

# Drought Indicators Report

Georgia Environmental Protection Division  
February 2017

# Background

Pursuant to the Rules for Drought Management, Section 391-3-3-.04 Drought Indicators and Triggers, the Director of EPD monitors climatic indicators and water supply conditions to assess drought occurrence and severity, and its impact upon the ability of public water systems to provide adequate supplies of water. These indicators and conditions may include, but not be limited, to the following:

- U.S. Drought Monitor;
- Precipitation;
- Streamflow;
- Groundwater;
- Reservoir levels;
- Short term climate predictions;
- Soil moisture; and
- Water supply conditions.

# Background

- The Rules require EPD to report on current climatic indicators at least semi-annually or monthly when any part of the state has experienced at least two consecutive months of severe drought.
- This reports compare current conditions to historical levels (and/or reservoir rule curves) for each of the following indicators:
  - Precipitation during the prior 3, 6, and 12 months;
  - Streamflow at the select United States Geological Survey gages;
  - Groundwater levels at select United States Geological Survey monitoring wells; and
  - Reservoir levels at Allatoona Lake, Lake Hartwell, Clarks Hill Lake, and Lake Lanier.
- The following sections of this presentation provide the data and information sources analyzed by EPD in developing this drought indicators report for conditions as of February 23, 2017.

# Drought Indicator Analysis Summary (slide 1 of 2)

**U.S. Drought Monitor** – Extreme drought is in all or parts of 21 counties in the northern quarter of the state. Severe drought remains in an additional 34 counties north of the fall line. This week marks the 39th week of continuous severe (or more intense) drought in northwest Georgia, the 37th week for the northern Atlanta metro area, the 36th week in parts of the northeast.

**Precipitation**– The 3 month records show surplus amounts of rainfall in the southern 2/3 of the state, but extreme north Georgia still show deficits of more than -8” in the worst areas. The 6 month records show areas north of the fall line with the worst deficits, with extreme northwest, north central, and northeast Georgia showing deficits of -12” to more than -20” in the worst areas. The 12 month records show near normal to a slight surplus of rainfall in southwest, south central, and parts of southeast Georgia, while the greatest deficits still exist north of the fall line. Central Georgia and parts of southeast Georgia still show slight deficits in the long term.

**Soil Moisture** – Much of the state shows normal wetness or abnormal to severe wetness except for extreme north Georgia. Soil moisture conditions in northwest, north central, and northeast Georgia show abnormal to extreme dryness.

**Stream Flows** -- Recent rains have helped stream flows rebound but many tend to drop quickly after the rains subside. 9 of the 34 observation sites are at or below 2007 and/or 2011 levels and many locations show January levels well above normal.

# Drought Indicator Analysis Summary (slide 2 of 2)

**Groundwater** –Groundwater levels vary by location. Six wells are above median levels and six are below median levels. Two are below the 5th percentile of the historical record.

**Reservoir Levels** –In the ACT, Allatoona is at winter guide curve and Carters Lake is in zone 2. In the ACF, Lanier is zone 4, WestPoint and George both remain slightly above winter guide. ACF Composite storage is zone 2 and is projected to go into Zone 3. In the Savannah Basin, both Hartwell and Thurmond are in level 2 and remain in Corps drought level 2 operations.

**Short Term Climate Prediction** – Drought conditions in north Georgia are predicted to improve in the areas just north of the fall line, but persist in the more northern counties.

**Water Supplies** – Many systems are reporting that local water supplies have recovered or nearly recovered. Lanier is the primary exception, and it is approximately 10 feet down. Systems are still generally advising a cautious approach to discretionary water use. No water systems have drought variances at this time.

# US Drought Monitor

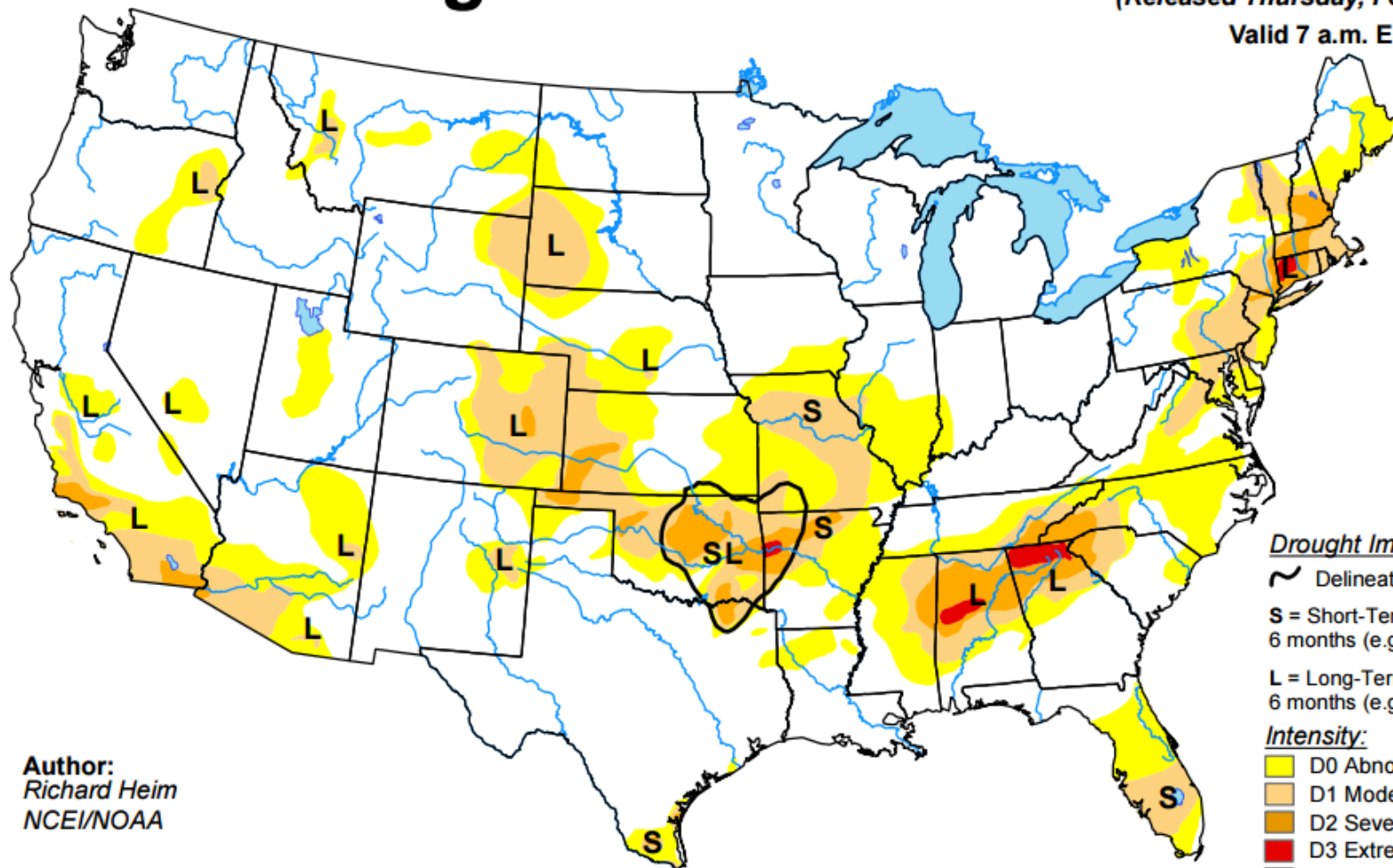
Data Source:

<http://droughtmonitor.unl.edu/>

# U.S. Drought Monitor

February 21, 2017  
(Released Thursday, Feb. 23, 2017)

Valid 7 a.m. EST



Author:  
Richard Heim  
NCEI/NOAA

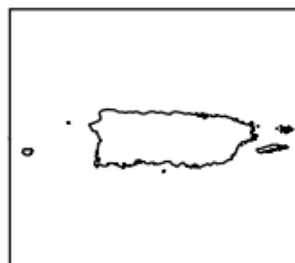
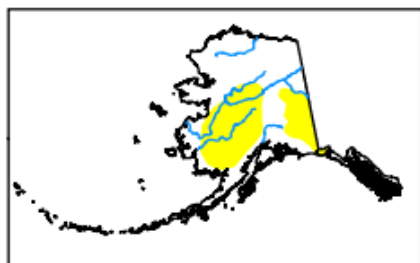
## Drought Impact Types:

- ~ Delineates dominant impacts
- S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

## Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.



<http://droughtmonitor.unl.edu/>

# U.S. Drought Monitor

## Georgia

**February 21, 2017**



(Released Thursday, Feb. 23, 2017)

Valid 7 a.m. EST

*Drought Conditions (Percent Area)*

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
<b>Current</b>	63.07	36.93	28.32	19.91	8.08	0.00
<b>Last Week</b> <i>2/14/2017</i>	63.07	36.93	30.94	19.79	5.39	0.00
<b>3 Months Ago</b> <i>11/22/2016</i>	0.00	100.00	76.64	67.76	56.60	33.78
<b>Start of Calendar Year</b> <i>1/3/2017</i>	11.31	88.69	73.48	39.33	19.28	0.00
<b>Start of Water Year</b> <i>9/27/2016</i>	35.37	64.63	45.84	34.50	14.67	1.58
<b>One Year Ago</b> <i>2/23/2016</i>	98.71	1.29	0.00	0.00	0.00	0.00

### Intensity:

 D0 Abnormally Dry	 D3 Extreme Drought
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 D2 Severe Drought	

*The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.*

### **Author:**

Richard Heim  
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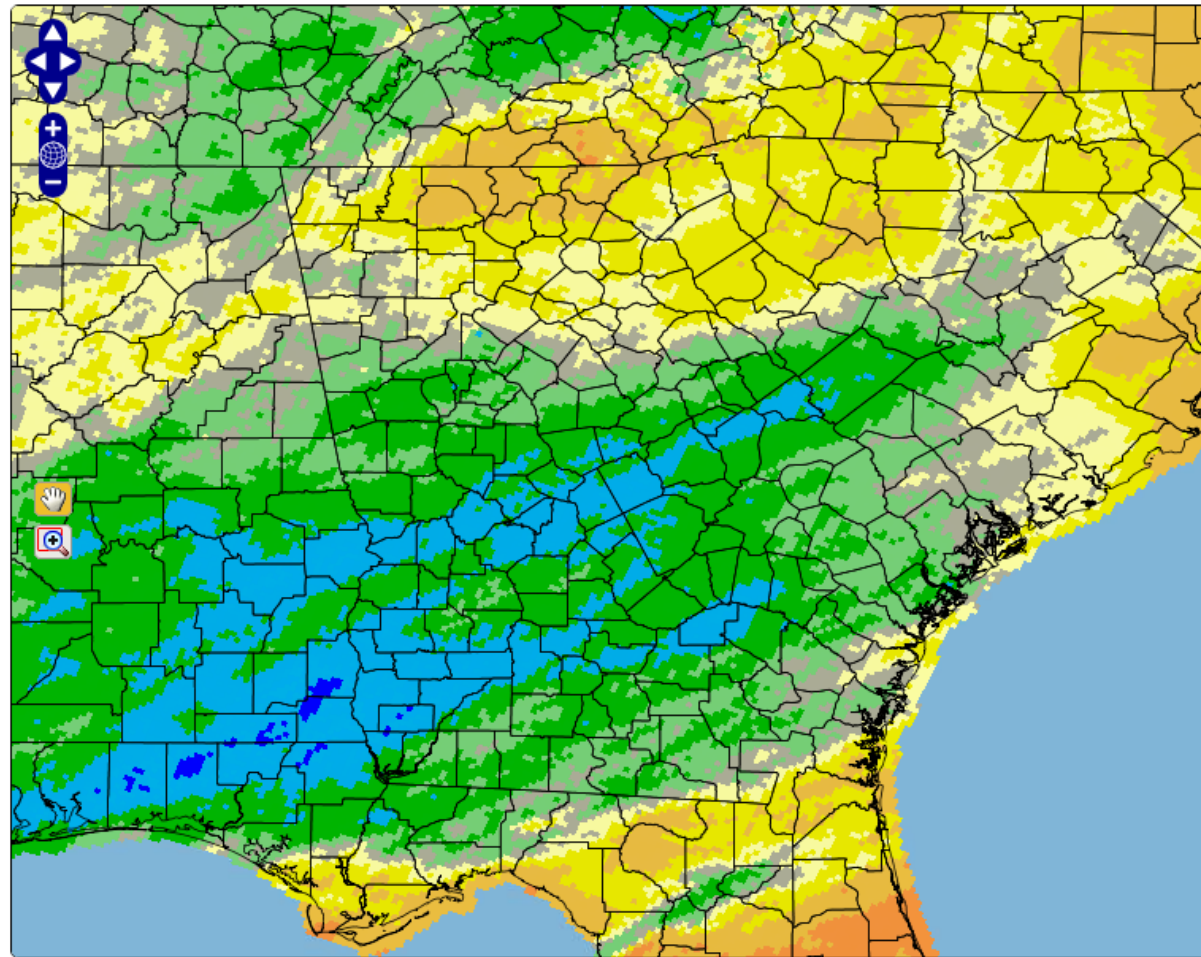


# 3, 6, and 12 Month Percent of Normal Precipitation

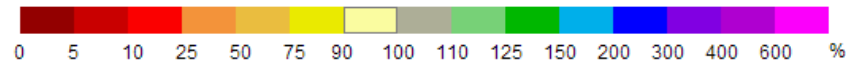
Data Source:

<http://climate.ncsu.edu/drought>

# 3 Month Percent of Normal Precipitation



90 day Percent of Normal Precipitation for February 13, 2017

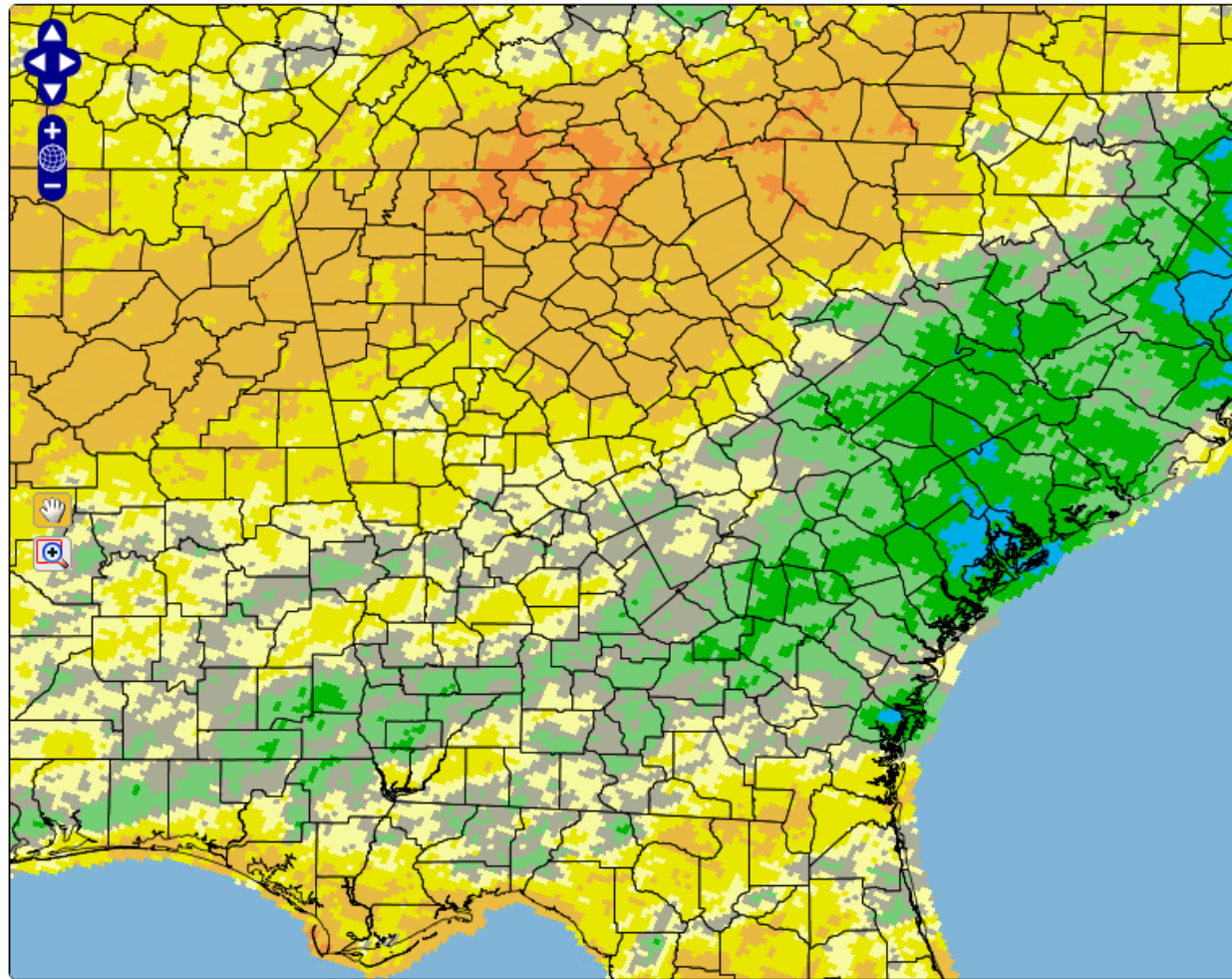


Transparency:

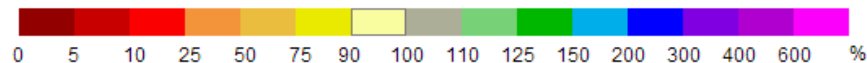


Map generated with  
AHPS Precipitation  
and 1981-2010  
PRISM normals

# 6 Month Percent of Normal Precipitation



6 month Percent of Normal Precipitation for February 13, 2017

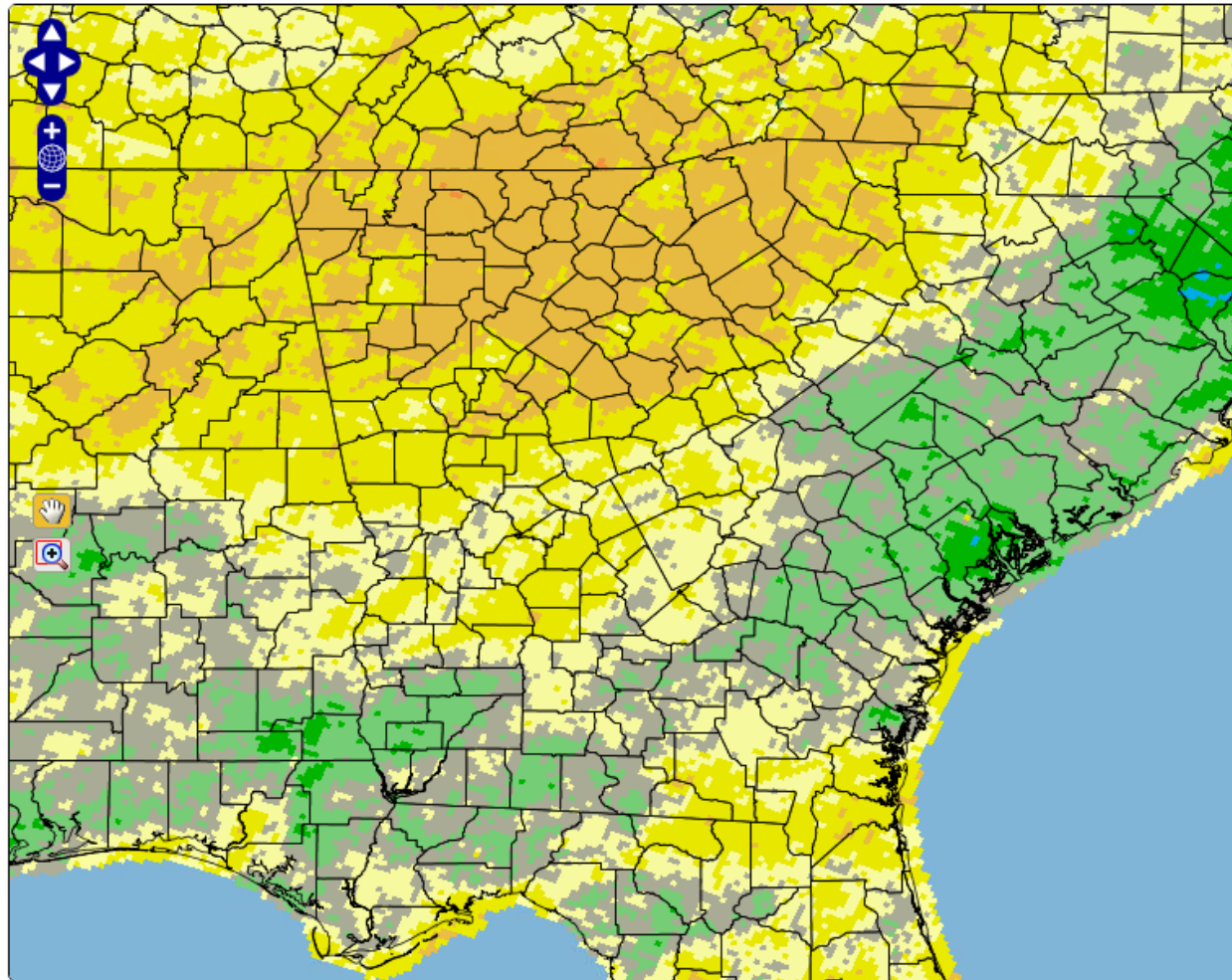


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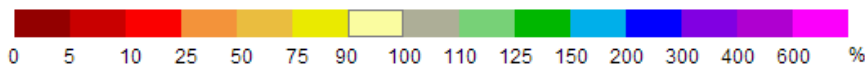


[About these maps](#)

# 12 Month Percent of Normal Precipitation



12 month Percent of Normal Precipitation for February 13, 2017



Transparency:



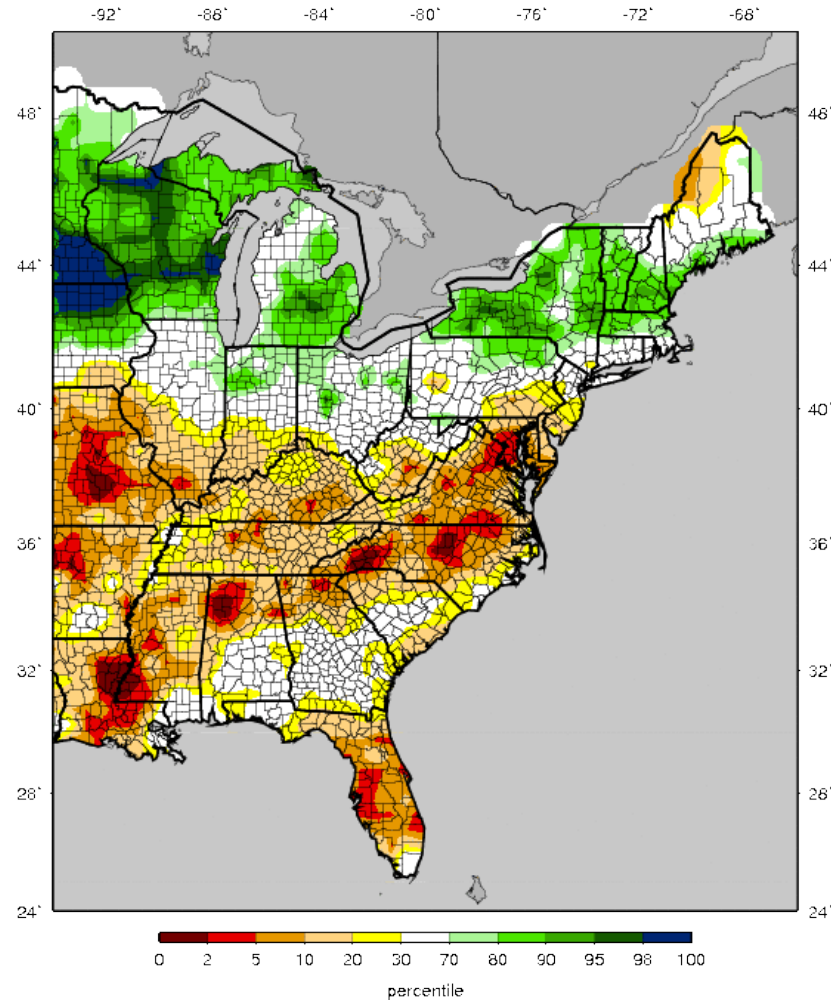
[About these maps](#)

# Soil Moisture Conditions

Data Source:

[http://www.hydro.washington.edu/forecast/monitor/curr/conus.mexico/east.vic.sm\\_qnt.gif](http://www.hydro.washington.edu/forecast/monitor/curr/conus.mexico/east.vic.sm_qnt.gif)

VIC Soil Moisture Percentiles (wrt/ 1916-2004)  
Eastern United States - 20170221



Current (daily updated) percentiles for soil moisture (SWE) with respect to the climatological period (1916-2004).

# Streamflow Conditions

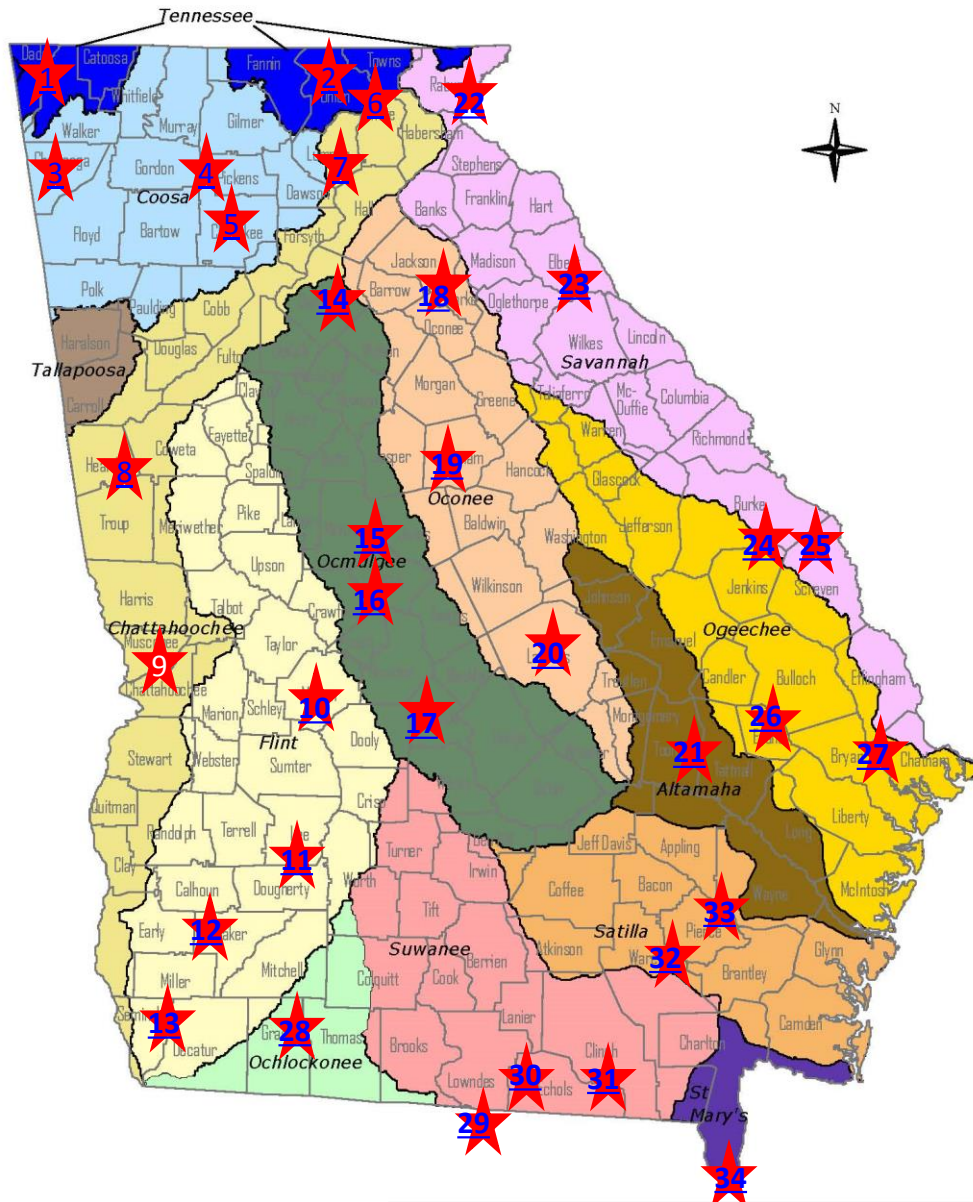
Data Source: USGS

# Streamflow Monitoring

- As shown on the following slide, EPD Monitors 34 USGS stream gages in 13 of the State's major river basins to assess drought conditions.
- These gages were selected because each has:
  - Long-term and relatively complete records for recent decades; and
  - Relatively low consumptive water use implications and streamflows are not heavily influenced by dams.
- Note: Hydrologic conditions of major rivers with streamflows that are heavily influenced by dams can be assessed by reviewing status of major storage reservoirs



# Georgia's 14 River Basins



## USGS Stream Gages Monitored by EPD to Assess Drought Conditions

<u>GAGE#</u>	<u>BASIN</u>	<u>GAGE NAME</u>
1	TENNESSEE	LOOKOUT CREEK NEAR NEW ENGLAND
2	TENNESSEE	NOTTELY RIVER NEAR BLAIRSVILLE
3	COOSA	CHATTOOGA RIVER AT SUMMERVILLE
4	COOSA	TALKING ROCK CREEK NEAR HINTON
5	COOSA	ETOWAH RIVER AT CANTON
6	CHATTAHOOCHEE	CHATTAHOOCHEE RIVER AT CORNELIA
7	CHATTAHOOCHEE	CHESTATEE RIVER NEAR DAHLONEGA
8	CHATTAHOOCHEE	NEW RIVER AT GA 100 NEAR CORINTH
9	CHATTAHOOCHEE	UPATOI CREEK AT COLUMBUS
10	FLINT	FLINT RIVER AT GA26 NEAR MONTEZUMA
11	FLINT	FLINT RIVER AT ALBANY
12	FLINT	ICHAWAYNOCHAWAY CREEK AT MILFORD
13	FLINT	SPRING CREEK NEAR IRON CITY
14	OCMULGEE	ALCOVY RIVER ABOVE COVINGTON
15	OCMULGEE	OCMULGEE RIVER AT MACON
16	OCMULGEE	TUBESOFKEE CREEK NEAR MACON
17	OCMULGEE	TUCSAWHATCHEE CREEK NEAR HAWKINSVILLE
18	OCONEE	MIDDLE OCONEE RIVER NEAR ATHENS
19	OCONEE	LITTLE RIVER NEAR EATONTON
20	OCONEE	OCONEE RIVER AT DUBLIN
21	ALTAMAHA	OHOOPEE RIVER NEAR REIDSVILLE
22	SAVANNAH	CHATTOOGA RIVER NEAR CLAYTON
23	SAVANNAH	BROAD RIVER NEAR BELL
24	SAVANNAH	BEAVERDAM CREEK NEAR SARDIS
25	SAVANNAH	BRIER CREEK AT MILLHAVEN
26	OGEECHEE	CANOOCHEE RIVER NEAR CLAXTON
27	OGEECHEE	OGEECHEE RIVER NEAR EDEN
28	OCHLOCKONEE	OCHLOCKONEE RIVER NEAR THOMASVILLE
29	SUWANEE	WITHLACOOCHEE RIVER NEAR PINETTA FL
30	SUWANEE	ALAPAHA RIVER AT STATENVILLE
31	SUWANEE	SUWANNEE RIVER AT US 441, AT FARGO
32	SATILLA	SATILLA RIVER NEAR WAYCROSS
33	SATILLA	LITTLE SATILLA RIVER NEAR OFFERMAN
34	ST MARY	ST MARYS RIVER NEAR MACCLENNY FL

# Streamflow Graphs

- For each of the 34 gages, EPD has prepared a graph that shows monthly average streamflow from January, 2017 through January, 2017;
- To help put these streamflow conditions into perspective, for comparison purposes, each graph also shows:
  - Monthly average streamflows for the years 2007 and 2011 when streamflows were at or near recorded low levels across much of the state; and
  - A statistical composite of historical conditions showing the “driest” 50, 20, 10, and 5 percent of all recorded monthly average stream flows at the same gage.

# How to Read the Streamflow Graphs

## Example #1: [Etowah River at Canton](#)

The streamflow graph for Gage #5, [USGS Etowah River gage at Canton](#) shows :

- Average stream flow for January 2017 was 603 cfs. The statistical composite of all historical data for this gage shows that average streamflow in January has historically been lower than January 2017 about 5% of the time; about 95% of the time in January it has been higher.
- Average stream flow in January 2011 was 611 cfs. The statistical composite of all historical data for this gage shows that average streamflow for January has historically been lower than January 2011 only 5% of the time; 95% of the time in January it has been higher.
- Average stream flow in January 2007 was 1596 cfs. The statistical composite of all historical data for this gage shows that average streamflow for January has historically been lower than January 2007 only 50% of the time; 50% of the time in January it has been higher.

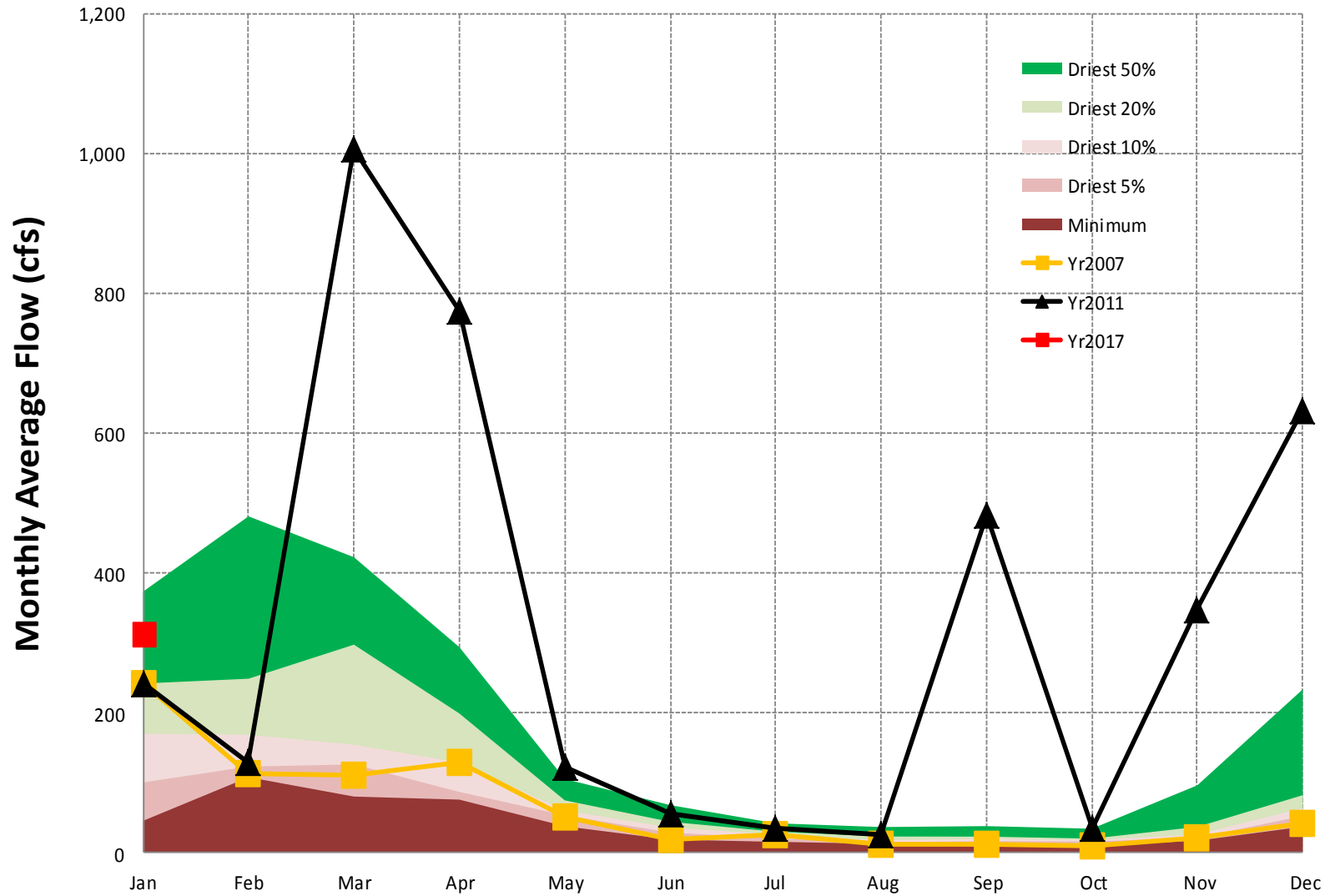
# How to Read the Streamflow Graphs

## Example #2: [Flint River at Albany](#)

The streamflow graph for Gage #11, [USGS Flint River gage at Albany](#) shows:

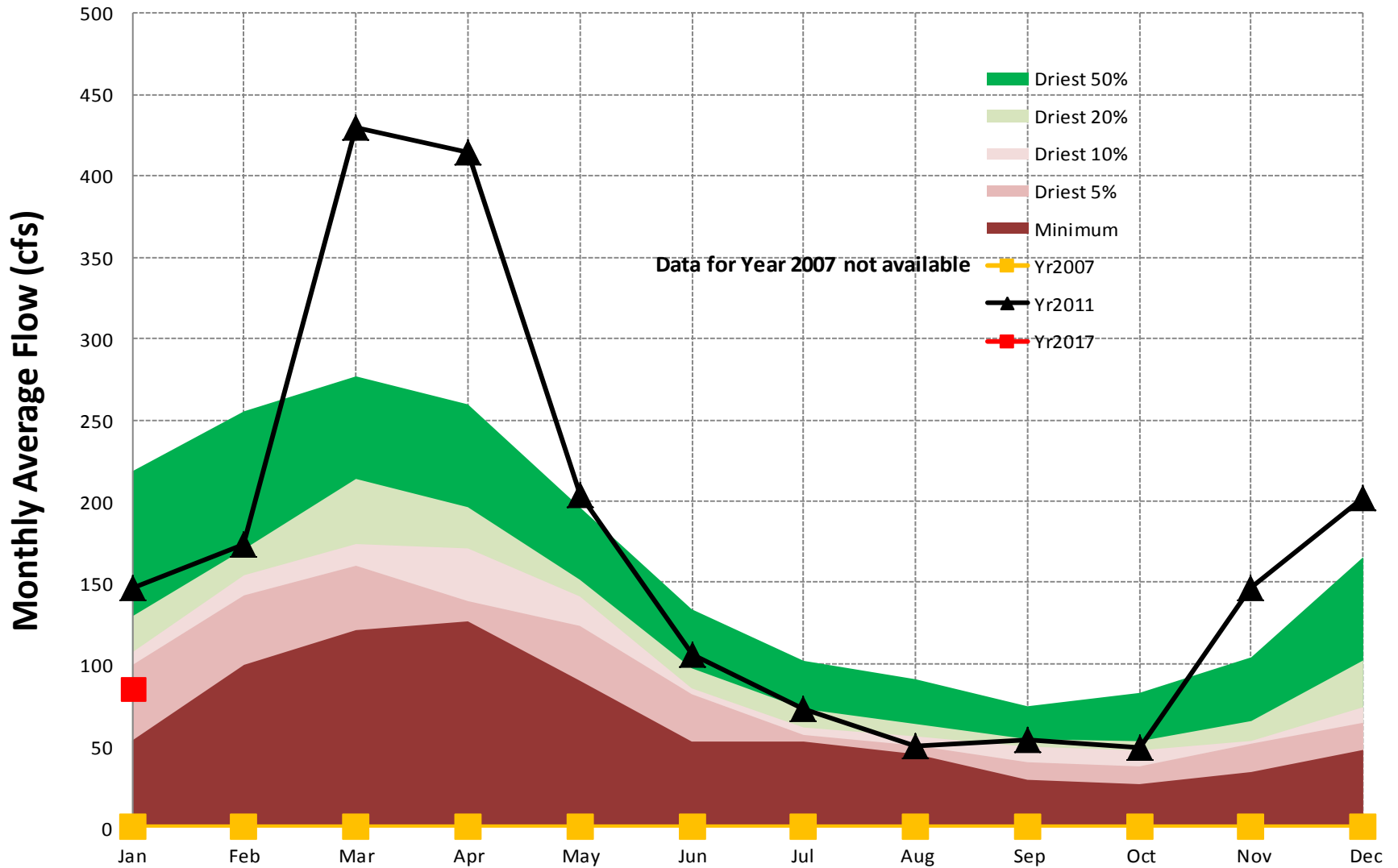
- Average stream flow for January 2017 was 12,238 cfs. The statistical composite of all historical data for this gage shows that average streamflow in January has historically been lower than January 2017 about 50% of the time; about 50% of the time in January it has been higher.
- Average stream flow in January 2011 was 3,207 cfs. The statistical composite of all historical data for this gage shows that average streamflow for January has historically been lower than January 2011 about 5% of the time; about 95% of the time in January it has been higher.
- Average stream flow in January 2007 was 6,215 cfs. The statistical composite of all historical data for this gage shows that average streamflow for January has historically been lower than January 2007 about 50% of the time; about 50% of the time in January it has been higher.

# Gage #1. USGS #03568933, Tennessee Basin, LOOKOUT CREEK NEAR NEW ENGLAND, GA



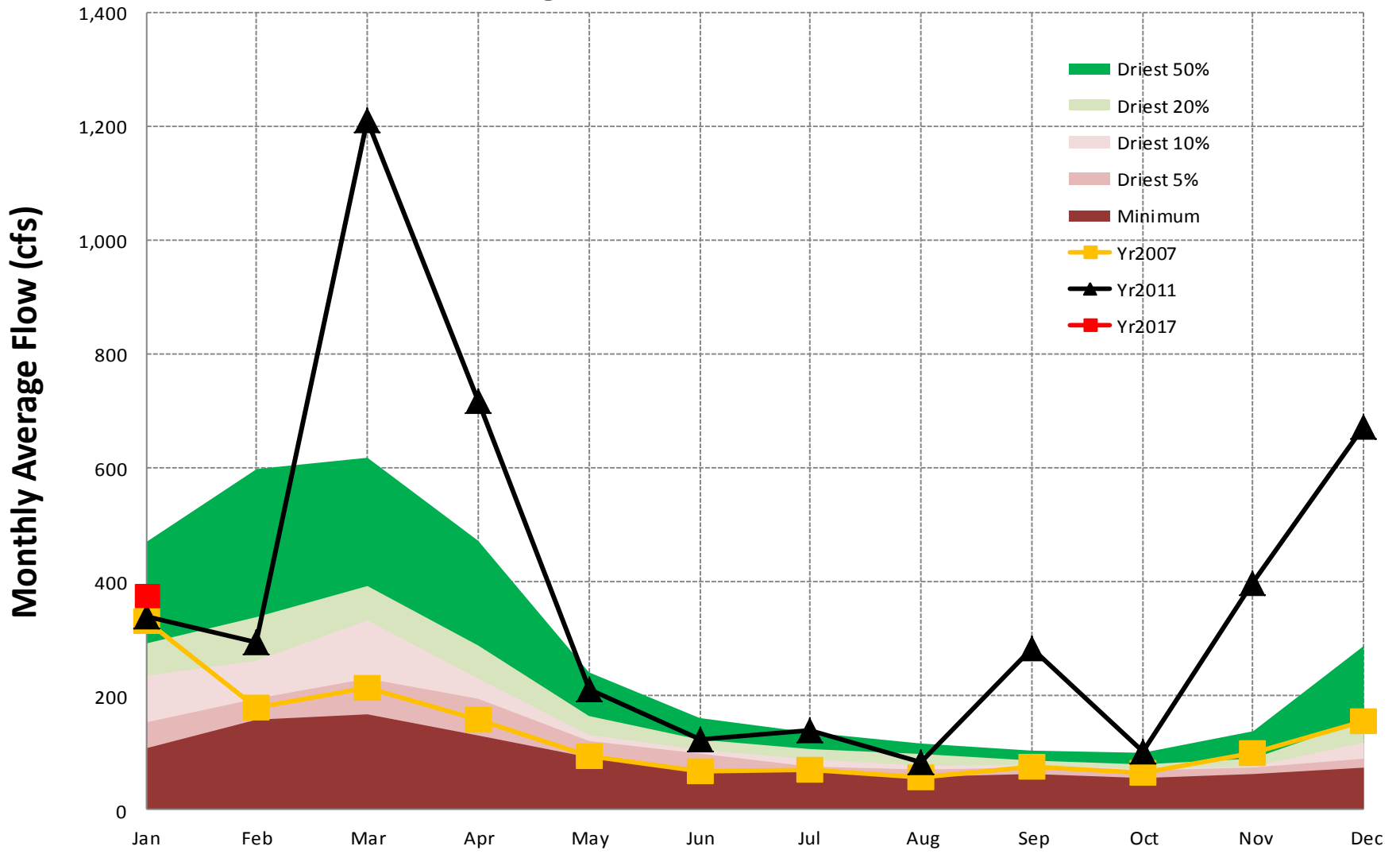
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# Gage #2, USGS #03550500, Tennessee Basin, NOTTELY RIVER NEAR BLAIRSVILLE, GA



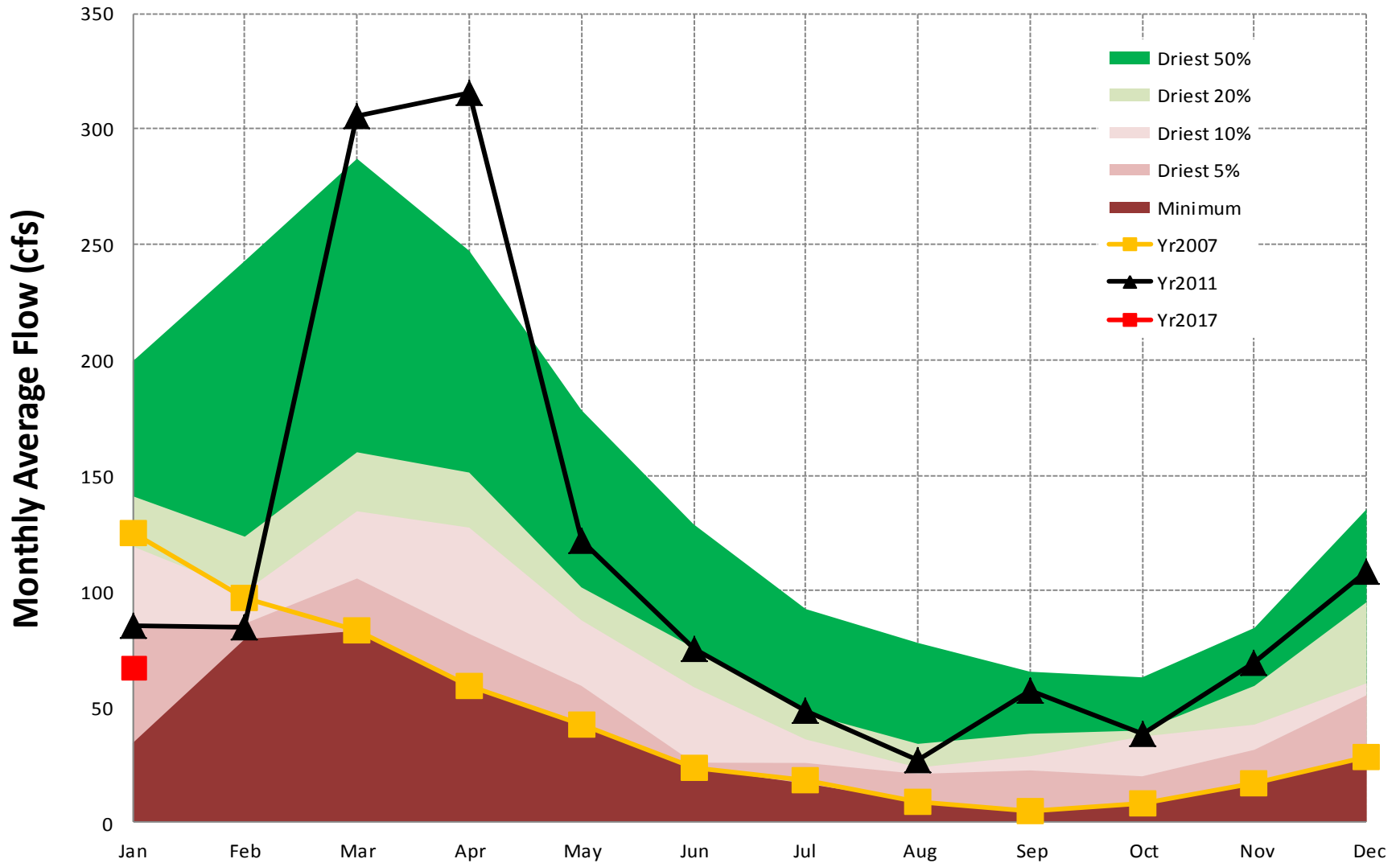
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### Gage #3. USGS #02398000, Coosa Basin, Chattooga River at Summerville, GA



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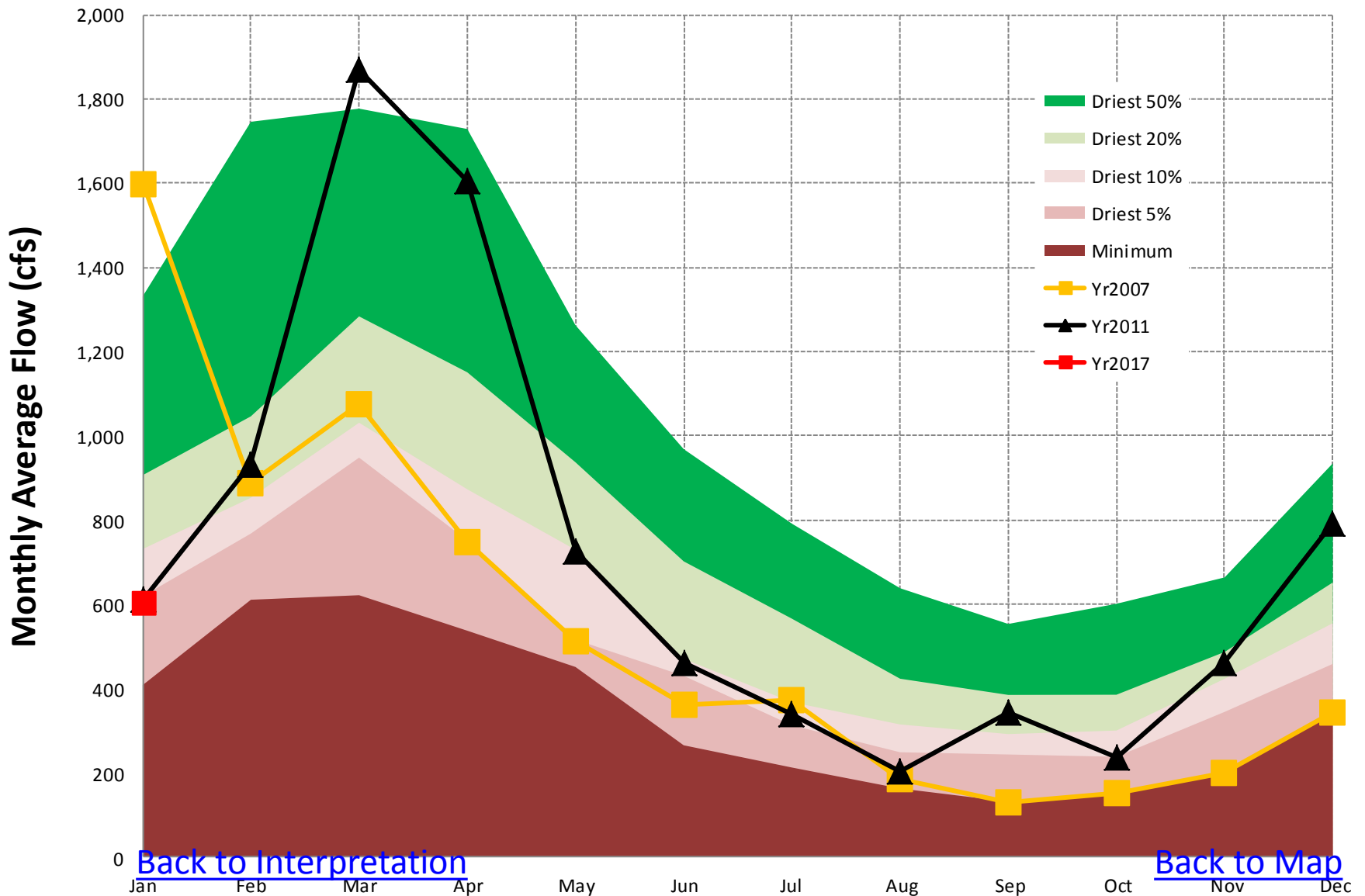
# Gage #4, USGS #02382200, Coosa Basin, TALKING ROCK CREEK NEAR HINTON, GA



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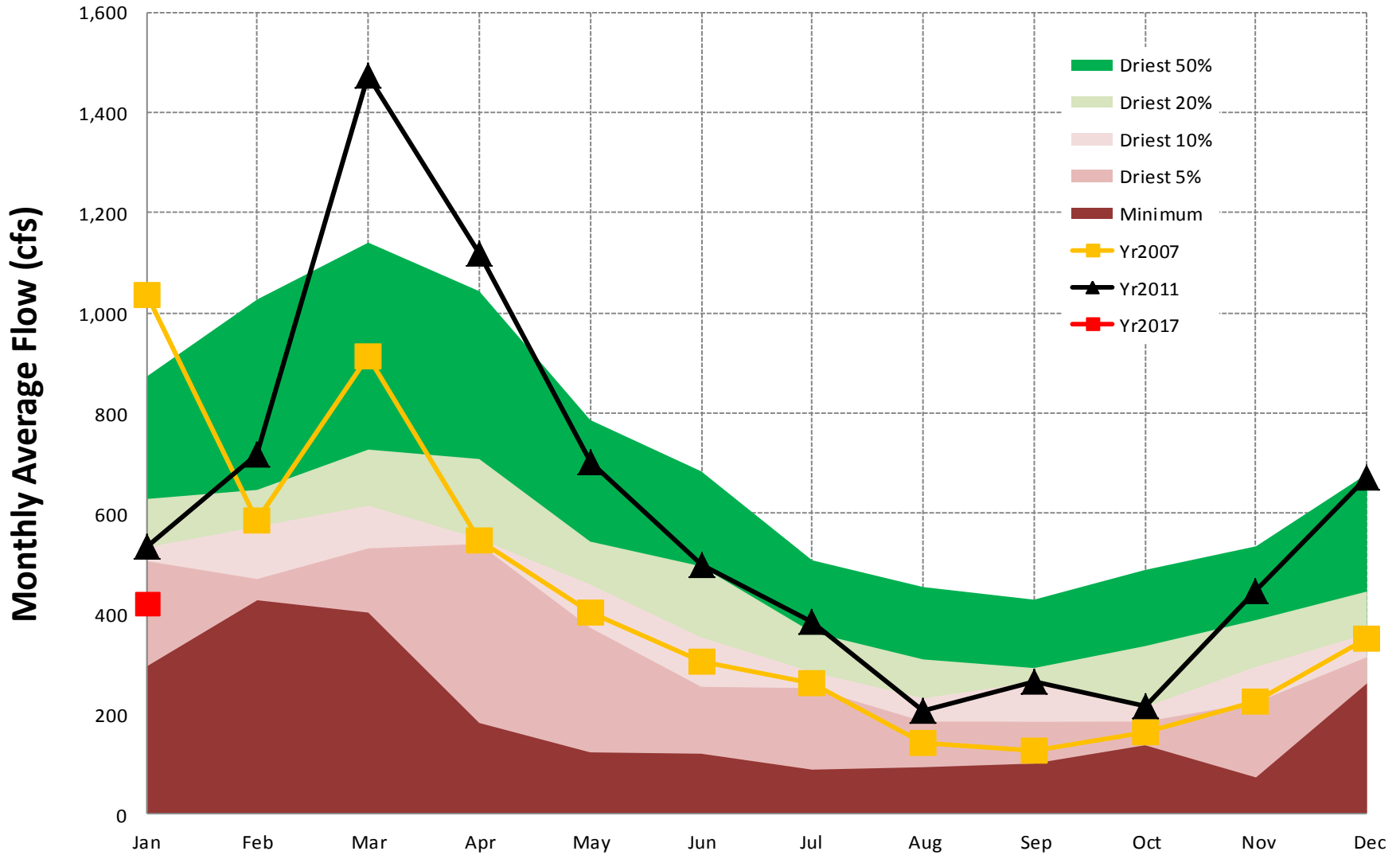
# Gage #5, USGS #02392000, Coosa Basin, Etowah River at Canton, GA



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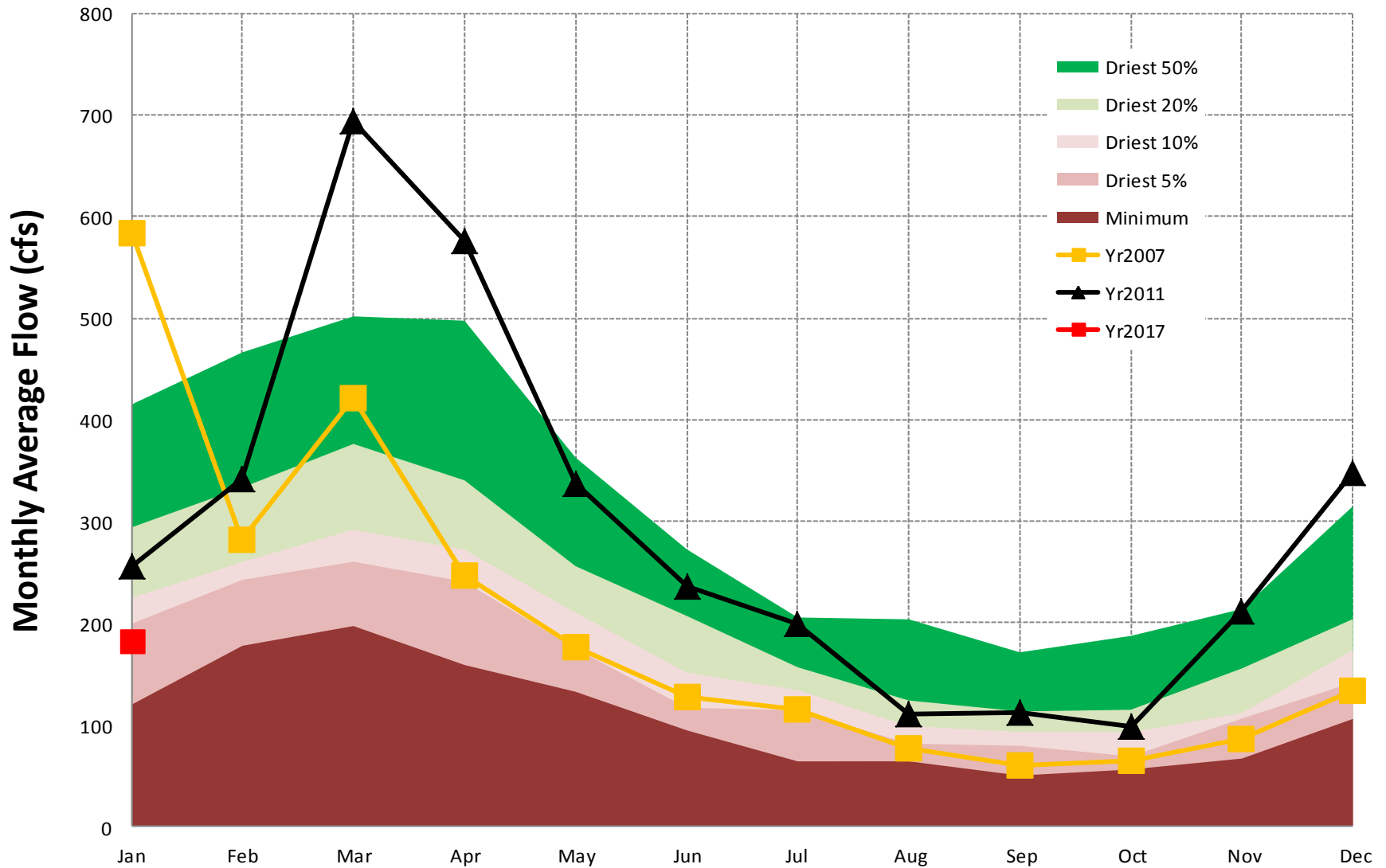
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# Gage #6, USGS #02331600, Chatthoochee Basin, CHATTAHOOCHEE RIVER AT CORNELIA, GA



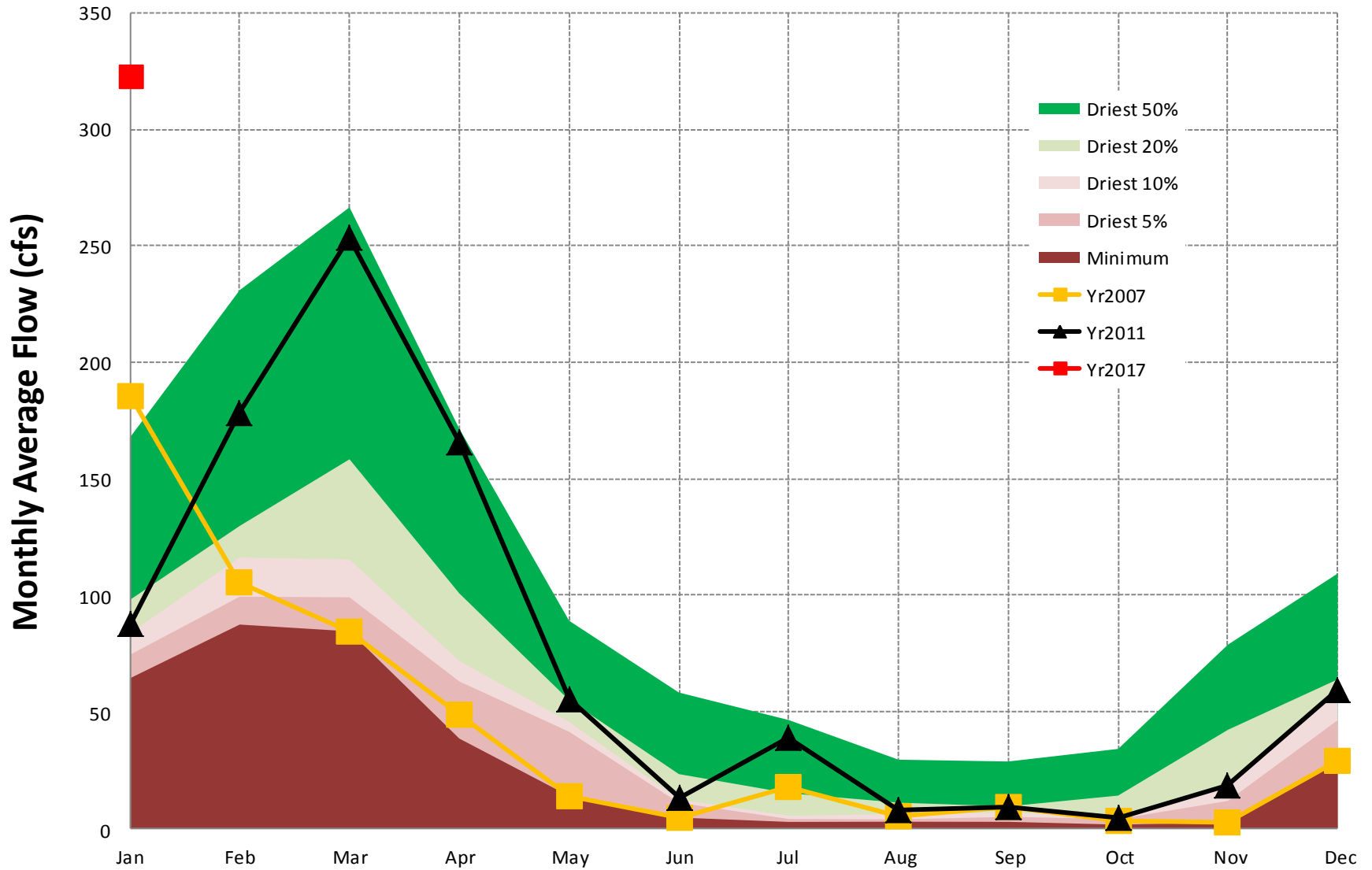
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**Gage #7, USGS #02333500, Chatahoochee Basin,  
CHESTATEE RIVER NEAR DAHLONEGA, GA**



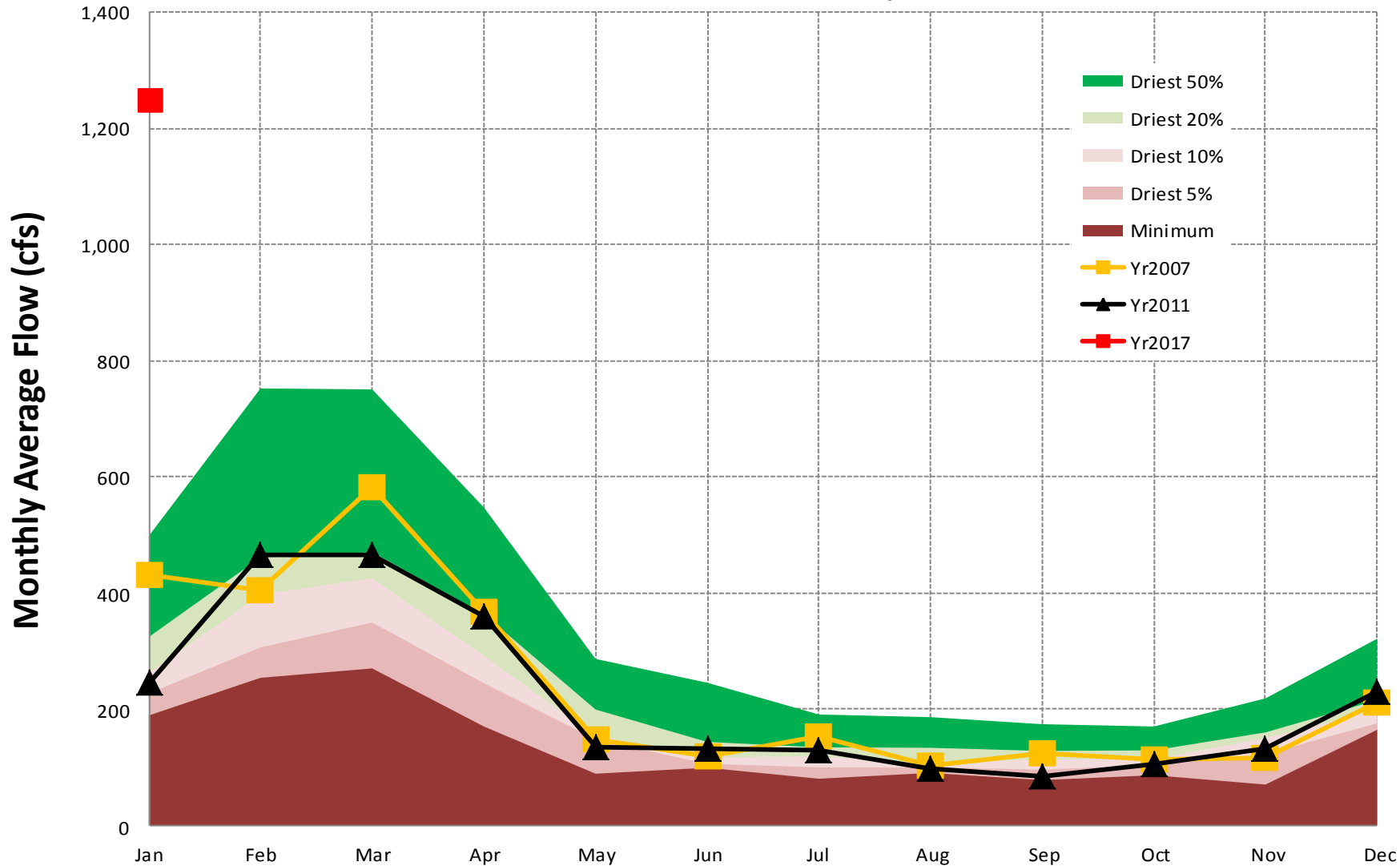
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**Gage #8, USGS #02338660, Chattahoochee Basin,  
NEW RIVER AT GA 100, NEAR CORINTH**



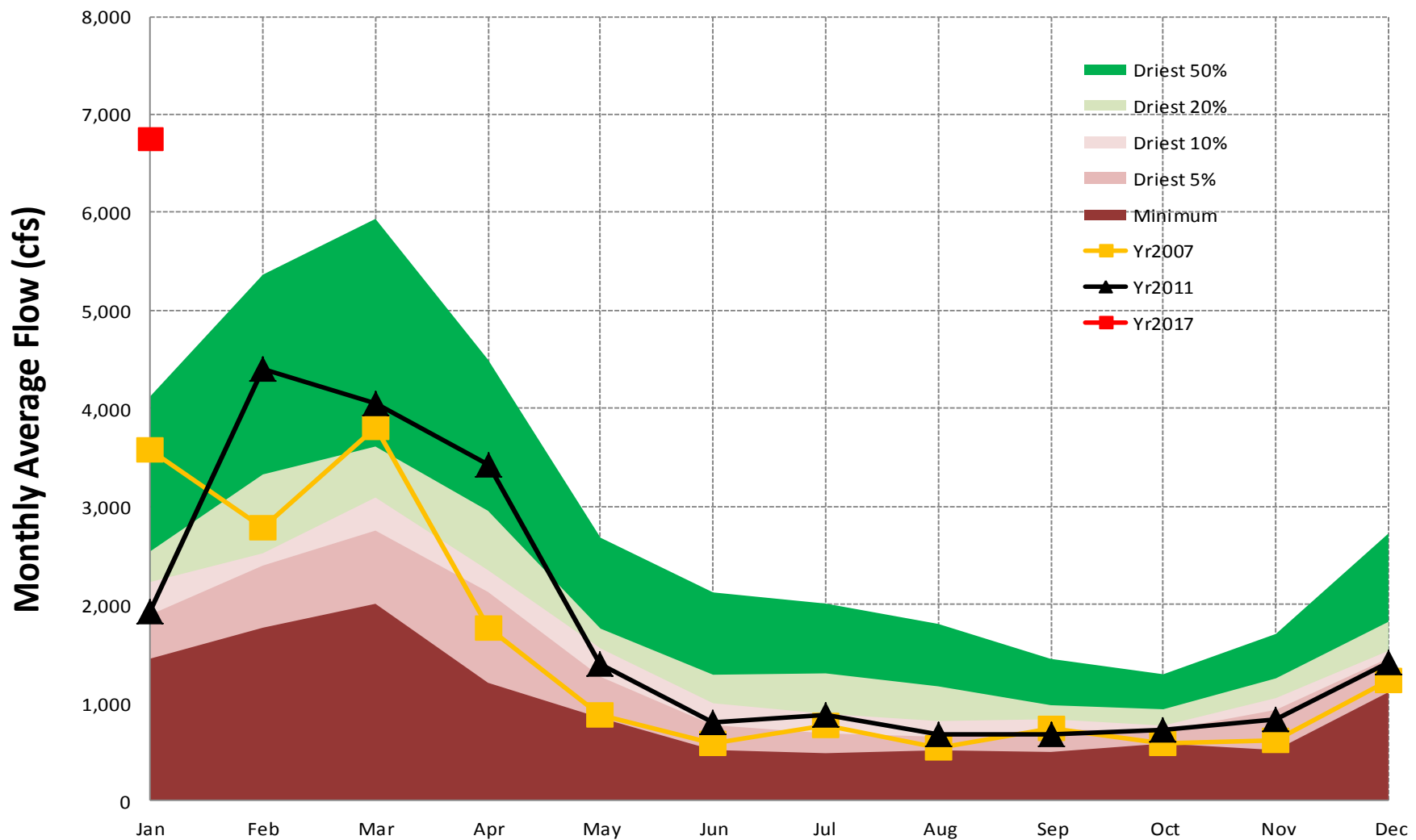
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**Gage #9, USGS #02341800, Chattahoochee Basin,  
UPatoi CREEK NEAR COLUMBUS, GA**



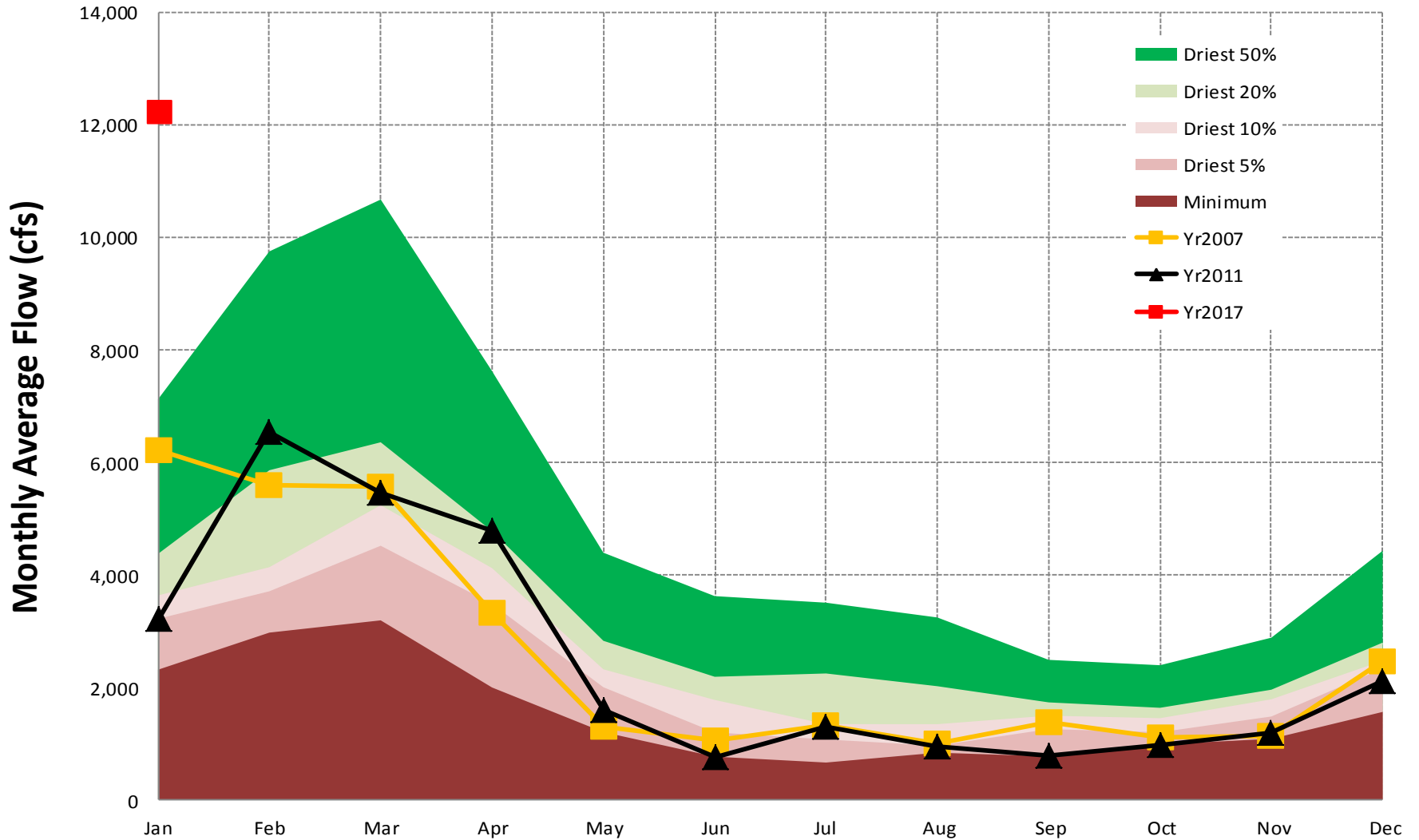
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# **Gage #10. USGS #02349605, Flint Basin, FLINT RIVER AT GA26 NEAR MONTEZUMA, GA**



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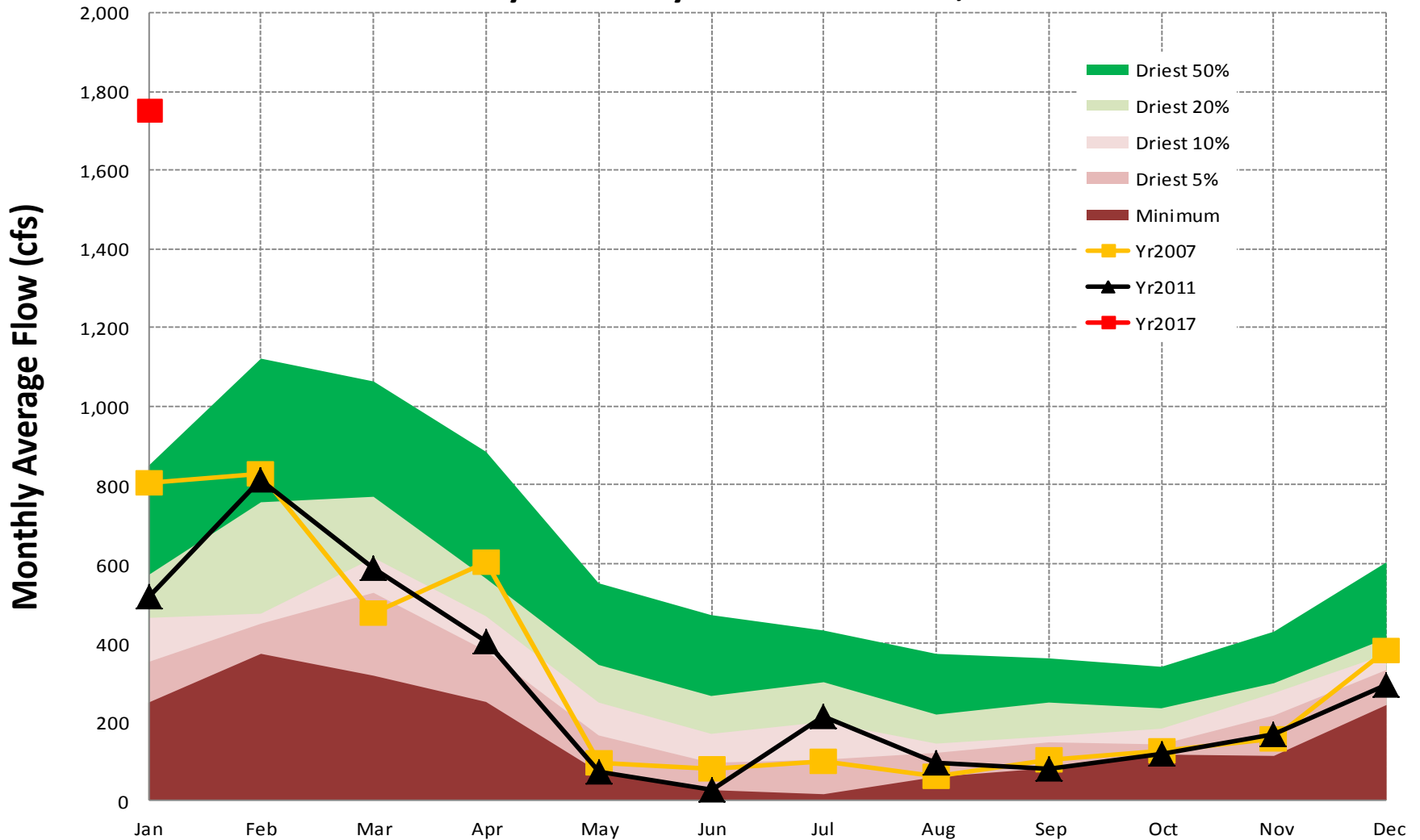
# Gage #11, USGS #02352500, Flint Basin, FLINT RIVER AT ALBANY, GA



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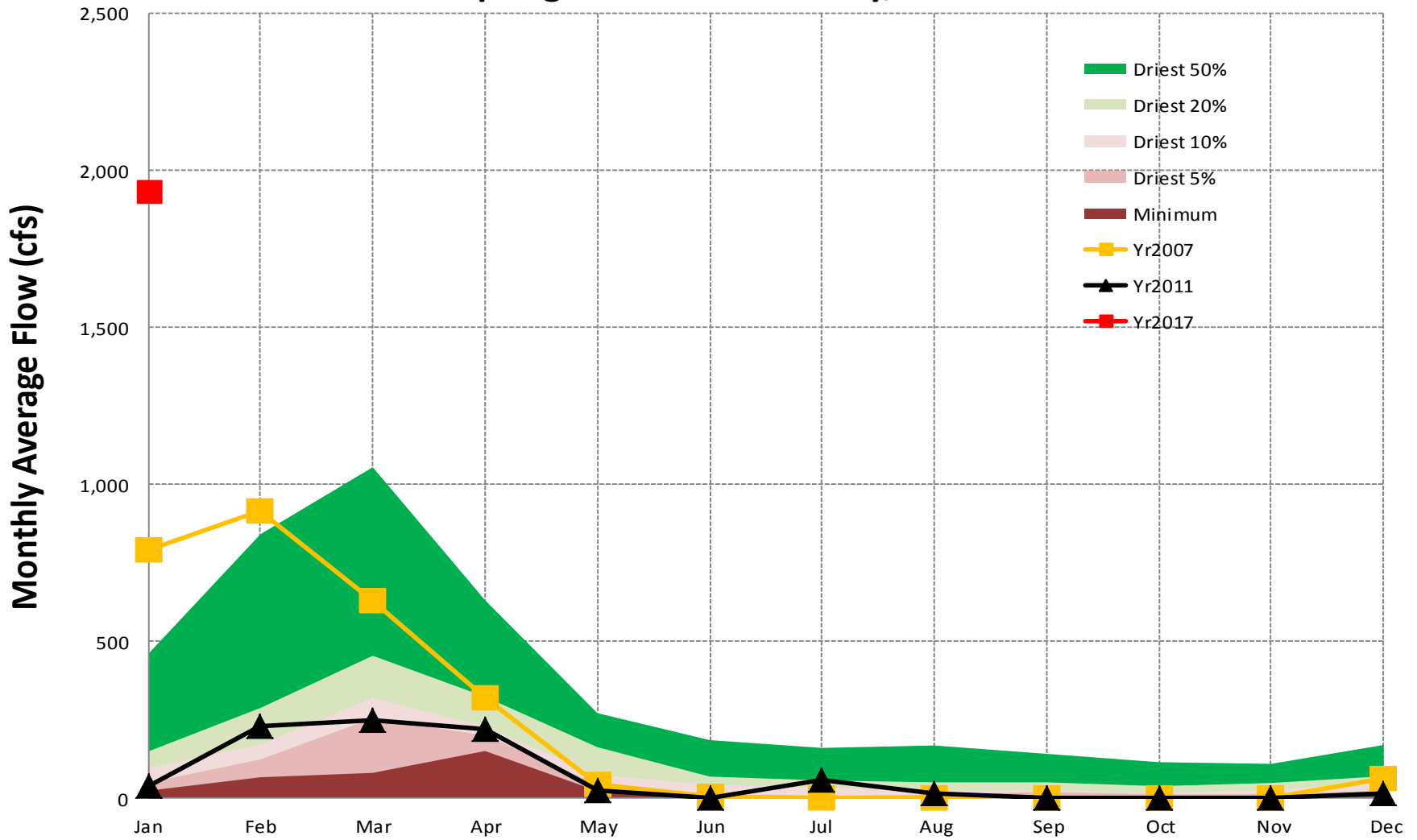
# Gage #12. USGS #02353500, Flint Basin, Ichawaynochaway Creek at Milford, GA



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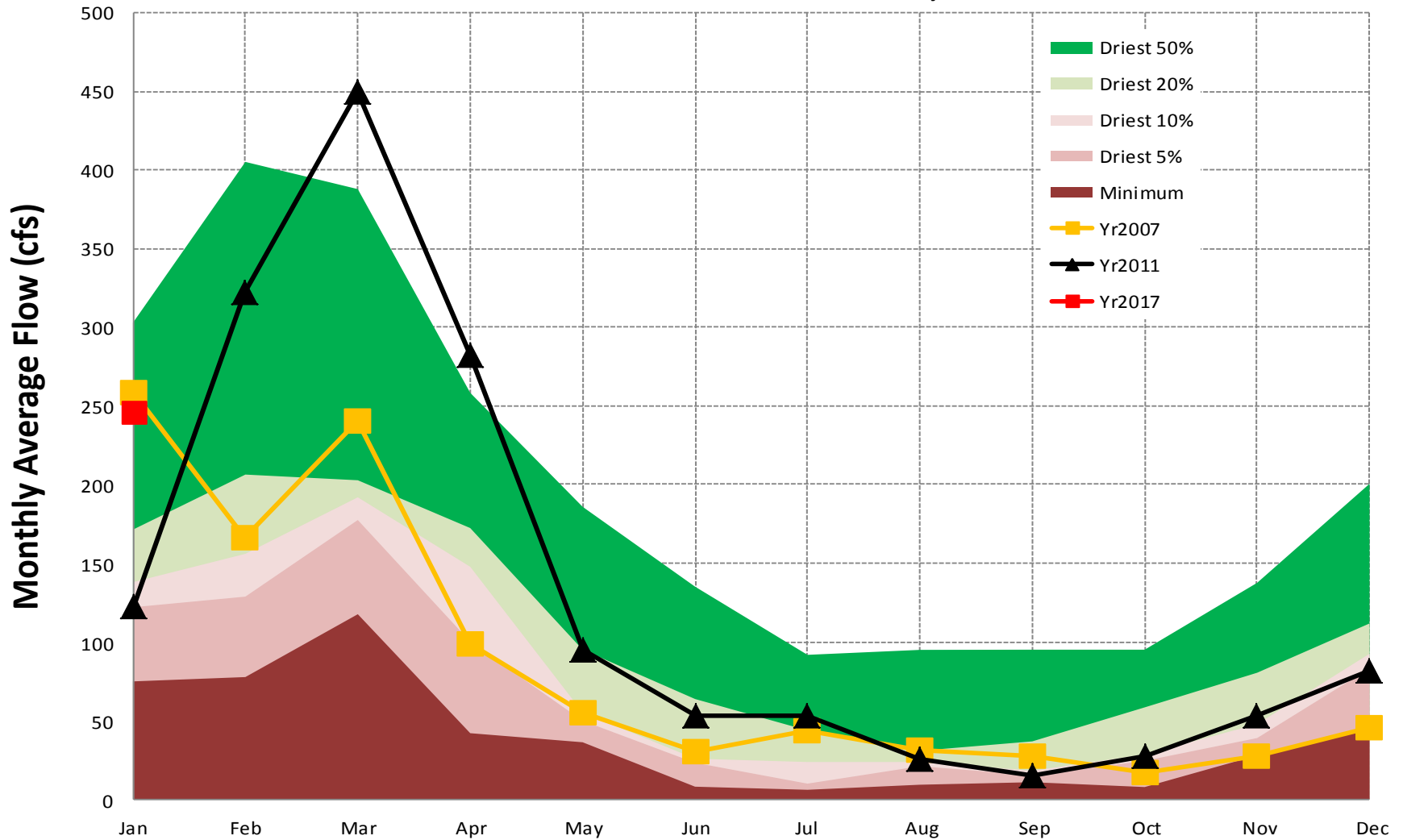


# Gage #13. USGS #02357000, Flint River, Spring Creek near Iron City, GA



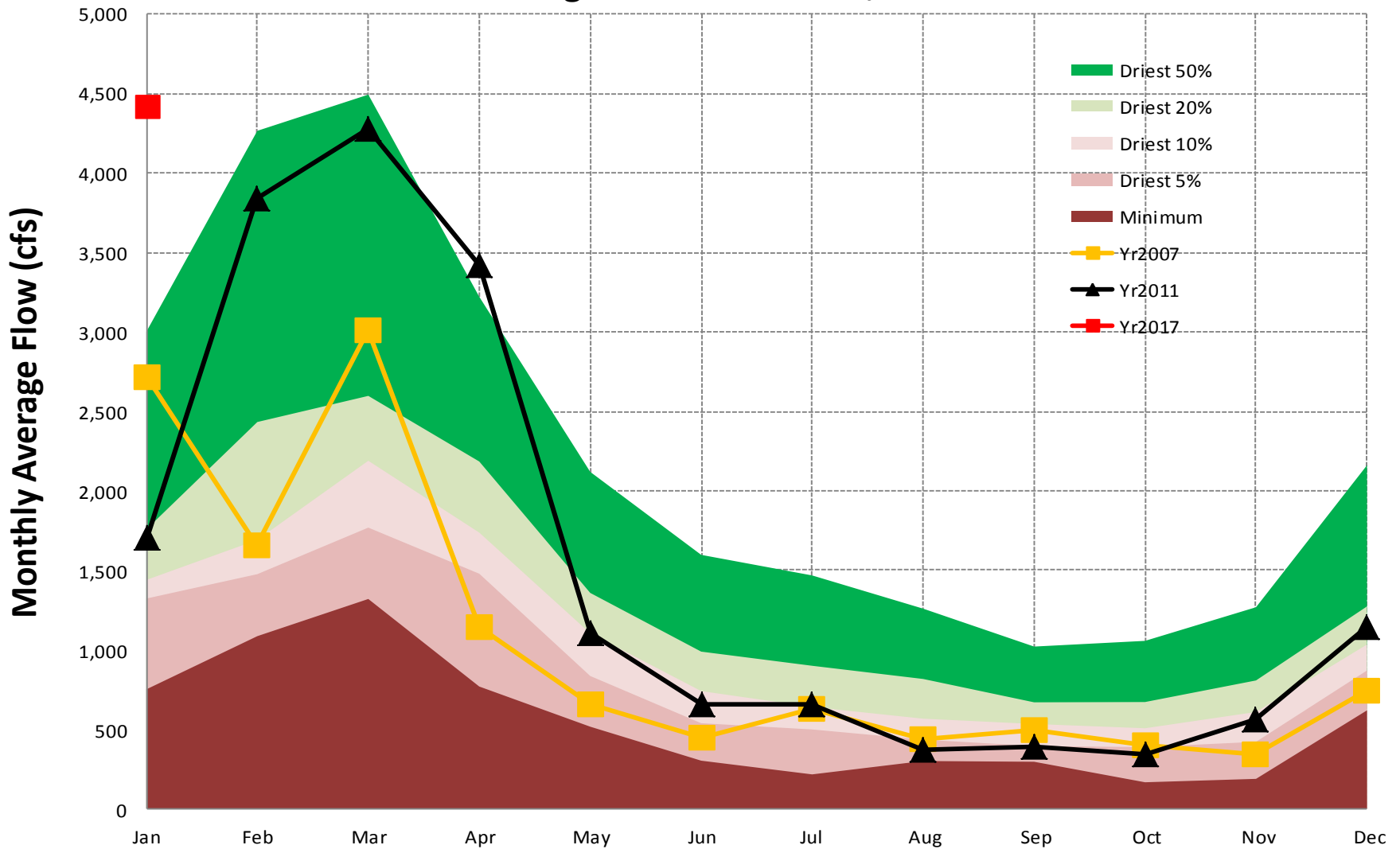
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**Gage #14. USGS #02208450, Ocumulgee Basin,  
ALCOVY RIVER above COVINGTON, GA**



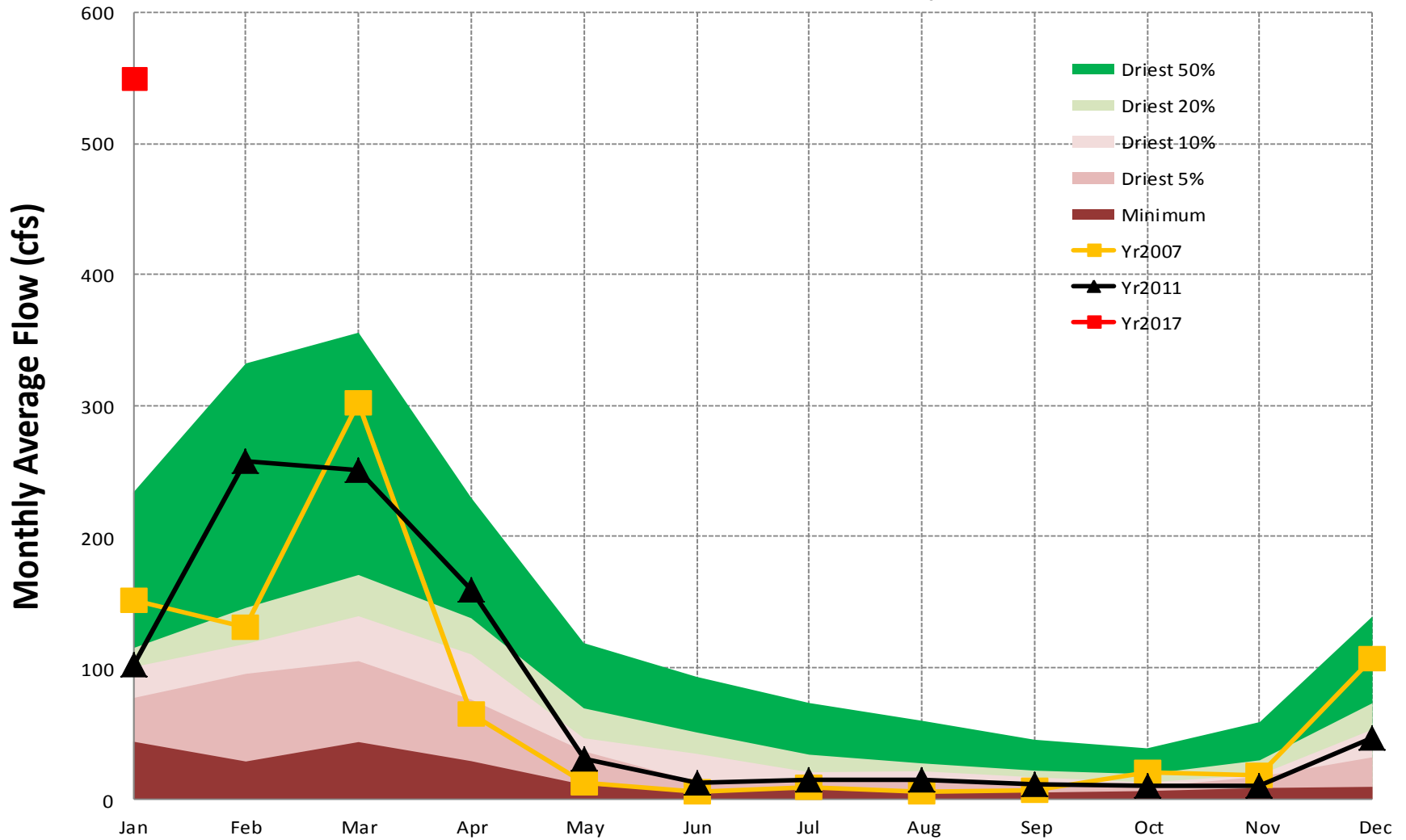
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## Gage #15. USGS #02213000, Ocmulgee Basin, Ocmulgee River at Macon, GA



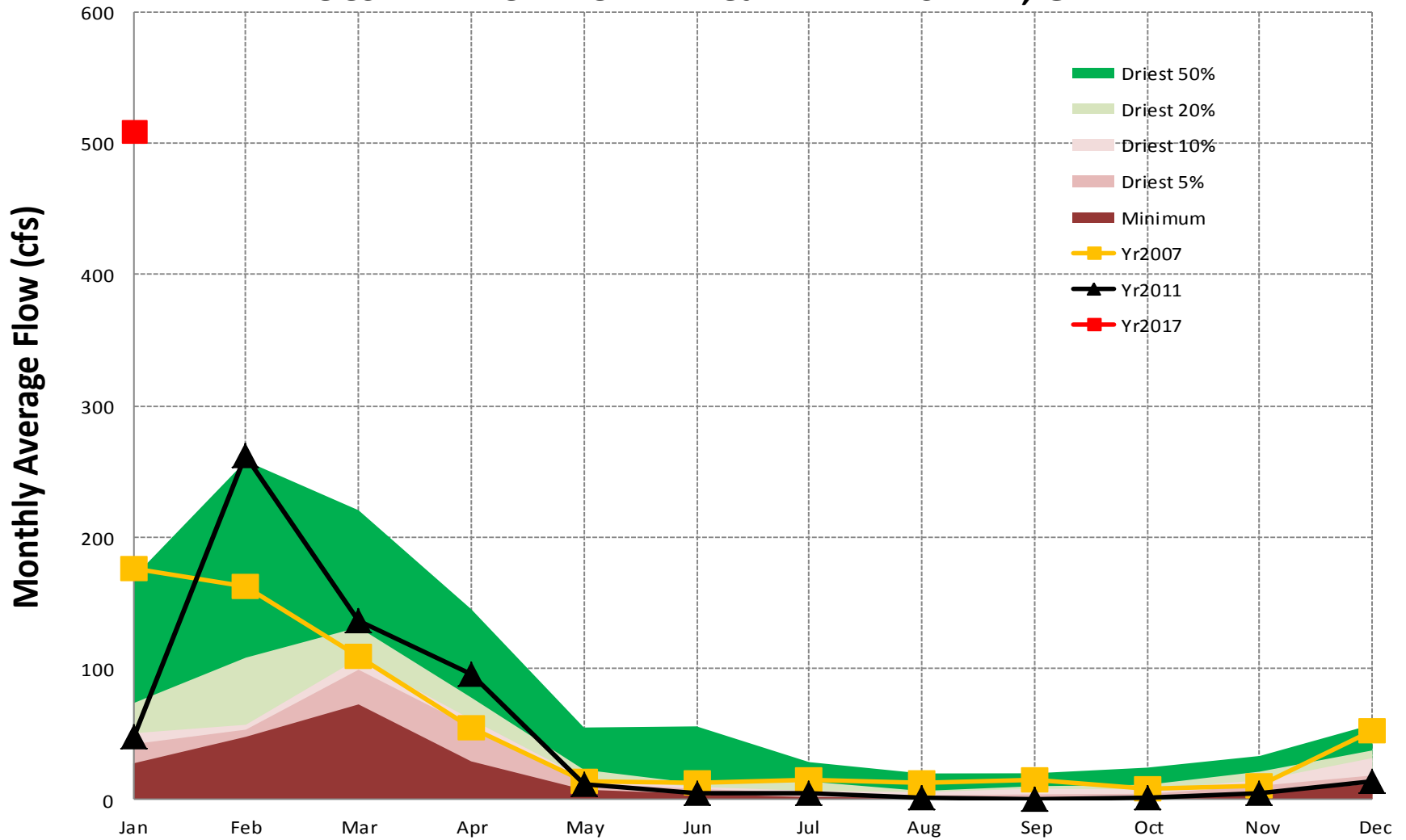
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**Gage #16. USGS #02213500, Ocmulgee Basin,  
TOBESOFKEE CREEK near MACON, GA**



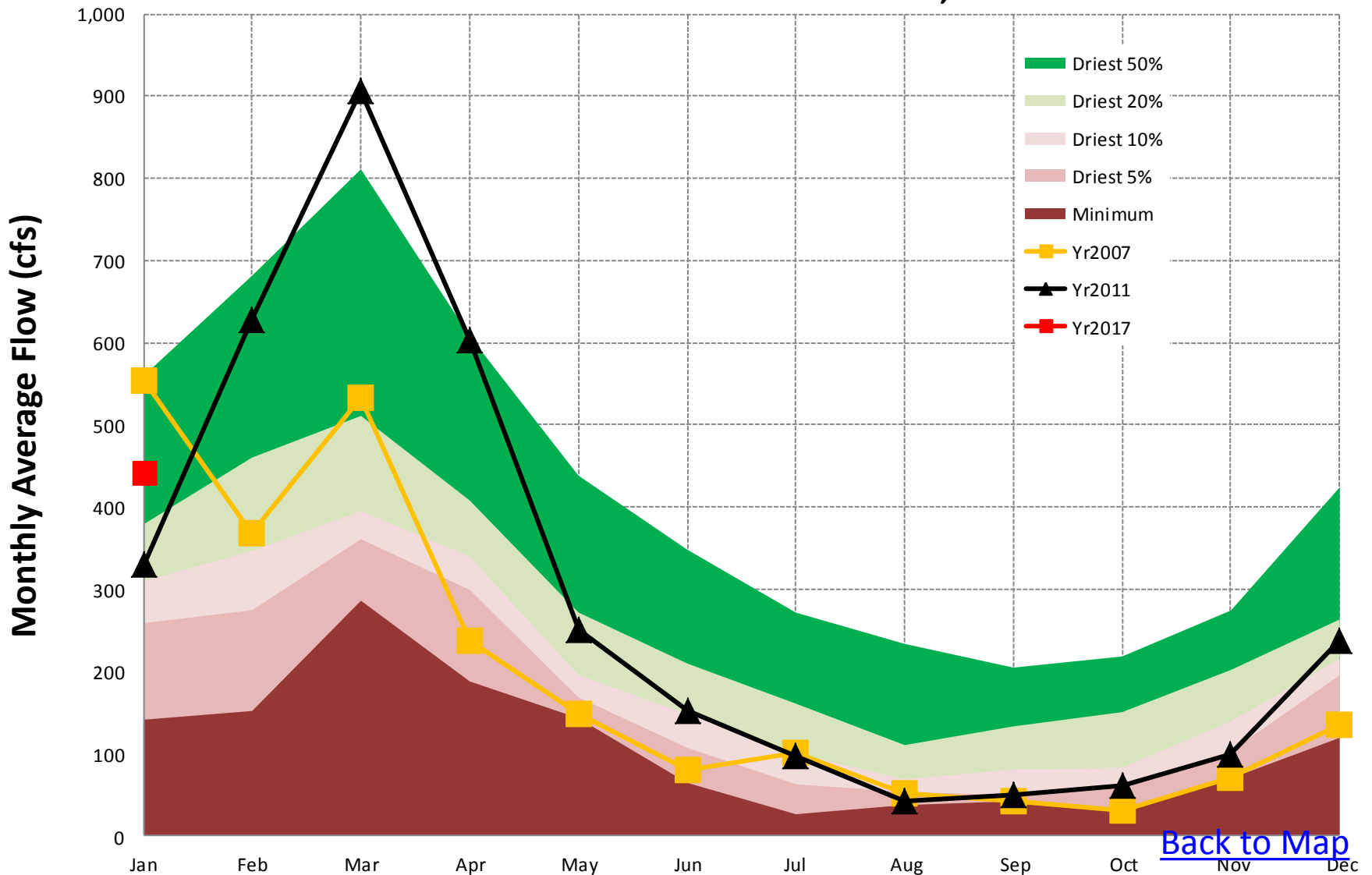
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**Gage #17. USGS #02215100, Ocmulgee Basin,  
TUCSAWHATCHEE CREEK near HAWKINSVILLE, GA**



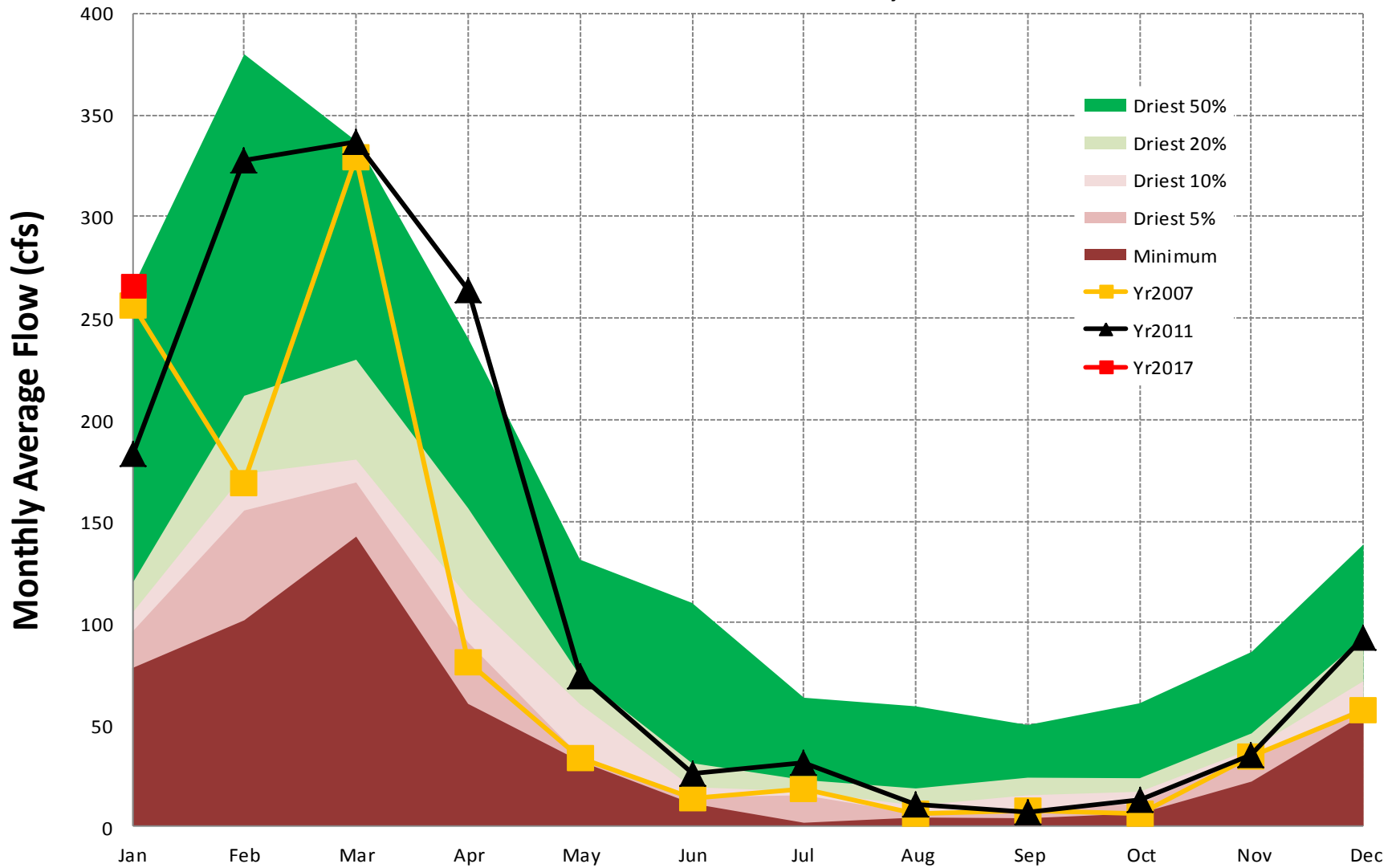
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# Gage #18. USGS #02217500, Oconee Basin, MIDDLE OCONEE RIVER near ATHENS, GA



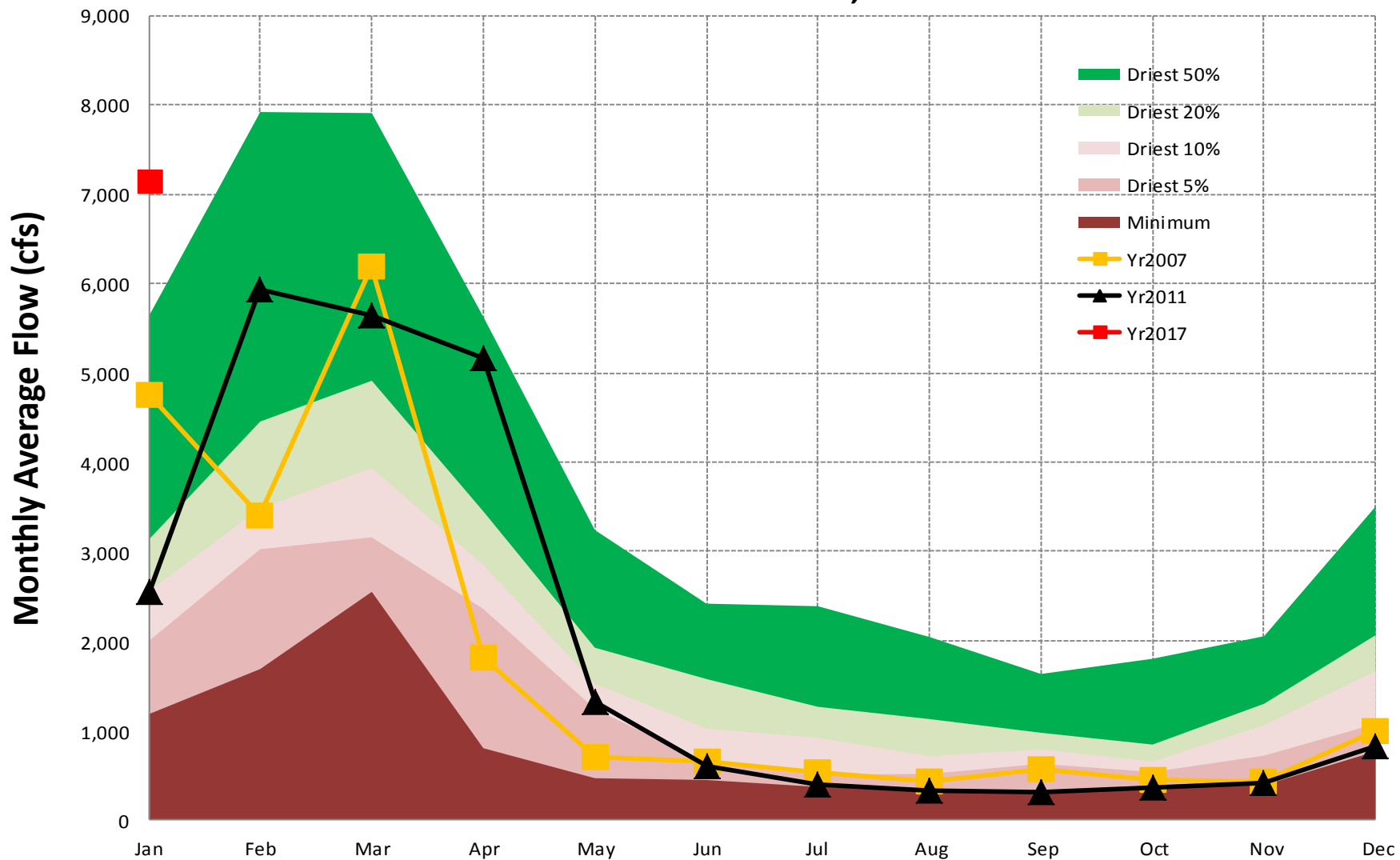
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**Gage #19. USGS #02220900, Oconee Basin,  
LITTLE RIVER near EATONTON, GA**



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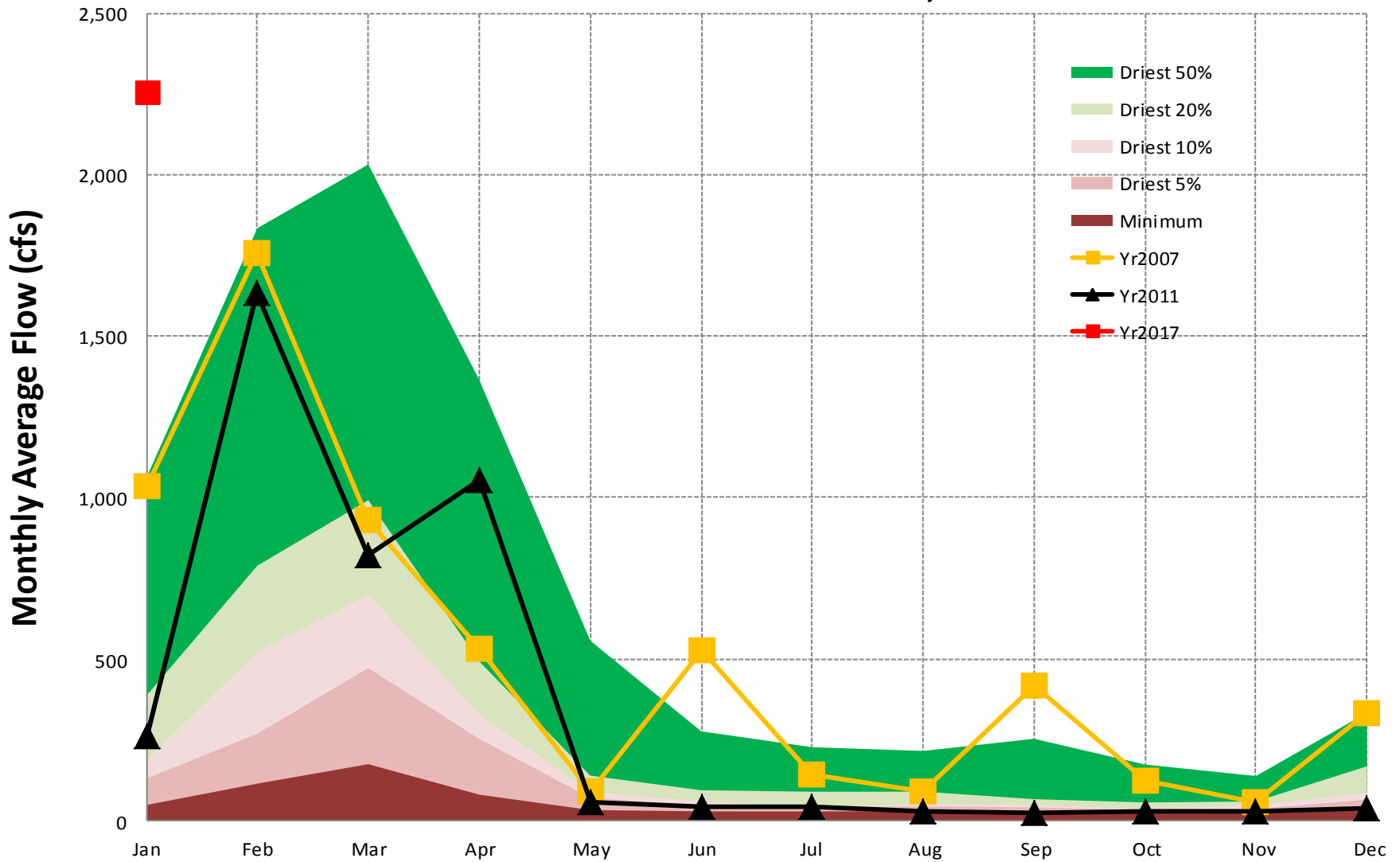
# Gage #20. USGS #02223500, Oconee Basin, Oconee River at Dublin, GA



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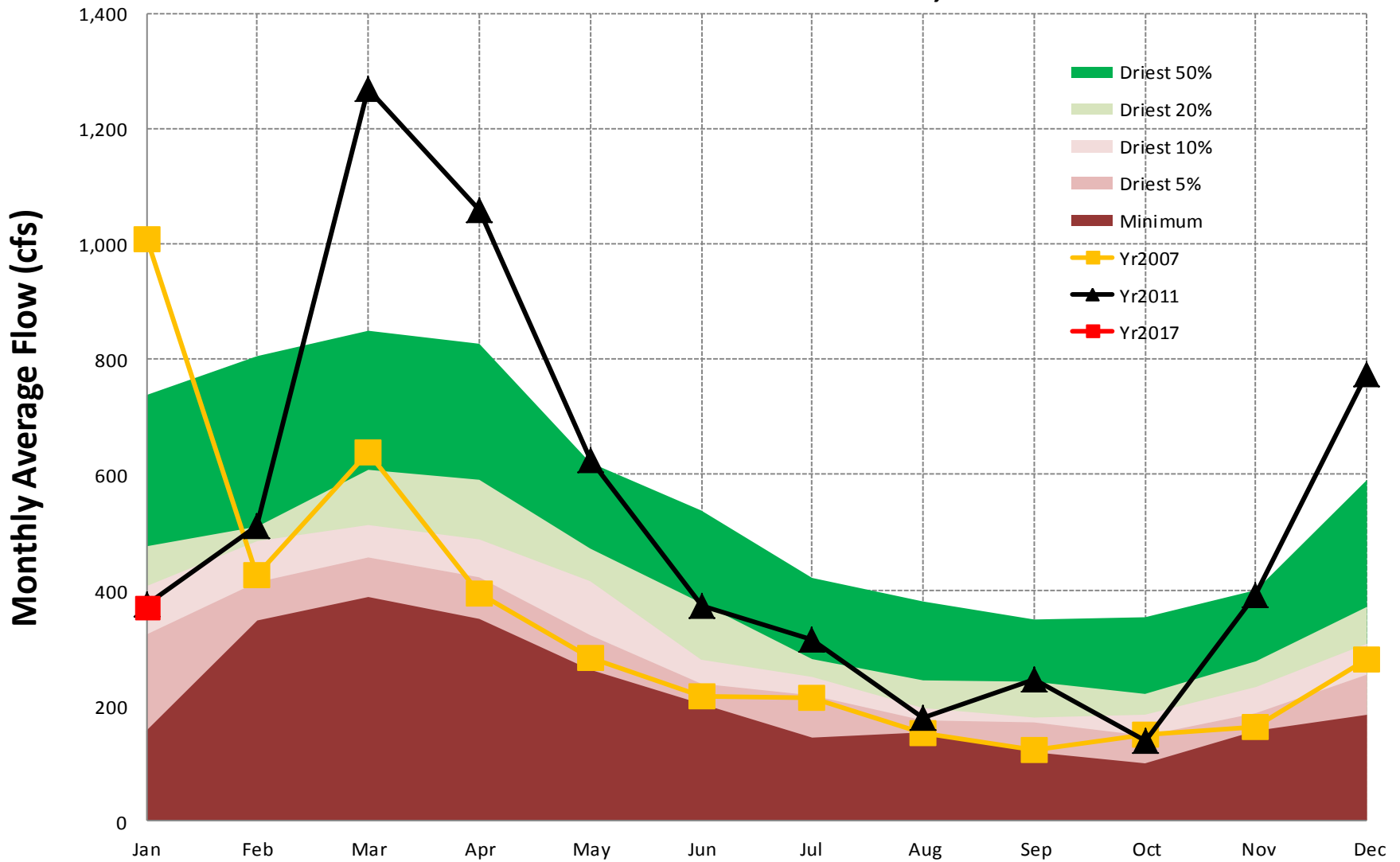


# Gage #21. USGS #02225500, Altamaha Basin, OHOOPEE RIVER near REIDSVILLE, GA



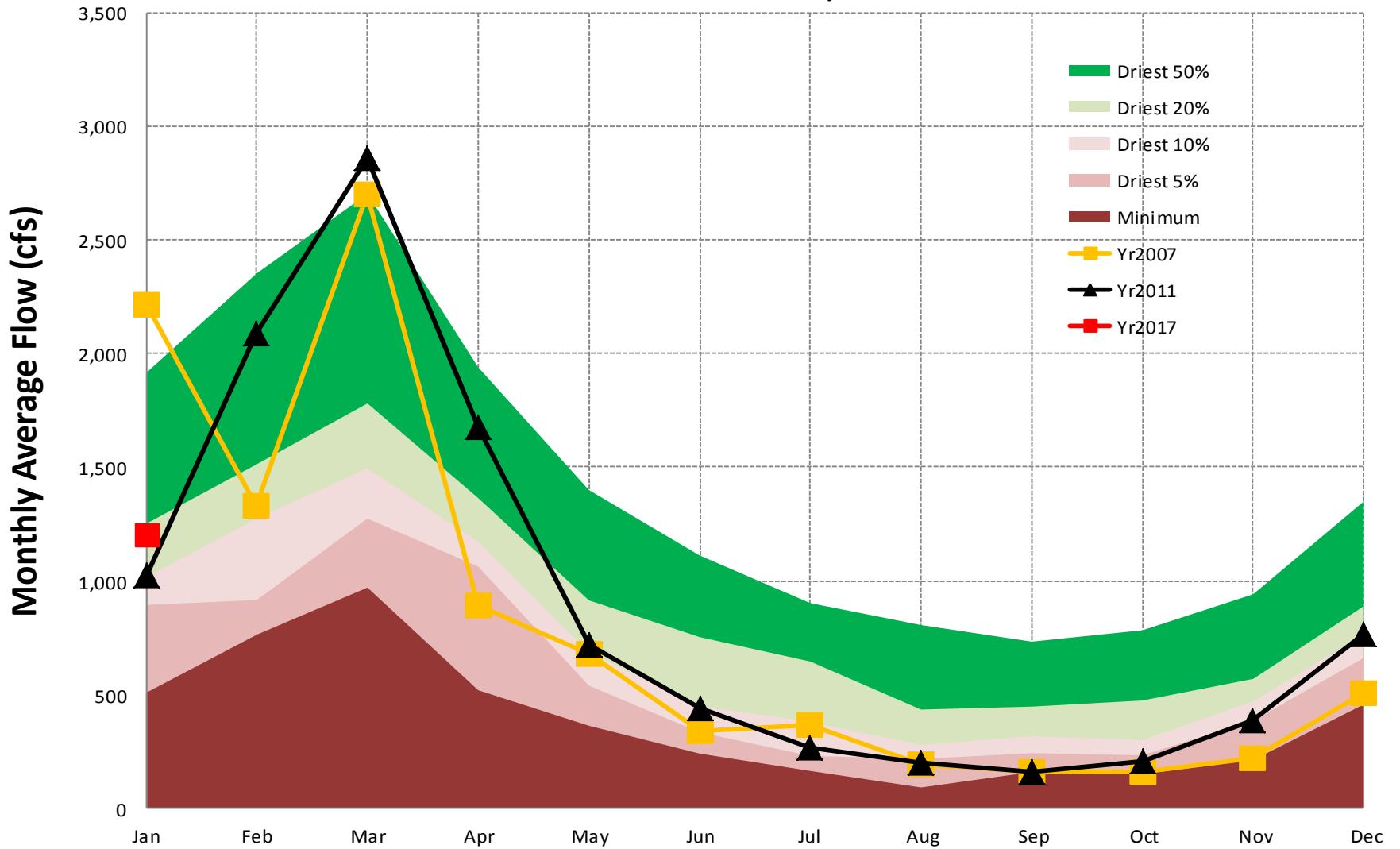
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**Gage #22. USGS #02177000, Savannah Basin,  
CHATTOOGA RIVER near CLAYTON, GA**



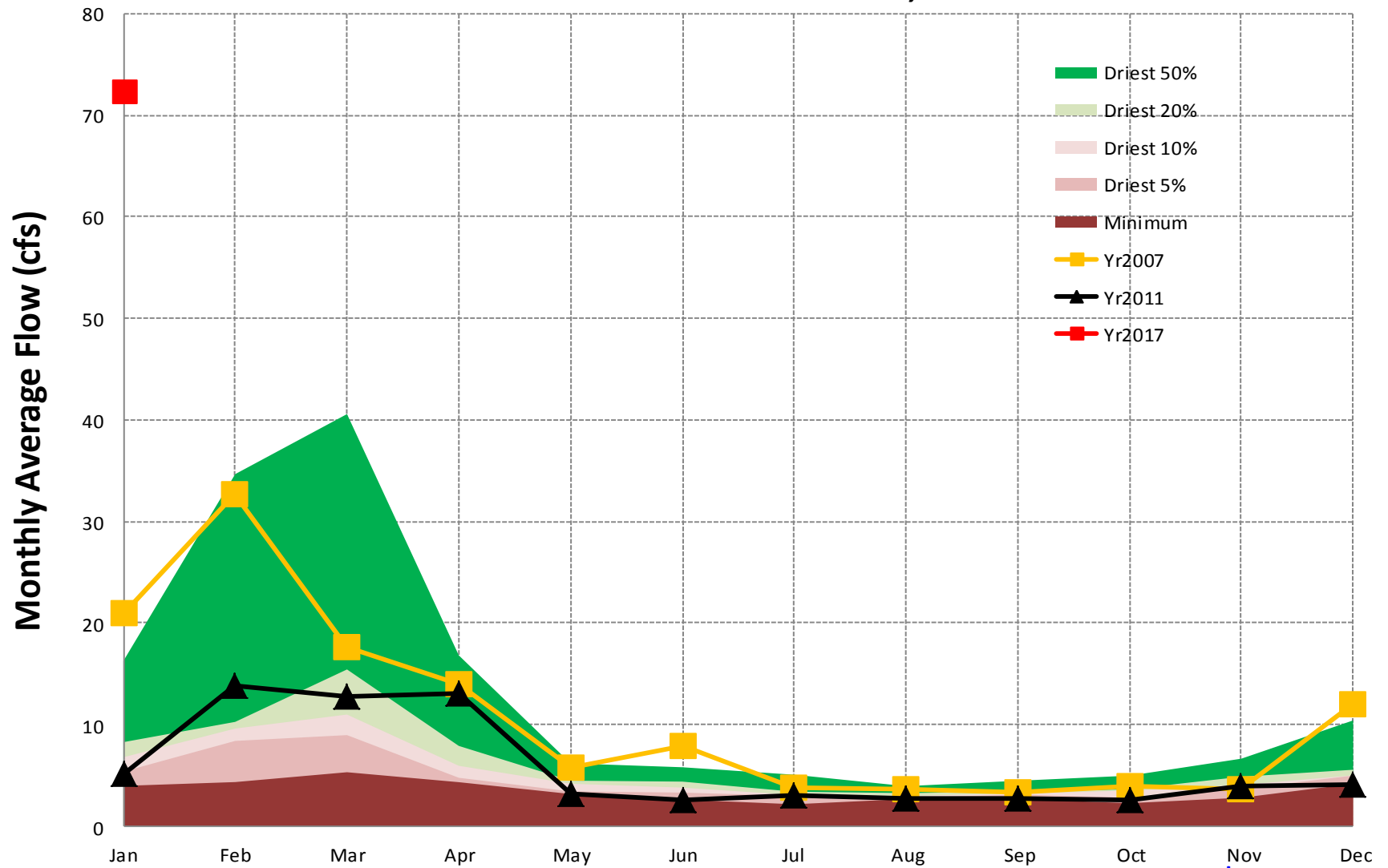
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## Gage #23. USGS #02192000, Savannah Basin Broad River near Bell, GA



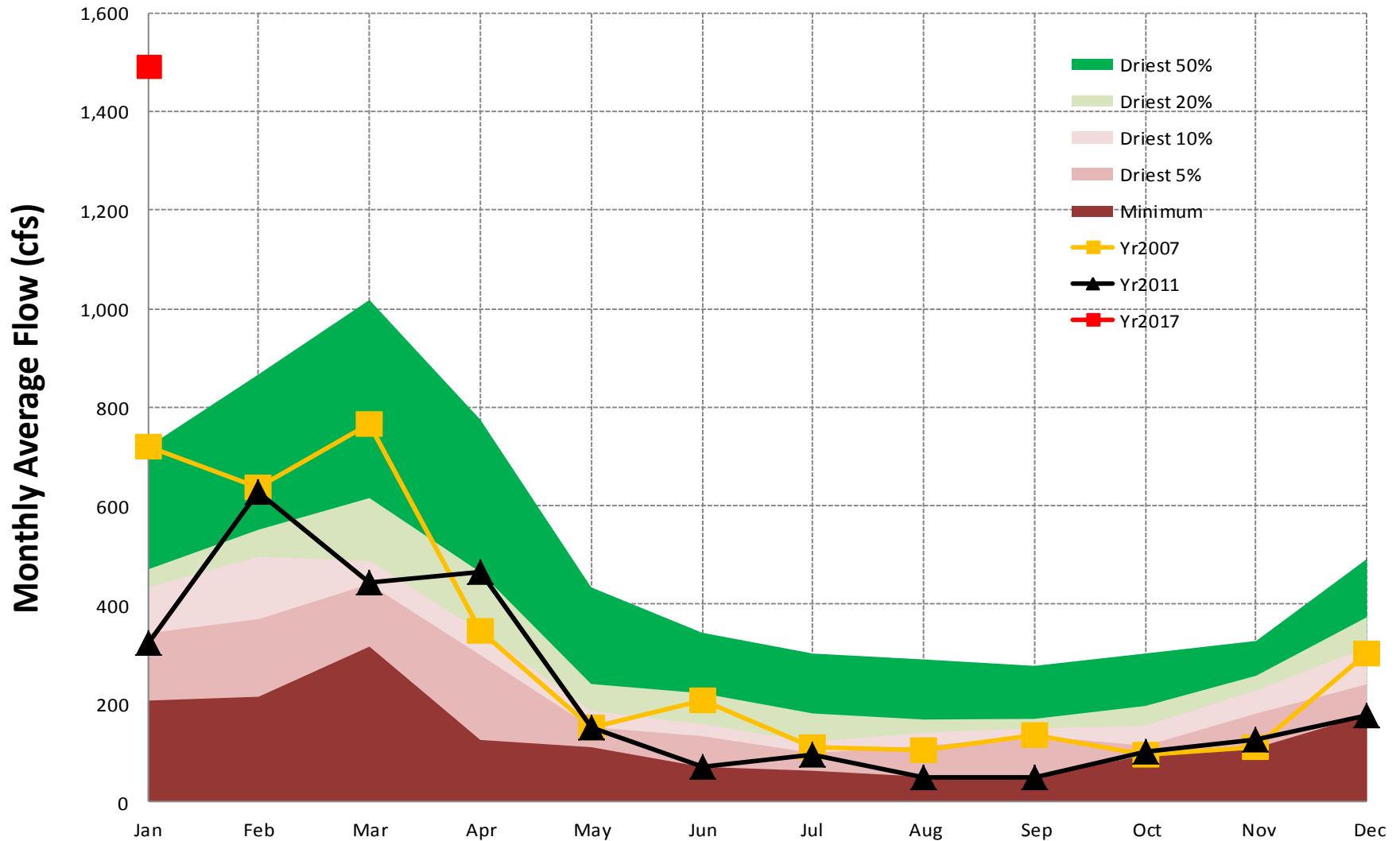
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**Gage #24. USGS #02198100, Savannah Basin,  
BEAVERDAM CREEK near SARDIS, GA**



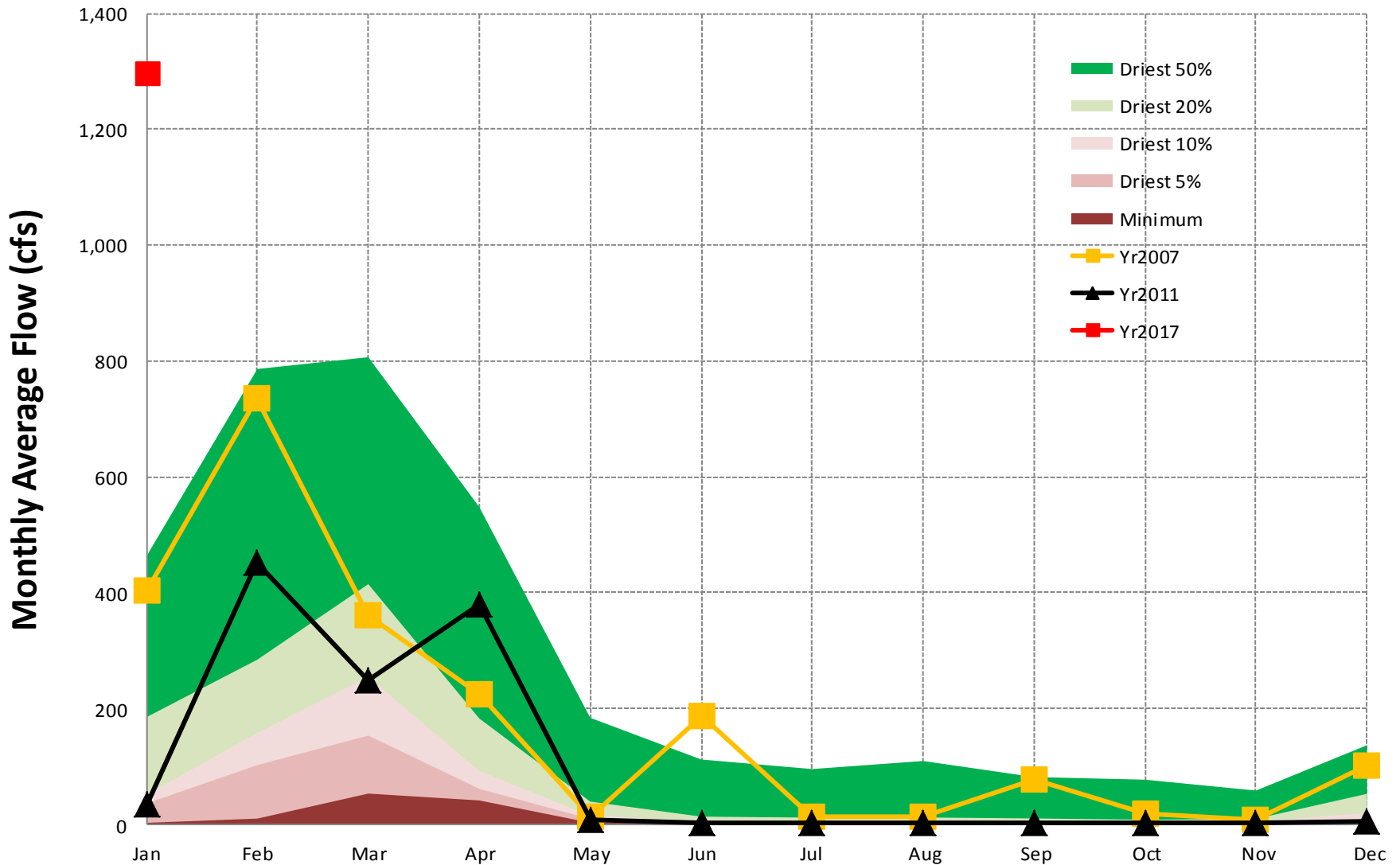
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# Gage #25. USGS #02198000 , Savannah Basin, BRIER CREEK at MILLHAVEN, GA



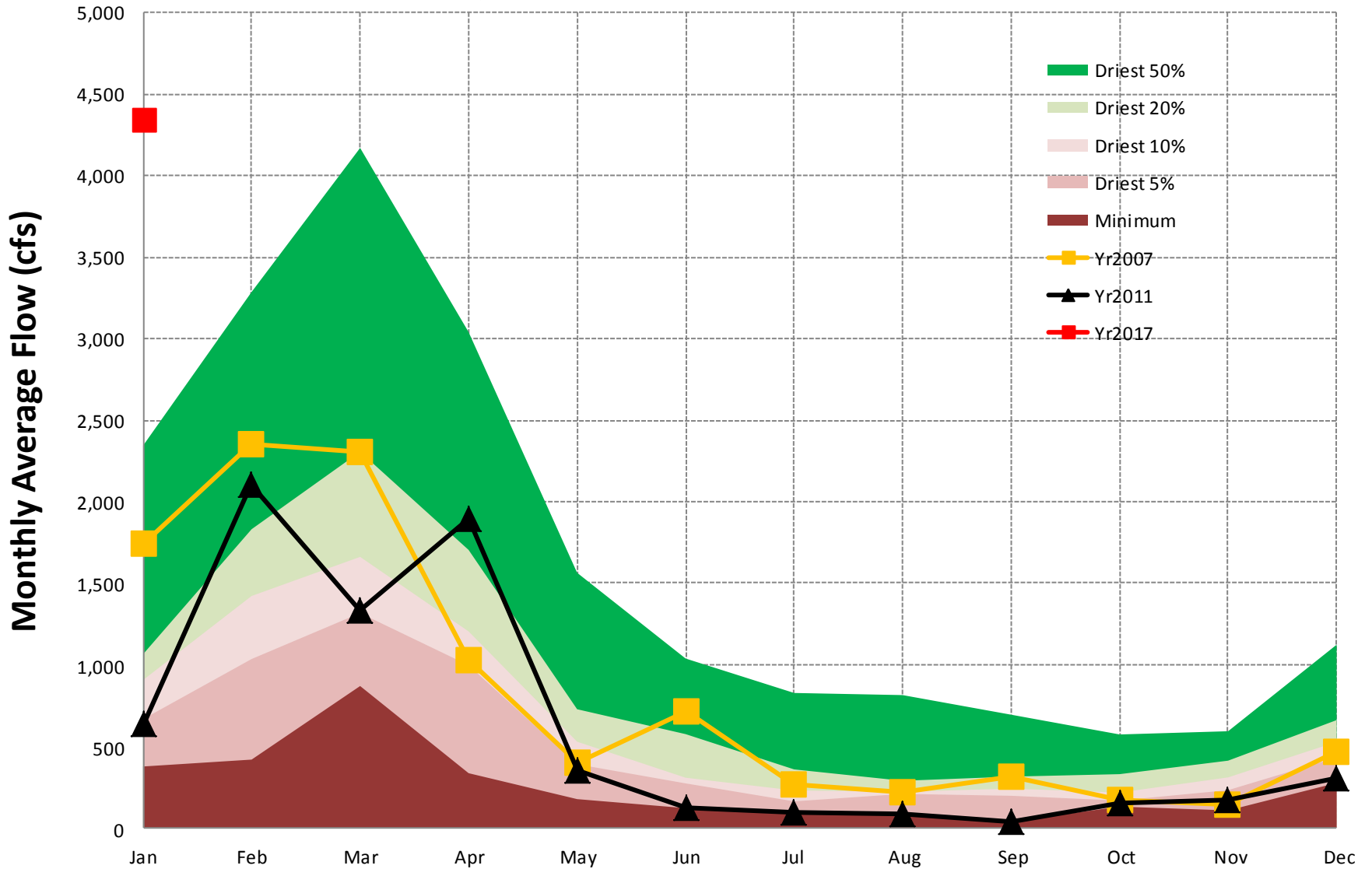
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**Gage #26. USGS #02203000, Ogeechee Basin,  
CANOOCHEE RIVER near CLAXTON, GA**



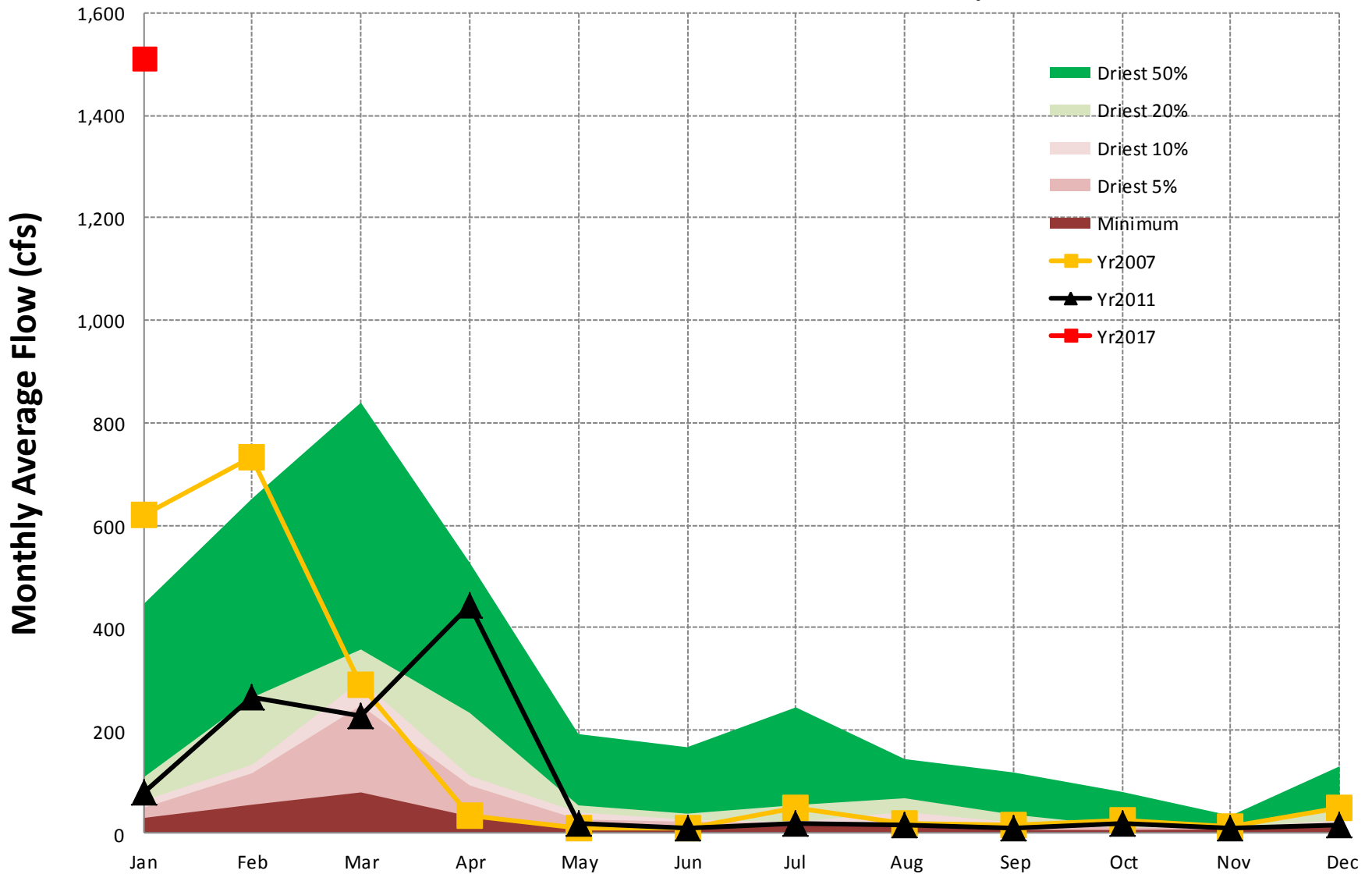
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## Gage #27. USGS #02202500, Ogeechee Basin, Ogeechee River near Eden, GA



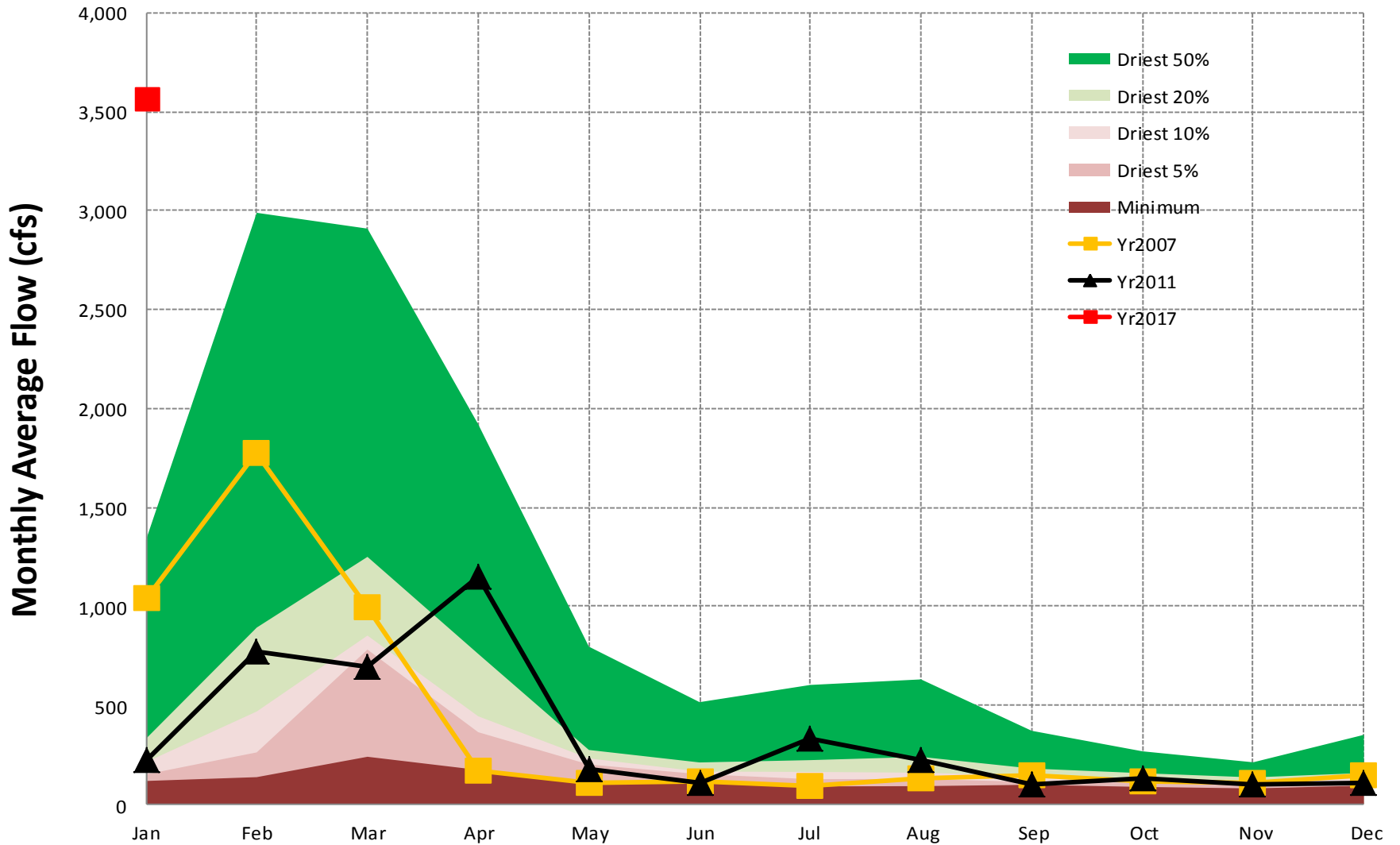
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# Gage #28. USGS #02327500, Ochlockonee Basin, OCHLOCKONEE RIVER near THOMASVILLE, GA



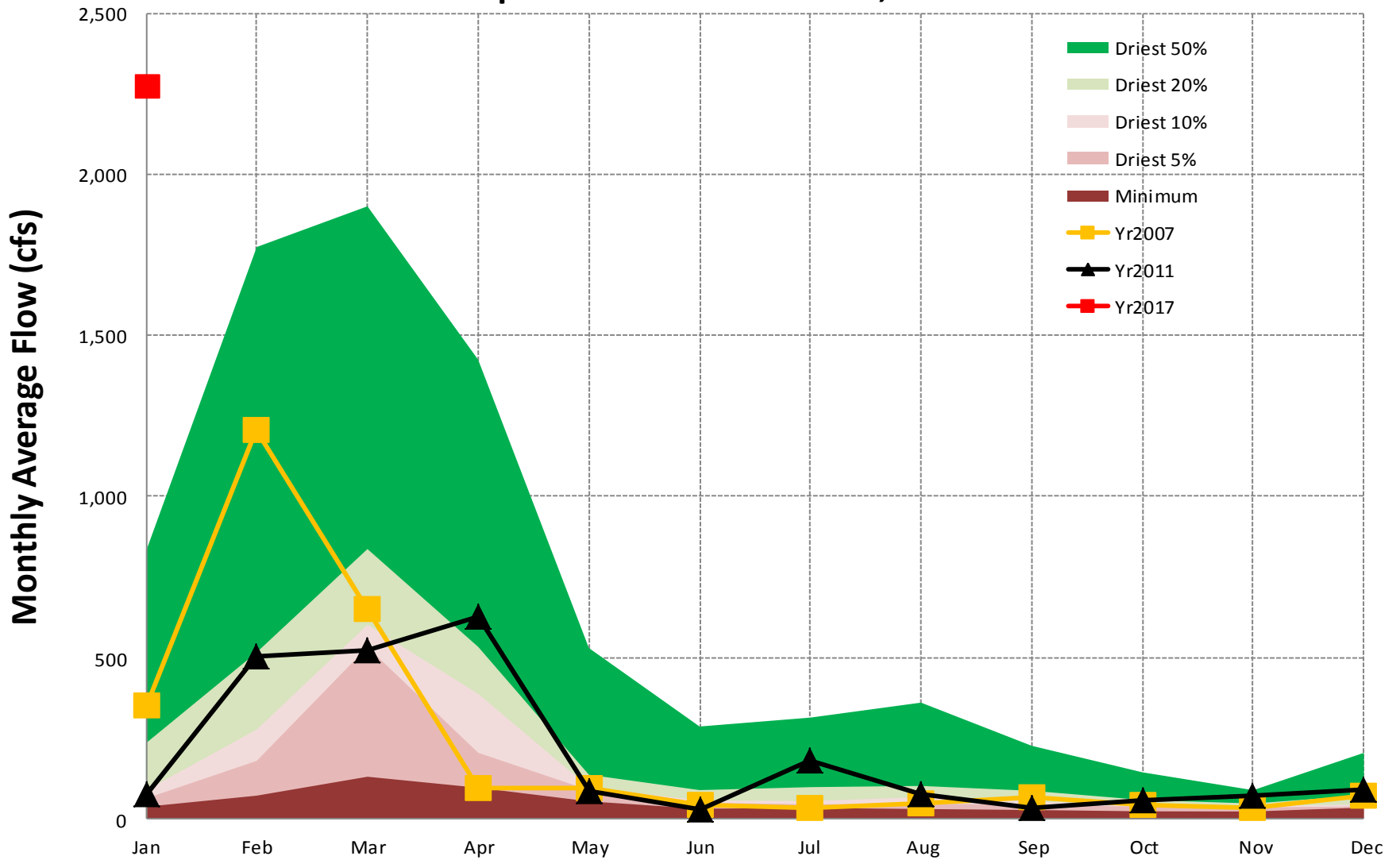


# Gage #29. USGS #02319000, Suwannee Basin, WITHLACOOCHEE RIVER near PINETTA, FL



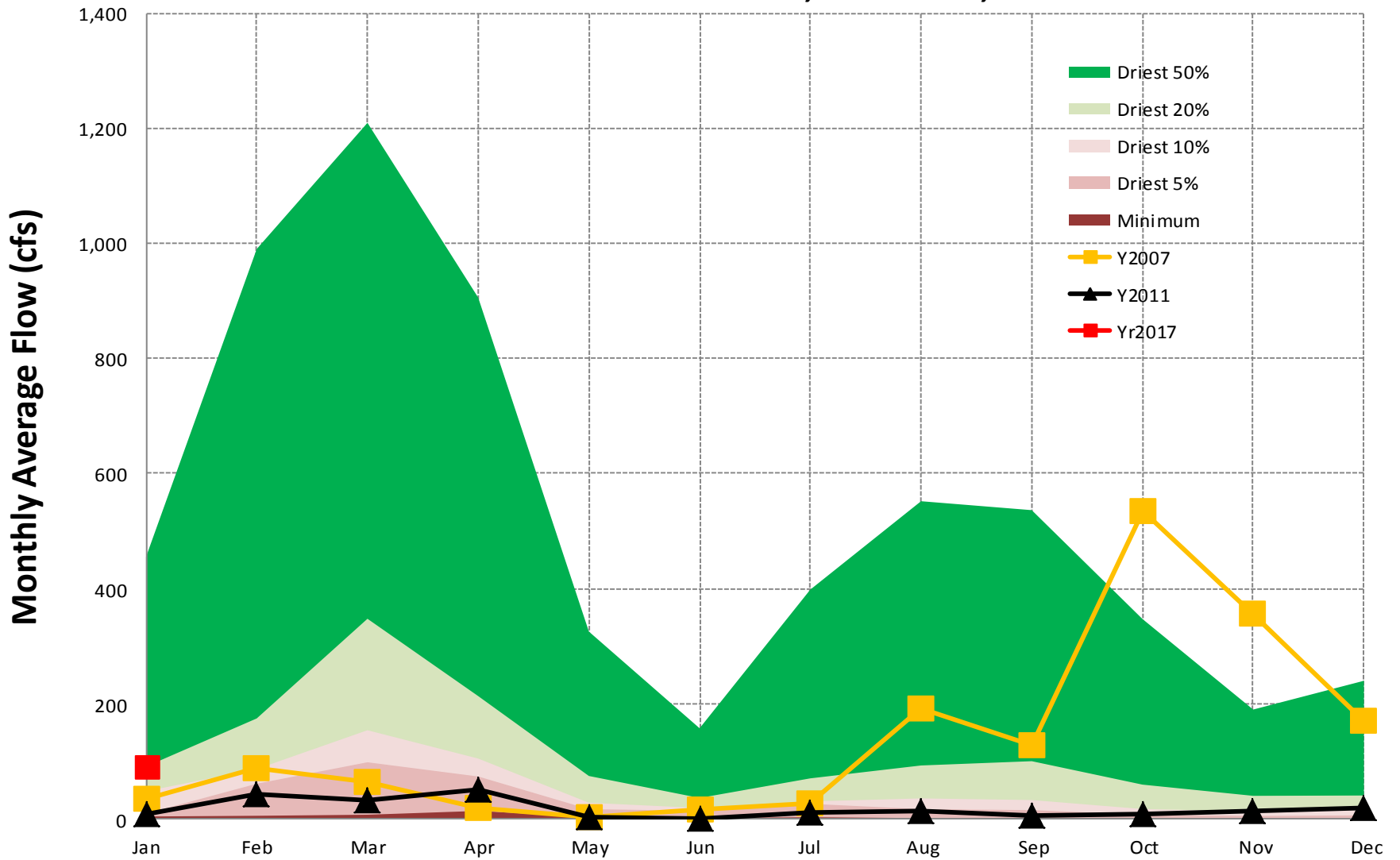
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# Gage #30. USGS #02317500, Suwanee Basin, Alapaha River at Statenville, GA



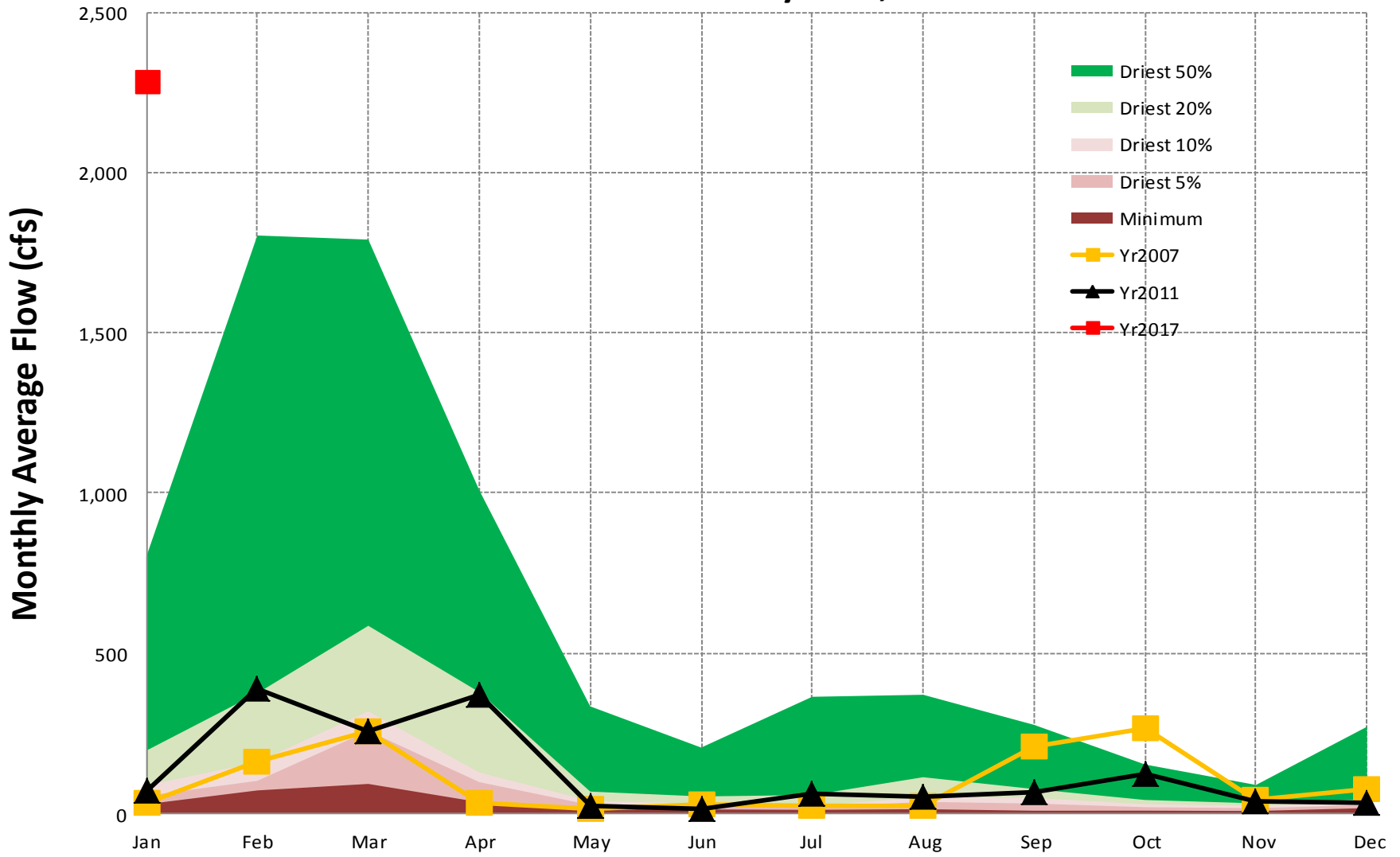
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# Gage #31. USGS #02314500, Suwannee Basin, SUWANNEE RIVER AT US 441, AT FARGO, GA



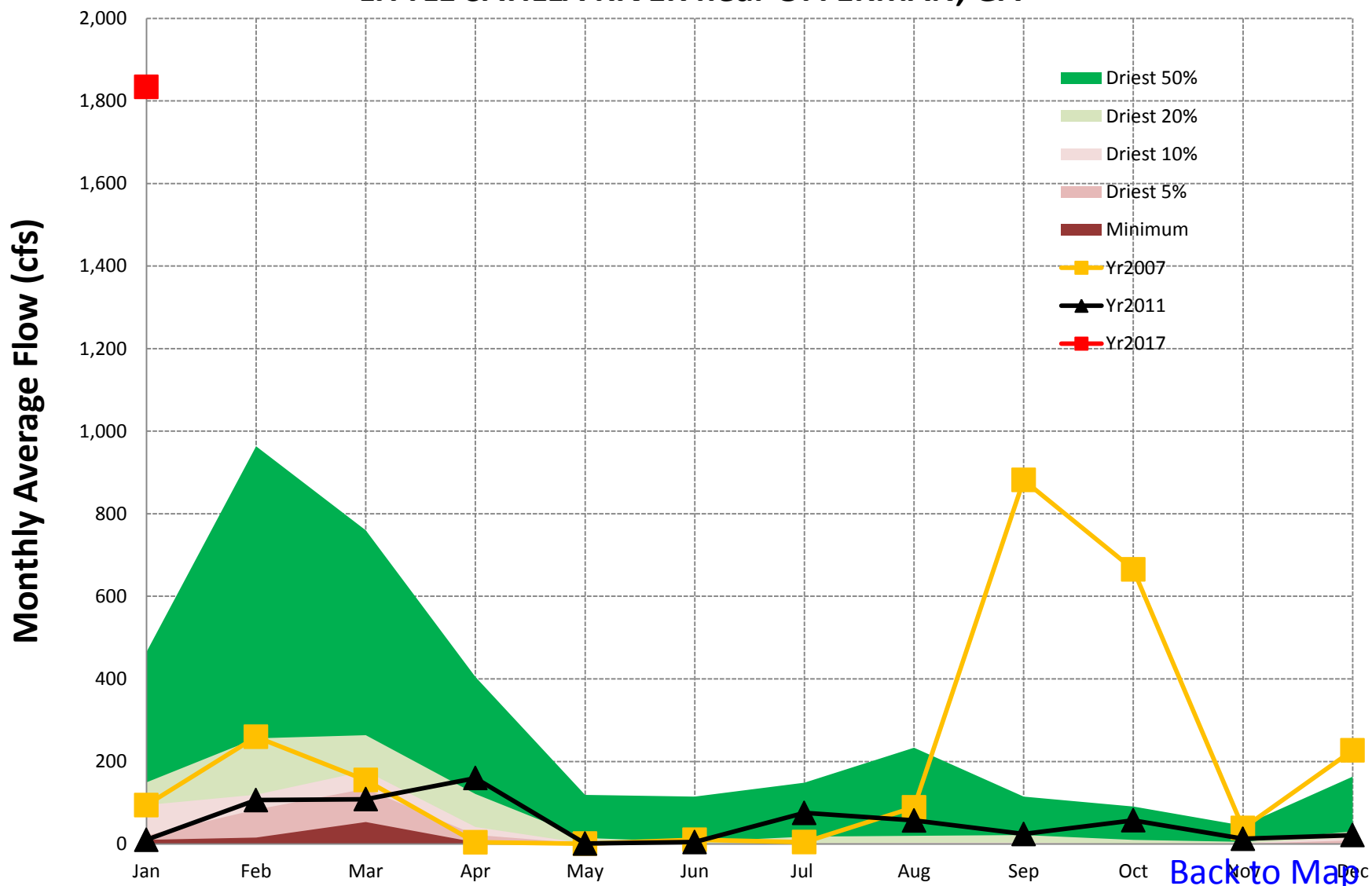
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## Gage #32. USGS #02226500, Satilla Basin, Satilla River near Waycross, GA



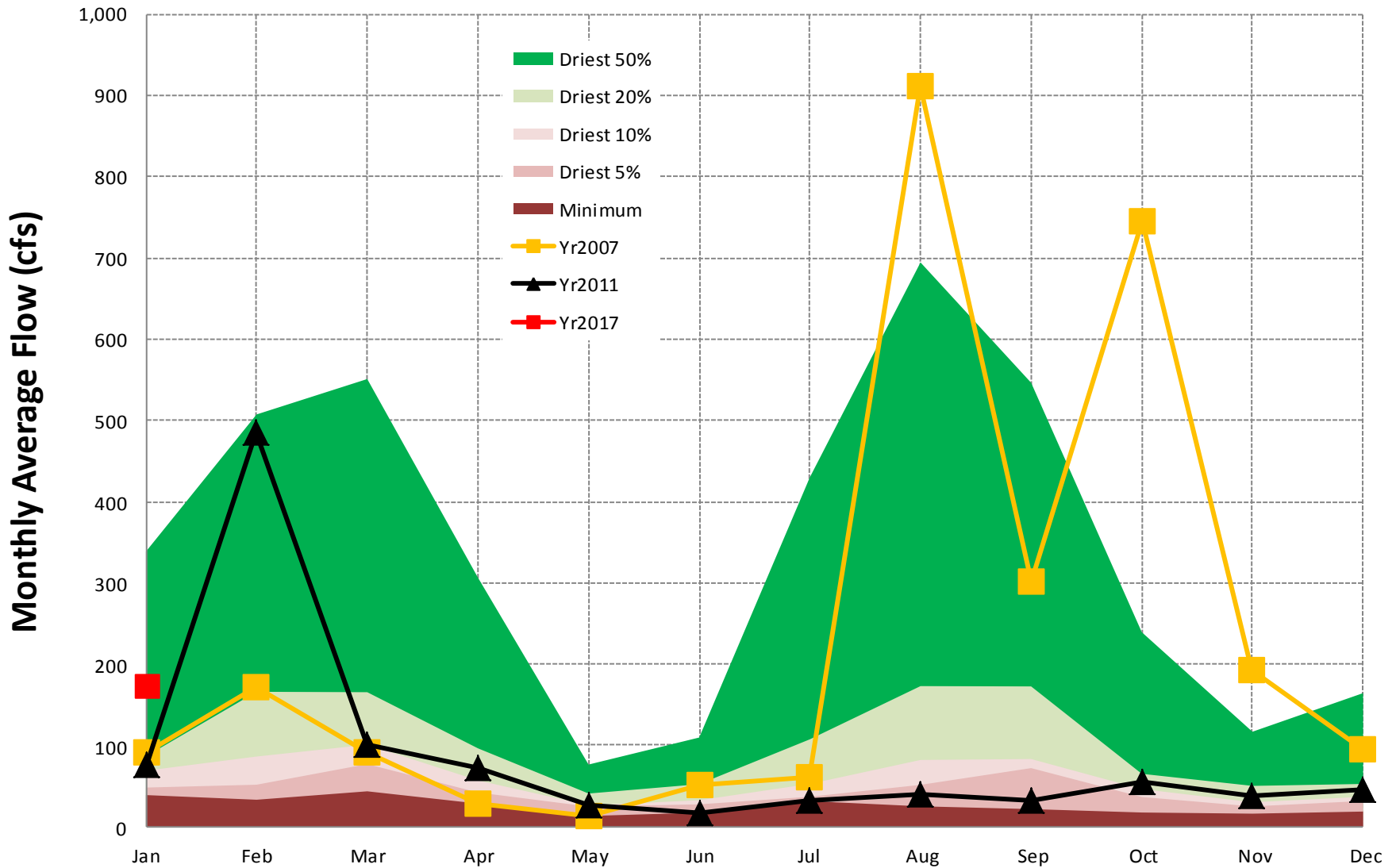
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# Gage #33. USGS #02227500, Satilla Basin, LITTLE SATILLA RIVER near OFFERMAN, GA



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**Gage #34. USGS #02231000, St Mary Basin,  
ST. MARYS RIVER near MACCLENNY, FL**



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# Groundwater Levels

Data Source: USGS

# Rationale for Choosing USGS Monitoring Wells

EPD monitors 14 groundwater USGS monitoring wells shown on the following slide to assess drought conditions. These wells were selected for monitoring because they have:

- Long-term monitoring records consisting of three decades or more of data; and
- Real-time monitoring that represents the most up-to-date conditions.



# USGS Wells Monitored by EPD to Assess Drought Conditions

## Savannah Basin

1. 30AA04

## Flint Basin

2. 11AA01
3. 13L180
4. 12M017
5. 08K001
6. 11K003
7. 12K014
8. 13J004
9. 08G001
10. 10G313
11. 09F520

## Oconee Basin

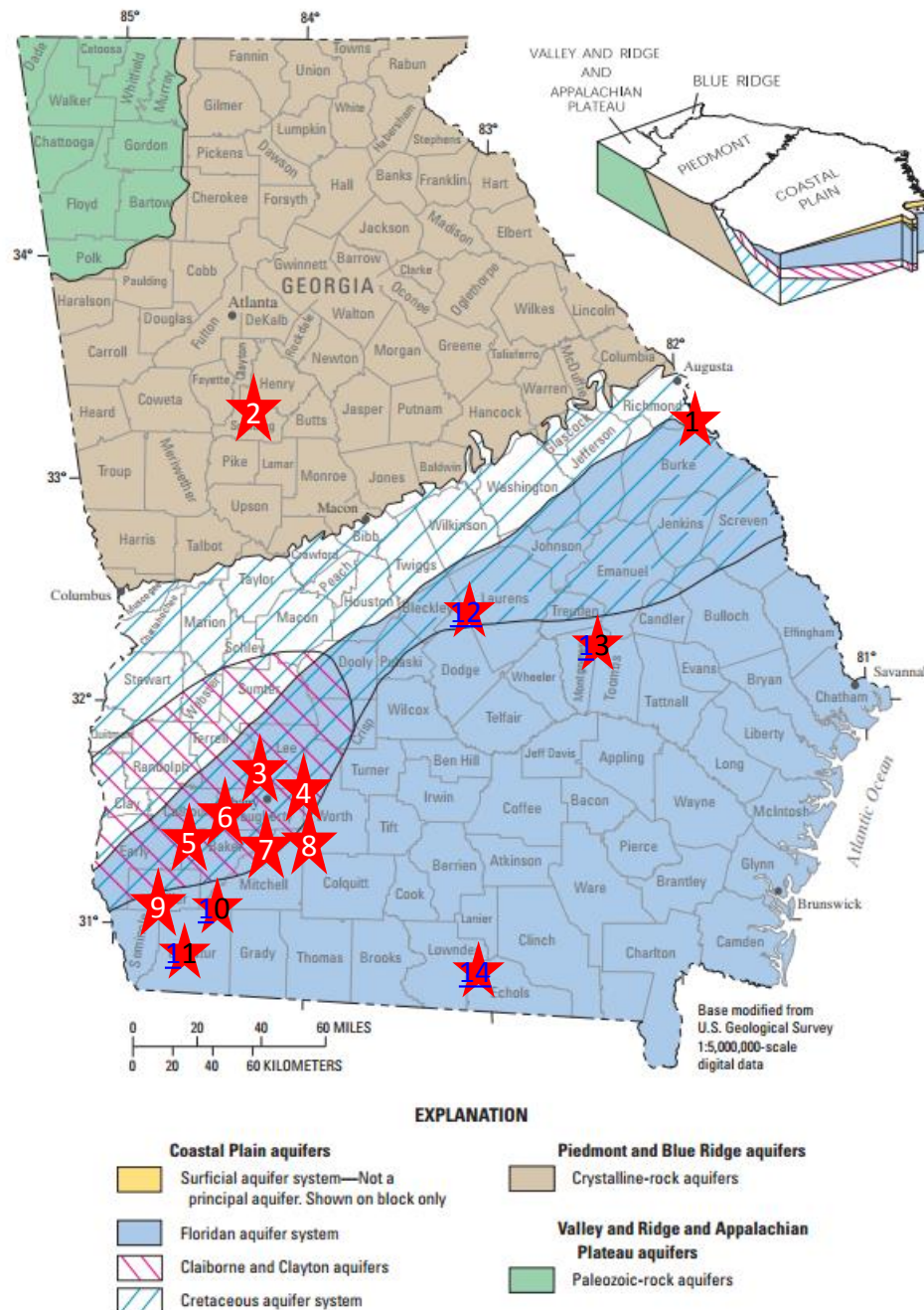
12. 21T001

## Altamaha Basin

13. 26R001

## Suwanee Basin

14. 19E009



**Figure 2.** Area of use of principal aquifers and physiographic provinces in Georgia (modified from U.S. Geological Survey, 2006).

# Groundwater Level Graphs

- For each of the 15 groundwater wells, EPD has prepared a graph that shows monthly average groundwater levels from January, 2017 through January, 2017;
- To help put these levels into perspective, for comparison purposes, each graph also shows:
  - Monthly average levels at that same well for the years 2007 and 2011 when groundwater levels were at or near recorded low levels across much of the state; and
  - And a statistical composite of historical conditions at that same gage showing the “lowest” 50, 20, 10, and 5 percent of all recorded monthly average levels at the same well.

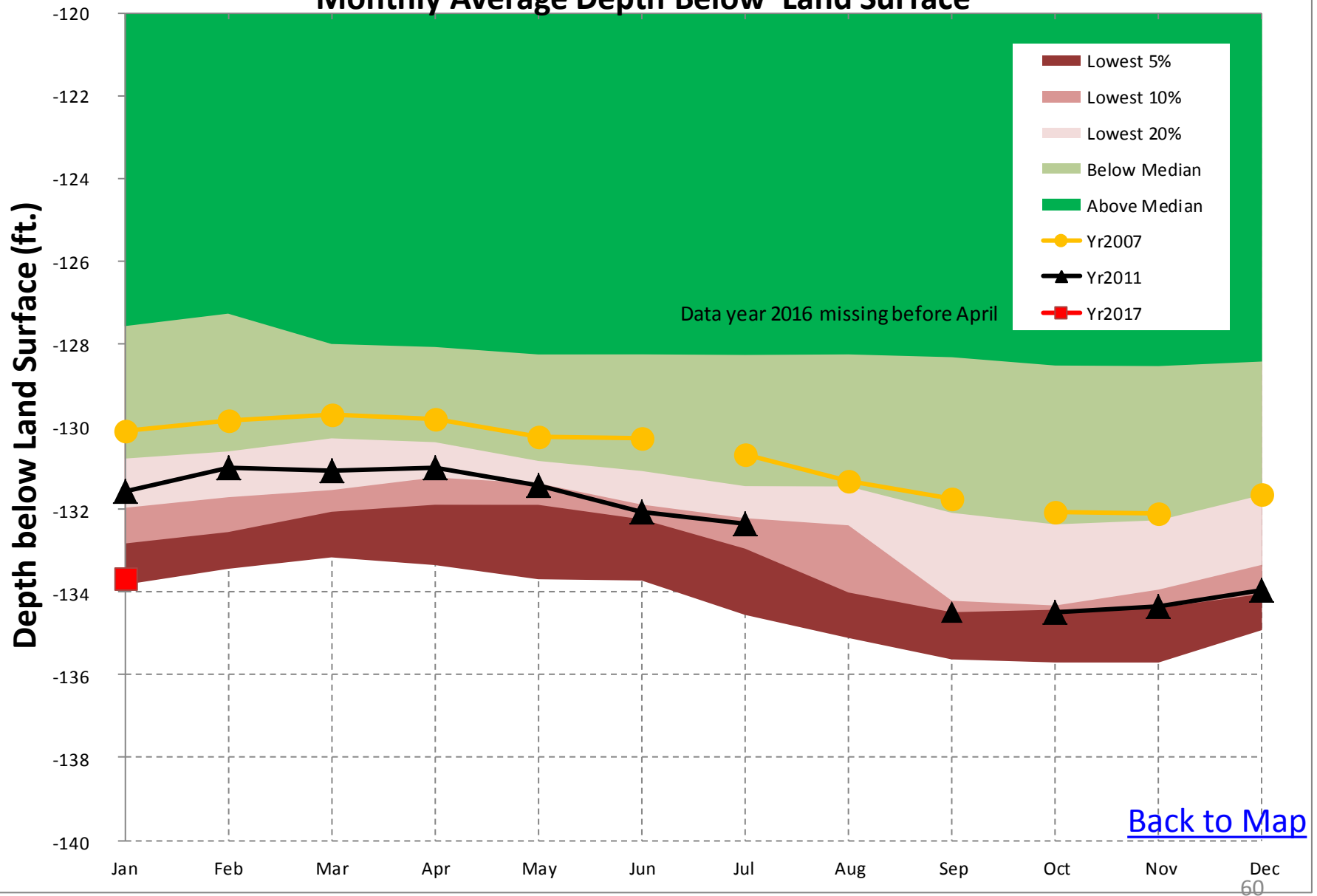
# How to Read the Groundwater Level Graphs

## Example: [Well #11, 09F520, Flint River Basin](#)

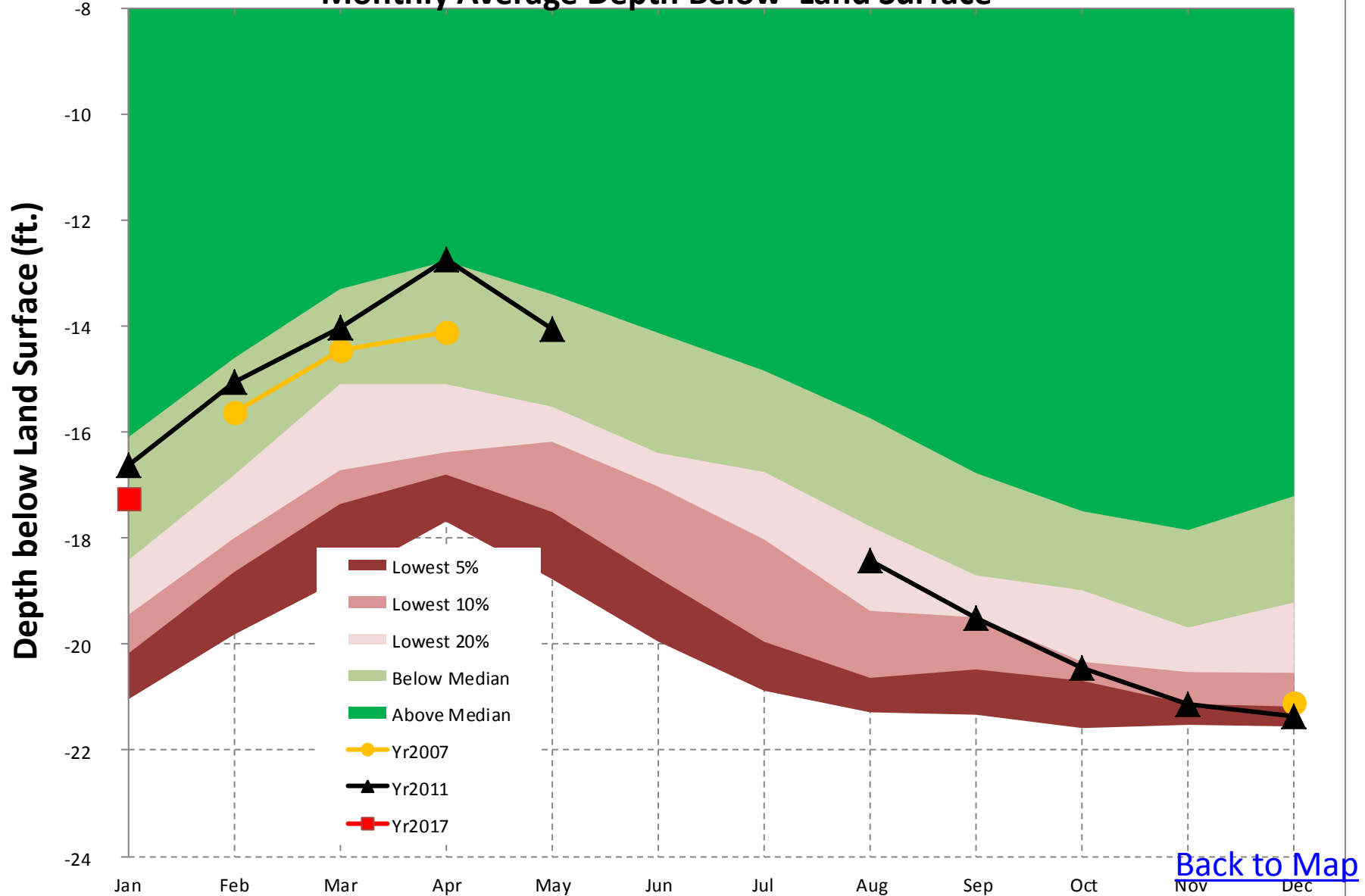
The groundwater level graph for Well #11, USGS 09F520 shows:

- The average monthly groundwater level for January 2017 was 48ft below land surface. The statistical composite of all historical data for this well shows that monthly average groundwater levels in January have historically been lower than January 2017 about 50% of the time; about 50% of the time in January they have been higher.
- The average monthly groundwater level in January 2011 was 49ft below land surface. The statistical composite of all historical data for this well shows that monthly average groundwater levels in January have historically been lower than January 2017 about 20% of the time; about 80% of the time in January they have been higher.
- The average monthly groundwater level in January 2007 was 48ft below land surface. The statistical composite of all historical data for this well shows that monthly average groundwater levels in January have historically been lower than January 2017 about 50% of the time; about 50% of the time in January they have been higher.

# Well #1, 30AA04, Gordon & Dublin Aquifers in Savannah Basin, Monthly Average Depth Below Land Surface

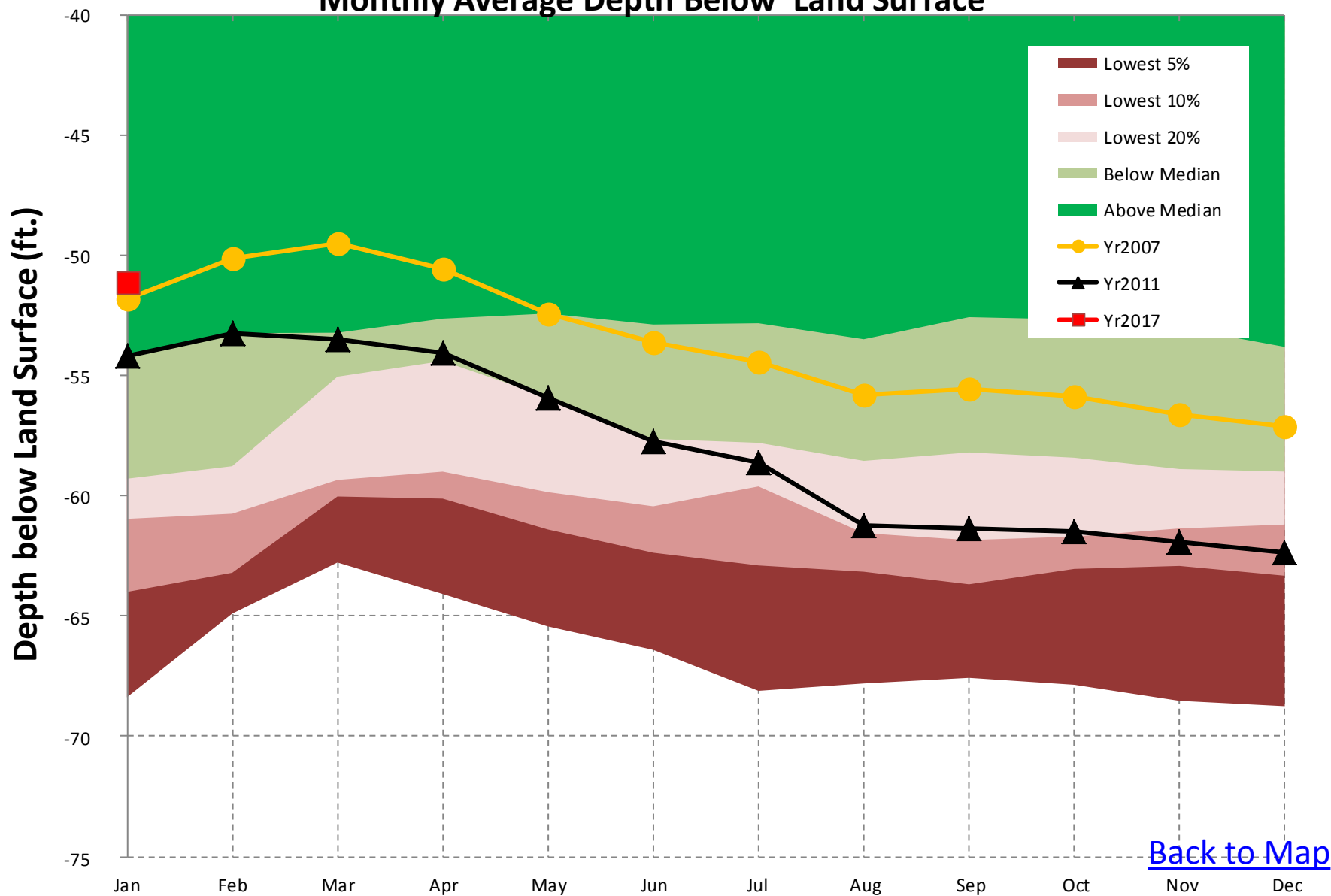


# Well #2, 11AA01, Surficial Aquifer in Flint Basin, Monthly Average Depth Below Land Surface



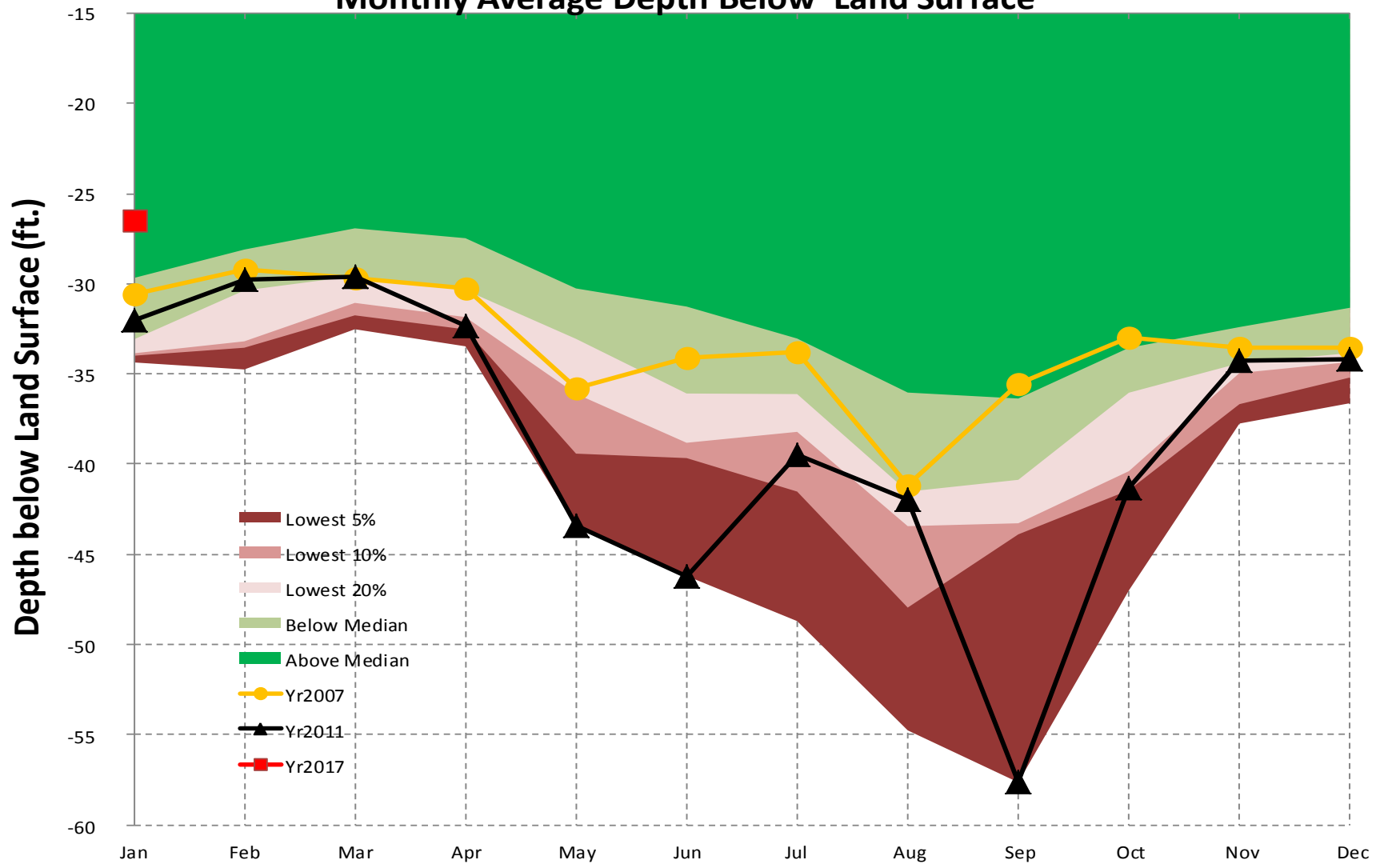
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# Well #3, 13L180, Floridan Aquifer in Flint Basin, Monthly Average Depth Below Land Surface



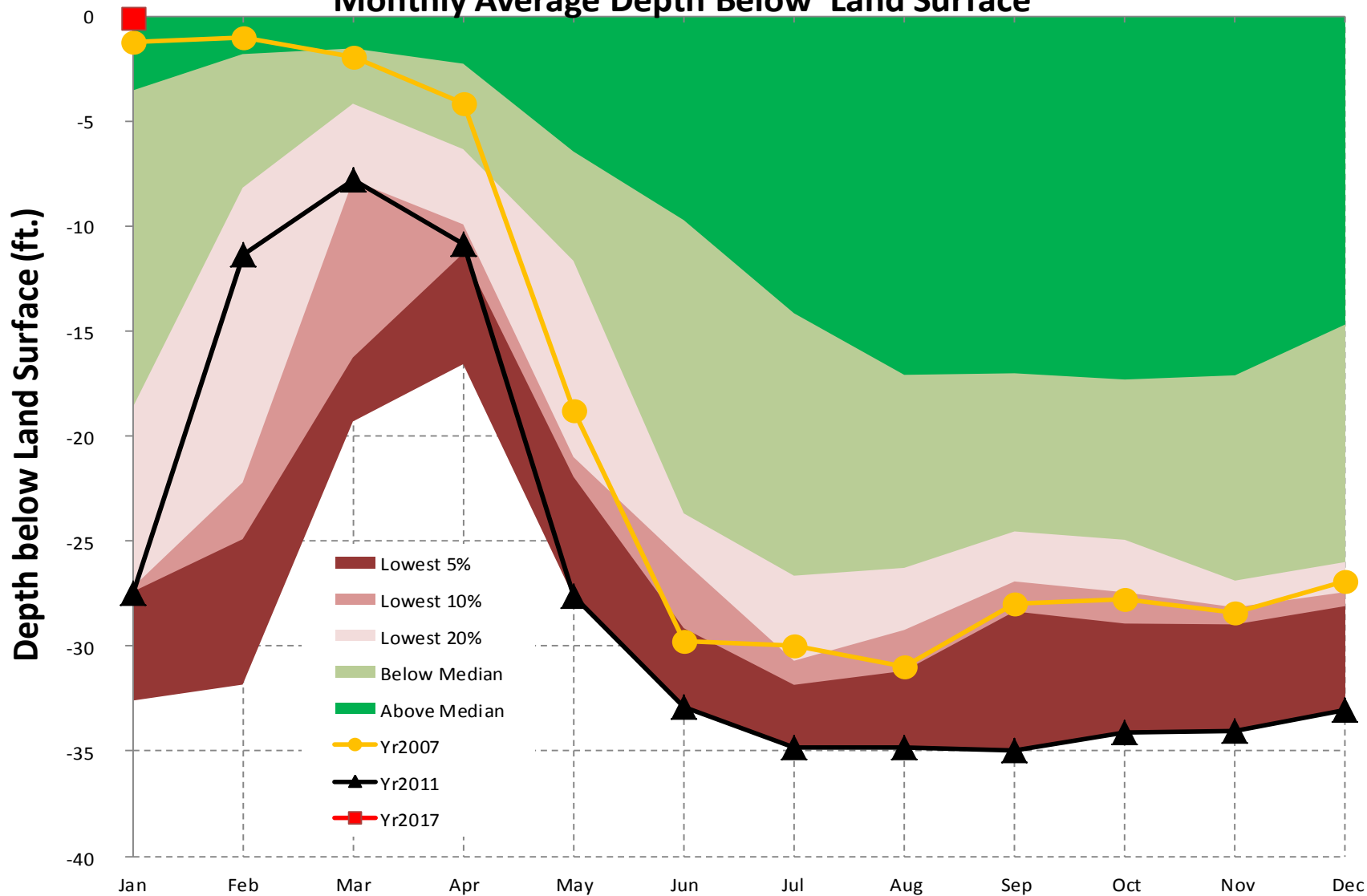
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# Well #4, 12M017, Floridan Aquifer in Flint Basin, Monthly Average Depth Below Land Surface



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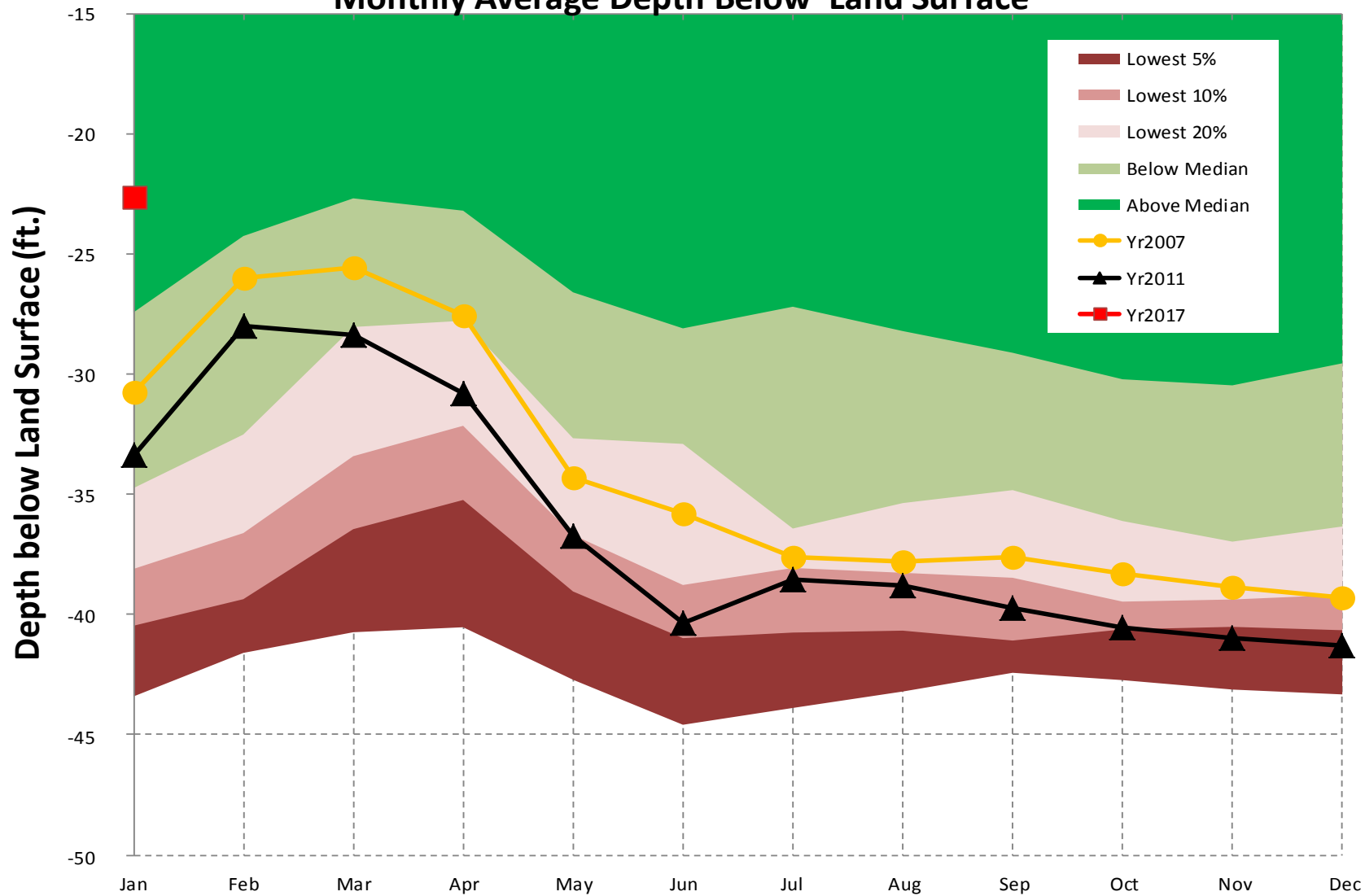
# Well #5, 08K001, Floridan Aquifer in Flint Basin, Monthly Average Depth Below Land Surface



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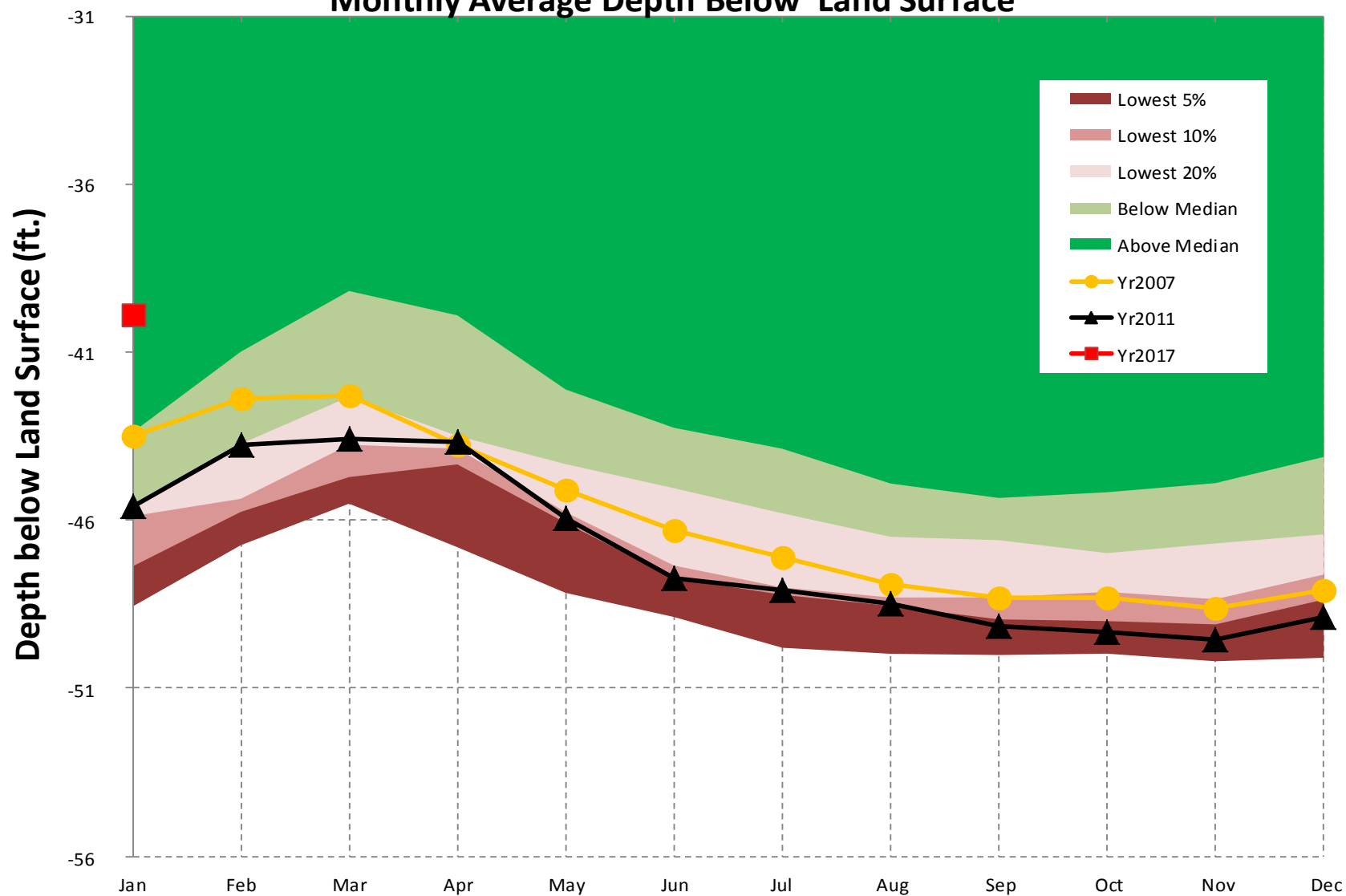


# Well #6, 11K003, Floridan Aquifer in Flint Basin, Monthly Average Depth Below Land Surface



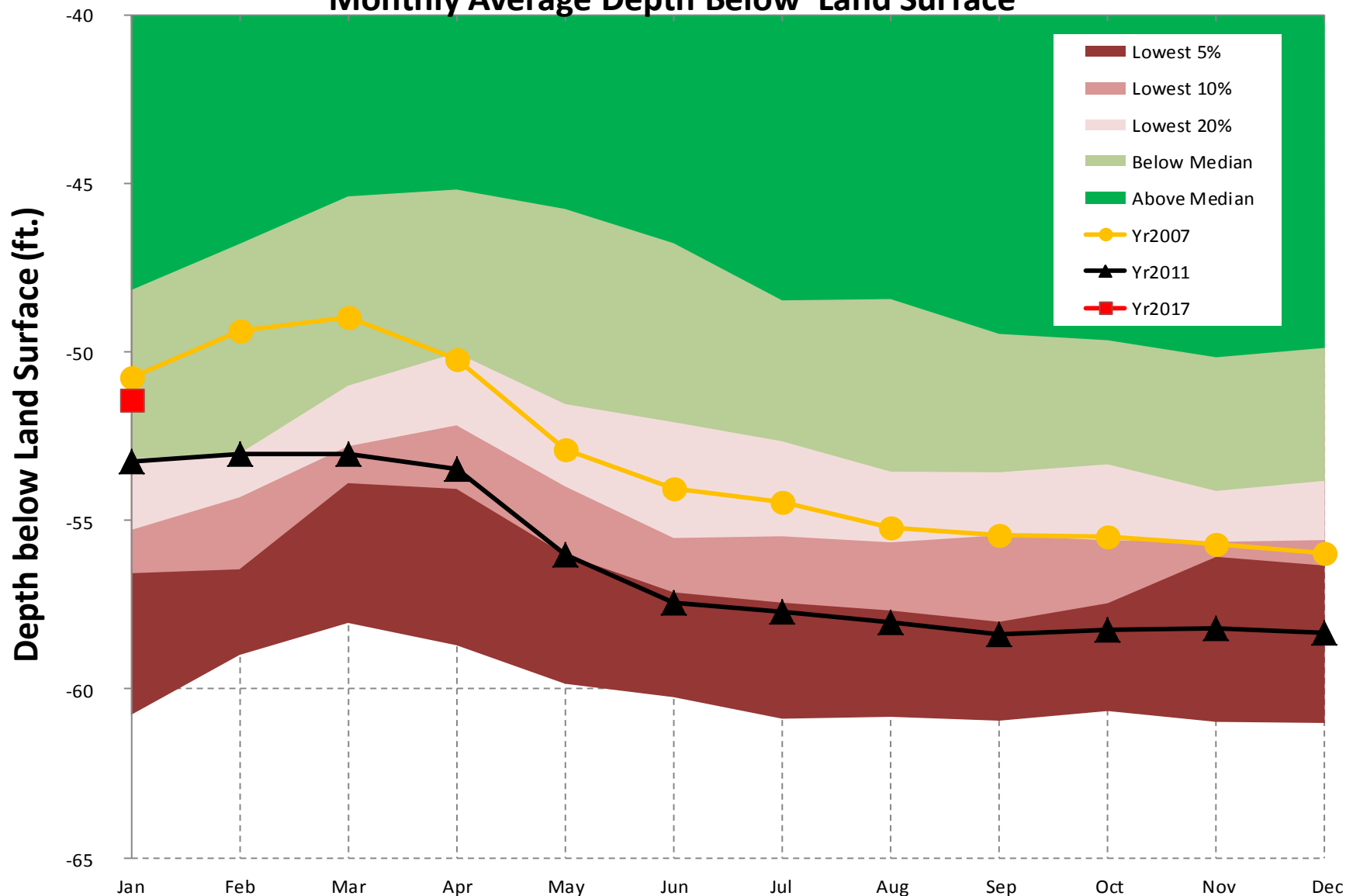
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# Well #7, 12K014, Floridan Aquifer in Flint Basin, Monthly Average Depth Below Land Surface



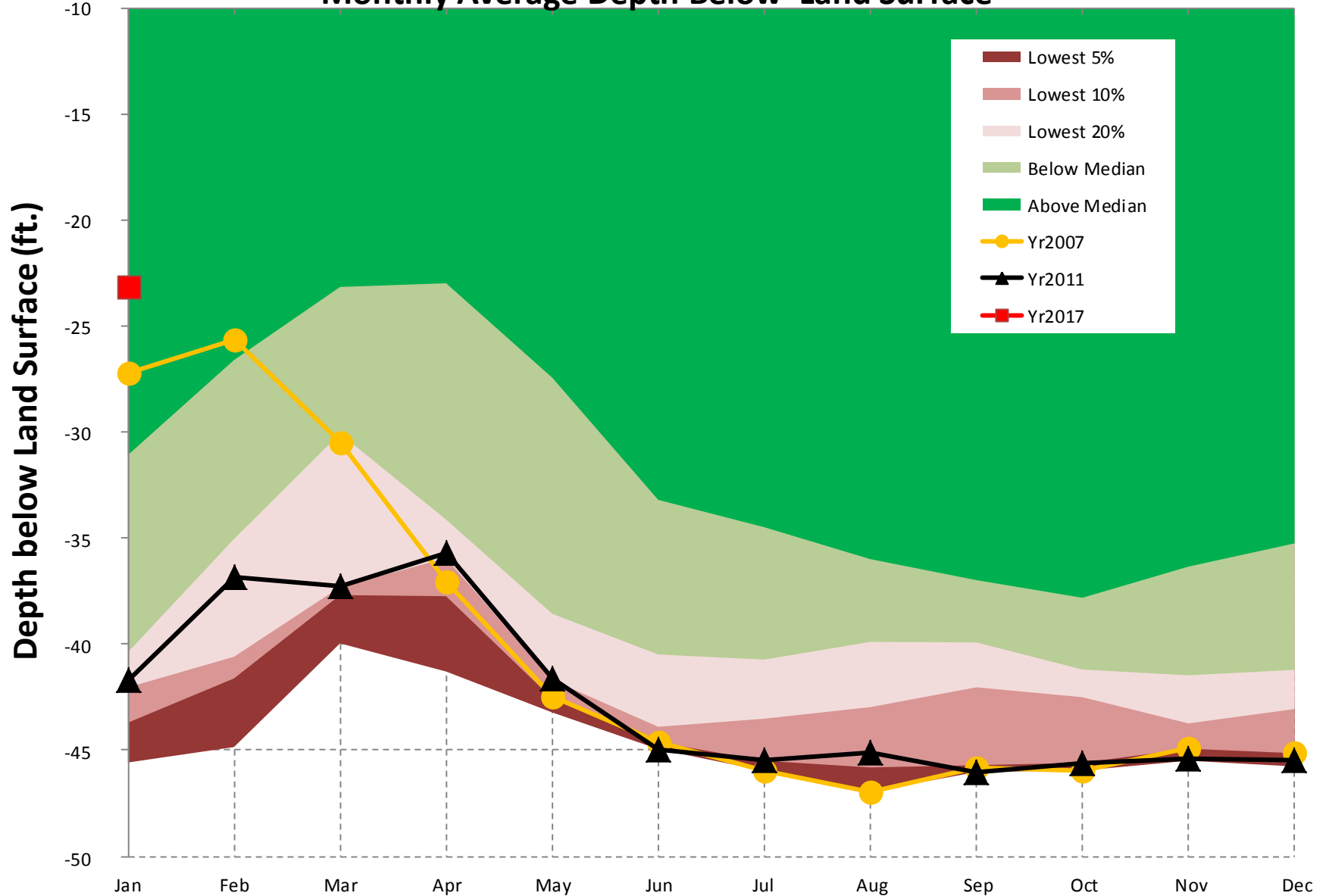
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# Well #8, 13J004, Floridan Aquifer in Flint Basin, Monthly Average Depth Below Land Surface

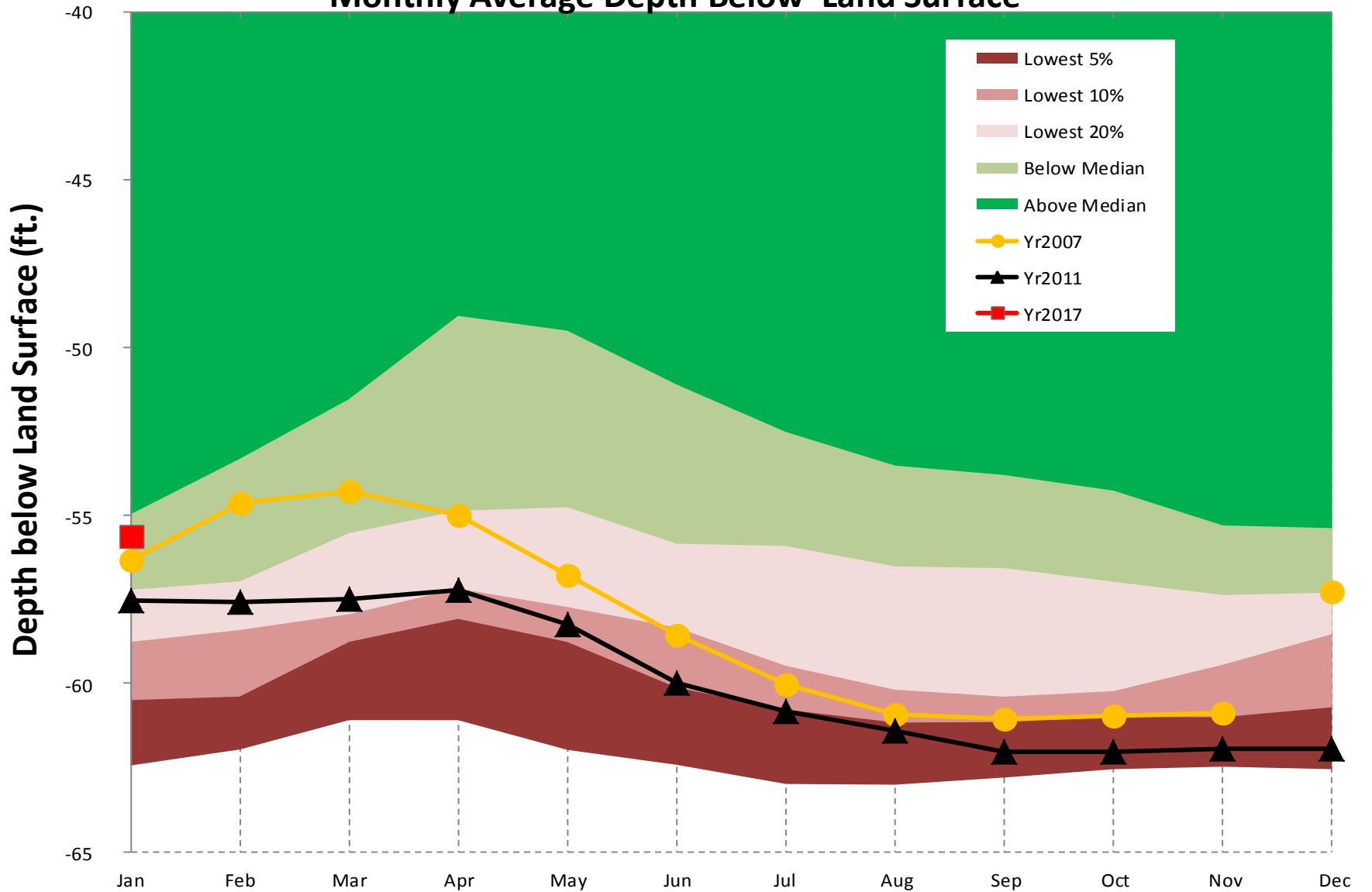


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# Well #9, 08G001, Floridan Aquifer in Flint Basin, Monthly Average Depth Below Land Surface

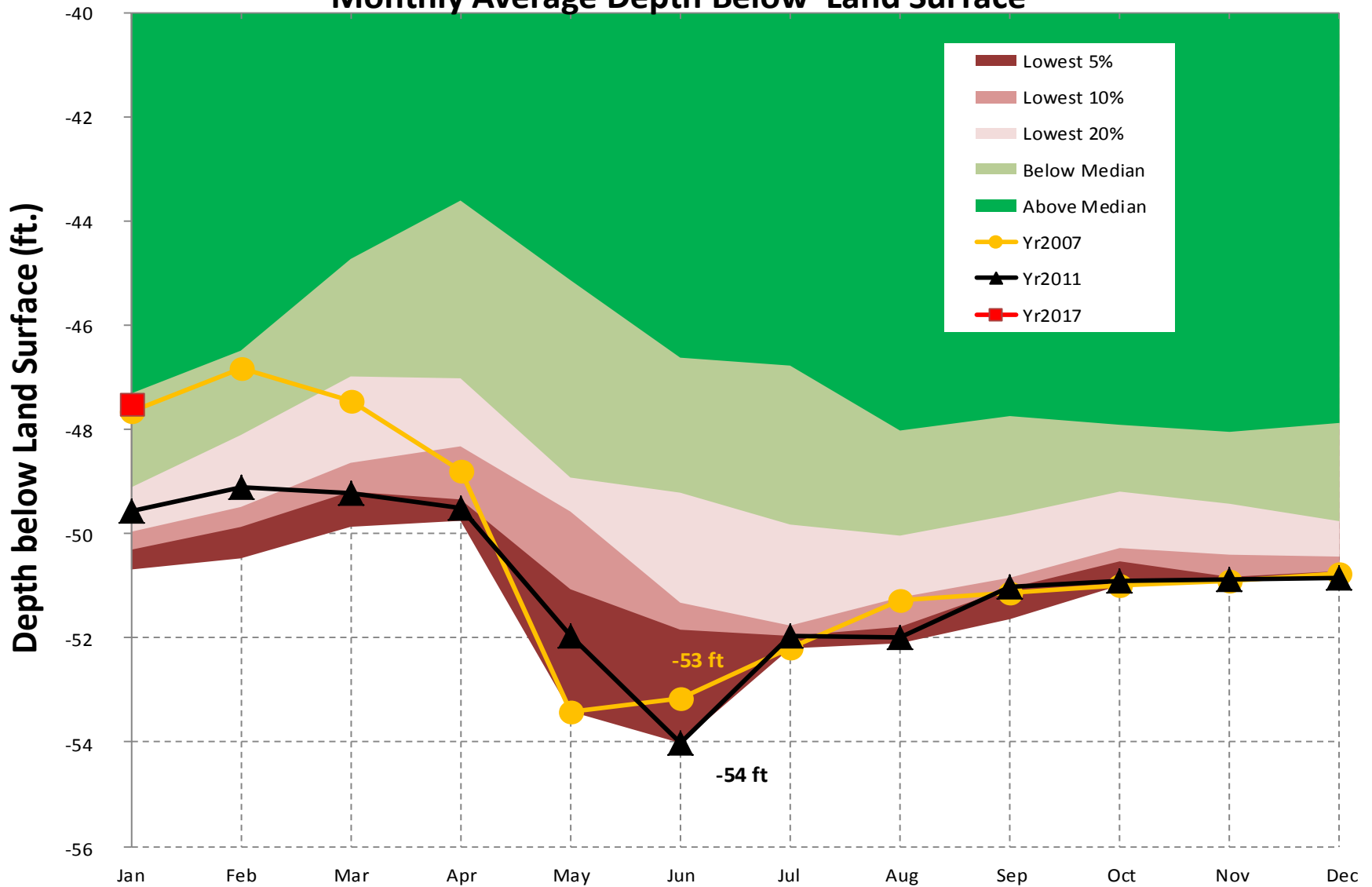


# Well #10, 10G313, Floridan Aquifer in Flint Basin, Monthly Average Depth Below Land Surface



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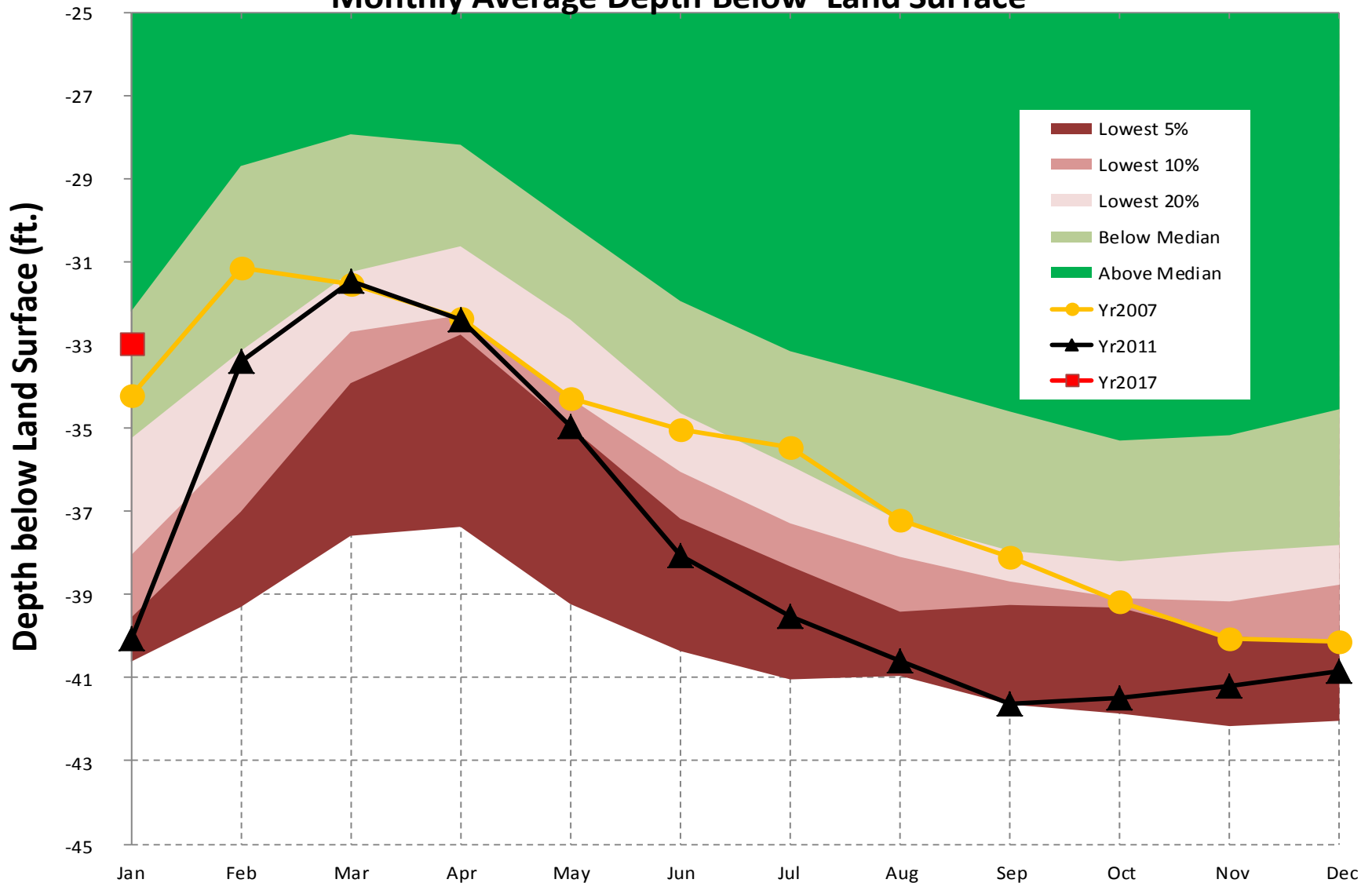
# Well #11, 09F520, Floridan Aquifer in Flint Basin, Monthly Average Depth Below Land Surface



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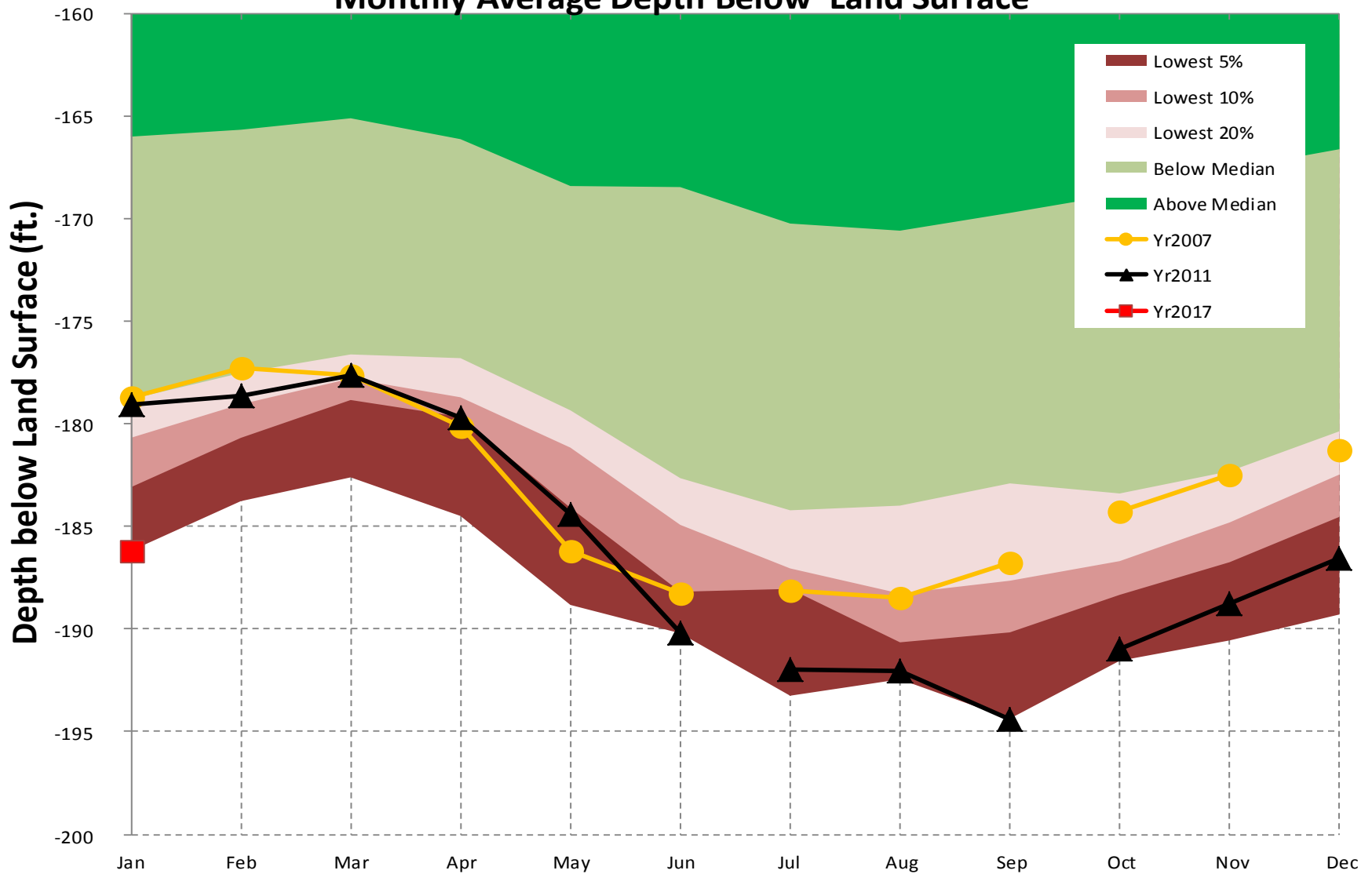
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# Well #12, 21T001, Floridan Aquifer in Ocone Basin, Monthly Average Depth Below Land Surface



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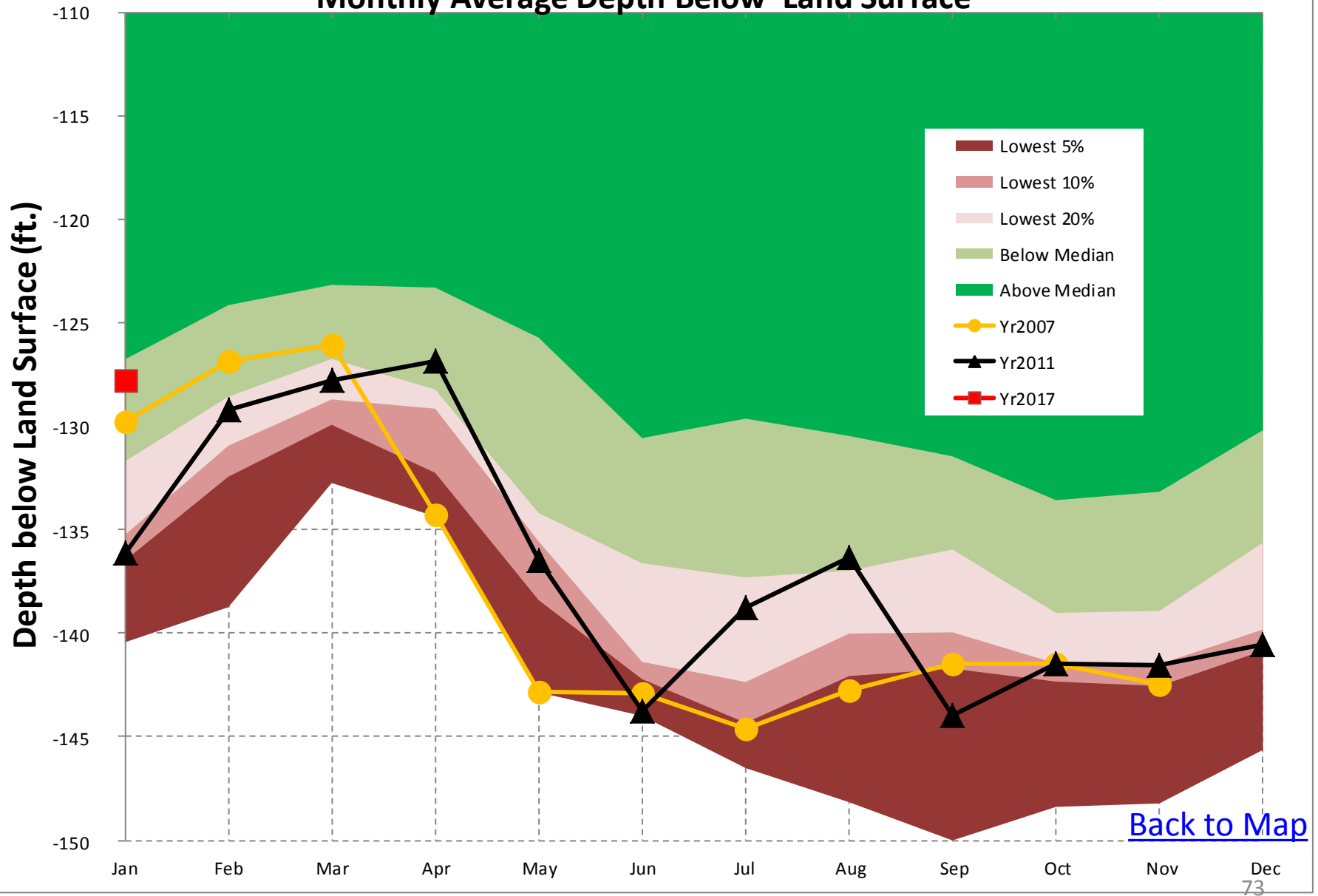
# Well #13, 26R001, Floridan Aquifer in Altamaha Basin, Monthly Average Depth Below Land Surface



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# Well #14, 19E009, Floridan Aquifer in Suwannee Basin, Monthly Average Depth Below Land Surface



# Reservoir Levels

Data Source:  
US Army Corps of Engineers

### Coosa Basin

1. Carters
2. Allatoona

### Chattahoochee Basin

3. Lanier
4. West Point
5. W.F. George

### Savannah Basin

6. Hartwell
7. Thurmond

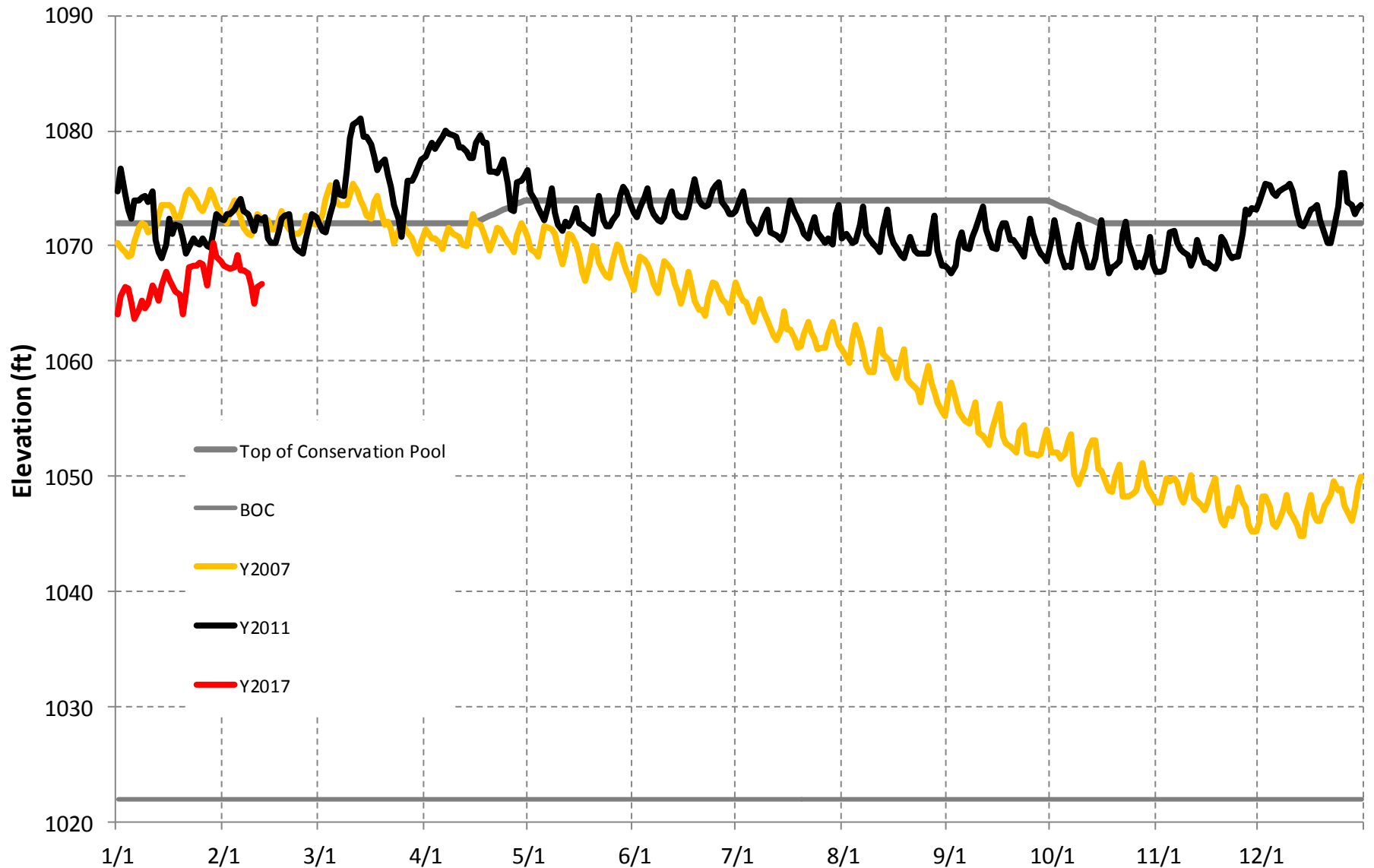


EPD monitors the water levels of seven reservoirs to assess drought conditions.

# Reservoir Elevation Graphs

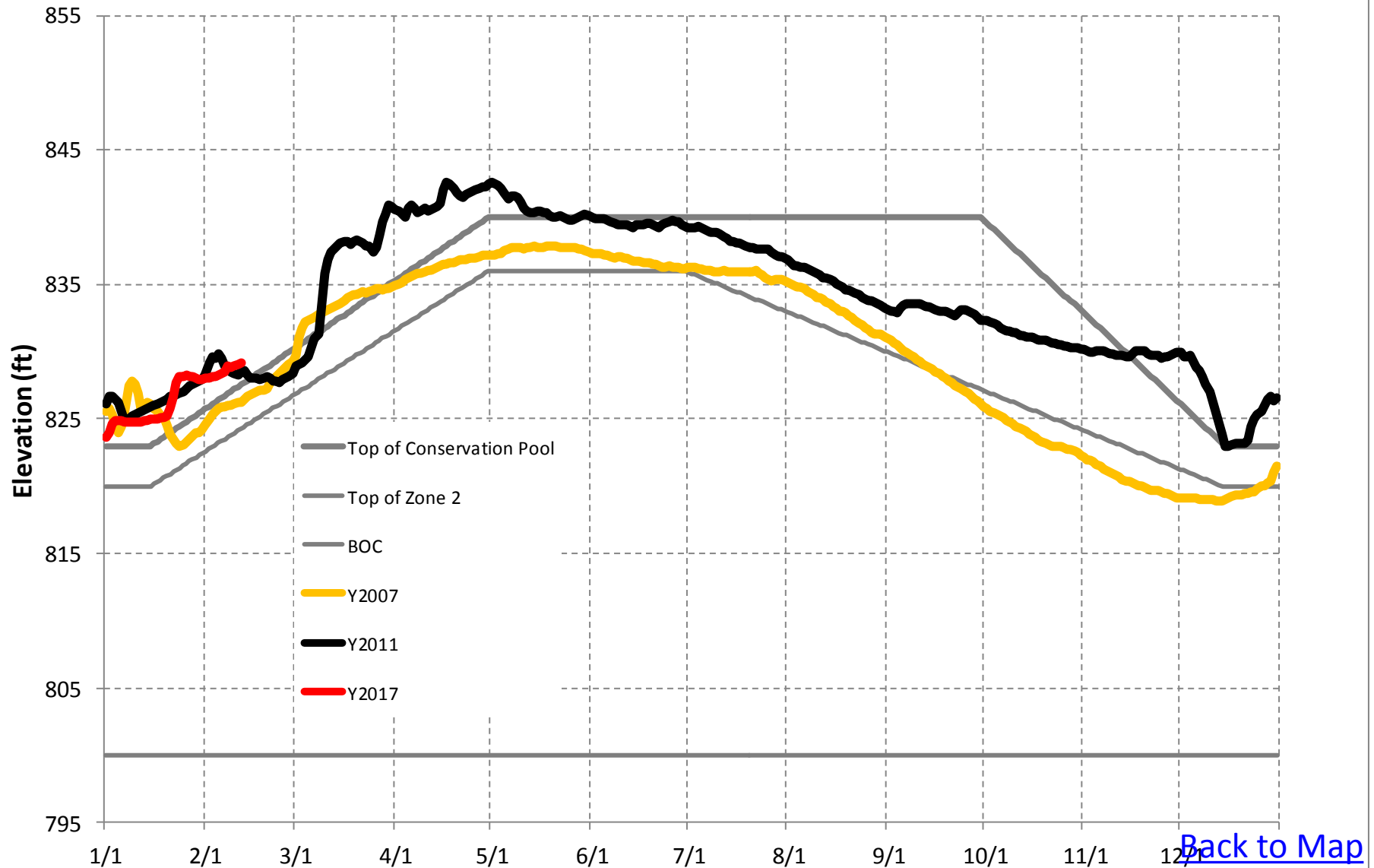
- The following graphs show the reservoir elevation curves for January, 2017 through January, 2017.
- Each graph also shows the Action Zone Divides (or Levels) for each reservoir
  - Zone 1 is the top layer of the conservation pool
  - Zone 2 is the layer below Zone 1
  - Zone 4 is the lowest layer in the conservation pool
  - There is no conservation storage below the bottom of Zone 4
- To put 2017 reservoir elevations into perspective, elevations for 2007 and 2011 are also shown.

# CARTERS ELEVATION



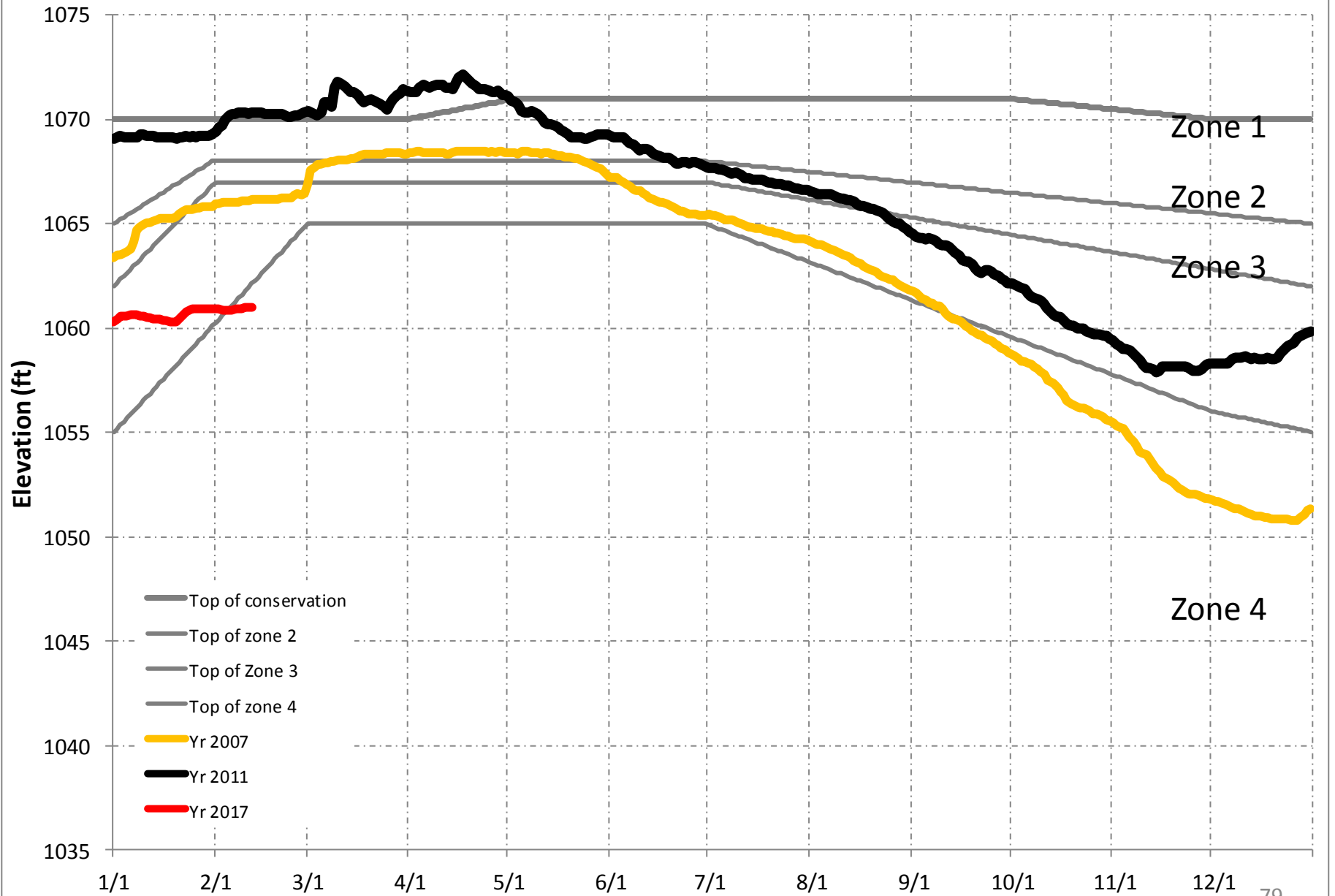
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# ALLATOONA ELEVATION



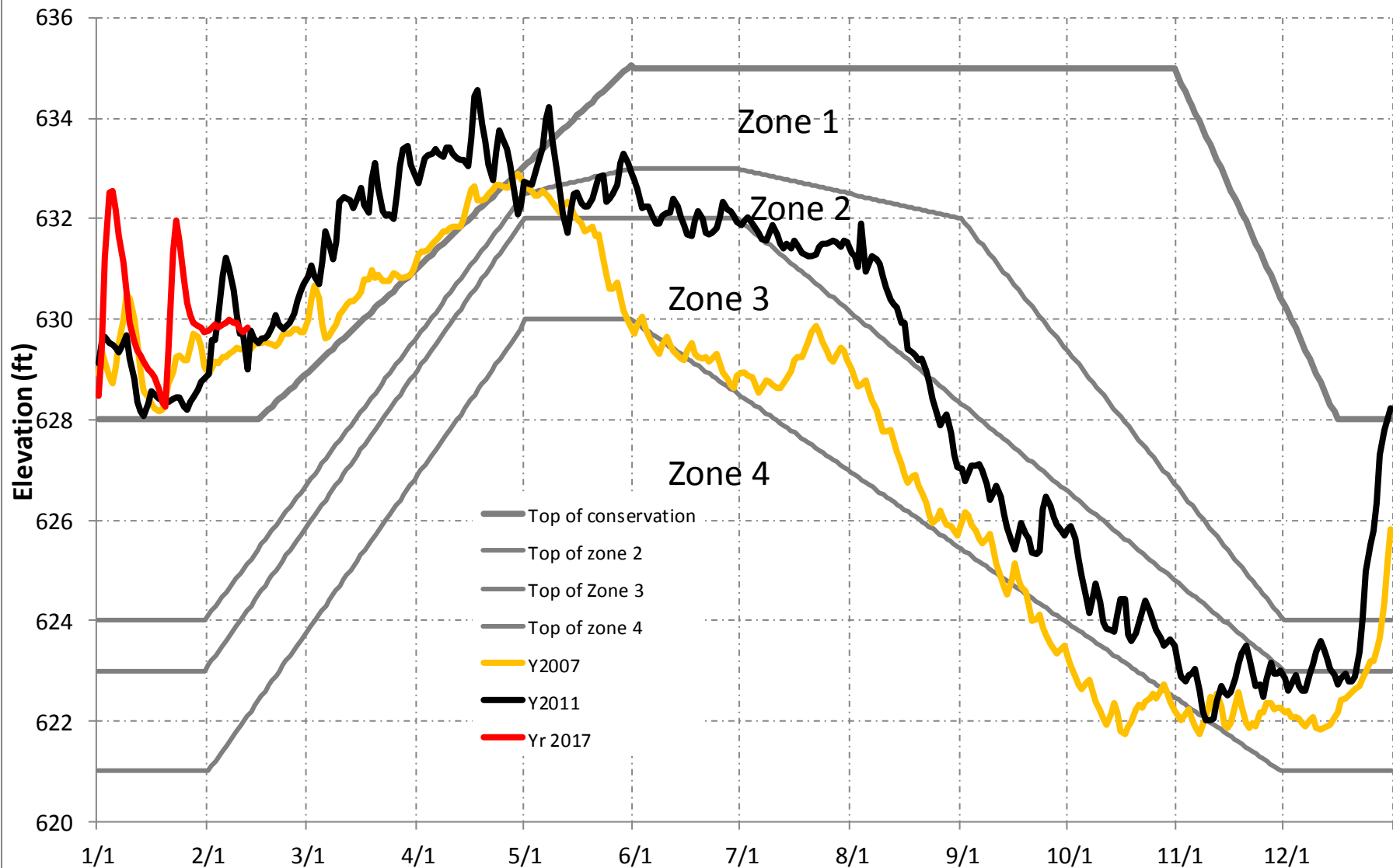
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# LAKE LANIER ELEVATION



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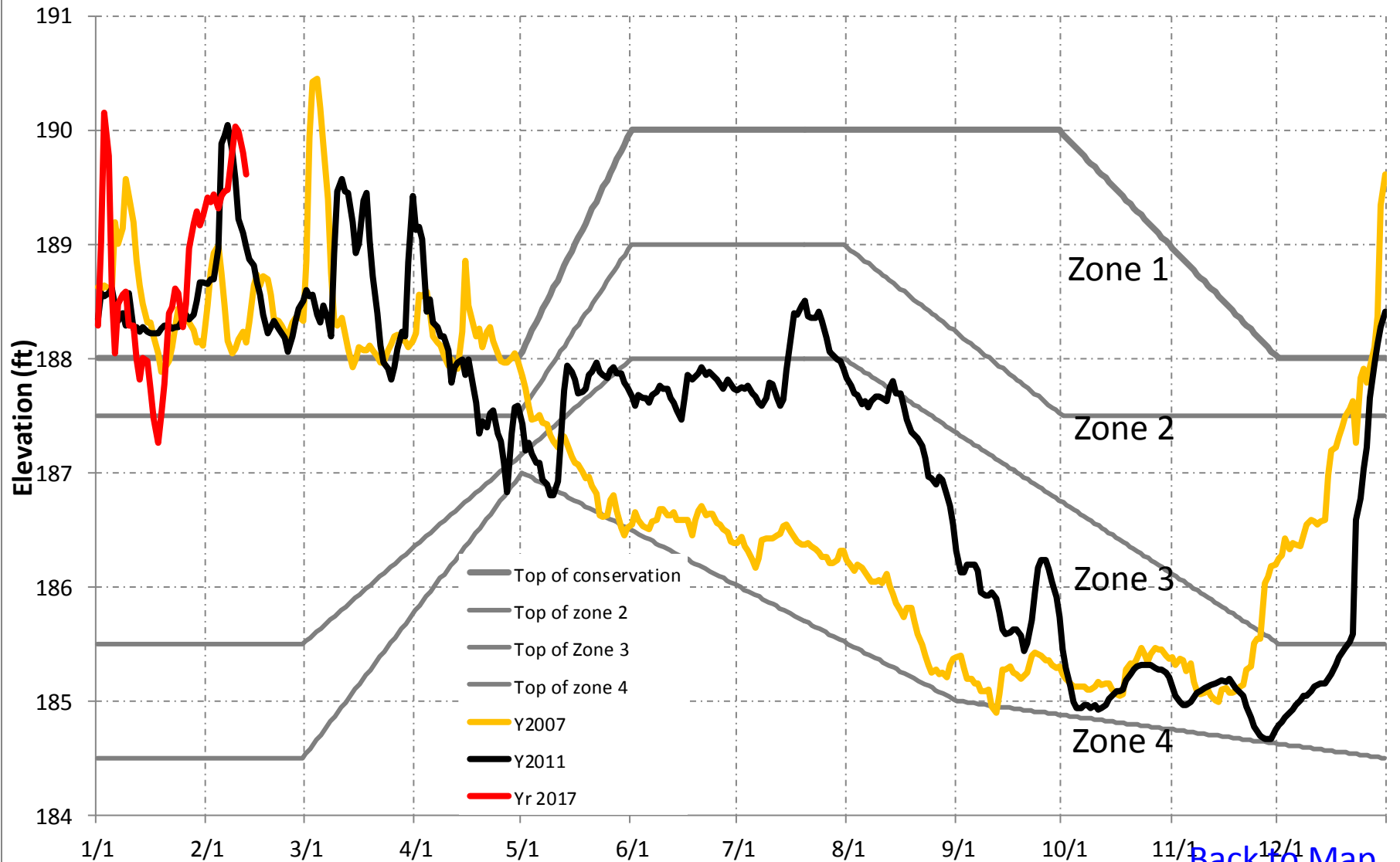
# WEST POINT ELEVATION



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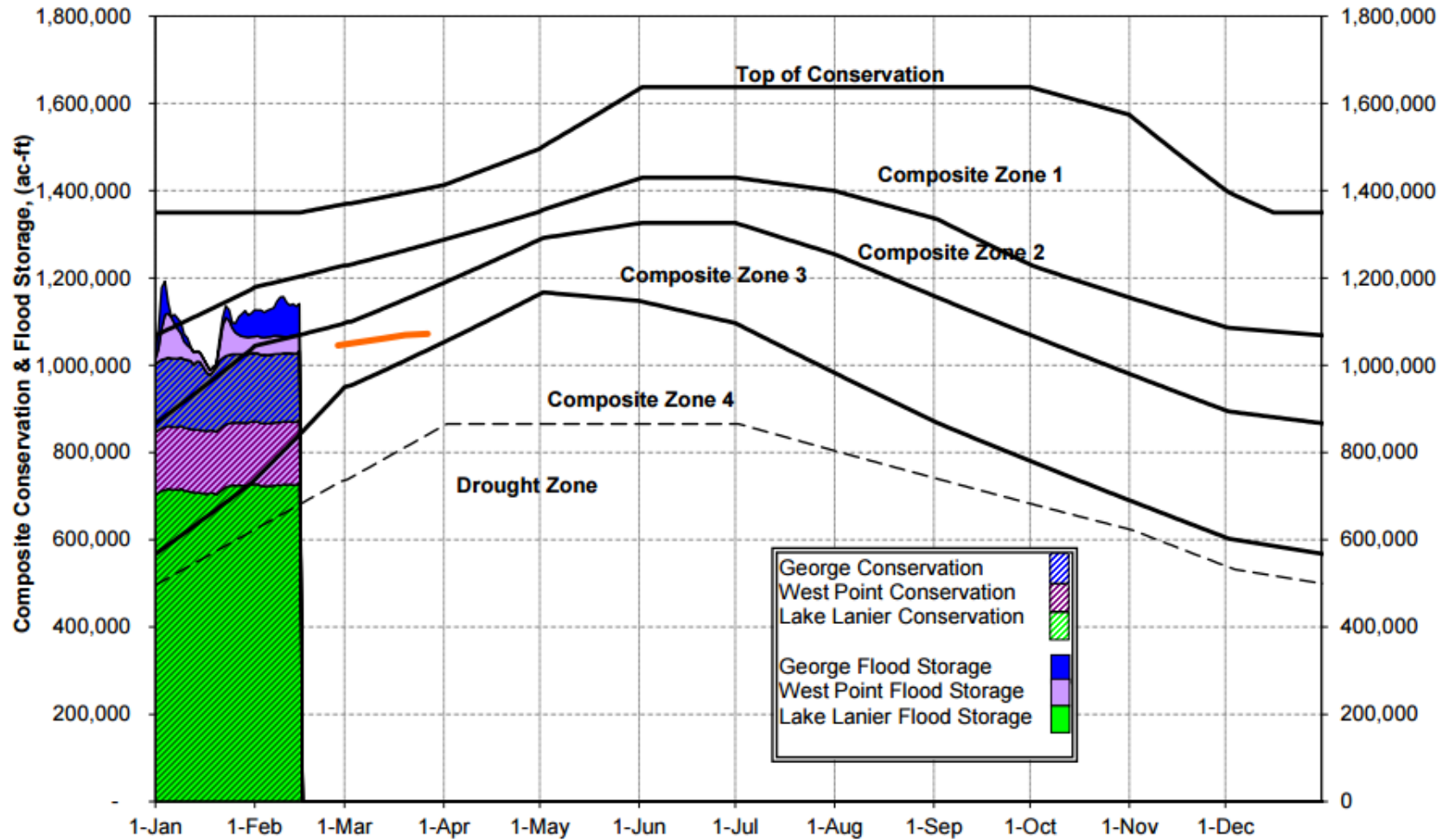


# W.F.GEORGE ELEVATION



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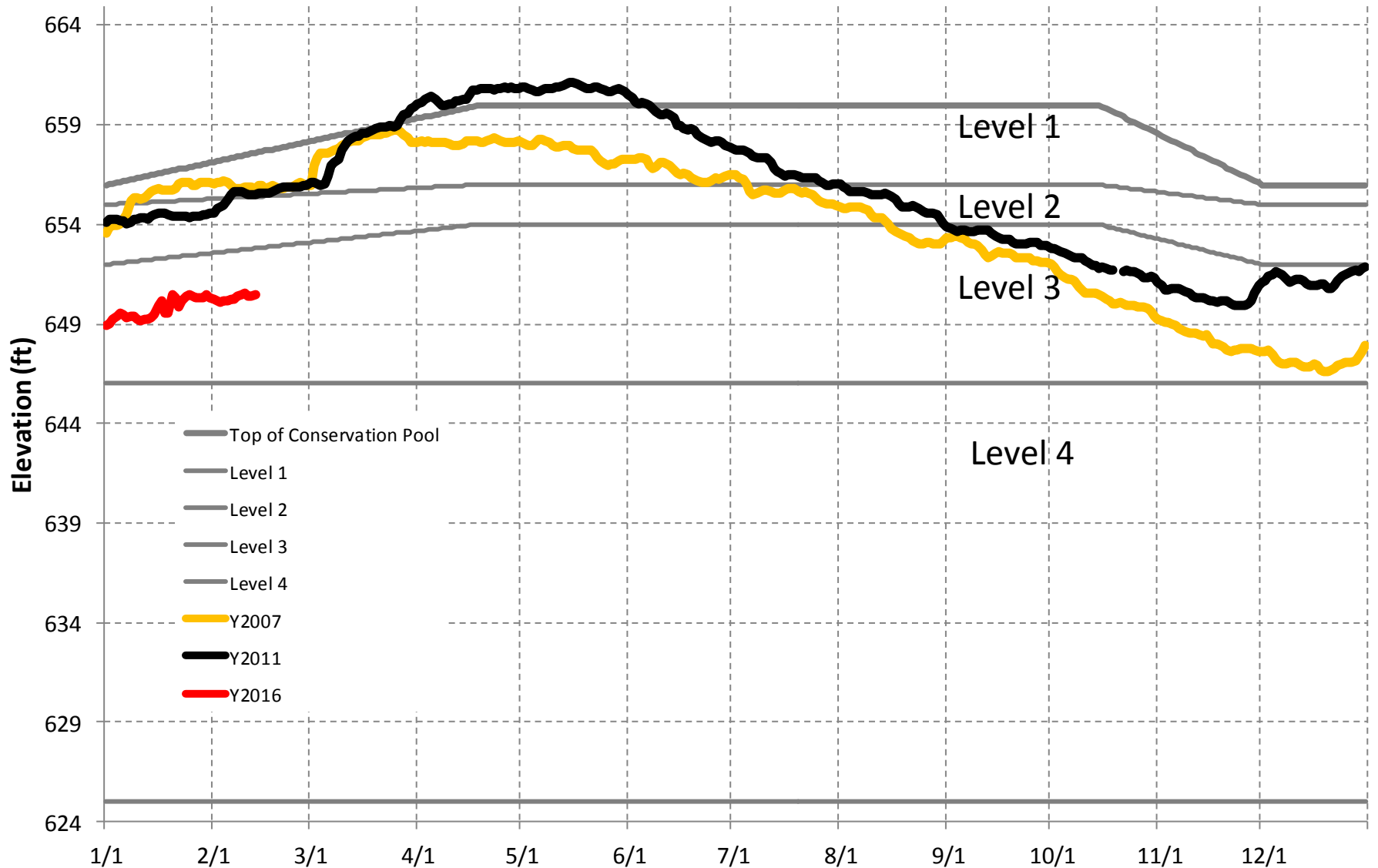
## 2017 ACF Basin Composite Conservation and Flood Storage



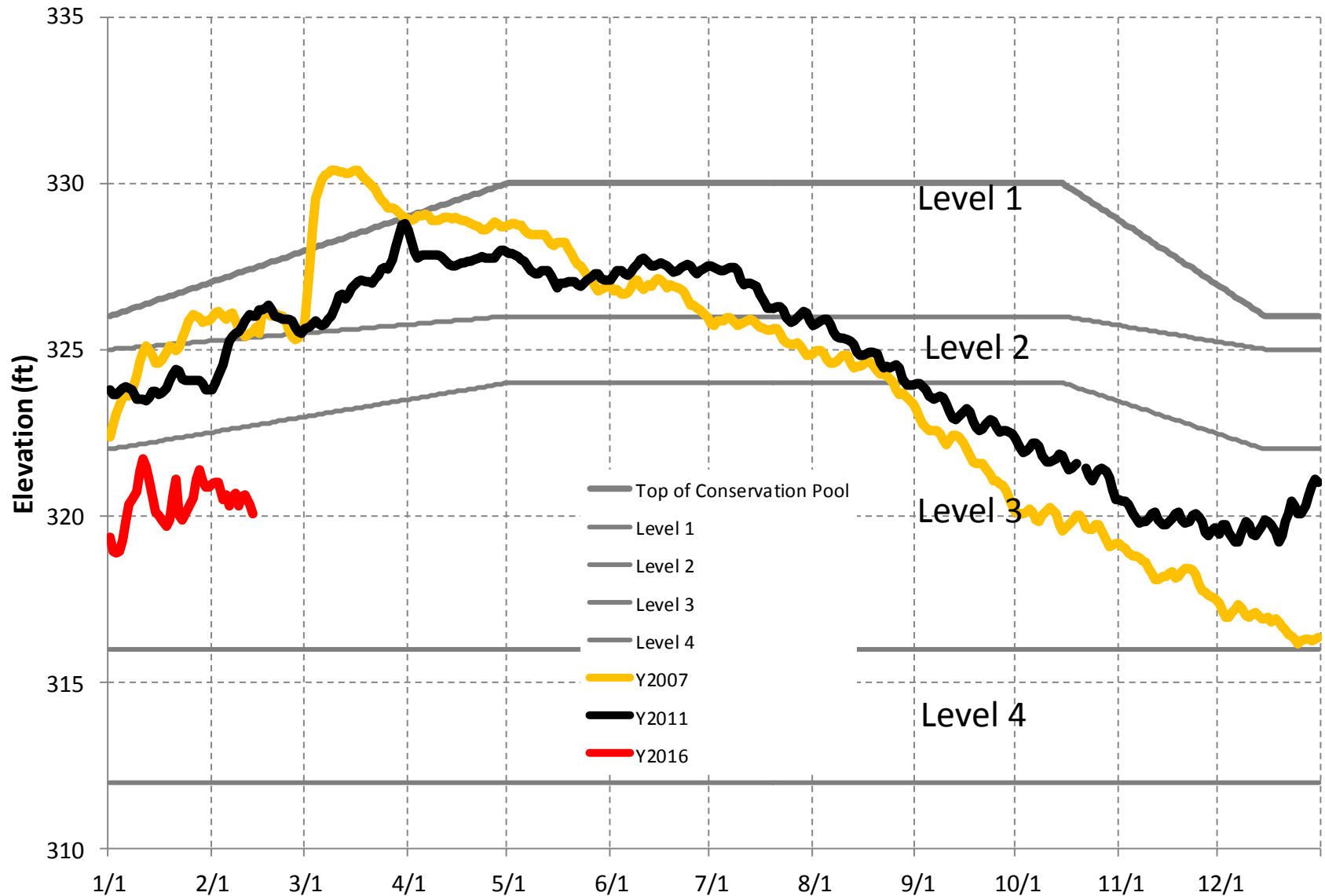
Actual data thru 2-21-2017

Add value of 1,856,000 acre-ft to include inactive storage.

# Lake HARTWELL ELEVATION



## LAKE CLARK HILL (THURMOND) ELEVATION

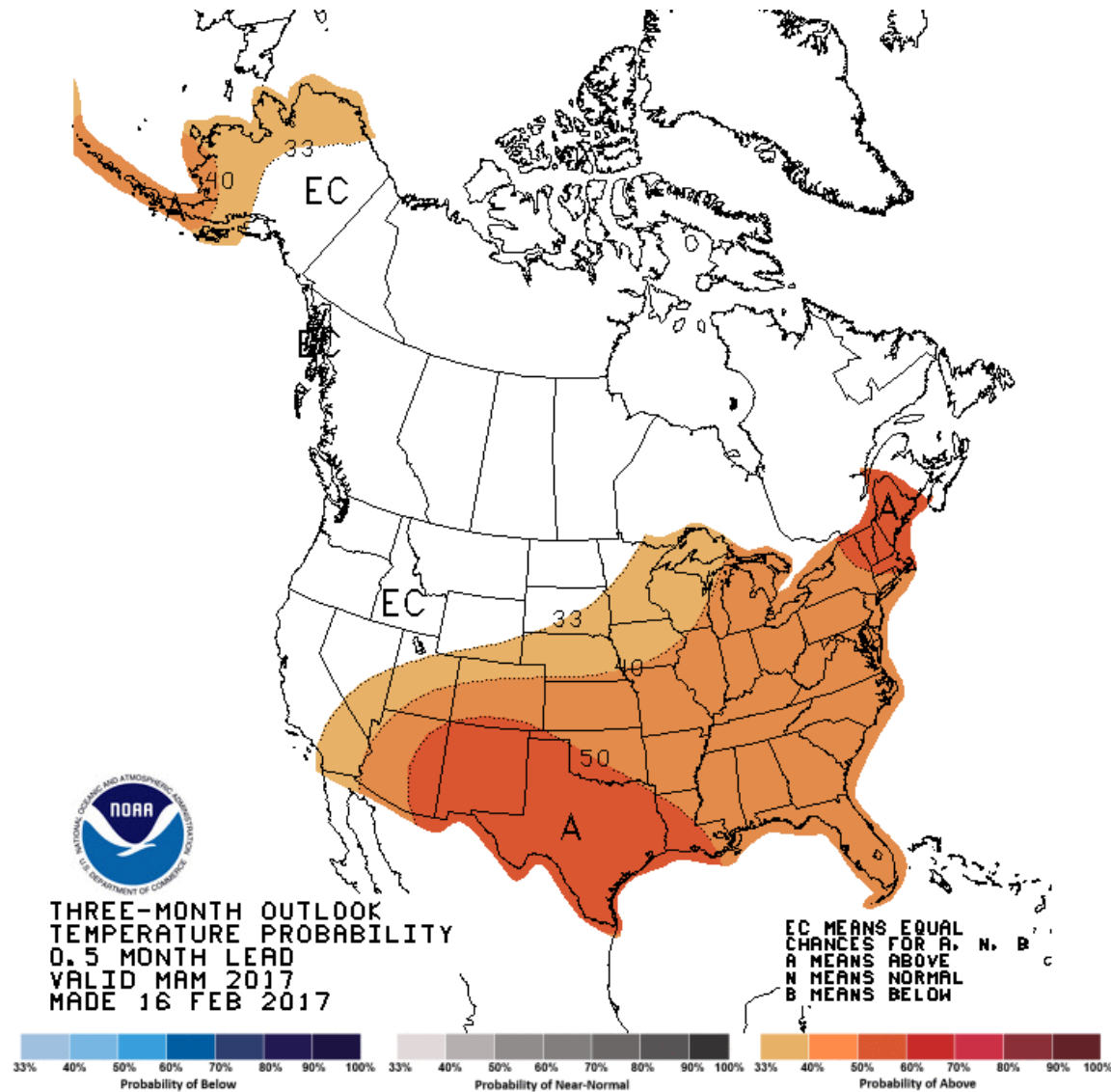


# Climate Prediction Center 3-month Temperature and Precipitation Probability Outlook and Seasonal Drought Outlook

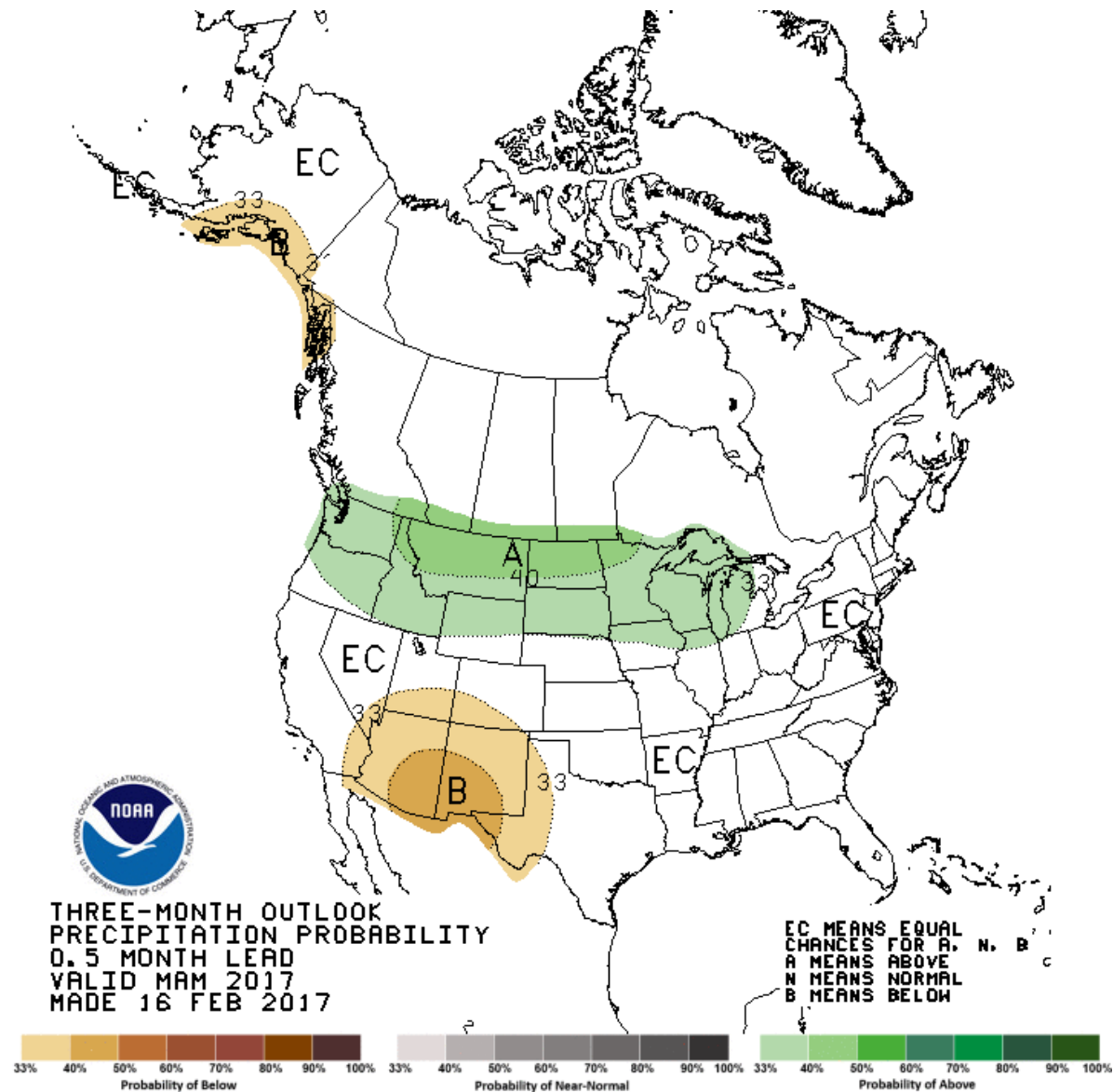
Data Source:

<http://www.cpc.ncep.noaa.gov/>

# Temperature Outlook



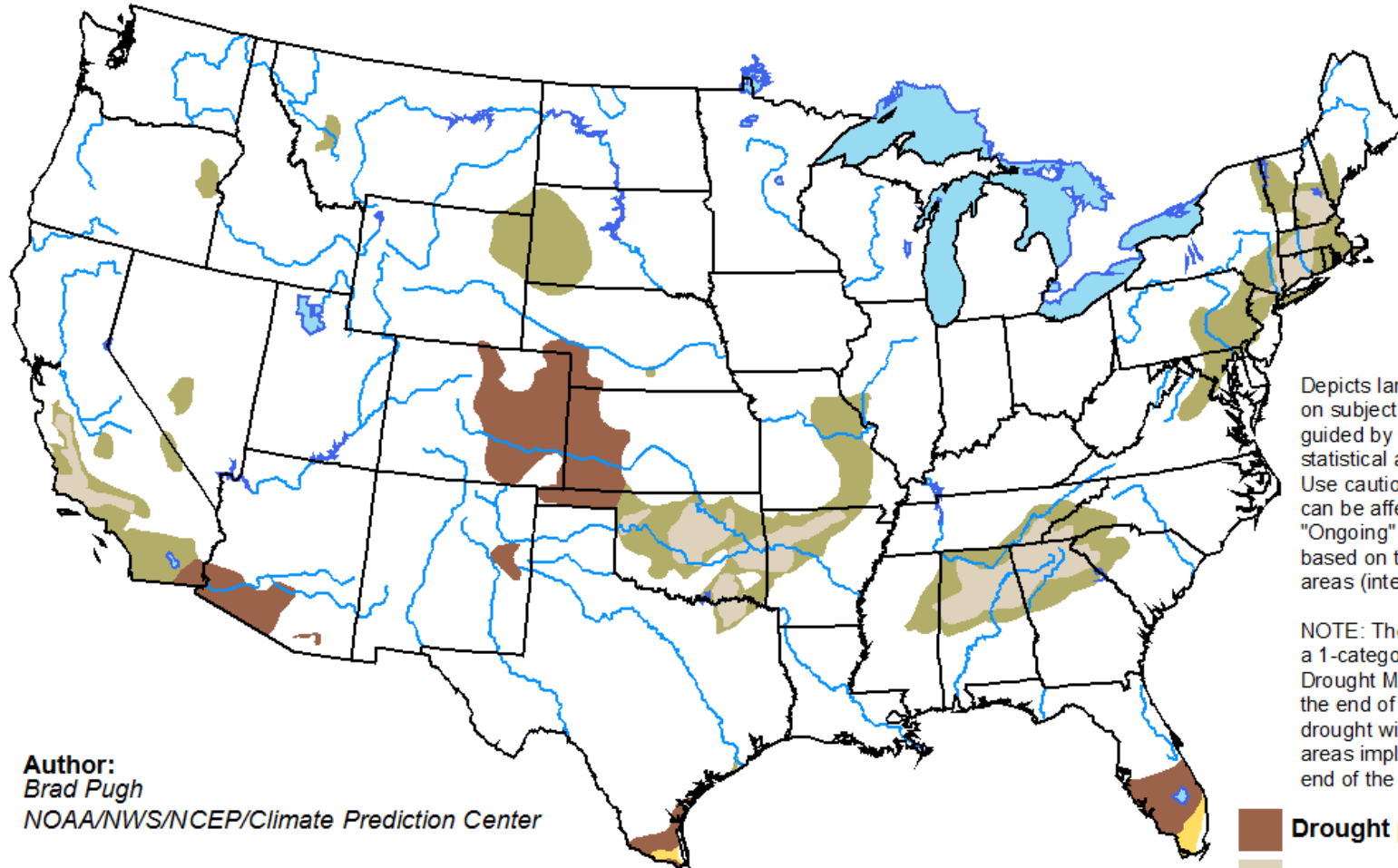
# Precipitation Outlook



# U.S. Seasonal Drought Outlook

## Drought Tendency During the Valid Period





Valid for February 16 - May 31, 2017  
Released February 16, 2017

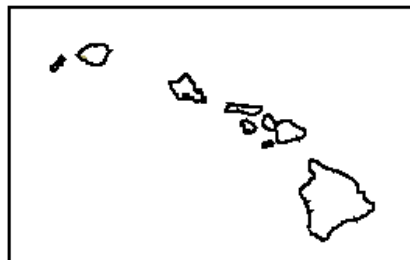
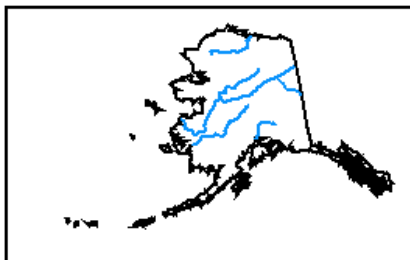


**Author:**  
Brad Pugh  
NOAA/NWS/NCEP/Climate Prediction Center

Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Use caution for applications that can be affected by short lived events. "Ongoing" drought areas are based on the U.S. Drought Monitor areas (intensities of D1 to D4).

NOTE: The tan areas imply at least a 1-category improvement in the Drought Monitor intensity levels by the end of the period, although drought will remain. The green areas imply drought removal by the end of the period (D0 or none).

-  **Drought persists**
-  **Drought remains but improves**
-  **Drought removal likely**
-  **Drought development likely**



<http://go.usa.gov/3eZ73>