Sedimentation Patterns Within the Atchafalaya Basin and Morganza Spillway Before and After the Lower Mississippi Flood of 2011.

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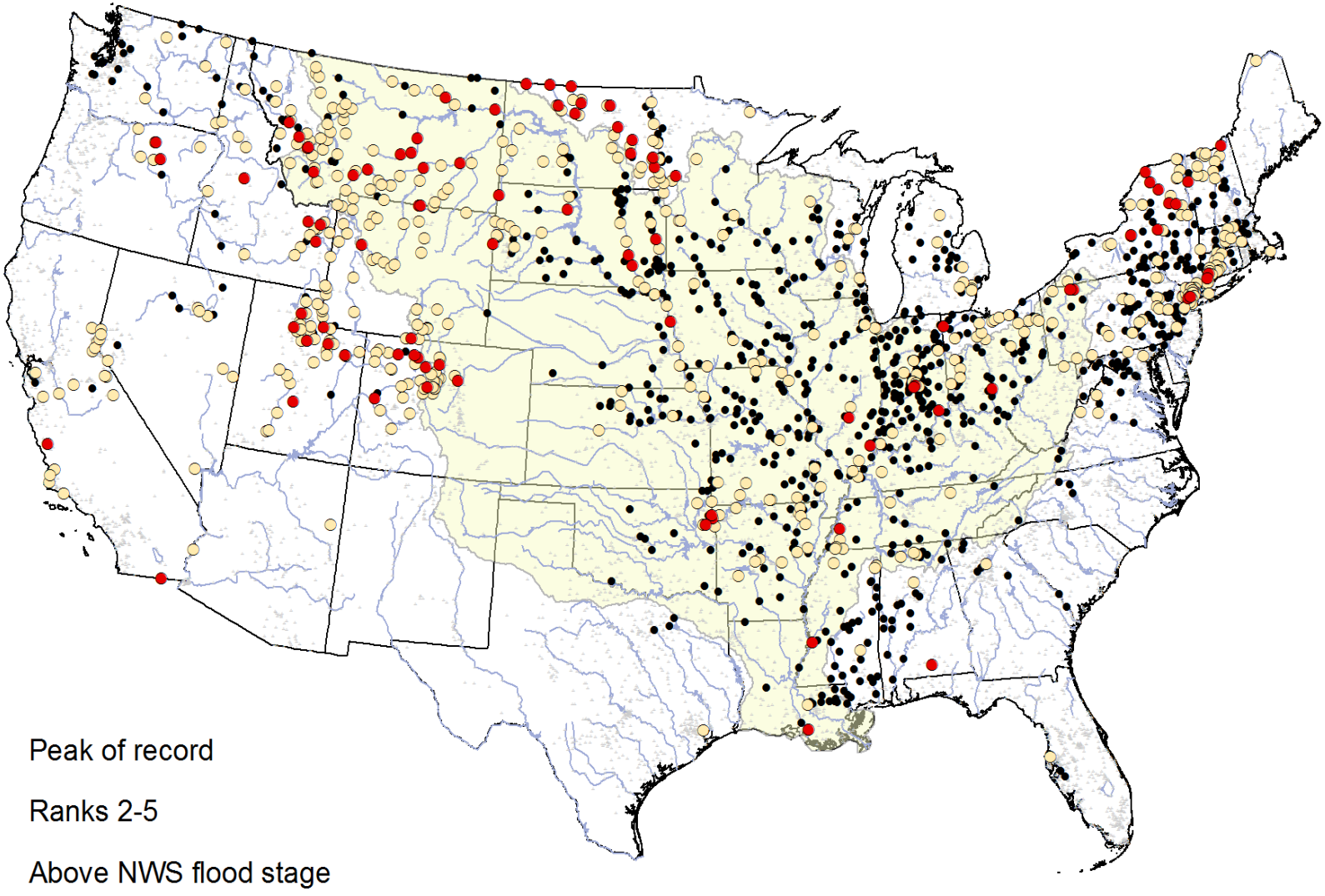
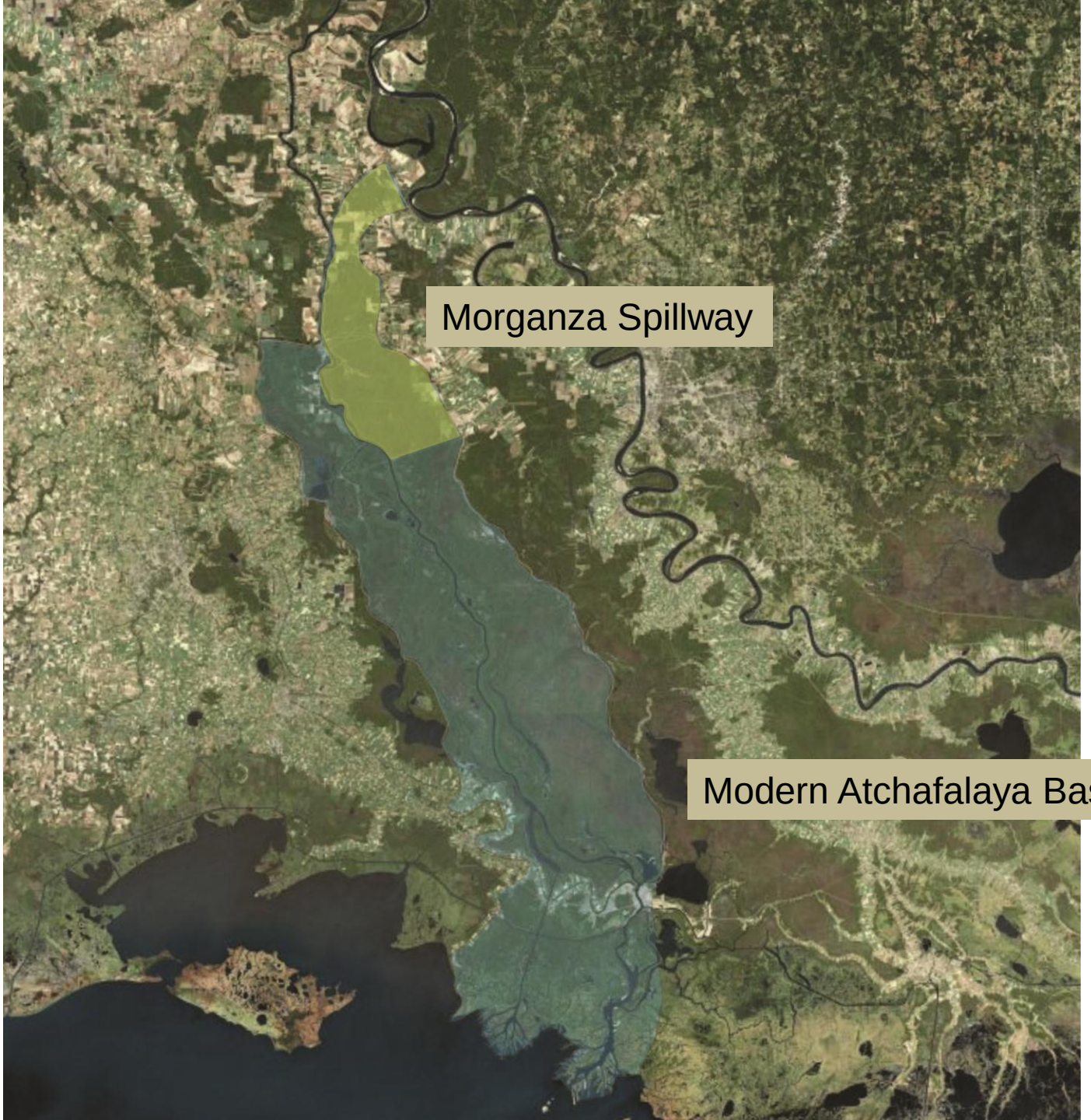
Morganza Spillway during the 2011 release

2011 Major Flood Peaks



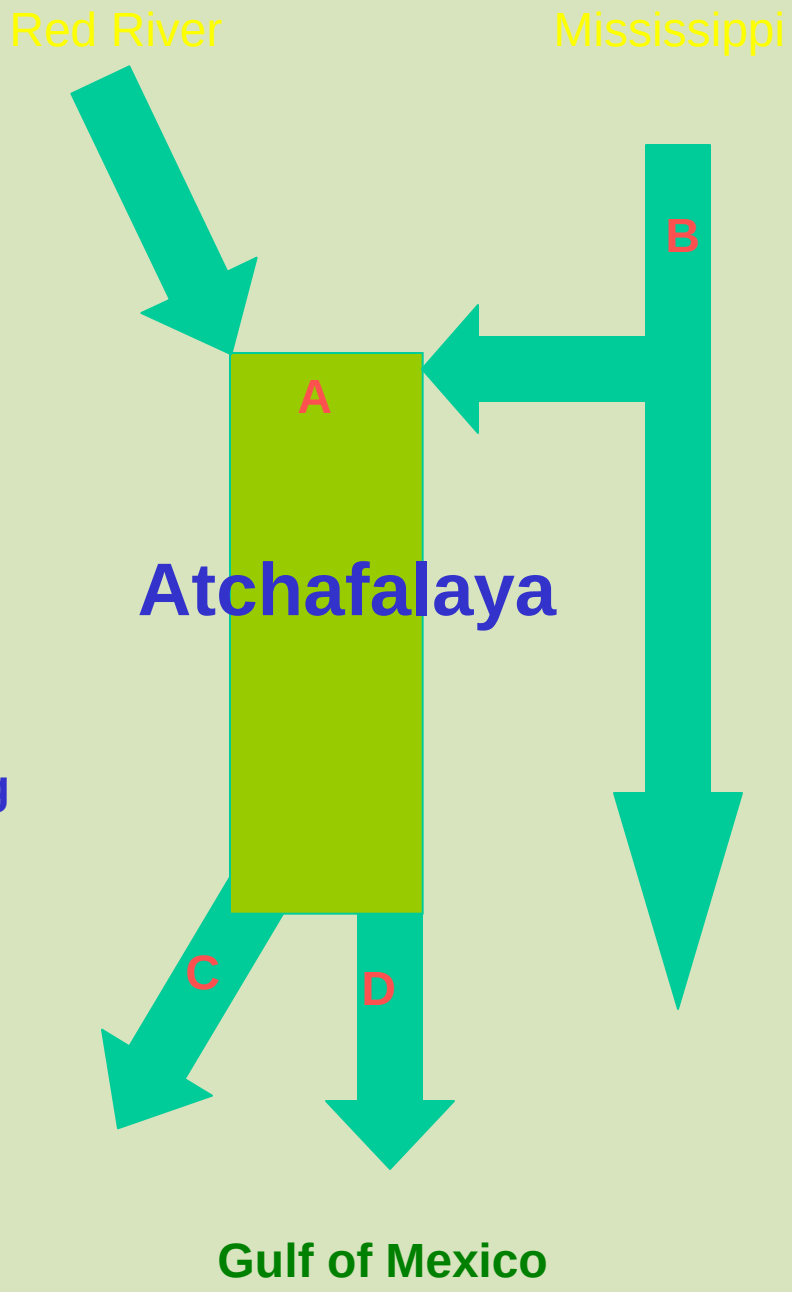
USGS


Morganza Spillway
Modern Atchafalaya Basin

Atchafalaya River, mainstem

- Average annual discharge of 6410 m^3/s (5^{th} largest in U.S.).
- Receives about 25% of the Mississippi River flow annually and all of the Red River flow.
- Conducts as much as 35% of the suspended- and 60% of the bed-sediment load of the Mississippi River.
- The Basin wetland (5670 km2) is about 70% forested (largest contiguously forested wetland in the U.S); the remainder is open water and marshland.
- The Basin is about 160 km long and 20 to 30 km wide, which discharges into the Gulf of Mexico (deltaic sedimentation).
- Forests are of three main communities; 1. typical bottomland hardwoods on levees and transitional areas, 2. cypress/tupelo stands in backswamps, 3. successional, predominantly willow stands on recently aggraded bars (common).

The Atchafalaya Basin is the only sizable semi natural riparian area along the Mississippi River below the confluence of the Ohio River. (remaining)



Annual Sequestration:

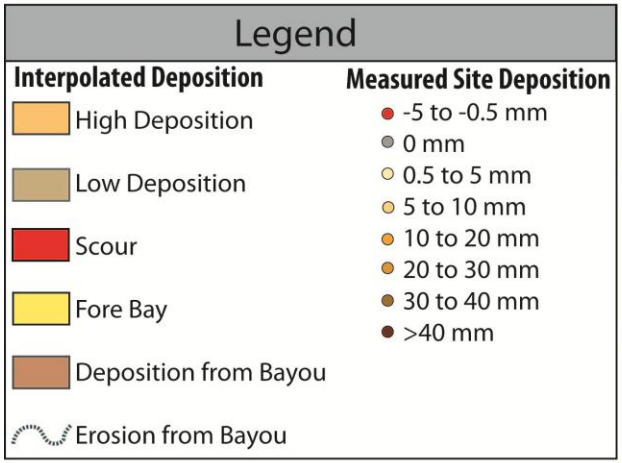
Sediment **4.3 billion kg**

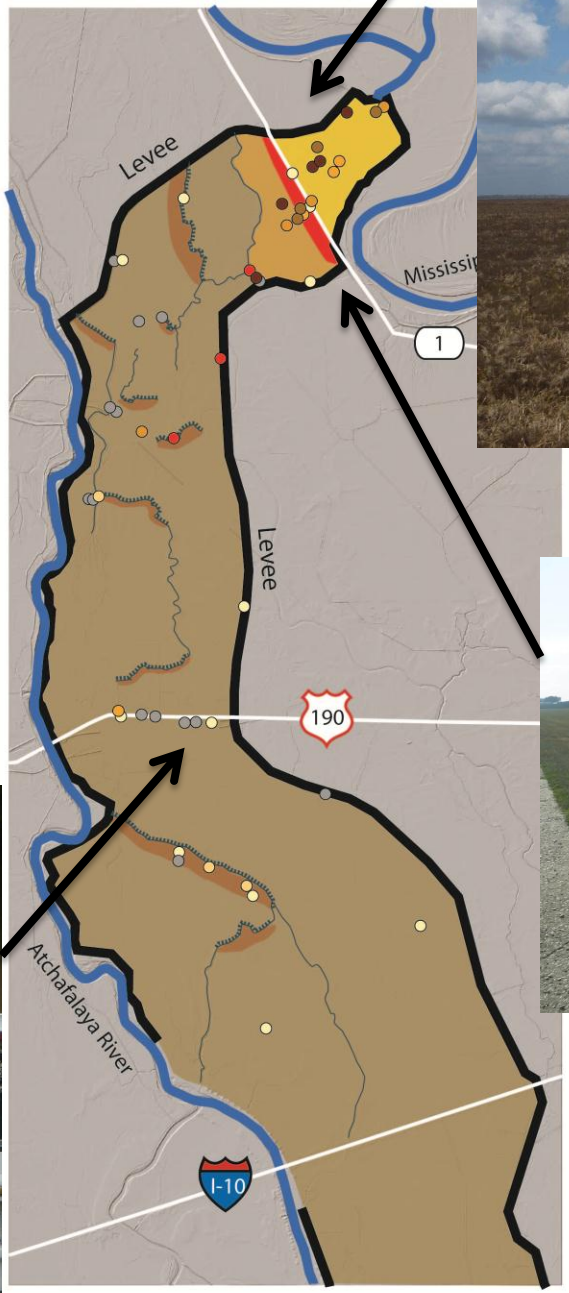
Organic Material **435 million kg**

Total Carbon **175 million kg**

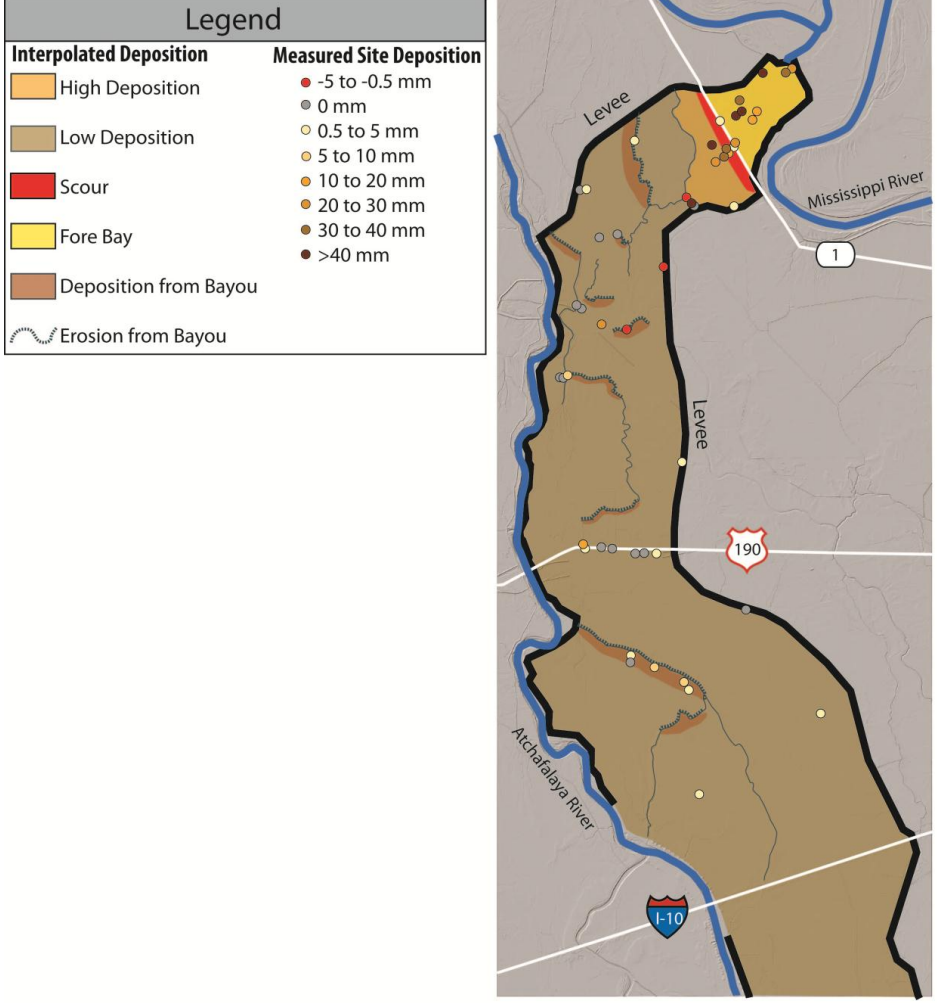
Strong case for stream restoration, and reconnection of streamflow to the riparian zone


6286 ft
Image © 2011 GeoEye
Google

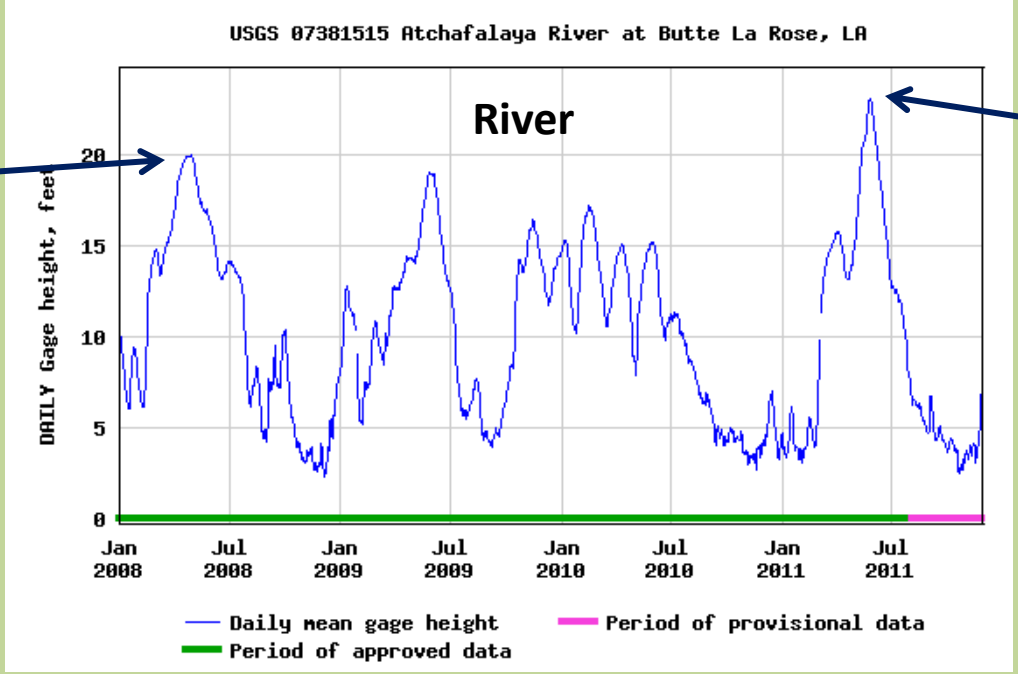

Legend
Interpolated Deposition
High Deposition
Low Deposition
Scour
Fore Bay
Deposition from Bayou
Erosion from Bayou
Measured Site Deposition
-5 to -0.5 mm
0 mm
0.5 to 5 mm
5 to 10 mm
10 to 20 mm
20 to 30 mm
30 to 40 mm
>40 mm


Levee
Mississi
1
Levee
190
Atchafalaya River
I-10


TAHOE

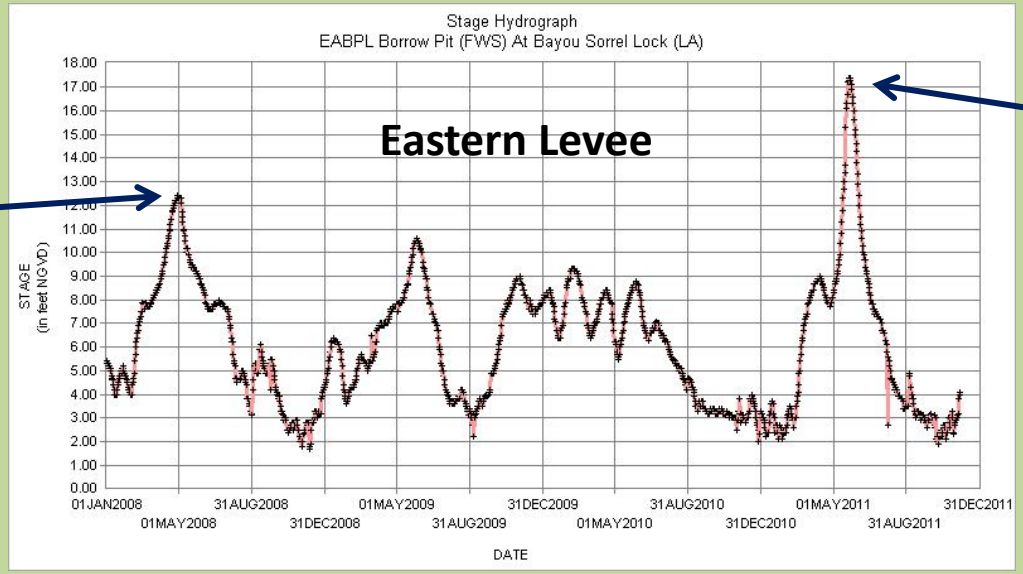


	Deposition volume (m^3)	Sediment g/m^2	TC g/m^2	TN g/m^2	P g/m^2
Forebay	303,514	99	4.27	0.32	0.07
Backbay scour area	-326,000				
Backbay near (High deposition on map)	915,005	155	6.64	0.50	0.11
Backbay far (low deposition on map)	1,157,600	17	0.73	0.06	0.01



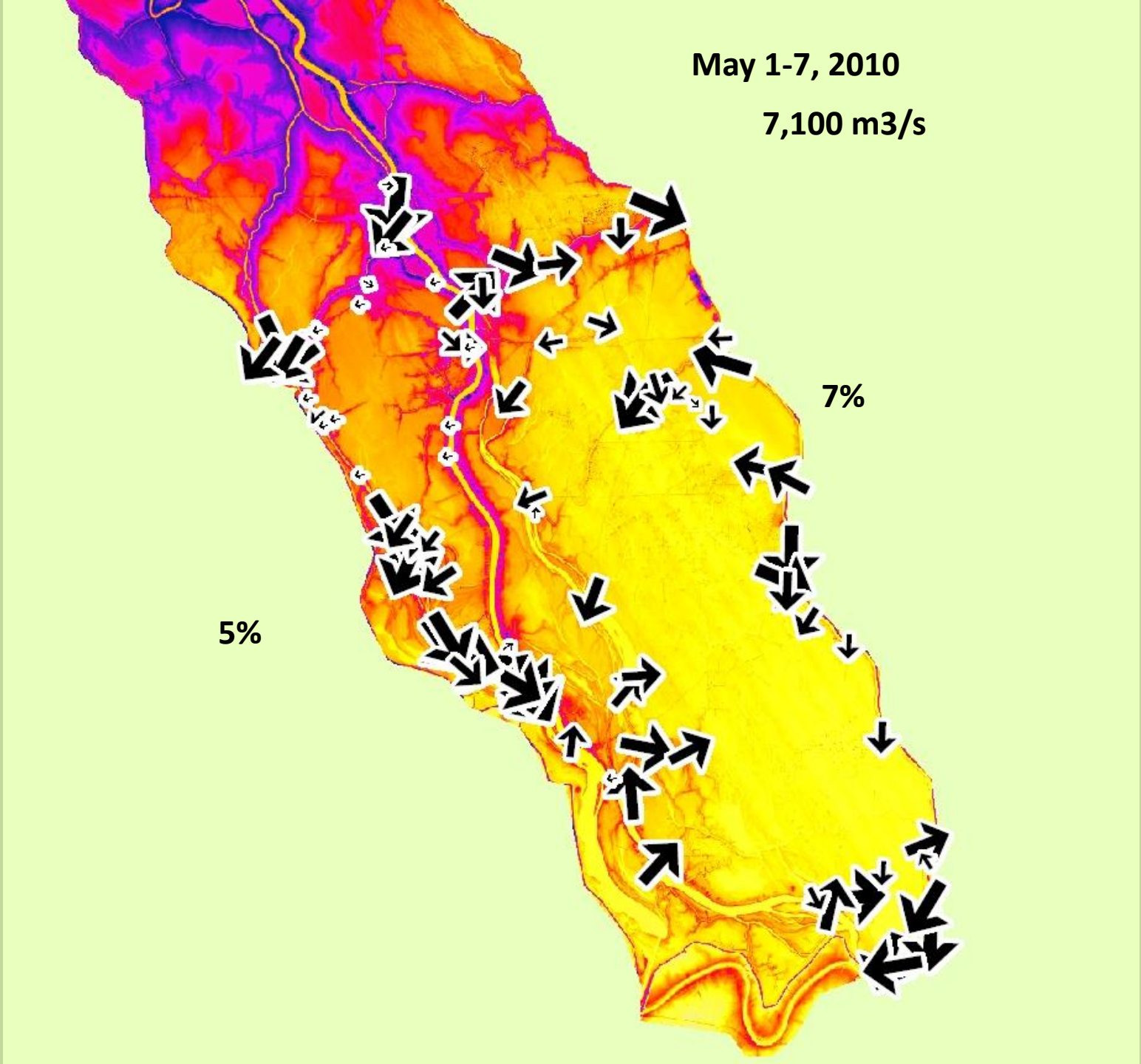
6.1 m

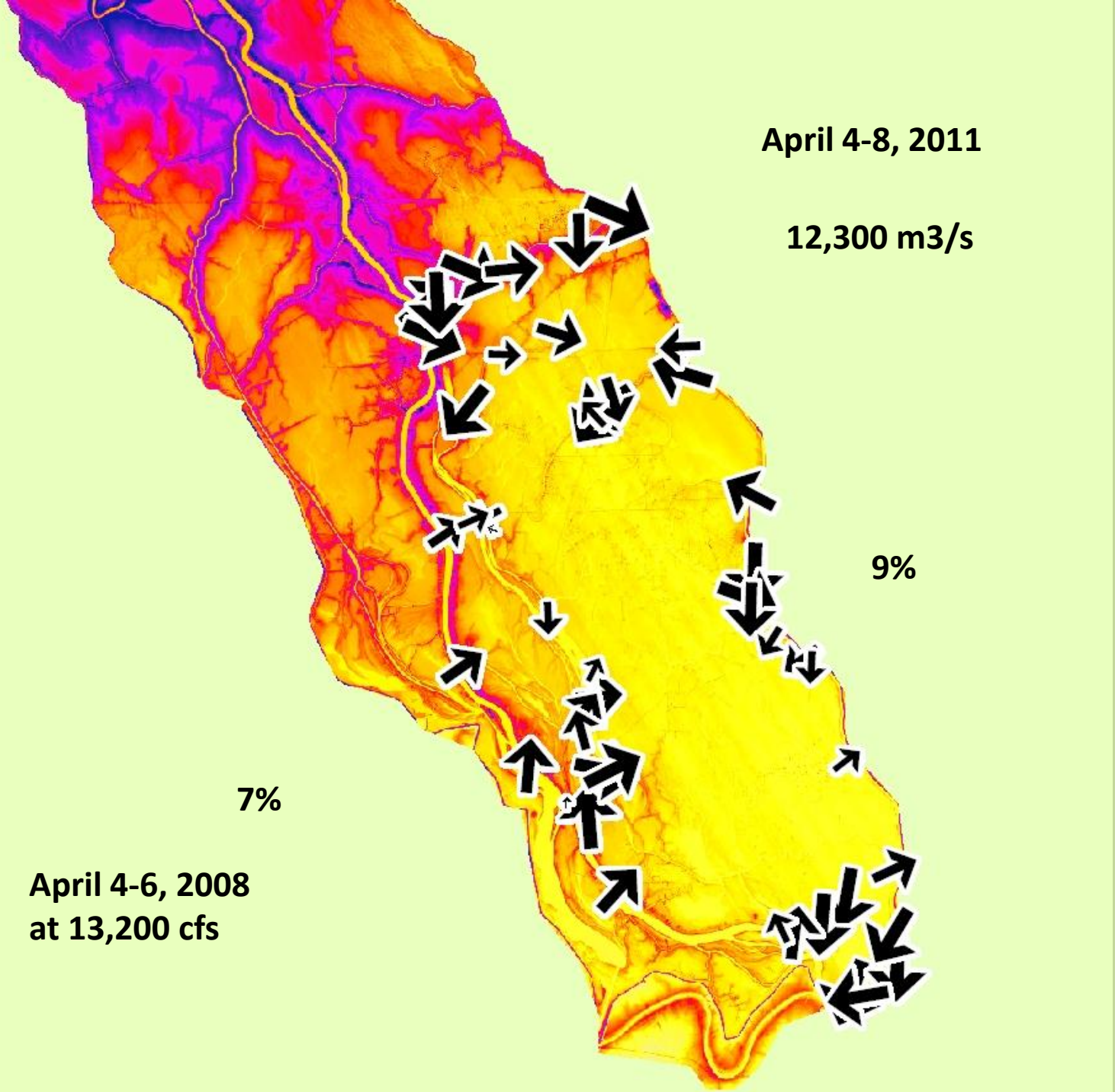
6.7 m

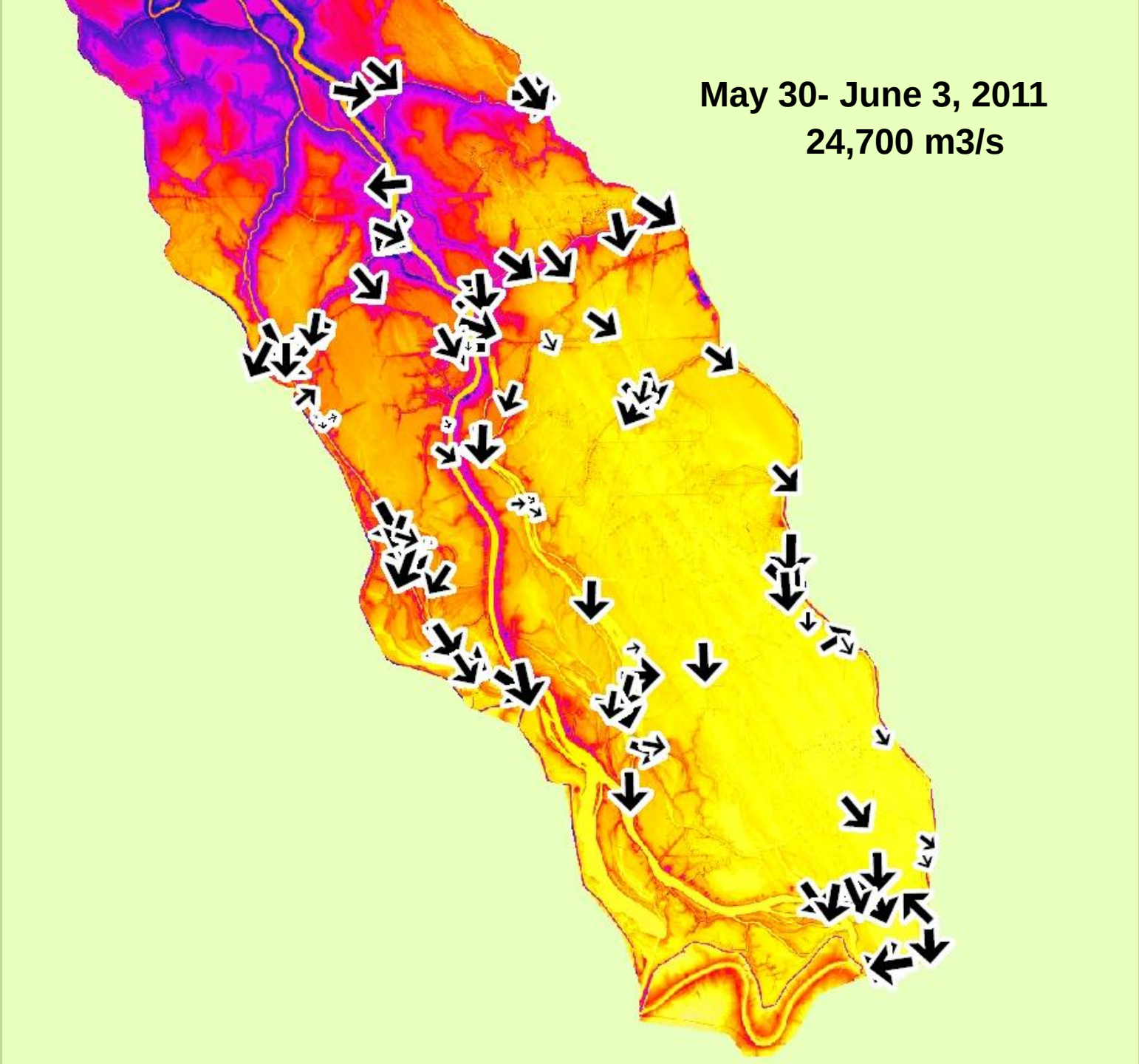


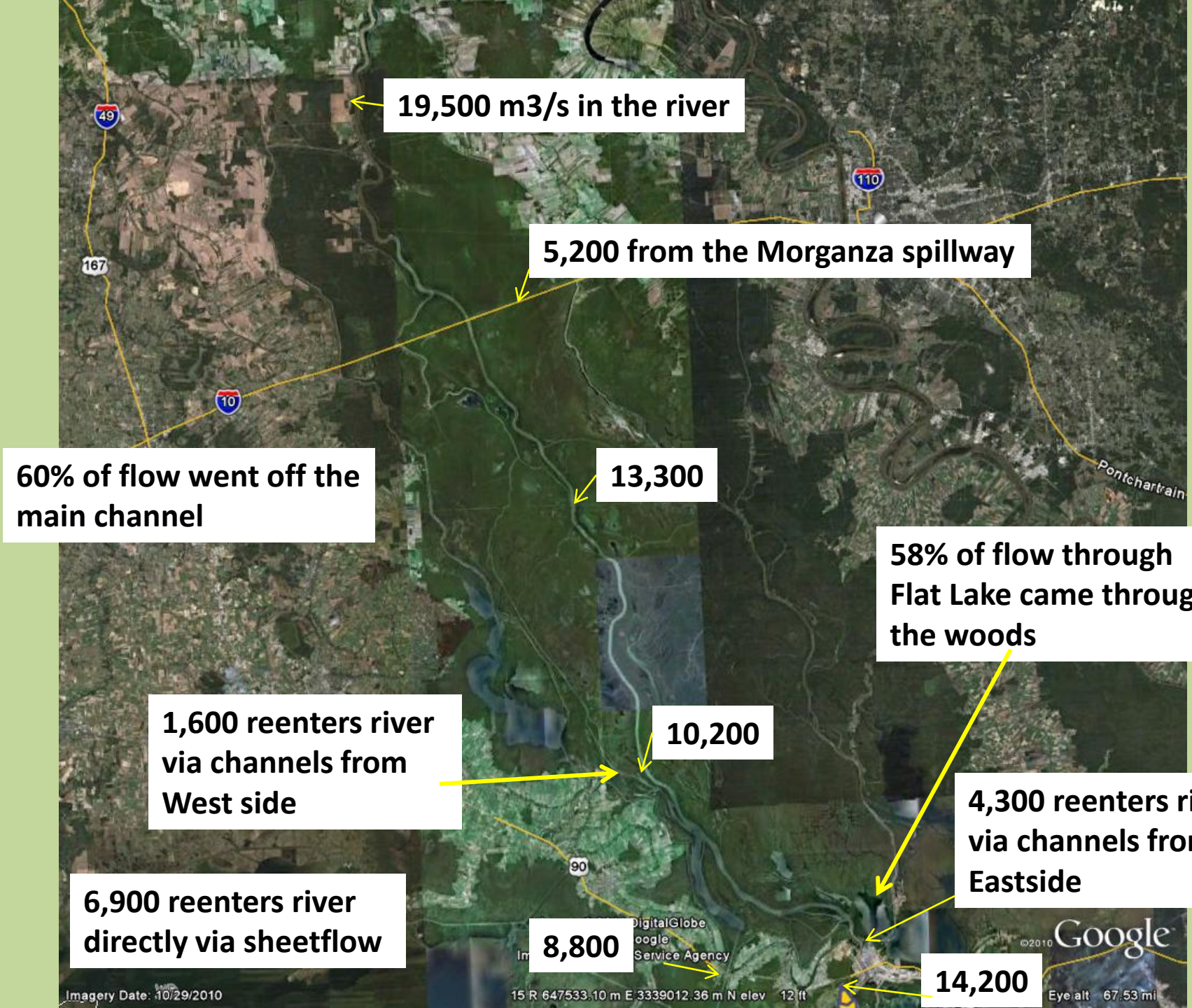
3.8 m

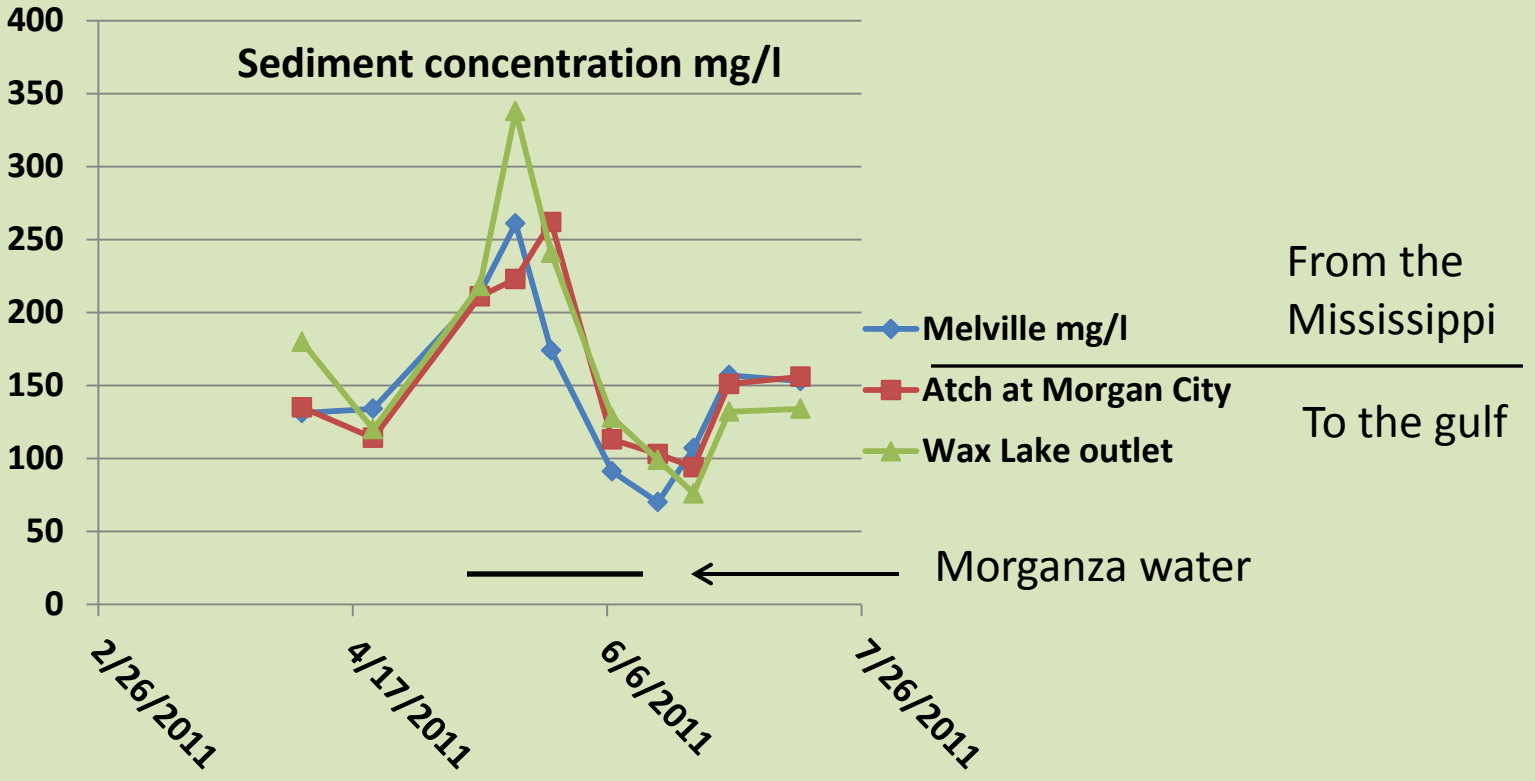
5.3 m

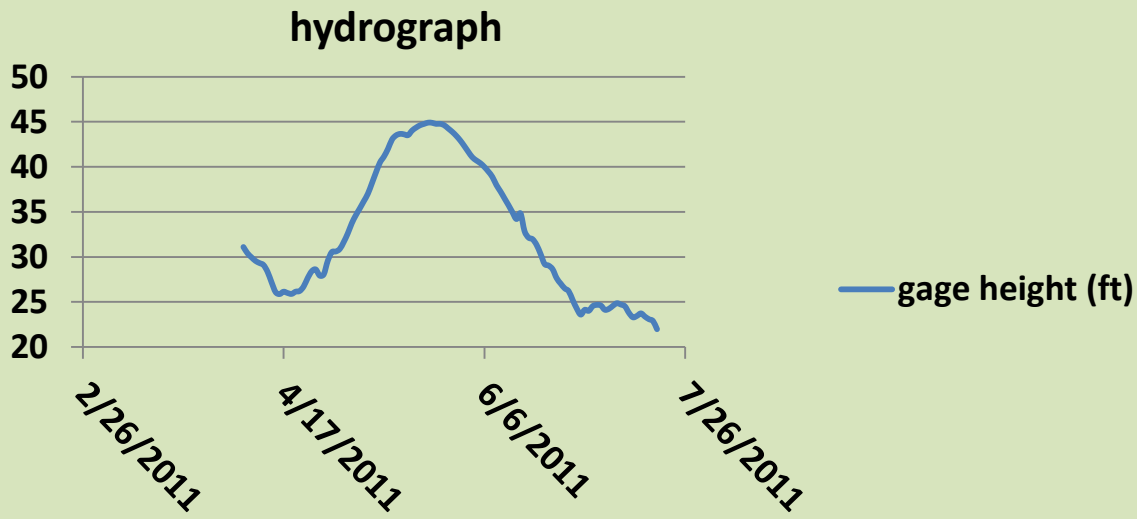

May 1-7, 2010
7,100 m3/s
7%
5%


April 4-8, 2011
12,300 m3/s
9%
7%
April 4-6, 2008
at 13,200 cfs


May 30- June 3, 2011
24,700 m3/s


19,500 m3/s in the river
5,200 from the Morganza spillway
60% of flow went off the main channel
13,300
58% of flow through Flat Lake came through the woods
1,600 reenters river via channels from West side
10,200
4,300 reenters river via channels from Eastside
6,900 reenters river directly via sheetflow
8,800
14,200
49
167
10
110
90
Pontchartrain
DigitalGlobe
Service Agency
©2010 Google
Imagery Date: 10/29/2010
15 R 647533.10 m E 3339012.36 m N elev 12 ft
Eye alt 67.53 mi


Sediment concentration mg/l
400
350
300
250
200
150
100
50
0
2/26/2011
4/17/2011
6/6/2011
7/26/2011
Melville mg/l
Atch at Morgan City
Wax Lake outlet
From the Mississippi
To the gulf
Morganza water

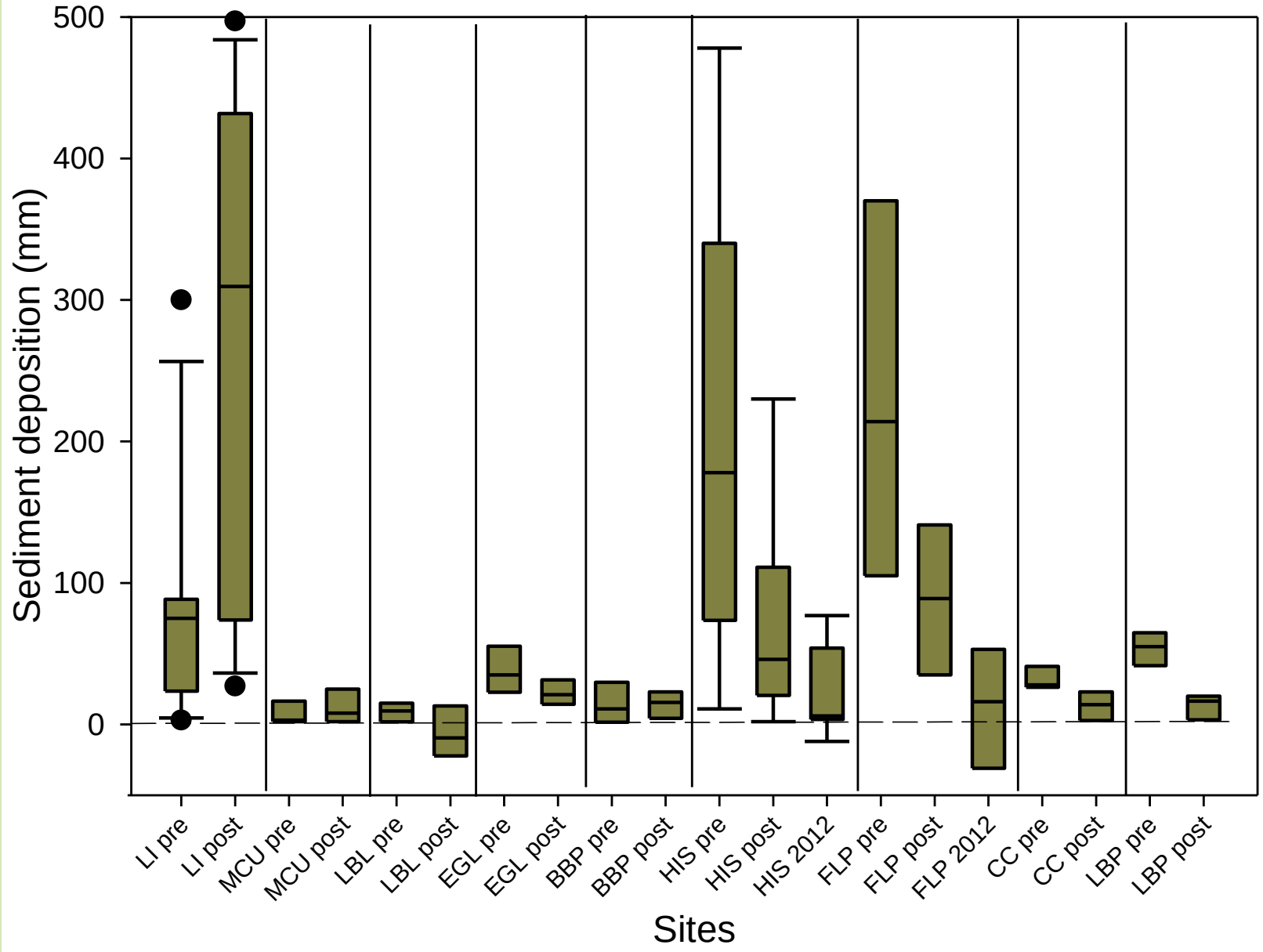

hydrograph
50
45
40
35
30
25
20
2/26/2011
4/17/2011
6/6/2011
7/26/2011
gage height (ft)

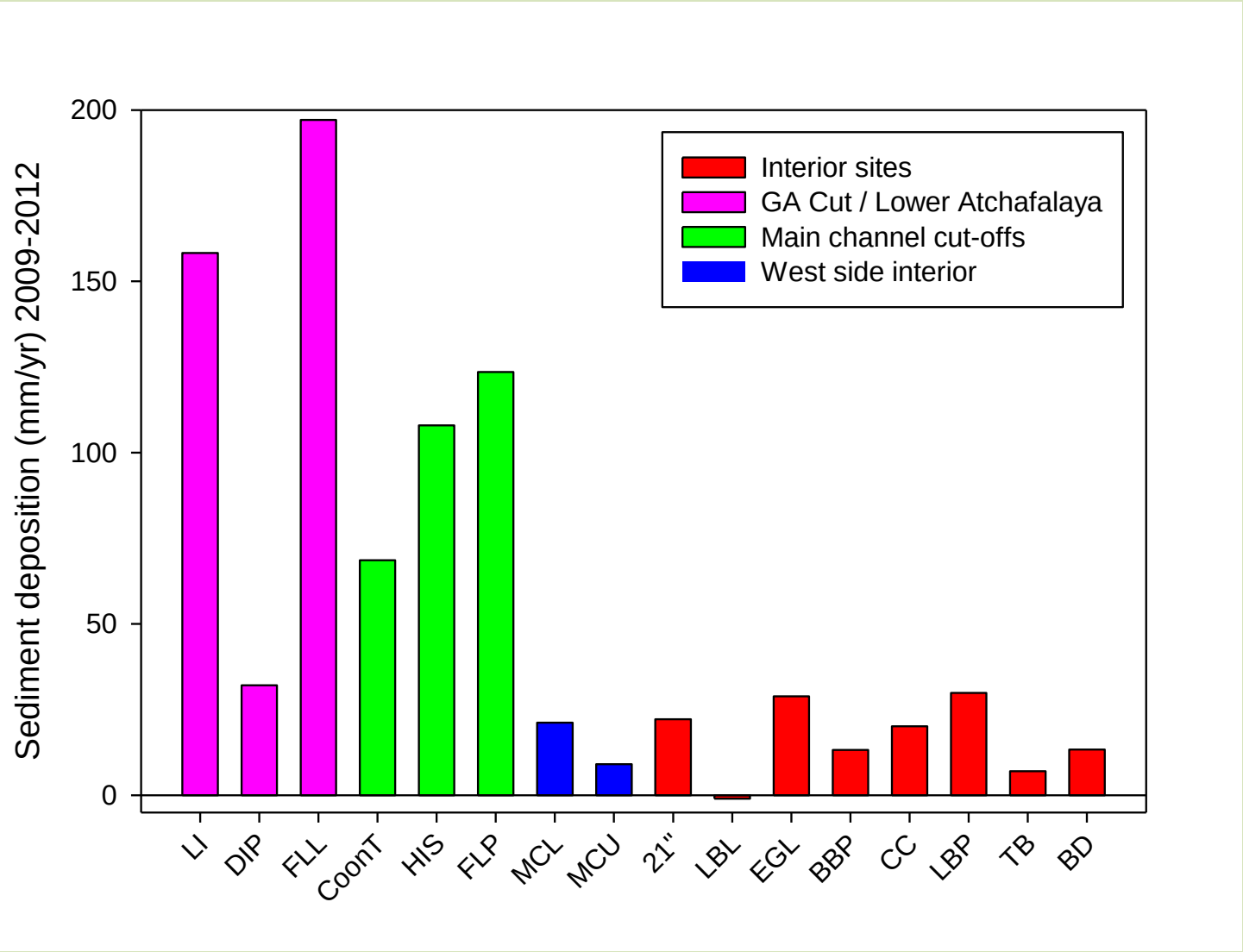
Summer 2009

Spring 2012


FLP
HIS
© 2012 Google
Image U.S. Geological Survey
Google earth
30°03'20.93" N 91°27'15.90" W elev 9 ft
Eye alt 8267 ft
FLP
HIS
1909 ft
© 2012 Google
Image USDA Farm Service Agency
Imagery Date: 12/31/2009
1998
30°03'20.93" N 91°27'15.90" W elev 9 ft


1990
2010
LI
LI
© 2012 Google
Image U.S. Geological Survey
Google earth
1373 ft
© 2012 Google
Image USDA Farm Service Agency
1373 ft


Sediment deposition (mm)
500
400
300
200
100
0
LI pre
LI post
MCU pre
MCU post
LBL pre
LBL post
EGL pre
EGL post
BBP pre
BBP post
HIS pre
HIS post
HIS 2012
FLP pre
FLP post
FLP 2012
CC pre
CC post
LBP pre
LBP post
Sites


Sediment deposition (mm/yr) 2009-2012
200
150
100
50
0
Interior sites
GA Cut / Lower Atchafalaya
Main channel cut-offs
West side interior
LI
DIP
FLL
CoonT
HIS
FLP
MCL
MCU
21"
LBL
EGL
BBP
CC
LBP
TB
BD

Reading a Sediment Elevation Table (SET)

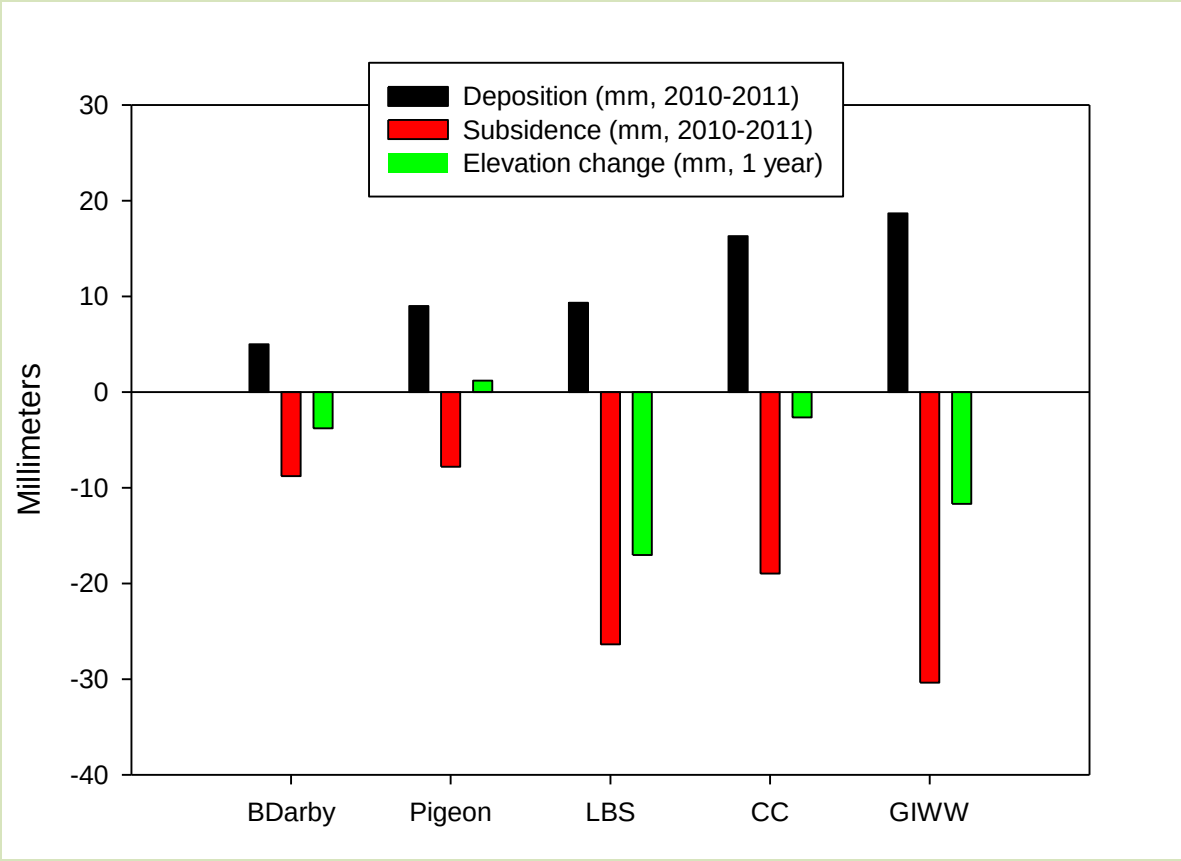
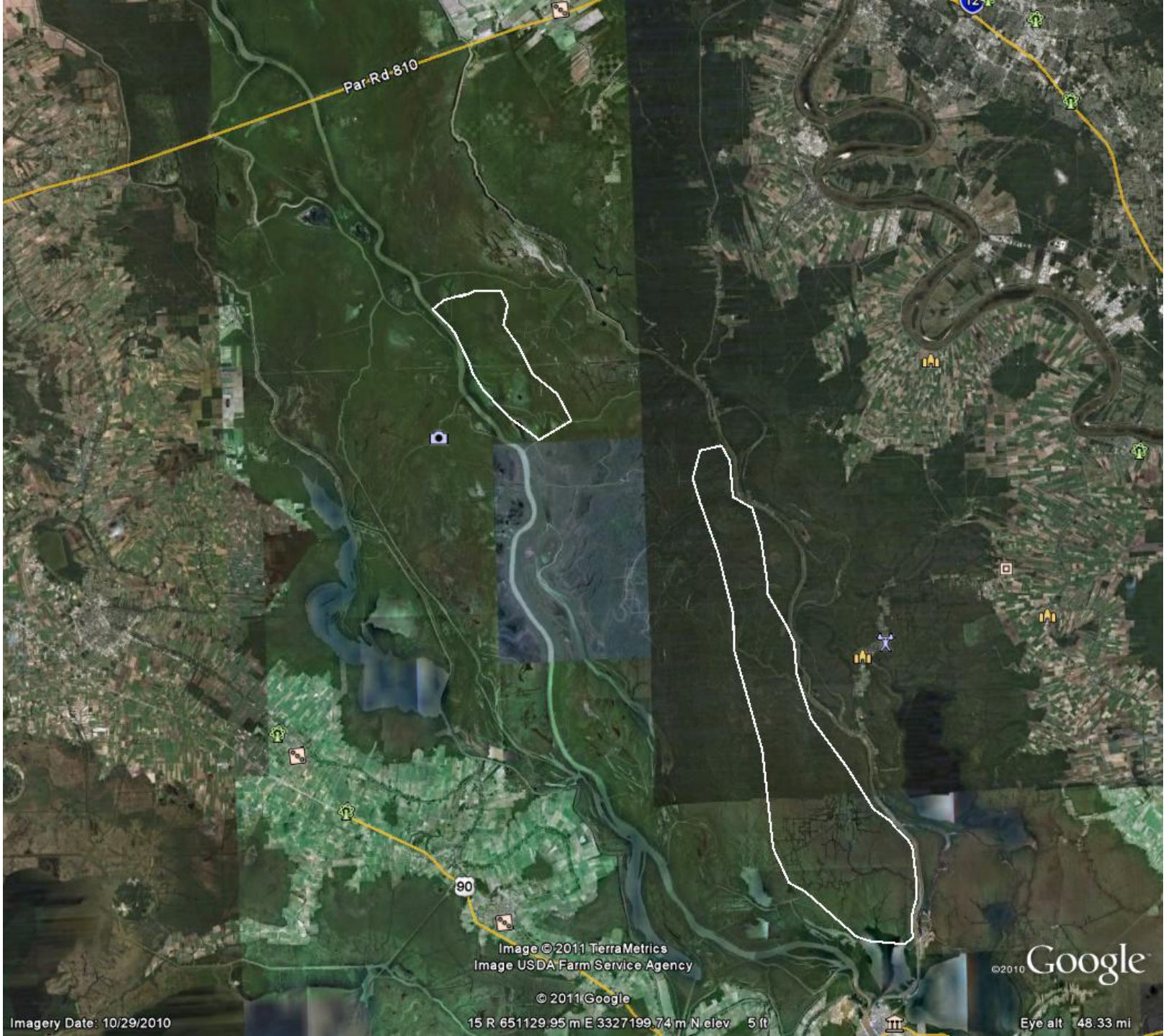
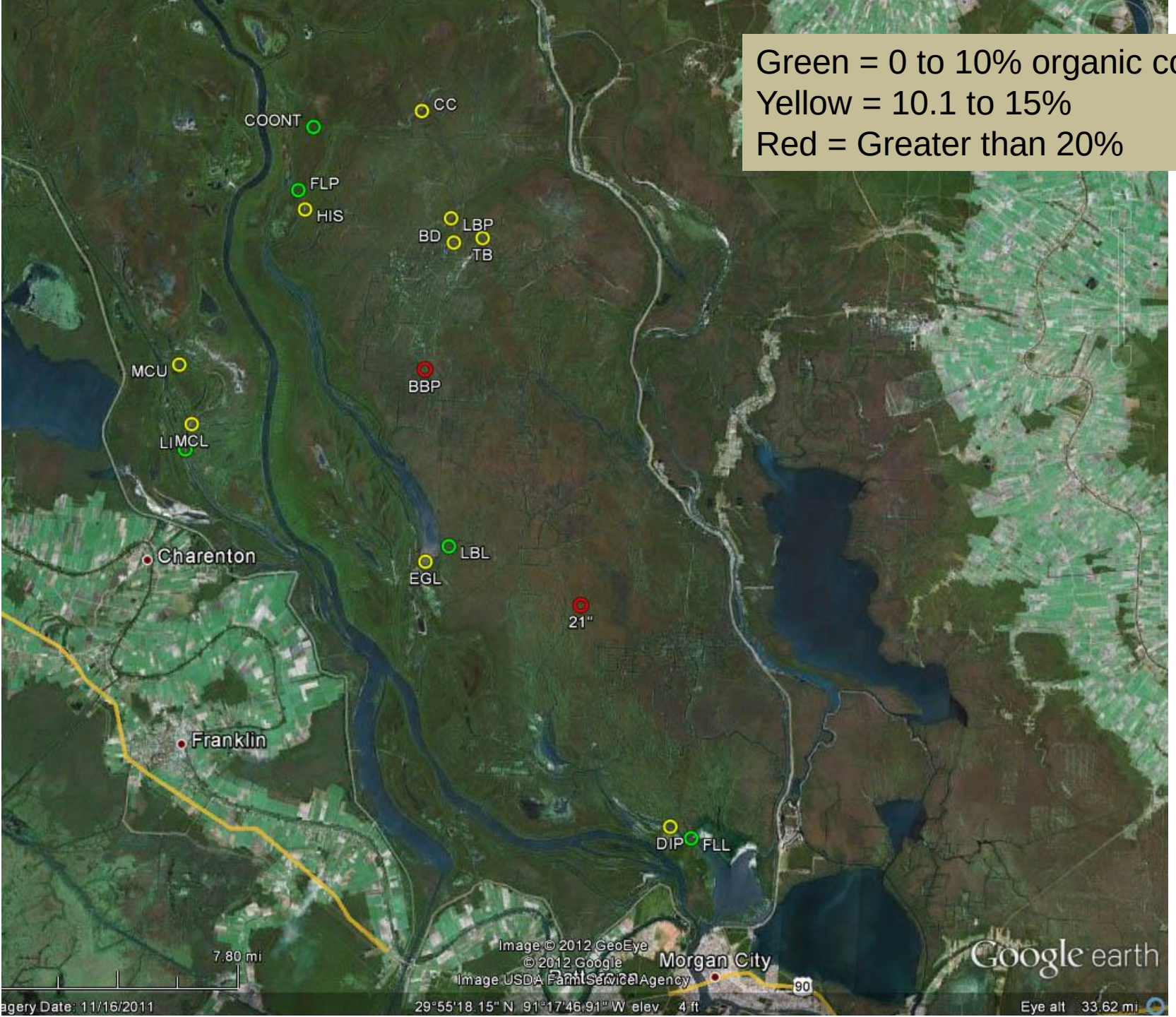
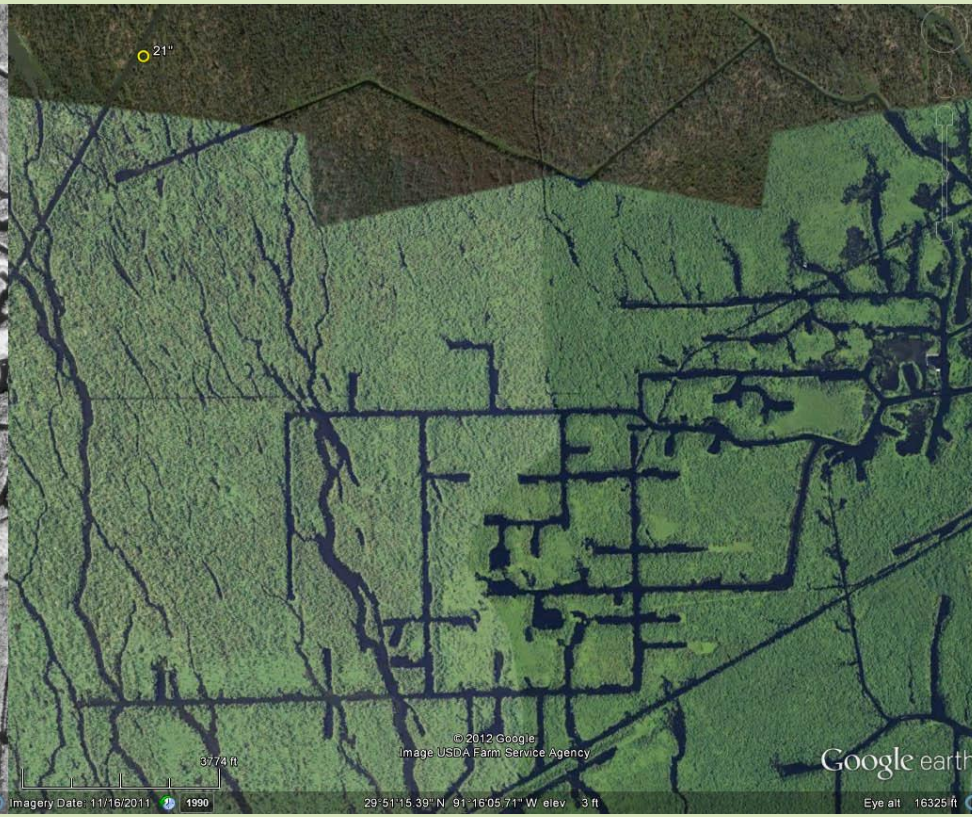

Deposition (mm, 2010-2011)
Subsidence (mm, 2010-2011)
Elevation change (mm, 1 year)
Millimeters
30
20
10
0
-10
-20
-30
-40
BDarby
Pigeon
LBS
CC
GIWW


Image USDA Farm Service Agency
Image © 2011 GeoEye
6.93 mi
Google earth
Imagery Date: 5/17/2009
lat 29.882511° lon -91.335223° elev 4 ft
Eye alt 29.89 mi

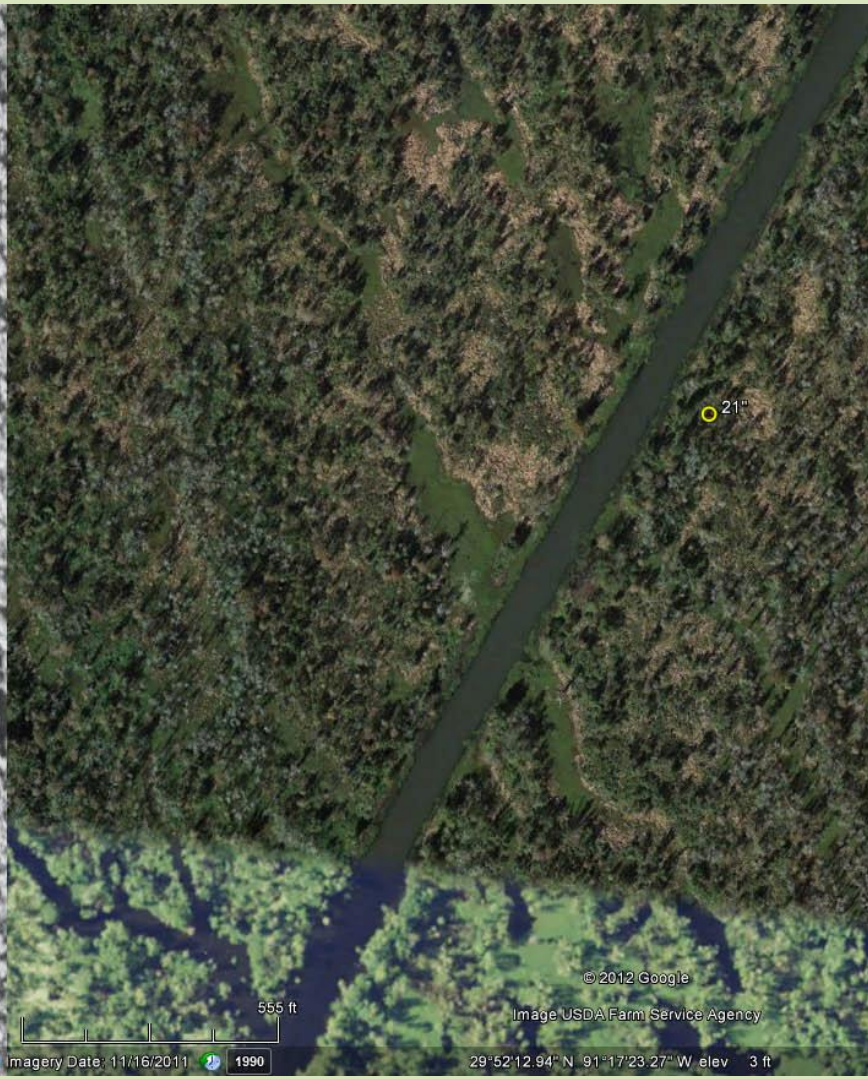

Par Rd 810
90
Image © 2011 TerraMetrics
Image USDA Farm Service Agency
© 2011 Google
©2010 Google
Imagery Date: 10/29/2010
15 R 651129.95 m E 3327199.74 m N elev 5 ft
Eye alt 48.33 mi


Green = 0 to 10% organic composition
Yellow = 10.1 to 15%
Red = Greater than 20%
COONT
CC
FLP
HIS
LBP
BD
TB
MCU
BBP
LIMCL
Charenton
LBL
EGL
21"
Franklin
DIP
FLL
Morgan City
90
7.80 mi
Image © 2012 GeoEye
© 2012 Google
Image USDA Farm Service Agency
Google earth
agery Date: 11/16/2011
29°55'18.15" N 91°17'46.91" W elev 4 ft
Eye alt 33.62 mi


21"
© 2012 Google
Image U.S. Geological Survey
3774 ft
Google earth
Imagery Date: 10/11/1990
1990
29°51'15.39" N 91°16'05.71" W elev 3 ft
Eye alt 16325 ft


21"
© 2012 Google
Image USDA Farm Service Agency
3774 ft
Google earth
Imagery Date: 11/16/2011
1990
29°51'15.39" N 91°16'05.71" W elev 3 ft
Eye alt 16325 ft


21"
© 2012 Google
Image U.S. Geological Survey
555 ft
Google earth
1990
29°52'12.94" N 91°17'23.27" W elev 3 ft
Eye alt 2407 ft


21"
© 2012 Google
Image USDA Farm Service Agency
555 ft
Imagery Date: 11/16/2011
1990
29°52'12.94" N 91°17'23.27" W elev 3 ft


100 mg/l
8 mg/l

Conclusions:

Opening the Morganza Spillway allowed for main channel water and sediment to be diverted to the West side of the Basin and downstream.

The middle of the Basin is still hypoxic and losing land.

Areas near dominant flood flow paths are accreting rapidly (though not necessarily from the flood of 2011).

The flood of 2011 was a scour event for the main channel.

Subsidence rates are substantial and can dwarf even relatively large sedimentation rates.

U.S Geological Survey
In cooperation with:

Audubon Society
Louisiana Department of Natural Resources
U.S. Army Corp of Engineers