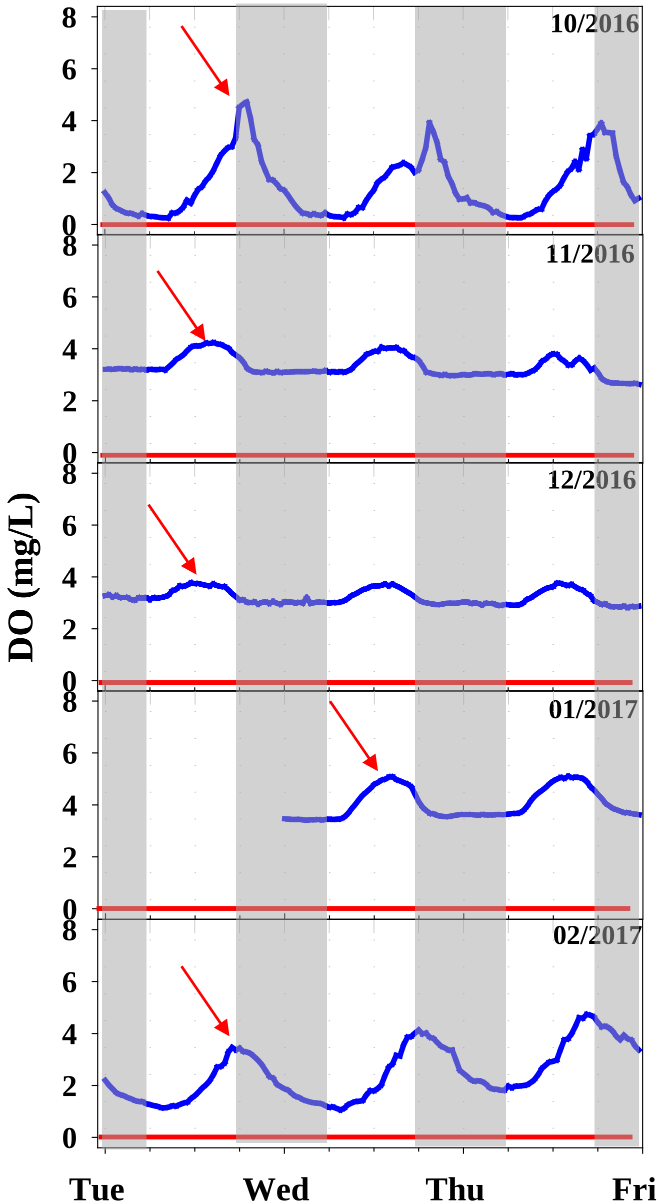
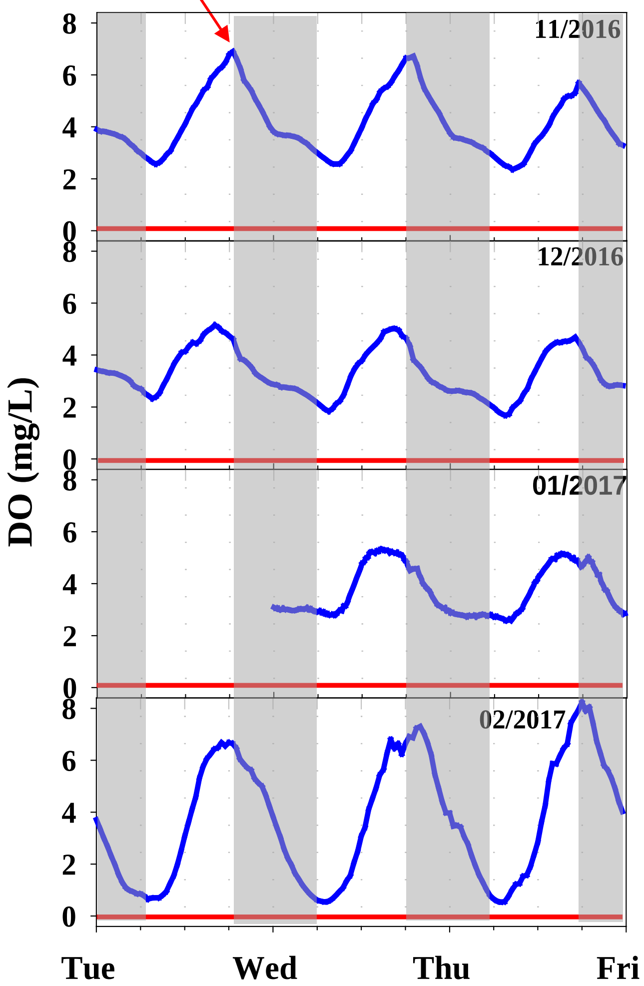
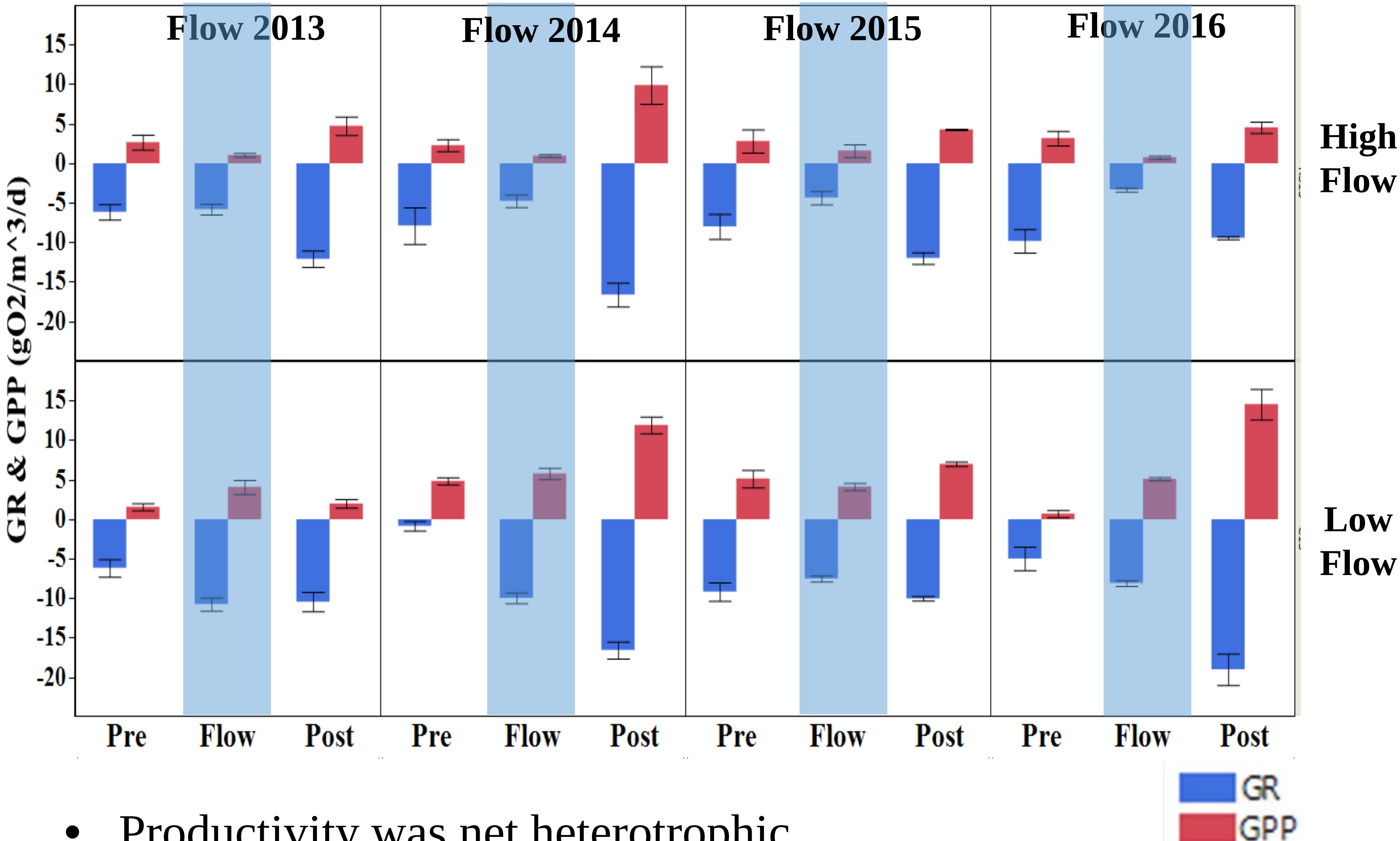
High-flow Site

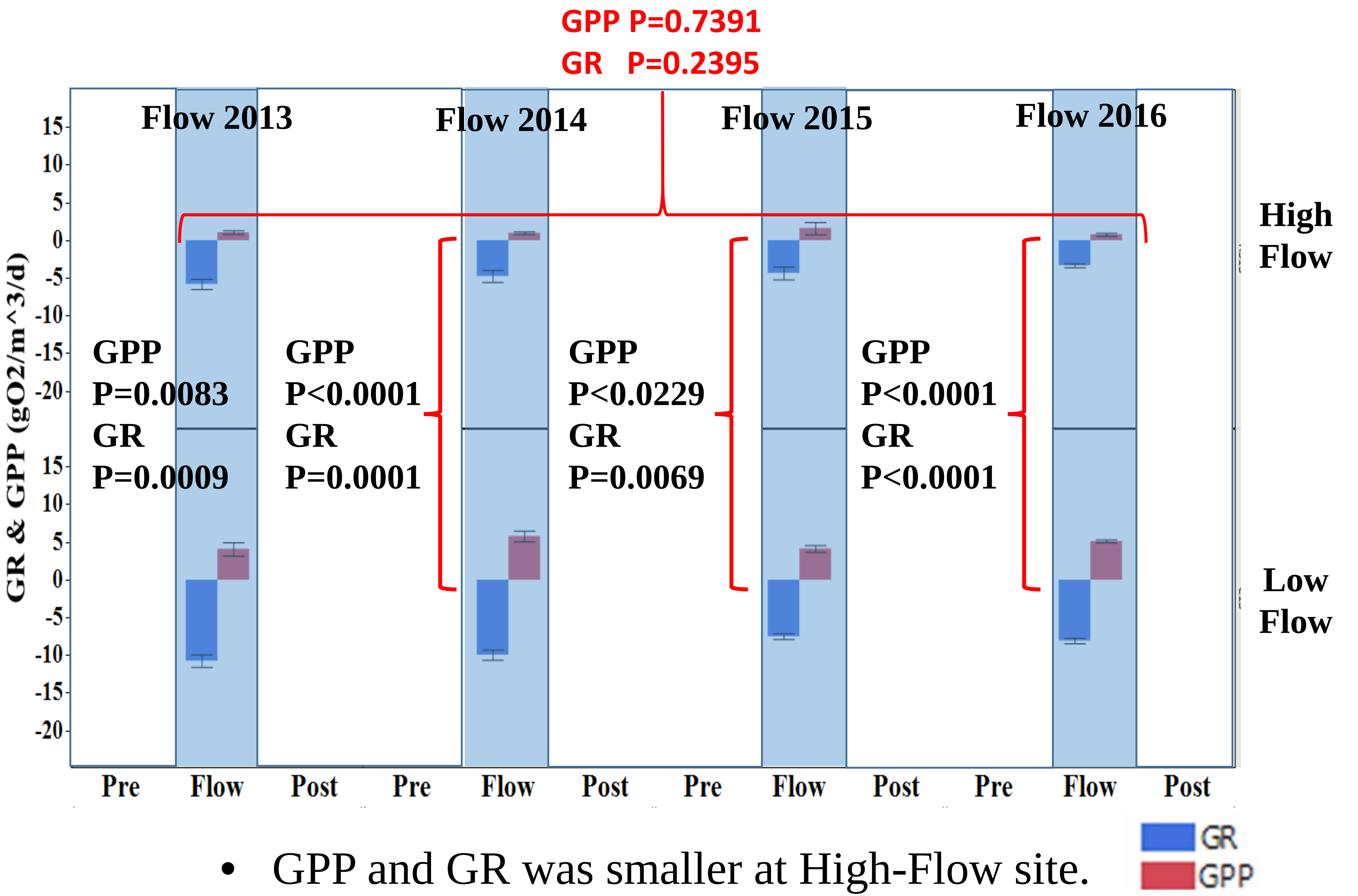


Low-flow Site

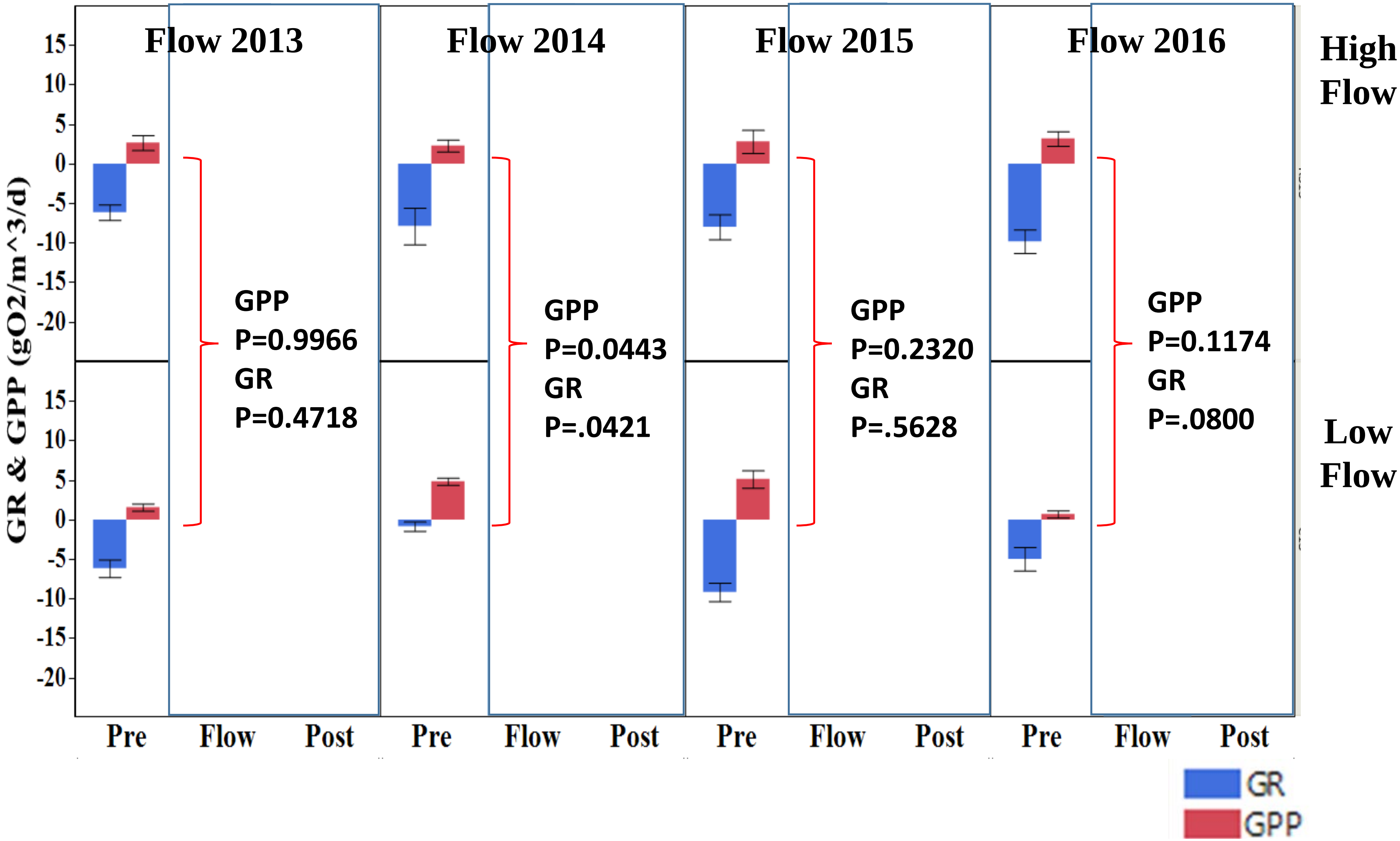


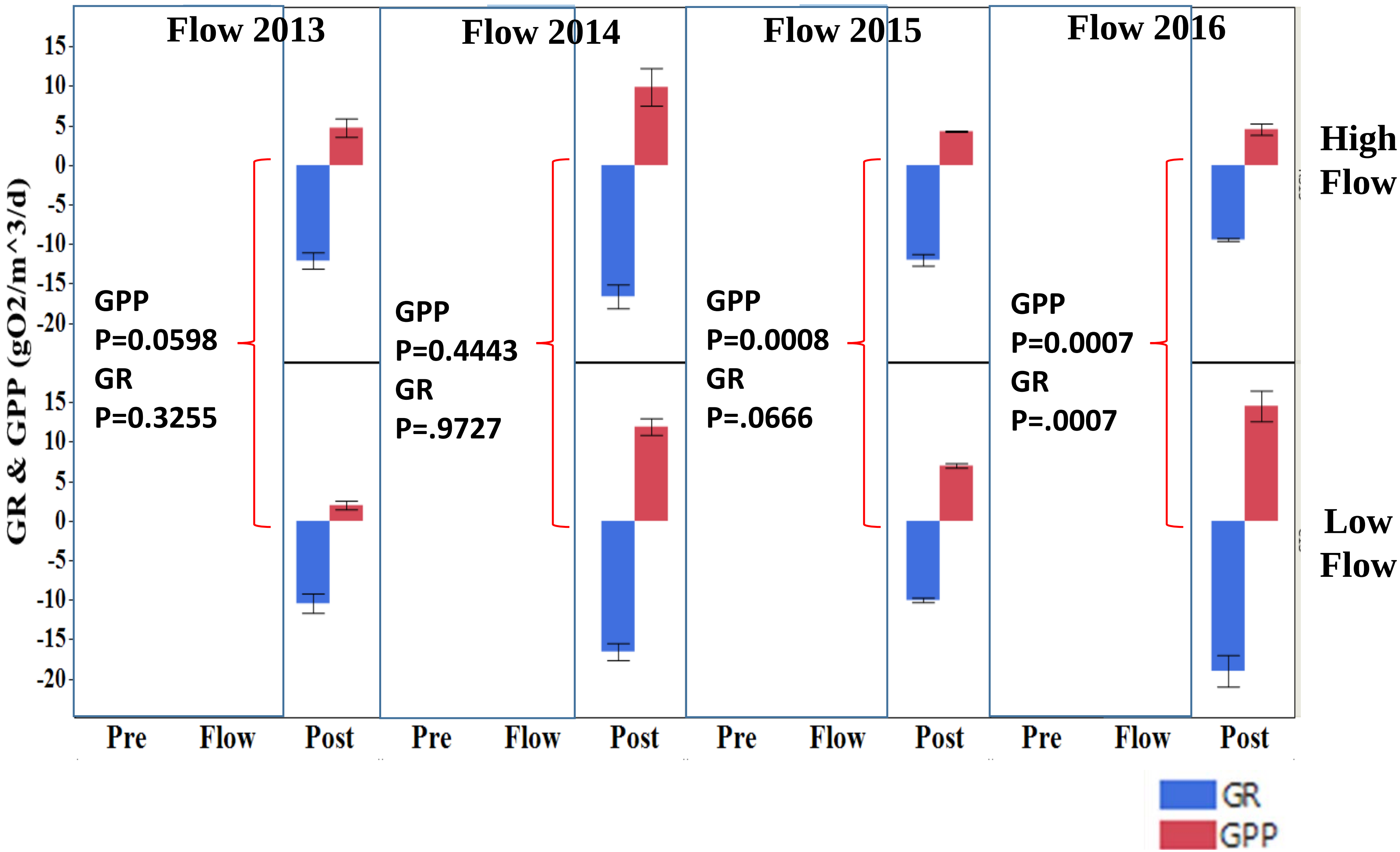


- Productivity was net heterotrophic
  - Similar to (McCormick et al 1997, Hagerthey et al. 2010)



- GPP and GR was smaller at High-Flow site.


Flow 2013
Flow 2014
Flow 2015
Flow 2016
High Flow
Low Flow
GR & GPP (gO2/m^3/d)
15
10
5
0
-5
-10
-15
-20
GPP
P=0.9966
GR
P=0.4718
GPP
P=0.0443
GR
P=.0421
GPP
P=0.2320
GR
P=.5628
GPP
P=0.1174
GR
P=.0800
Pre
Flow
Post
GR
GPP


Flow 2013
Flow 2014
Flow 2015
Flow 2016
GR & GPP (gO2/m^3/d)
15
10
5
0
-5
-10
-15
-20
GPP
P=0.0598
GR
P=0.3255
GPP
P=0.4443
GR
P=.9727
GPP
P=0.0008
GR
P=.0666
GPP
P=0.0007
GR
P=.0007
High Flow
Low Flow
Pre
Flow
Post
GR
GPP

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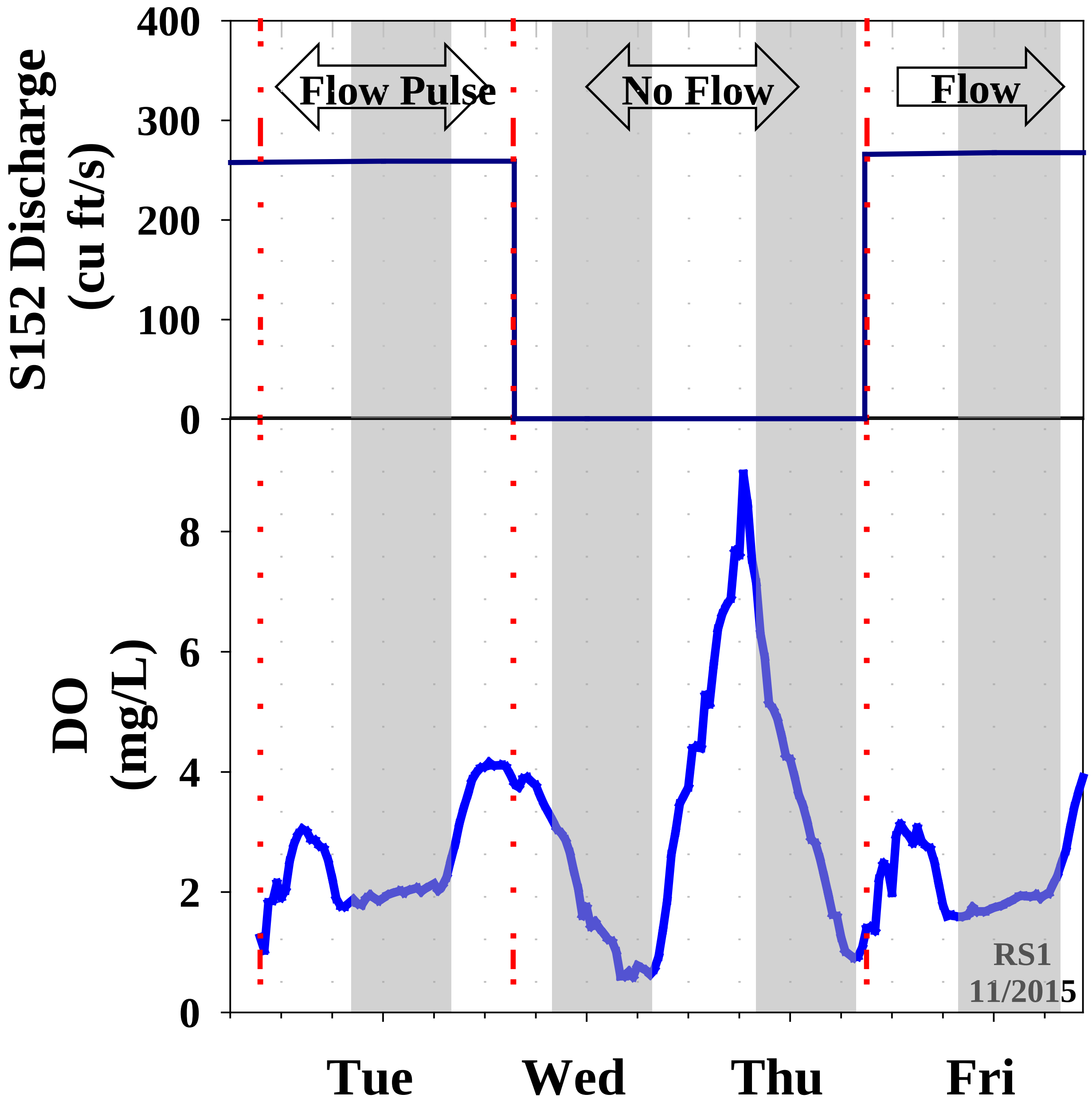
    II. **Aquatic Metabolism**
III. **Sudden Changes in Flow**

2015 Pulse Test



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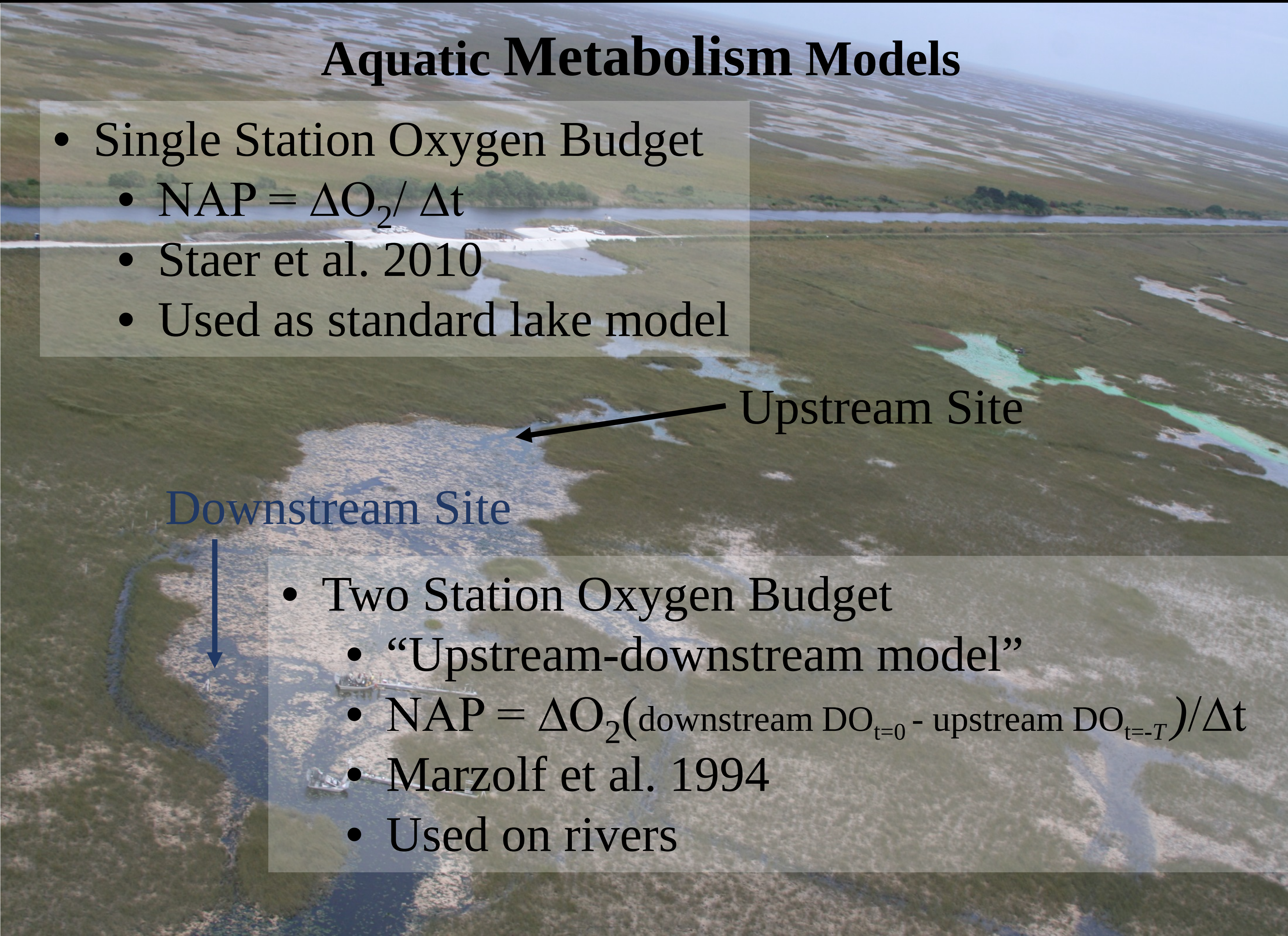
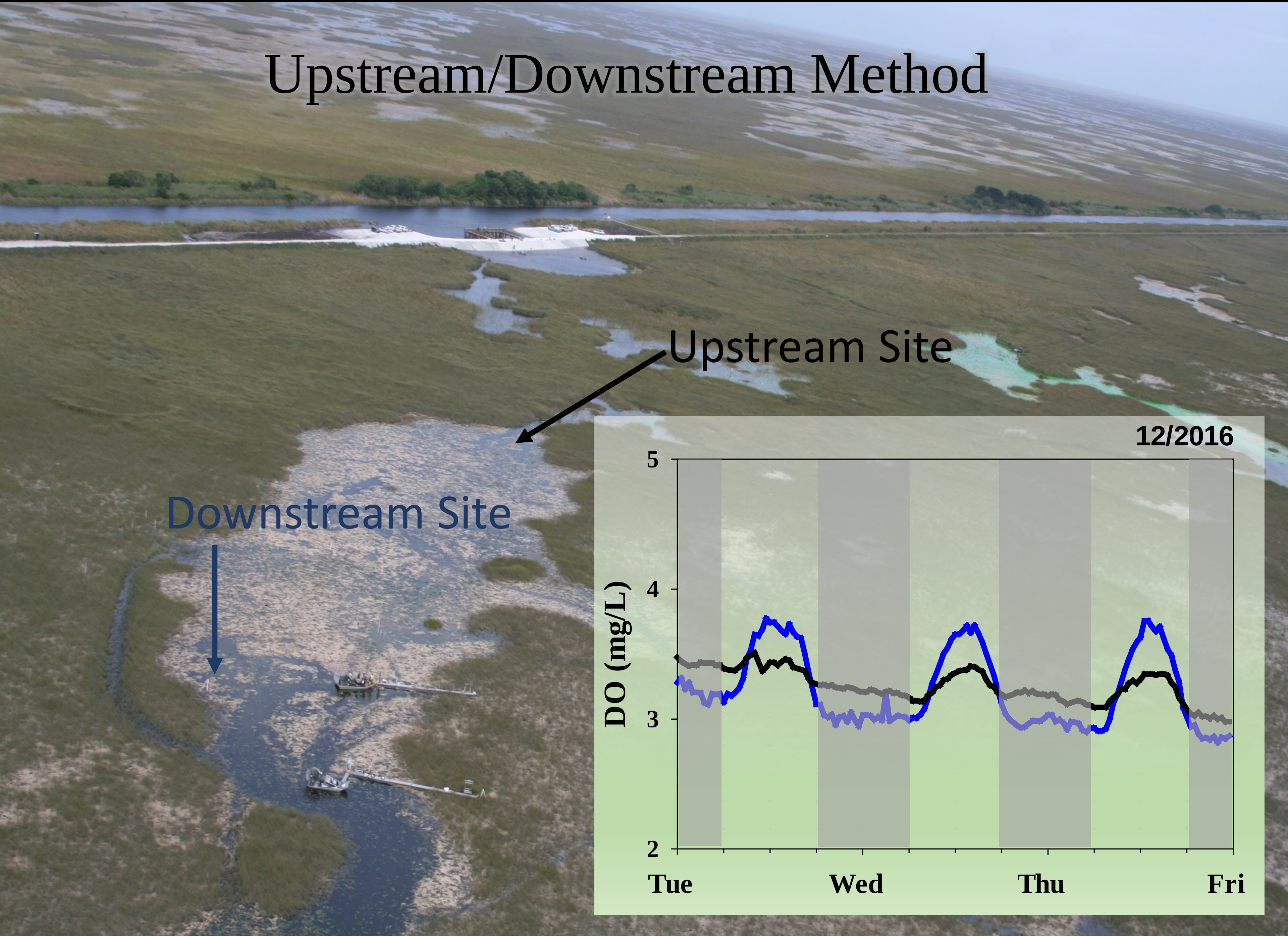
Aquatic **Metabolism** Models

- Single Station Oxygen Budget
  - $NAP = \Delta O_2 / \Delta t$
  - Staer et al. 2010
  - Used as standard lake model

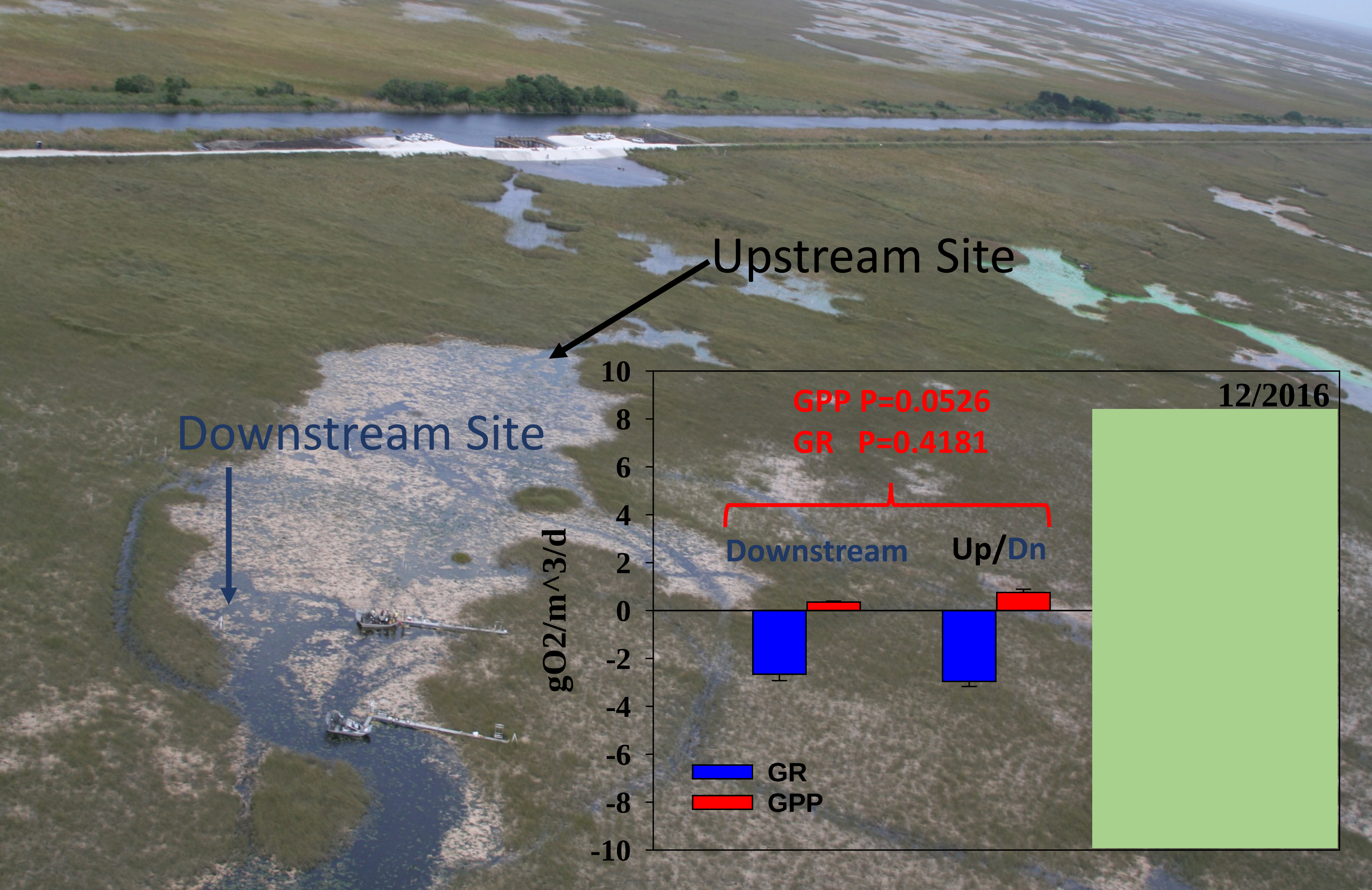


- Two Station Oxygen Budget
  - "Upstream-downstream model"
  - $NAP = \Delta O_2(\text{downstream } DO_{t=0} - \text{upstream } DO_{t=-T})/\Delta t$
  - Marzolf et al. 1994
  - Used on rivers

Upstream/Downstream Method



Upstream/Downstream Method



Conclusions

- Aquatic production decreased under high-flow compared to low-flow.
- Daily range of the DO diurnal curve was reduced during flow which translates to reduced aquatic respiration.
- Single-station oxygen budget method able to detect changes in aquatic metabolism.
- The change in production and respiration rates likely has an impact on phosphorus and organic matter budgets which may have implications for Everglades restoration – See Colin Saunders' presentation.

Acknowledgements

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