Case Study: “Losing Ground”

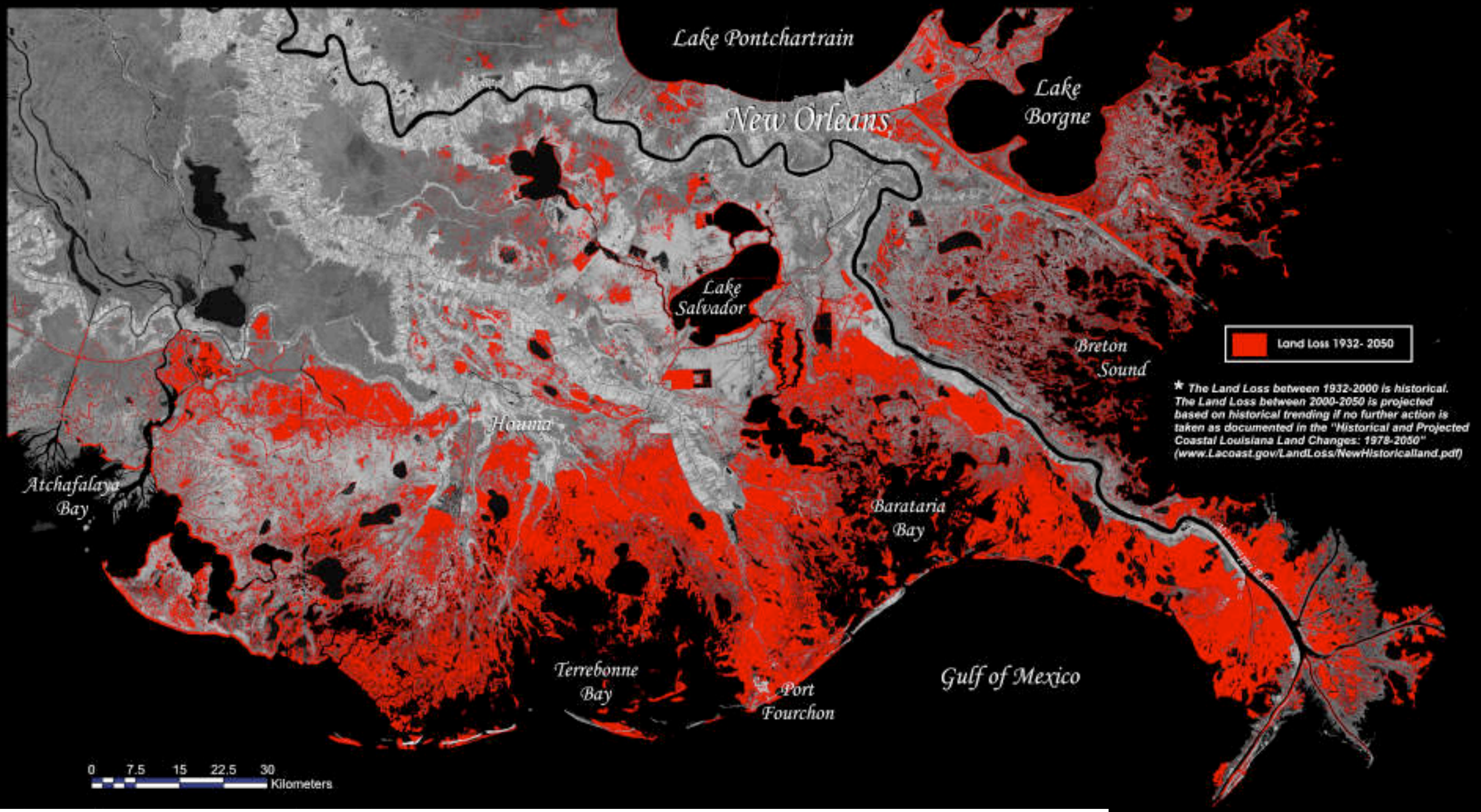
@A_L

http://j.mp/nicar-louisiana

NASA Landsat, processed by ProPublica

Southeast Louisiana Land Loss

**Historical and Projected Land Loss in the Deltaic Plain*



http://www.nwrc.usgs.gov/factshts/2005-3101/2005-3101.htm

primarily
Louisiana

http://theadvocate.com/news/neworleans/5827922-148/areas-gone-on-noaa-charts

1956

1972

2013

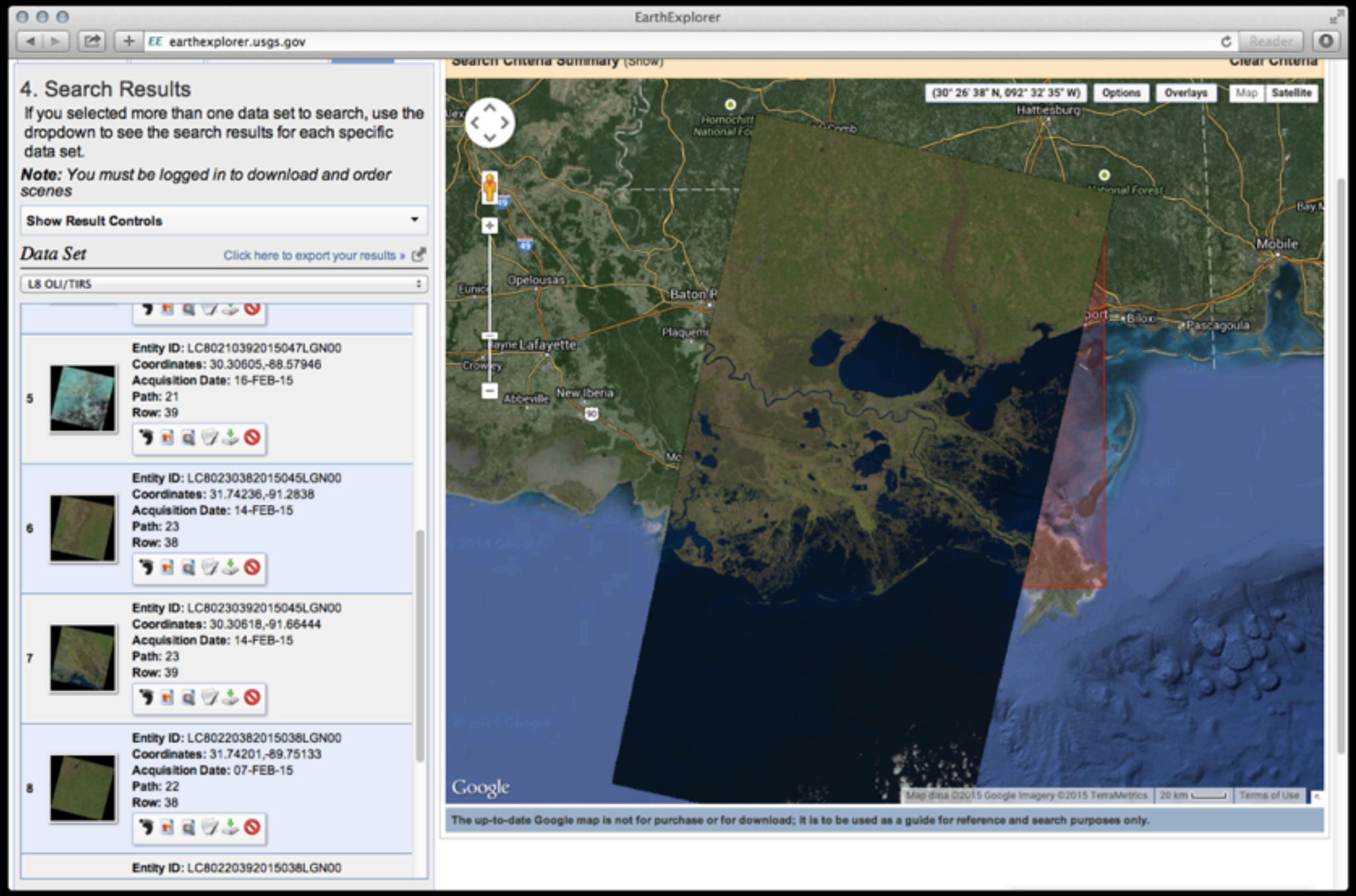
“Wagon wheel,” Venice, La.

USGS Aerials

Investigative Space Journalism!

NASA

Acquiring Imagery



http://earthexplorer.usgs.gov

landsat-util

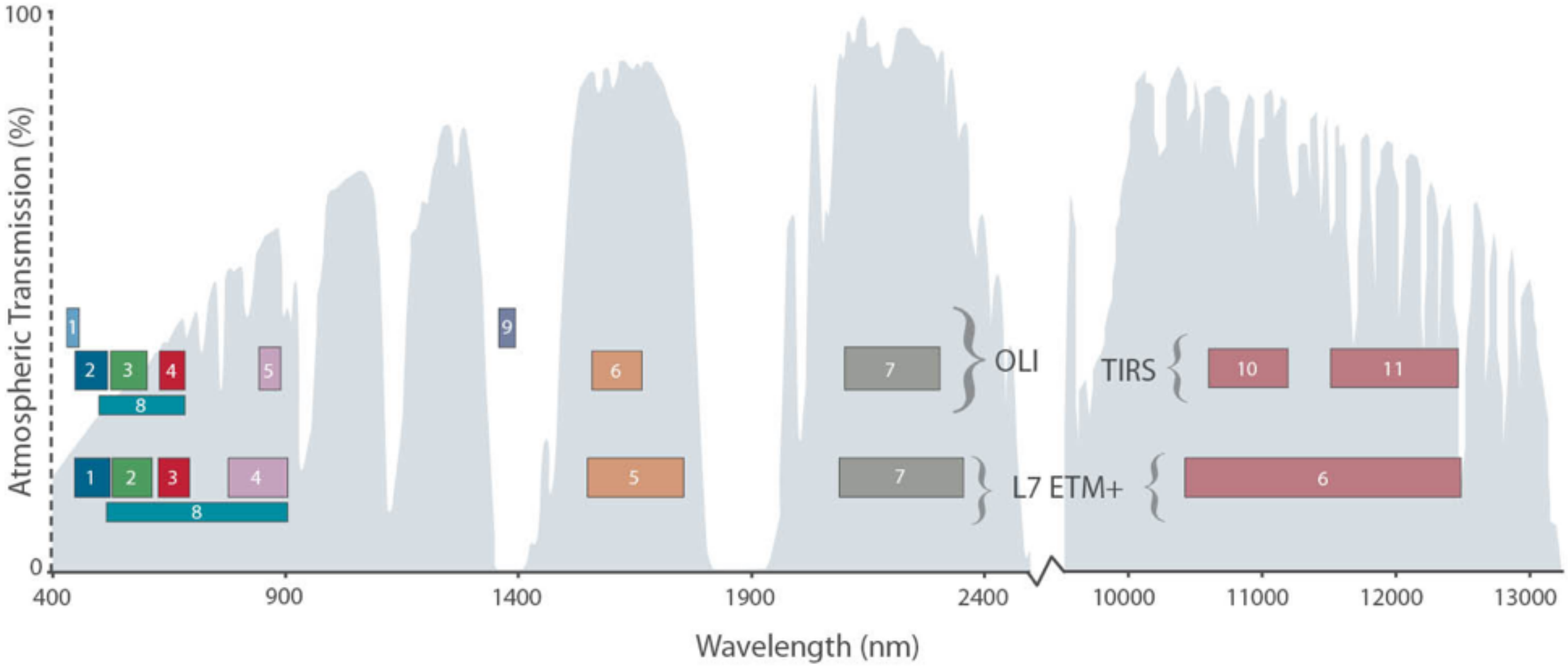
https://github.com/developmentseed/landsat-util

```
landsat search --download --cloud 4 --start "january 01 2014"
--end "january 10 2014" pr 009 045

landsat process path/to/LC80090452014008LGN00.tar.bz
```

TBA command line processing hotness: Jeff Larson's lightning talk tomorrow

Landsat 8



NASA

Landsat 8

Landsat 8 Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS) Launched February 11, 2013	Bands	Wavelength (micrometers)	Resolution (meters)
	Band 1 - Coastal aerosol	0.43 - 0.45	30
	Band 2 - Blue	0.45 - 0.51	30
	Band 3 - Green	0.53 - 0.59	30
	Band 4 - Red	0.64 - 0.67	30
	Band 5 - Near Infrared (NIR)	0.85 - 0.88	30
	Band 6 - SWIR 1	1.57 - 1.65	30
	Band 7 - SWIR 2	2.11 - 2.29	30
	Band 8 - Panchromatic	0.50 - 0.68	15
	Band 9 - Cirrus	1.36 - 1.38	30
	Band 10 - Thermal Infrared (TIRS) 1	10.60 - 11.19	100 * (30)
	Band 11 - Thermal Infrared (TIRS) 2	11.50 - 12.51	100 * (30)

NASA

LC80450292013225LGN00_B1.TIF
LC80450292013225LGN00_B2.TIF
LC80450292013225LGN00_B3.TIF
LC80450292013225LGN00_B4.TIF
LC80450292013225LGN00_B5.TIF
LC80450292013225LGN00_B6.TIF
LC80450292013225LGN00_B7.TIF
LC80450292013225LGN00_B8.TIF
LC80450292013225LGN00_B9.TIF
LC80450292013225LGN00_B10.TIF
LC80450292013225LGN00_B11.TIF
LC80450292013225LGN00_BQA.TIF
LC80450292013225LGN00_MTL.txt

http://earthobservatory.nasa.gov/blogs/elegantfigures/2013/10/22/how-to-make-a-true-color-landsat-8-image/

https://www.mapbox.com/blog/putting-landsat-8-bands-to-work/

Mapbox

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BLOG

Putting Landsat 8's Bands to Work

By Charlie Loyd on June 14 2013

Here's a picture of LA, just like an ordinary digital camera would take (if it had ten times as many megapixels and were in space). The image is only two weeks old, taken from Landsat 8, launched by NASA late this winter. Landsat 8 is already one of our favorite data sources – and not just ours: at State of the Map last weekend, it kept coming up in conversation with people from all kinds of backgrounds. More than just adding fresh true-color imagery from Landsat 8 to MapBox Satellite, we're investing in data services using the multispectral information that the satellite provides. Its non-visual bands let us analyze everything from terrain types to crop growth to natural disasters – all around the world, sometimes within hours. This post introduces some of Landsat 8's features, to give you a feel for what the world looks like through its lens.

http://earthobservatory.nasa.gov/blogs/elegantfigures/2013/10/22/how-to-make-a-true-color-landsat-8-image/

EARTH OBSERVATORY
Where every day is Earth Day

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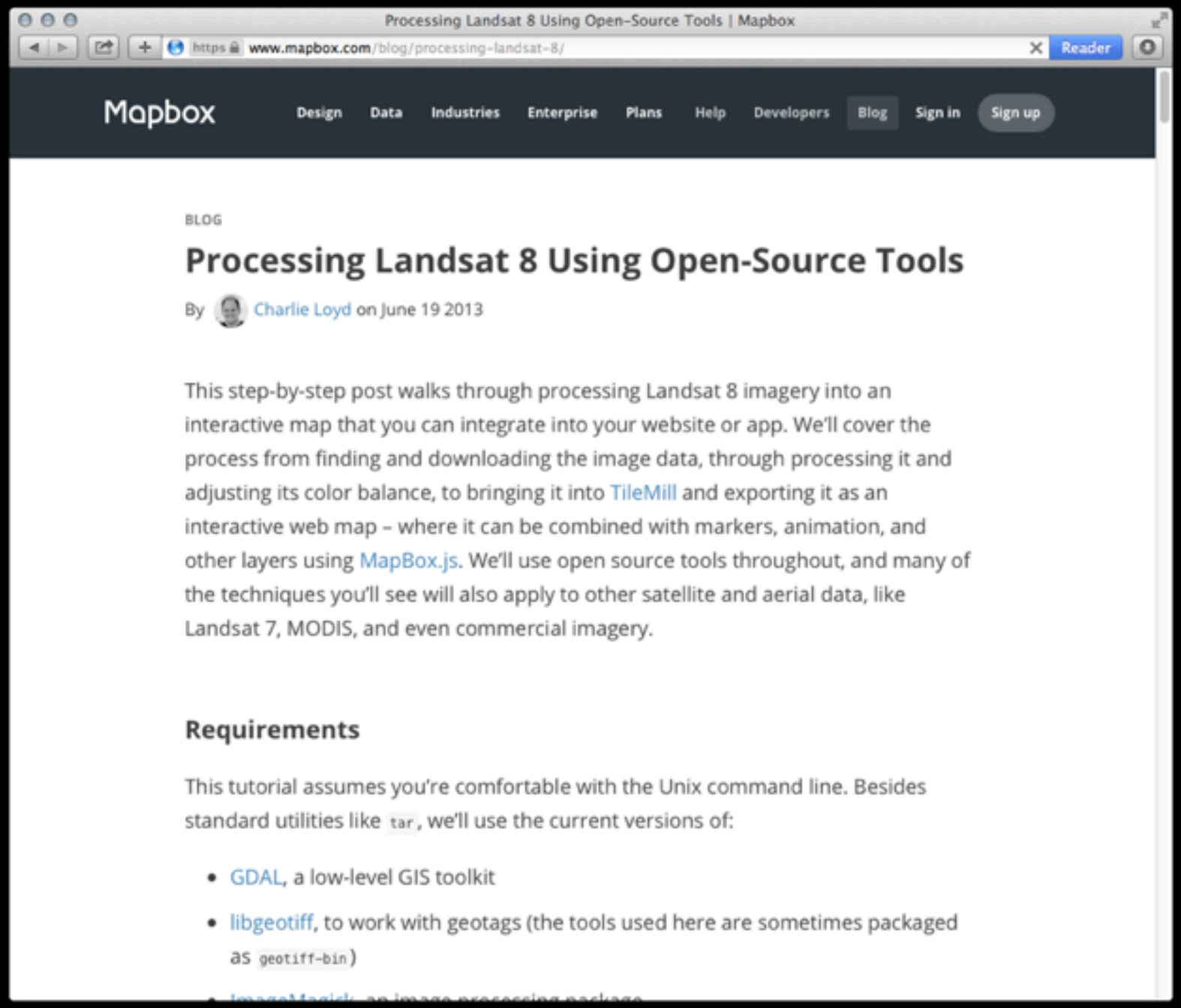
How To Make a True-Color Landsat 8 Image

October 22nd, 2013 by Robert Simmon

Share

Since its launch in February 2013, Landsat 8 has collected about 400 scenes of the Earth's surface per day. Each of these scenes covers an area of about 185 by 185 kilometers (115 by 115 miles)—34,200 square km (13,200 square miles)—for a total of 13,690,000 square km (5,290,000 square miles) per day. An area about 40% larger than the united states. Every day.

https://www.mapbox.com/blog/processing-landsat-8/



http://j.mp/charlie-loyd-rake

charlie-loyd.rake

https://www.mapbox.com/blog/processing-landsat-8

```ruby
# https://www.mapbox.com/blog/processing-landsat-8/
task :landsat_2014 => :environment do
  dirs = Dir["#{Rails.root.to_s}/db/initial/raster/*"].reject {|q| q =~ /tar\.gz/ }
  dirs.each do |dir|
    scene_id = dir.split("/")[-1]
    [4,3,2].each do |band|
      `gdalwarp -t_srs EPSG:3857 #{dir}/#{scene_id}_B#{band}.TIF #{dir}/#{scene_id}_B#{band}-projected.tif`
    end
    `convert -combine #{dir}/#{scene_id}_B{4,3,2}-projected.tif #{dir}/#{scene_id}_RGB-projected.tif && \
     convert -channel B -gamma 0.925 -channel R -gamma 1.03 -channel RGB -sigmoidal-contrast 50x16% #{dir}/
       #{scene_id}_RGB-projected.tif #{dir}/#{scene_id}_RGB-projected-corrected.tif && \
     convert -depth 8 #{dir}/#{scene_id}_RGB-projected-corrected.tif  #{dir}/#{scene_id}_RGB-projected-
       corrected-8bit.tif && \
     listgeo -tfw #{dir}/#{scene_id}_B4-projected.tif && \
     mv #{dir}/#{scene_id}_B4-projected.tfw #{dir}/#{scene_id}_RGB-projected-corrected-8bit.tfw && \
     gdal_edit.py -a_srs EPSG:3857 #{dir}/#{scene_id}_RGB-projected-corrected-8bit.tif && \
     gdal_translate -a_nodata 0 #{dir}/#{scene_id}_RGB-projected-corrected-8bit.tif #{dir}/#{scene_id}_RGB-
       projected-corrected-8bit-nodata.tif`
  end
end

task :landsat_2014_merge => :environment do
  dirs = Dir["#{Rails.root.to_s}/db/initial/raster/*"].reject {|q| q =~ /\..*$/ }
  scenes = dirs.map do |q|
    scene_id = q.split("/")[-1]
    corrected = "#{q}/#{scene_id}_RGB-projected-corrected-8bit-nodata.tif"
  end
  `cd #{Rails.root.to_s}/db/initial/raster/ && gdalwarp --config GDAL_CACHEMAX 3000 -wm 3000 #{scenes.join("
    ")} #{Rails.root.to_s}/db/initial/raster/merged.tif`
end
```

Line 26, Column 4 Spaces: 2 Ruby

charlie-loyd.rake

```ruby
# https://www.mapbox.com/blog/processing-landsat-8/
task :landsat_2014 => :environment do
  dirs = Dir["#{Rails.root.to_s}/db/initial/raster/*"].reject {|q| q =~ /tar\.gz/ }
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    scene_id = dir.split("/")[-1]
    [4,3,2].each do |band|
      `gdalwarp -t_srs EPSG:3857 #{dir}/#{scene_id}_B#{band}.TIF #{dir}/#{scene_id}_B#{band}-projected.tif`
    end
    `convert -combine #{dir}/#{scene_id}_B{4,3,2}-projected.tif #{dir}/#{scene_id}_RGB-projected.tif && \
     convert -channel R -gamma 0.975 -channel B -gamma 1.08 -channel RGB -sigmoidal-contrast 50x16% #{dir}/
       #{scene_id}_RGB-projected.tif #{dir}/#{scene_id}_RGB-projected-corrected.tif && \
     convert -depth 8 #{dir}/#{scene_id}_RGB-projected-corrected.tif  #{dir}/#{scene_id}_RGB-projected-
       corrected-8bit.tif && \
     listgeo -tfw #{dir}/#{scene_id}_B4-projected.tif && \
     mv #{dir}/#{scene_id}_B4-projected.tfw #{dir}/#{scene_id}_RGB-projected-corrected-8bit.tfw && \
     gdal_edit.py -a_srs EPSG:3857 #{dir}/#{scene_id}_RGB-projected-corrected-8bit.tif && \
     gdal_translate -a_nodata 0 #{dir}/#{scene_id}_RGB-projected-corrected-8bit.tif #{dir}/#{scene_id}_RGB-
       projected-corrected-8bit-nodata.tif`
  end
end

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  scenes = dirs.map do |q|
    scene_id = q.split("/")[-1]
    corrected = "#{q}/#{scene_id}_RGB-projected-corrected-8bit-nodata.tif"
  end
  `cd #{Rails.root.to_s}/db/initial/raster/ && gdalwarp --config GDAL_CACHEMAX 3000 -wm 3000 #{scenes.join(" ")} #{Rails.root.to_s}/db/initial/raster/merged.tif`
end
```

stitch scenes together and reproject

ImageMagick on the command line

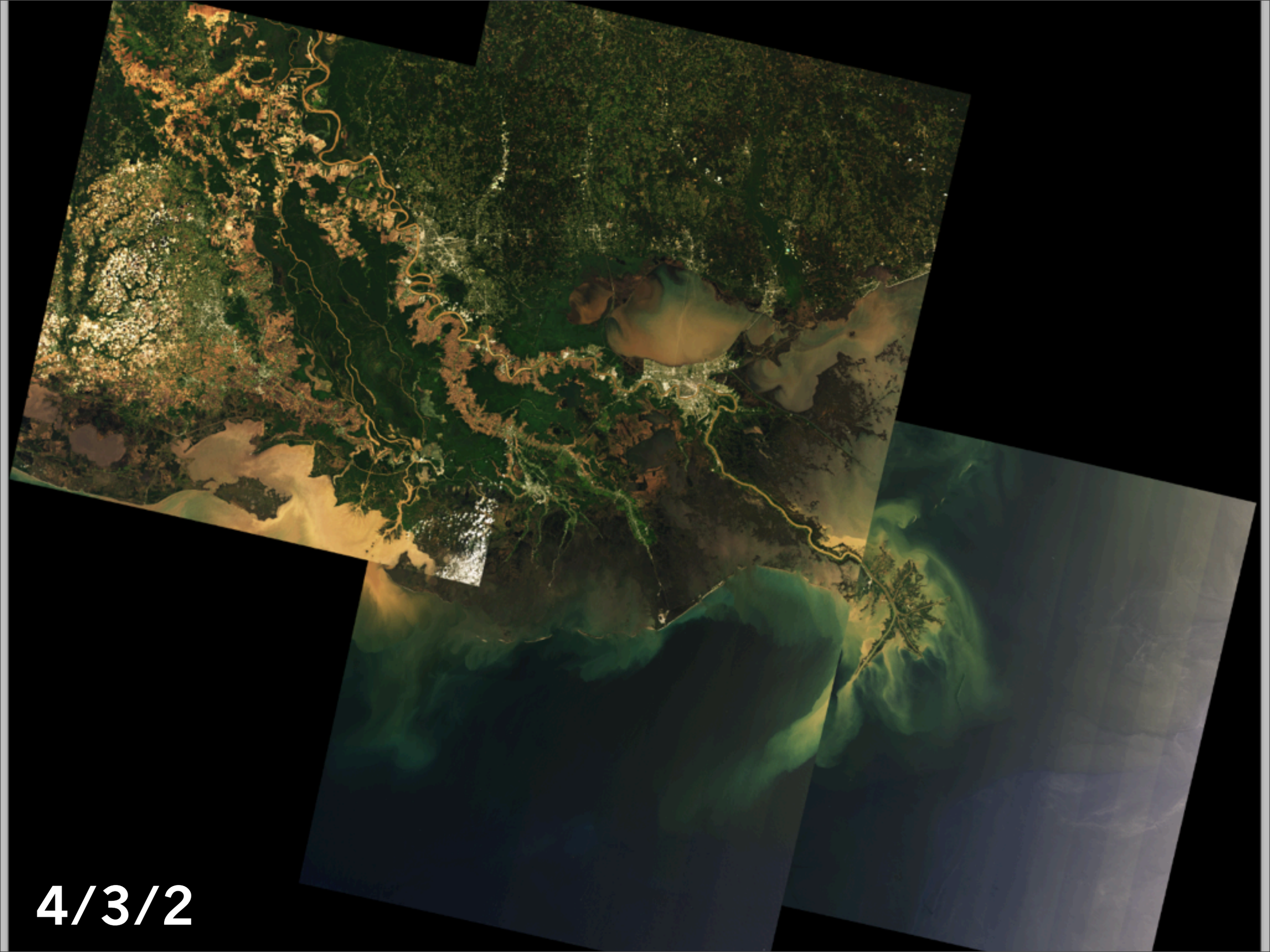
save geo headers to use files with Photoshop or ImageMagick

add geo headers back in

convert between formats

More!

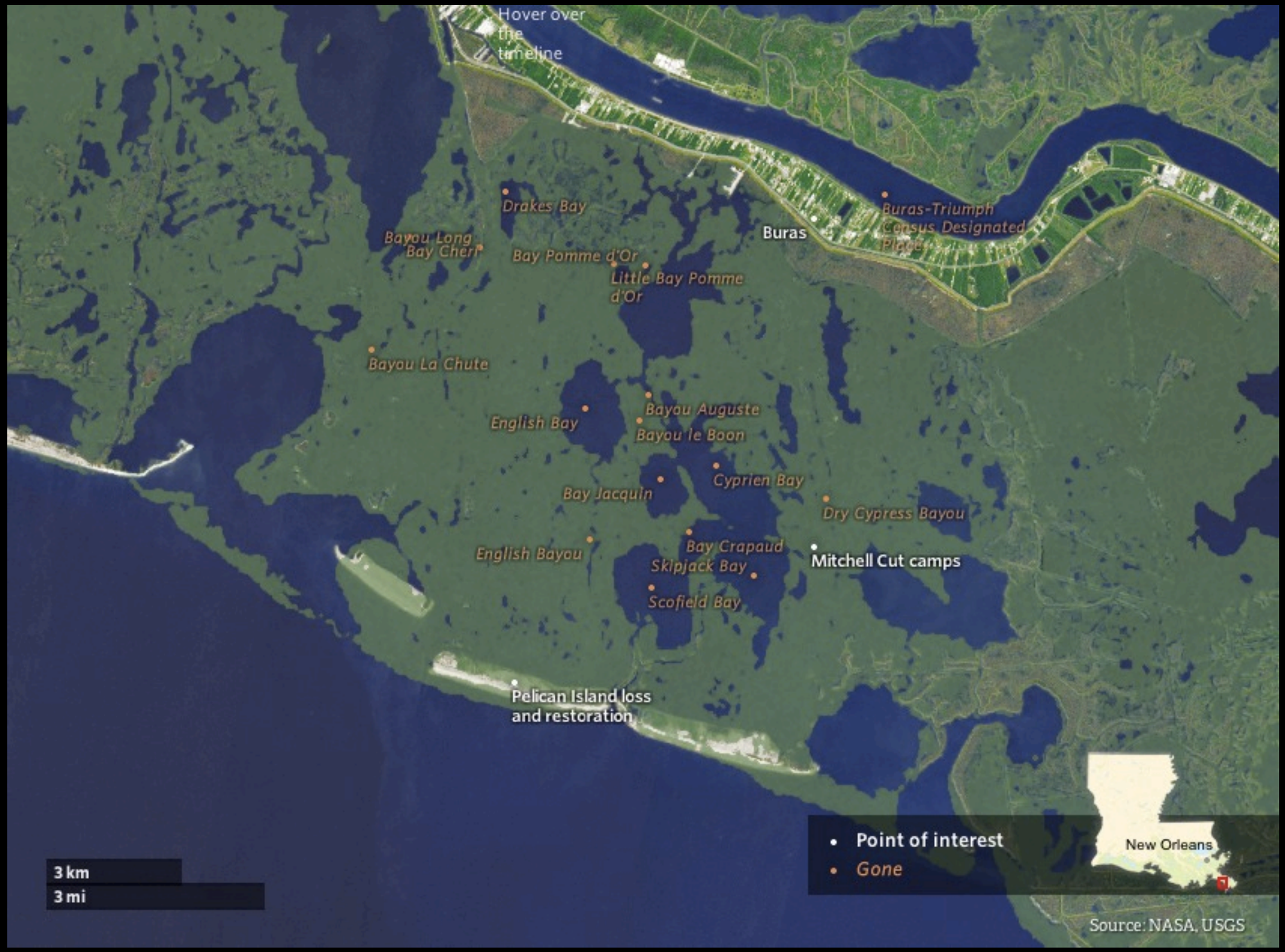
https://github.com/dwtkns/gdal-cheat-sheet#raster-operations


4/3/2


7/5/3


4/3/2 + 5 mask

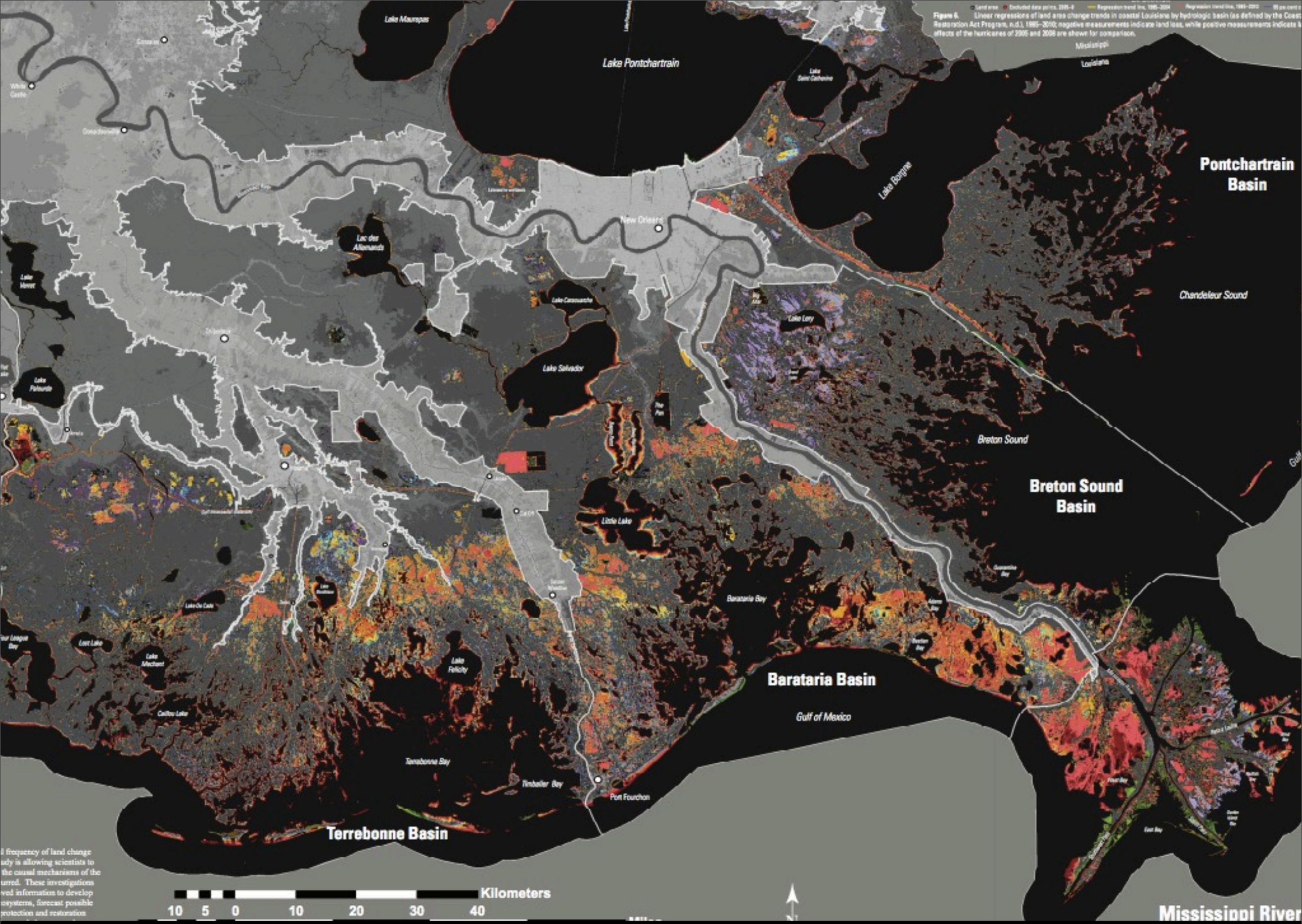
Creating “land”



Buras, La. land loss 1932 to present via USGS, over 2014 Landsat 8

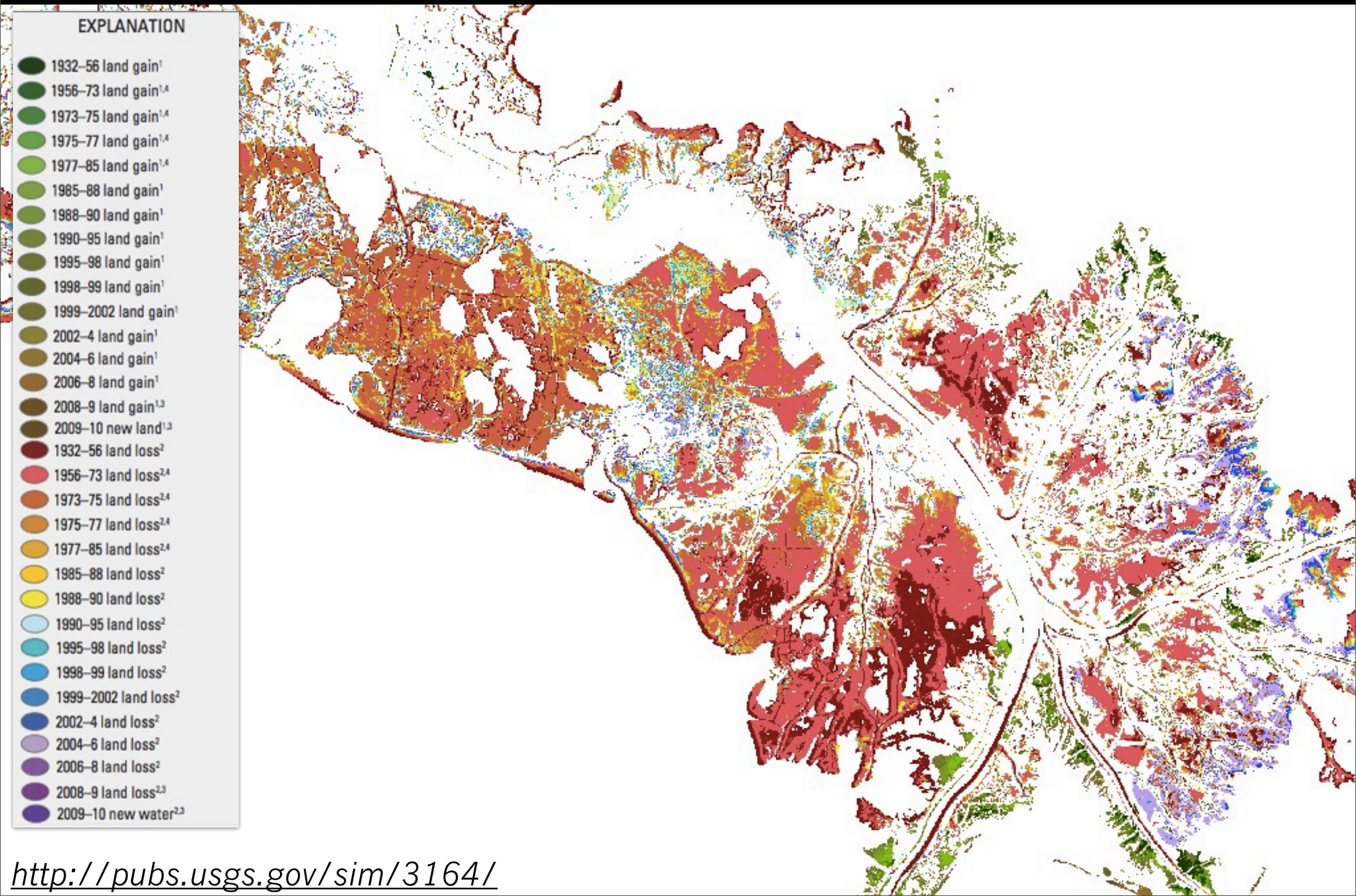
Creating “land”

Buras, La. land loss 2009 via USGS, over 2014 Landsat 8



http://pubs.usgs.gov/sim/3164/

Creating “land”



http://pubs.usgs.gov/sim/3164/

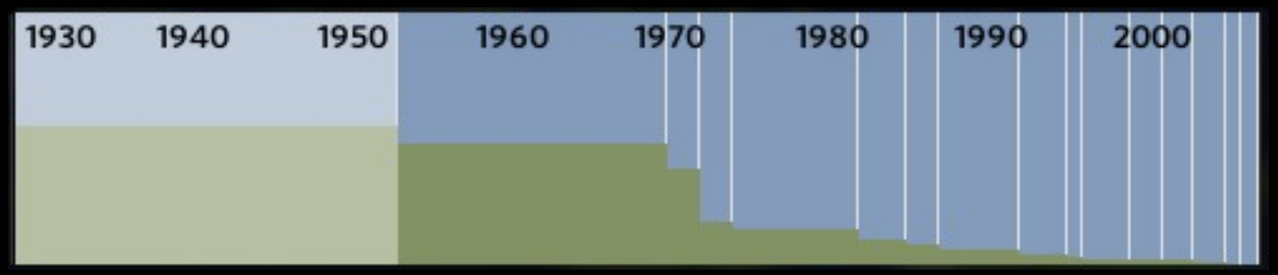
Creating “land”

```
colors = {
  "1932-1956-gain"   =>   "srgba(0,66,0,1)",
  "1956-1973-gain"   =>   "srgba(28,102,0,1)",
  "1973-1975-gain"   =>   "srgba(51,135,5,1)",
  "1975-1977-gain"   =>   "srgba(76,168,10,1)",
  "1977-1985-gain"   =>   "srgba(102,201,15,1)",
  "1985-1988-gain"   =>   "srgba(109,165,28,1)",
  "1988-1990-gain"   =>   "srgba(109,150,33,1)",
  "1990-1995-gain"   =>   "srgba(107,135,38,1)",
  "1995-1998-gain"   =>   "srgba(102,119,40,1)",
  "1998-1999-gain"   =>   "srgba(96,107,45,1)",
  "1999-2002-gain"   =>   "srgba(112,114,45,1)",
  "2002-2004-gain"   =>   "srgba(135,132,43,1)",
  "2004-2006-gain"   =>   "srgba(147,117,43,1)",
  "2006-2008-gain"   =>   "srgba(153,104,43,1)",
  "2008-2009-gain"   =>   "srgba(104,79,33,1)",
  "2009-2010-gain"   =>   "srgba(114,79,33,1)",
  "1932-1956-loss"   =>   "srgba(137,0,0,1)",
  "1956-1973-loss"   =>   "srgba(239,71,84,1)",
  "1973-1975-loss"   =>   "srgba(211,94,43,1)",
  "1975-1977-loss"   =>   "srgba(219,132,35,1)",
  "1977-1985-loss"   =>   "srgba(229,165,25,1)",
  "1985-1988-loss"   =>   "srgba(255,198,17,1)",
  "1988-1990-loss"   =>   "srgba(244,242,10,1)",
  "1990-1995-loss"   =>   "srgba(168,255,255,1)",
  "1995-1998-loss"   =>   "srgba(2,191,201,1)",
  "1998-1999-loss"   =>   "srgba(5,163,229,1)",
  "1999-2002-loss"   =>   "srgba(10,130,234,1)",
  "2002-2004-loss"   =>   "srgba(76,30,242,1)",
  "2004-2006-loss"   =>   "srgba(198,153,239,1)",
  "2006-2008-loss"   =>   "srgba(168,38,204,1)",
  "2008-2009-loss"   =>   "srgba(130,51,137,1)",
  "2009-2010-loss"   =>   "srgba(107,7,168,1)"
}
```

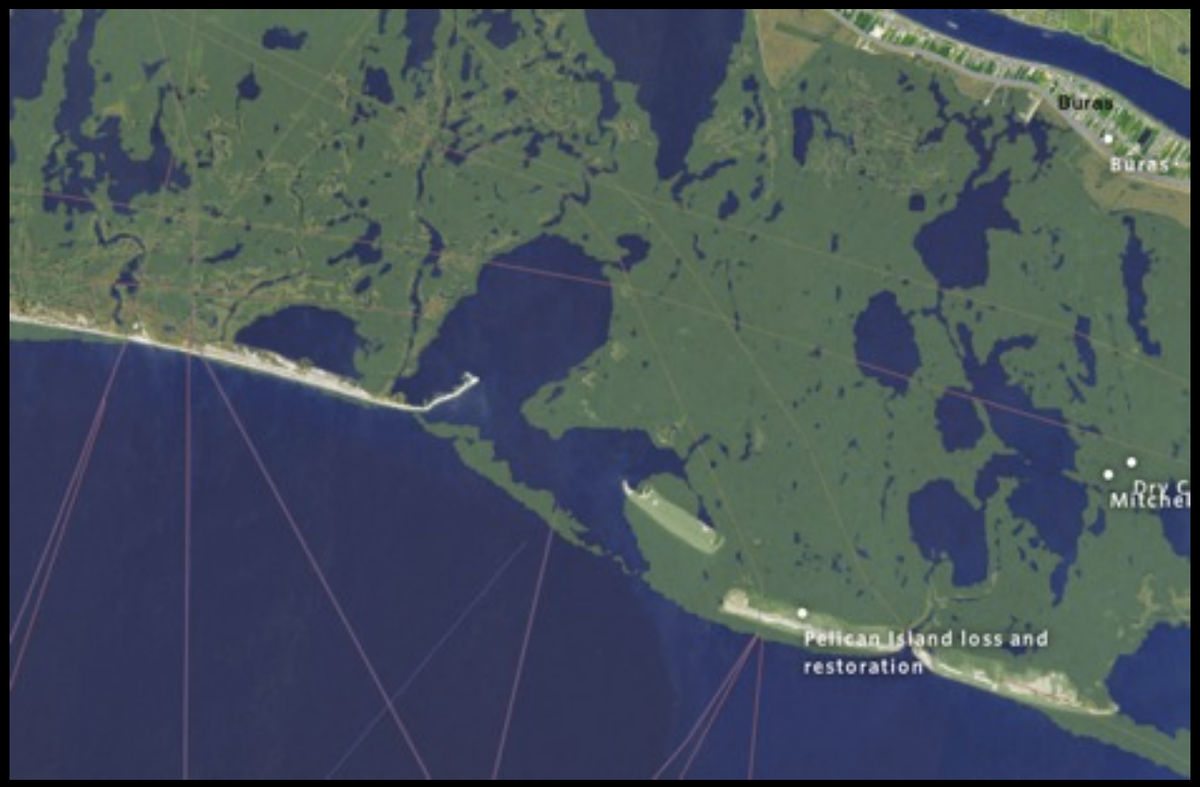
Creating “land”

For each time period, create an image by combining land loss from the current period to the last period, and land gain from the first period to the current period

Buras, La.: 1932-2014




```
pixels = `convert #{file} -colorspace rgb -colors 10 -format "%c"
          histogram:info:`
transPixels = pixels.match(/[^:]*/)
transPct = `convert #{file} -format "%[fx:100*#{transPixels}/(w*h)]%%" info:`
```



projects.propublica.org/louisiana

Losing Ground

projects.propublica.org/louisiana/

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DONATE TO PROPUBLICA | DONATE TO THE LENS

PAST / PRESENT: 1922 | 2014

AN ENGINEERED COAST: LEVEES | CANALS | OIL/GAS

AN UNCERTAIN FUTURE: SEVERE | MODERATE

2014

Today, residents of Southeast Louisiana face a losing equation: They live on narrow slices of high ground that are sinking as the Gulf rises. The state has an ambitious plan that could balance that equation by 2060, but it doesn't have the $50 billion to pay for it.

Source: NASA/USGS Landsat

Louisiana is drowning, quickly.

In just 80 years, some 2,000 square miles of its coastal landscape have turned to open water, wiping places off maps, bringing the Gulf of Mexico to the back door of New Orleans and posing a lethal threat to an energy and shipping corridor vital to the nation's economy.

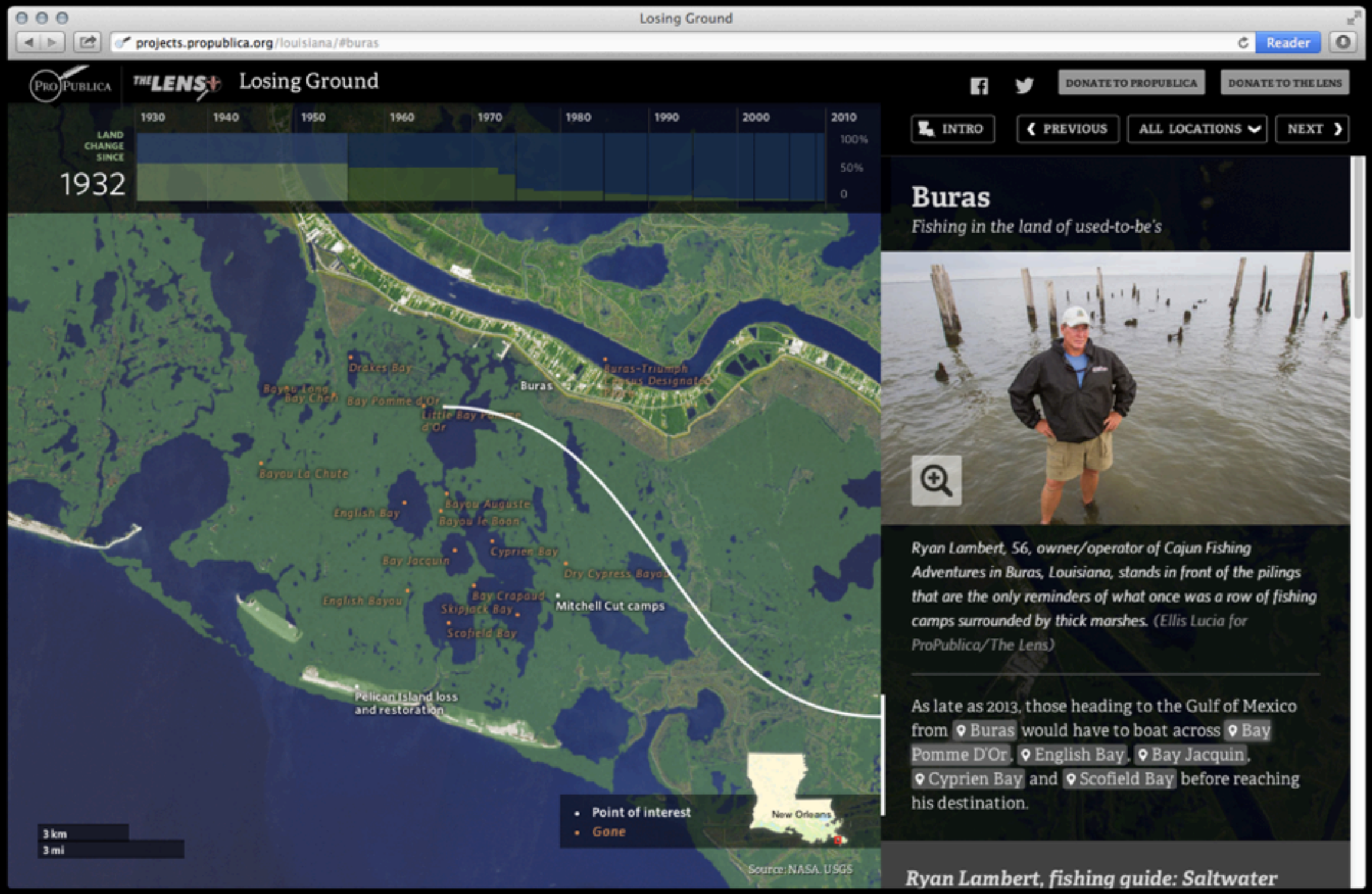
And it's going to get worse, even quicker.

Scientists now say one of the greatest environmental and economic disasters in the nation's history is rushing toward a catastrophic conclusion over the next 50 years, so far unabated and largely unnoticed.

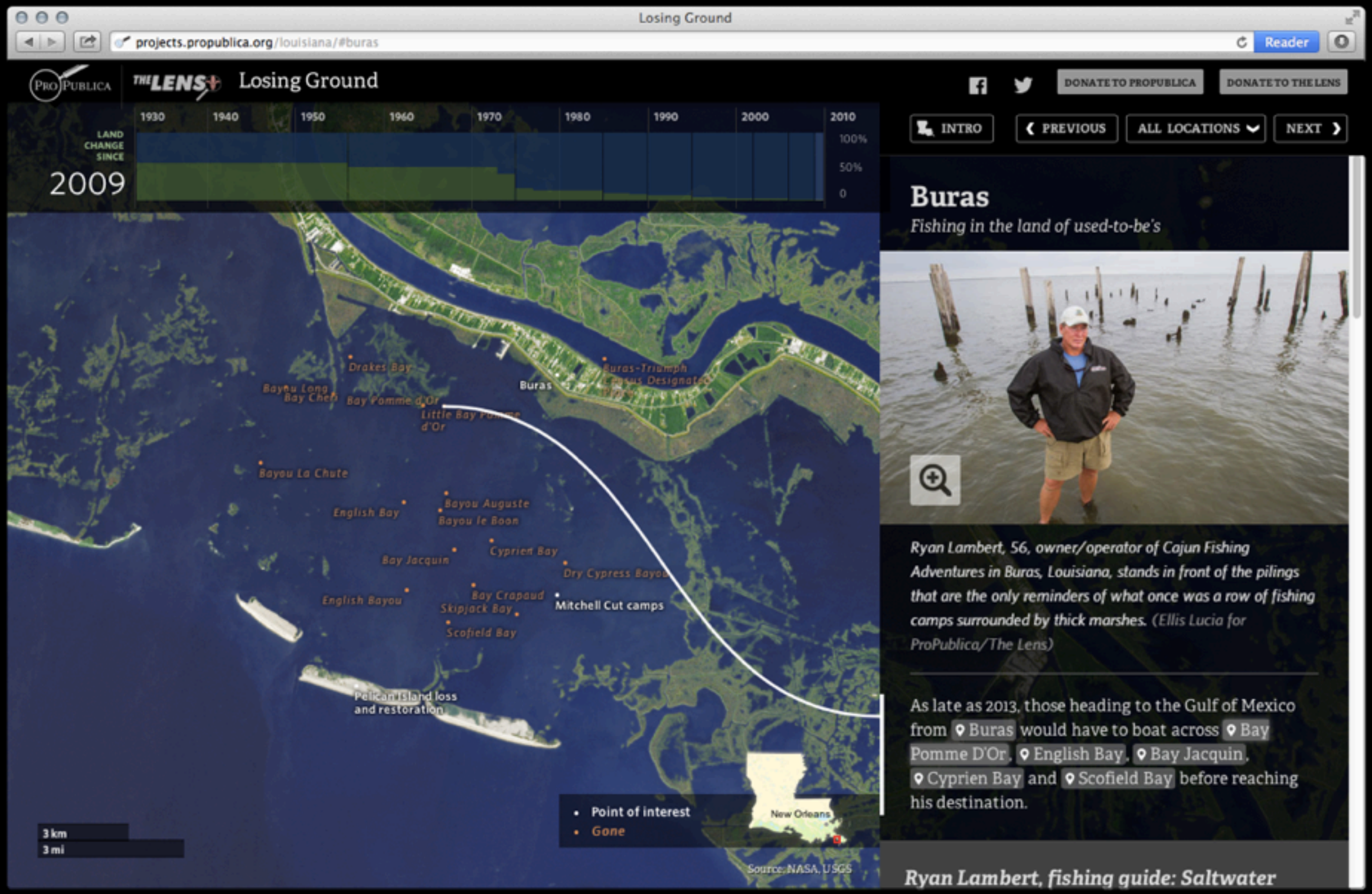
At the current rates that the sea is rising and land is sinking, National Oceanic and Atmospheric Administration scientists say by 2100 the Gulf of Mexico could rise as much as 4.3 feet across this landscape, which has an average elevation of about 3 feet. If that happens, everything outside the protective levees — most of Southeast Louisiana — would be underwater.

Explore Delacroix, La.

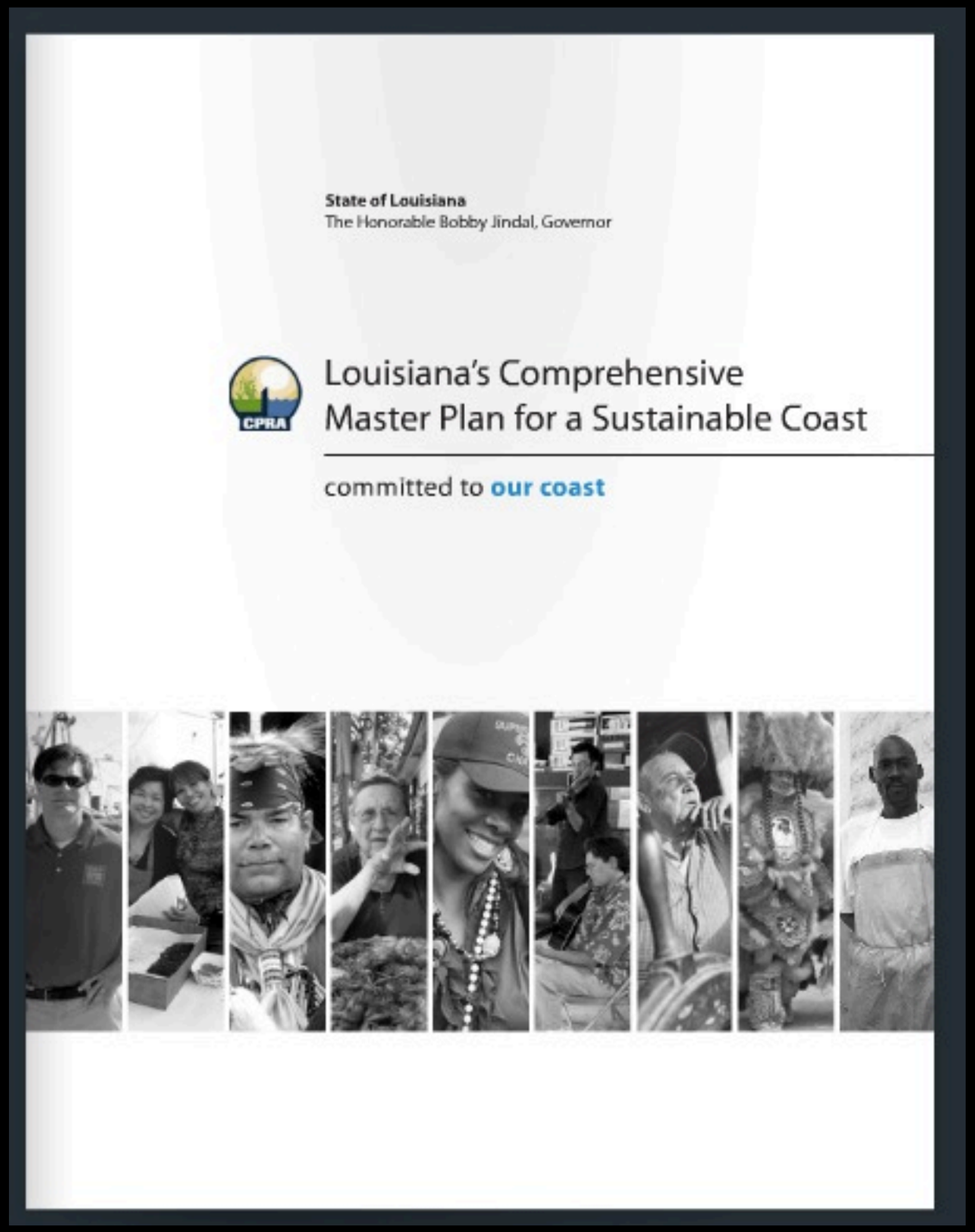
projects.propublica.org/louisiana



projects.propublica.org/louisiana



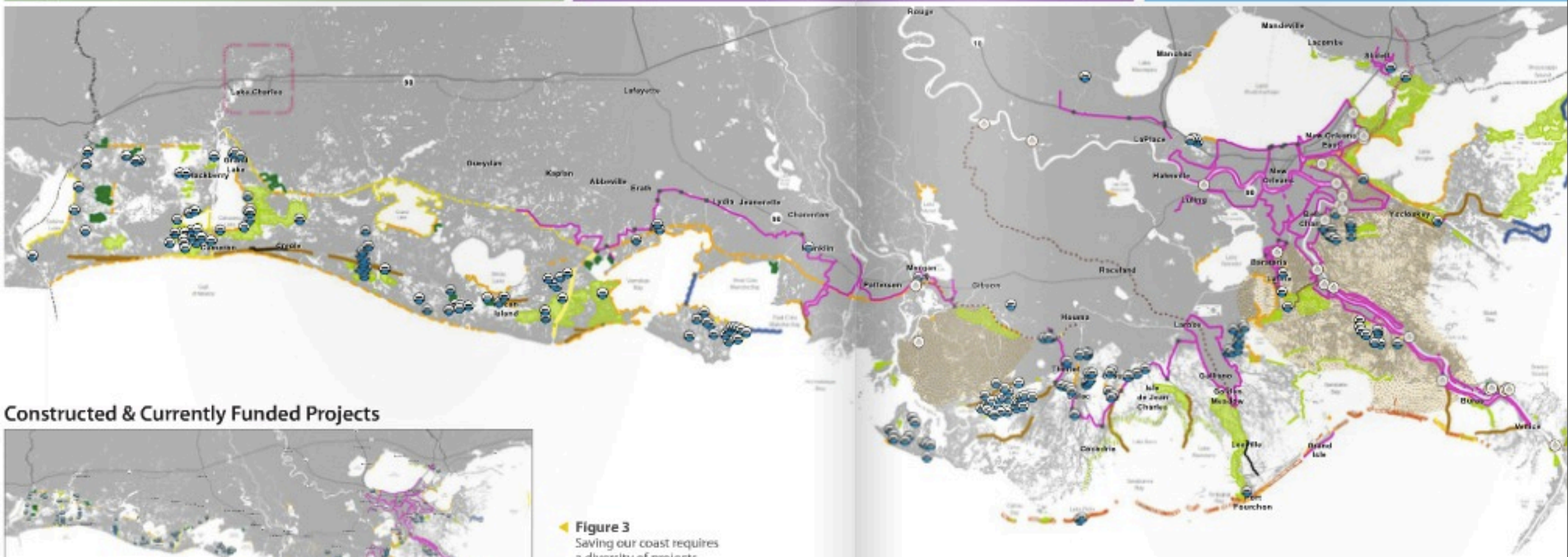
What is the state doing about this?



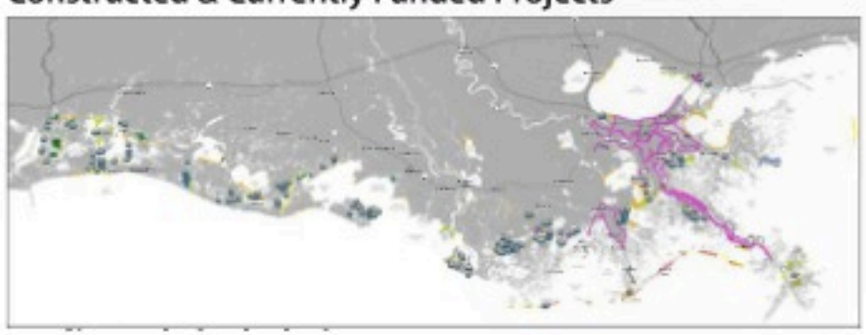
http://coastal.la.gov/a-common-vision/2012-coastal-master-plan/

Responding to the Crisis

Louisiana's Coastal Program: Past, Present, and Future



Constructed & Currently Funded Projects



2012 Coastal Master Plan: Future Projects

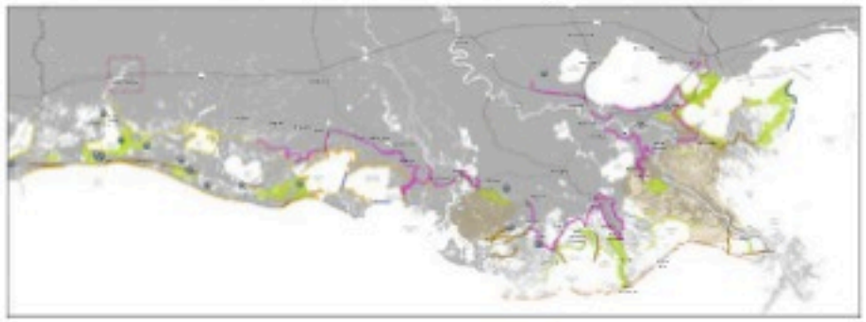


Figure 3
Saving our coast requires a diversity of projects throughout our communities. The smaller map to the left (upper)shows projects that have been or are being constructed. The map to the left (lower) shows future projects in the 2012 Coastal Master Plan. The large map combines both sets of projects to show the complete scope of the state's work for Louisiana's coast.

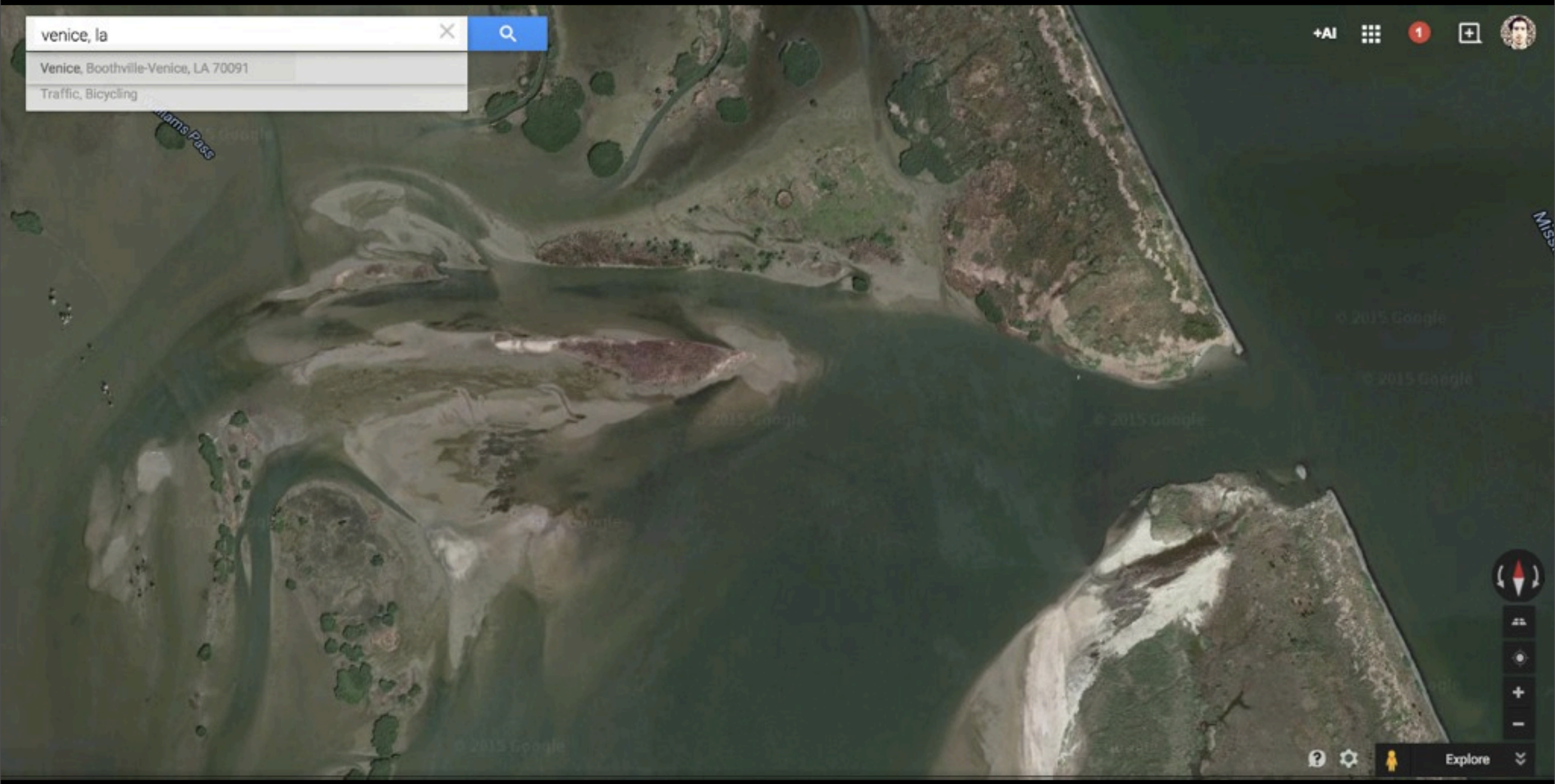
Project Types

http://coastal.la.gov/a-common-vision/2012-coastal-master-plan/

Marsh Creation: Lake Hermitage

Google Maps (2012 USGS imagery)

Sediment Diversions: West Bay



Google Maps (2012 USGS imagery)

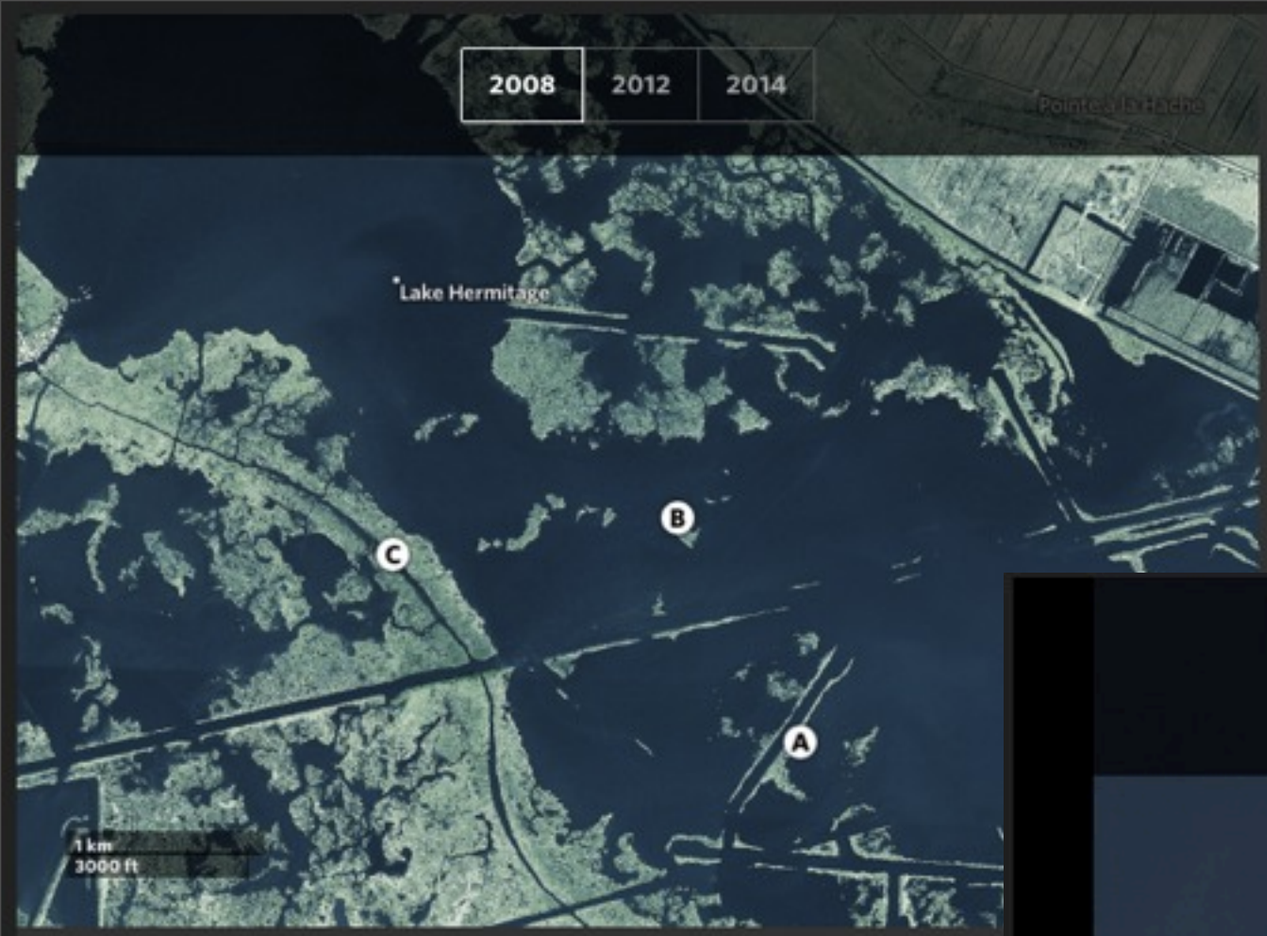
Imagery: 2012—now?

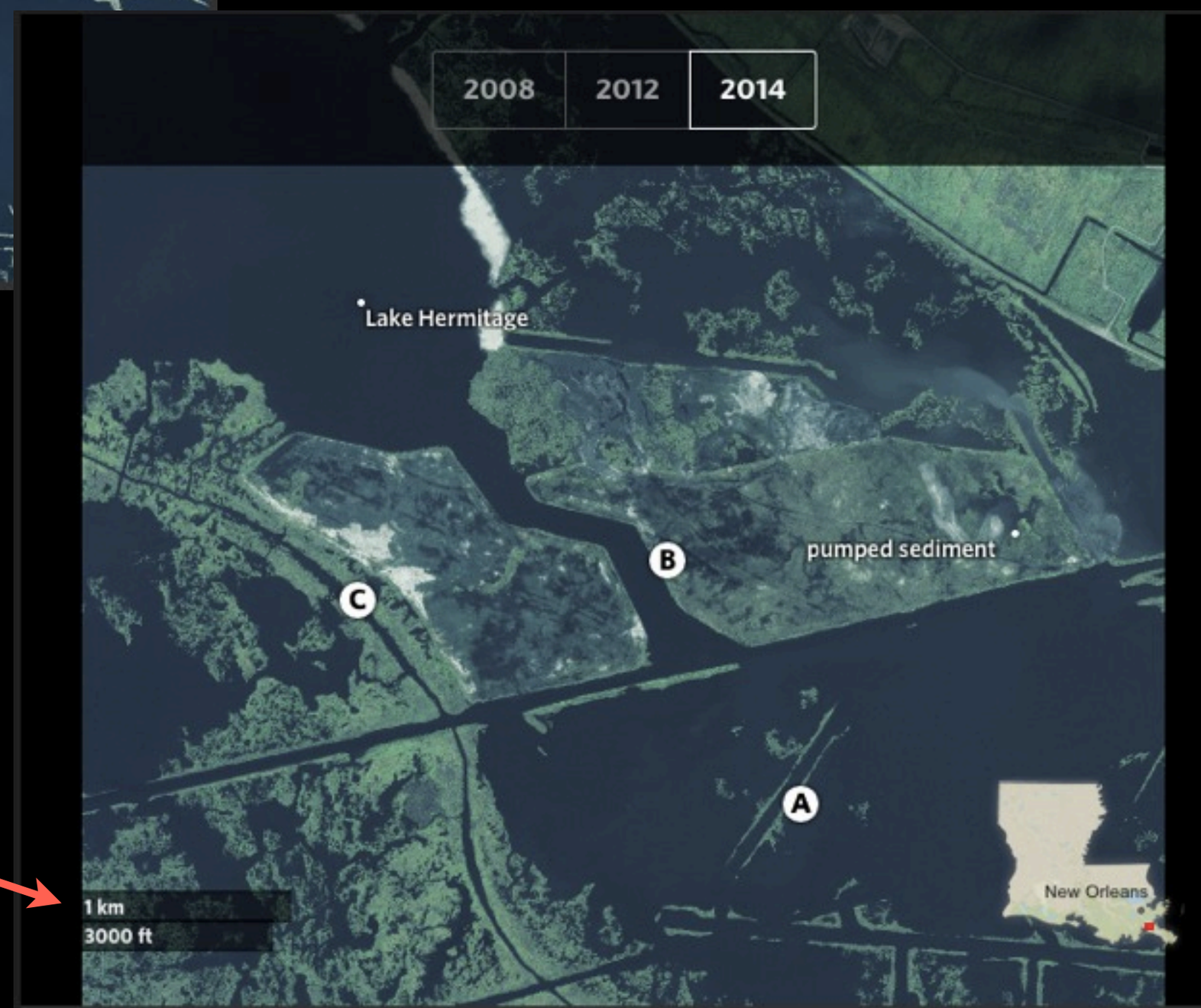
Lake Hermitage

Lake Hermitage

http://www.propublica.org/nerds/item/reporting-from-the-youngest-land-in-the-world

When you have to buy imagery: Digital Globe

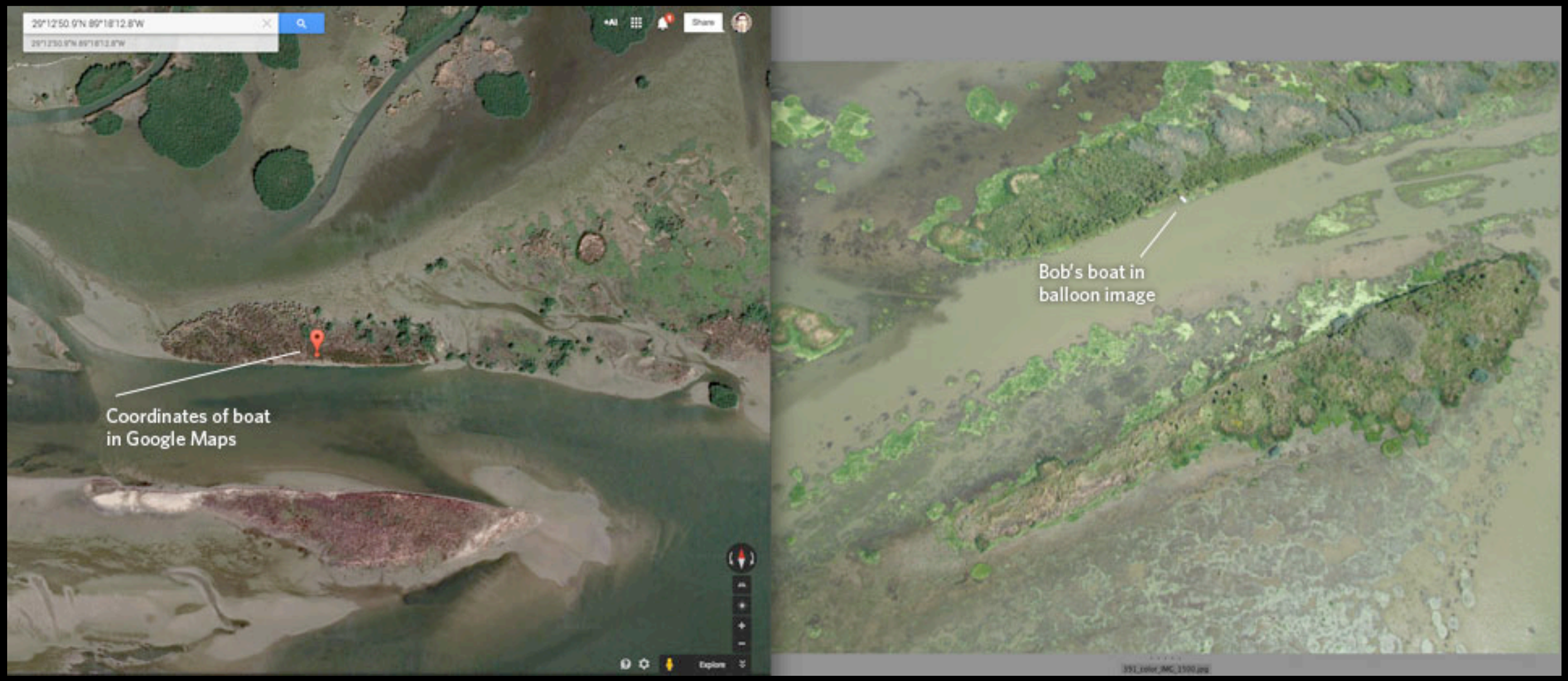




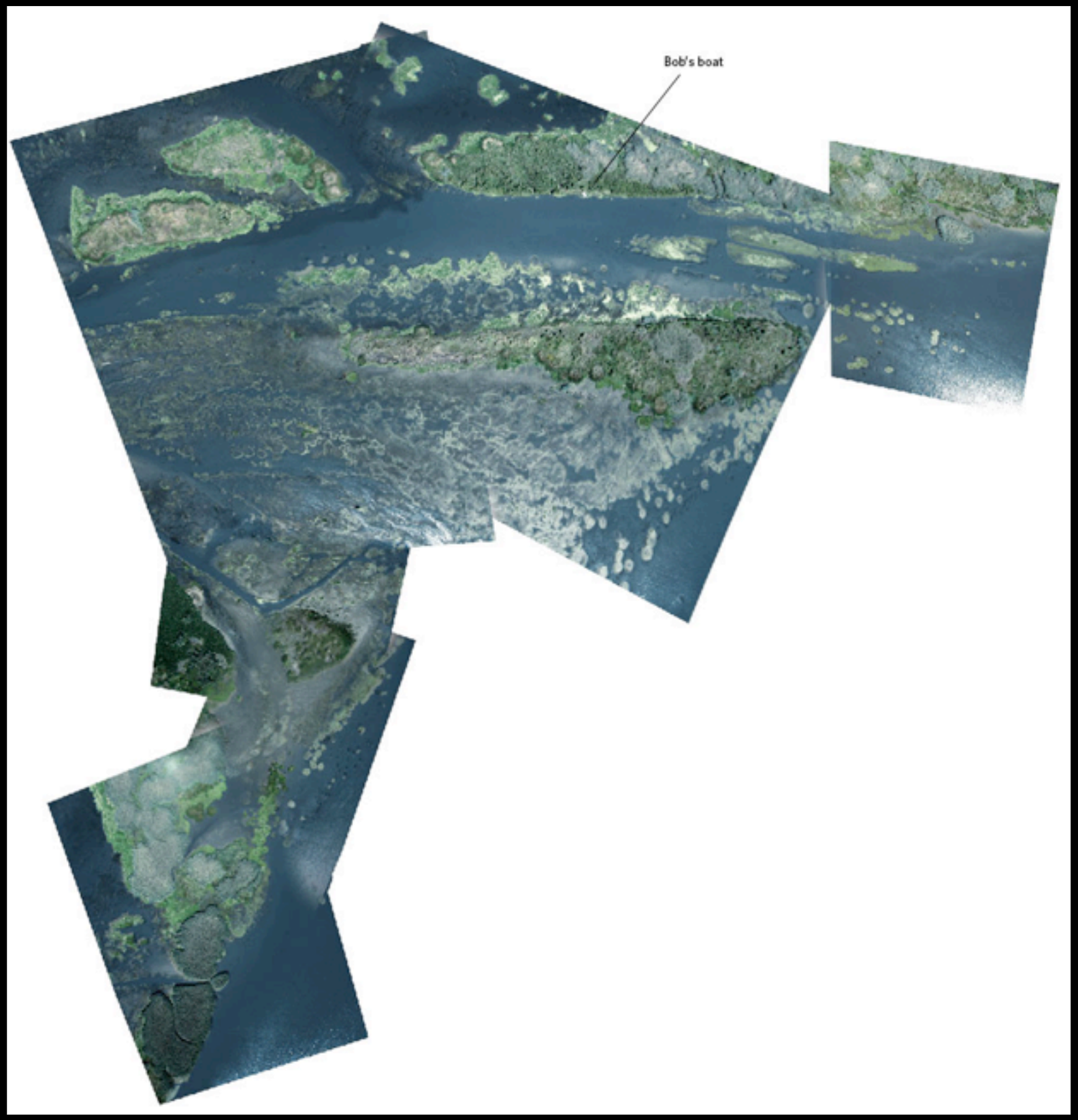
Digital Globe, USGS

West Bay Diversion

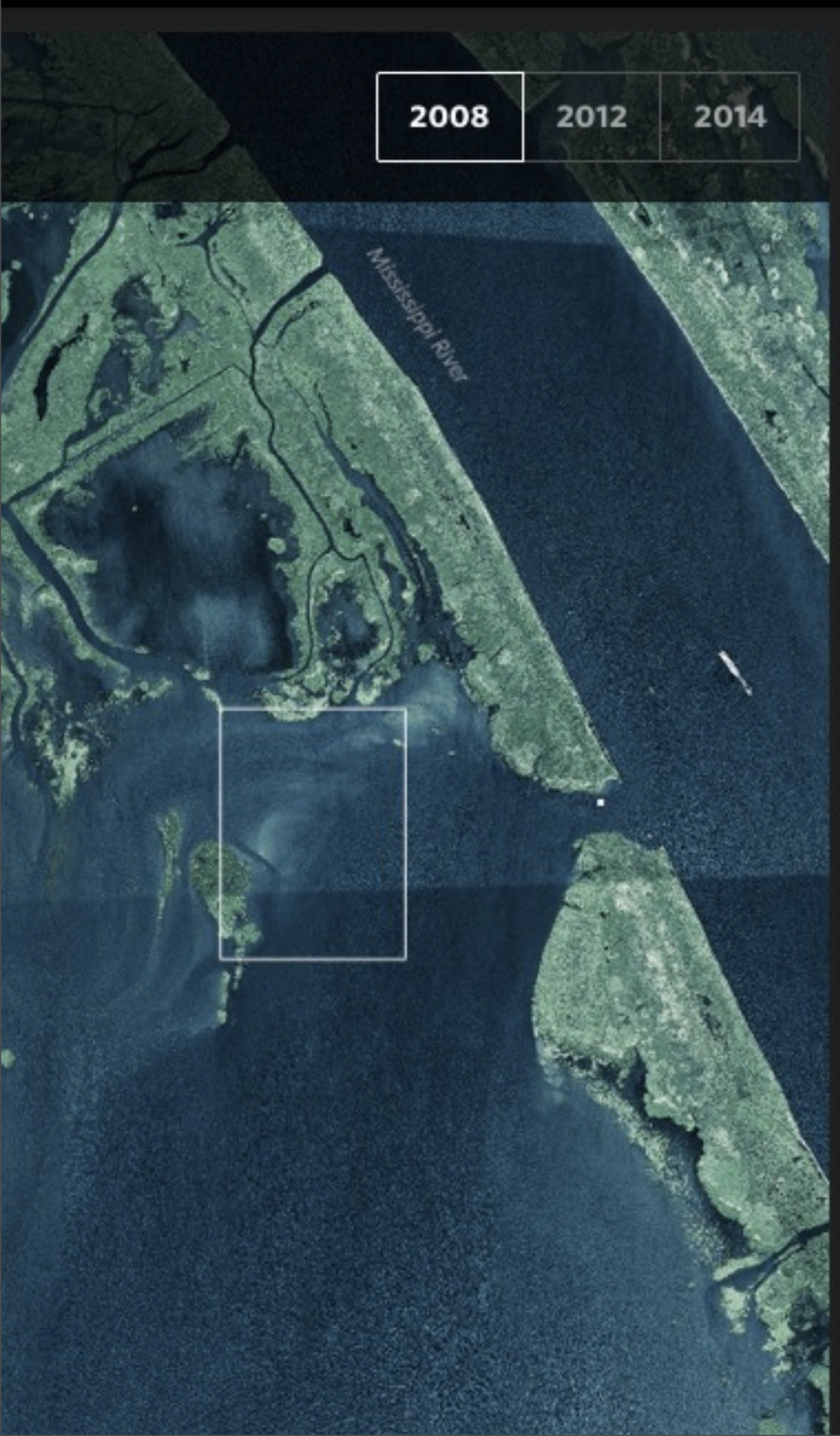
West Bay Diversion

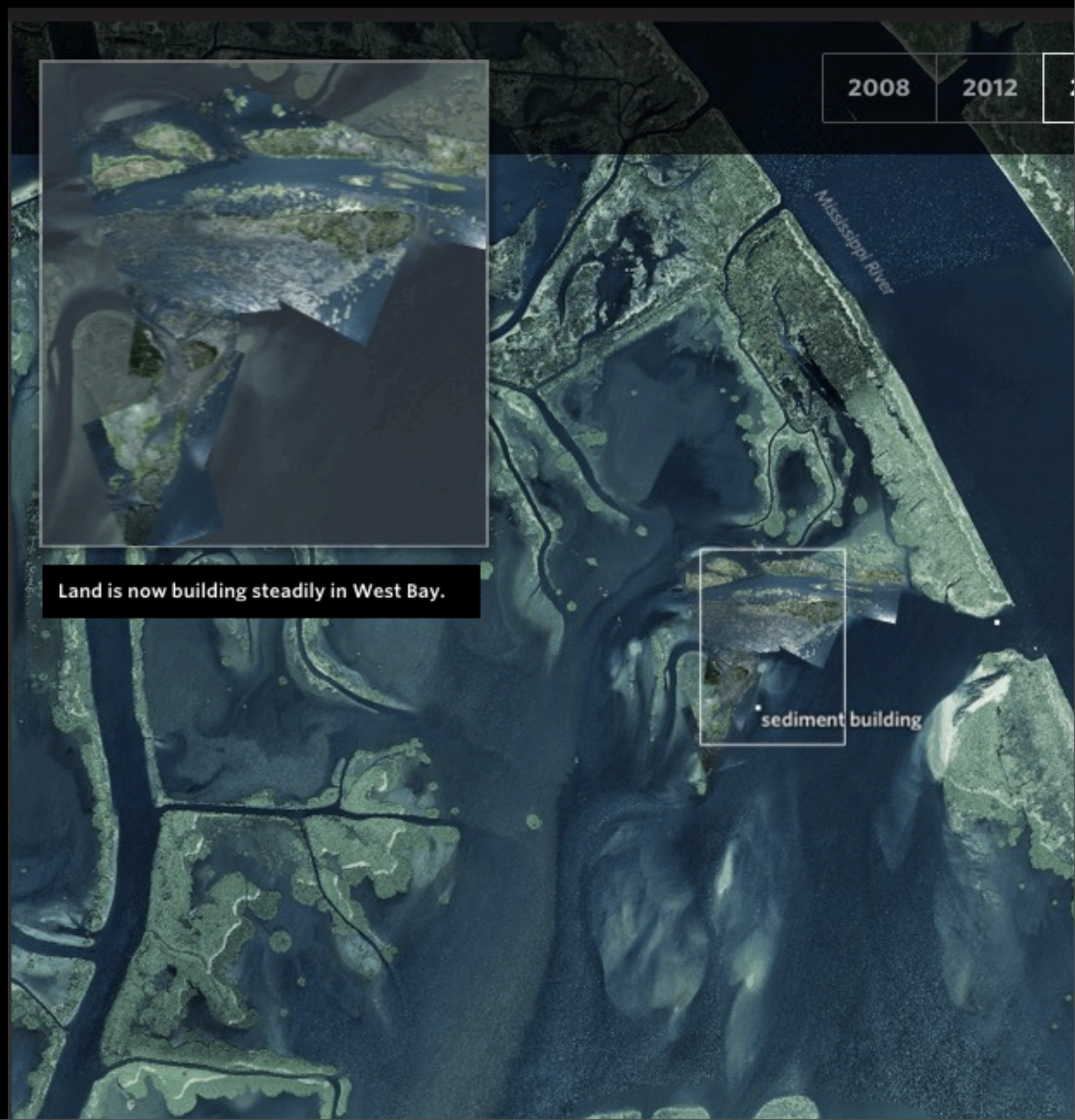


West Bay Diversion



West Bay Diversion





projects.propublica.org/larestoration