

# Presentation of Alternative Congressional Districting Plans for Alabama

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## 1 Background, qualifications, and materials consulted

I am a Professor of Mathematics and a Senior Fellow in the Jonathan M. Tisch College of Civic Life at Tufts University. I hold an affiliation as Collaborating Faculty in Department of Race, Colonialism, and Diaspora Studies (American Studies track). I hold a Ph.D. and an M.S in Mathematics from the University of Chicago as well as an A.B. in Mathematics and Women's Studies from Harvard University.

My general research areas are geometry, topology, dynamics, and applications of mathematics and computing to the study of elections, voting, and civil rights. My redistricting-related work has been published in venues such as the Election Law Journal, Political Analysis, Foundations of Data Science, the Notices of the American Mathematical Society, Statistics and Public Policy, the Virginia Policy Review, the Harvard Data Science Review, Foundations of Responsible Computing, and the Yale Law Journal Forum. My research has had continuous grant support from the National Science Foundation since 2009, including a CAREER grant from 2013–2018 and a Convergence Accelerator grant from 2019–2021 entitled "Network Science of Census Data." I am currently on the editorial board of the journals Advances in Mathematics and the Harvard Data Science Review. I was elected a Fellow of the American Mathematical Society in 2017 and was named a Radcliffe Fellow and a Guggenheim Fellow in 2018.

## Materials

I consulted a range of materials while preparing this report:

- Data products published by the Census Bureau, especially the PL94-171 Decennial Census release, the 2015-19 American Community Survey, and the ACS Special Tabulation from the same 5-year period. The Census Places dataset was used to extract block assignments to cities and towns. TIGER/Line shapefiles were used to pair demographics with geography.
- Block equivalency files defining the State's new enacted districts from [www.sos.alabama.gov/alabama-votes/state-district-maps](http://www.sos.alabama.gov/alabama-votes/state-district-maps).
- The Alabama Legislature's *Reapportionment Committee Redistricting Guidelines* [1], as well as the other articles cited in the bibliography below.

## 2 Introduction

On November 3, 2021, the Alabama Legislature enacted four districting plans: maps of 7 U.S. Congressional districts, 35 state Senate districts, 105 state House districts, and 8 state Board of Education districts. They were signed into law by Governor Kay Ivey the next day. This report presents alternative plans for Alabama Congressional districts and contrasts them with the enacted plan. I was asked to draw plans that establish that it is possible to create two majority-Black districts in a map that maintains population balance, reasonable compactness, respect for political boundaries, and other traditional districting principles. In particular, I was instructed to emphasize the Polsby-Popper (isoperimetric) definition of compactness.

I will be comparing the following plans: the enacted plan HB-1 and a set of alternative plans that I have drawn, labeled Plan A, Plan B, Plan C, and Plan D. They are shown in Figures 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 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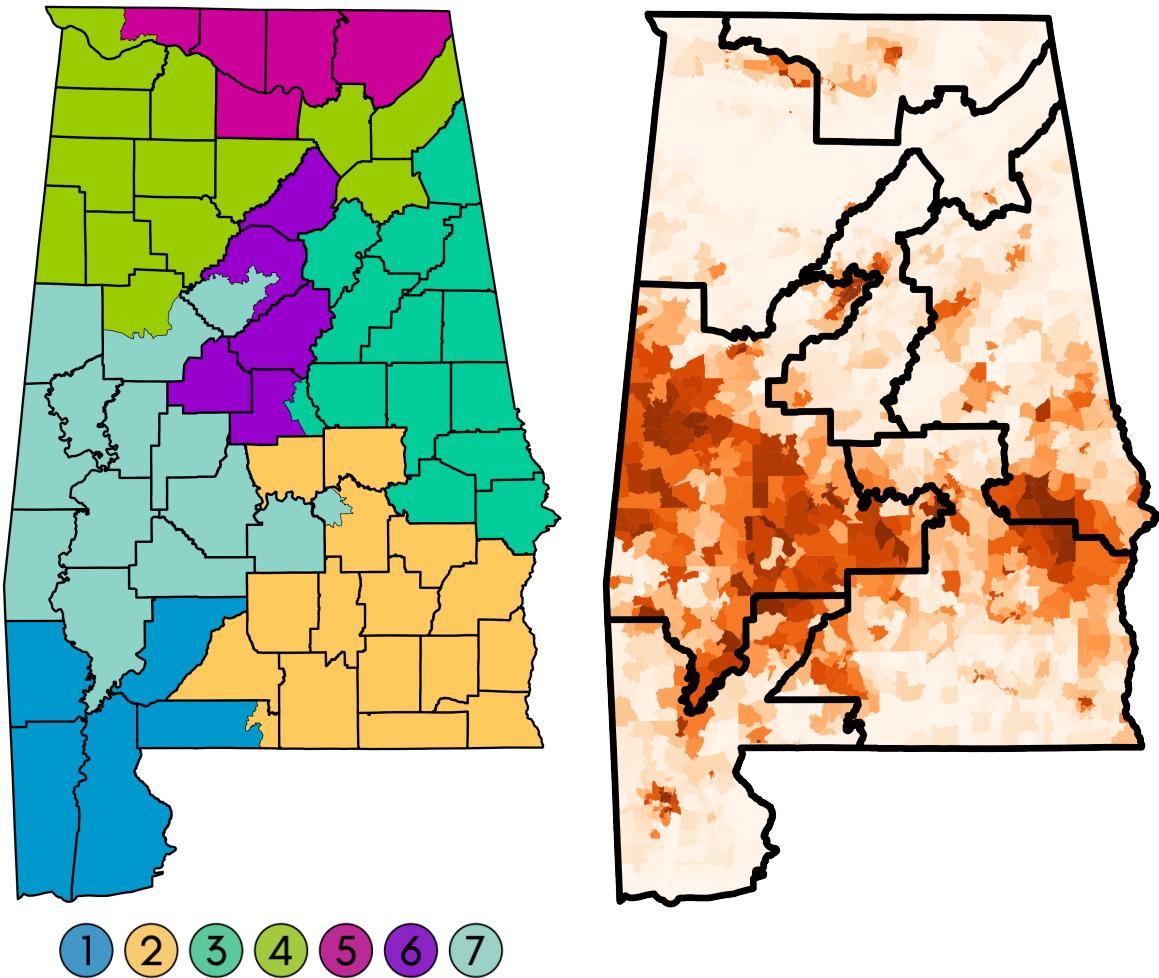


Figure 1: The State's plan HB-1 is shown (left) next to a demographic map (right). Darker shading indicates precincts with a higher share of BVAP, or Black voting age population. The State's plan packs Black population into District 7 at an elevated level of over 55% BVAP, then cracks Black population in Mobile, Montgomery, and the rural Black Belt across Districts 1, 2, and 3, so that none of them has more than about 30% BVAP.

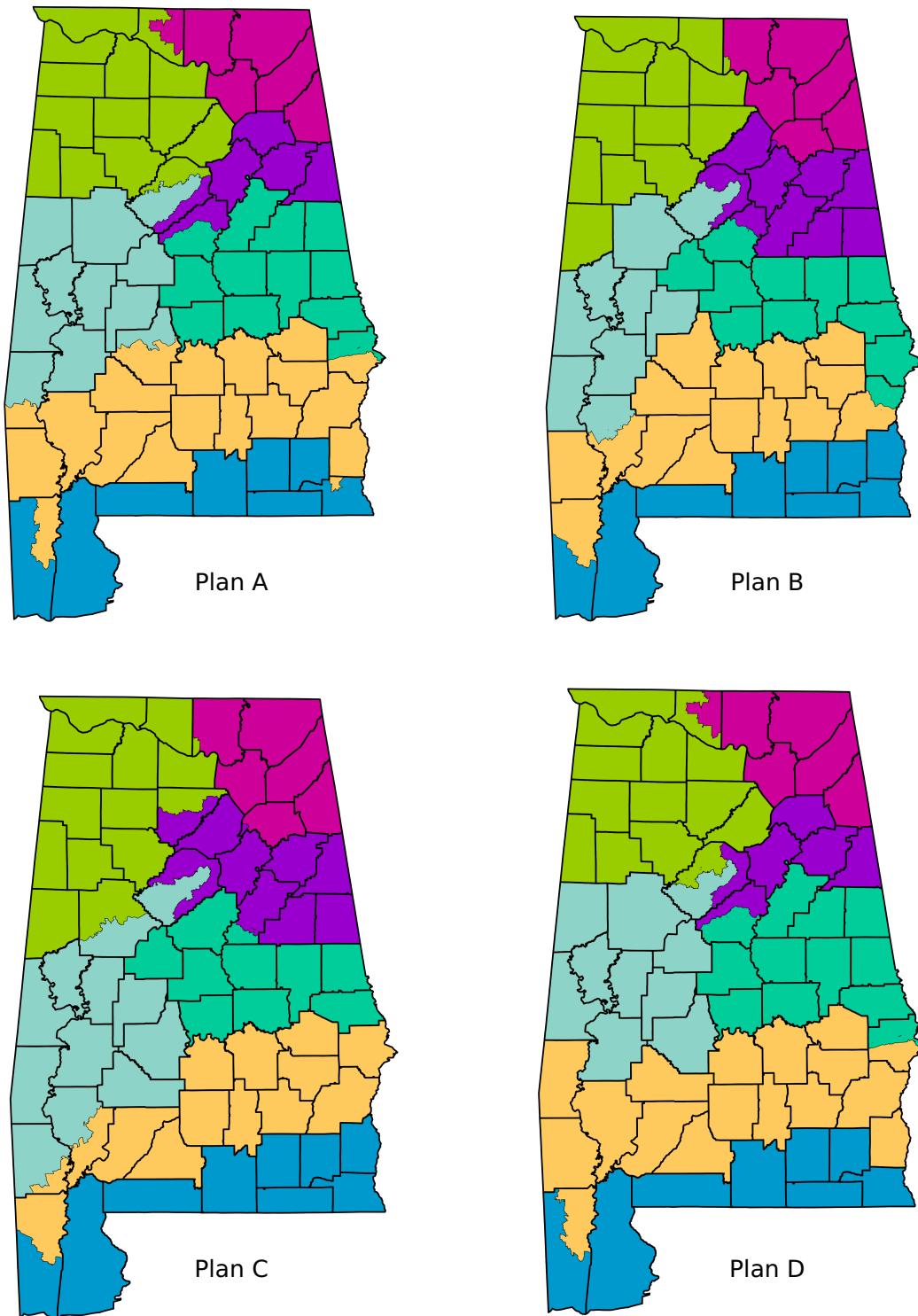


Figure 2: The four alternative plans presented in this report.

### 3 Traditional districting principles

I will begin by surveying the criteria discussed in the Alabama Legislature's *Reapportionment Committee Redistricting Guidelines* (henceforth, "the Guidelines") [1].

#### 3.1 Population balance

The standard interpretation of *One Person, One Vote* for Congressional districts is that districts should be balanced to as near mathematical equality of population as possible, using total population from the Decennial Census. As the Guidelines put it, "*Congressional districts shall have minimal population deviation.*" The State's plan and all four alternative plans have very tight population balance, with each district within one-person deviation from the rounded ideal population of 717,754.

#### 3.2 Contiguity

A district formed from census blocks can be called *contiguous* if it is possible to transit from any part of the district to any other part through a sequence of blocks that share boundary segments of positive length. As is traditional in Alabama (and affirmed in Section II.j.ii of the Guidelines), contiguity through water is accepted. The State's plan and the four alternative plans all satisfy contiguity.

#### 3.3 Respect for political subdivisions

The Guidelines call for districting plans to "*respect communities of interest, neighborhoods, and political subdivisions*"; in redistricting terms, respect for political subdivisions can be interpreted as attempting to keep intact as many localities (counties, cities, and towns) as possible. In order to make seven finely population-tuned districts, it is necessary to split at least six of Alabama's 67 counties into two pieces, or to split some counties into more than two pieces. All of the plans under consideration—the State's plan and the four alternative maps—split nine counties or fewer, giving them high marks for respecting these major political subdivisions. Plan D in fact splits only five counties, with the largest county (Jefferson) touching three districts. On the municipal level, Alabama has 172 cities and 290 towns, according to the 2020 Census. All of the alternative plans are comparable to the State's plan on locality splits, with Plan B splitting fewer localities than HB-1.

**Number of localities split, by type**

	localities (out of 529)	counties (out of 67)	municipalities (out of 462)	majority-Black cities (out of 32)
HB-1	42	6	36	Adamsville, Bessemer, Birmingham, Montgomery, Tarrant (5)
Plan A	48	8	40	Adamsville, Bessemer, Birmingham, Pritchard (4)
Plan B	39	7	32	Bessemer, Birmingham (2)
Plan C	51	9	42	Adamsville, Bessemer, Birmingham (3)
Plan D	49	5	44	Adamsville, Bessemer, Birmingham, Pleasant Grove, Tarrant (5)

Table 1: Comparing the plans' conformance to political boundaries. Municipalities are defined as cities and towns, and localities includes these as well as counties.

### 3.4 Compactness

The two compactness metrics most commonly appearing in redistricting are the *Polsby-Popper score* and the *Reock score*. Polsby-Popper is the name given in this setting to a metric from ancient mathematics: the isoperimetric ratio comparing a region's area to its perimeter via the formula  $4\pi A/P^2$ . Higher scores are considered more compact, with circles uniquely achieving the optimum score of 1. Political scientist Ernest Reock created a different score based on the premise that circles were ideal: it is computed as the ratio of a region's area to that of its circumcircle, where the circumcircle is defined as the smallest circle in which the region can be circumscribed. Polsby-Popper is thought to be relevant as a measure of how erratically the geographical boundaries divide the districts, but this sometimes penalizes districts for natural features like coastlines of bays and rivers. Reock has a much weaker justification, since the primacy of circles is the goal rather than the consequence of the definition.<sup>3</sup>

These scores depend on the planar contours of a district and have been criticized as being too dependent on map projections or on cartographic resolution [2] [3]. Besides having the weakest relevance to redistricting, the Reock score is also technically flawed, subject to large distortions among different equally reasonable methods of computation. Recently, some mathematicians have argued for using discrete compactness scores, taking into account the units of Census geography from which the district is built. The most commonly cited discrete score for districts is the *cut edges* score, which counts how many adjacent pairs of geographical units receive different district assignments. In other words, cut edges measures the "scissors complexity" of the districting plan: how much work would have to be done to separate the districts from each other? Plans with a very intricate boundary would require many separations. Relative to the contour-based scores, this better controls for factors like coastline and other natural boundaries, and focuses on the units actually available to redistricters rather than treating districts like free-form Rorschach blots.

#### Compactness

	block cut edges (lower is better)	average Polsby-Popper (higher is better)	average Reock (higher is better)
HB-1	3230	0.222	0.427
Plan A	3417	0.256	0.378
Plan B	3127	0.282	0.365
Plan C	3774	0.255	0.338
Plan D	3540	0.249	0.399

Table 2: Comparing compactness scores via one discrete and two contour-based metrics. Plan B is the most compact by cut edges. All four alternative plans are superior to the State's plan on the Polsby-Popper metric and have very reasonable Reock scores, especially Plan D.

### 3.5 Additional principles

- **Communities of interest.** The Guidelines describe communities of interest in terms that are congruent with the usage across many states: "A *community of interest* is defined as an area with recognized similarities of interests, including but not limited to ethnic, racial, economic, tribal, social, geographic, or historical identities."

In Alabama, there was no sustained effort by any state authority to formally collect community of interest (COI) maps, to my knowledge. Without this, it is difficult to produce a suitable metric based on public testimony or submissions.

<sup>3</sup>Reock took the idealization of the circle for granted: "The most compact plane figure is the circle, for here the maximum area is enclosed within a given perimeter. The circle, therefore, can be used as the ideal of compactness..." [4]. No further justification is given for why non-circular shapes are plausible indicators of gerrymandering.

However, it is possible to identify several clear examples of communities of interest of particular salience to Black Alabamians. The "Black Belt" of 18 mostly rural counties will be discussed below in §4.2.2.

- **Cores of prior districts.** The State's plan HB-1 bears a close resemblance to the plan from the prior Census cycle, which was engineered to have one district with a Black supermajority, while the other six do not approach one-third Black population. Therefore it should be expected that plans designed to address Voting Rights Act concerns would disrupt the structure of the prior plans, which can be confirmed in the alternative plans presented here.

## 4 Racial demographics

### 4.1 Demographics

Over 1.3 million Alabamians, or 1,364,736 to be precise, identified as Black or African-American on the 2020 Decennial Census.<sup>4</sup> Over a million of these, namely 1,014,372, are of voting age. Black residents constitute 27.16% of total population, 25.9% of voting-age population, and 26.3% of citizen voting-age population in the state.<sup>5</sup> But in the last Census cycle as in the State's new proposed plan, just one district out of seven had close to a Black majority—that one district constitutes just under 14.3% of the seats, while two majority-Black districts can readily be produced in alternative districting plans.

BVAP Share by District					BCVAP Share by District						
CD	HB-1	Plan A	Plan B	Plan C	Plan D	CD	HB-1	Plan A	Plan B	Plan C	Plan D
1	25.61%	14.50%	15.73%	15.73%	15.36%	1	25.77%	14.54%	15.77%	15.77%	15.41%
2	30.12%	51.37%	51.06%	50.06%	50.05%	2	30.49%	52.05%	51.75%	50.78%	50.71%
3	24.99%	23.96%	22.28%	19.64%	23.96%	3	25.21%	24.26%	22.63%	19.97%	24.26%
4	7.70%	8.30%	10.86%	11.03%	8.58%	4	7.70%	8.35%	10.91%	11.10%	8.62%
5	18.06%	16.02%	15.66%	15.66%	16.02%	5	18.23%	16.25%	15.84%	15.84%	16.25%
6	18.93%	15.44%	15.32%	15.51%	15.37%	6	19.33%	15.62%	15.48%	15.66%	15.53%
7	55.26%	51.50%	50.24%	53.50%	51.73%	7	56.34%	52.40%	51.28%	54.51%	52.64%

WVAP Share by District					WCVAP Share by District						
CD	HB-1	Plan A	Plan B	Plan C	Plan D	CD	HB-1	Plan A	Plan B	Plan C	Plan D
1	66.00%	76.25%	75.20%	75.20%	75.47%	1	65.17%	75.19%	74.13%	74.13%	74.40%
2	62.03%	42.33%	42.60%	43.14%	43.56%	2	61.43%	41.89%	42.19%	42.65%	43.14%
3	67.74%	67.78%	68.47%	70.99%	67.78%	3	67.49%	67.61%	68.37%	71.04%	67.61%
4	82.41%	82.98%	80.12%	79.98%	82.63%	4	82.50%	82.62%	79.88%	79.78%	82.30%
5	70.89%	71.62%	72.56%	72.56%	71.62%	5	70.42%	71.24%	72.28%	72.28%	71.24%
6	71.16%	75.39%	76.73%	76.49%	75.58%	6	71.23%	75.83%	76.63%	76.35%	76.01%
7	38.60%	42.08%	42.71%	40.04%	41.82%	7	38.02%	41.51%	42.24%	39.53%	41.22%

Table 3: Demographics broken out as a comparison of Black and White population.

<sup>4</sup>Here and throughout, we use the so-called "Any Part Black" definition, which counts people who self-identified as Black on the Census form, possibly in combination with other races, whether Hispanic or not, for total population and voting-age population. Abbreviations such as BVAP refer to this construction. Citizen voting-age population is derived from the American Community Survey (ACS) in combination with the Decennial Census. The racial group constructions are fully defined in the supplemental material.

<sup>5</sup>Black citizen voting-age population is derived from the 5-year ACS, 2015–2019. The supplemental material contains an explanation of how BCVAP and WCVAP are constructed.

	CD	WVAP	BVAP	HVAP	WCVAP	BCVAP	HCVAP
HB-1	1	66.00%	25.61%	3.23%	65.17%	25.77%	2.45%
	2	62.03%	30.12%	3.57%	61.43%	30.49%	2.55%
	3	67.74%	24.99%	3.07%	67.49%	25.21%	2.29%
	4	82.41%	7.70%	5.66%	82.50%	7.70%	2.84%
	5	70.89%	18.06%	5.28%	70.42%	18.23%	3.31%
	6	71.16%	18.93%	5.38%	71.23%	19.33%	2.81%
	7	38.60%	55.26%	3.65%	38.02%	56.34%	2.05%
Plan A	CD	WVAP	BVAP	HVAP	WCVAP	BCVAP	HCVAP
	1	76.25%	14.50%	4.00%	75.19%	14.54%	3.07%
	2	42.33%	51.37%	2.68%	41.89%	52.05%	1.77%
	3	67.78%	23.96%	3.98%	67.61%	24.26%	2.62%
	4	82.98%	8.30%	4.58%	82.62%	8.35%	2.58%
	5	71.62%	16.02%	6.50%	71.24%	16.25%	3.67%
	6	75.39%	15.44%	3.91%	75.83%	15.62%	2.26%
Plan B	7	42.08%	51.50%	4.18%	41.51%	52.40%	2.32%
	CD	WVAP	BVAP	HVAP	WCVAP	BCVAP	HCVAP
	1	75.20%	15.73%	3.99%	74.13%	15.77%	3.06%
	2	42.60%	51.06%	2.60%	42.19%	51.75%	1.71%
	3	68.47%	22.28%	4.59%	68.37%	22.63%	2.92%
	4	80.12%	10.86%	4.68%	79.88%	10.91%	2.70%
	5	72.56%	15.66%	6.23%	72.28%	15.84%	3.40%
Plan C	6	76.73%	15.32%	3.46%	76.63%	15.48%	2.11%
	7	42.71%	50.24%	4.29%	42.24%	51.28%	2.41%
	CD	WVAP	BVAP	HVAP	WCVAP	BCVAP	HCVAP
	1	75.20%	15.73%	3.99%	74.13%	15.77%	3.06%
	2	43.14%	50.06%	2.93%	42.65%	50.78%	1.95%
	3	70.99%	19.64%	4.46%	71.04%	19.97%	2.82%
	4	79.98%	11.03%	4.70%	79.78%	11.10%	2.69%
Plan D	5	72.56%	15.66%	6.23%	72.28%	15.84%	3.40%
	6	76.49%	15.51%	3.51%	76.35%	15.66%	2.13%
	7	40.04%	53.50%	4.01%	39.53%	54.51%	2.26%
	CD	WVAP	BVAP	HVAP	WCVAP	BCVAP	HCVAP
	1	75.47%	15.36%	4.01%	74.40%	15.41%	3.07%
	2	43.56%	50.05%	2.68%	43.14%	50.71%	1.79%
	3	67.78%	23.96%	3.98%	67.61%	24.26%	2.62%
	4	82.63%	8.58%	4.66%	82.30%	8.62%	2.61%
	5	71.62%	16.02%	6.50%	71.24%	16.25%	3.67%
	6	75.58%	15.37%	3.93%	76.01%	15.53%	2.25%
	7	41.82%	51.73%	4.08%	41.22%	52.64%	2.30%

Table 4: Demographics by district in the State's plan HB-1 and the alternative plans.

By contrast, the non-Hispanic White population share in Alabama is 63.12% and the corresponding shares of voting-age population and citizen voting-age population are 65.47% and 65.07%, respectively. By any of these measures, proportional representation for White voters would be between 4.4 and 4.6 of Alabama's 7 seats in the U.S. House. The State's map HB-1 orchestrates a non-Hispanic White VAP share of at least 60% in all districts besides CD-7—that is, in 6 out of 7 Congressional districts.

## 4.2 Centers of Black population

### 4.2.1 Urban

The four largest cities in Alabama today are Huntsville (population 215,006), Birmingham (population 200,733), Montgomery (population 200,603), and Mobile (population 187,041). Together, they have over 400,000 Black residents, comprising roughly 1/3 of the Black population in the state. Of these cities, Birmingham, Montgomery, and Mobile are majority-Black, with population shares of 69.9%, 60.8%, and 51.5%, respectively, making them two among Alabama's 52 majority-Black cities.

Of those four largest cities, the State's plan HB-1 only includes parts of Birmingham and parts of Montgomery in a majority-Black district. In particular, this means that the hundreds of thousands of Black voters in Montgomery and Mobile are located in districts in which Black population share falls short of one-third.

All four alternative plans retain most of Birmingham in a majority-Black district, but by adding a second majority district the alternative plans are able to include all of Montgomery and most of Mobile as well.

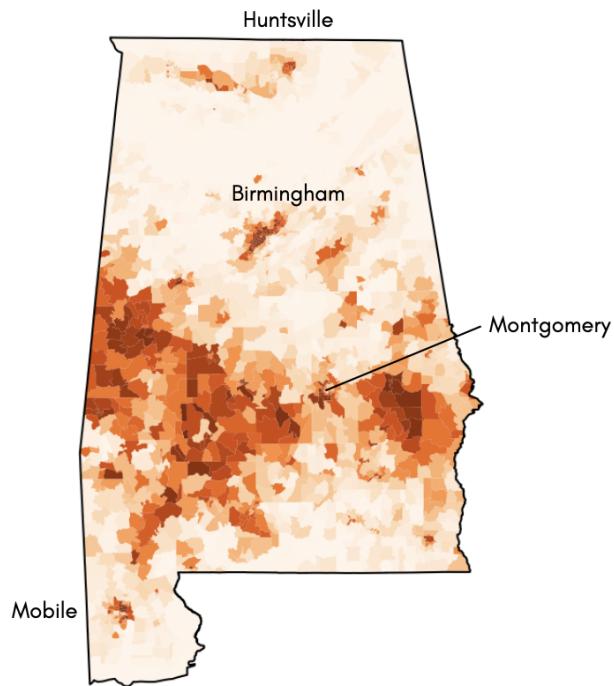


Figure 3: Black voting-age population share is shown by shading at the precinct level. The major cities have visible concentrations of Black population, and the Black Belt rural counties are clearly visible running East-West across the state.

#### 4.2.2 Rural: Alabama's Black Belt

Alabama also has a significant Black population in rural counties, especially in the 18 "Black Belt" counties of Barbour, Bullock, Butler, Choctaw, Crenshaw, Dallas, Greene, Hale, Lowndes, Macon, Marengo, Montgomery, Perry, Pickens, Pike, Russell, Sumter, and Wilcox. These counties have a long shared history from plantation slavery to sharecropping to Jim Crow and up to the present—these constitute very clear communities of interest by the Guidelines definition. (Recalling from above, that definition holds that "*A community of interest is defined as an area with recognized similarities of interests, including but not limited to ethnic, racial, economic, tribal, social, geographic, or historical identities.*")

The Black Belt includes 8 of the 10 least populous counties in the state, each with under 13,000 residents. Together, the Black Belt region has over 300,000 Black residents.

In the State's plan, eight of these are partially or fully excluded from majority-Black districts: Barbour, Bullock, Butler, Crenshaw, Macon, Pike, and Russell are excluded from CD-7 while Montgomery County is split.

Each of the 18 Black Belt counties is contained in majority-Black districts in at least some of the alternative plans presented here: Plan A and Plan D include all but part of Russell County, Plan B includes all but Russell and part of Barbour County, and Plan C includes the entirety of the Black Belt. Forming a district that reaches south into Mobile County and eastward across the Black Belt is natural for a mapmaker following traditional principles. In fact, the State's own recently enacted State Board of Education map, which has two majority-Black districts out of eight, does just this in a manner similar to my illustrative Congressional plans.

## 5 Conclusion

I have presented four alternative maps that all secure population majorities for Black Alabamians in two districts, rather than just one district, out of seven.

- The State's map and all four alternative plans have districts balanced to within  $\pm 1$  person from rounded ideal size. All four plans are contiguous, and all split five to nine counties, at or close to the theoretical minimum level of splitting.
- All four alternative plans have strong compactness scores; in fact, all four are significantly superior to the State's plan in the most common compactness metric, the average Polsby-Popper score.
- The State's plan splits Montgomery County and Montgomery City, even though Montgomery County is less than one-third the size of a Congressional district. All four alternative plans hold the city and county whole.
- Proportionality for the White non-Hispanic population in Alabama would amount to roughly 4.5 out of 7 seats in Congress, but the State's map would lock in fully 6 out of 7 seats for White-preferred candidates—a massively super-proportional showing.
- All four alternative plans place thousands of Black voters in the population centers of Montgomery and Mobile, as well as voters across the rural Black Belt, in majority-Black districts. Seven Black Belt counties are wholly excluded from the sole majority-Black district, and another is split, in the State's plan. Relative to HB-1, each one of the alternative plans allows over 300,000 additional Black Alabamians—including plaintiffs Shalela Dowdy (Mobile), Evan Milligan (Montgomery), and Khadidah Stone (Montgomery)—to live in majority-Black districts.

## References

- [1] Alabama Legislative Reapportionment Committee Redistricting Guidelines, dated May 5, 2021. Available at [www.legislature.state.al.us](http://www.legislature.state.al.us).
- [2] Assaf Bar-Natan, Elle Najt, and Zachary Schutzmann, *The gerrymandering jumble: Map projections permute districts' compactness scores*. Cartography and Geographic Information Science, Volume 47, Issue 4, 2020, 321–335.
- [3] Richard Barnes and Justin Solomon, *Gerrymandering and Compactness: Implementation Flexibility and Abuse*. Political Analysis, Volume 29, Issue 4, October 2021, 448–466.
- [4] Ernest C. Reock, Jr., *A Note: Measuring Compactness as a Requirement of Legislative Apportionment*. Midwest Journal of Political Science, Vol. 5, No. 1 (Feb., 1961), 70–74.

## A Supplemental information

### Definition of Black by Census Codes (within **total population**)

Black or African American alone P0010004  
White; Black or African American P0010011  
Black or African American; American Indian and Alaska Native P0010016  
Black or African American; Asian P0010017  
Black or African American; Native Hawaiian and Other Pacific Islander P0010018  
Black or African American; Some Other Race P0010019  
White; Black or African American; American Indian and Alaska Native P0010027  
White; Black or African American; Asian P0010028  
White; Black or African American; Native Hawaiian and Other Pacific Islander P0010029  
White; Black or African American; Some Other Race P0010030  
Black or African American; American Indian and Alaska Native; Asian P0010037  
Black or African American; American Indian and Alaska Native; Native Hawaiian and Other Pacific Islander P0010038  
Black or African American; American Indian and Alaska Native; Some Other Race P0010039  
Black or African American; Asian; Native Hawaiian and Other Pacific Islander P0010040  
Black or African American; Asian; Some Other Race P0010041  
Black or African American; Native Hawaiian and Other Pacific Islander; Some Other Race P0010042  
White; Black or African American; American Indian and Alaska Native; Asian P0010048  
White; Black or African American; American Indian and Alaska Native; Native Hawaiian and Other Pacific Islander P0010049  
White; Black or African American; American Indian and Alaska Native; Some Other Race P0010050  
White; Black or African American; Asian; Native Hawaiian and Other Pacific Islander P0010051  
White; Black or African American; Asian; Some Other Race P0010052  
White; Black or African American; Native Hawaiian and Other Pacific Islander; Some Other Race P0010053  
Black or African American; American Indian and Alaska Native; Asian; Native Hawaiian and Other Pacific Islander P0010058  
Black or African American; American Indian and Alaska Native; Asian; Some Other Race P0010059  
Black or African American; American Indian and Alaska Native; Native Hawaiian and Other Pacific Islander; Some Other Race P0010060  
Black or African American; Asian; Native Hawaiian and Other Pacific Islander; Some Other Race P0010061  
White; Black or African American; American Indian and Alaska Native; Asian; Native Hawaiian and Other Pacific Islander P0010064  
White; Black or African American; American Indian and Alaska Native; Asian; Some Other Race P0010065  
White; Black or African American; American Indian and Alaska Native; Native Hawaiian and Other Pacific Islander; Some Other Race P0010066  
White; Black or African American; Asian; Native Hawaiian and Other Pacific Islander; Some Other Race P0010067  
Black or African American; American Indian and Alaska Native; Asian; Native Hawaiian and Other Pacific Islander; Some Other Race P0010069  
White; Black or African American; American Indian and Alaska Native; Asian; Native Hawaiian and Other Pacific Islander; Some Other Race P0010071

### Definition of Black by Census Codes (within **voting-age population**)

Black or African American alone P0030004  
White; Black or African American P0030011  
Black or African American; American Indian and Alaska Native P0030016  
Black or African American; Asian P0030017  
Black or African American; Native Hawaiian and Other Pacific Islander P0030018  
Black or African American; Some Other Race P0030019  
White; Black or African American; American Indian and Alaska Native P0030027  
White; Black or African American; Asian P0030028  
White; Black or African American; Native Hawaiian and Other Pacific Islander P0030029  
White; Black or African American; Some Other Race P0030030  
Black or African American; American Indian and Alaska Native; Asian P0030037  
Black or African American; American Indian and Alaska Native; Native Hawaiian and Other Pacific Islander P0030038  
Black or African American; American Indian and Alaska Native; Some Other Race P0030039  
Black or African American; Asian; Native Hawaiian and Other Pacific Islander P0030040  
Black or African American; Asian; Some Other Race P0030041  
Black or African American; Native Hawaiian and Other Pacific Islander; Some Other Race P0030042  
White; Black or African American; American Indian and Alaska Native; Asian P0030048  
White; Black or African American; American Indian and Alaska Native; Native Hawaiian and Other Pacific Islander P0030049  
White; Black or African American; American Indian and Alaska Native; Some Other Race P0030050  
White; Black or African American; Asian; Native Hawaiian and Other Pacific Islander P0030051  
White; Black or African American; Asian; Some Other Race P0030052  
White; Black or African American; Native Hawaiian and Other Pacific Islander; Some Other Race P0030053  
Black or African American; American Indian and Alaska Native; Asian; Native Hawaiian and Other Pacific Islander P0030058  
Black or African American; American Indian and Alaska Native; Asian; Some Other Race P0030059  
Black or African American; American Indian and Alaska Native; Native Hawaiian and Other Pacific Islander; Some Other Race P0030060  
Black or African American; Asian; Native Hawaiian and Other Pacific Islander; Some Other Race P0030061  
White; Black or African American; American Indian and Alaska Native; Asian; Native Hawaiian and Other Pacific Islander P0030064  
White; Black or African American; American Indian and Alaska Native; Asian; Some Other Race P0030065  
White; Black or African American; American Indian and Alaska Native; Native Hawaiian and Other Pacific Islander; Some Other Race P0030066  
White; Black or African American; Asian; Native Hawaiian and Other Pacific Islander; Some Other Race P0030067  
Black or African American; American Indian and Alaska Native; Asian; Native Hawaiian and Other Pacific Islander; Some Other Race P0030069  
White; Black or African American; American Indian and Alaska Native; Asian; Native Hawaiian and Other Pacific Islander; Some Other Race P0030071

### Definition of Black via Census products (within **citizen voting-age population**)

The 2015-2019 5-year ACS Special Tabulation produces 2010 tract-level estimates of citizen voting age population (CVAP) with some subpopulations. I selected the Non-Hispanic White (WCVAP), Non-Hispanic Black or African American (BCVAP), and Hispanic (HCVAP) categories. The 2015-2019 ACS also provides 2010 tract-level voting age population (VAP) estimates by tract, from which we use White (WVAP), Black or African American (BVAP), and Hispanic (HVAP). From these two products I have calculated the citizenship share for each subpopulation in each 2010 Census tract in Alabama. This citizenship share tracks, for example, BCVAP / BVAP—the share of non-Hispanic Black citizens of voting age over the total number of Black citizens, independent of ethnicity. To calculate 2020 CVAP estimates on 2020 Census blocks, I start with the 2020 PL-94 to determine the VAP share in each block for each subpopulation, then multiply by the corresponding citizenship share. For instance, we compute the 2020 BVAP count in each block  $b$  (independent of ethnicity) and multiply it by the BCVAP / BVAP citizenship share assigned to the 2010 tract that contains  $b$ . An exactly similar method is used for WCVAP and HCVAP.