



# USGS Nonindigenous Aquatic Species Flood and Storm Tracker (NAS FaST) Maps

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# Nonindigenous Aquatic Species (NAS) information resource for the United States Geological Survey

- The program is the central repository for spatially referenced accounts of introduced aquatic species.
- The program provides scientific reports, online/ realtime queries, spatial data sets, distribution maps, and general information.
- The data are made available for use by biologists, interagency groups, and the general public.
- Part of the Early Detection Rapid Response



<https://nas.er.usgs.gov/>



# Nonindigenous Aquatic Species (NAS) information resource for the United States Geological Survey

- Tracks 1,245 aquatic species
- Across Conterminous US, Alaska, Hawaii, and US territories
- NAS Database has 515,532 expert verified records

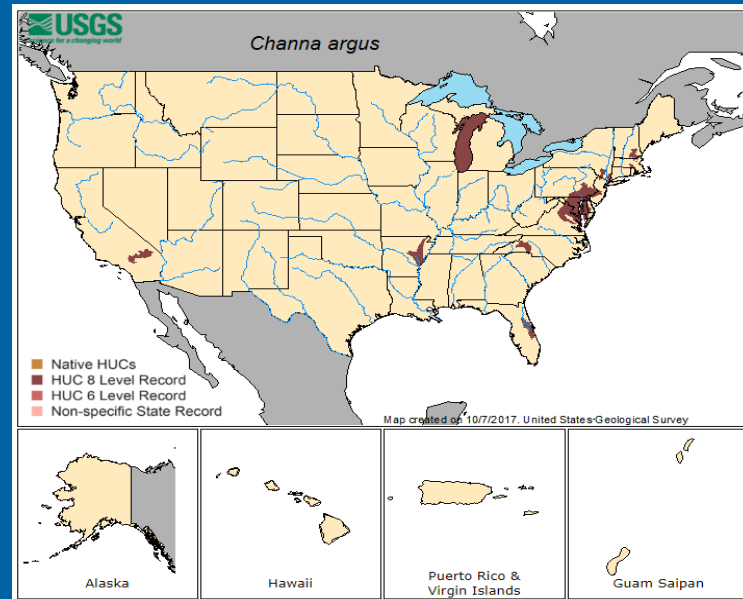


<https://nas.er.usgs.gov/>



# Nonindigenous Aquatic Species (NAS) information resource for the United States Geological Survey

- Nonindigenous occurrences
  - In a downloadable database
  - Displayed on interactive point distribution maps
    - If native, also includes the native range
- Species profile
  - Information on identification, ecology, means of introduction, impact of introduction, and much more



Northern Snakehead  
(*Channa argus*) range



# Nonindigenous Aquatic Species Flood and Storm Tracker (NAS FaST) Maps

- Flooding during storm and hurricane events has the potential to transport nonindigenous aquatic species.
- As part of the EDRR system, the NAS program is interested in alerting managers of these possible new introductions.
- Once a species is introduced, the best chance of eradication or containment is as an incipient population.




# NAS FaST Maps

- Created to help assess transportation of nonindigenous aquatic species between drainages due to storm surge and inland flooding.
- Help natural resource managers determine potential new locations for individual species, or to develop a watchlist of potential new species within a watershed.
- Maps were created by using known locations of established or possibly established species.
  - All surrounding hydrologic units (HUCs at the 8 digit level) were selected as potential areas of infestation



# NAS FaST Maps

- <https://nas.er.usgs.gov/viewer/Flooding/>



**NAS - Nonindigenous Aquatic Species**

Home    Alert System    Database & Queries    Taxa Information

**NAS FaST - Flood and Storm Tracker**

Welcome to the Nonindigenous Aquatic Species (NAS) information resource for the United States Geological Survey. Located at Gainesville, Florida, this site has been established as a central repository for spatially referenced biogeographic accounts of introduced aquatic species. The program provides scientific reports, online/realtime queries, spatial data sets, distribution maps, and general information. The data are made available for use by biologists, interagency groups, and the general public. The geographical coverage is the United States.

## Flooding Maps

These maps were created to help assess impacts on nonindigenous aquatic species distributions due to flooding associated with storms. Storm surge and flood events can assist expansion and distribution of nonindigenous aquatic species through adjacent watersheds, backflow of water upstream of impoundments, increased downstream flow, and/or creation of bridges along coastal regions. These maps will help natural resource managers determine potential new locations for species, or to develop a watchlist of potential new species within a watershed.

Hurricane images courtesy of NASA

### Hurricane Nate

October 4, 2017 - October 11, 2017



### Hurricane Maria

September 16, 2017 - October 3, 2017



### Hurricane Irma

August 30, 2017 - September 16, 2017



### Hurricane Harvey

August 25, 2017 - September 3, 2017



# NAS FaST Maps

Stage 1  
2-4 Days

Initial rapid response and the creation of a map of potential flooded HUCs. Maps will include information about NAS that could spread.

Stage 2  
4-6 Weeks

Follow-up assessment of drainages that had flooding conditions that could breach drainage divides from coastal storm surge or inland flooding.

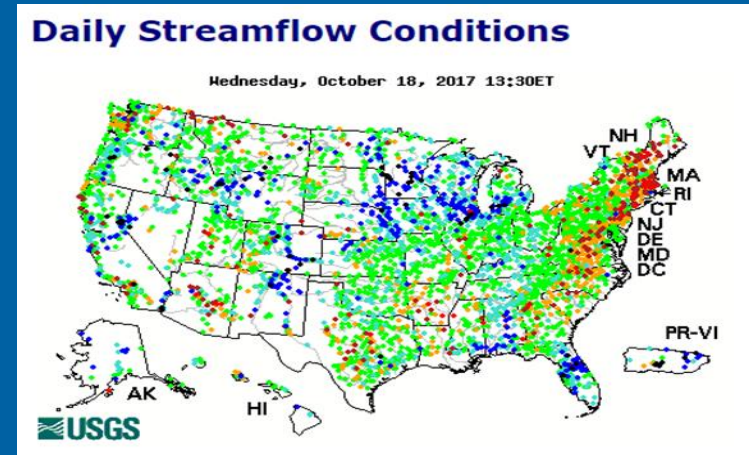
Stage 3  
12-18 Months

Final review of which drainages were connected from flooding and any records of potential NAS transport due to coastal storm surge or inland flooding.



# Stage 1 of NAS FaST Maps (2-4 Days)

- Area of interest was defined using USGS WaterWatch data on flood and high flow conditions.
- The areas with stream gages or storm tide sensors at flood stage were selected.
- The map was created by using known locations of established or possibly established species. All surrounding hydrologic units (HUCs at the 8 digit level) were selected as potential areas of infestation.
- Led by Wesley Daniel (USGS)



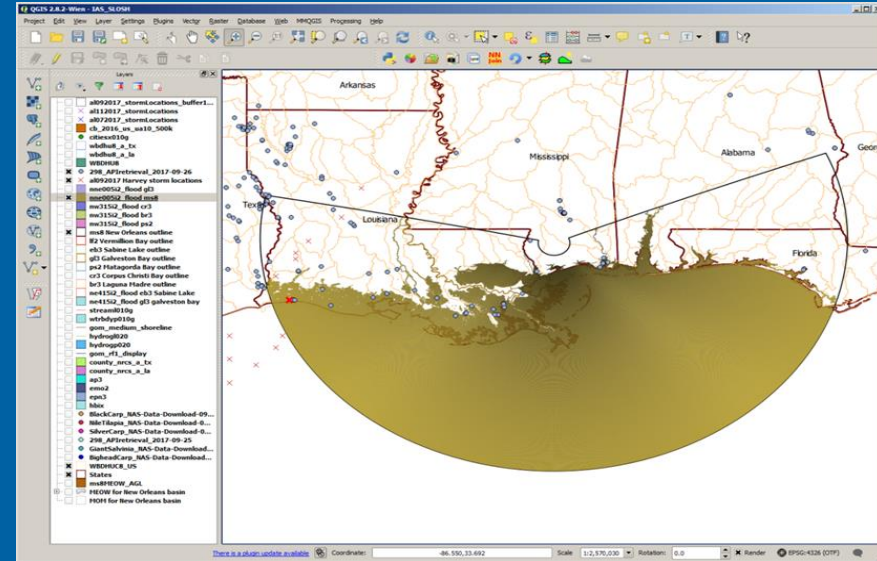
USGS Streamflow gages

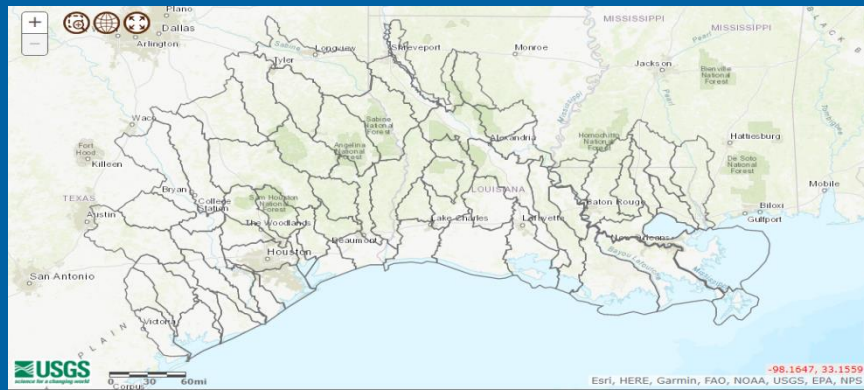
# Additional in the near future

# Modeled storm surge flooding

## Pilot Storm surge modeling

- Storm surge of hurricanes based on data from NOAA:
- storm category
- direction
- forward speed
- initial tide level
- Identify coastal drainages that have the potential to flood
- Led by Bogdan Chivoiu (USGS)

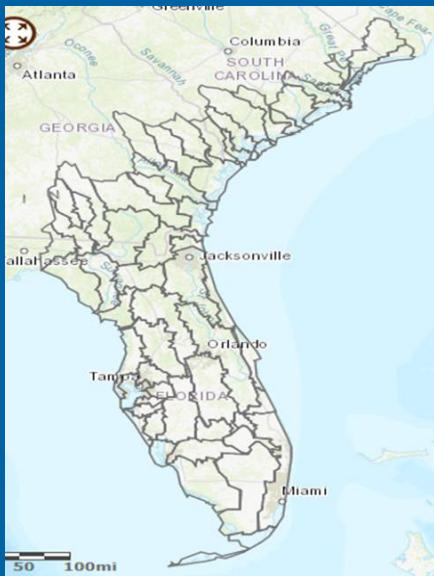




# Hurricane Harvey

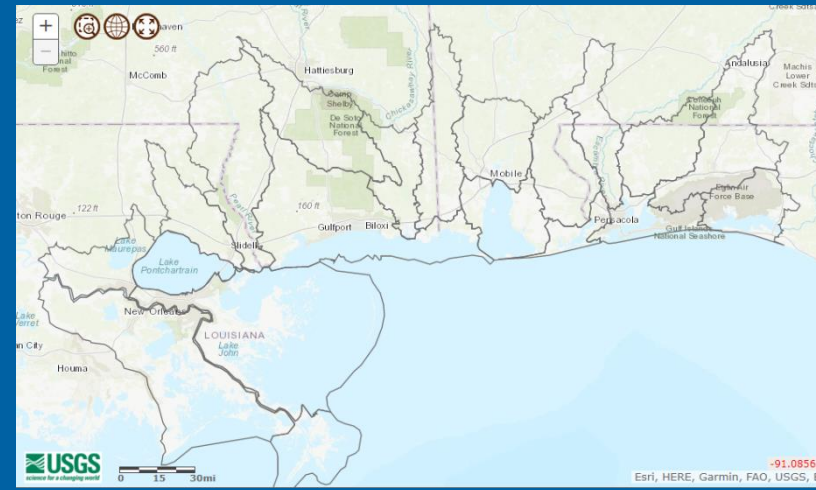


# Hurricane Maria



# Hurricane Nate

# Hurricane Irma



# Current and future flood maps

## Current maps

- Hurricane Harvey
- Hurricane Irma
- Hurricane Maria
- Hurricane Nate

## Future maps

- Any future hurricane or storm event with significant flooding.
- Hurricane Matthew
- August 2016 Baton Rouge, LA flood
- October 2015 North American storm complex

# Hurricane Irma (Aug. 30<sup>th</sup> – Sept. 16<sup>th</sup>)



## NAS - Nonindigenous Aquatic Species

[Home](#)[Alert System](#)[Database & Queries](#)[Taxa Information](#)[Report a Sighting](#)

### Potential Hurricane Irma Impact

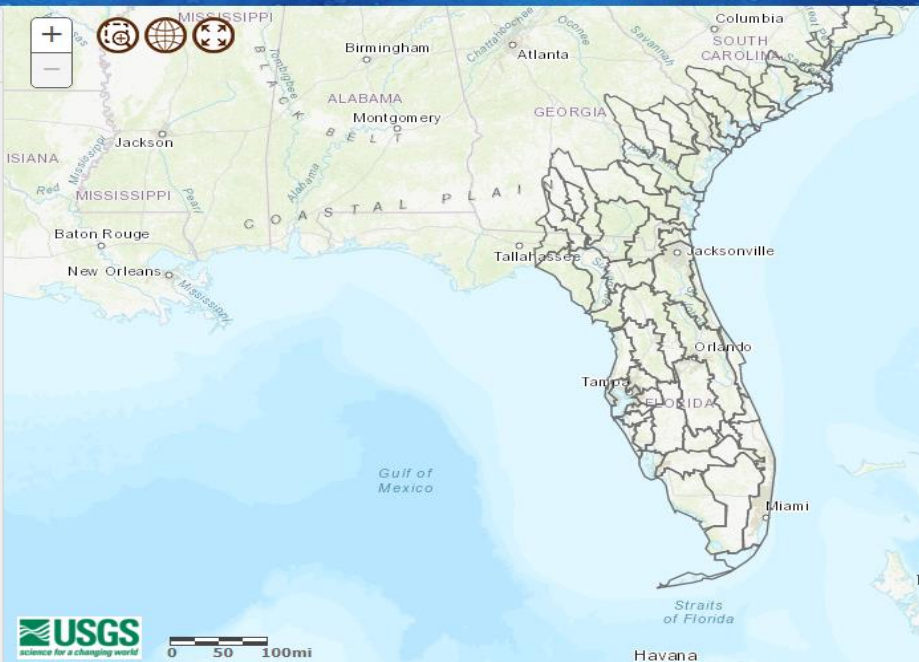
Select a species:

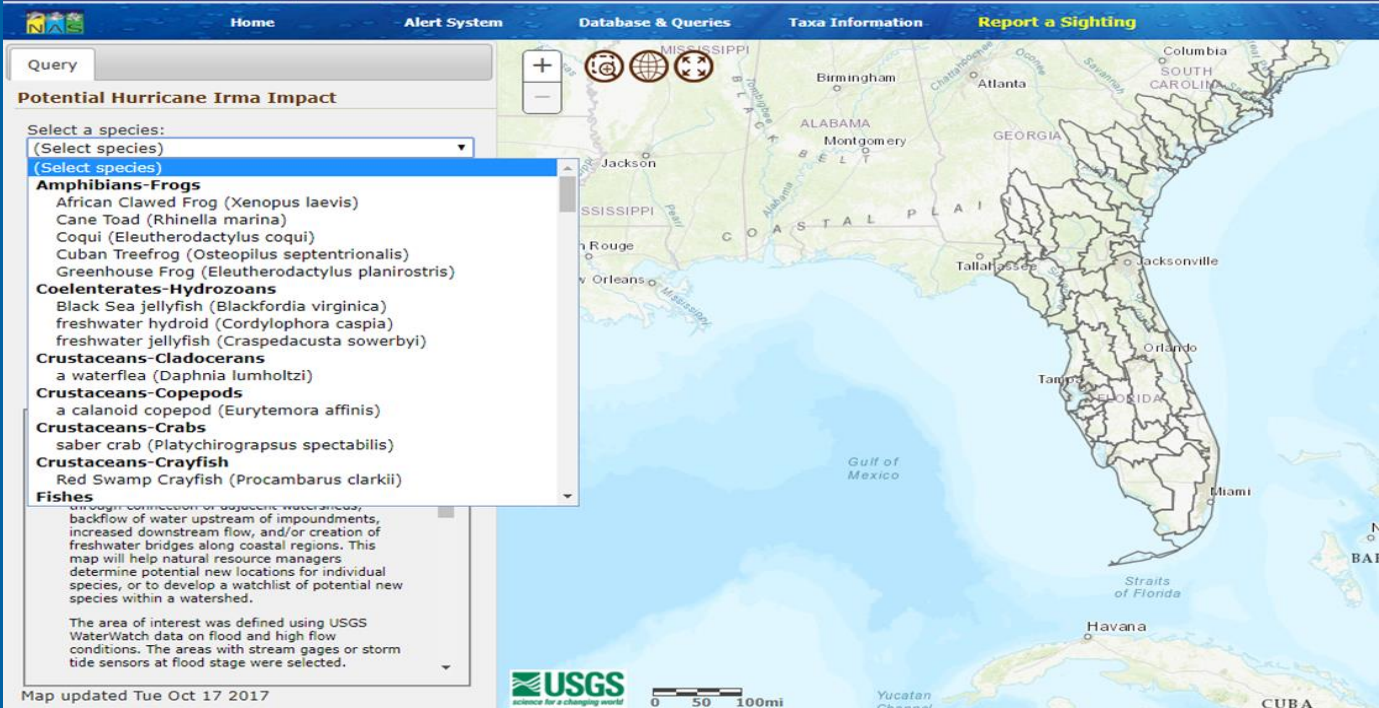
#### Explanation/Disclaimer

This map was created to help assess impacts on nonindigenous aquatic species distributions due to flooding associated with Hurricane Irma. Storm surge and flood events can assist expansion and distribution of nonindigenous aquatic species through connection of adjacent watersheds, backflow of water upstream of impoundments, increased downstream flow, and/or creation of freshwater bridges along coastal regions. This map will help natural resource managers determine potential new locations for individual species, or to develop a watchlist of potential new species within a watershed.

The area of interest was defined using USGS WaterWatch data on flood and high flow conditions. The areas with stream gages or storm tide sensors at flood stage were selected.

Map updated Tue Oct 17 2017





Query

Potential Hurricane Irma Impact

Select a species:  
(Select species)

(Select species)

**Amphibians-Frogs**  
African Clawed Frog (*Xenopus laevis*)  
Cane Toad (*Rhinella marina*)  
Coqui (*Eleutherodactylus coqui*)  
Cuban Treefrog (*Osteopilus septentrionalis*)  
Greenhouse Frog (*Eleutherodactylus planirostris*)

**Coelenterates-Hydrozoans**  
Black Sea jellyfish (*Blackfordia virginica*)  
freshwater hydroid (*Cordylophora caspia*)  
freshwater jellyfish (*Craspedacusta sowerbyi*)

**Crustaceans-Cladocerans**  
a waterflea (*Daphnia lumholzi*)

**Crustaceans-Copepods**  
a calanoid copepod (*Eurytemora affinis*)

**Crustaceans-Crabs**  
saber crab (*Platychirograpsus spectabilis*)

**Crustaceans-Crayfish**  
Red Swamp Crayfish (*Procambarus clarkii*)

**Fishes**  
through connection of adjacent water areas, backflow of water upstream of impoundments, increased downstream flow, and/or creation of freshwater bridges along coastal regions. This map will help natural resource managers determine potential new locations for individual species, or to develop a watchlist of potential new species within a watershed.

The area of interest was defined using USGS WaterWatch data on flood and high flow conditions. The areas with stream gages or storm tide sensors at flood stage were selected.

Map updated Tue Oct 17 2017

USGS science for a changing world

0 50 100mi

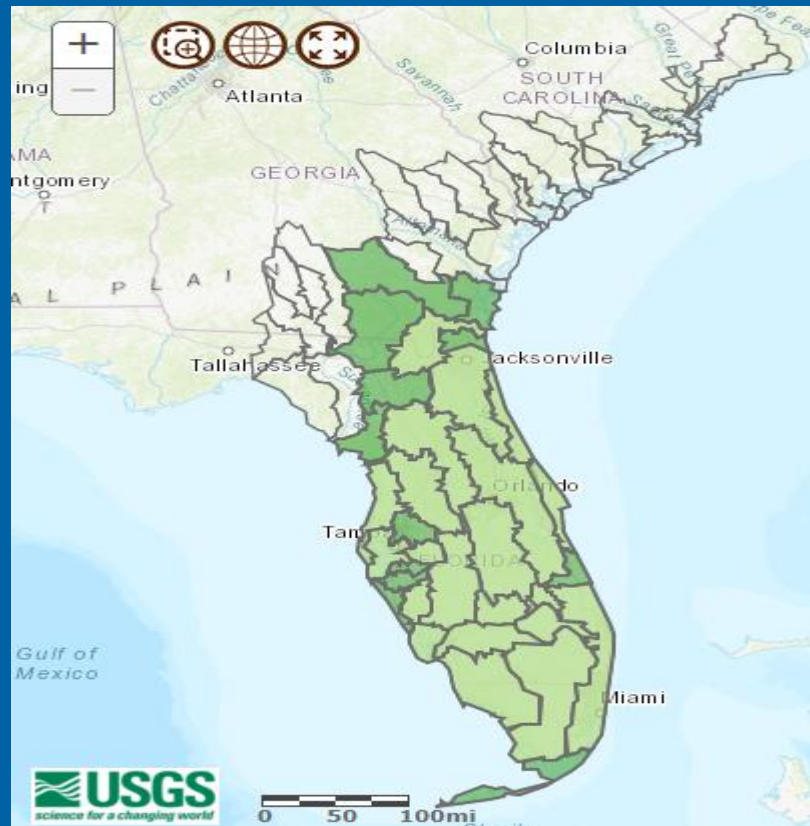
Yucatan Channel

CUBA

- All potential Nonindigenous Aquatic Species (plants and animals) that could be spread between drainages

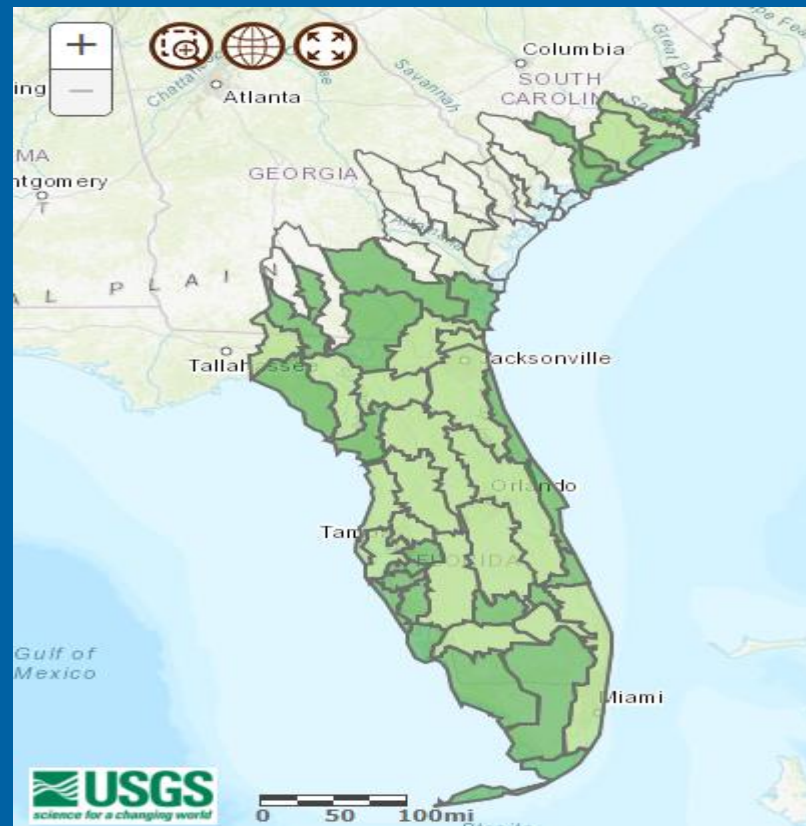
# Hurricane Irma

- Brown Hoplo (*Hoplosternum littorale*)
- Native to South America, east of the Andes and north of Buenos Aires
- Introduced range throughout the Florida peninsula and southwest Georgia.



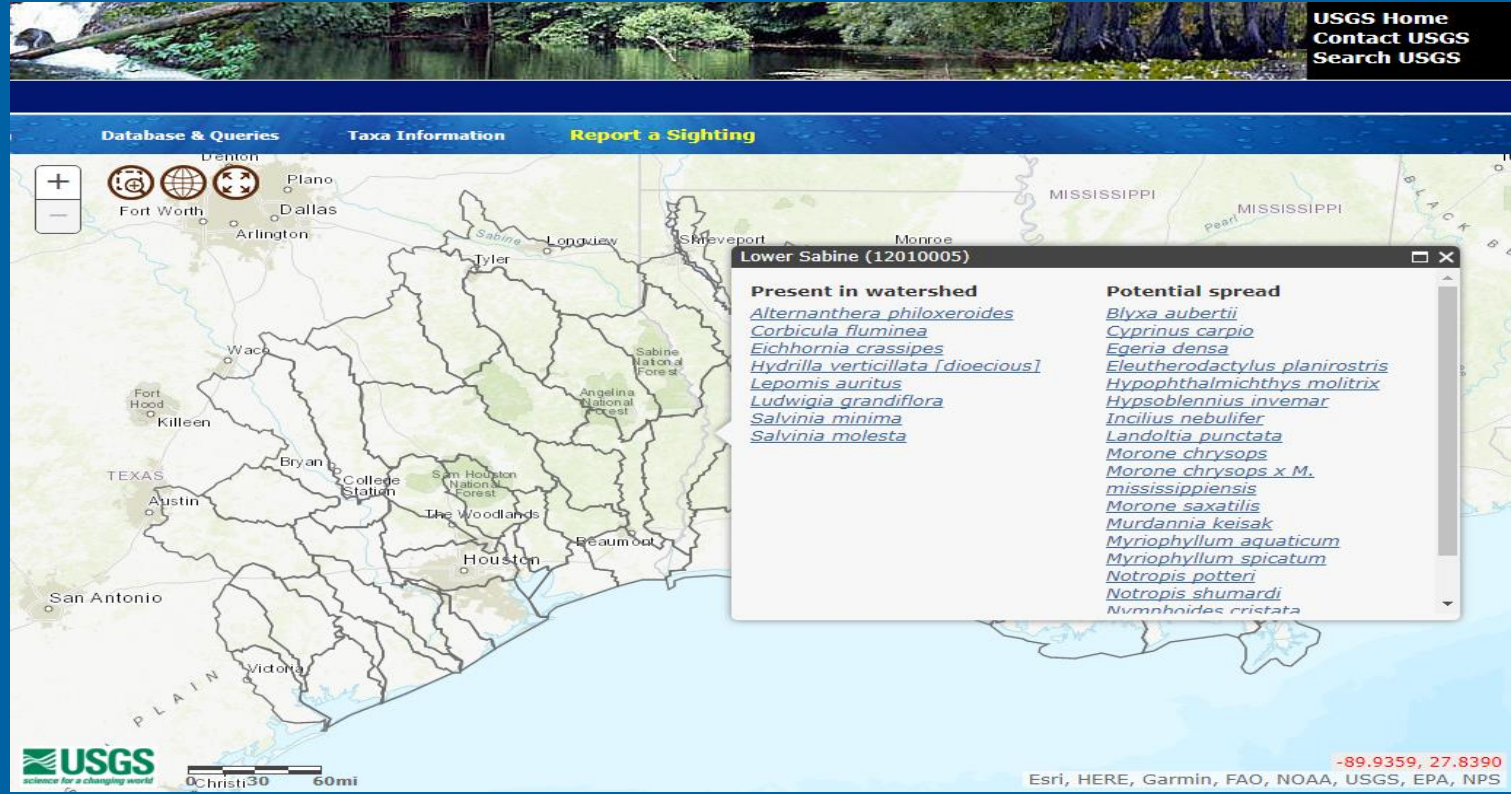
# Hurricane Irma

- Brazilian waterweed (*Egeria densa*)
- Native to South America, central Brazil, coast of Argentina, and coast of Uruguay.
- Introduced range throughout southeast and Midwest US and the west coast.



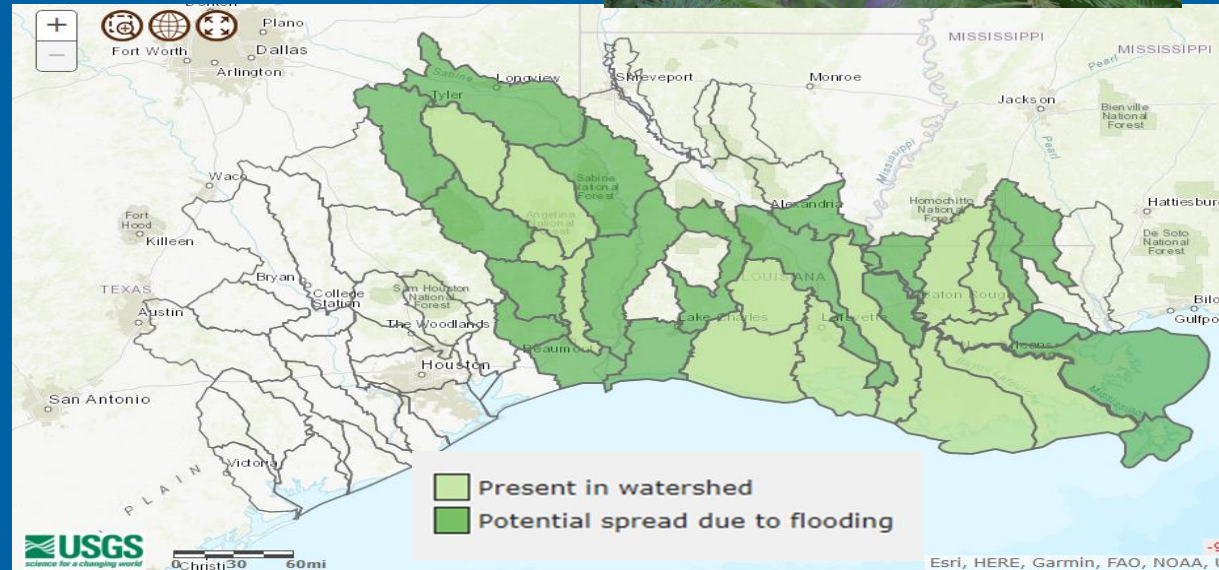


# Hurricane Harvey (Aug. 25<sup>th</sup> – Sept. 3<sup>rd</sup>)



# Hurricane Harvey

- Parrot Feather (*Myriophyllum aquaticum*)
- Native of the Amazon River basin in South America, including Brazil, Bolivia, Ecuador, Peru, as well as Argentina, Chile, and Paraguay.
- Introduced range throughout Southeast US and the West Coast.

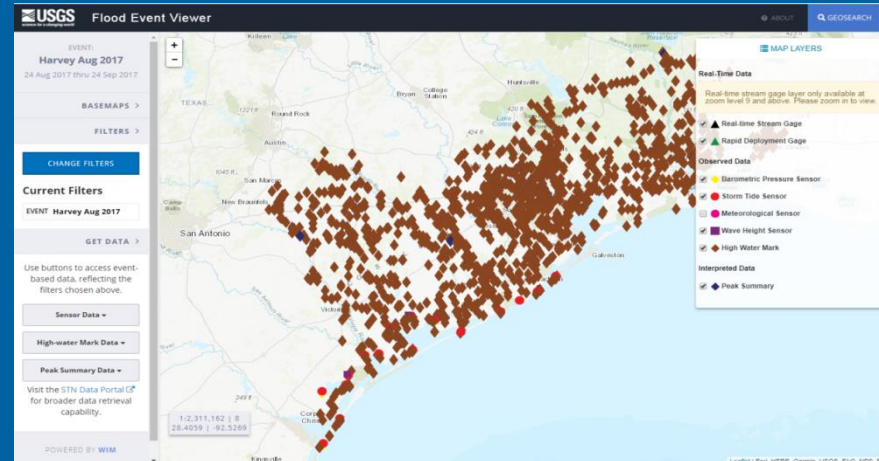


# Stage 2 of NAS FaST Maps

## 4-6 weeks post-hurricane

- Identify flooding conditions that could breach drainage divides from coastal storm surge or inland flooding.
- Make use of USGS WaterWatch data of stream gages or storm tide sensors at flood stage.
- Identify which drainages that had flooding conditions that would breach drainage divides.

High water marks from  
USGS WaterWatch

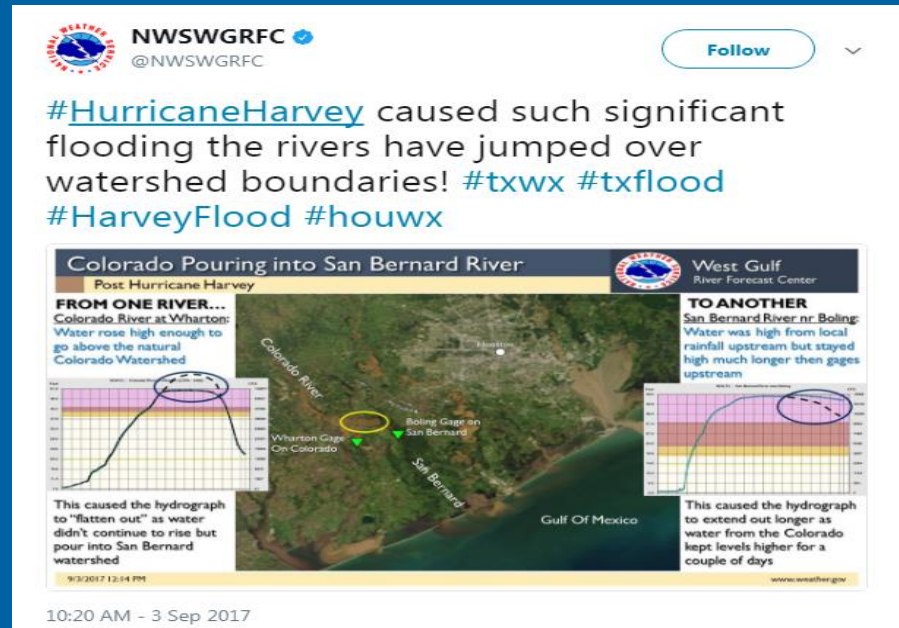


# Stage 3 of NAS FaST Maps

## 12-18 months post-hurricane

- Review post-hurricane NAS surveys or sightings to identify any species that could have been transported by flooding.
  - Will take time to potentially find
- Utilize final USGS WaterWatch data to determine which drainages were connected.

Picture from Twitter showing the Colorado River flooding into the San Bernard River



# Upcoming enhancements

- Moving from a HUC-8 to HUC-12 maps
  - More accurate picture of drainage flooding



# Upcoming enhancements

- **Addition of life history traits**
  - **Assess the species ability to be transported in flood conditions**
    - **Salinity tolerance (freshwater lens around coastal areas)**
    - **Ability to float (e.g. apple snails)**
    - **Movement of nonindigenous plants by vegetative fragmentation**



# NAS FaST Maps

- NAS FaST Maps provides a additional tool for Early Detection and Rapid Response (EDRR) system for managers or public to assist with post-storm detection and assessment efforts.
- The ability to know what flood level or surge height could spread these species, and where they could move.
- Once a species is introduced, the best chance of eradication or containment is as an incipient population.

<https://nas.er.usgs.gov/viewer/Flooding/>



# Questions?



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