

Drought Indicators Report

Georgia Environmental Protection Division
Hydrology Unit
July 2019

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 June 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 July 3, 2019.

Drought Indicator Analysis Summary (slide 1 of 2)

- **U.S. Drought Monitor** - Abnormally dry (D0, the least intense level) is indicated in roughly 30% of the state area, including part of Coosa basin and parts of southern GA (south of the fall line). Moderate Drought (D1) is indicated in roughly 7% of the state area, including the entirety or parts of 20 counties in west Coosa, lower Chattahoochee, middle Ocmulgee, west Ochlockonee, and east Suwanee river basins.
- **Precipitation** - Three-month precipitation is below normal rainfall in west Coosa basin and most parts of the southern GA. In the southeast region, some isolated areas show between 50% and 75% of normal rainfall. Six-month precipitation is above normal in northwest GA and below normal in rest of the state. Twelve-month precipitation is mostly normal or above normal, with slightly below normal in the southern part of the Savannah basin.
- **Soil Moisture** - Soil moisture conditions show dryness (20 to 30 percentile) in parts of northwest, central, and southeast GA. Some severe dryness exists in parts of Floyd and Bartow counties (5 to 10 percentile), and in parts of Polk, Haralson, Paulding, Jeff Davis, Coffee, Bacon, and Appling counties (10 to 20 percentile).

Drought Indicator Analysis Summary (slide 2 of 2)

- **Streamflow** – Stream flows observed at most selected USGS gages have been above normal or near normal to the northwest of a demarcation line Augusta, GA to the southwest corner of the State, with three gage flows (each in Tennessee, lower Flint, and Ocmulgee basins) between the driest 20th percentile and the median, and one in lower Flint between the driest 10th and 20th percentiles. To the southeast of this demarcation, most selected stream gage flows are between the driest 20th and the median, with two gage flows (each in Suwanee and St. Mary basins) between the driest 5th and 10th percentiles.
- **Groundwater Level** – Majority of Groundwater levels observed at selected wells are above normal or near normal. Five wells (two in lower Flint, one in Oconee, and two in Suwanee basin) are between the lowest 20th percentile and the median.
- **Reservoir Levels** – At the end of the June 2019, all federal reservoirs in Georgia (ACF, ACT, and Savannah basins) are at levels above their respective top of conservation (normal) pools, except Lake W.F. George (below the normal pool but in Zone 1).
- **Short-term Climate Prediction** – National Climatic Prediction Center projects above normal temperature statewide in July – September 2019. U.S. Drought Outlook predicts drought removal likely in July - September for isolated areas where currently indicate the least drought (D1) and predicts drought remaining but improving for parts of Coffee, Atkinson, and Ware counties.
- **Water Supplies** – No issues with water availability to water supply providers were reported.

US Drought Monitor

Data Source:

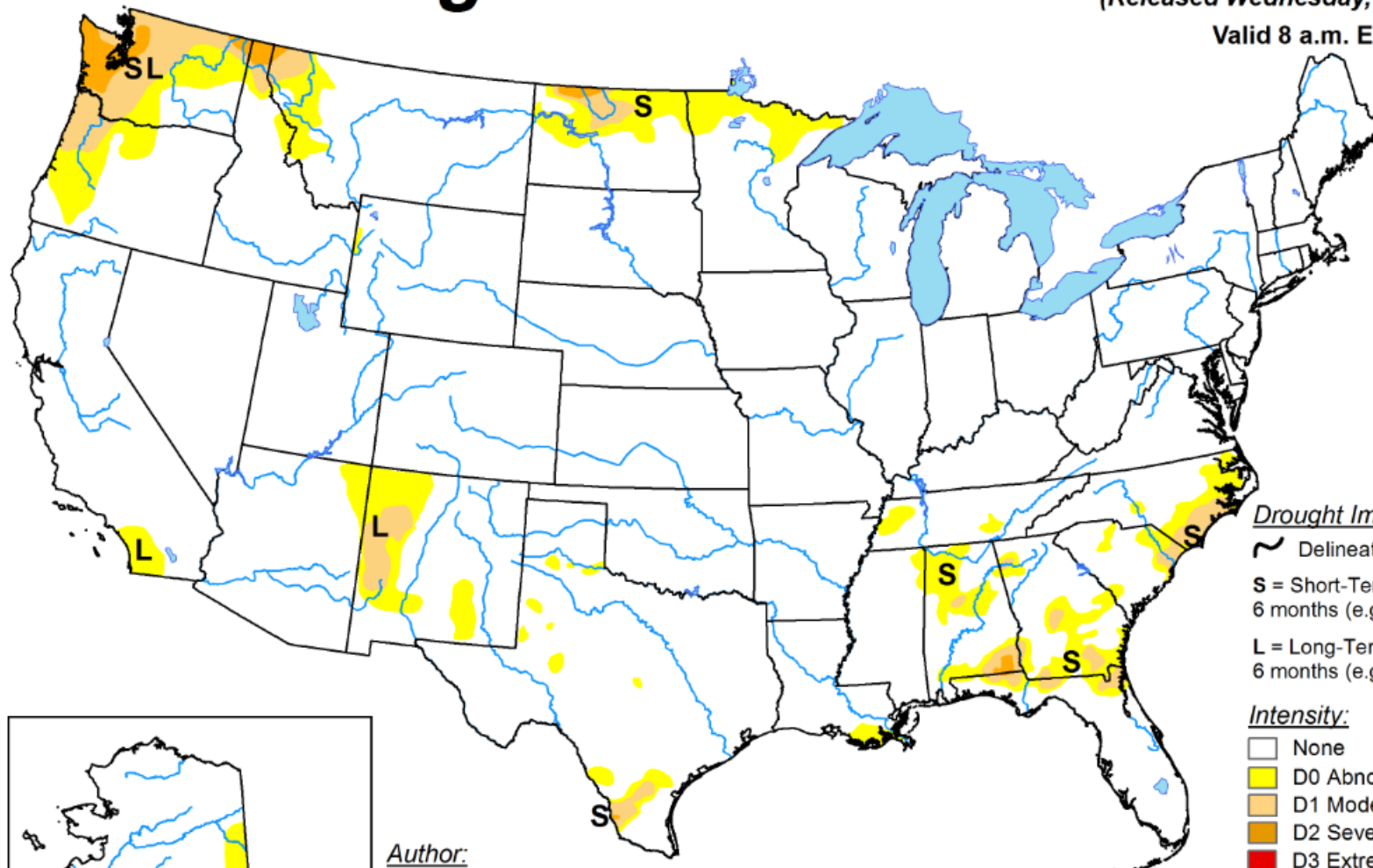
<http://droughtmonitor.unl.edu/>

U.S. Drought Monitor

July 2, 2019

(Released Wednesday, Jul. 3, 2019)

Valid 8 a.m. EDT



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:

None

D0 Abnormally Dry

D1 Moderate Drought

D2 Severe Drought

D3 Extreme Drought

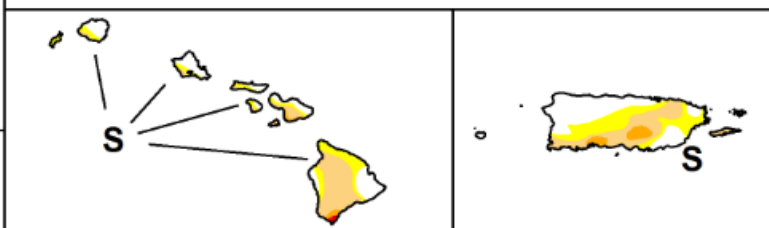
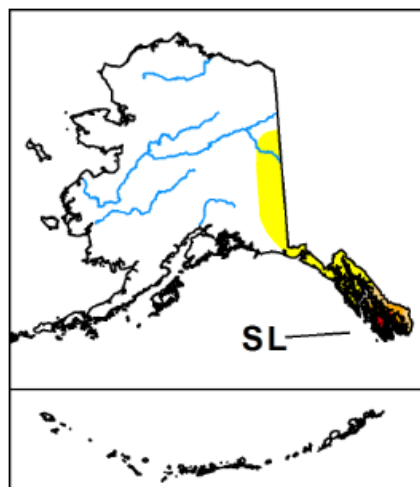
D4 Exceptional Drought

Author:

Richard Tinker

CPC/NOAA/NWS/NCEP

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



droughtmonitor.unl.edu

U.S. Drought Monitor

Georgia

July 2, 2019

(Released Wednesday, Jul. 3, 2019)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	63.35	36.65	6.89	0.00	0.00	0.00
Last Week 06-25-2019	56.68	43.32	6.12	0.00	0.00	0.00
3 Months Ago 04-02-2019	20.88	79.12	12.95	0.00	0.00	0.00
Start of Calendar Year 01-01-2019	100.00	0.00	0.00	0.00	0.00	0.00
Start of Water Year 09-25-2018	70.95	29.05	6.72	0.00	0.00	0.00
One Year Ago 07-03-2018	100.00	0.00	0.00	0.00	0.00	0.00

Intensity:

 None	 D2 Severe Drought
 D0 Abnormally Dry	 D3 Extreme Drought
 D1 Moderate Drought	 D4 Exceptional Drought

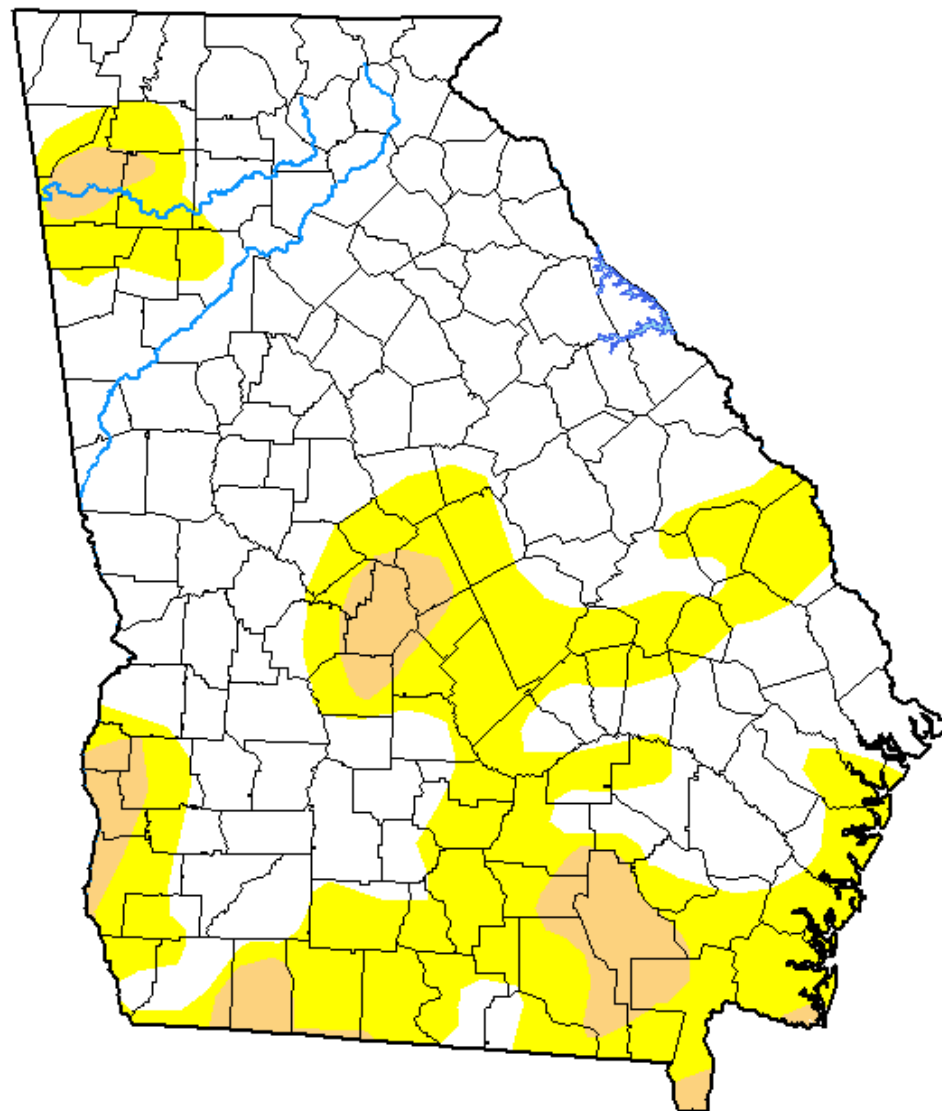
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

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Richard Tinker
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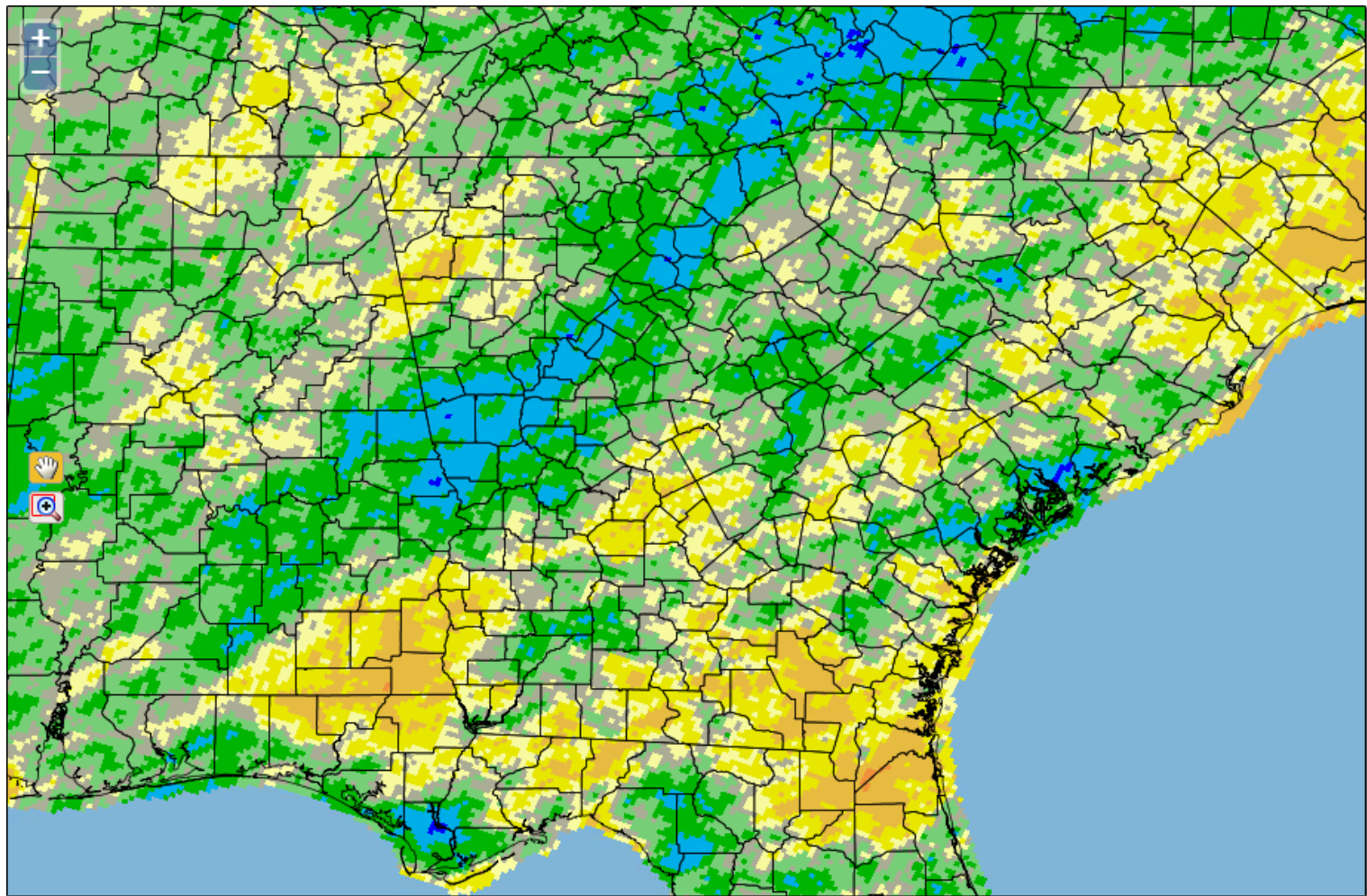


3, 6, and 12 Month Percent of Normal Precipitation

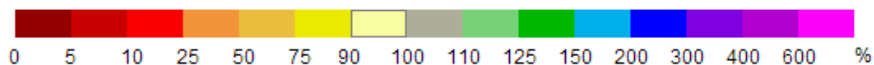
Data Source:

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

3 Month Percent of Normal Precipitation



90 day Percent of Normal Precipitation for July 02, 2019

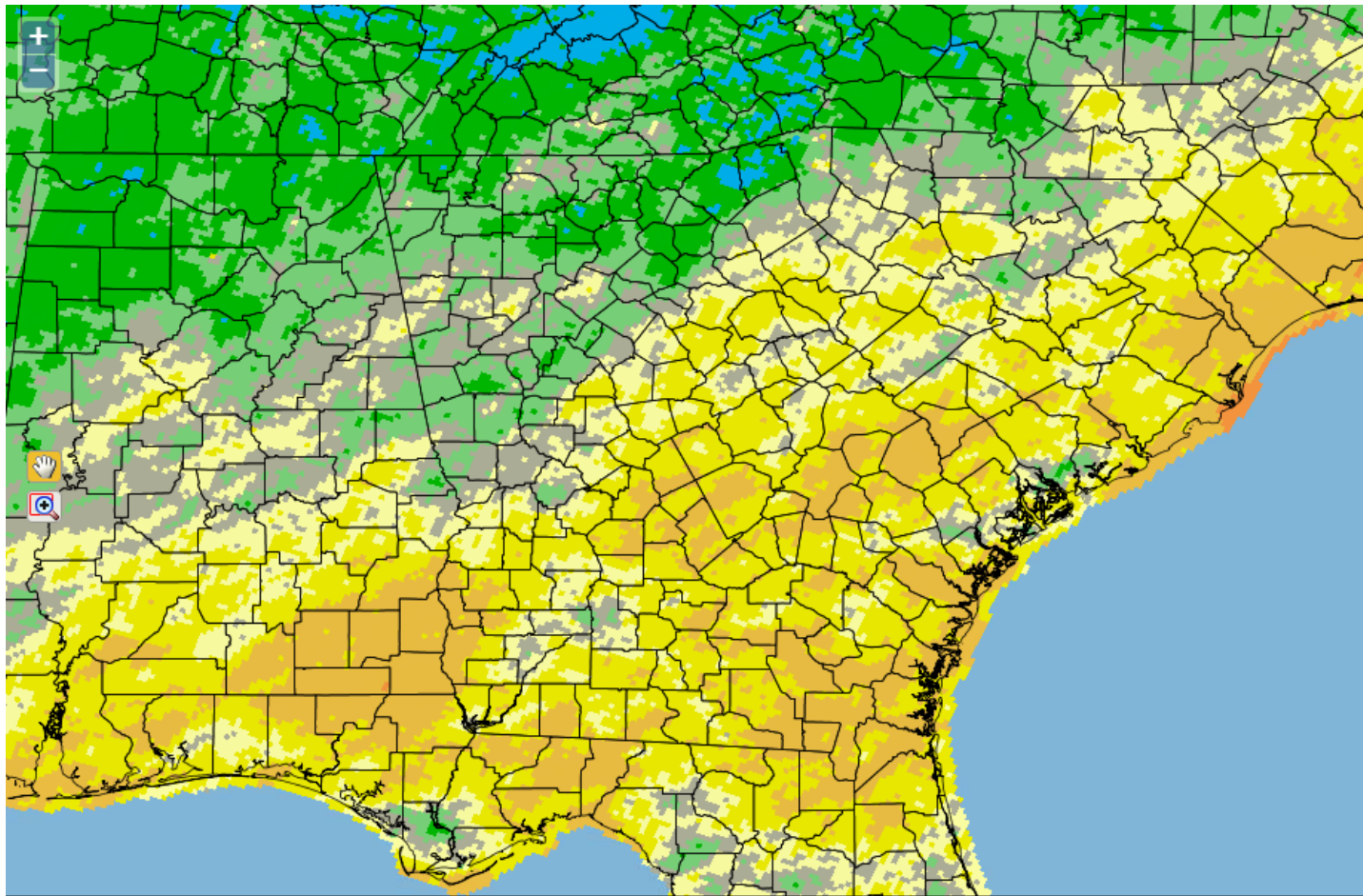


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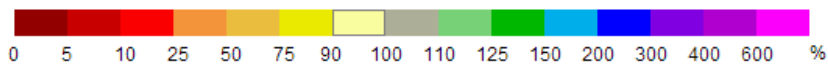


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6 Month Percent of Normal Precipitation



6 month Percent of Normal Precipitation for July 02, 2019

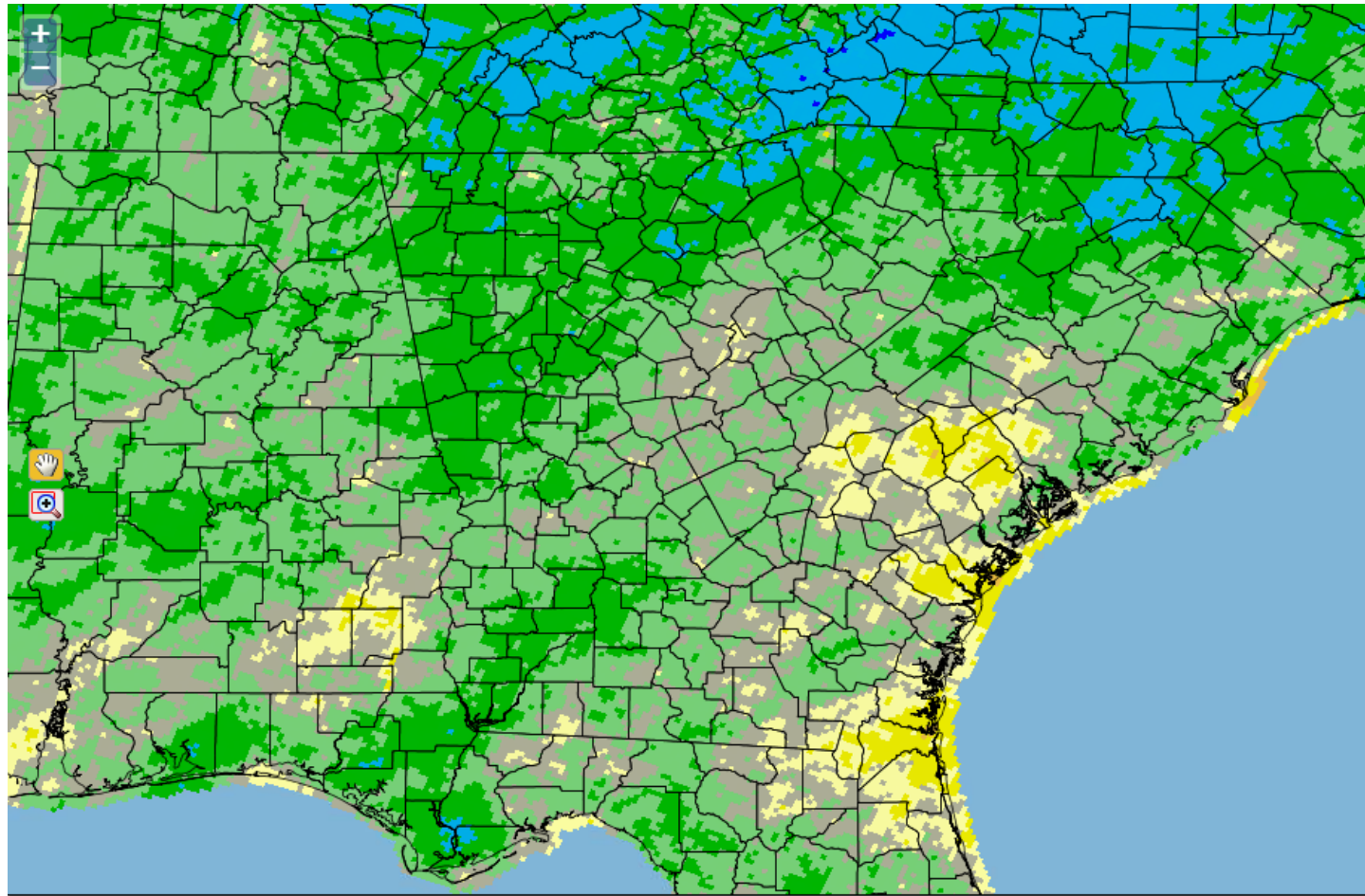


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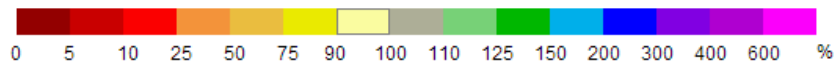


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12 Month Percent of Normal Precipitation



12 month Percent of Normal Precipitation for July 02, 2019



Transparency:

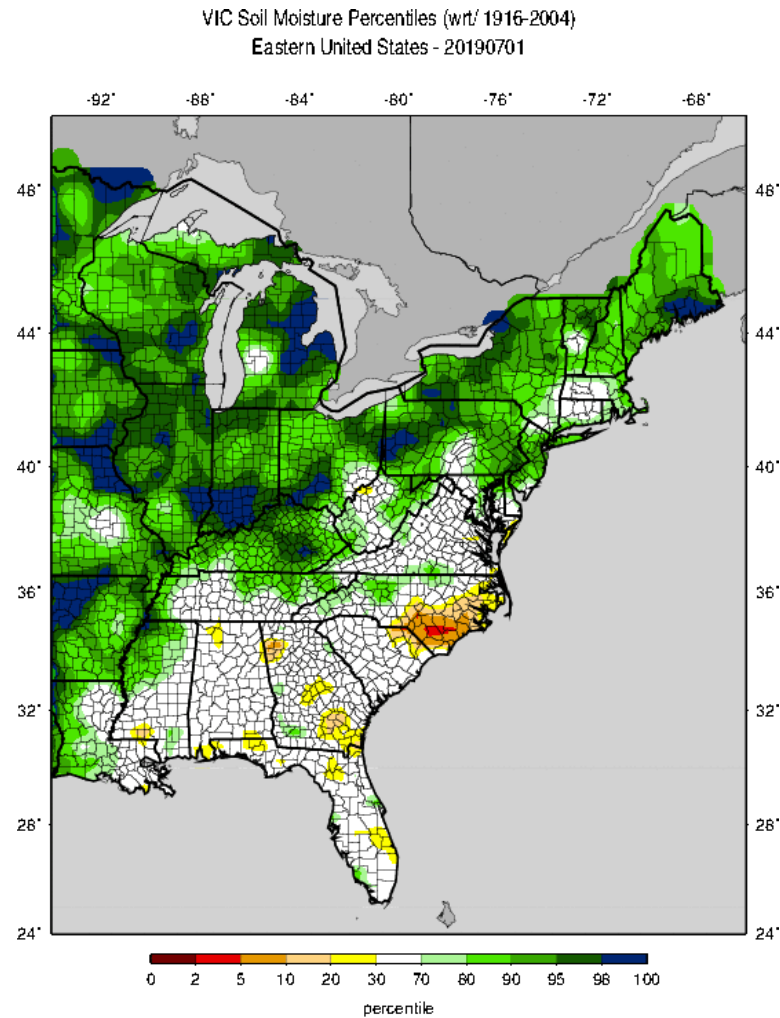


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Soil Moisture Conditions

Data Source:

http://www.hydro.ucla.edu/SurfaceWaterGroup/forecast/monitor/curr/conus.mexico/east.vic.sm_qnt.gif



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

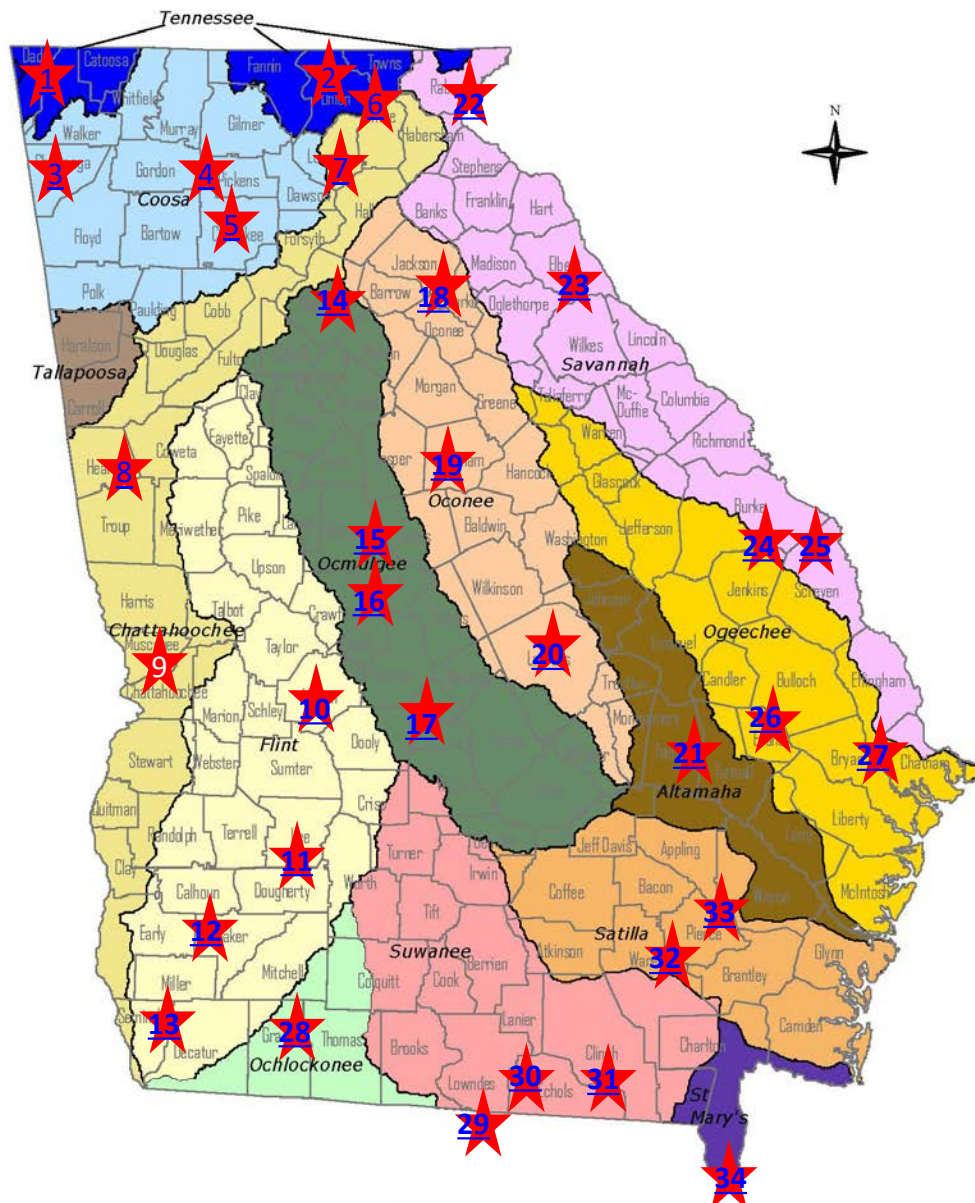
Streamflow Conditions

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	TOBESOFKEE 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, 2019 through June, 2019;
- 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 June 2019 was 1,271 cfs. The statistical composite of all historical data for this gage shows that average streamflow in June has historically been lower than June 2019 about 80% of the time; about 20% of the time in June it has been higher.
- Average stream flow in June 2011 was 459 cfs. The statistical composite of all historical data for this gage shows that average streamflow for June has historically been lower than June 2011 only 5% of the time; 95% of the time in June it has been higher.
- Average stream flow in June 2007 was 359 cfs. The statistical composite of all historical data for this gage shows that average streamflow for June has historically been lower than June 2007 only 3% of the time; 97% of the time in June it has been higher.

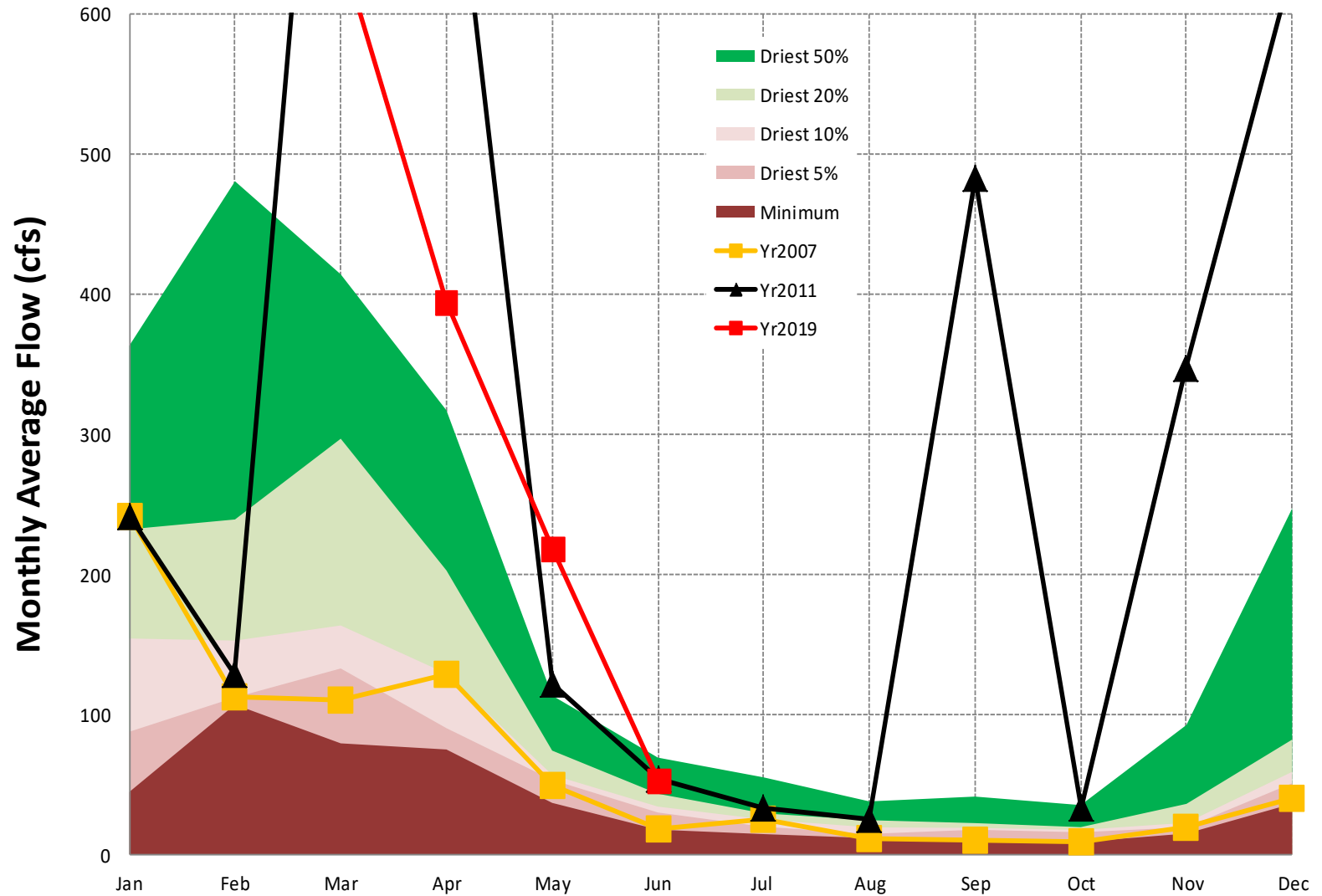
How to Read the Streamflow Graphs

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

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

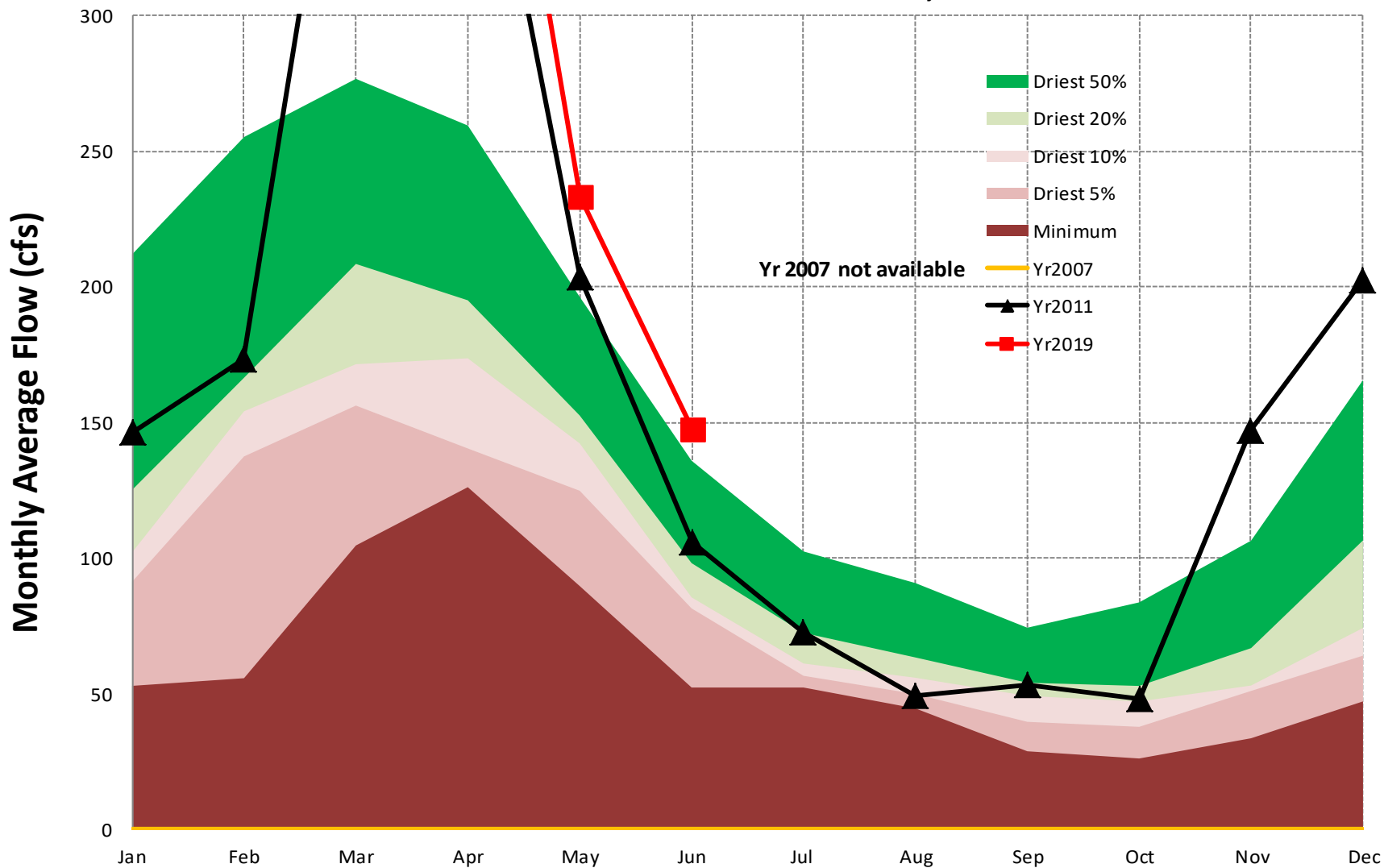
- Average stream flow for June 2019 was 3,760 cfs. The statistical composite of all historical data for this gage shows that average streamflow in June has historically been lower than June 2019 about 50% of the time; about 50% of the time in June it has been higher.
- Average stream flow in June 2011 was 759 cfs. The statistical composite of all historical data for this gage shows that average streamflow for June has historically been lower than June 2011 about 0.1% of the time; about 99.9% of the time in June it has been higher.
- Average stream flow in June 2007 was 1,045 cfs. The statistical composite of all historical data for this gage shows that average streamflow for June has historically been lower than June 2007 about 2% of the time; about 98% of the time in June it has been higher.

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



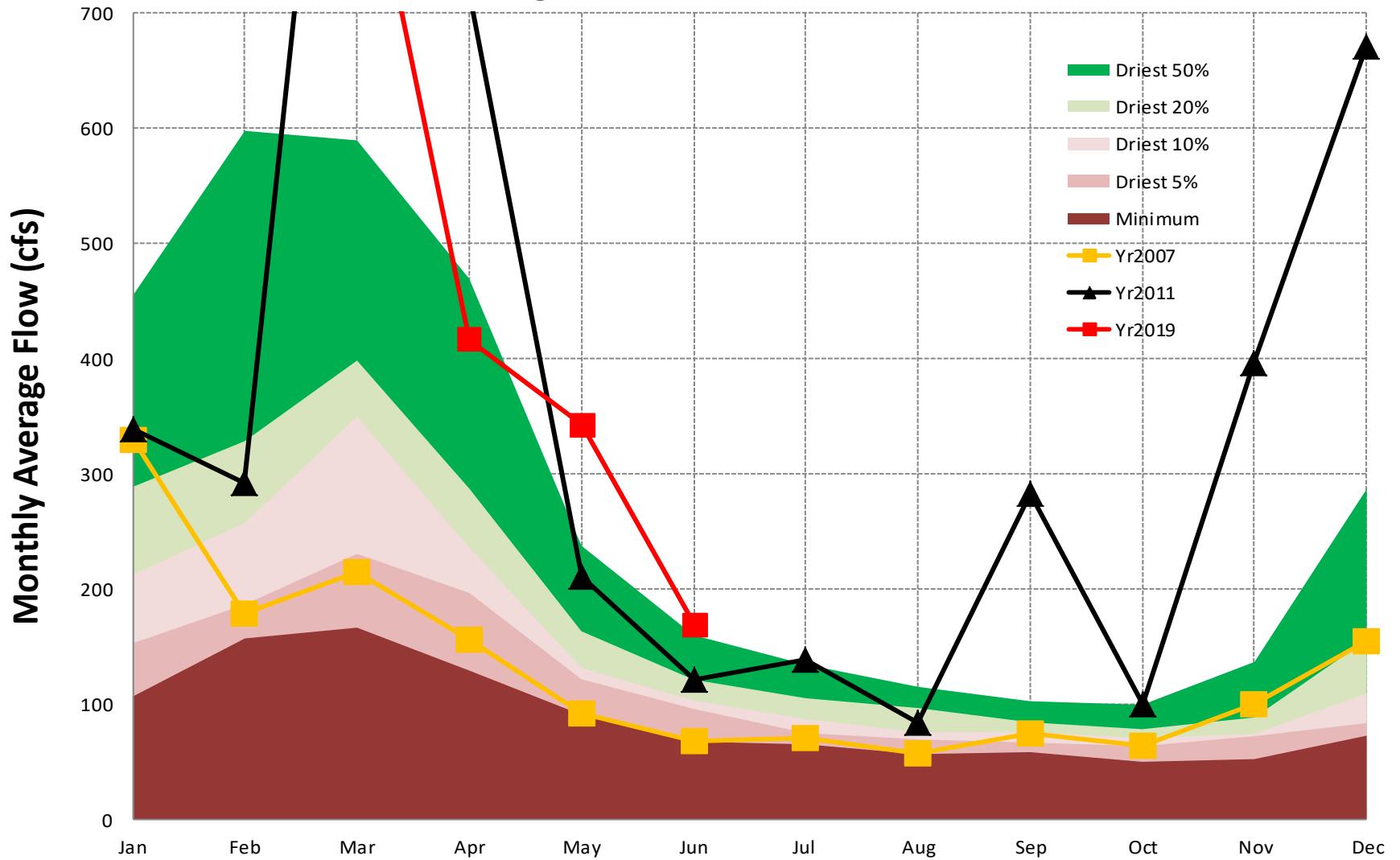
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**Gage #2, USGS #03550500, Tennessee Basin,
NOTTELY RIVER NEAR BLAIRSVILLE, GA**



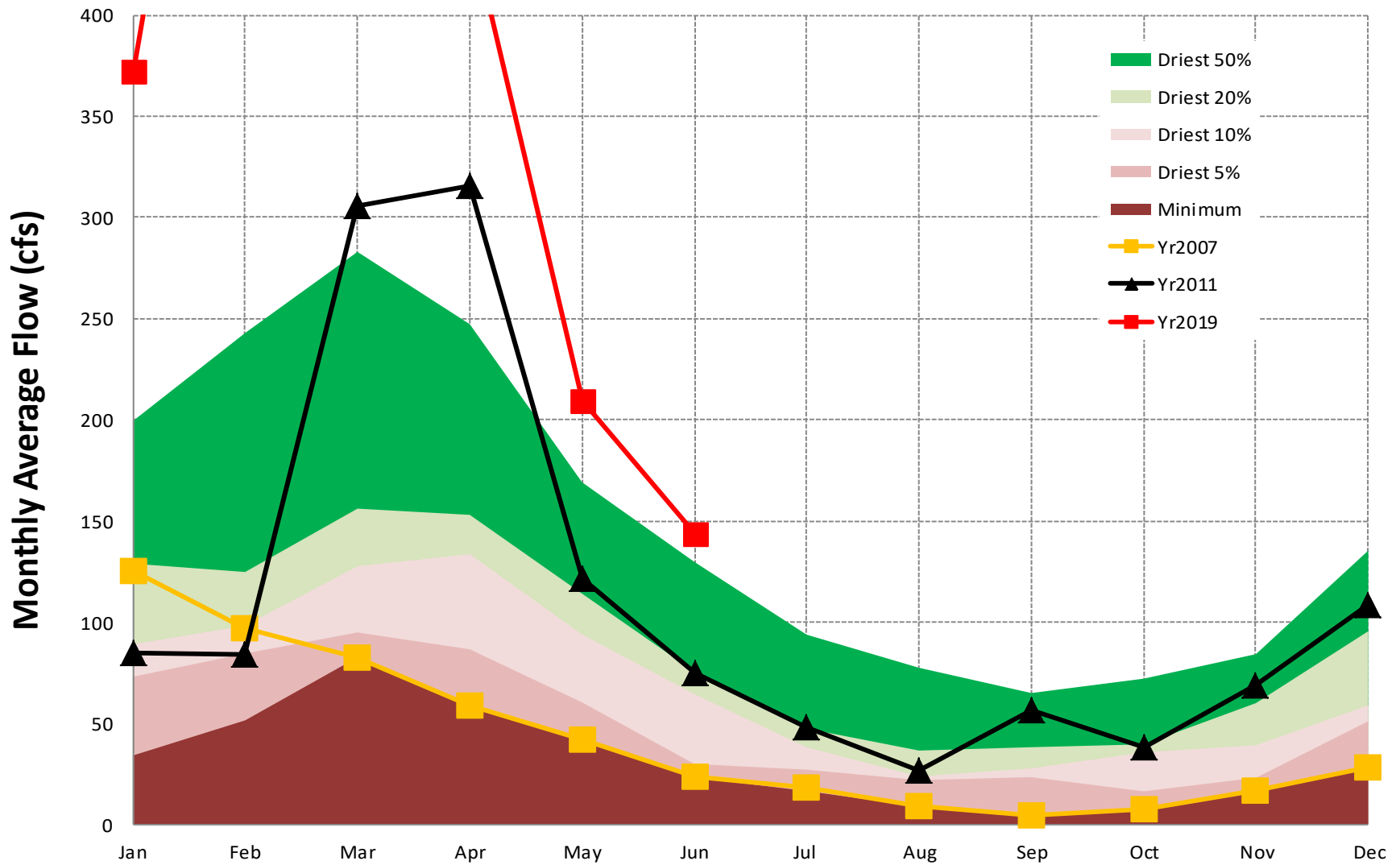
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Gage #3. USGS #02398000, Coosa Basin, Chattooga River at Summerville, GA



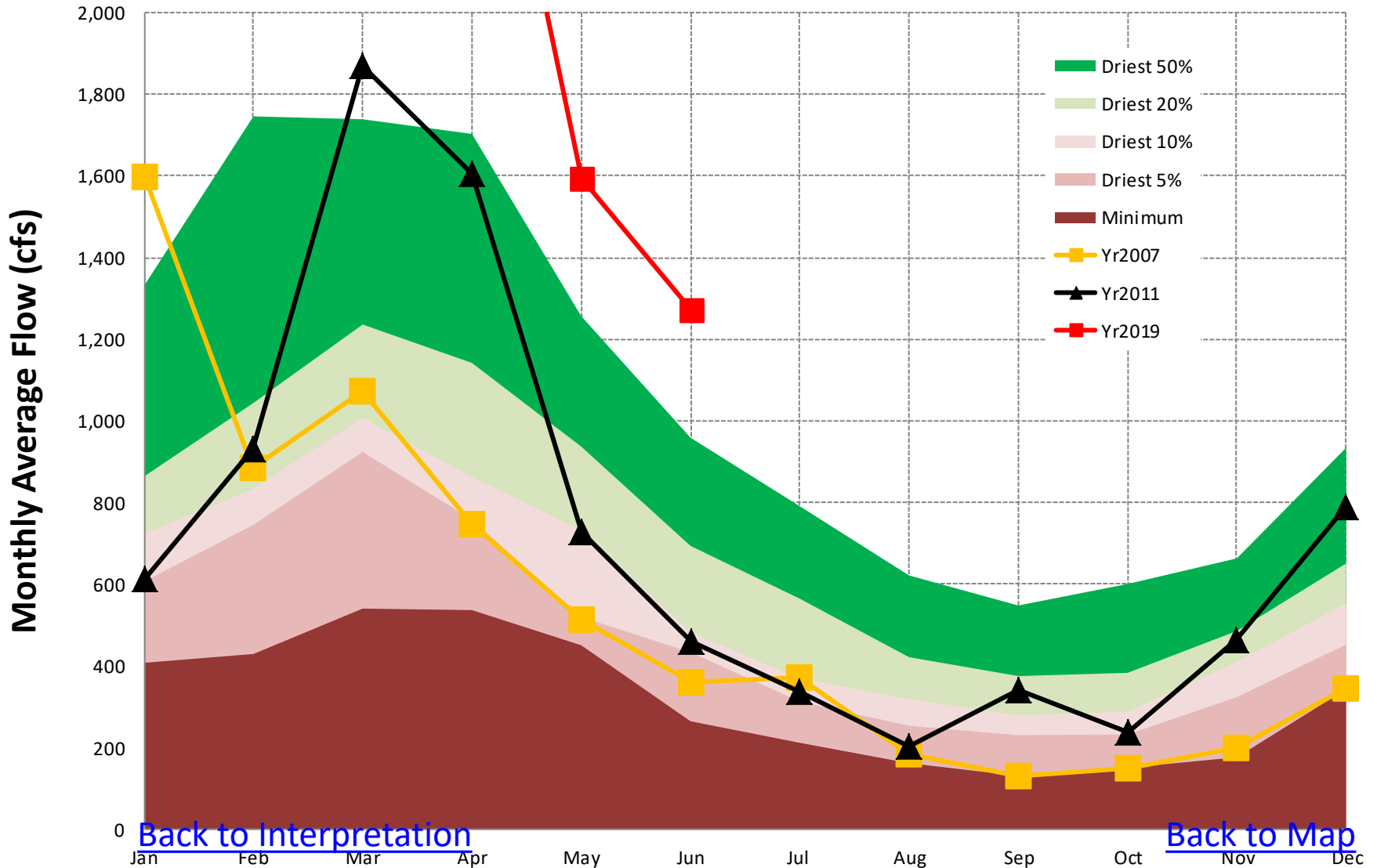
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Gage #4, USGS #02382200, Coosa Basin, TALKING ROCK CREEK NEAR HINTON, GA



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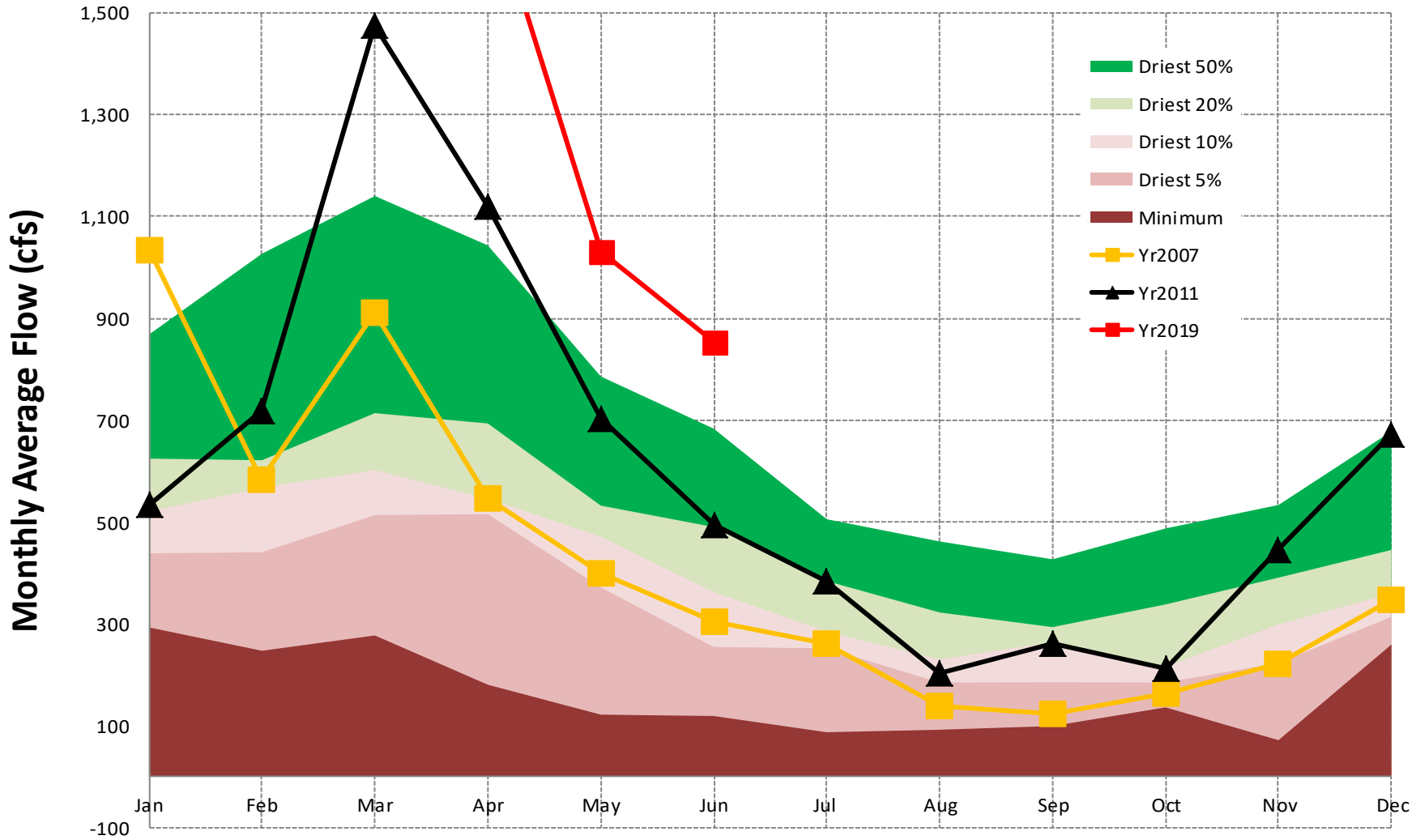
Gage #5, USGS #02392000, Coosa Basin, Etowah River at Canton, GA



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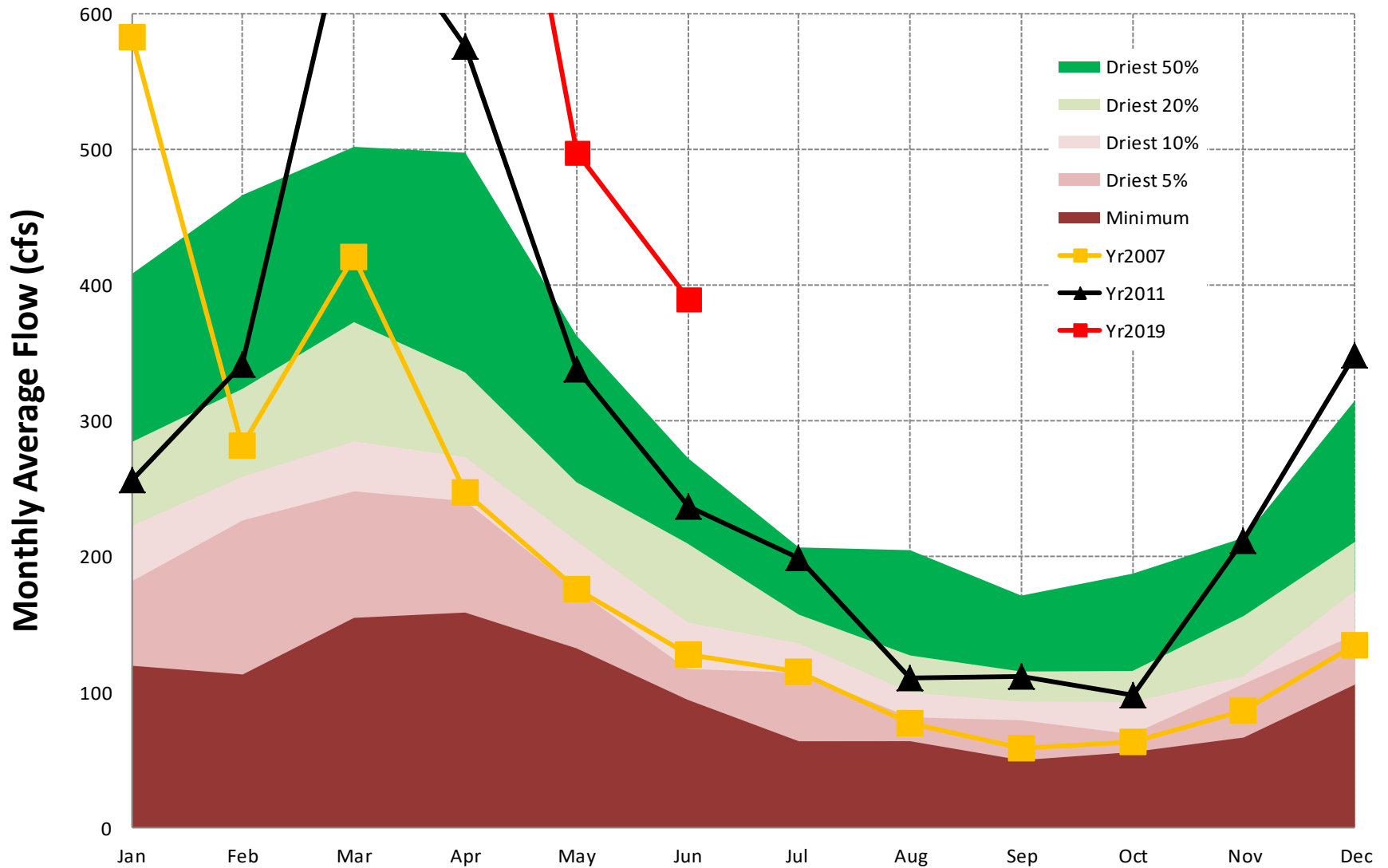
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Gage #6, USGS #02331600, Chatthoochee Basin, CHATTAHOOCHEE RIVER AT CORNELIA, GA



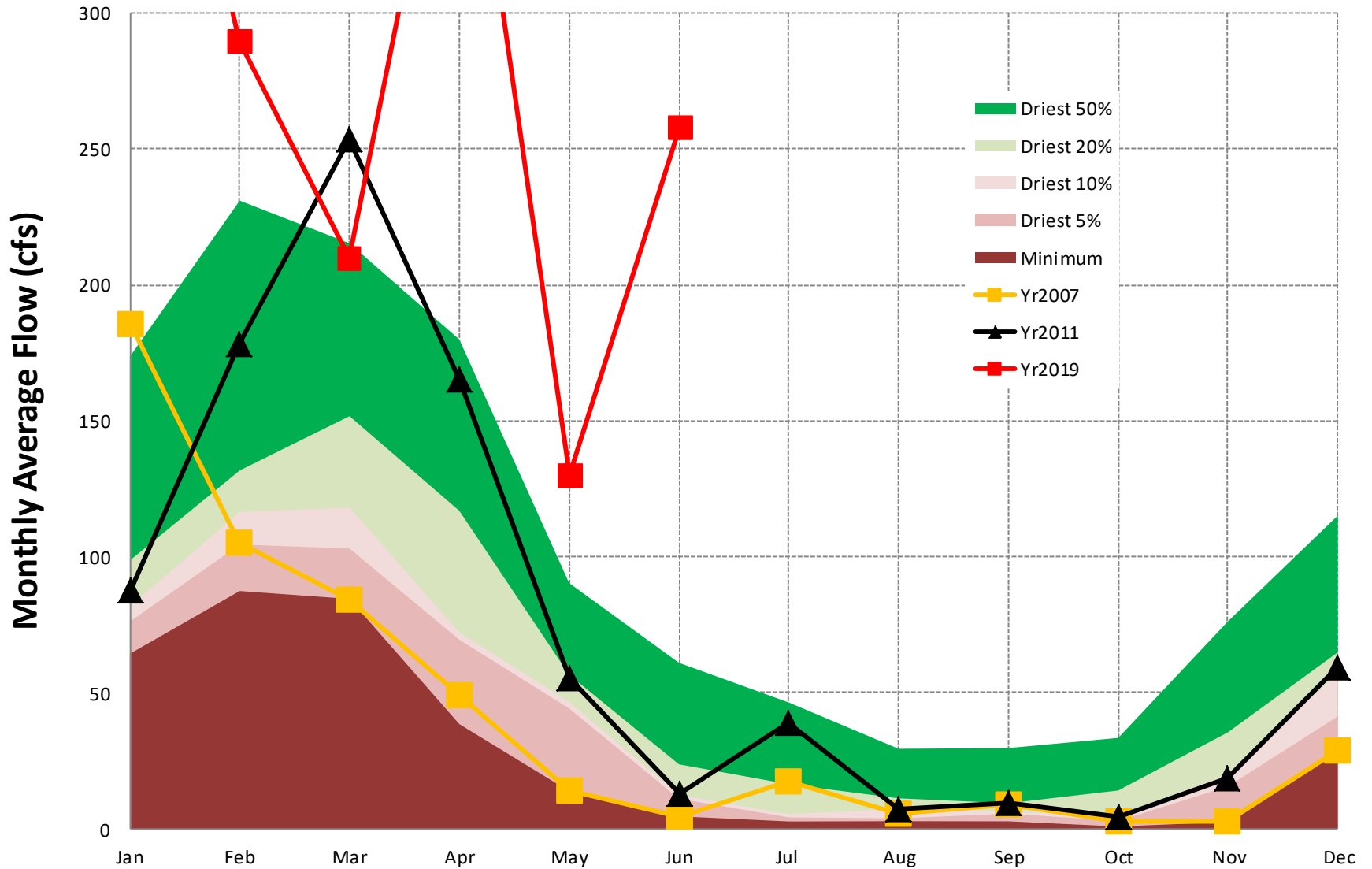
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**Gage #7, USGS #02333500, Chatahoochee Basin,
CHESTATEE RIVER NEAR DAHLONEGA, GA**



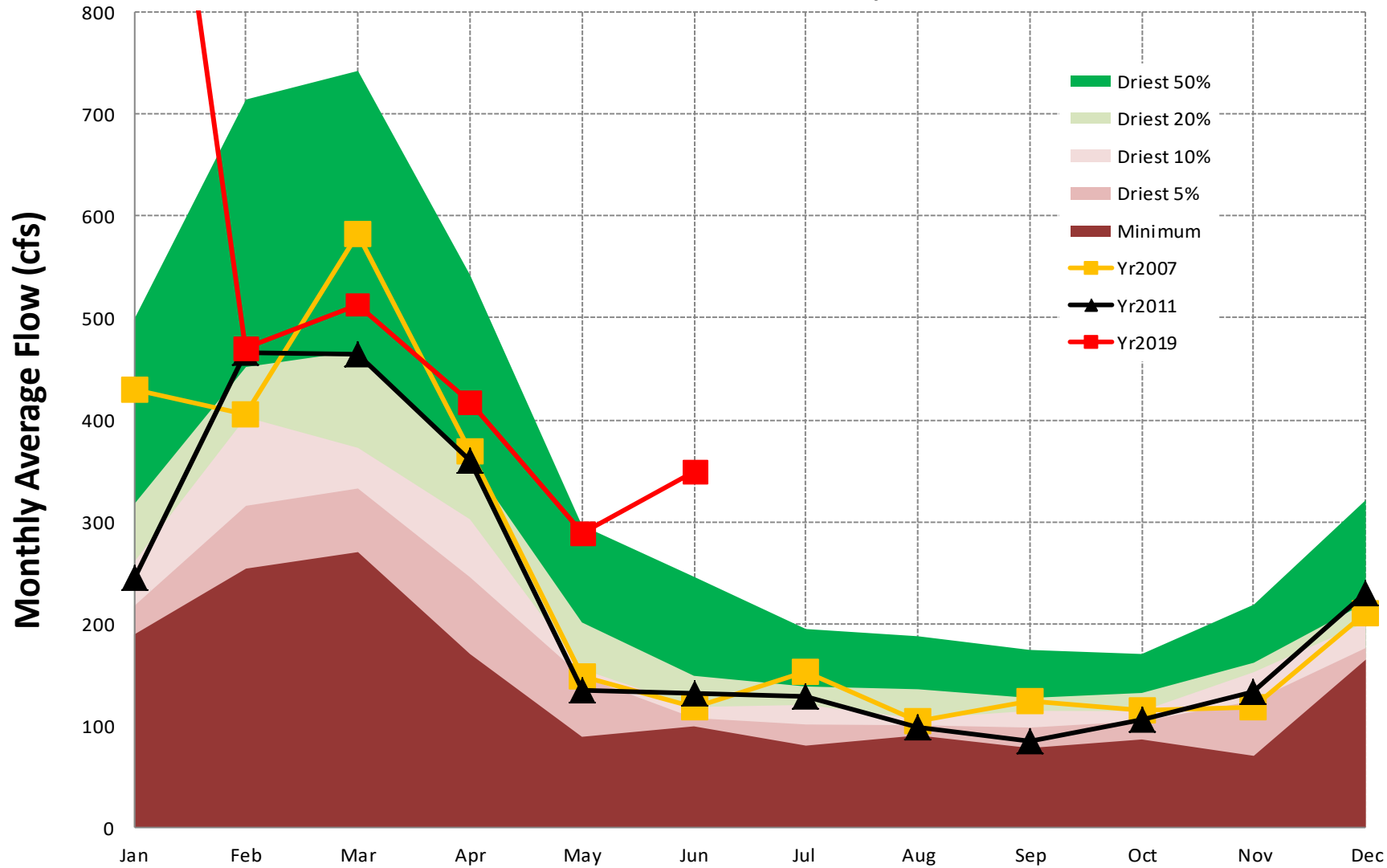
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**Gage #8, USGS #02338660, Chattahoochee Basin,
NEW RIVER AT GA 100, NEAR CORINTH**



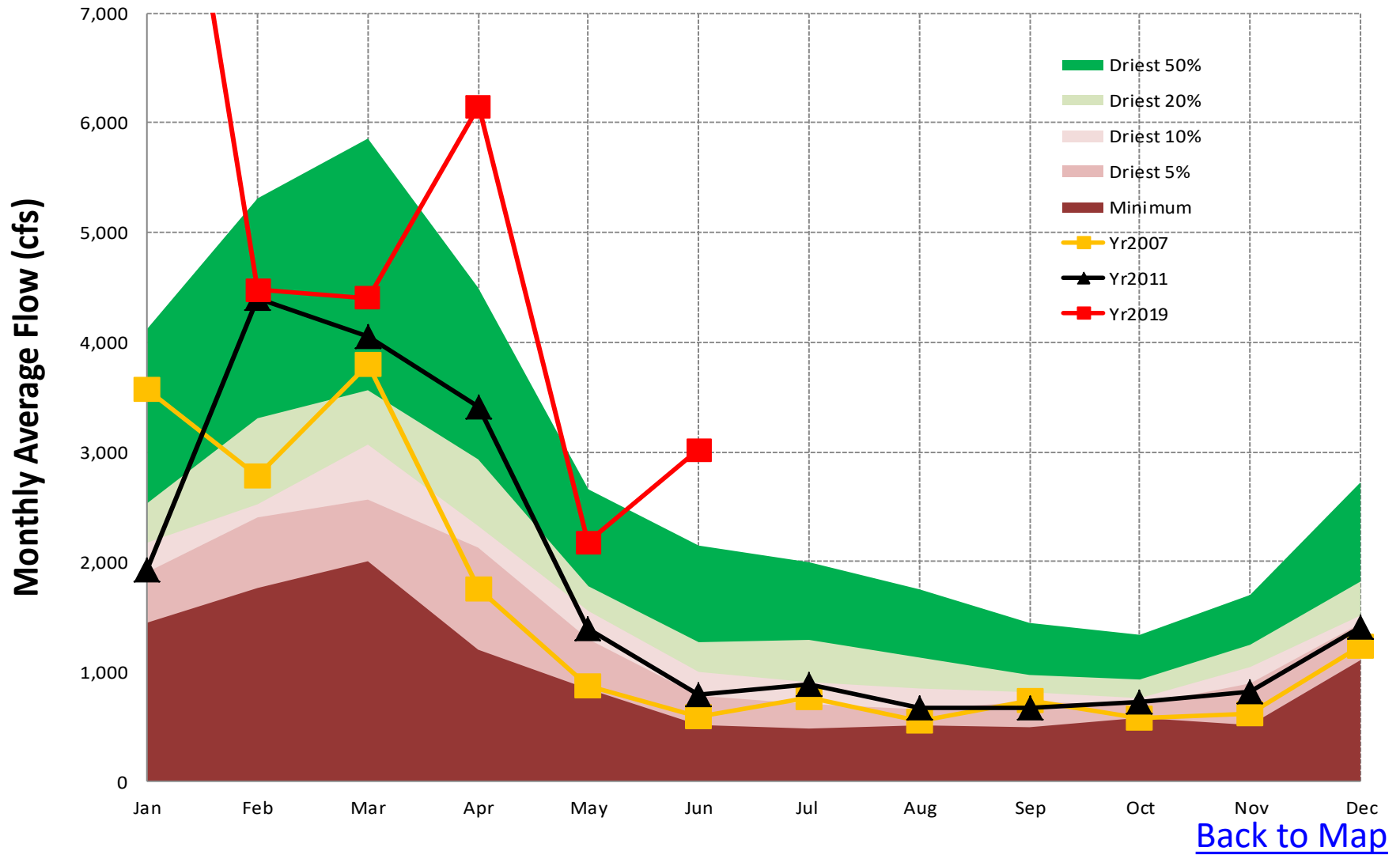
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Gage #9, USGS #02341800, Chattahoochee Basin, UPatoi CREEK NEAR COLUMBUS, GA

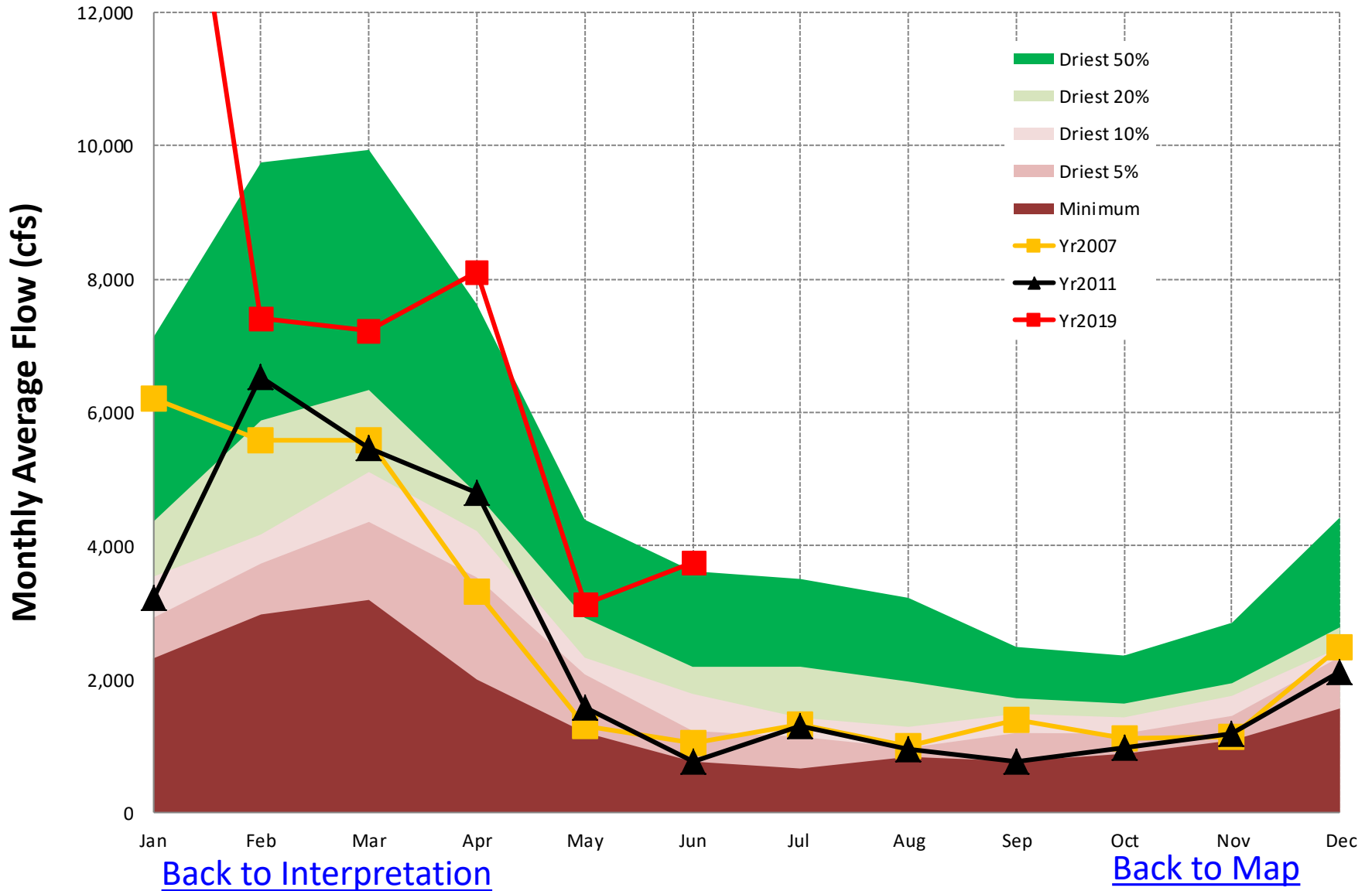


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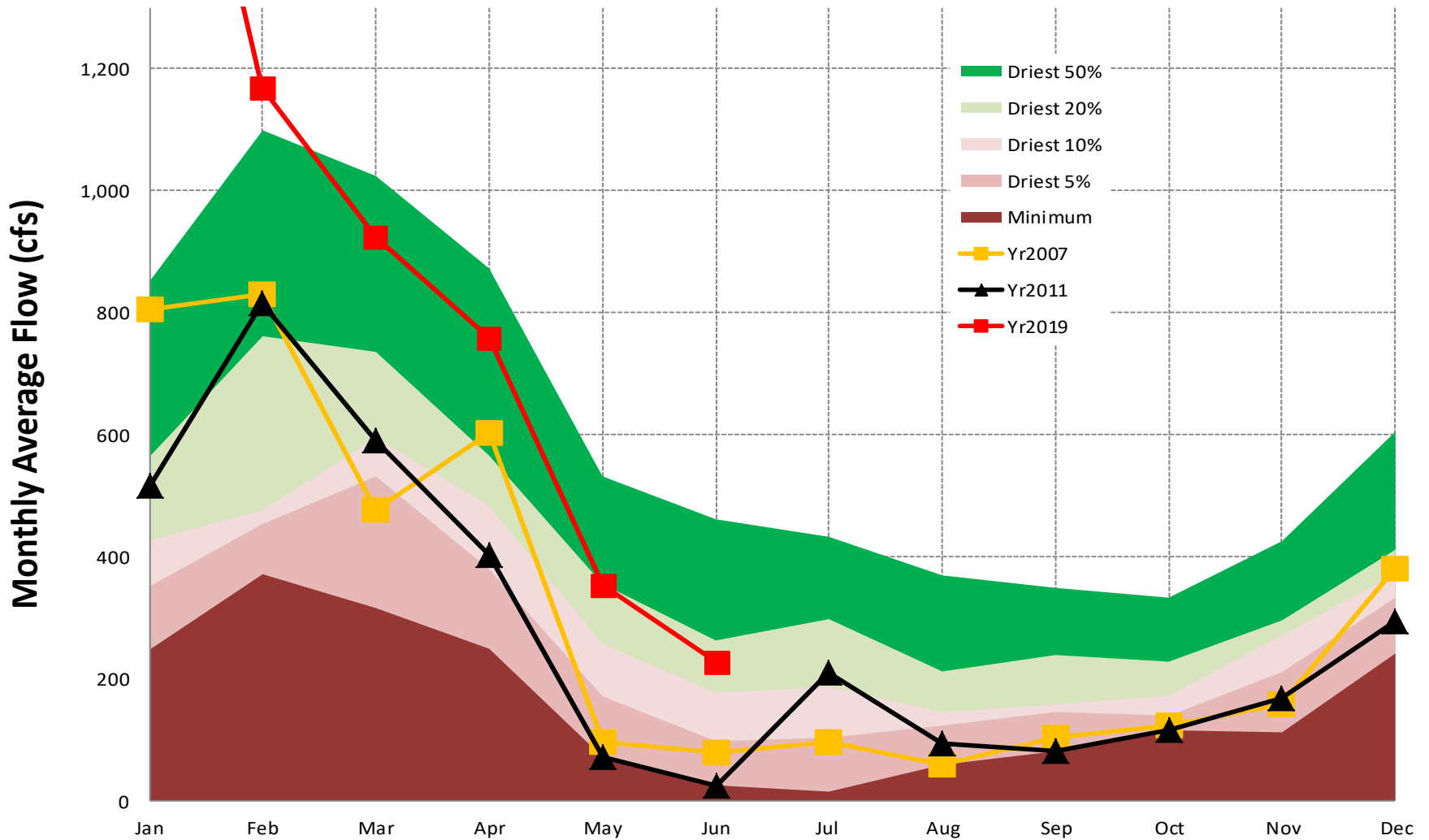
Gage #10. USGS #02349605, Flint Basin, FLINT RIVER AT GA26 NEAR MONTEZUMA, GA



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

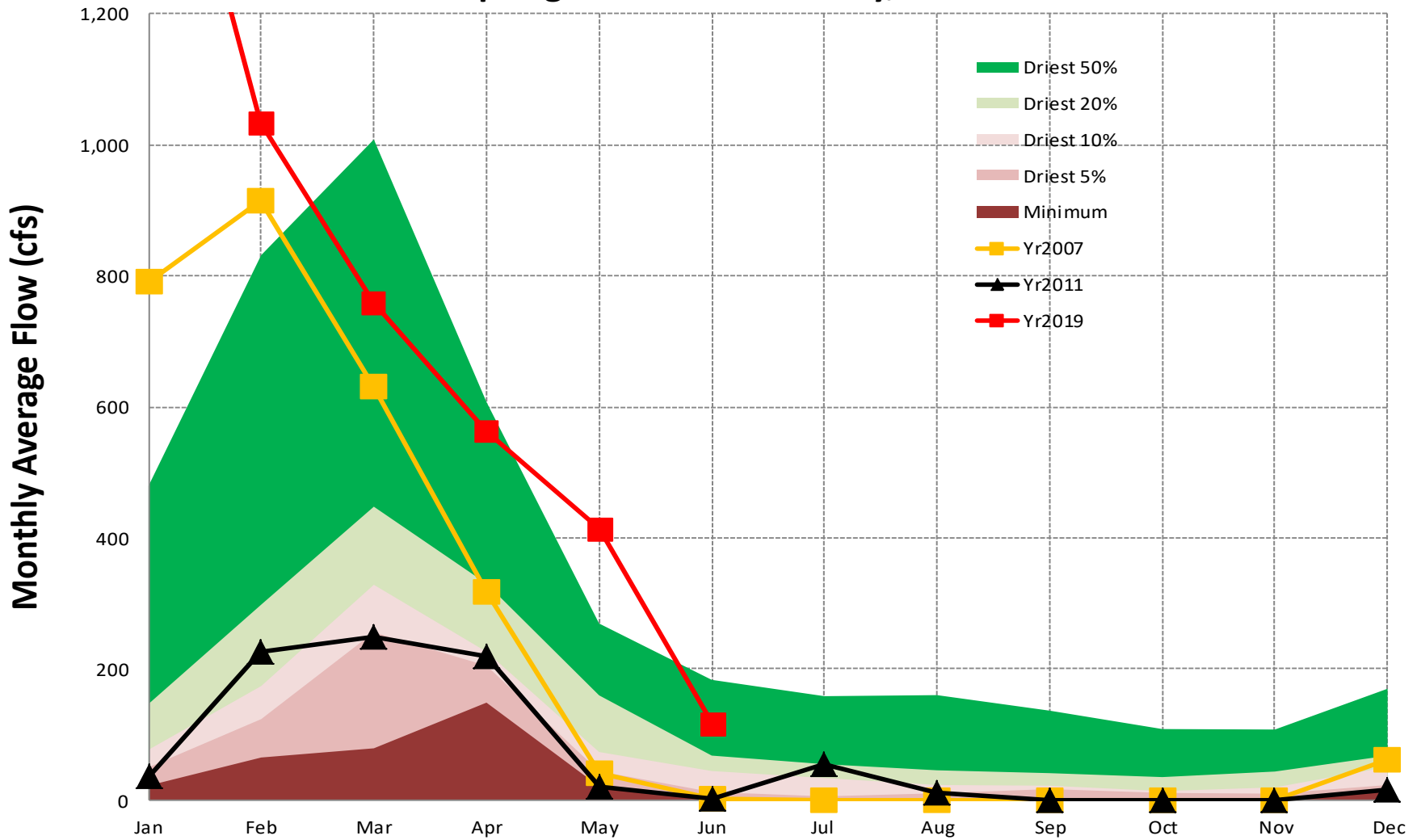


Gage #12. USGS #02353500, Flint Basin, Ichawaynochaway Creek at Milford, GA



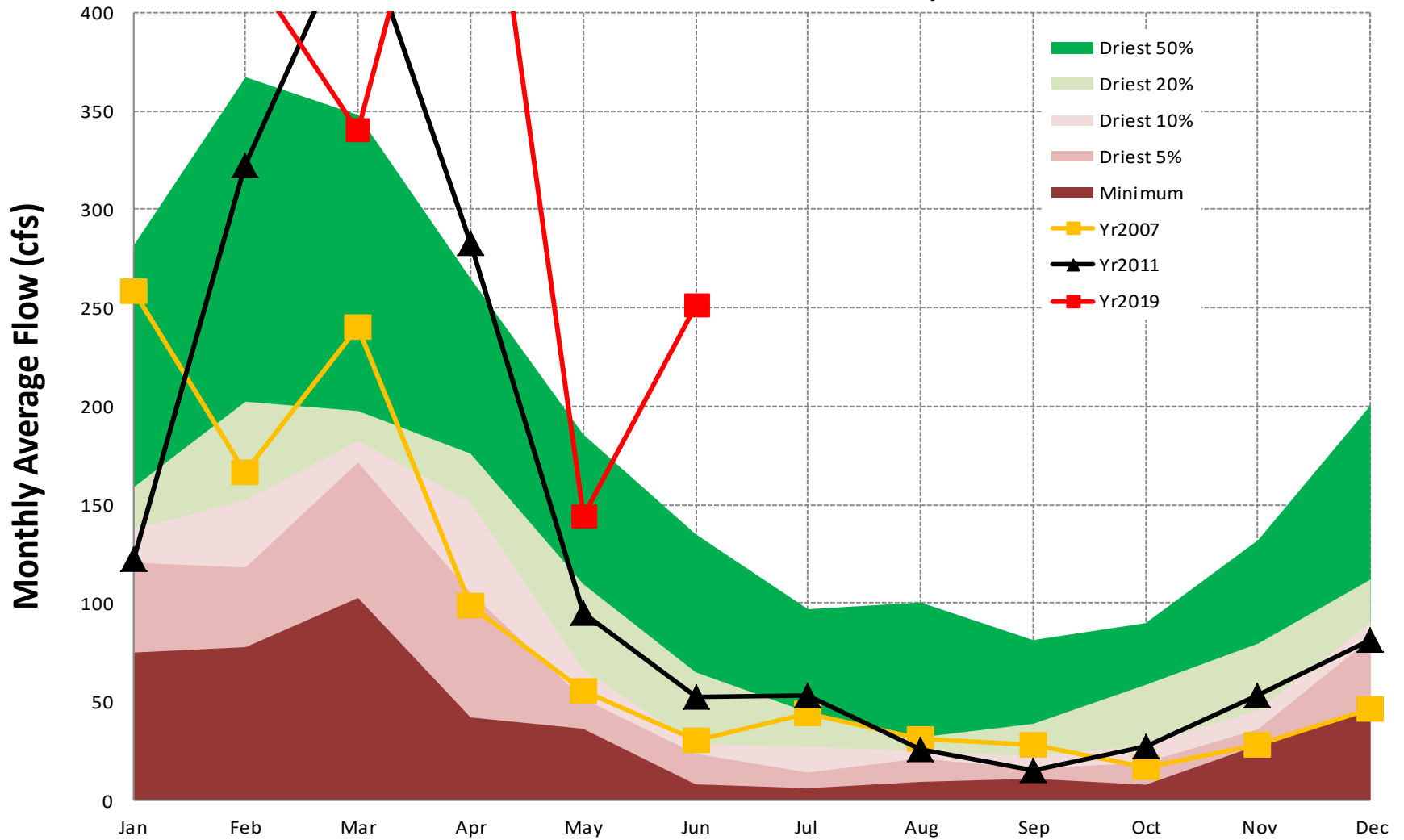
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Gage #13. USGS #02357000, Flint River, Spring Creek near Iron City, GA



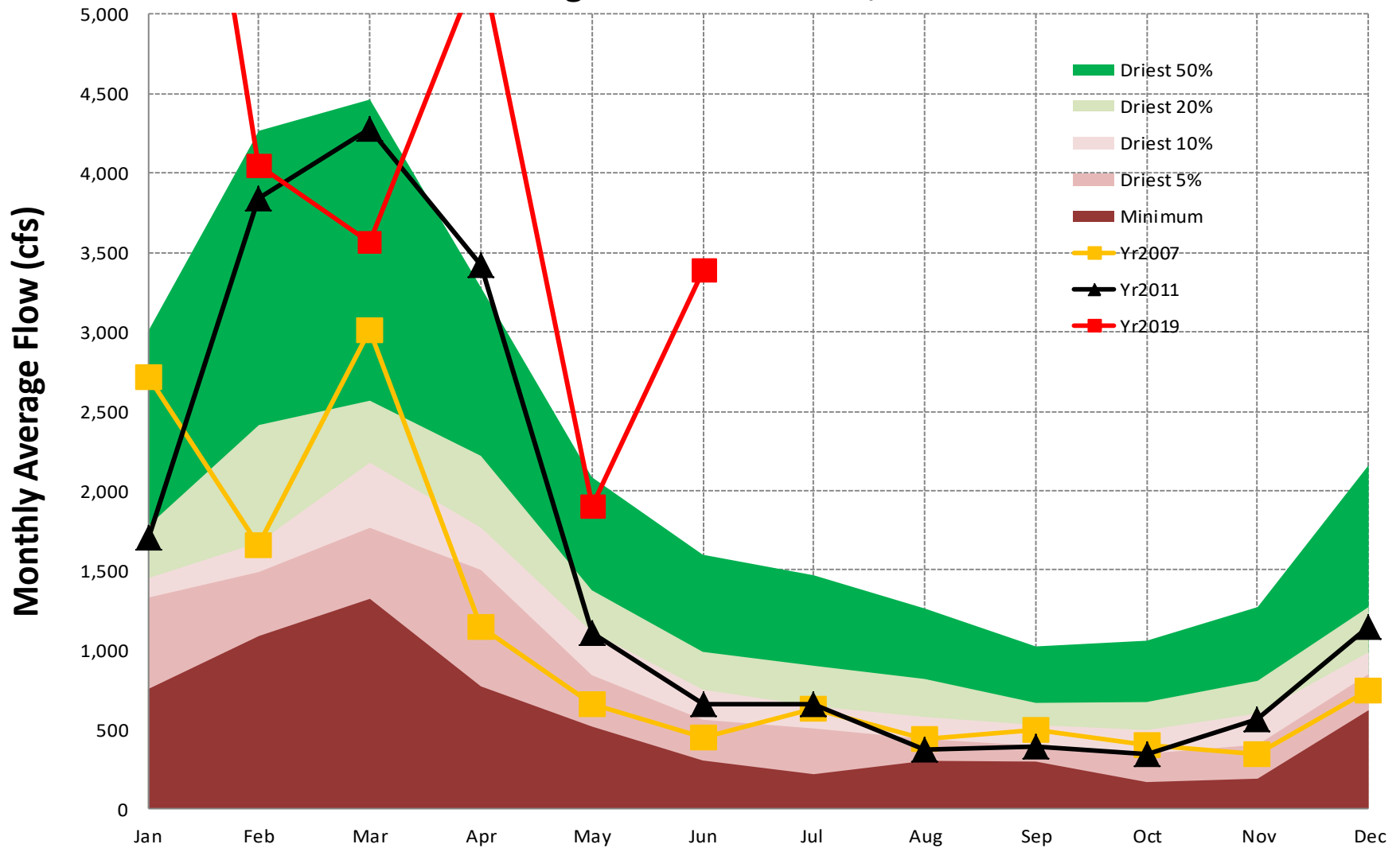
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**Gage #14. USGS #02208450, Ocumulgee Basin,
ALCOVY RIVER above COVINGTON, GA**



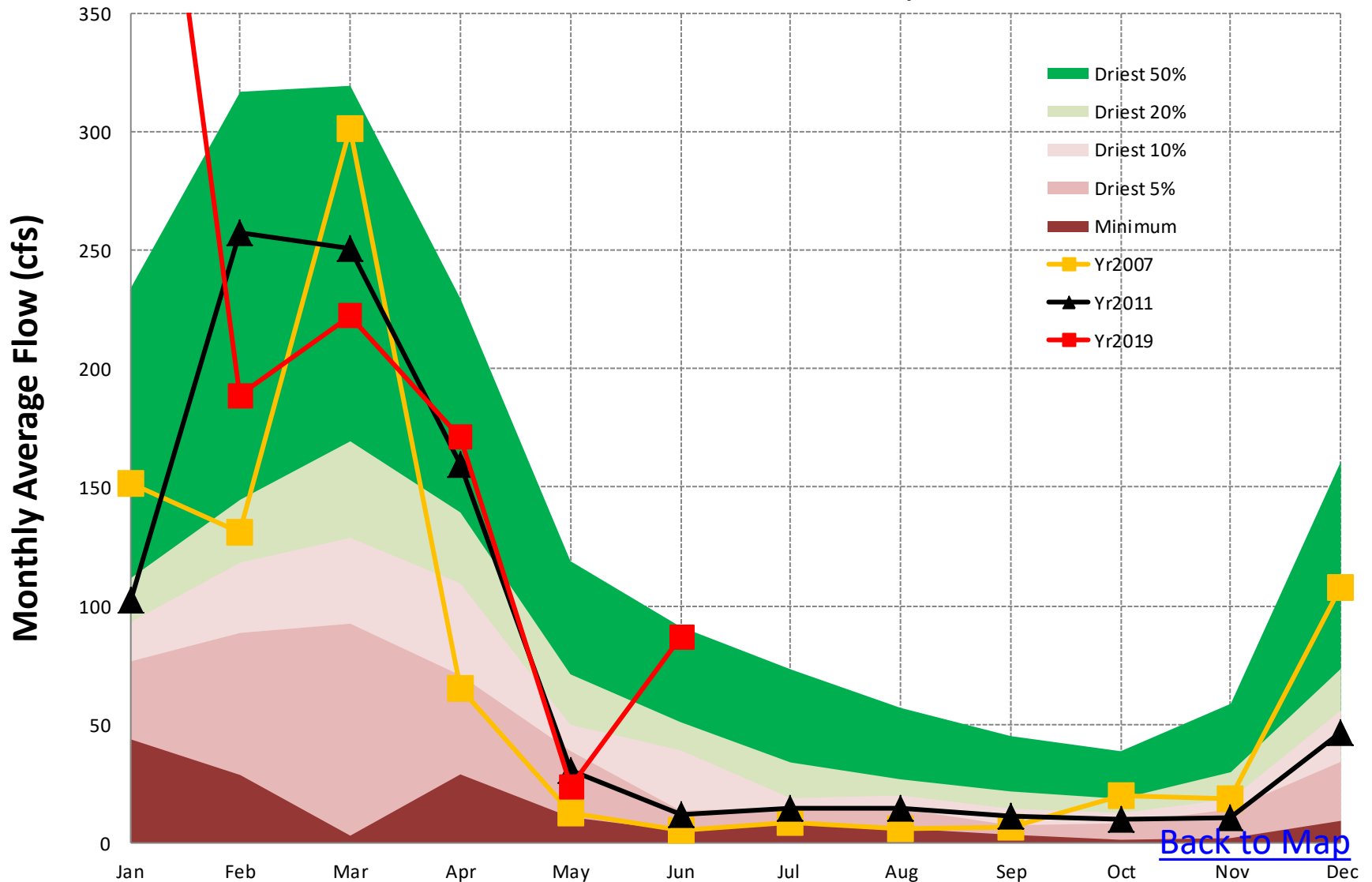
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Gage #15. USGS #02213000, Ocmulgee Basin, Ocmulgee River at Macon, GA



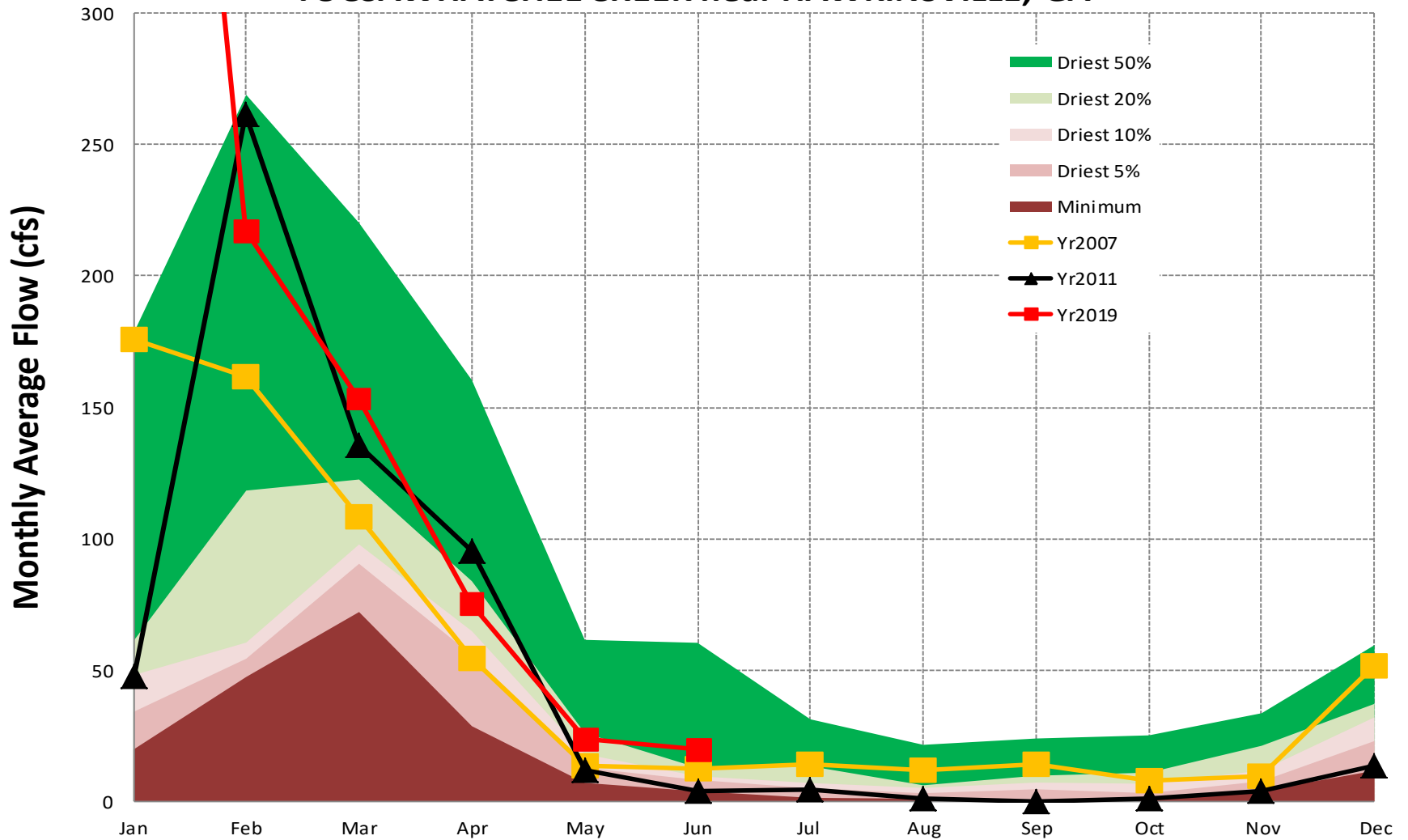
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**Gage #16. USGS #02213500, Ocmulgee Basin,
TOBESOFKEE CREEK near MACON, GA**



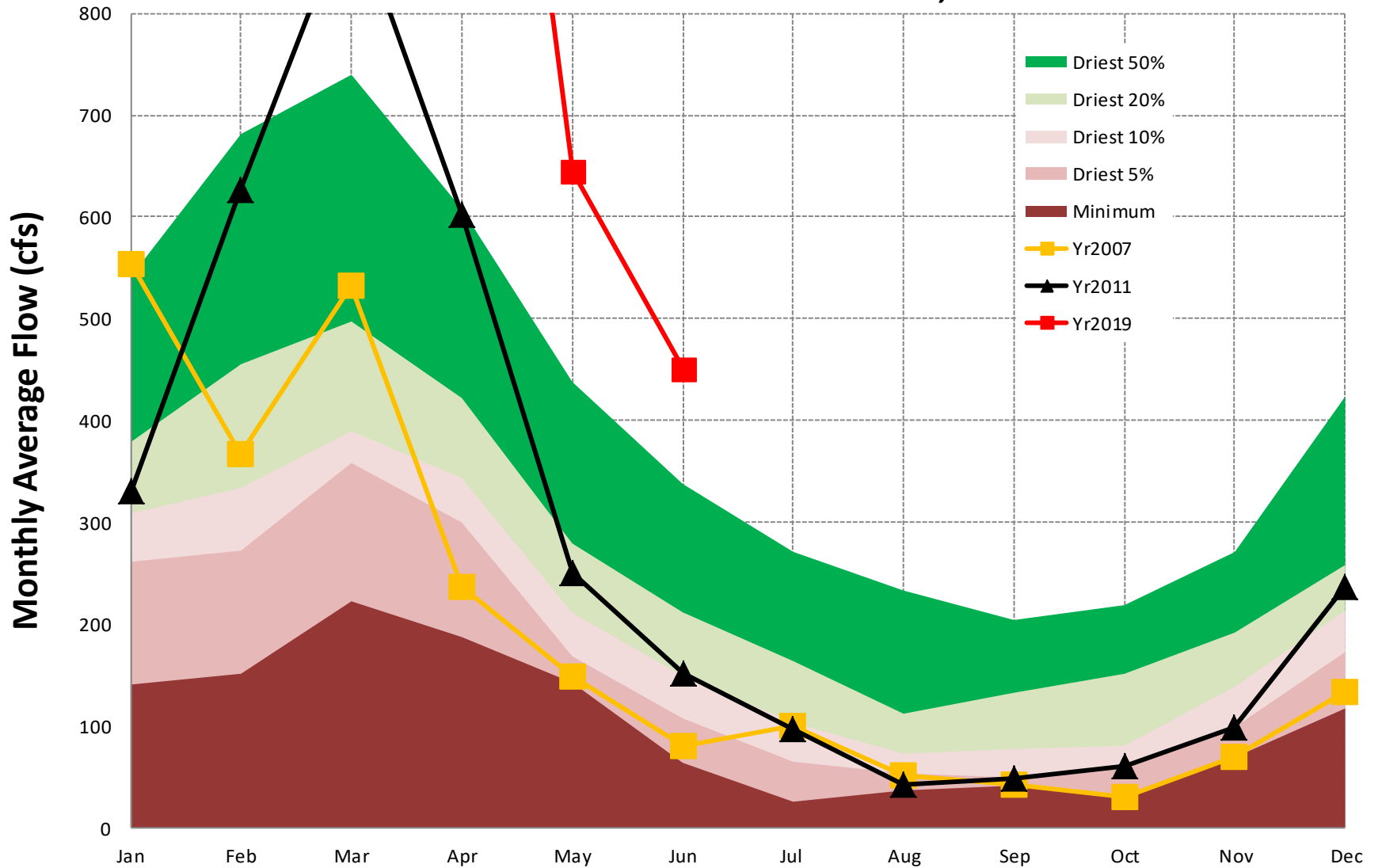
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Gage #17. USGS #02215100, Ocmulgee Basin, TUCSAWHATCHEE CREEK near HAWKINSVILLE, GA



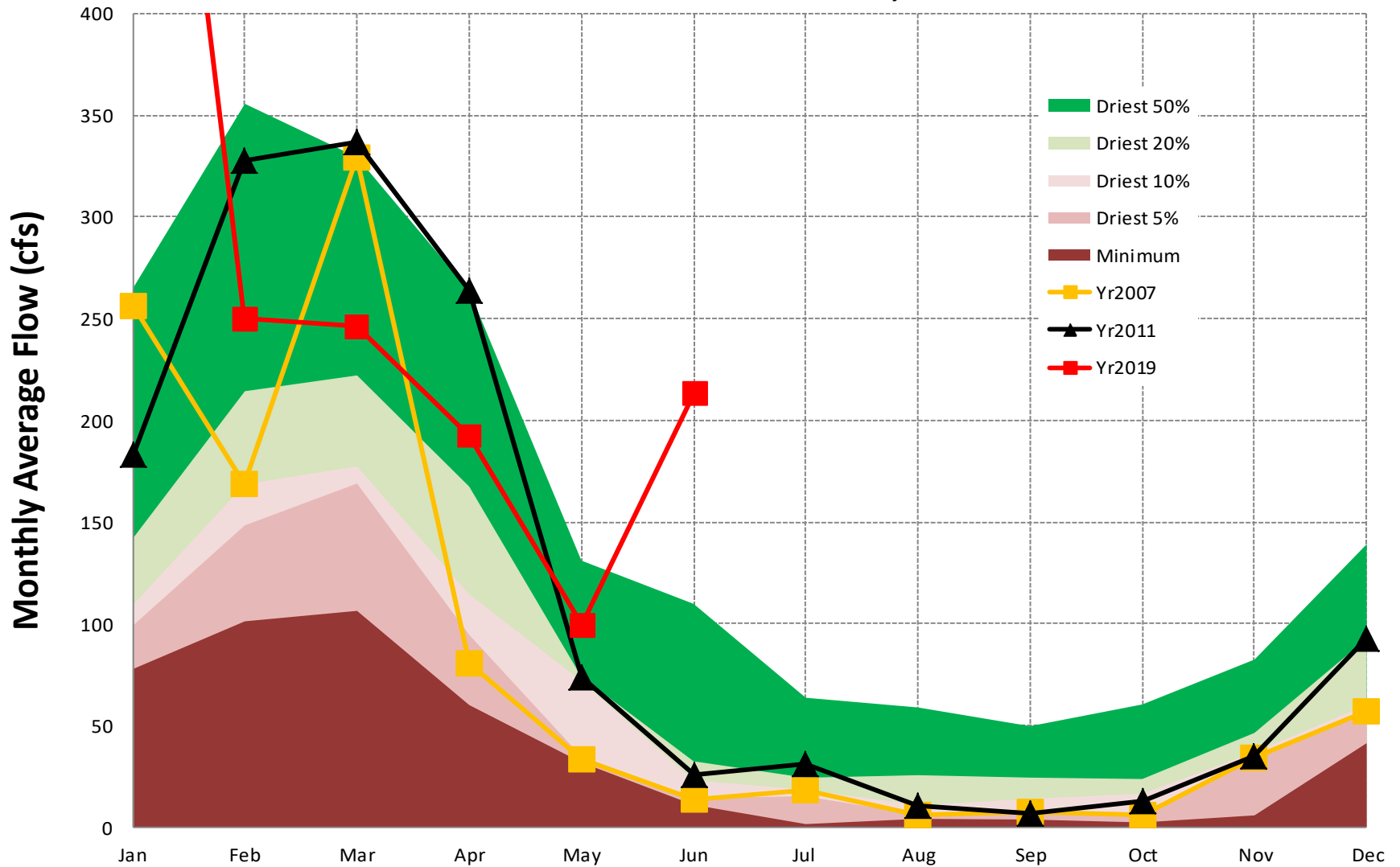
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**Gage #18. USGS #02217500, Oconee Basin,
MIDDLE OCONEE RIVER near ATHENS, GA**



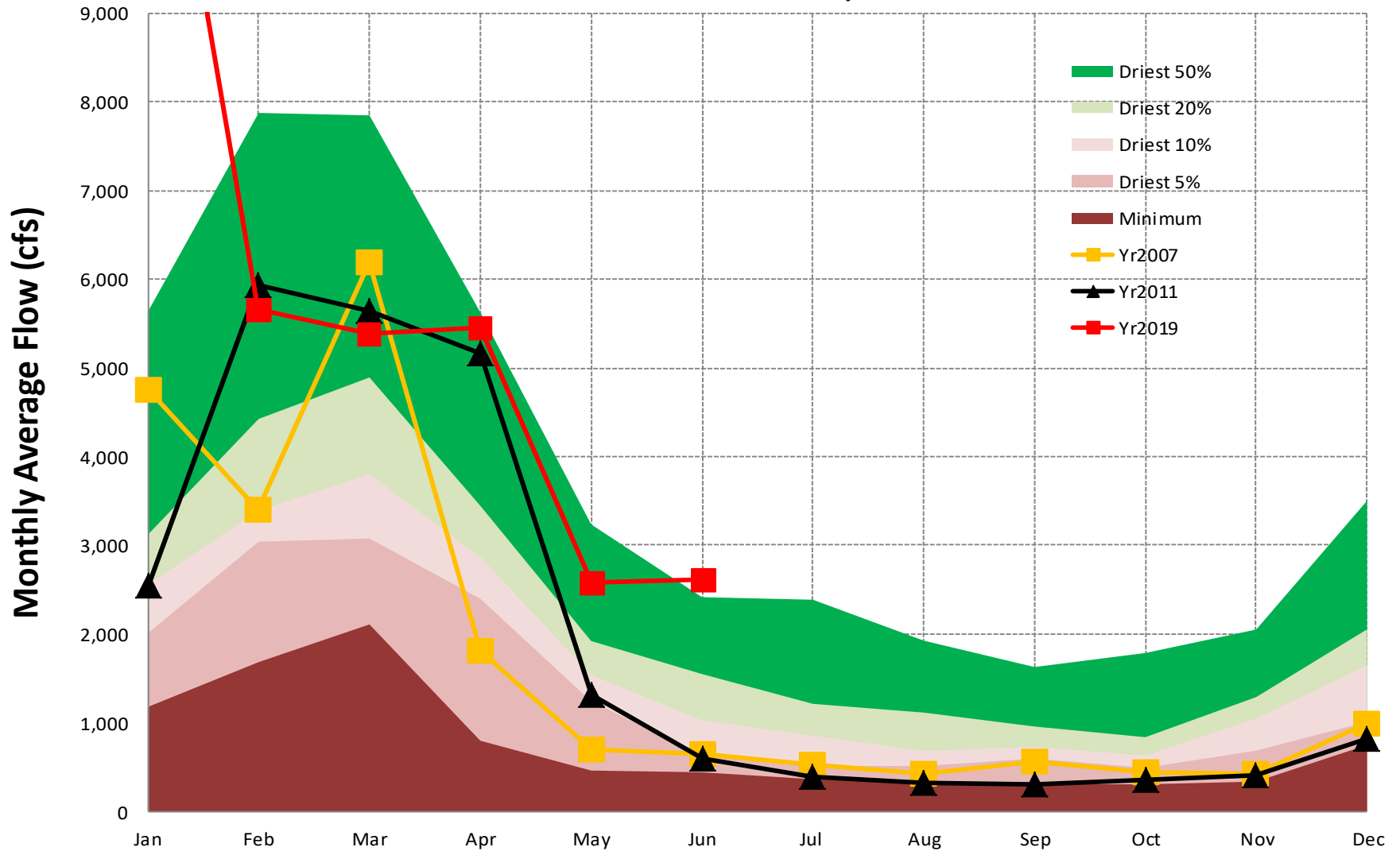
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**Gage #19. USGS #02220900, Oconee Basin,
LITTLE RIVER near EATONTON, GA**



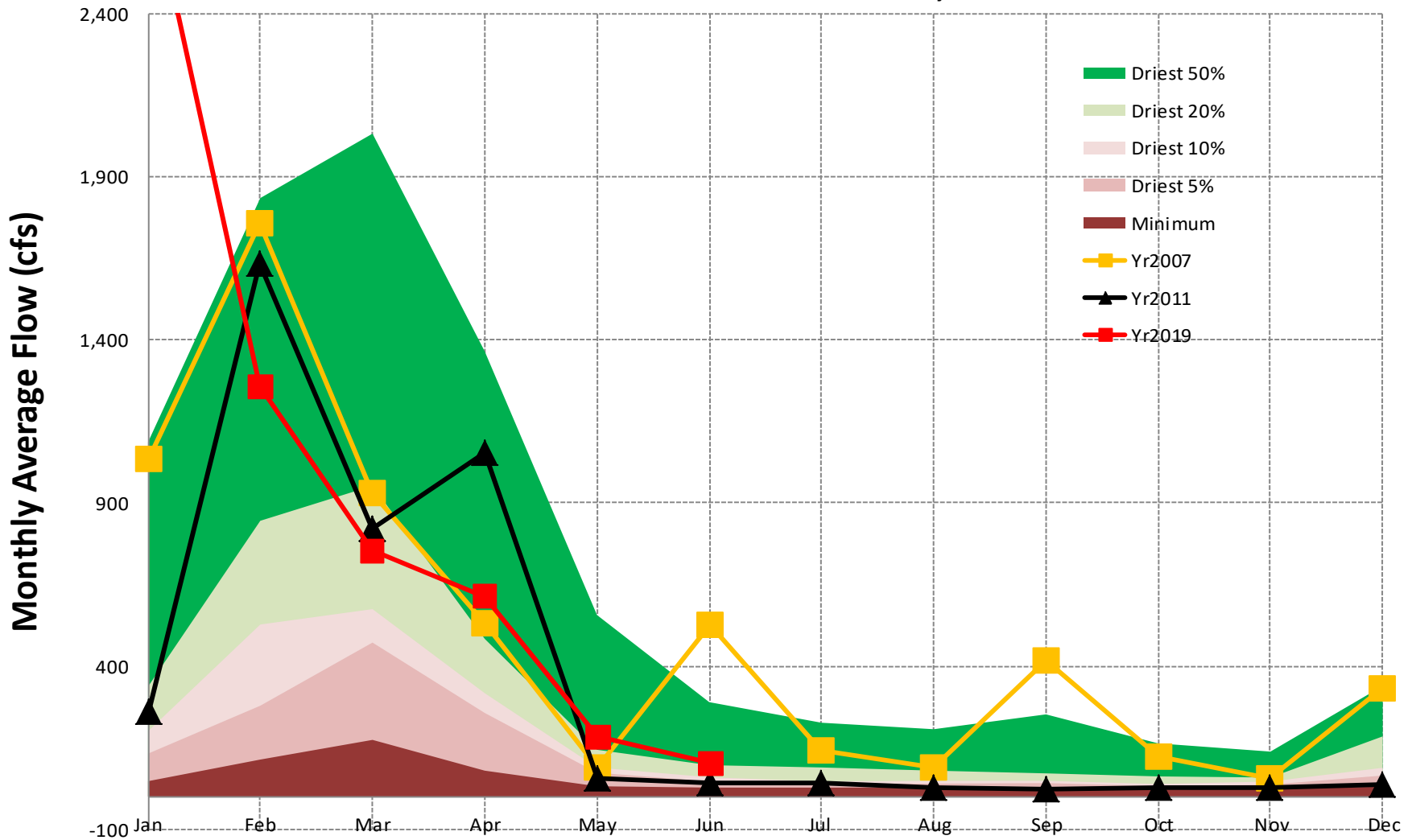
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Gage #20. USGS #02223500, Oconee Basin, Oconee River at Dublin, GA



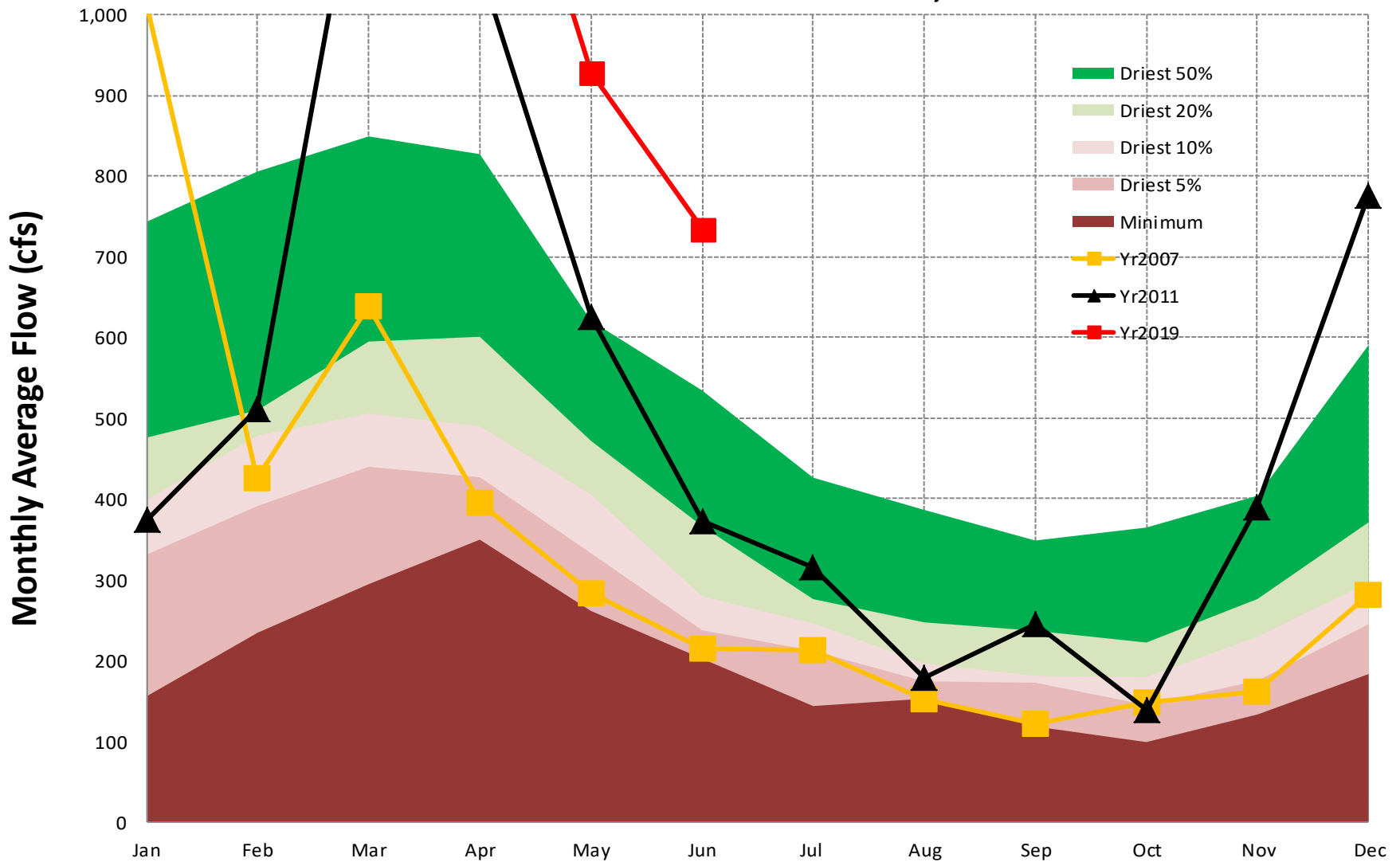
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**Gage #21. USGS #02225500, Altamaha Basin,
OHOOPEE RIVER near REIDSVILLE, GA**



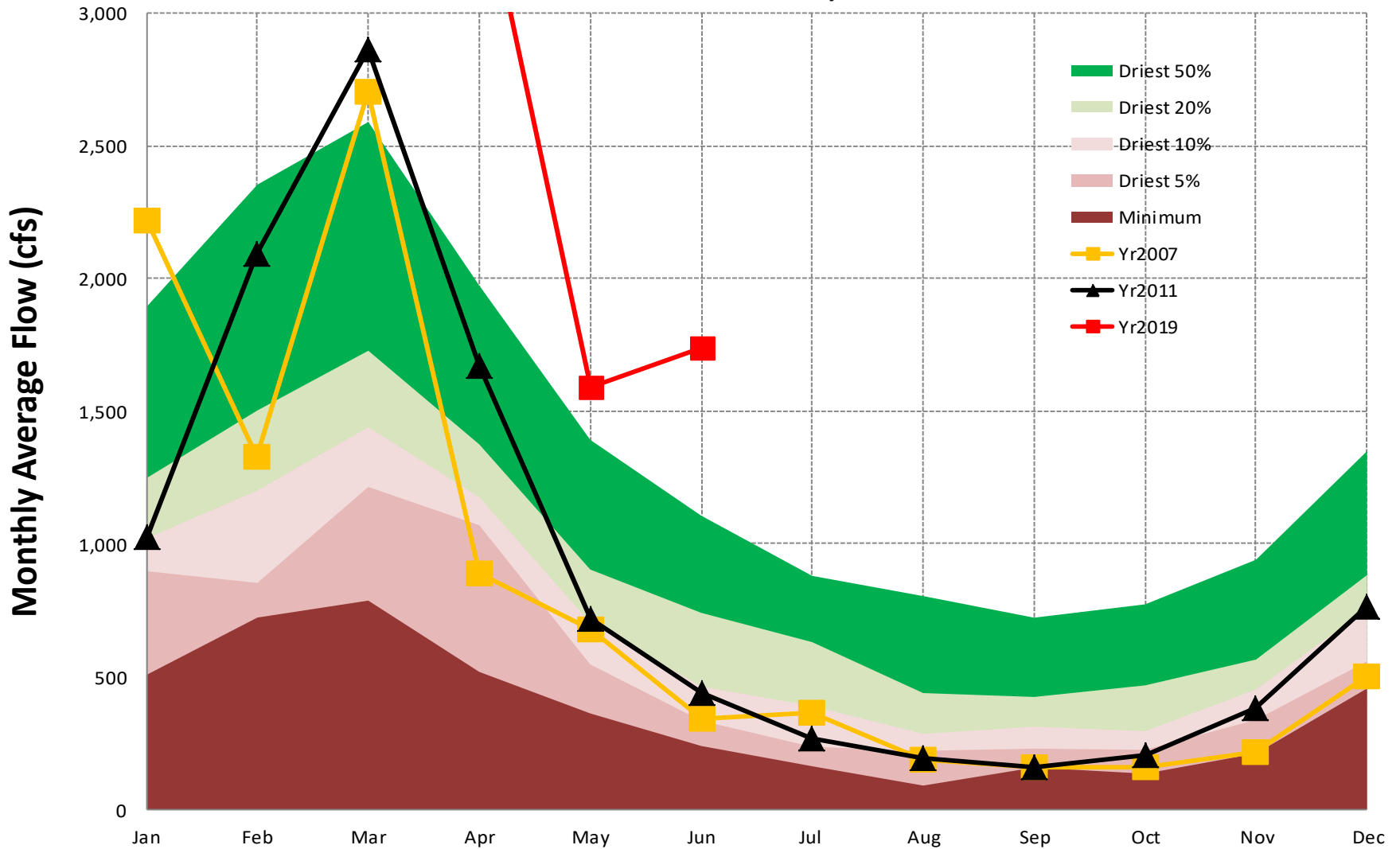
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**Gage #22. USGS #02177000, Savannah Basin,
CHATTOOGA RIVER near CLAYTON, GA**



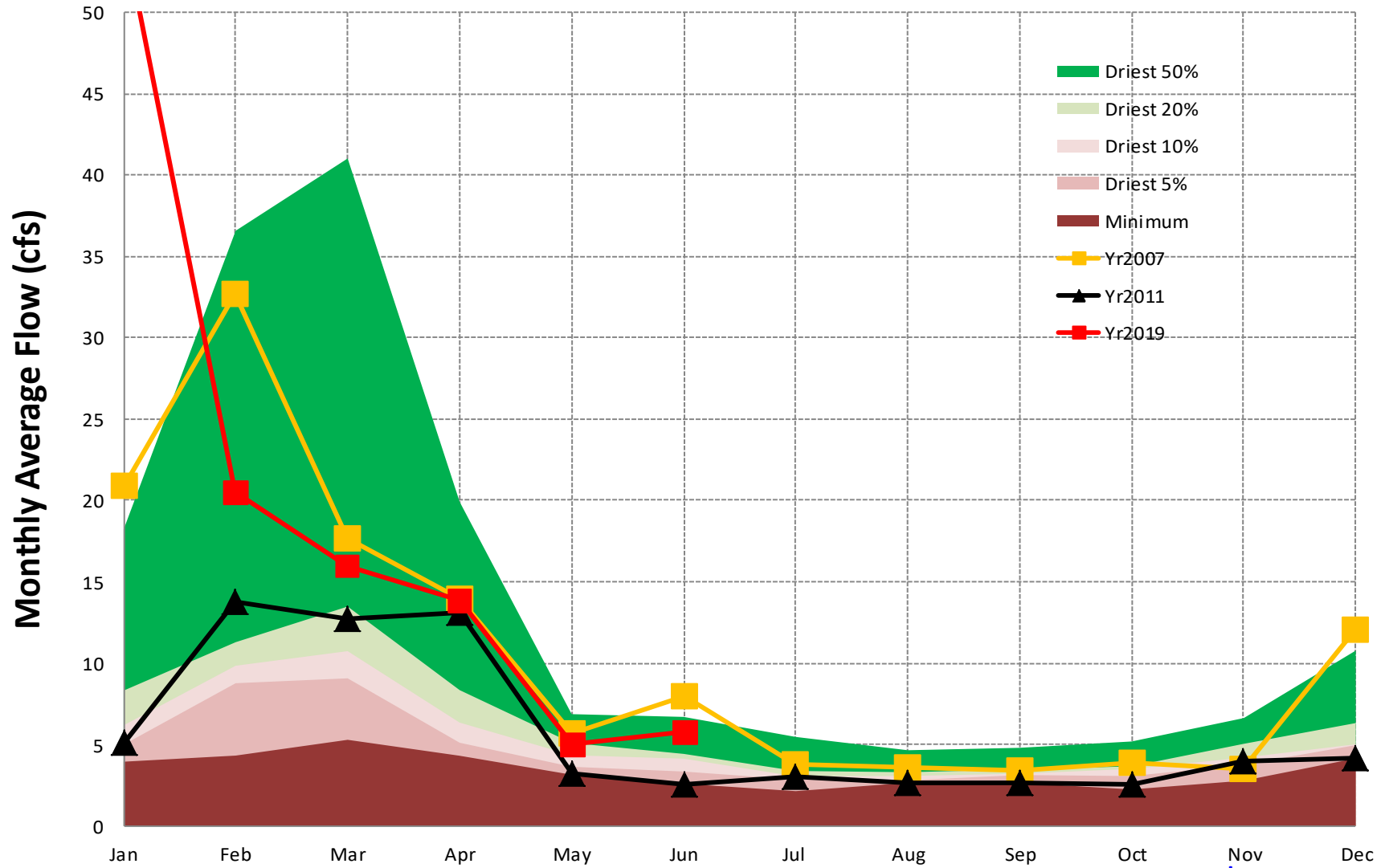
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Gage #23. USGS #02192000, Savannah Basin Broad River near Bell, GA



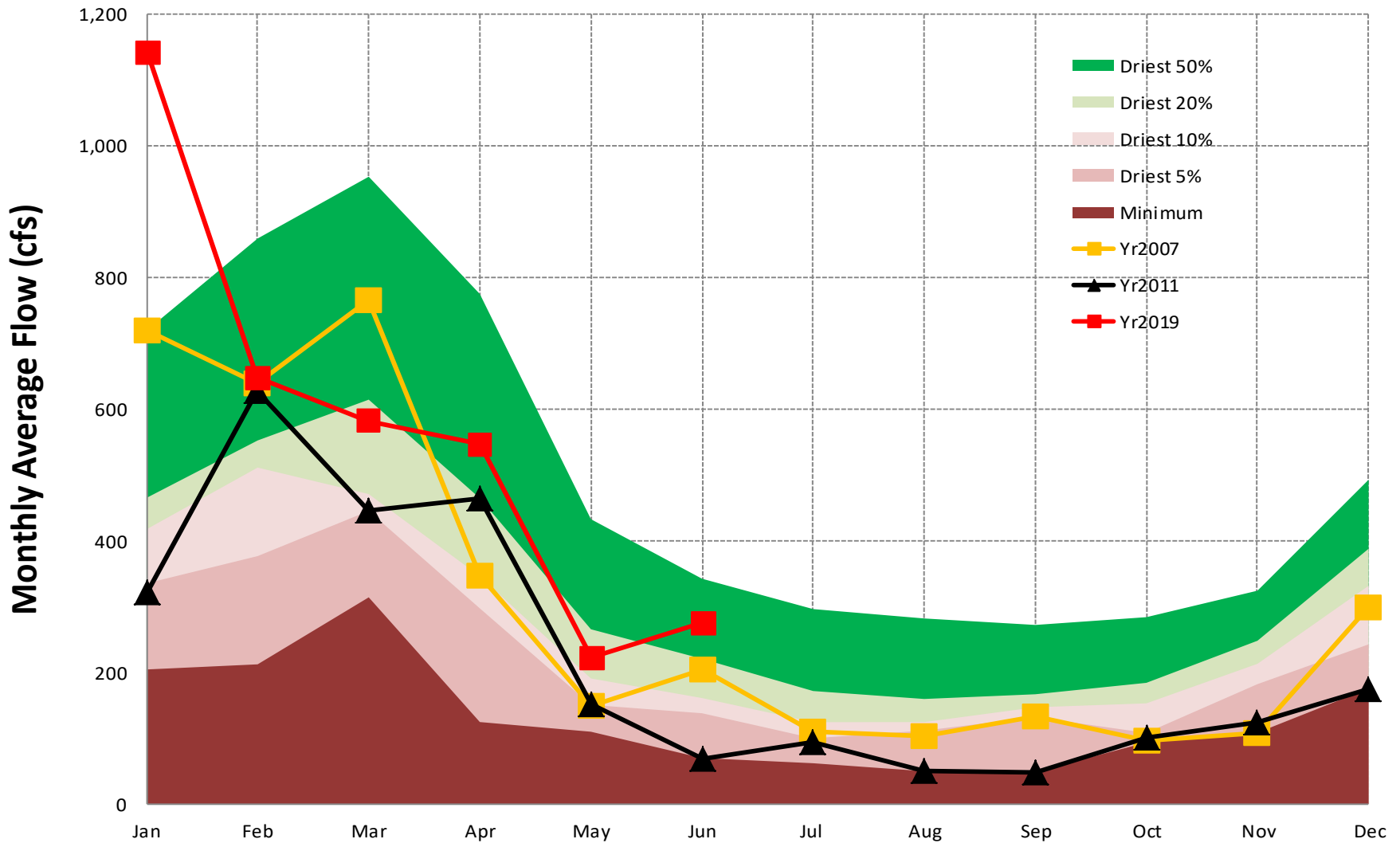
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**Gage #24. USGS #02198100, Savannah Basin,
BEAVERDAM CREEK near SARDIS, GA**



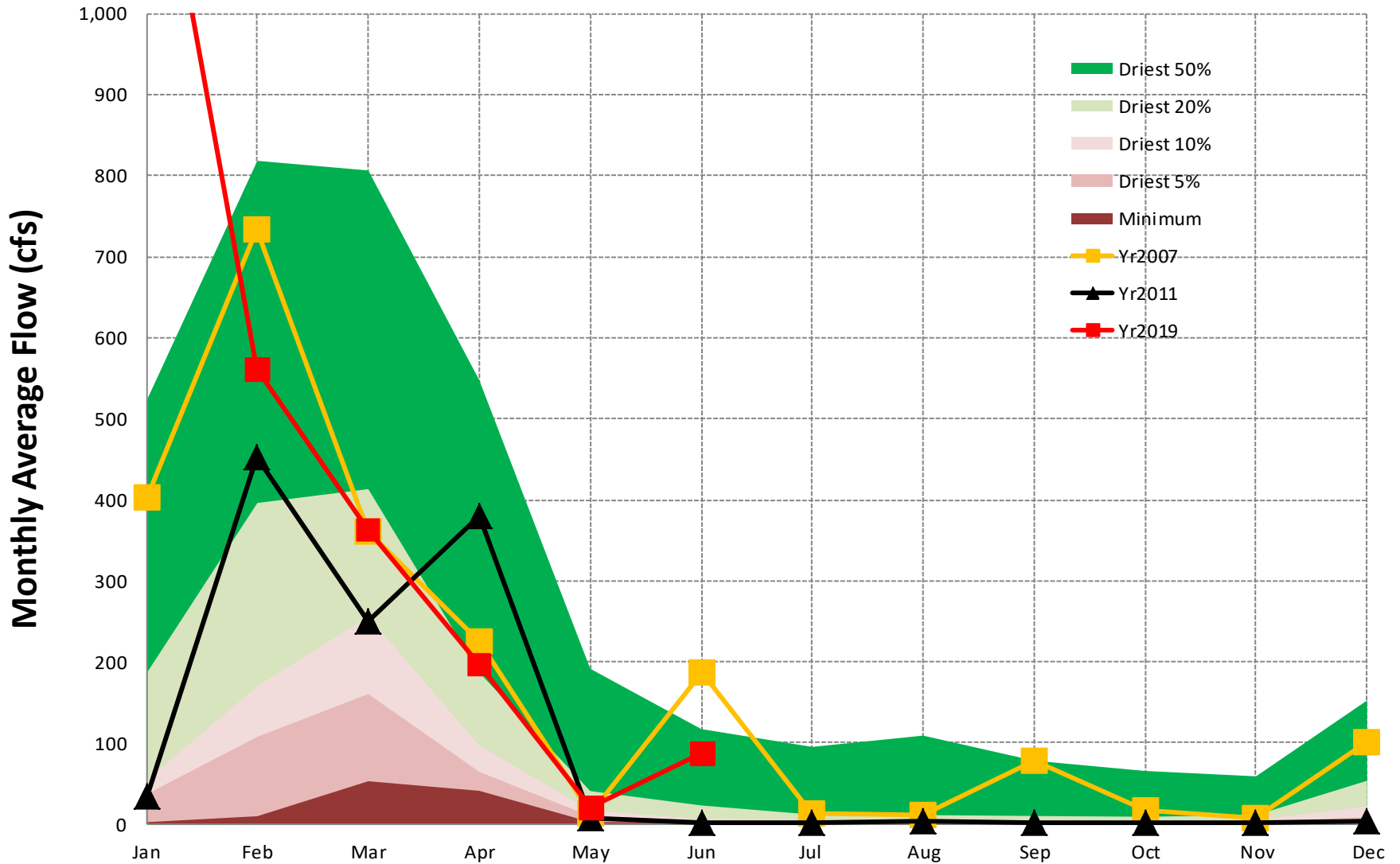
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Gage #25. USGS #02198000, Savannah Basin, BRIER CREEK at MILLHAVEN, GA



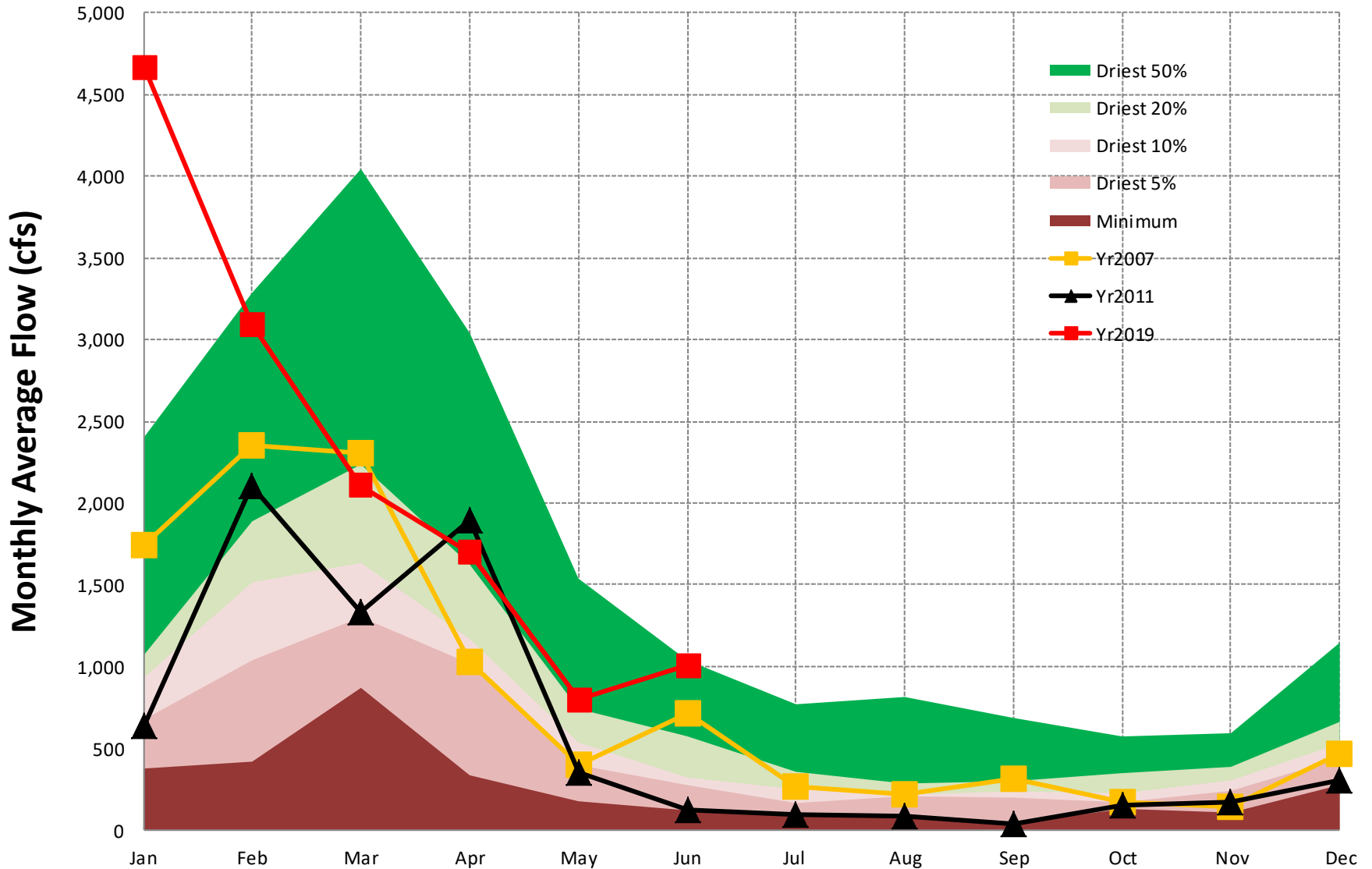
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**Gage #26. USGS #02203000, Ogeechee Basin,
CANOOCHEE RIVER near CLAXTON, GA**



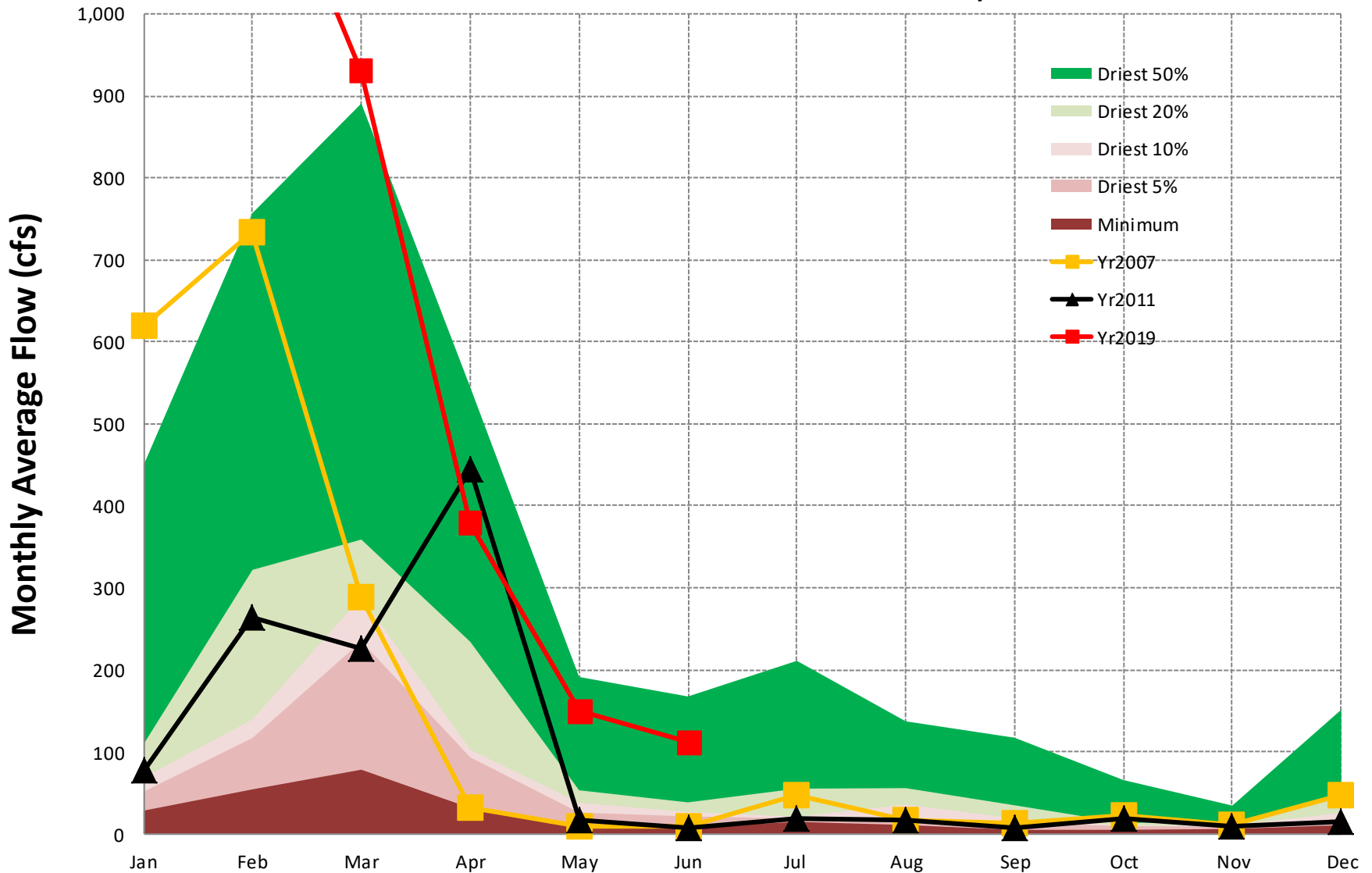
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Gage #27. USGS #02202500, Ogeechee Basin, Ogeechee River near Eden, GA

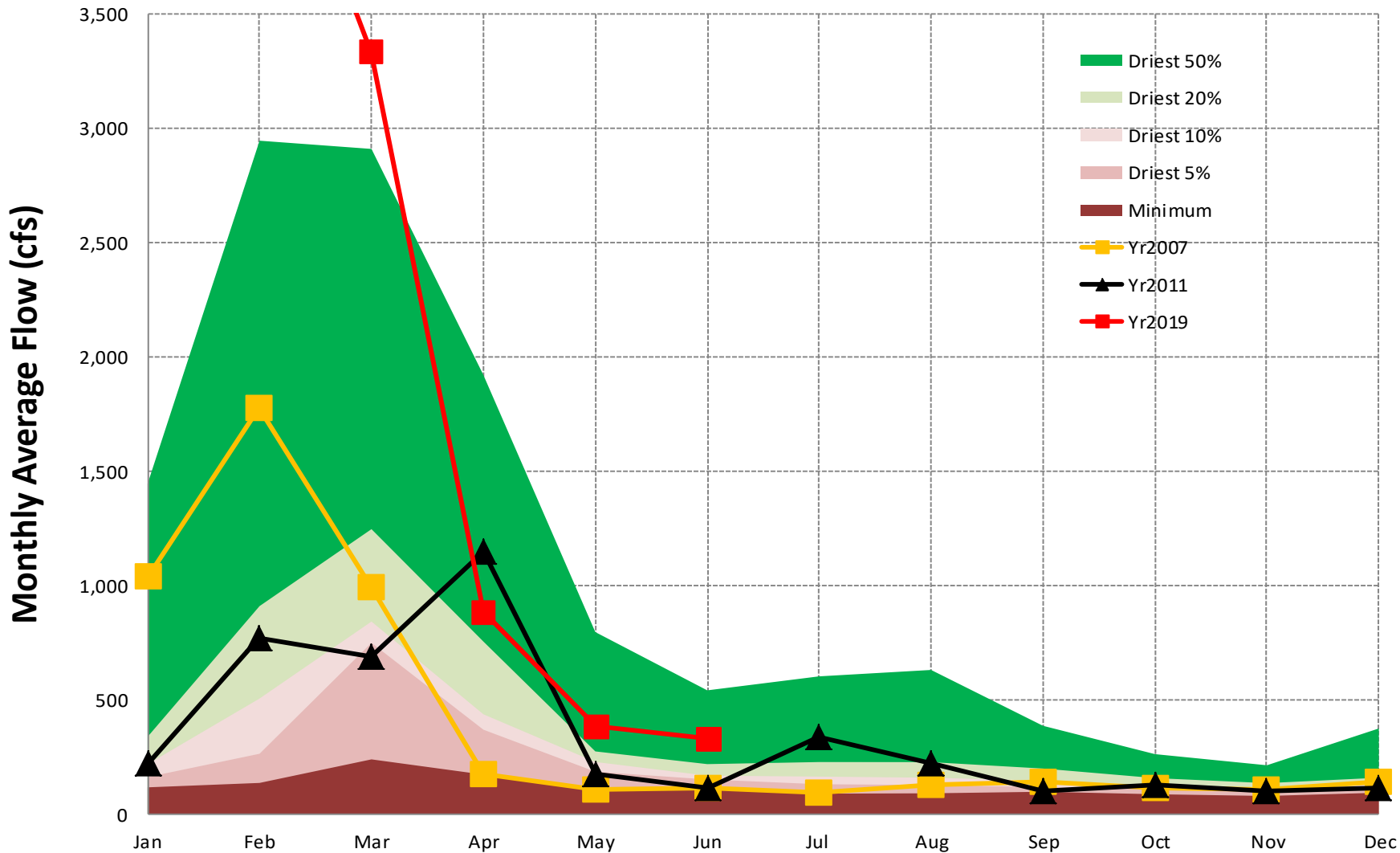


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Gage #28. USGS #02327500, Ochlockonee Basin, OCHLOCKONEE RIVER near THOMASVILLE, GA

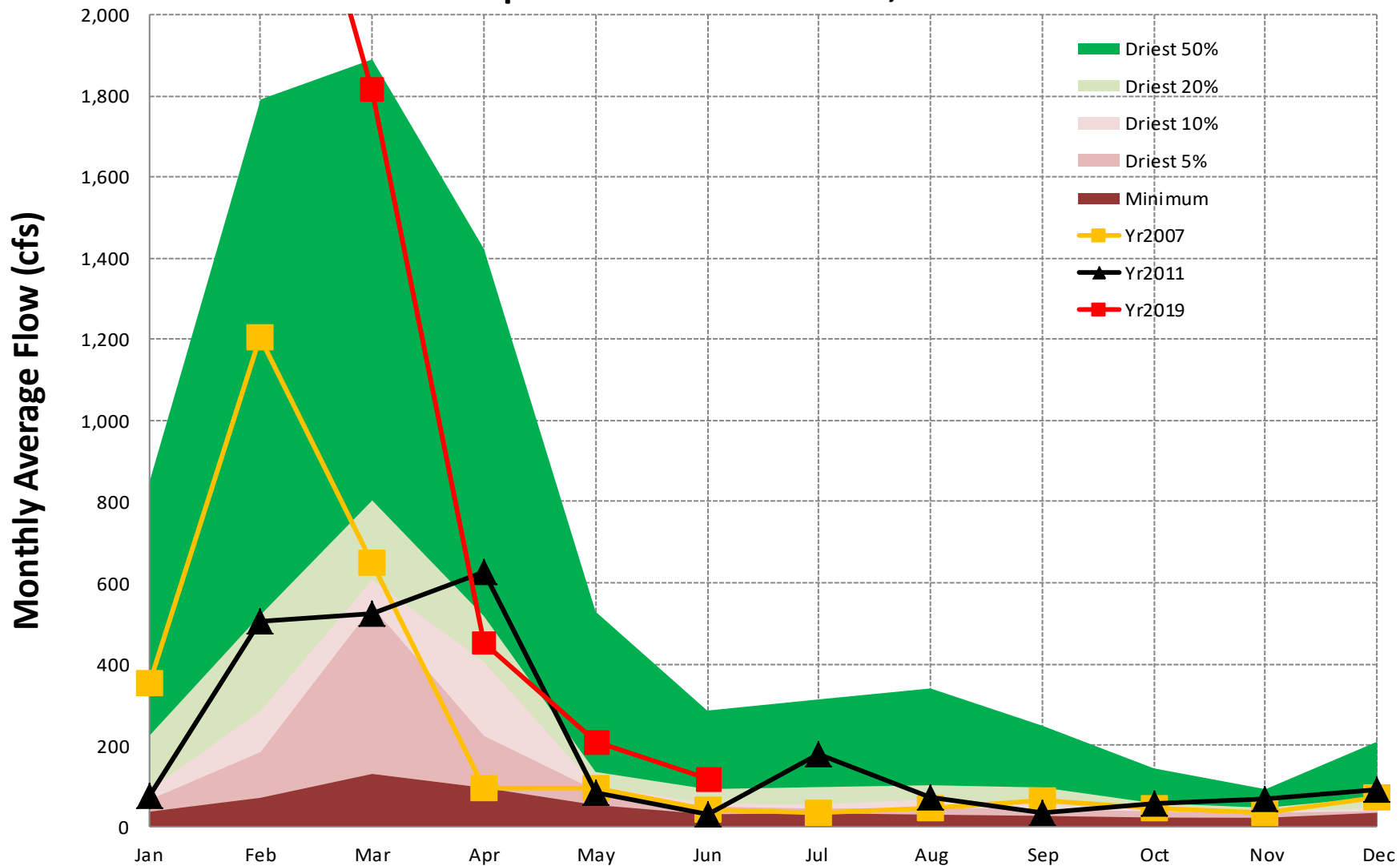


Gage #29. USGS #02319000, Suwannee Basin, WITHLACOOCHEE RIVER near PINETTA, FL



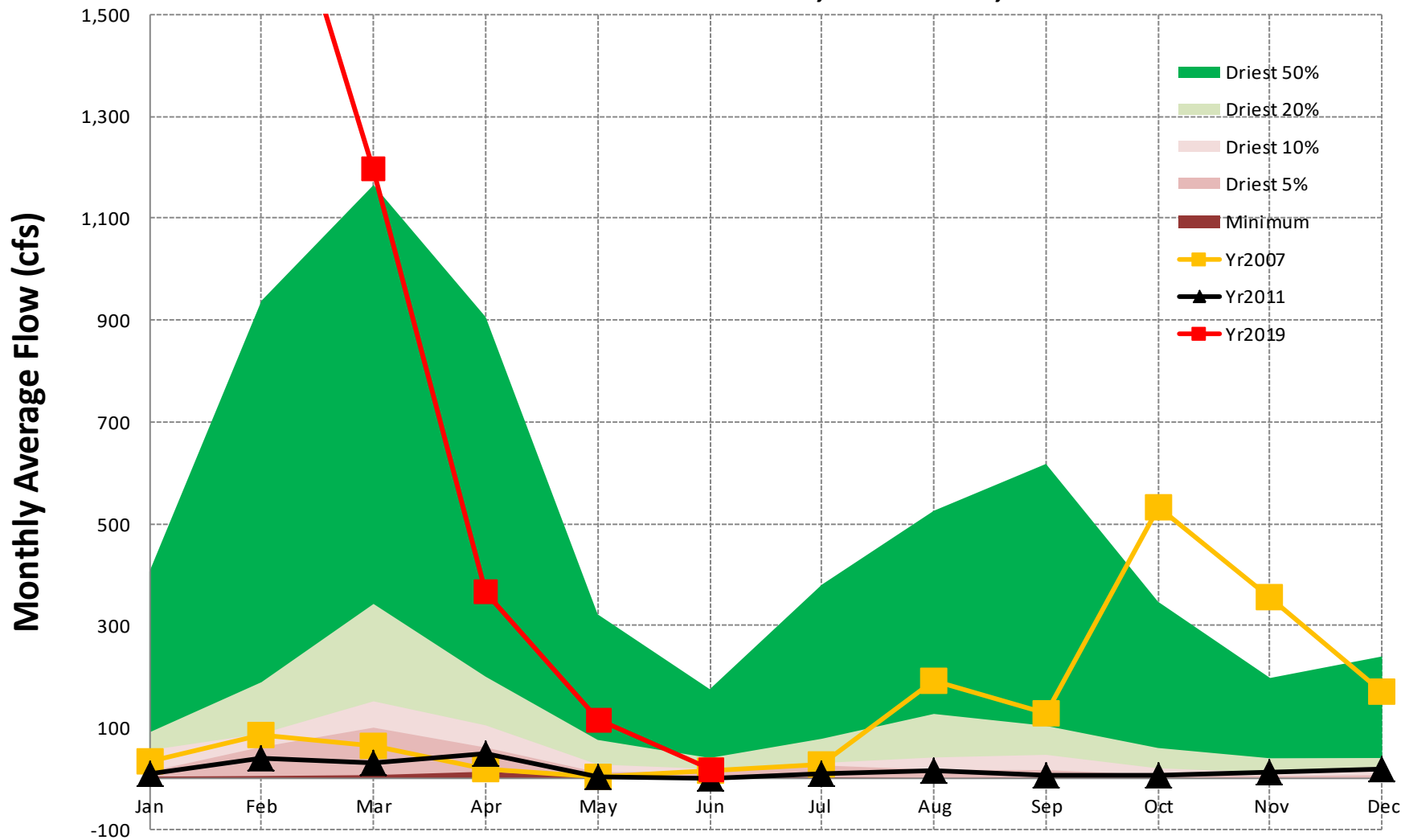
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Gage #30. USGS #02317500, Suwanee Basin, Alapaha River at Statenville, GA



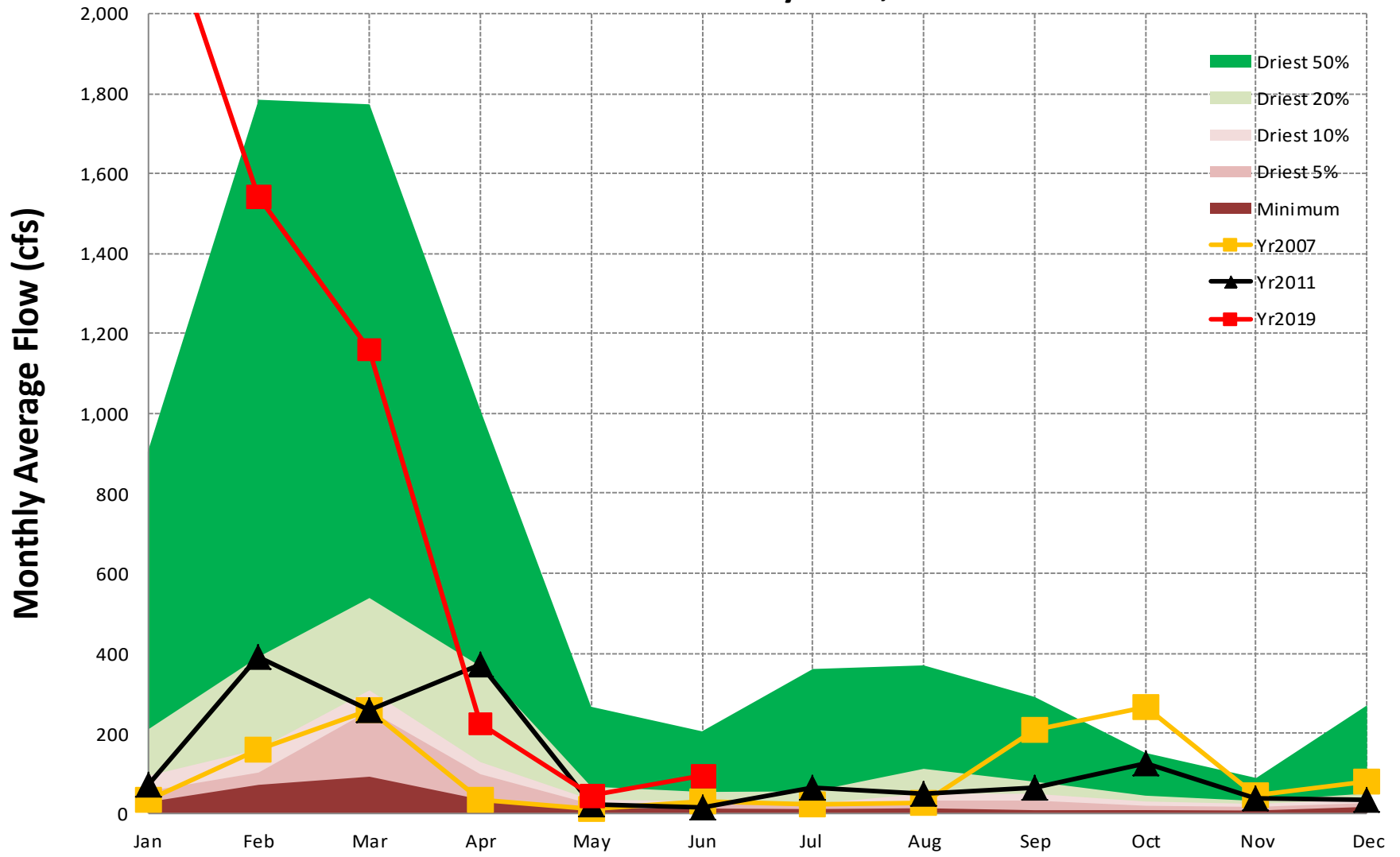
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Gage #31. USGS #02314500, Suwannee Basin, SUWANNEE RIVER AT US 441, AT FARGO, GA



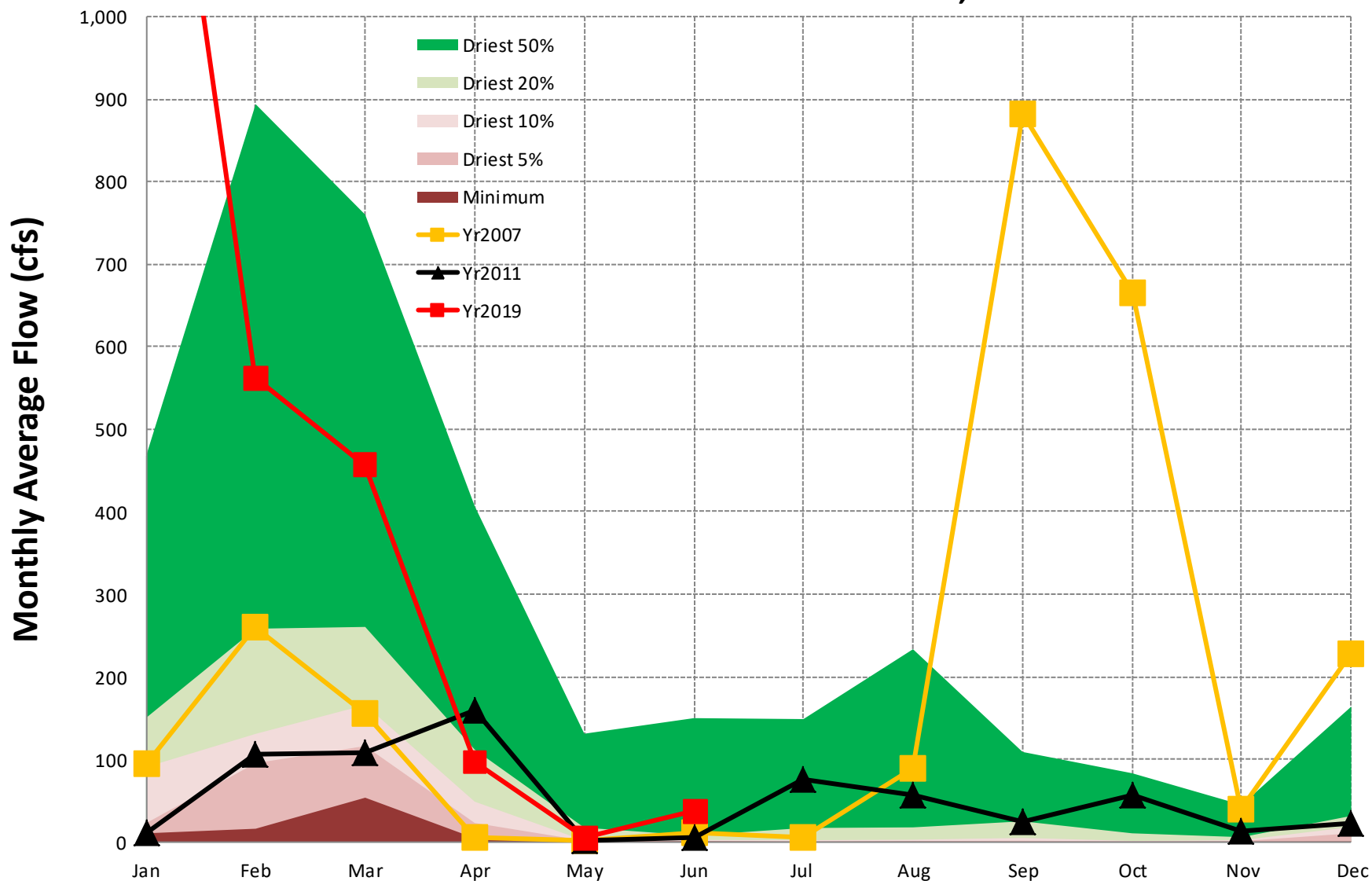
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Gage #32. USGS #02226500, Satilla Basin, Satilla River near Waycross, GA

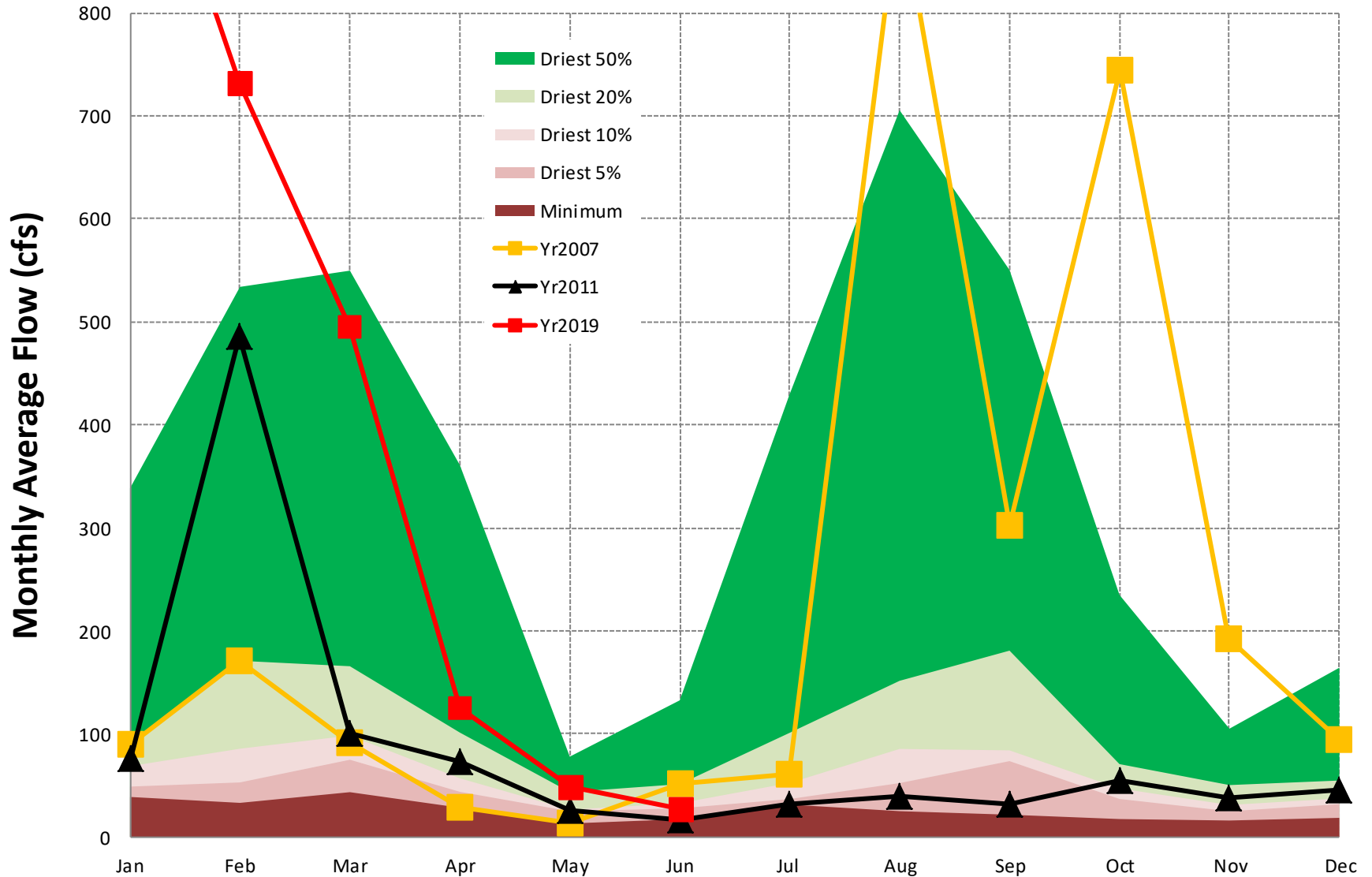


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Gage #33. USGS #02227500, Satilla Basin, LITTLE SATILLA RIVER near OFFERMAN, GA



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 17 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

Chattahoochee Basin

1. 16MM03

Flint Basin

2. 11AA01
3. 13L180
4. 12M017
5. 08K001
6. 11K003
7. 12K014
8. 13J004
9. 08G001
10. 10G313
11. 09F520
16. 11J011

Oconee Basin

12. 21T001

Tennessee Basin

13. 03PP01

Suwanee Basin

14. 19E009
17. 27E004

Ogeechee Basin

15. 35P094

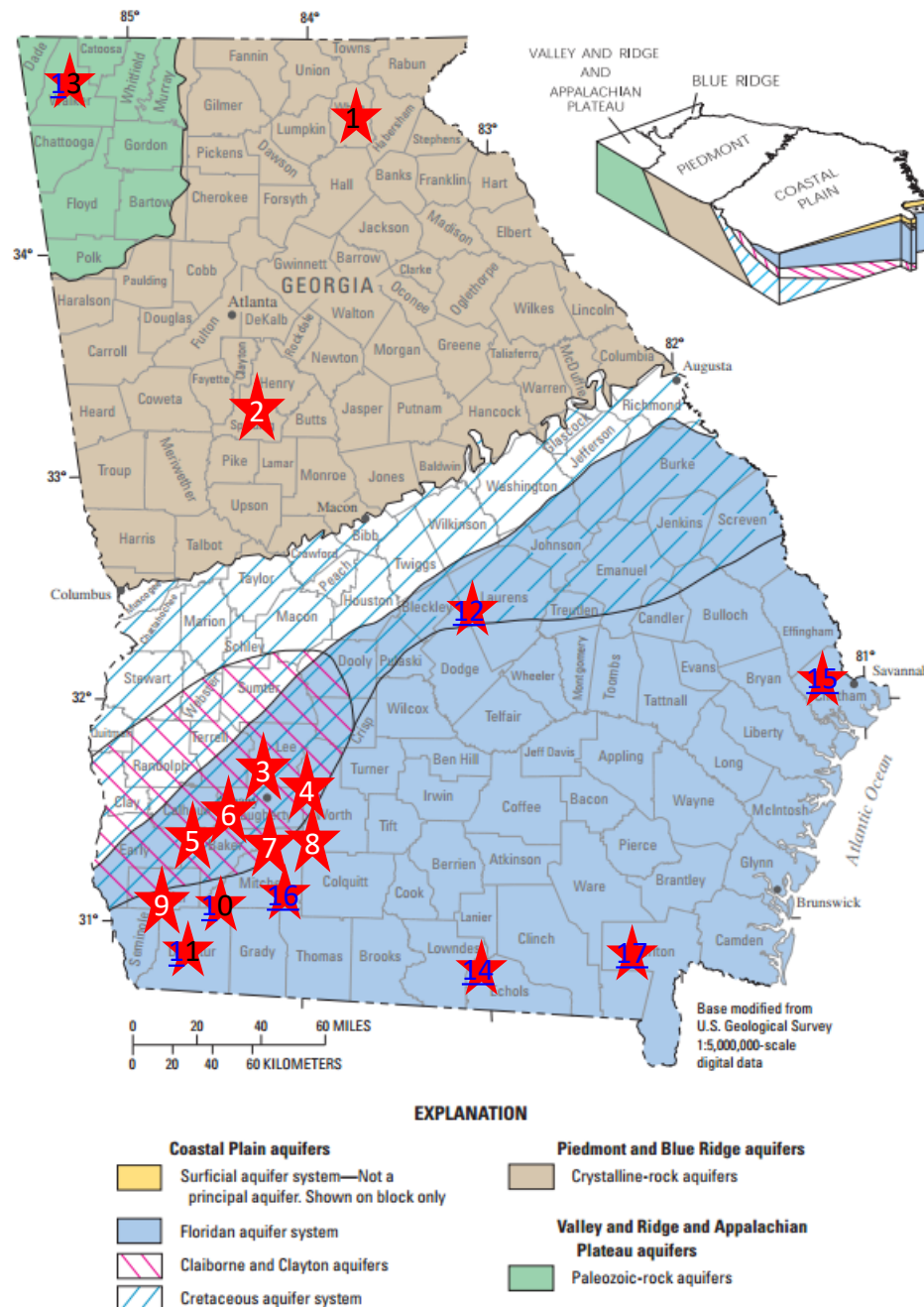


Figure 2. Area of use of principal aquifers and physiographic provinces in Georgia (modified from U.S. Geological Survey, 2006).

Groundwater Level Graphs

- For each of the 17 groundwater wells, EPD has prepared a graph that shows monthly average groundwater levels from January, 2019 through June, 2019;
- 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.

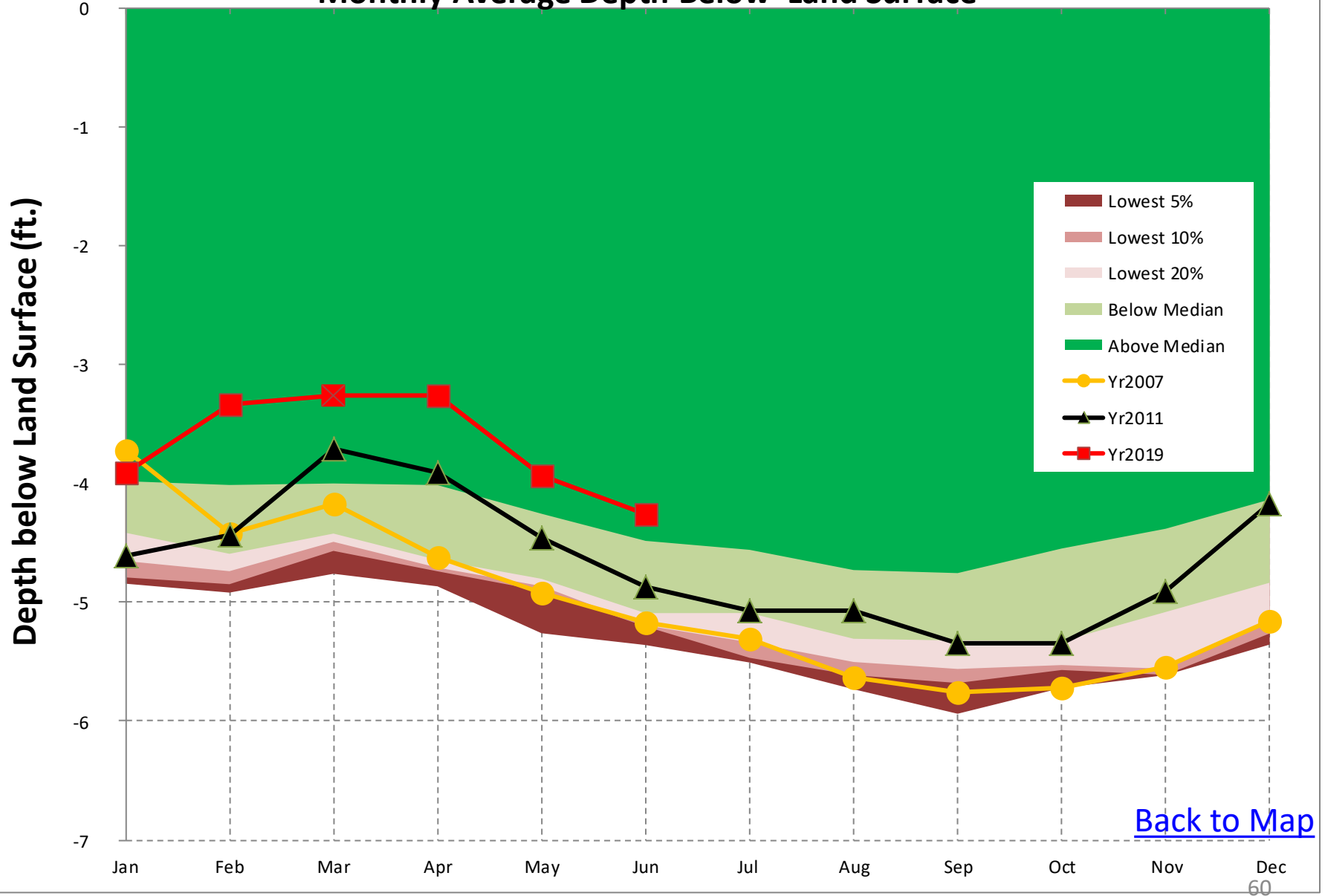
How to Read the Groundwater Level Graphs

Example: **Well #11, 09F520, Flint River Basin**

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

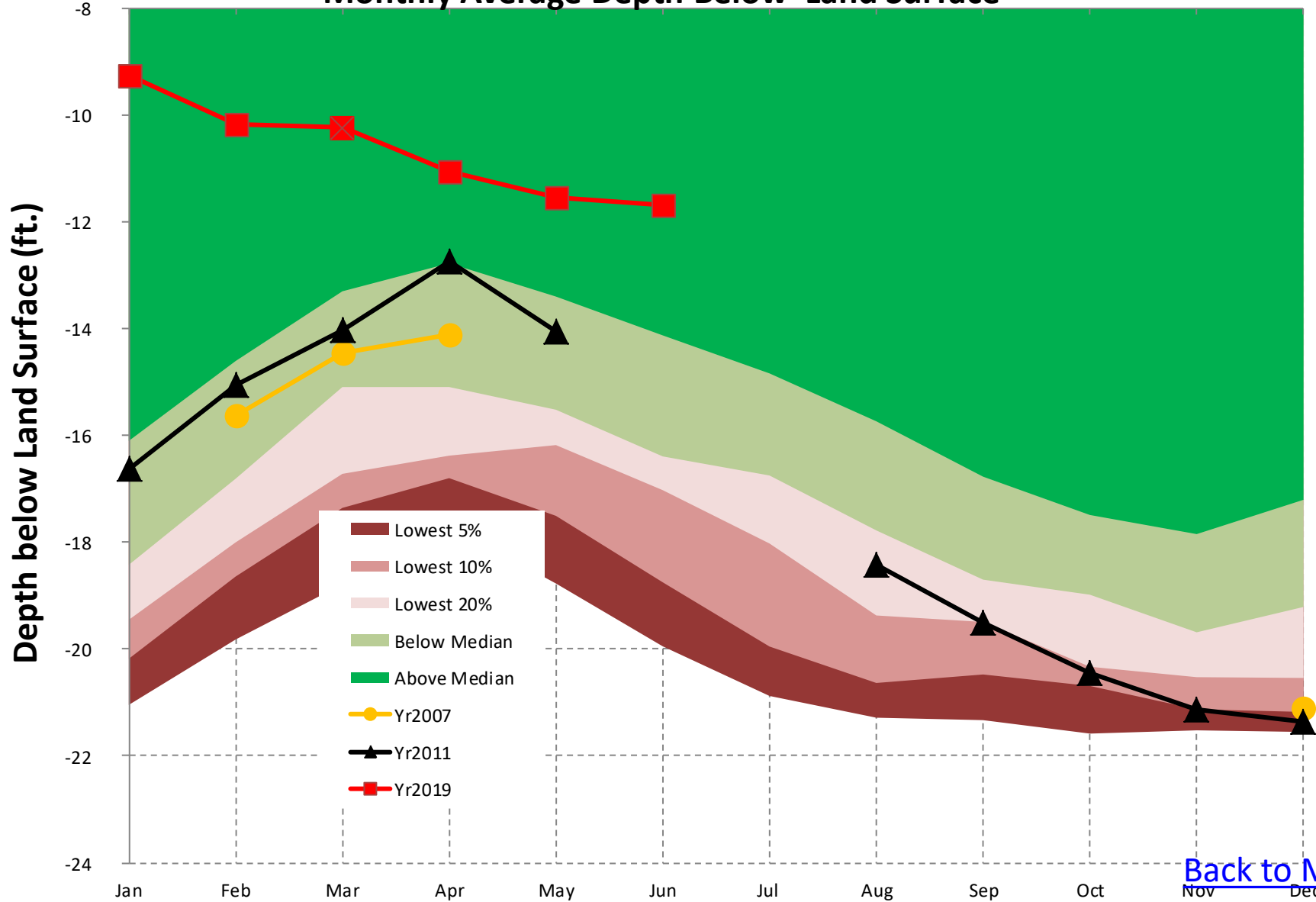
- The average monthly groundwater level for June 2019 was 46ft below land surface. The statistical composite of all historical data for this well shows that monthly average groundwater levels in June have historically been lower than June 2019 about 50% of the time; about 50% of the time in June they have been higher.
- The average monthly groundwater level in June 2011 was 54ft below land surface. June 2011 value is the lowest historical monthly average groundwater level in June for this well.
- The average monthly groundwater level in June 2007 was 53ft below land surface. The statistical composite of all historical data for this well shows that monthly average groundwater levels in June have historically been lower than June 2007 about 2% of the time; about 98% of the time in June they have been higher.

Well #1, 16MM03, Crystalline Rocks Aquifer in Chattahoochee Basin, Monthly Average Depth Below Land Surface



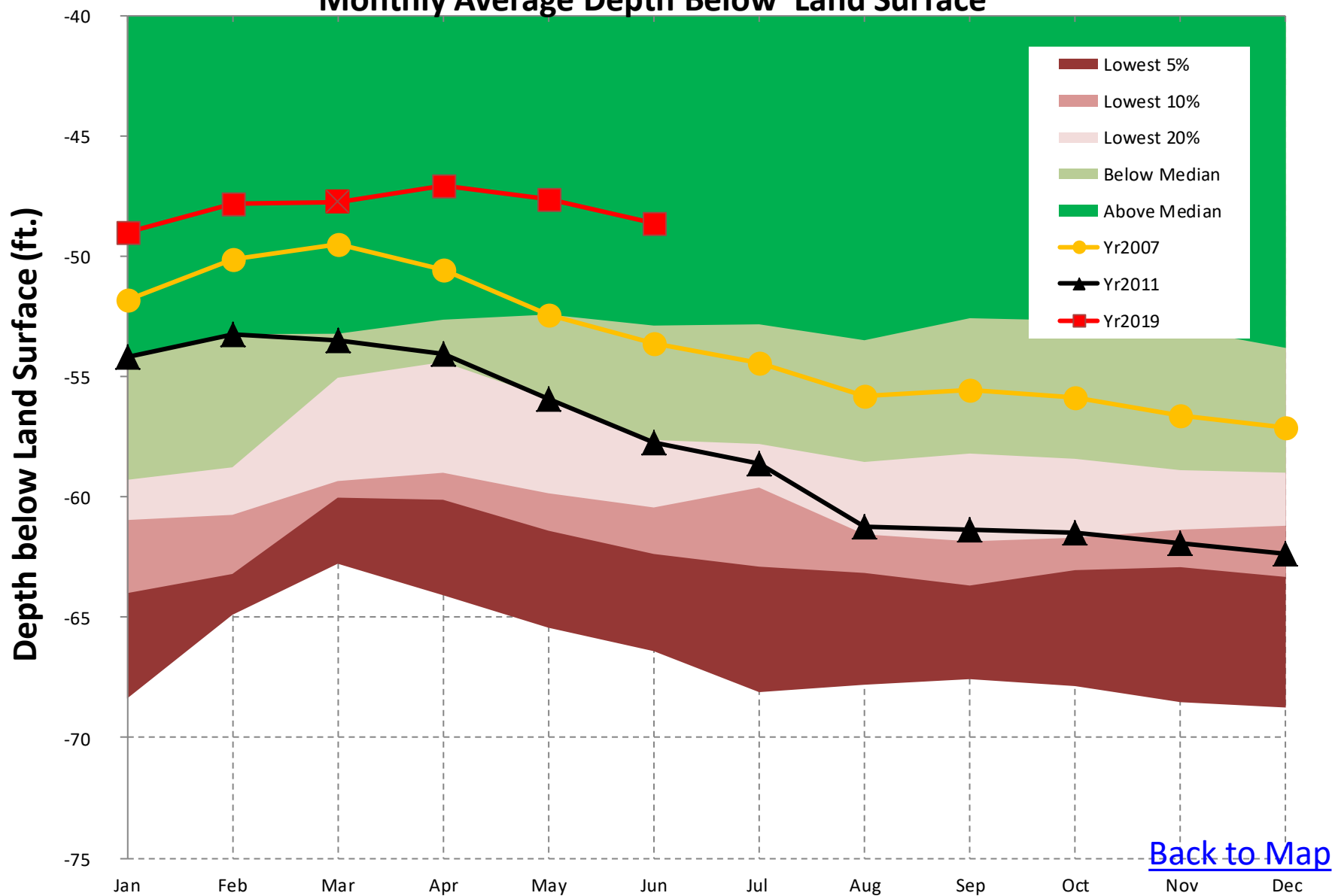
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Well #2, 11AA01, Surficial Aquifer in Flint Basin, Monthly Average Depth Below Land Surface



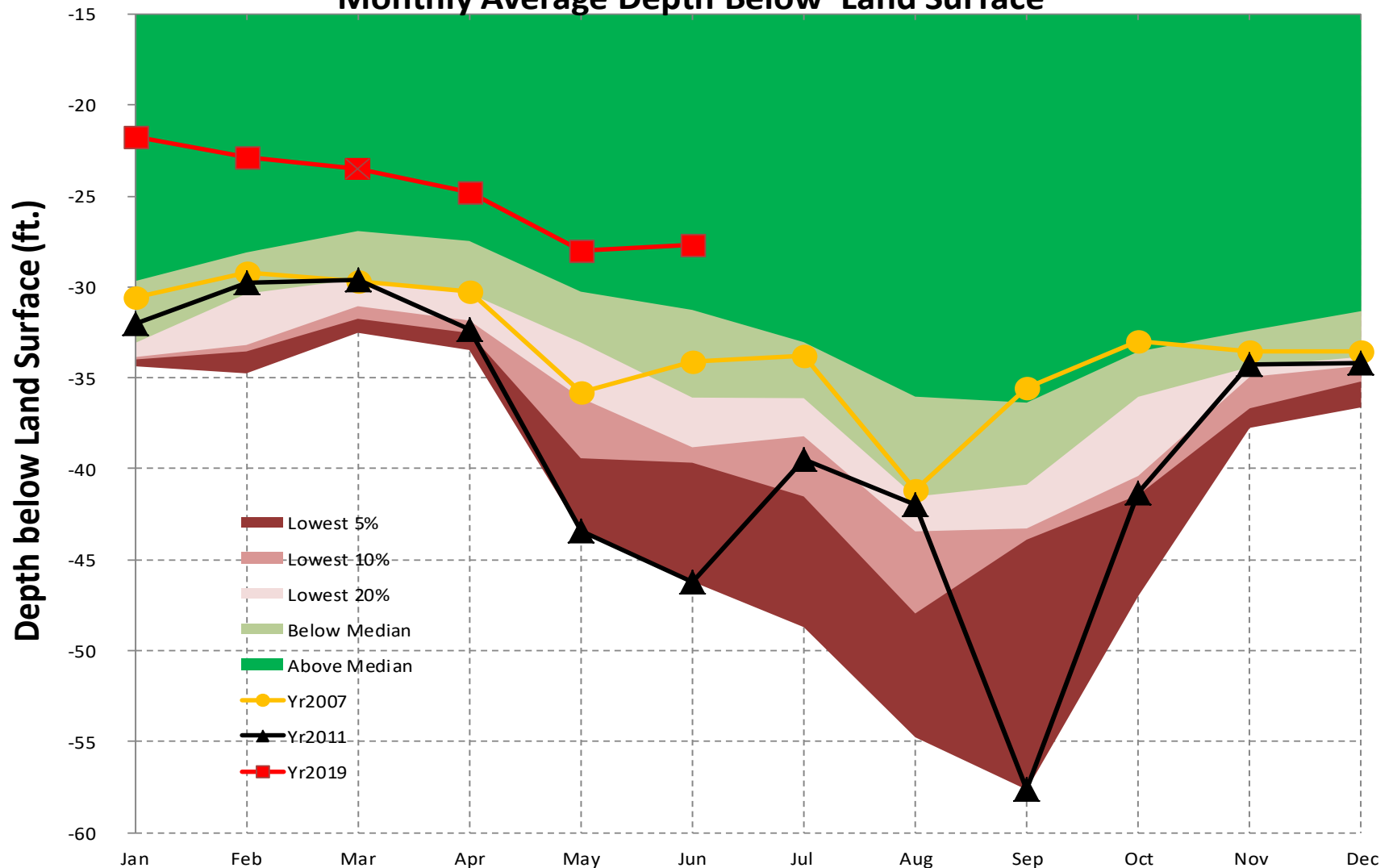
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Well #3, 13L180, Floridan Aquifer in Flint Basin, Monthly Average Depth Below Land Surface



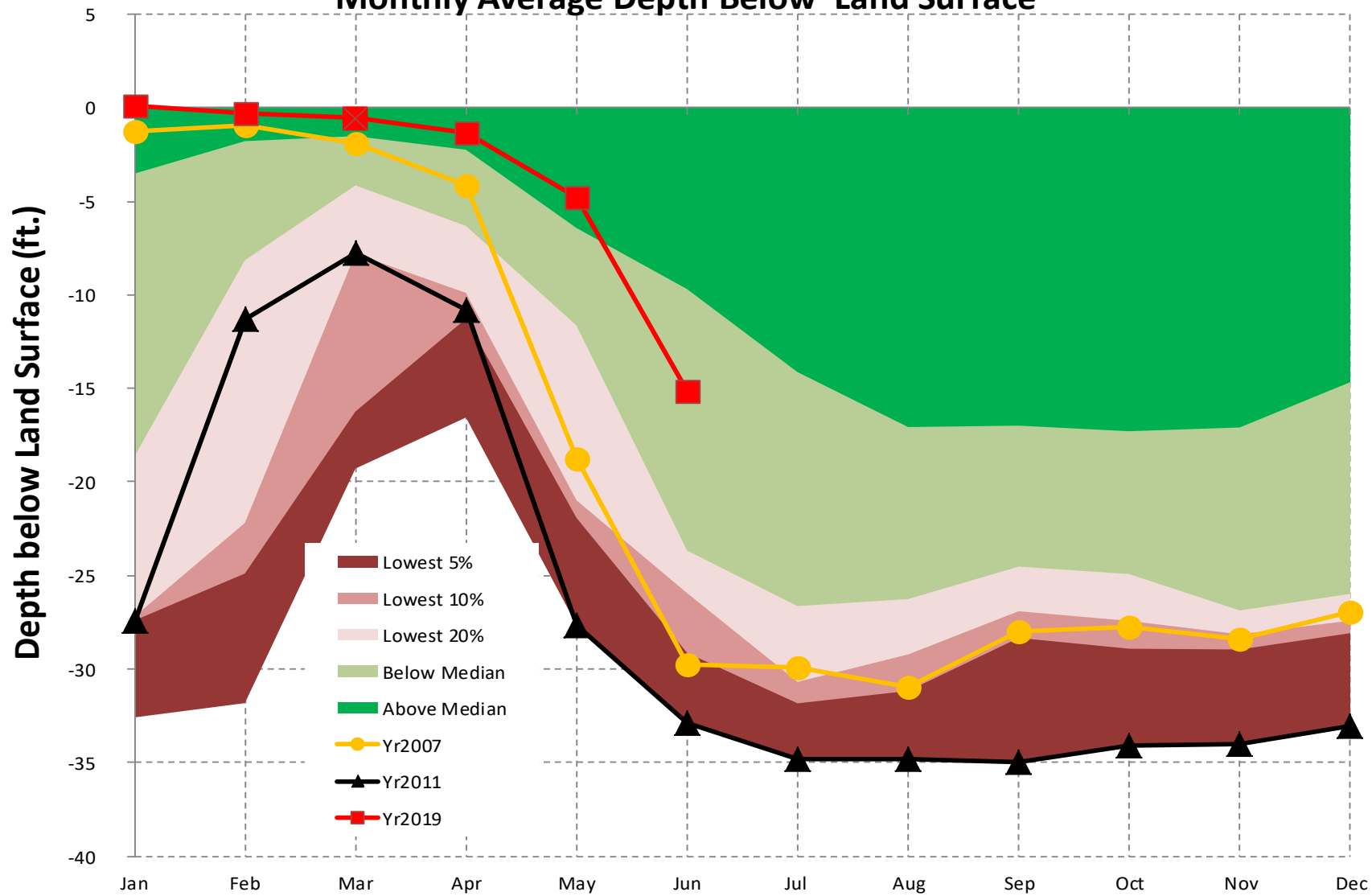
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Well #4, 12M017, Floridan Aquifer in Flint Basin, Monthly Average Depth Below Land Surface



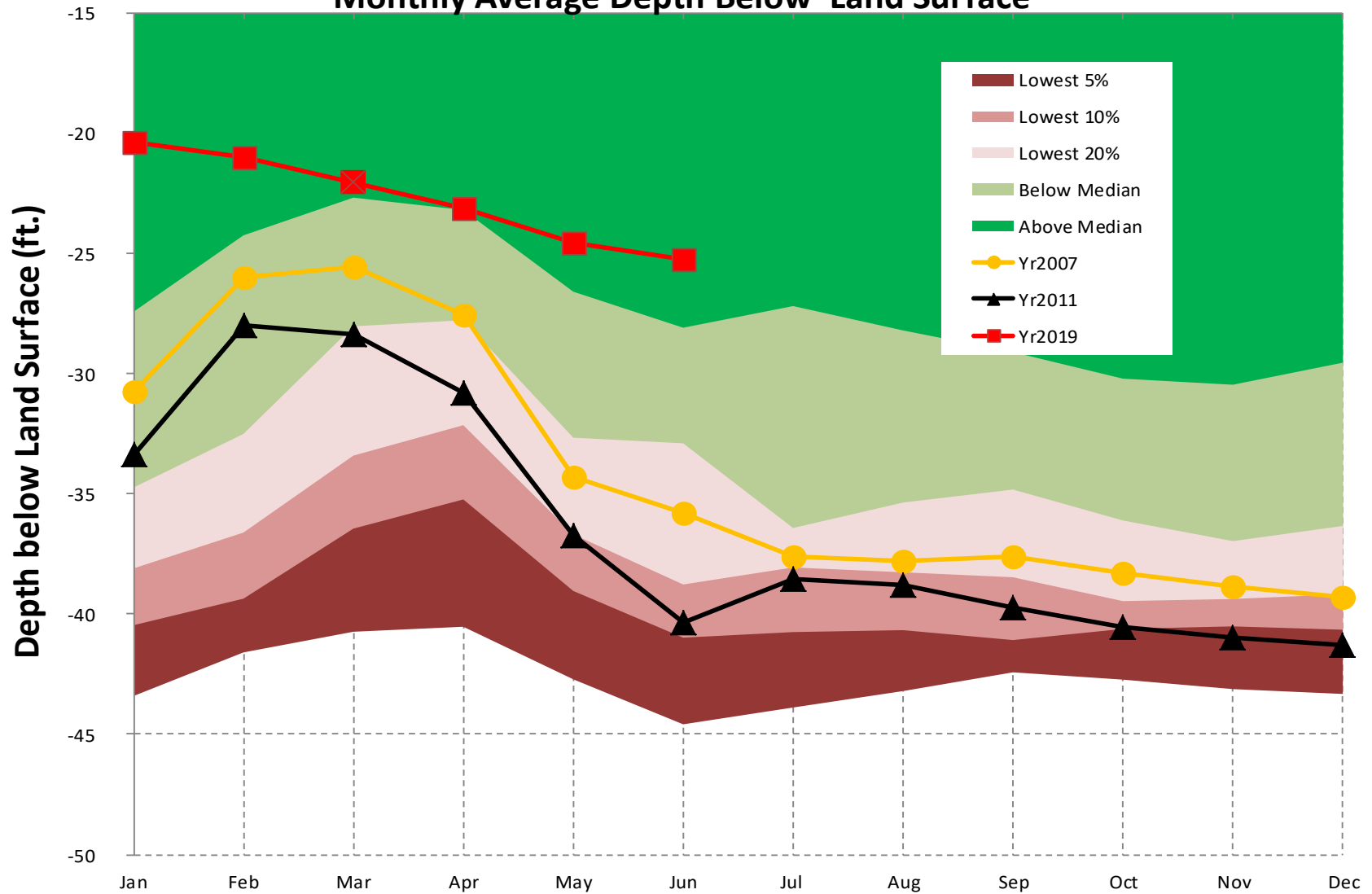
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Well #5, 08K001, Floridan Aquifer in Flint Basin, Monthly Average Depth Below Land Surface



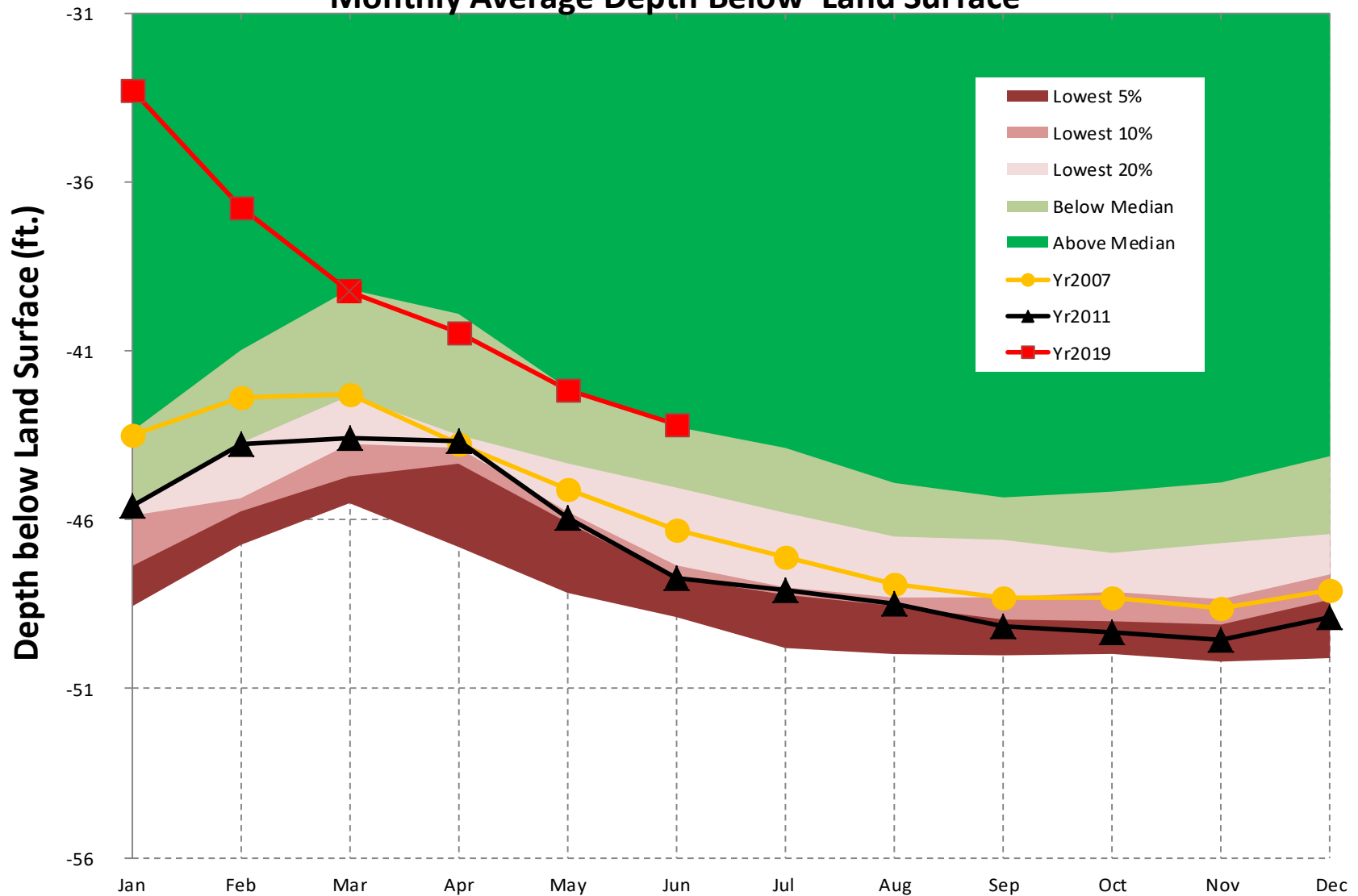
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Well #6, 11K003, Floridan Aquifer in Flint Basin, Monthly Average Depth Below Land Surface



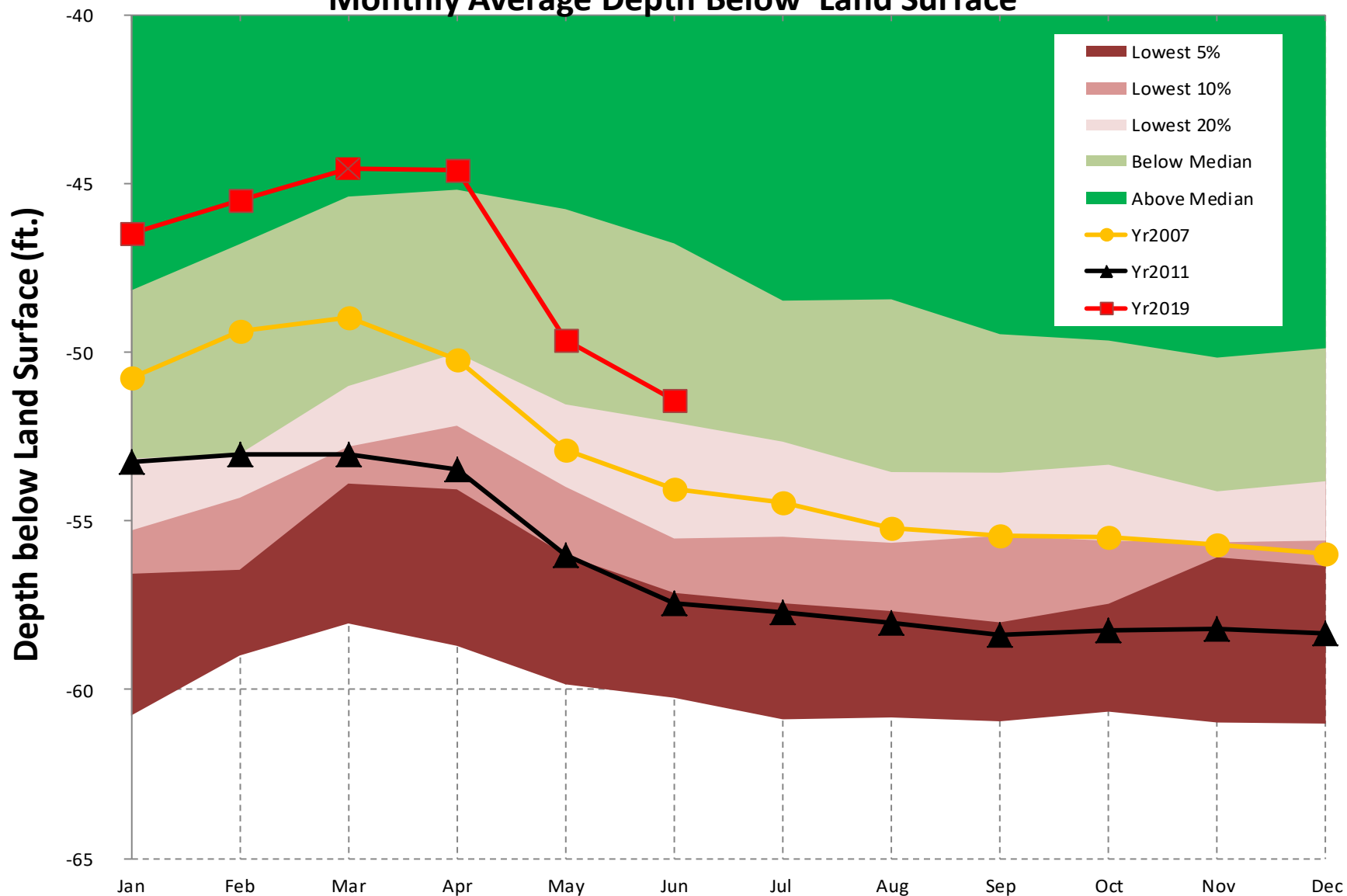
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Well #7, 12K014, Floridan Aquifer in Flint Basin, Monthly Average Depth Below Land Surface



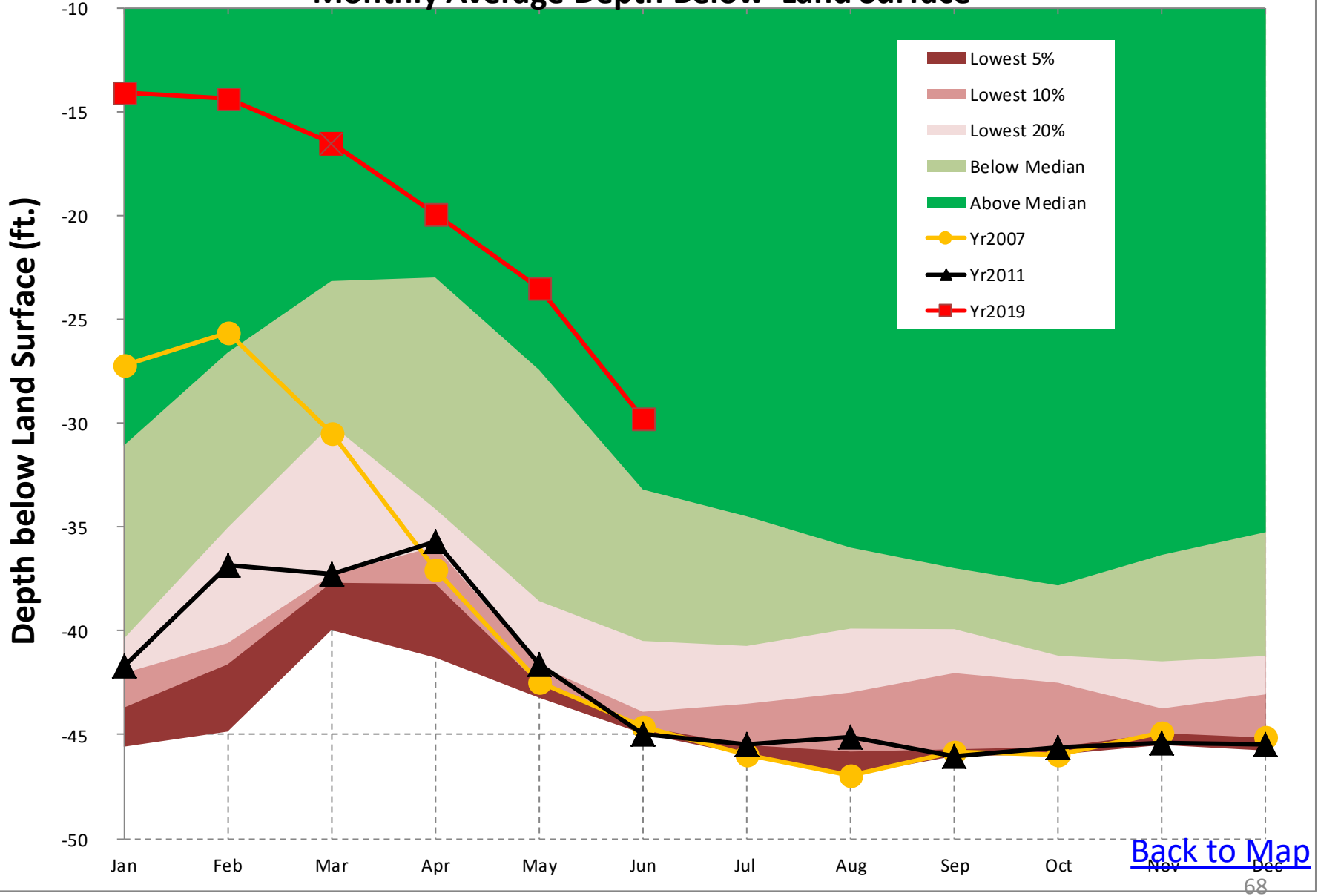
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Well #8, 13J004, Floridan Aquifer in Flint Basin, Monthly Average Depth Below Land Surface

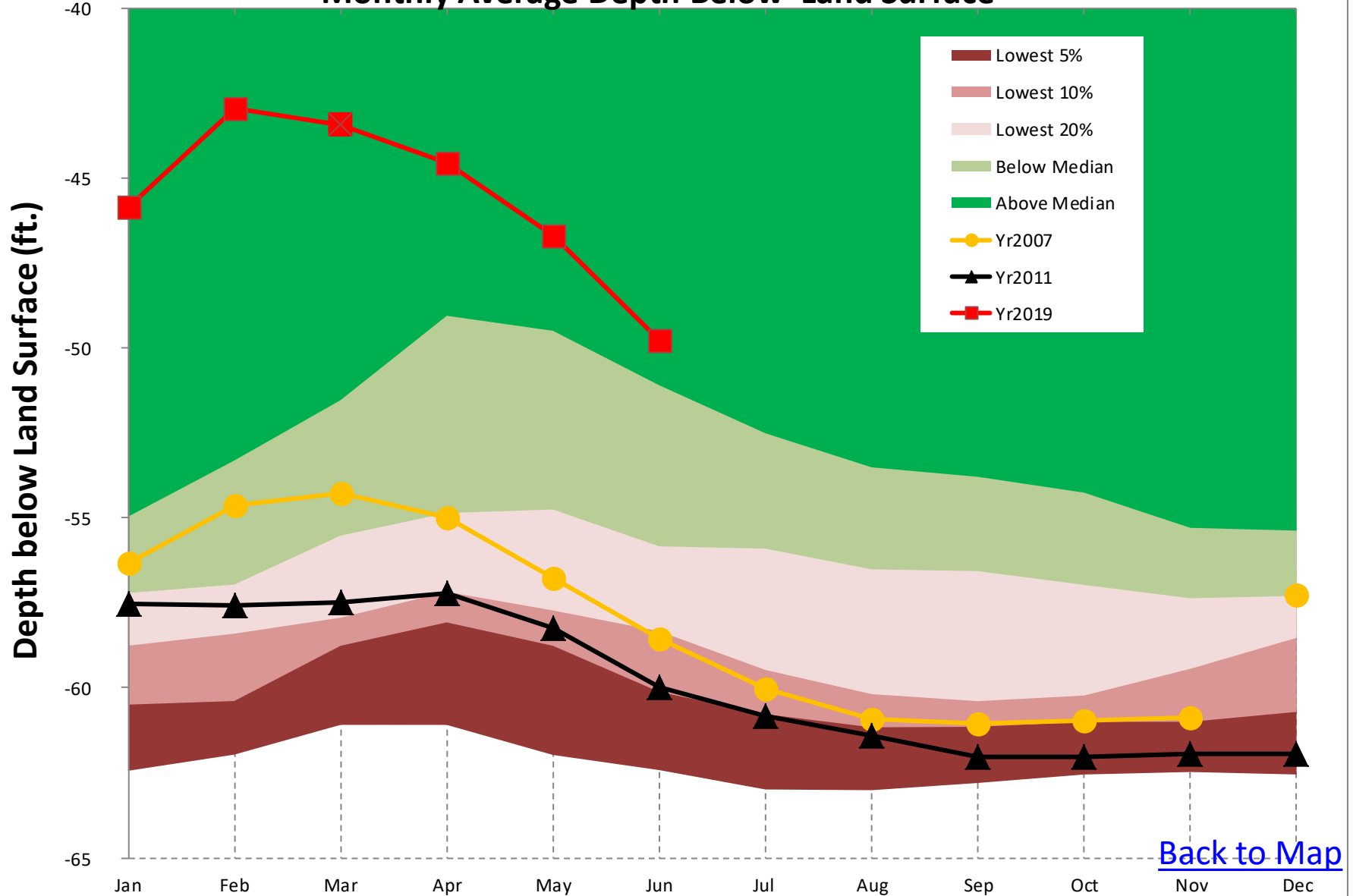


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Well #9, 08G001, Floridan Aquifer in Flint Basin, Monthly Average Depth Below Land Surface

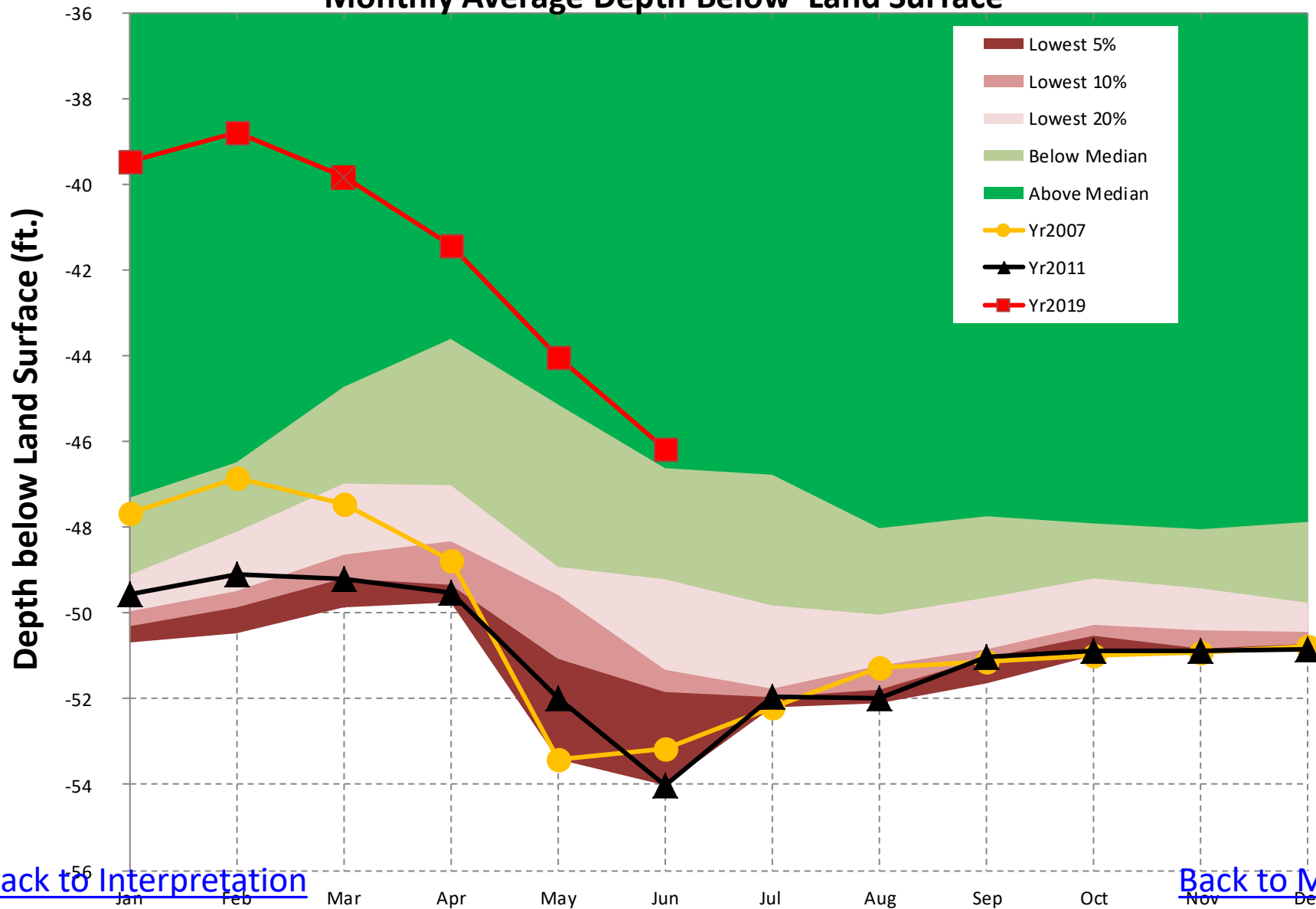


Well #10, 10G313, Floridan Aquifer in Flint Basin, Monthly Average Depth Below Land Surface



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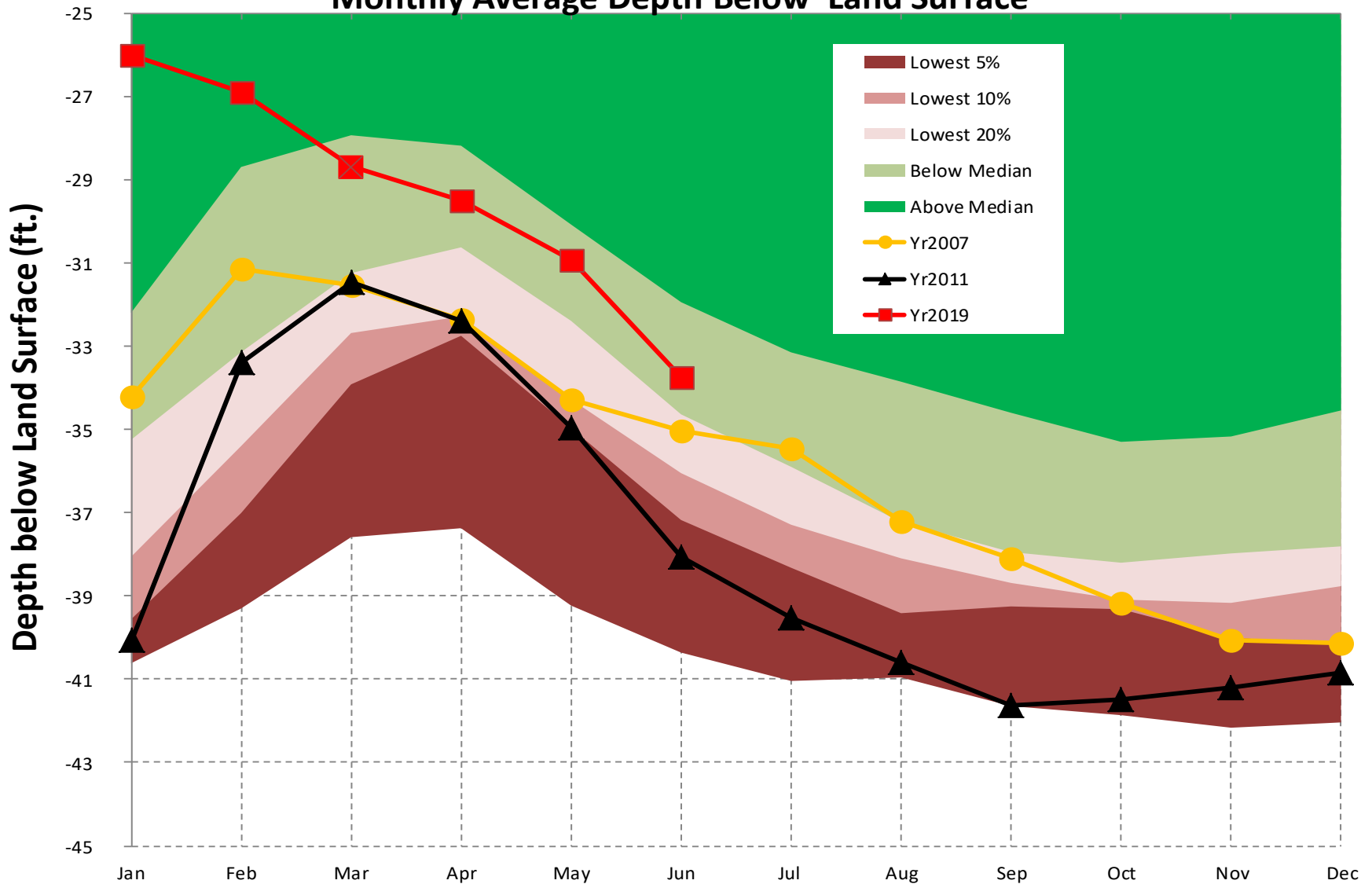
Well #11, 09F520, Floridan Aquifer in Flint Basin, Monthly Average Depth Below Land Surface



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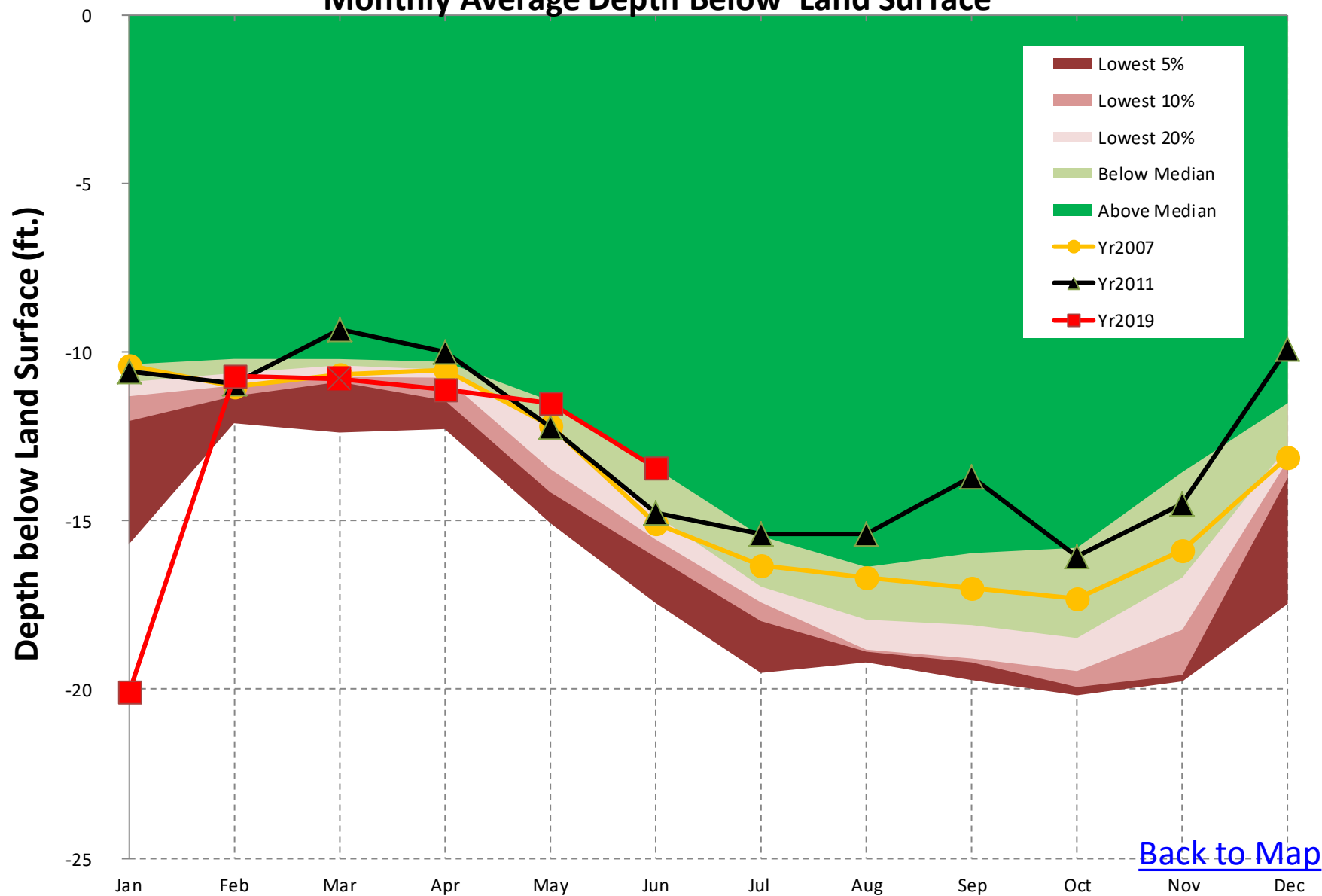
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Well #12, 21T001, Floridan Aquifer in Ocone Basin, Monthly Average Depth Below Land Surface



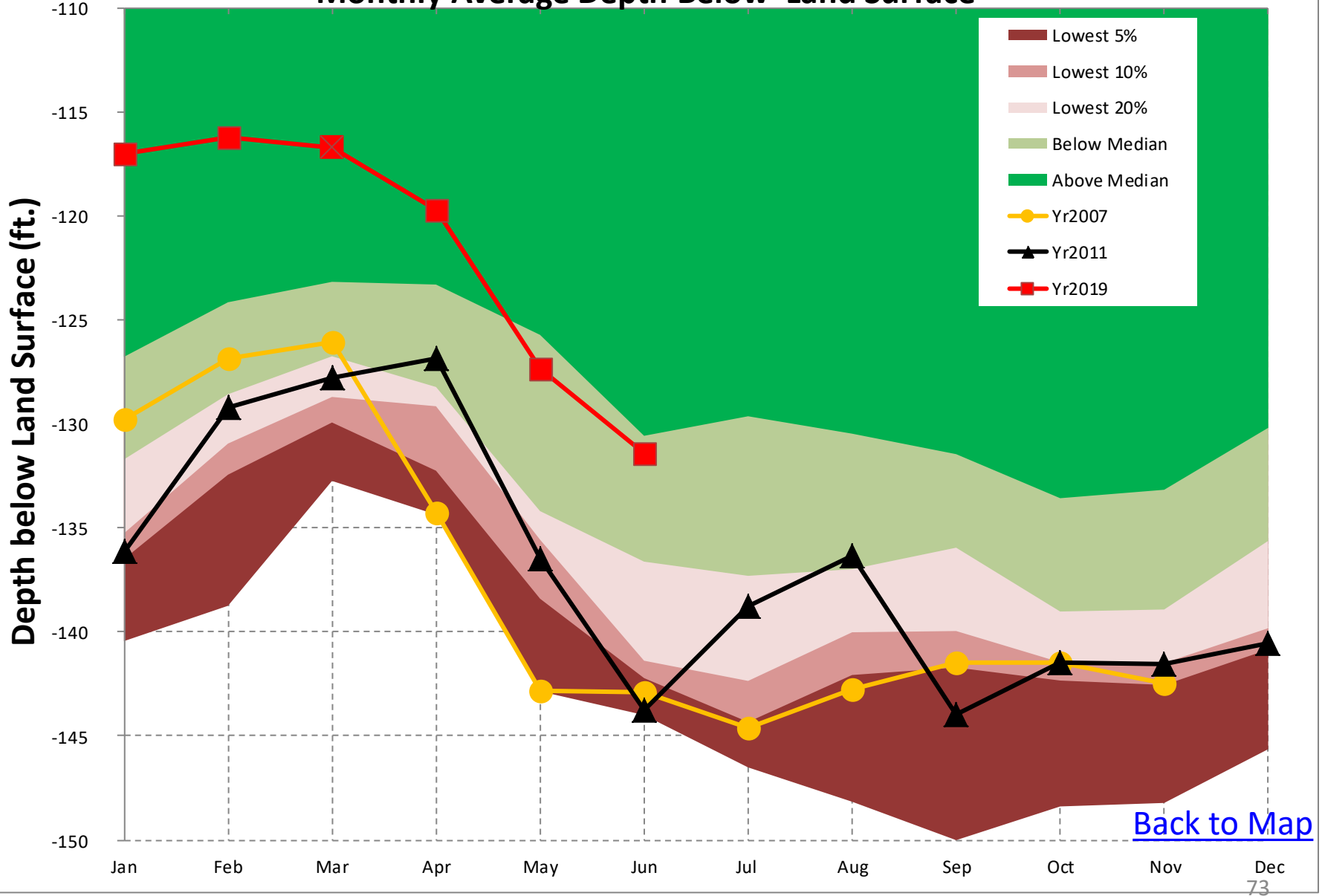
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Well #13, 03PP01, Valley and Ridge Aquifer in Tennessee Basin, Monthly Average Depth Below Land Surface



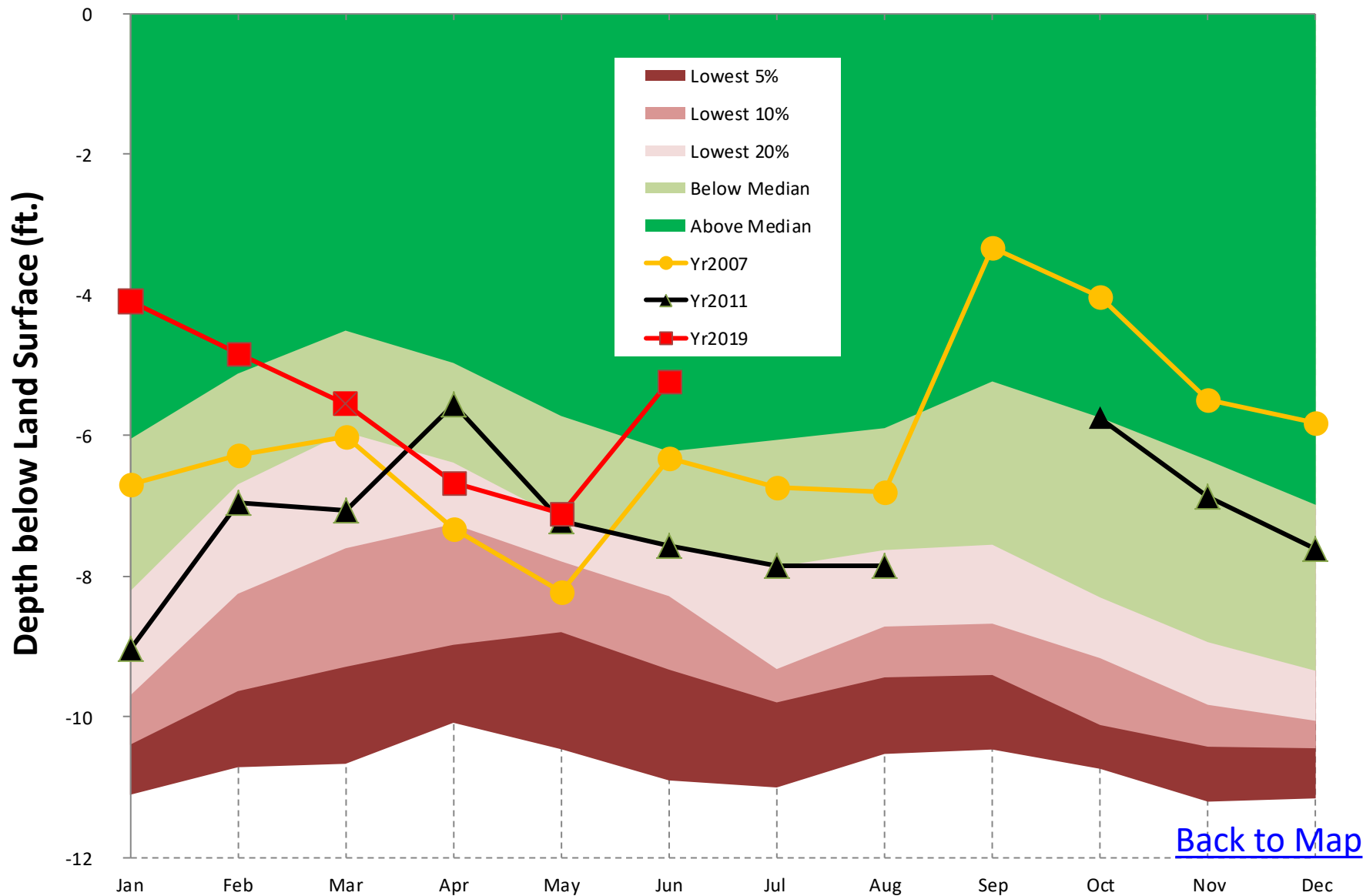
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Well #14, 19E009, Floridan Aquifer in Suwannee Basin, Monthly Average Depth Below Land Surface



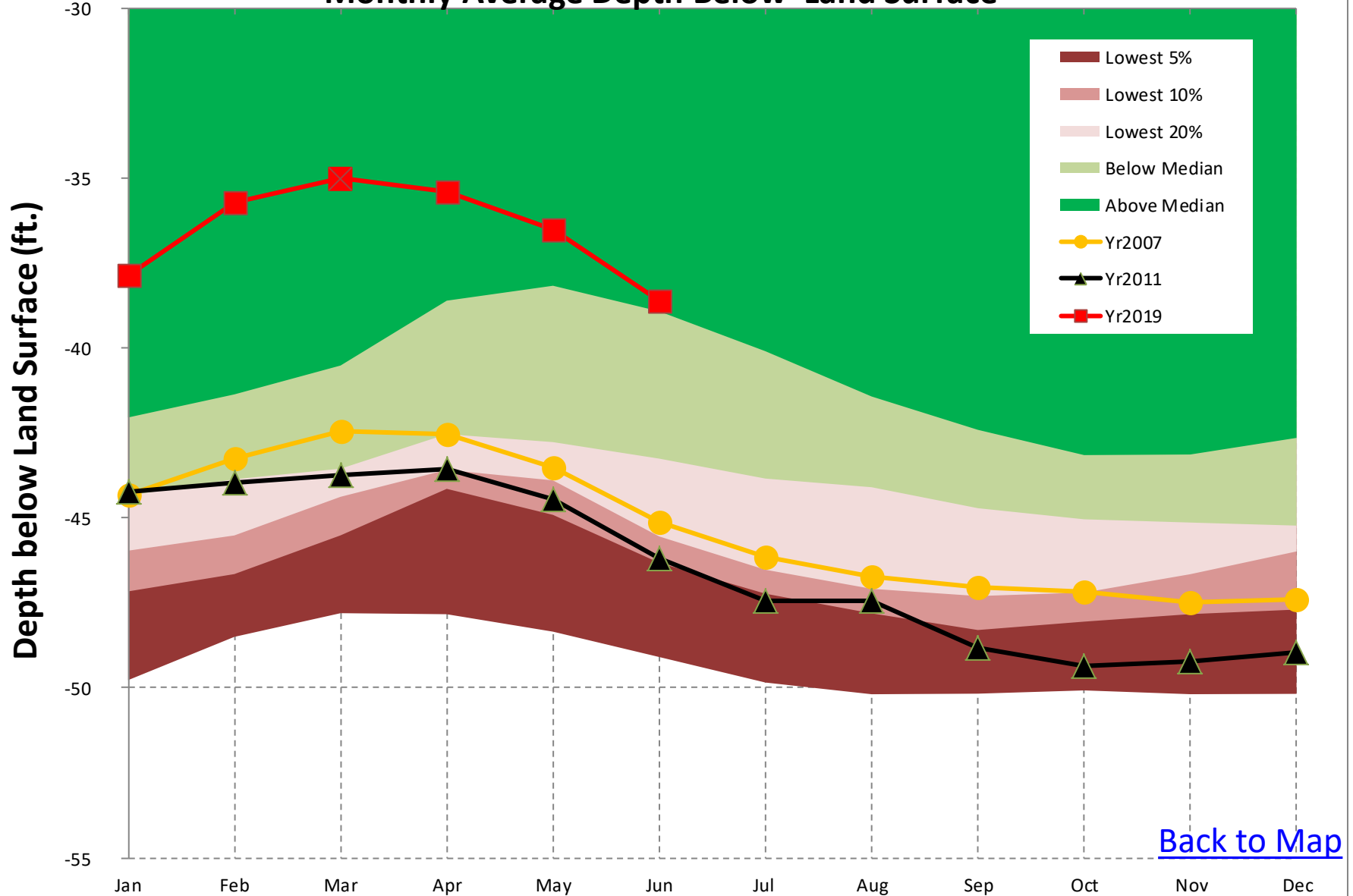
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Well #15, 35P094, Surficial Aquifer in Ogeechee Basin, Monthly Average Depth Below Land Surface



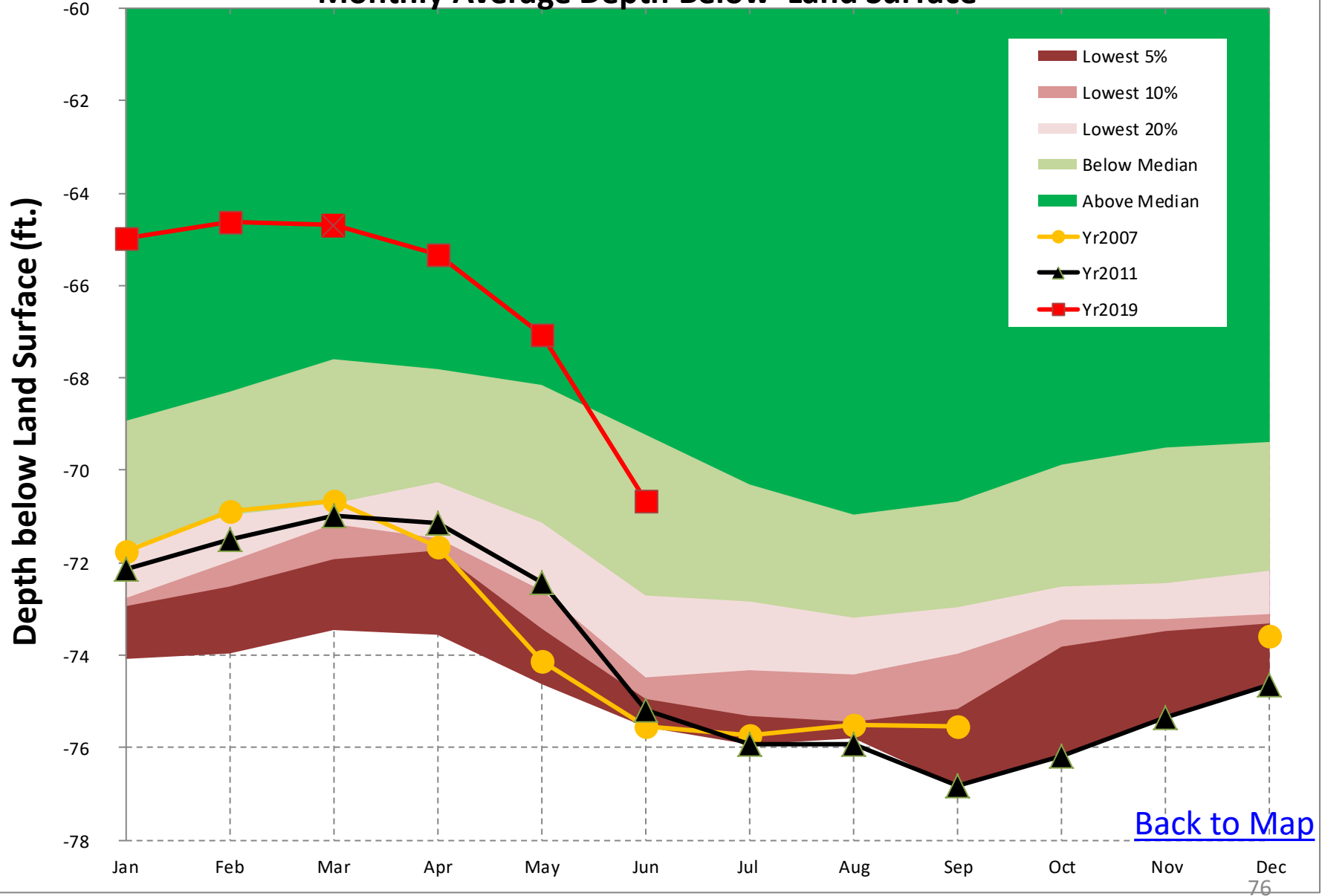
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Well #16, 11J011, Claiborne Aquifer in Flint Basin, Monthly Average Depth Below Land Surface



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Well #17, 27E004, Floridan Aquifer in Suwannee Basin, Monthly Average Depth Below Land Surface



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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

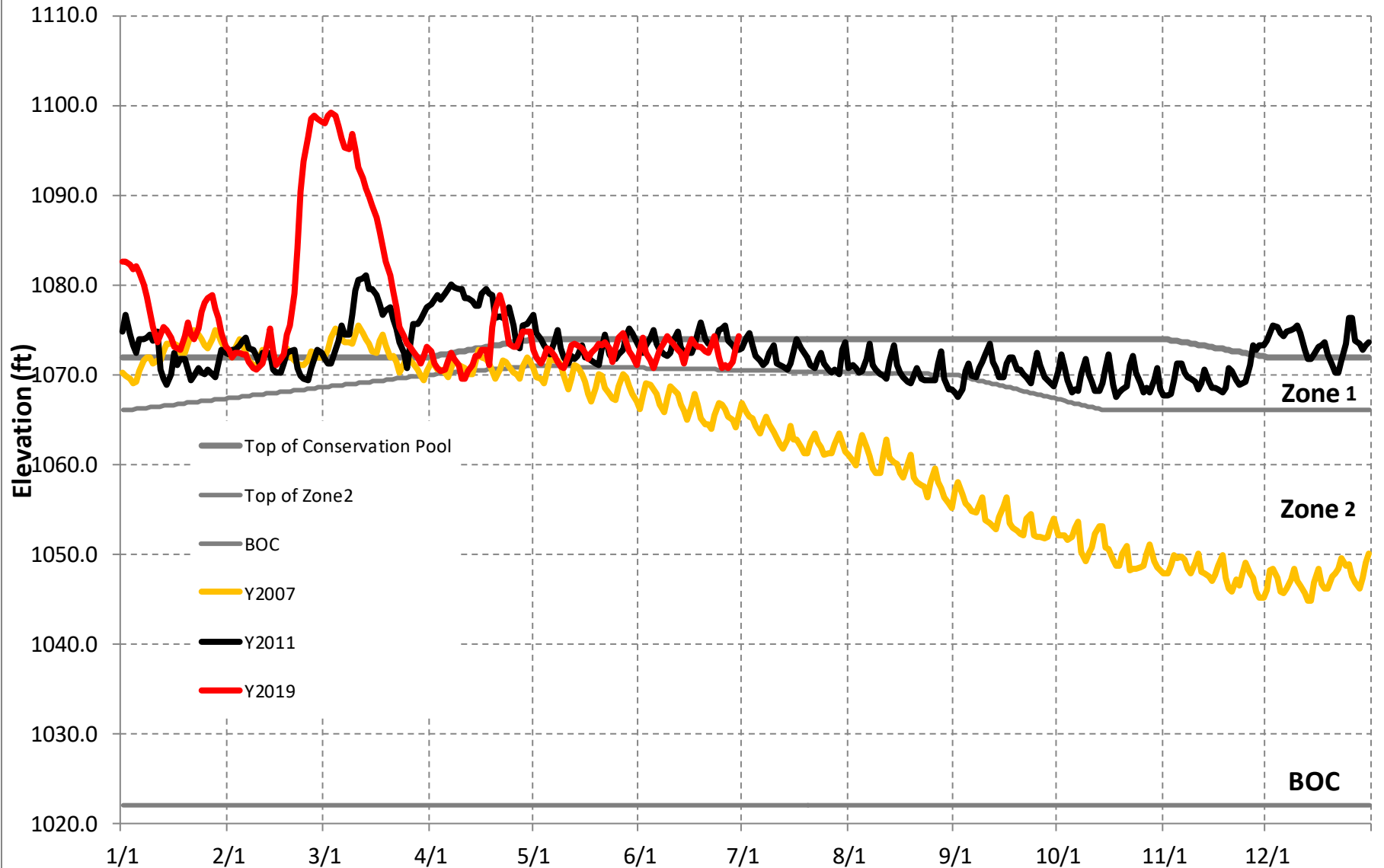


EPD monitors the water levels of seven reservoirs to assess drought conditions.

Reservoir Elevation Graphs

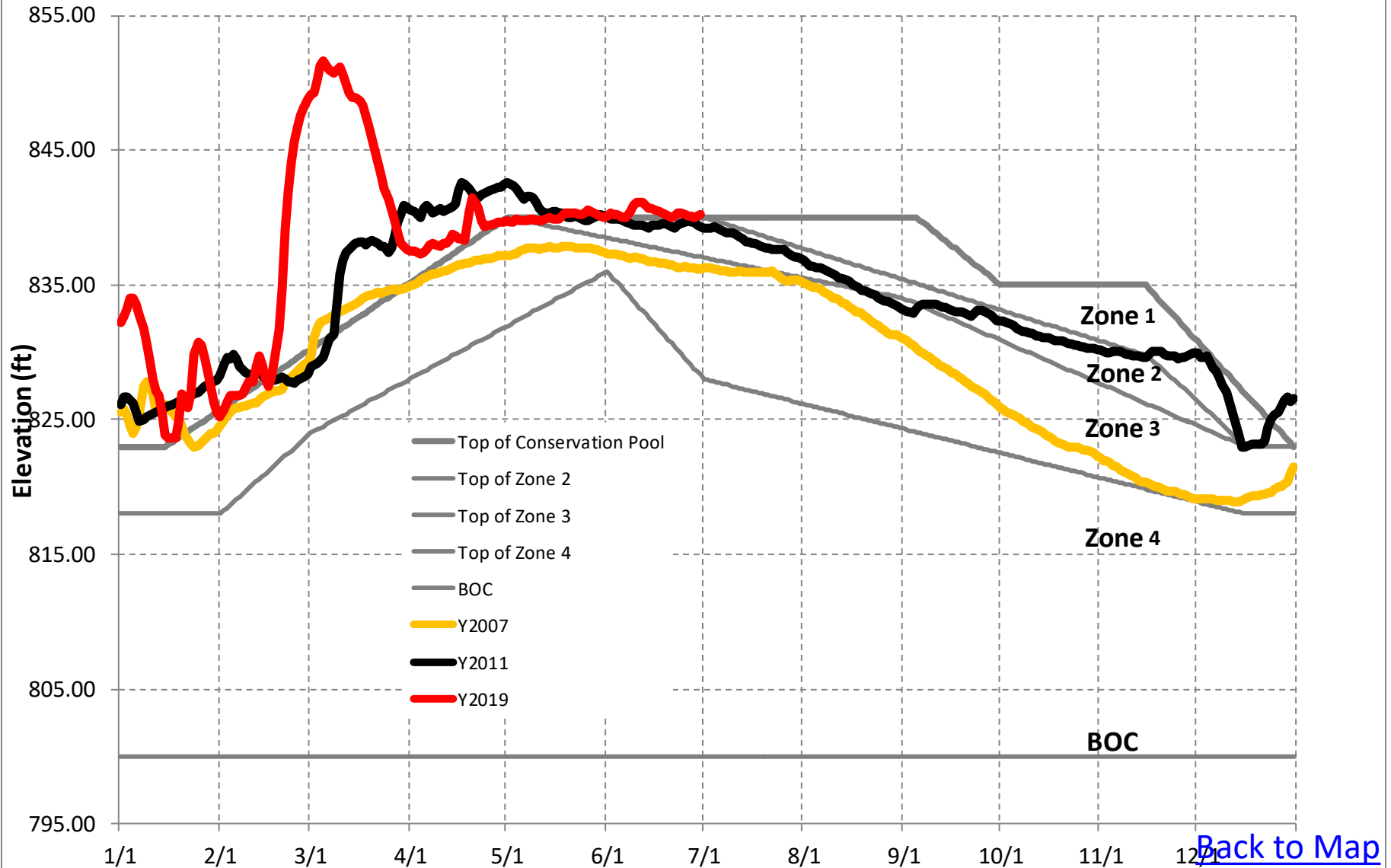
- The following graphs show the reservoir elevation curves for January, 2019 through June, 2019.
- Each graph also shows the Action Zone Divides (or Levels) for each reservoir
 - Zone 1 is the top layer of the conservation pool
 - Zone 2 is the layer below Zone 1
 - Zone 4 is the lowest layer in the conservation pool
 - There is no conservation storage below the bottom of Zone 4
- To put 2019 reservoir elevations into perspective, elevations for 2007 and 2011 are also shown.

CARTERS ELEVATION



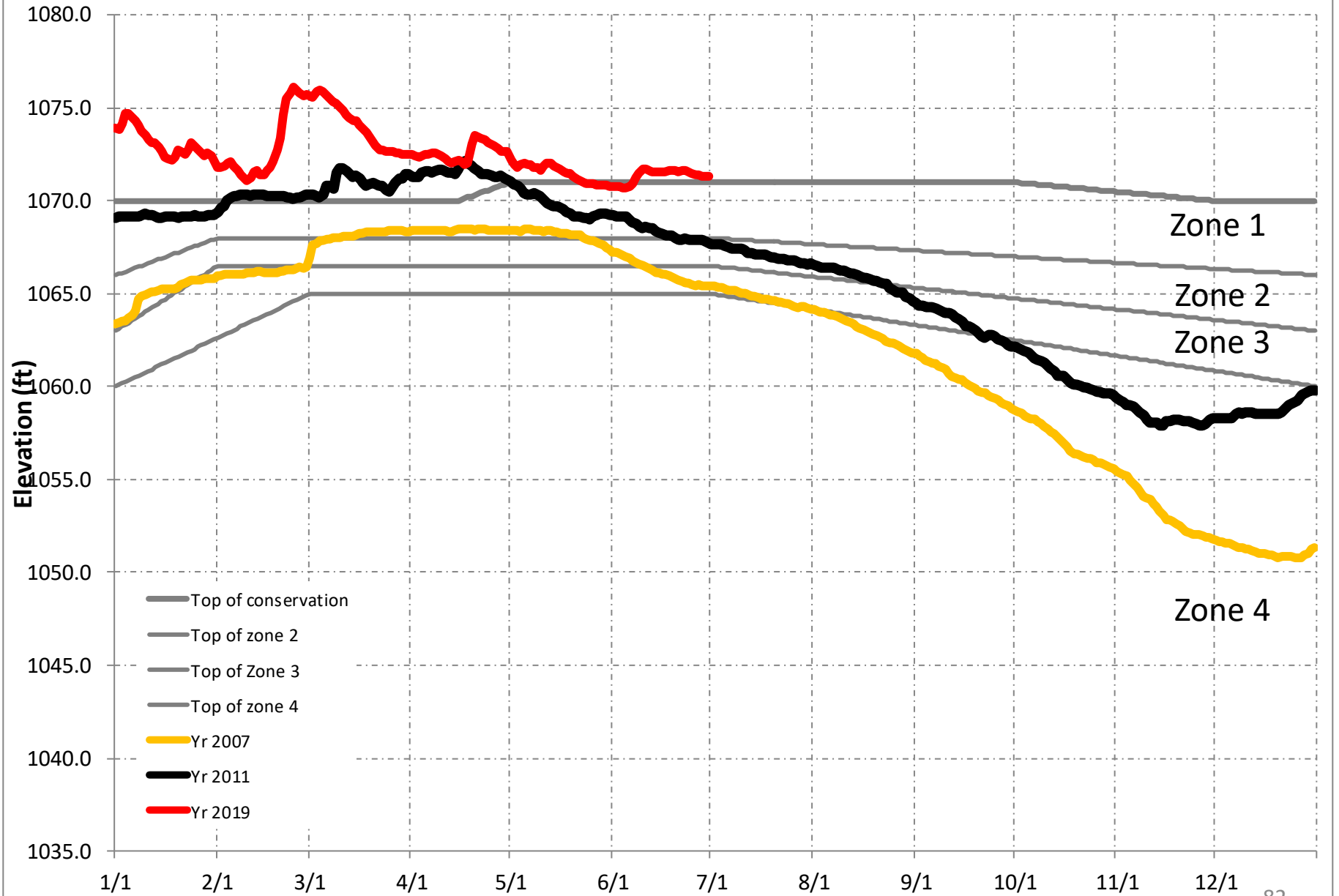
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ALLATOONA ELEVATION



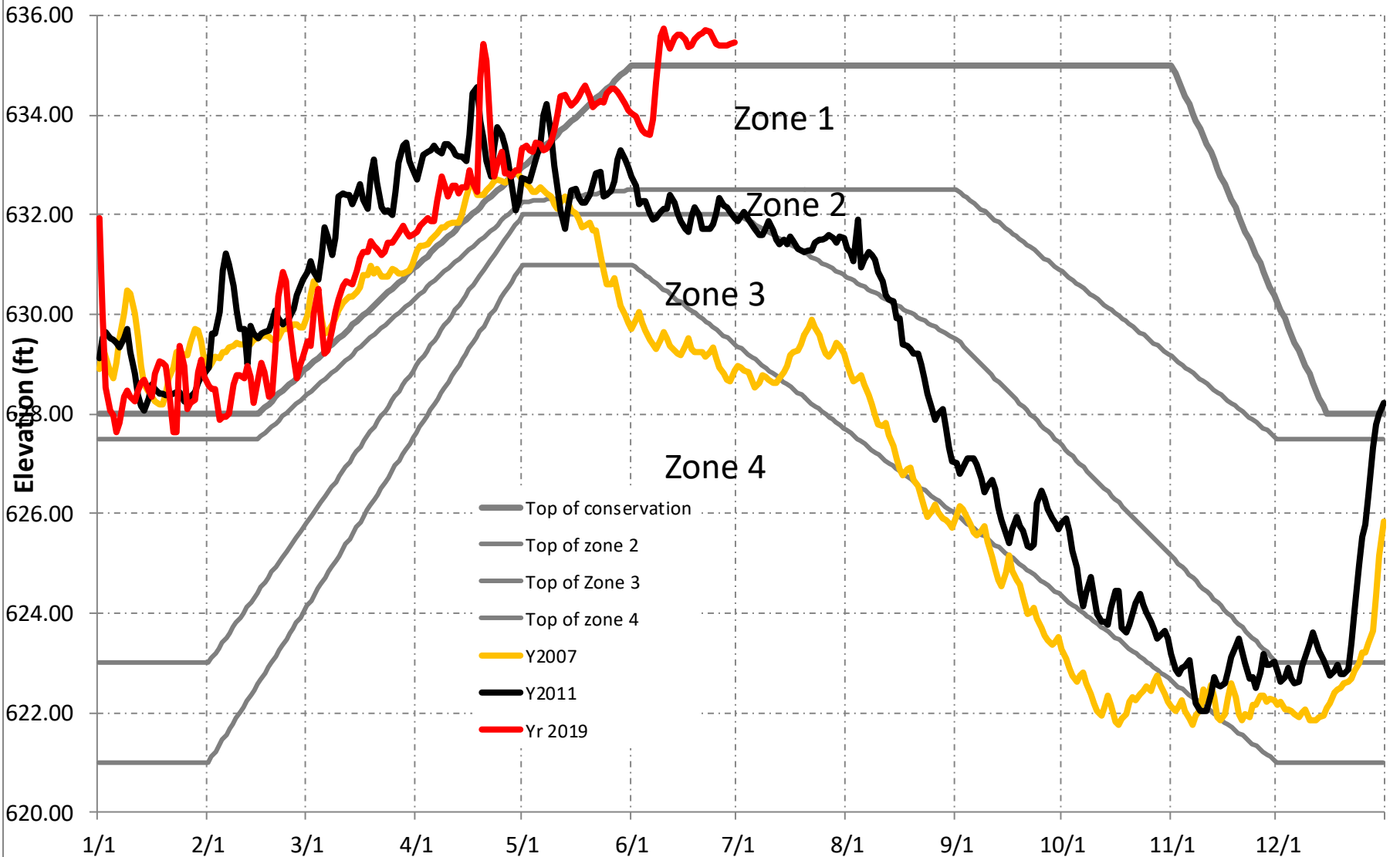
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LAKE LANIER ELEVATION



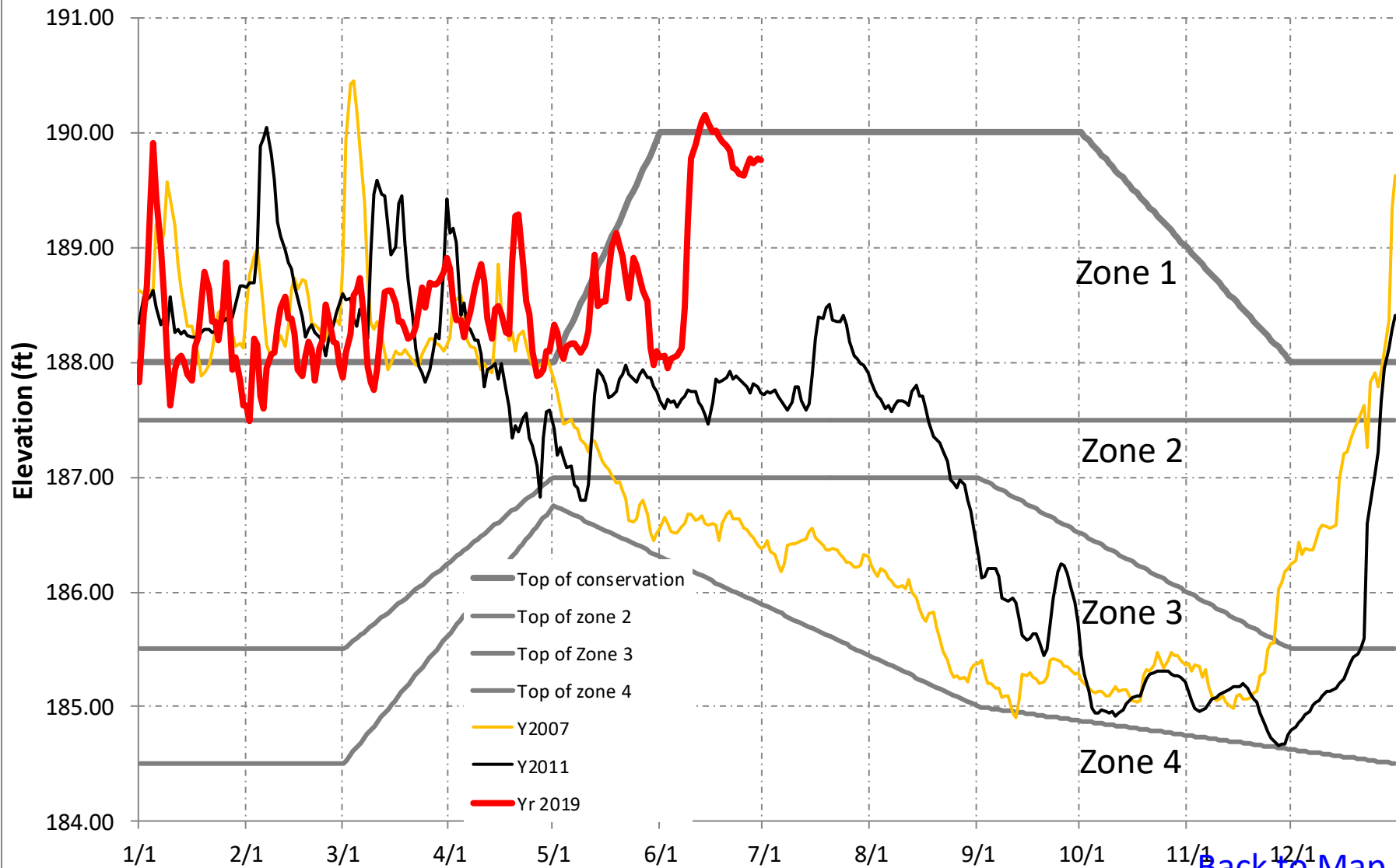
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WEST POINT ELEVATION



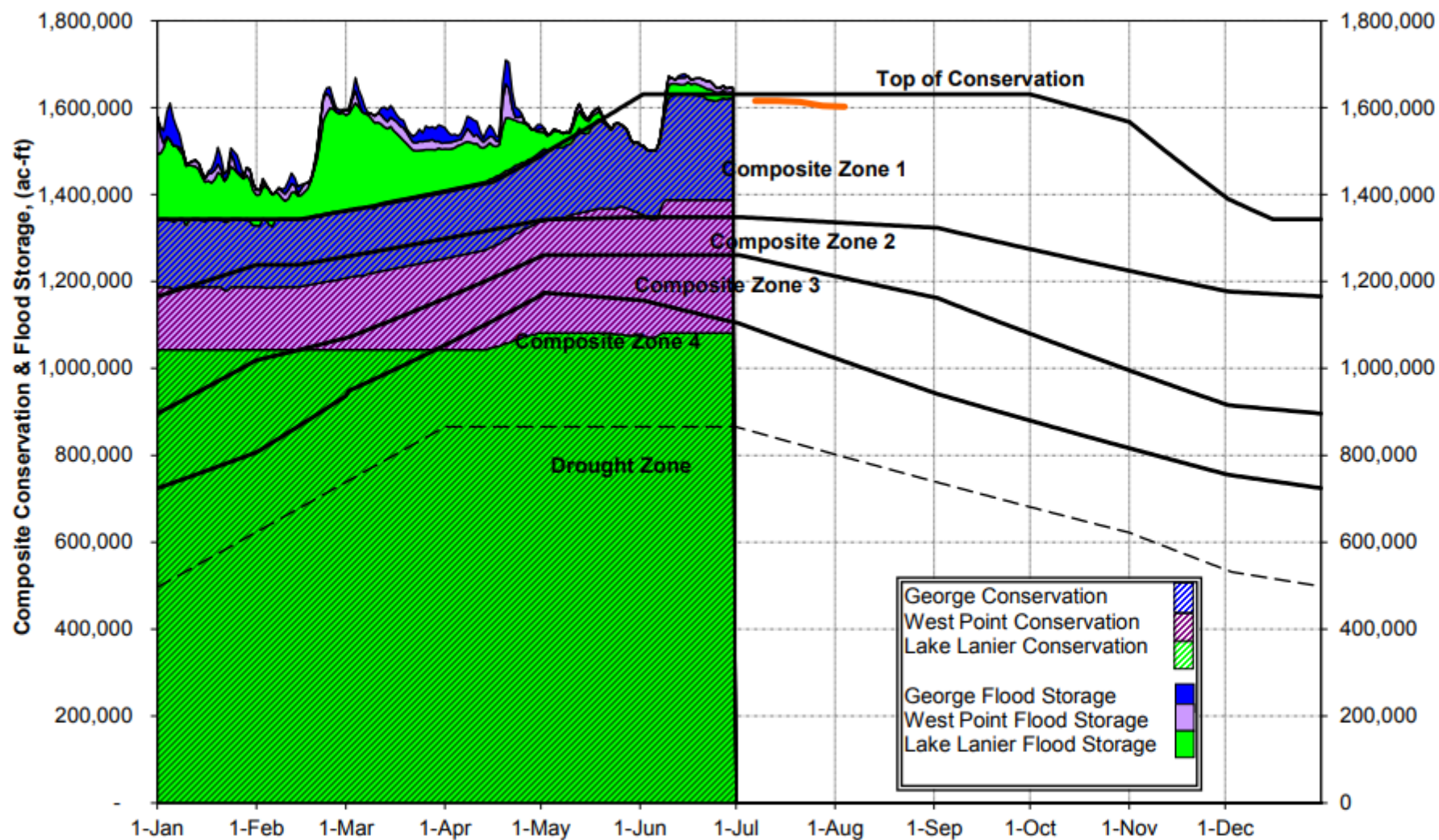
[Back to Map](#)

W.F.GEORGE ELEVATION



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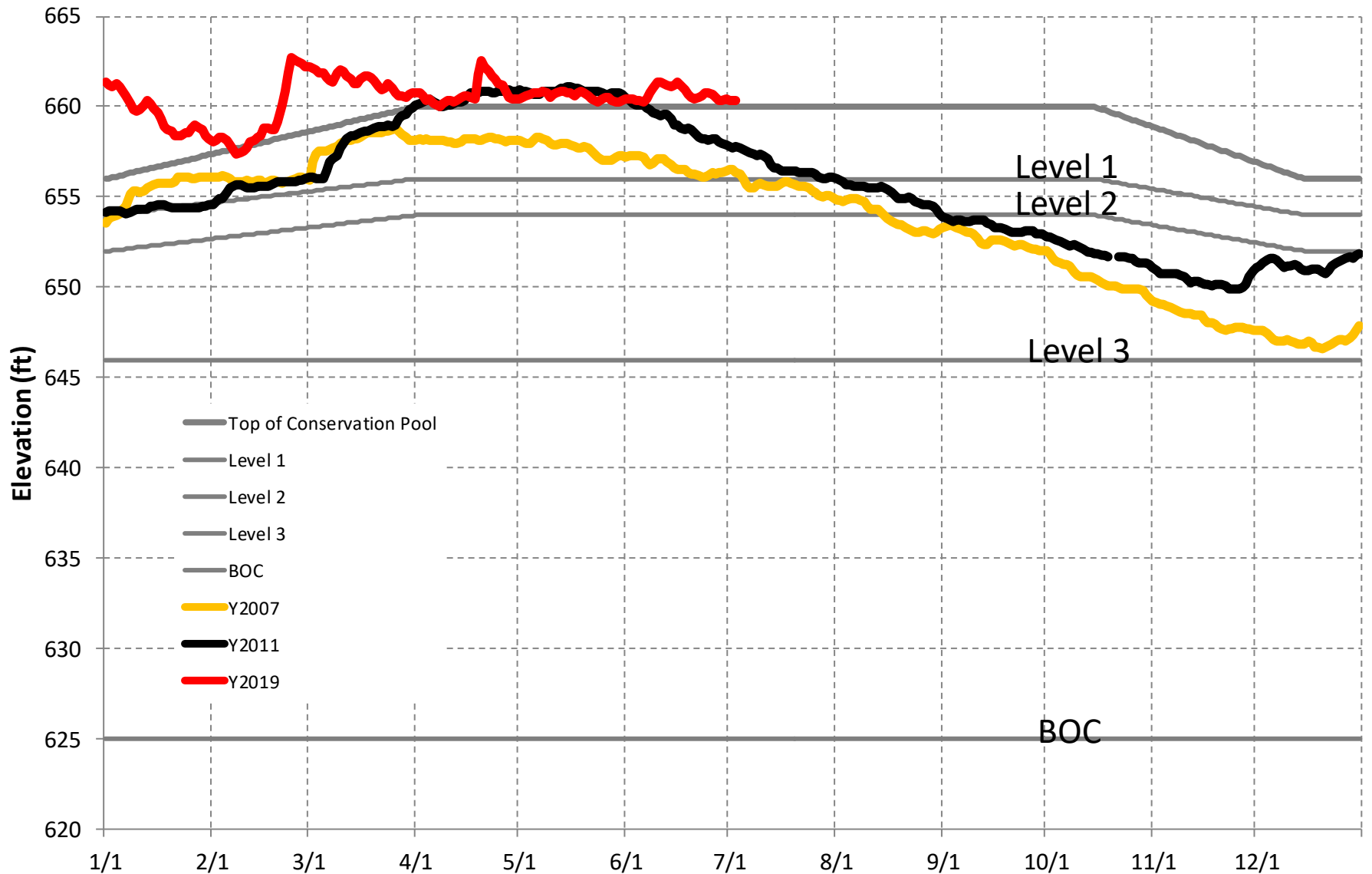
2019 ACF Basin Composite Conservation and Flood Storage



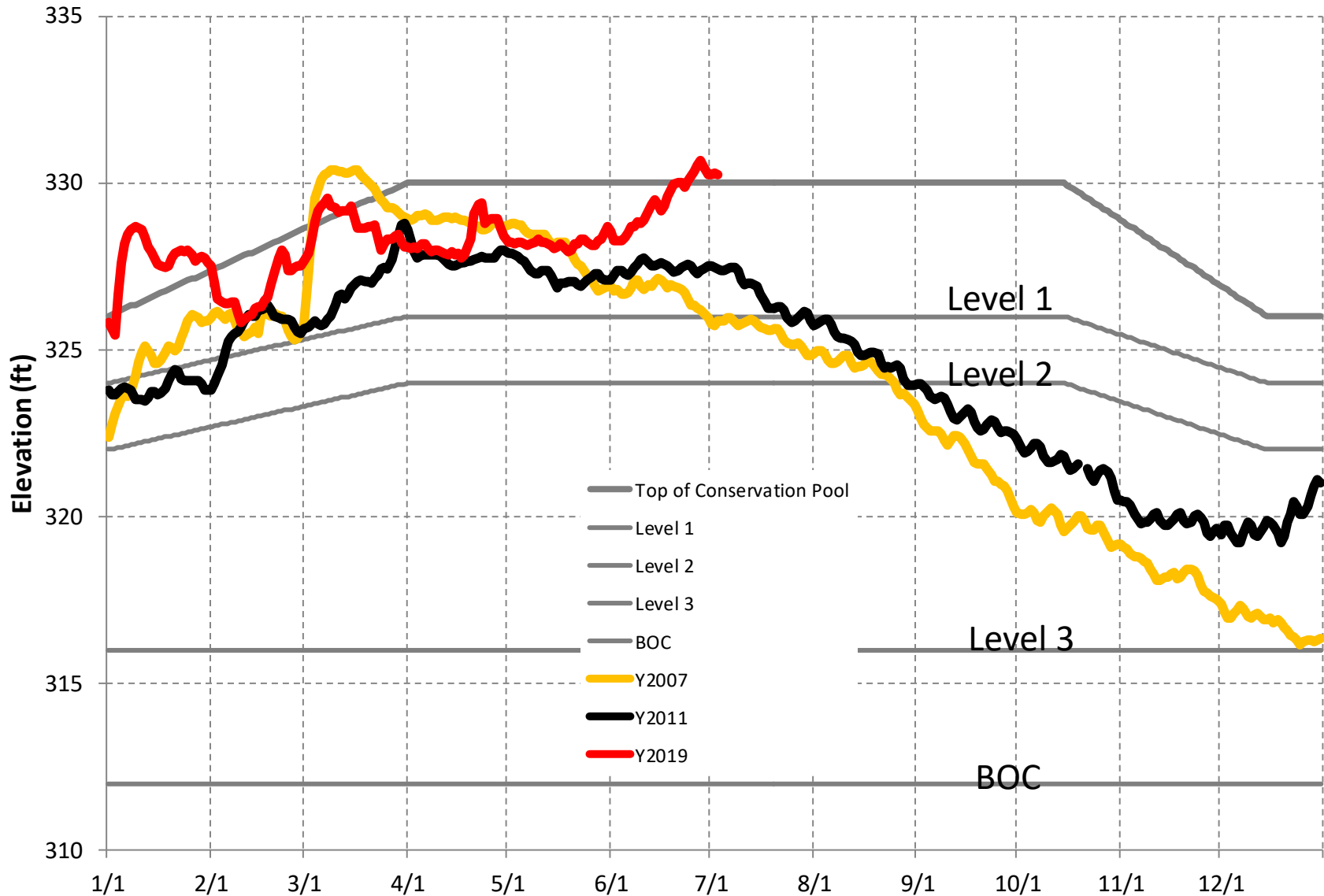
Actual data thru 7-1-2019

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

Lake HARTWELL ELEVATION



LAKE CLARK HILL (THURMOND) ELEVATION

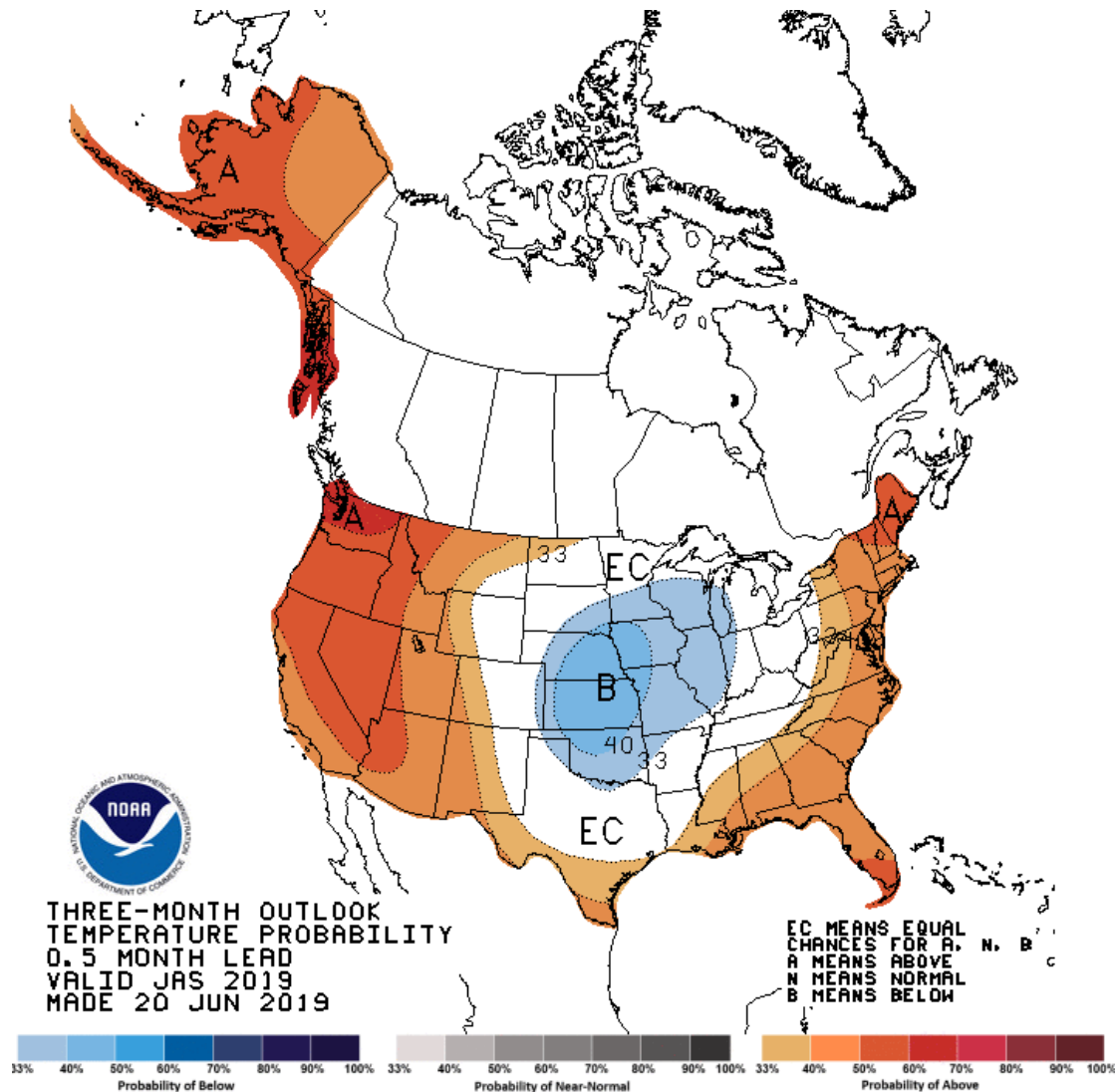


Climate Prediction Center 3-month Temperature and Precipitation Probability Outlook and Seasonal Drought Outlook

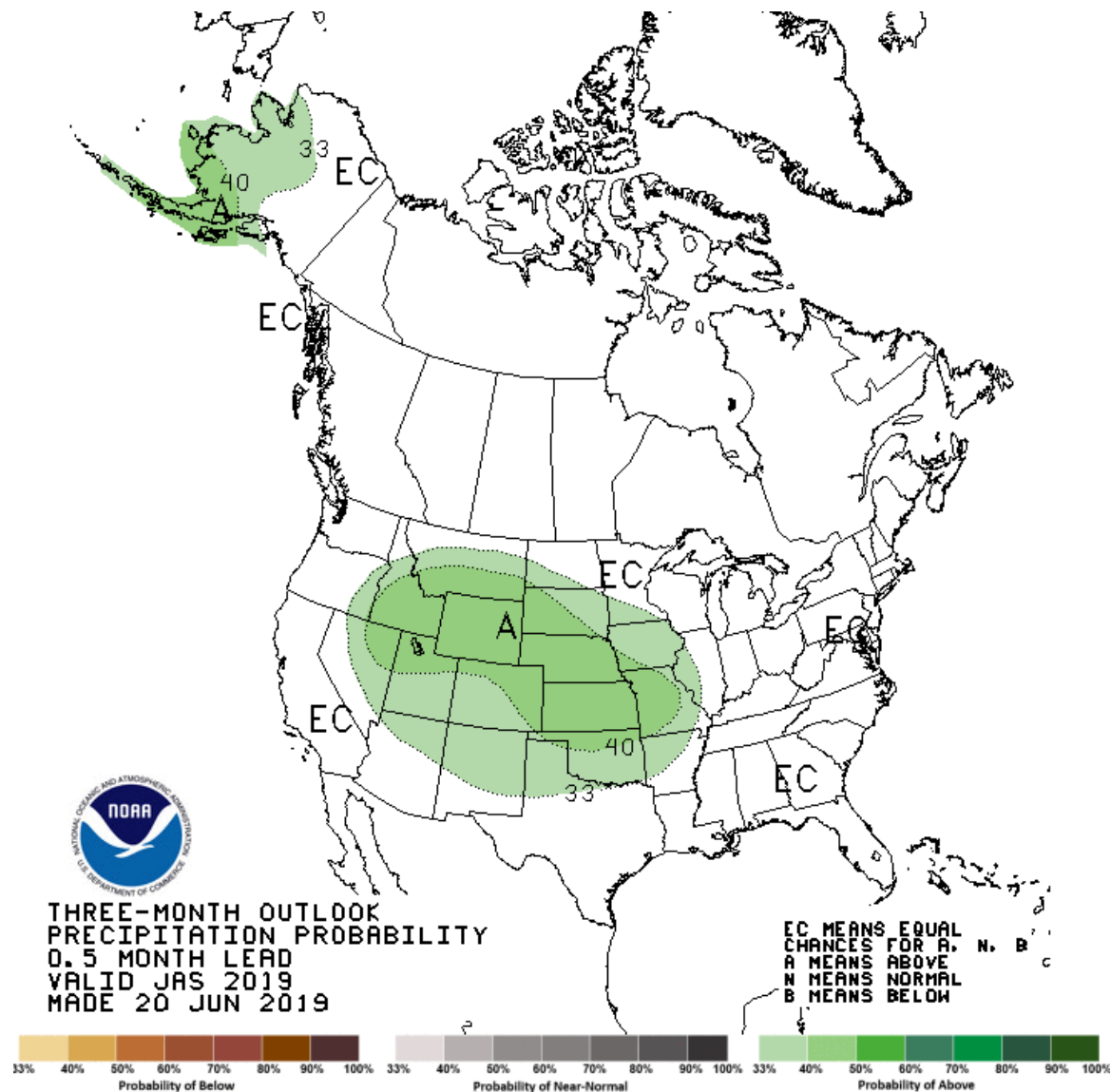
Data Source:

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

Temperature Outlook



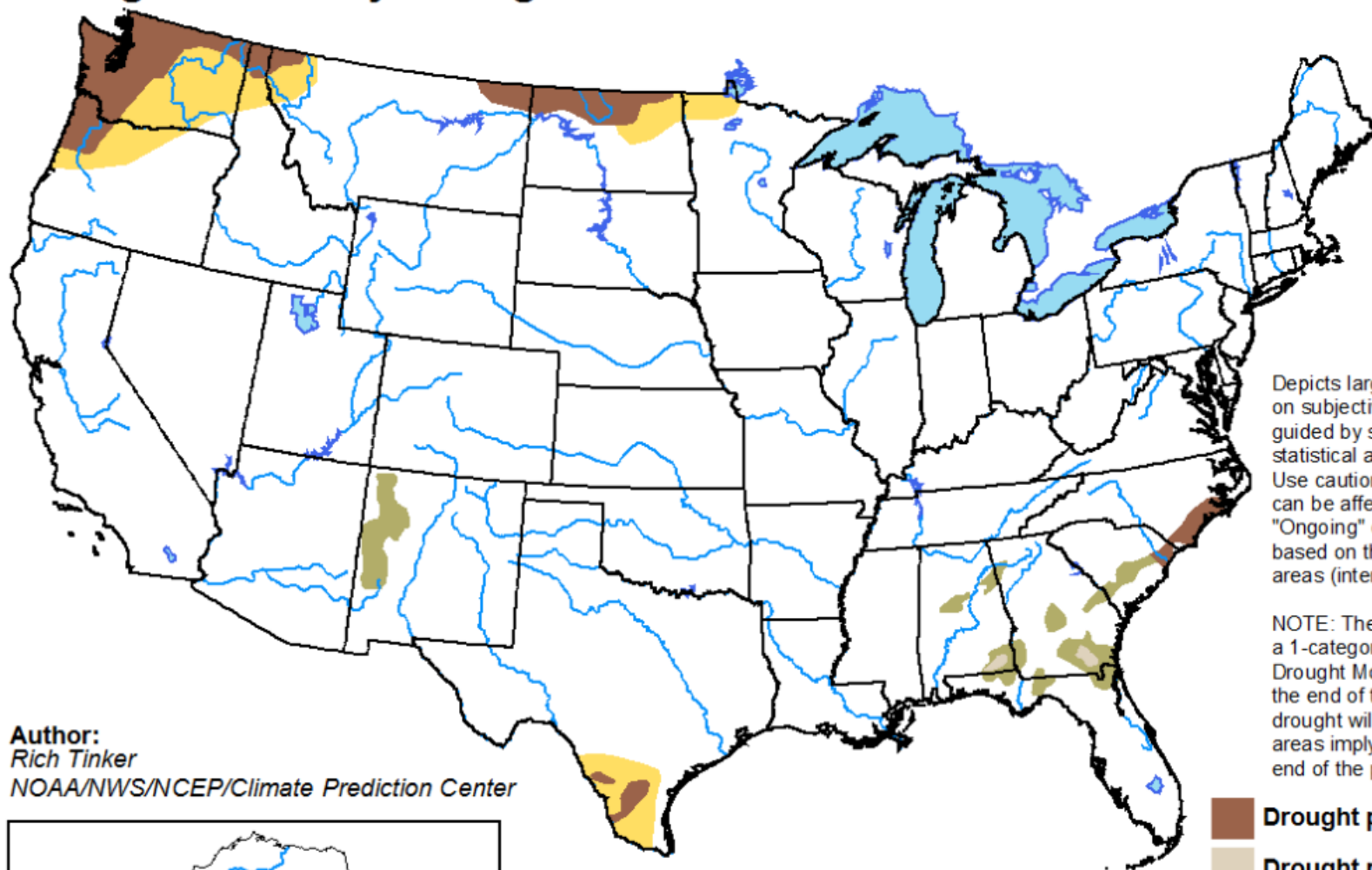
Precipitation Outlook



U.S. Seasonal Drought Outlook

Drought Tendency During the Valid Period





Valid for June 20 - September 30, 2019
Released June 20



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).

Author:
Rich Tinker
NOAA/NWS/NCEP/Climate Prediction Center

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



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