STATE OF NORTH CAROLINA

COUNTY OF WAKE

IN THE GENERAL COURT OF JUSTICE
SUPERIOR COURT DIVISION
18 CVS 014001

COMMON CAUSE, et al.,

Plaintiffs,

v.

DAVID LEWIS, IN HIS OFFICIAL CAPACITY AS SENIOR CHAIRMAN OF THE HOUSE SELECT COMMITTEE ON REDISTRICTING, et al.,

Defendants.

PLAINTIFFS' OPPOSITION TO LEGISLATIVE DEFENDANTS' MOTION IN LIMINE TO PRECLUDE CERTAIN TESTIMONY BY PLAINTIFFS' EXPERTS

INTRODUCTION

This Court should deny Legislative Defendants' motion *in limine* to exclude certain testimony by Plaintiffs' experts, Dr. Jowei Chen and Dr. Christopher Cooper. Legislative Defendants' motion is built on a flawed premise that, in a redistricting case, the intent or motive in drawing the challenged map is a question of law, rather than of fact. In fact, the opposite is true: a person's intent or motive is a quintessential factual question generally, and it is routinely the central factual question in redistricting litigation specifically. For this reason, expert testimony by Dr. Chen and others, applying computer simulation and other techniques to draw conclusions about mapmakers' intent, is routinely admitted in redistricting cases. It should be admitted here too.

Furthermore, it is irrelevant that some terms used by Plaintiffs' experts—like "packing," "cracking," and "gerrymandering" (without any qualifier such as unlawful or unconstitutional)—can also have legal meanings in some contexts. In their expert reports and depositions, Dr. Chen and Dr. Cooper make clear that they are assigning specific factual meanings to these terms, and those meanings are based on their extensive expertise in political science and redistricting.

For these and others reasons detailed below, Legislative Defendants' motion should be denied.

BACKGROUND

Dr. Chen is an Associate Professor in the Department of Political Science at the University of Michigan, Ann Arbor, and will testify as an expert in, among other things, legislative districting and political geography. Dr. Chen will testify that, by using computer simulation programming techniques to produce a large number of nonpartisan districting plans that adhere to traditional districting criteria such as compactness and avoiding splitting

municipalities and voting tabulation districts ("VTDs"), he can assess whether an enacted plan is a statistical outlier with respect to its adherence to these traditional criteria and with respect to its partisan makeup. Ex. 1 at 7-10. Stated differently, Dr. Chen is able to assess whether partisan considerations predominated over, or "subordinated," non-partisan traditional districting criteria in creating an enacted plan. *Id.* Here, Dr. Chen concluded, on the basis of this analysis, that the enacted 2017 House and Senate Plans are extreme statistical outliers in their level of partisan bias in favor of Republicans, in their lack of compactness, and in the number of municipalities and VTDs they split. *Id.* at 3-4. Dr. Chen thus concluded, among other things, "that partisan considerations predominated over non-partisan districting criteria, particularly geographic compactness and minimizing municipality and precinct splits, in the drawing of the 2017 House Plan and the 2017 Senate Plan." *Id.* at 4. Dr. Chen has offered similar expert testimony in at least five other partisan gerrymandering cases, and in all of those cases, the trial courts accepted and credited his testimony. *See id.* at 1-2 (collecting cases).

Dr. Cooper is Professor and Department Head of Political Science and Public Affairs at Western Carolina University in Cullowhee, North Carolina. Dr. Cooper will testify as an expert in political science, in particular the political geography and political history of North Carolina. Dr. Cooper will testify about the disjunction between North Carolina's statewide voting patterns and the electoral outcomes in North Carolina state legislative races after the 2011 round of redistricting. *See* Ex. 2 at 4-25. He will discuss the specific state legislative districts at issue here and the electoral impact of their boundaries. He will analyze specific county groupings and explain in detail how the district lines in each relevant county grouping reflect an intentional effort to pack and crack Democratic voters in order to minimize the total number of seats that Democrats can win. *See id.* at 25-102. He will also discuss how certain files in the possession of

Legislative Defendants' redistricting consultant and mapmaker, Dr. Thomas Hofeller, disprove the opinions of Legislative Defendants' experts that the Whole County Rule constrained Dr. Hofeller in using partisan consideration, and that North Carolina's natural political geography can purportedly explain the partisan composition of districts within certain geographic areas. *See* Mot. at Ex. 4.

ARGUMENT

This Court should deny Legislative Defendants' motion in its entirety. Despite spending multiple pages summarizing the requirements for qualifying a witness as an expert and for assessing the reliability of an expert's methodology, Legislative Defendants do not dispute that Dr. Chen and Dr. Cooper are qualified. Nor do Legislative Defendants dispute in this context that Dr. Chen's and Dr. Cooper's methodologies are reliable. Instead, Legislative Defendants assert that Dr. Chen and Dr. Cooper may not testify about the General Assembly's "intent" or "motivation" in drawing the 2017 Plans, about whether certain features of the 2017 Plans are the result of "gerrymandering," or about whether the 2017 Plans "pack" or "crack" Democratic voters. Legislative Defendants contend that such testimony offers impermissible "legal conclusions." Mot. at 1, 6, 8-10.[1] Legislative Defendants' arguments are wrong on every level.

I. Dr. Chen's and Dr. Cooper's Testimony Will Not Present Legal Conclusions

Legislative Defendants' motion is built on the false premise that the relevant testimony from Dr. Chen and Dr. Cooper about the intent behind the 2017 Plans involves "legal

[1] Like Dr. Chen and Dr. Cooper, Plaintiffs' two other principal experts—Dr. Wesley Pegden and Dr. Jonathan Mattingly—disclosed in their expert reports that they too will offer testimony about the partisan intent and motivation for the 2017 Plans. *See, e.g.*, Ex. 3 (section heading of Pegden report entitled, "Quantifying Intentional and Excessive Use of Partisanship"); Ex. 4 (Mattingly report stating, "[t]he chance of making so many independent choices which bias the results towards the Republican Party unintentionally is astronomically small"). In their motion *in limine*, Legislative Defendants do not seek to exclude or limit the testimony of Dr. Pegden or Dr. Mattingly in any way.

conclusions." Questions of intent, and whether Legislative Defendants engaged in intentional "gerrymandering," "packing," and "cracking," are quintessential questions of fact, not law.

The North Carolina Supreme Court "has long held that intent" is not a legal conclusion, but rather a "question[] of fact to be determined by the jury." *Trivette v. Yount*, 735 S.E.2d 306, 313 (N.C. 2012). In the redistricting context in particular, the North Carolina Supreme Court recently confirmed that "[a] court's determination of the predominant motive underlying a redistricting plan is factual in nature"—in other words, it is a "factual finding[]," and not a "[c]onclusion[] of law." *Dickson v. Rucho*, 781 S.E.2d 404, 423 (2015), *vacated on other grounds*, 137 S. Ct. 2186 (2017). The U.S. Supreme Court likewise has repeatedly held that a legislature's intent or motive in drawing particular district lines is a question of fact, not law. *See Cooper v. Harris*, 137 S. Ct. 1455, 1465, 1468 (2017); *Easley v. Cromartie*, 532 U.S. 234, 242 (2001).

Dr. Chen's deposition testimony makes clear that he is not offering any legal conclusion in his analysis of the partisan intent behind the 2017 Plans. Dr. Chen testified that his conclusions about partisan intent are entirely factual, based on empirical data and analysis. For instance, Dr. Chen had the following exchange with Legislative Defendants' counsel:

> Q. What does the term predominant factor mean?
>
> A. Sure. Predominant factor in the context of a partisan intent means the following to me: When I study an enacted plan or a proposed plan, I look at it in the context of -- here in the context of the non-partisan criteria that the General Assembly stated it was following, and so I asked the following question: Number one, did it produce -- did the enacted plan produce a partisan outlier compared to the sorts of plans that would normally be produced if one had pursued the non-partisan portions of the adopted criteria. And number two, if it did produce a partisan outlier, did it do so by subordinating the non-partisan portions of the adopted criteria. So I'm asking two questions there. I'm asking, one, whether partisanship predominated in the drawing of the plan and, number two, whether in doing so in the pursuit of this predominant partisan factor non-partisan criteria were subordinated in the pursuit of partisanship.

> Q. What's the standard that you are using to decide if partisan intent predominated?
>
> A. Well, *I'm not using any sort of legal standard if that's what you're trying to ask. My standard is purely based on empirical social science, meaning that I use statistical tests.* So I'm not going to be able to, say, layout for you some sort of legal standard as much as I'm just telling you about my statistical results and how I determine whether there's statistical significance in what I'm finding.
>
> Q. And is that the same answer for subordinated, you don't offer a legal standard for what that means?
>
> A. Exactly. When I use the word subordinate and when I use the word predominate, I have no legal understanding of those terms. I'm purely answering the specific empirical questions that I just laid out for you.

Ex. 5 at 90:12-92:3 (emphasis added).

As with "intent," the word "gerrymandering" likewise has a factual meaning; it is not strictly or always a legal conclusion. Without any adjective like "impermissible" or "unconstitutional," the word "gerrymandering" just denotes to lay people—and certainly to an expert political scientist—a circumstance in which district lines are deliberately drawn to achieve a self-serving purpose. Dr. Cooper confirmed at his deposition that his use of the term "gerrymandering" carries precisely this factual meaning. When asked, "How do you define gerrymandering," Dr. Cooper answered, "when one party draws lines to benefit themselves at the expense of the other party." Ex. 6 at 40:5-8. Legislative Defendants then asked Dr. Cooper if he is offering "a distinction between legal and illegal gerrymandering," and Dr. Cooper answered that he is not, because "that's for the court to decide." *Id.* at 40:8-16. Dr. Cooper made clear that he is not offering legal conclusions regarding the lawfulness of gerrymandering.

Like "gerrymandering," the terms "packing" and "cracking" also are not legal conclusions, but rather factual issues relating to how the district boundaries were drawn. Legislative Defendants assert that "packing" and "cracking" are "legal terms of art," but the only authority they cite is a law review article that omits the critical word "legal." Mot. at 8. The

article instead describes "packing" as "a term of art in redistricting parlance, referring to the overconcentration of voters beyond that necessary to elect." Mot. at 8-9 (quotation marks omitted). Dr. Cooper is undisputedly an expert on redistricting and political geography, and thus understands the meaning of the "term[s] of art in redistricting parlance."

Again, Dr. Cooper's deposition testimony confirms the point. Legislative Defendants asked Dr. Cooper: "How did you define those terms [of packing and cracking] for purposes of your report?" Ex. 6 at 121:21-23. Dr. Cooper answered, "Packing involves diluting the vote of one party by ensuring that they win one race by a large margin, thereby losing other races by smaller margins. Cracking involves diluting the representation of the other party by splitting them into multiple districts." *Id.* at 121:24-122:4. Dr. Cooper thus assigns only factual and social science meanings to these terms—not any legal conclusion.

II. Expert Testimony Is Not Inadmissible Merely Because It Employs Terminology that Also Can Express a Legal Conclusion

Even if the terms "intent," "motivation," "gerrymandering," and "packing and cracking" could also express legal conclusions in some contexts, that would still not be a basis to preclude Dr. Chen and Dr. Cooper from offering analysis based on *their* factual definitions of these terms.

As Legislative Defendants acknowledge, North Carolina Rule of Evidence 704, like the parallel federal rule, abrogates the common-law "ultimate issue rule." Mot. at 3. Rule 704 thus provides that opinion testimony "is not objectionable because it embraces an ultimate issue to be decided by the trier of fact." Thus, under Rule 704, the admissibility of expert opinion testimony does not turn on whether the testimony is "factual" or "legal" in nature. Indeed, "one of the reasons underlying the abolition of the ultimate-issue rule was to avoid the odd verbal circumlocutions in which courts engaged when attempting to draw the distinction between legal conclusions and opinions as to ultimate facts." 29 Wright & Miller, Fed. Prac. & Proc. Evid.

§ 6284 (2d ed.) (quotation marks omitted). Instead, admissibility properly hinges on whether, under Rule 702, the expert's testimony "will assist the trier of fact." As the North Carolina Supreme Court has explained, the critical question thus concerns "whether the opinion expressed is really one based on the special expertise of the expert, that is, whether the witness because of his expertise is in a better position to have an opinion on the subject than is the trier of fact." *HAJMM Co. v. House of Raeford Farms, Inc.*, 403 S.E.2d 483, 488 (N.C. 1991).

To be sure, in evaluating when expert testimony will assist the trier of fact, North Carolina courts have held that "an expert may not testify that a particular legal conclusion or standard has or has not been met, *at least where the standard is a legal term of art which carries a specific meaning not readily apparent to the witness*." *Id.* (emphasis added) (quotation marks omitted); *see also, e.g.*, *State v. Ford*, 782 S.E.2d 98, 107 (N.C. Ct. App. 2016) (same). In the circumstance described in that italicized phrase, that rule makes perfect sense. An expert opining about a legal term of art with no "readily apparent" non-legal meaning would "usurp the function of the judge," since it is "the province of the court to determine the applicable law and to instruct the jury as to that law." *HAJMM*, 403 S.E.2d at 489 (quotation marks omitted). And where a legal standard lacks an apparent non-legal meaning, "an expert is in no better position to conclude whether [the] legal standard has been satisfied . . . than is a jury." *Id.* For example, "[t]he term 'testamentary capacity' is a conclusion which the law draws from certain facts as premises," and has no accepted non-legal meaning. *HAJMM*, 403 S.E.2d at 488. For that reason, "[o]pinion testimony could not be offered on whether the *legal conclusion* that testamentary capacity existed should be drawn." *Id.* at 489.

The situation is entirely different when an expert testifies about a legal term that *also* carries a non-legal meaning readily apparent to the witness. Testifying about a term with a non-

legal meaning does not usurp the function of the judge in any sense—after all, "[i]n attempting to relate the facts[,] it often happens that a witness will use words that, though familiar to the layperson's vocabulary, also have a legal meaning." 2 *Brandis & Broun on North Carolina Evidence* § 182 (2018). And so long as the term's non-legal meaning is within the scope of the witness's expertise, an expert witness may well be in a superior position to opine about it than the factfinder. An expert thus may testify, for example, that a victim's death was a "homicide," since that term can describe not just a legal conclusion, but also a fact. *See id.* n.121 (collecting cases). Likewise, "a witness may state that she was in 'possession' of land or chattels, or that she 'bought' certain articles, or that she did not 'receive service' of process, or that the victim was 'raped,' or that a corporation 'claimed no interest' in a particular thing, or that it did not 'owe' a debt, if the words are employed in a popular sense." *Id.* (footnotes omitted).

Here, the terms Dr. Chen and Dr. Cooper will testify about—intent, motivation, gerrymandering, packing, and cracking—carry non-legal meanings that are readily apparent to Dr. Chen and Dr. Cooper based on their expertise in political science generally and redistricting specifically. "Intent" and "motivation" are everyday words whose ordinary meaning is well within the ken of nonlawyers. North Carolina courts thus commonly admit expert testimony on whether or not particular actions or consequences occurred intentionally (as opposed to randomly or accidentally). *E.g.*, *State v. Teague*, 518 S.E.2d 573, 578 (N.C. Ct. App. 1999) ("[A] medical expert is not precluded from testifying to his or her opinion that the defendant could not form a 'specific intent to kill.'"); *Ridley v. Wendel*, 795 S.E.2d 807, 811 (N.C. Ct. App. 2016) (holding that expert permissibly testified that defendant did not act "accidentally"); *see* 2 *Brandis & Broun on North Carolina Evidence* § 190 n.355 (2018) (collecting additional examples).

In redistricting cases in particular, state and federal courts routinely rely on expert testimony about legislative intent and motive in drawing districts. *E.g.*, *Cooper*, 137 S. Ct. at 1477; *League of Women Voters of Pa. v. Commonwealth*, 178 A.3d 737, 771-79, 818-20 (Pa. 2018). Numerous courts have relied on expert testimony about legislative intent from Dr. Chen in particular.[2] The Fourth Circuit has even held that a district court "clearly and reversibly erred in rejecting Dr. Chen's expert testimony" that the North Carolina General Assembly was "motivated by a partisan purpose" in redrawing the districts for two county legislative bodies in Wake County. *Raleigh Wake Citizens Ass'n v. Wake Cty. Bd. of Elections*, 827 F.3d 333, 344 (4th Cir. 2016). And the Pennsylvania Supreme Court, in striking down Pennsylvania's congressional plan on partisan gerrymandering grounds, found "Dr. Chen's expert testimony" to be "the most compelling evidence" that partisan motivations subordinated traditional districting criteria. *League of Women Voters of Pa.*, 178 A.3d at 818.

The terms "gerrymandering," "packing," and "cracking" also carry lay, non-legal meaning. As explained, Dr. Cooper defined these terms at his deposition to have precisely such meanings. There is nothing improper about an expert testifying using his or her own defined terms.

Nor is there any serious question that Dr. Chen and Dr. Cooper's testimony about these terms is based on their expertise. Legislative Defendants offer no authority or support for characterizing Dr. Chen's testimony as "conclusory statements." Mot. at 7. In fact, Dr. Chen's

[2] *E.g.*, *League of Women Voters*, 178 A.3d at 818 ("Perhaps the most compelling evidence concerning the 2011 Plan derives from Dr. Chen's expert testimony."); *League of Women Voters of Michigan v. Benson*, 373 F. Supp. 3d 867, 901 (E.D. Mich. 2019) ("The Court finds that Dr. Chen's data is reliable."); *Common Cause v. Rucho*, 318 F. Supp. 3d 777, 876 (M.D.N.C. 2018) ("Dr. Chen's analyses provide compelling evidence that the General Assembly's predominant intent in drawing and enacting the 2016 Plan was to subordinate the interests of non-Republican voters and entrench Republican congressmen in office."); *City of Greensboro v. Guilford Cty. Bd. of Elections*, 251 F. Supp. 3d 935, 943 (M.D.N.C. 2017) ("Credible evidence based on computer simulations run by Dr. Chen again establishes . . . that this partisan skew resulted from an intent to significantly favor Republican voters." (quotation marks omitted)).

expert reports in this case describe in detail the sophisticated computer simulation techniques that underlie his analyses and opinions. And again, Legislative Defendants do not dispute that the methodologies employed by both Dr. Chen and Dr. Cooper are reliable.

III. Dr. Cooper May Testify about the Partisan Motivation Behind the 2017 Plan Based on Dr. Hofeller's Files

At the back of their motion, Legislative Defendants assert that Dr. Cooper may not testify, based on analyses he conducted of Dr. Hofeller's mapping files, that "partisanship was the overwhelming, if not the sole, motivation in drawing the state House and state Senate districts at issue." Mot. at 9-10 (quoting Cooper Rebuttal Report at 3). Legislative Defendants challenge this testimony not on the ground that it expresses a legal conclusion, but on two other grounds. Neither is persuasive.

First, Legislative Defendants note that while Dr. Hofeller's files displayed partisan data for all of the relevant districts—indicating that Dr. Hofeller had full knowledge of the partisan implications of the district lines as he drew them—his files also contained population data. Mot. at 10. Plaintiffs believe this critique is meritless, but in any event, at best it goes "to weight and credibility of the evidence, not admissibility." *Blair v. Blair*, 818 S.E.2d 413, 416 (N.C. Ct. App. 2018).

Second, Legislative Defendants fault Dr. Cooper for "providing no metric for the Court to use" in determining whether "the maps at issue here [are] unconstitutional." Mot. at 10. This argument is backwards. The legal standard or "metric" for when a map is unconstitutional is a question of law for the courts to decide. Dr. Cooper's testimony is admissible precisely because he *declined* to usurp the province of the Court by offering that sort of legal conclusion.

IV. Legislative Defendants Have Not Shown a Need for a Pretrial *in Limine* Ruling

In addition to being unfounded for the reasons just explained, Legislative Defendants' requested relief is premature and unnecessary. This is a bench trial; there is no jury that could be irrevocably misled by inadmissible testimony. For that reason, there is simply no need for this Court to issue a prophylactic *in limine* order policing Dr. Chen's and Dr. Cooper's word choices before either of them takes the stand.

Legislative Defendants may object to specific testimony by Dr. Chen or Dr. Cooper at trial. The Court may rule on any such objection at that point, when the Court will have a much fuller picture of the witness's testimony and its place in Plaintiffs' case. The Court could even reserve decision on any such objection until after trial and simply decline in its findings of fact and conclusions of law to rely upon any testimony the Court concludes is inadmissible. In all events, there is no need for a pretrial order precluding any testimony by Dr. Chen or Dr. Cooper.

CONCLUSION

For the foregoing reasons, Legislative Defendants' motion *in limine* to exclude certain testimony of Plaintiffs' experts Dr. Chen and Dr. Cooper should be denied.

Respectfully submitted this the 1st day of July, 2019

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CERTIFICATE OF SERVICE

I hereby certify that I have this day served a copy of the foregoing *by email*, addressed to the following persons at the following addresses which are the last addresses known to me:

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This the 1st day of July, 2019.

/s/ Edwin M. Speas, Jr.
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Exhibit 1

EXPERT REPORT OF JOWEI CHEN, Ph.D.

April 8, 2019

I am an Associate Professor in the Department of Political Science at the University of Michigan, Ann Arbor. I am also a Research Associate Professor at the Center for Political Studies of the Institute for Social Research at the University of Michigan and a Research Associate at the Spatial Social Science Laboratory at Stanford University. In 2007, I received a M.S. in Statistics from Stanford University, and in 2009, I received a Ph.D. in Political Science from Stanford University. I have published academic papers on legislative districting and political geography in several political science journals, including *The American Journal of Political Science* and *The American Political Science Review*, and *Election Law Journal*. My academic areas of expertise include legislative elections, spatial statistics, geographic information systems (GIS) data, redistricting, racial politics, legislatures, and political geography. I have expertise in the use of computer simulations of legislative districting and in analyzing political geography, elections, and redistricting.

I have authored expert reports in the following redistricting court cases: The League of Women Voters of Florida et al. v. Ken Detzner et al. (Fla. 2d Judicial Cir. Leon Cnty. 2012); Rene Romo et al. v. Ken Detzner et al. (Fla. 2d Judicial Cir. Leon Cnty. 2013); Missouri National Association for the Advancement of Colored People v. Ferguson-Florissant School District and St. Louis County Board of Election Commissioners (E.D. Mo. 2014); Raleigh Wake Citizens Association et al. v. Wake County Board of Elections (E.D.N.C. 2015); Corrine Brown et al. v. Ken Detzner et al. (N.D. Fla. 2015); City of Greensboro et al. v. Guilford County Board of Elections (M.D.N.C. 2015); Common Cause et al. v. Robert A. Rucho et al. (M.D.N.C. 2016); The League of Women Voters of Pennsylvania et al. v. Commonwealth of Pennsylvania et al. (No. 261 M.D. 2017); Georgia State Conference of the NAACP et al. v. The State of Georgia et al. (N.D. Ga. 2017); The League of Women Voters of Michigan et al. v. Ruth Johnson et al. (E.D. Mich. 2017); and William Whitford et al. v. Beverly Gill et al. (W.D. Wis. 2018). I have testified either at deposition or at trial in the following cases: Rene Romo et al. v. Ken Detzner et al. (Fla. 2d Judicial Cir. Leon Cnty. 2013); Missouri National Association for the Advancement of Colored People v. Ferguson-Florissant School District and St. Louis County Board of Election Commissioners (E.D. Mo. 2014); Raleigh Wake Citizens Association et al. v. Wake County Board of Elections (E.D.N.C. 2015); City of Greensboro et al. v. Guilford County Board of

Elections (M.D.N.C. 2015); Common Cause et al. v. Robert A. Rucho et al. (M.D.N.C. 2016); The League of Women Voters of Pennsylvania et al. v. Commonwealth of Pennsylvania et al. (No. 261 M.D. 2017); Georgia State Conference of the NAACP et al. v. The State of Georgia et al. (N.D. Ga. 2017); The League of Women Voters of Michigan et al. v. Ruth Johnson et al. (E.D. Mich. 2017); and William Whitford et al. v. Beverly Gill et al. (W.D. Wis. 2018). My Curriculum Vitae is attached as an exhibit to this report. I am being compensated $500 per hour for my work in this case.

Research Question and Summary of Findings

The attorneys for the plaintiffs in this case asked me to analyze the legislative districting plans enacted in 2017 for North Carolina's House of Representatives and Senate districts (the "2017 House Plan" and the "2017 Senate Plan"). Specifically, I was asked to analyze:

1) Whether partisan intent was the predominant factor in the drawing of the 2017 House and 2017 Senate Plans, both at a statewide level and with respect to certain county groupings.
2) The effect of the enacted plans on the number of Democratic and Republican legislators elected from North Carolina, both at a statewide level and with respect to certain county groupings;
3) The extent to which the 2017 House and 2017 Senate Plans conform to the "2017 House and Senate Plans Criteria" adopted by the House and Senate Redistricting Committees (the “2017 Adopted Criteria”), with the exception of the criterion regarding political considerations, and relatedly, the extent to which partisan intent subordinated these Adopted Criteria.
4) The effect of the enacted plans on the partisan composition of the individual plaintiffs’ House and Senate districts.

In conducting my academic research on legislative districting, partisan and racial gerrymandering, and electoral bias, I have developed various computer simulation programming techniques that allow me to produce a large number of non-partisan districting plans that adhere to traditional districting criteria using US Census geographies as building blocks. This simulation process ignores all partisan and racial considerations when drawing districts. Instead, the

computer simulations are programmed to optimize districts with respect to various traditional districting goals, such as equalizing population, maximizing geographic compactness, and preserving political subdivisions such as county, municipal, and precinct boundaries. By randomly generating a large number of districting plans that closely adhere to these traditional districting criteria, I am able to assess an enacted plan drawn by a state legislature and determine whether partisan goals motivated the legislature to deviate from these traditional districting criteria. More specifically, by holding constant the application of non-partisan, traditional districting criteria through the simulations, I am able to determine whether the enacted plan could have been the product of something other than the intentional pursuit of partisan advantage. With respect to North Carolina's 2017 House and 2017 Senate Plans, I determined that it could not.

I use this simulation approach to analyze North Carolina's 2017 House and 2017 Senate Plans in several different ways:

Statewide Plan Results: First, I conduct an initial set of 1,000 independent simulations for each chamber, instructing the computer to generate legislative districting plans that strictly follow the traditional districting criteria within the Adopted Criteria (i.e., population equality, geographic compactness, contiguity, respecting county groupings, and preserving municipal and precinct boundaries). These simulations, which follow only non-partisan districting criteria, are referred to as House Simulation Set 1 and Senate Simulation Set 1. I then measure the extent to which the 2017 House Plan and the 2017 Senate Plan deviate from these simulated plans with respect to the non-partisan portions of the Adopted Criteria. The simulation results demonstrate that the enacted 2017 House and Senate Plans both split far more precincts and municipalities than is reasonably necessary. Both enacted plans' districts are also significantly less geographically compact than the computer-simulated districts. By either measure of compactness specified in the 2017 Adopted Criteria (i.e., Reock and Polsby-Popper), the 2017 House Plan is significantly less compact than every single one of the 1,000 simulated House districting plans, and the 2017 Senate Plan is significantly less compact than every single one of the 1,000 simulated Senate districting plans.

By significantly subordinating these non-partisan, traditional districting criteria of geographic compactness and preserving municipal and precinct boundaries, the 2017 House Plan was able to create a total of 78 Republican-leaning districts (out of a total of 120 districts), as

measured using results from the ten historical elections that the General Assembly considered in 2017 according to the Adopted Criteria; the 2017 Senate Plan was able to create a total of 32 Republican-leaning districts (out of a total of 50 districts), as measured using the results of these ten historical elections. By contrast, the simulation results demonstrate that a map-drawing process adhering strictly to non-partisan, traditional districting criteria consistently creates plans with more Democratic districts and fewer Republican districts. Every one of the 1,000 simulated plans in House Simulation Set 1 creates fewer Republican-leaning districts than the enacted 2017 House Plan, and every one of the 1,000 plans in Senate Simulation Set 1 creates fewer Republican-leaning districts than the enacted Senate plan. Thus, 2017 House Plan and the 2017 Senate Plan are both extreme statistical outliers, creating levels of partisan bias never observed in a single one of the 1,000 computer-simulated plans for each chamber. Both enacted plans create more Republican seats and fewer Democratic seats than what is generally achievable through a map-drawing process that adheres solely to non-partisan, traditional districting criteria. The simulation results thus warrant the conclusion that partisan considerations predominated over non-partisan districting criteria, particularly geographic compactness and minimizing municipality and precinct splits, in the drawing of the 2017 House Plan and the 2017 Senate Plan.

Incumbency Protection: Having found that partisan considerations predominated in the drawing of the 2017 House Plan and the 2017 Senate Plan, I then conducted a separate analysis to evaluate whether an attempt to protect incumbent legislators in North Carolina's House and Senate delegation might explain the partisan bias in the two enacted plans. The Adopted Criteria defined "Incumbency Protection" as "avoid[ing] pairing incumbent members of the House or Senate with another incumbent," and I employ that definition. As detailed later in this report, I identified every district in the current districting plans for which the incumbent was protected (i.e., not paired with another incumbent) at the time the district was created. Although the protection of incumbents is not a traditional districting principle, I nevertheless analyzed whether an intentional effort to protect these incumbents somehow altered the partisan composition of districting plans and explains the Republican advantage exhibited by the 2017 House and Senate Plans.

I therefore conducted a second set of 1,000 House simulations and 1,000 Senate simulations by instructing the computer to produce districting plans that intentionally protect the

mathematically maximum possible number of incumbents within each county grouping. I also instructed the simulation algorithm to protect the very same set of incumbents who were protected in the 2017 House Plan and the 2017 Senate Plan, while otherwise adhering strictly to the non-partisan districting criteria specified in the 2017 Adopted Criteria (i.e., population equality, geographic compactness, contiguity, respecting county groupings, and preserving municipal and precinct boundaries). These simulations, which protect incumbents while otherwise following non-partisan districting criteria, are referred to as House Simulation Set 2 and Senate Simulation Set 2.

Analysis of these two sets of simulations demonstrates that an effort to avoid pairing incumbents does not explain the extreme Republican bias exhibited by the enacted plans. Among the 1,000 simulated House plans in House Simulation Set 2, not a single plan exhibits the same extreme level of Republican bias as the enacted House plan; instead, every simulated plan has fewer Republican and more Democratic districts. Similarly, among the 1,000 simulated Senate plans in Senate Simulation Set 2, not a single plan exhibits the same extreme level of Republican bias as the enacted Senate plan; instead, every simulated plan produces fewer Republican and more Democratic districts. These simulation results clearly disprove any notion that an effort to avoid pairing incumbents can explain the extreme partisan bias observed in the 2017 House Plan and the 2017 Senate Plan.

County Grouping-by-Grouping Analysis: I also evaluate the extent to which partisan intent predominated in the drawing of districts within particular county groupings, as drawn under the 2017 House and 2017 Senate Plans. Using both sets of 1,000 simulated House plans described above (House Simulation Set 1 and House Simulation Set 2), I compared the 2017 House Plan's version of districts within a particular county grouping to the entire distribution of computer-simulated districts in that same grouping. These comparisons allowed me to identify the particular groupings in the 2017 House Plan that are partisan outliers compared to the computer-simulated versions of that same grouping. Using this methodology, as described in detail later in this report, I found that the 2017 House plan contains partisan outlier districts within the following 15 House county groupings:

1. The Alamance County grouping
2. The Anson-Union County grouping
3. The Brunswick-New Hanover County grouping

4. The Buncombe County grouping

5. The Cabarrus-Davie-Montgomery-Richmond-Rowan-Stanly County grouping

6. The Cleveland-Gaston County grouping

7. The Columbus-Pender-Robeson County grouping

8. The Cumberland County grouping

9. The Duplin-Onslow County grouping

10. The Forsyth-Yadkin County grouping

11. The Franklin-Nash County grouping

12. The Guilford County grouping

13. The Lenoir-Pitt County grouping

14. The Mecklenburg County grouping; and

15. The Wake County grouping.

For the Senate, using both sets of 1,000 simulated Senate plans described above (Senate Simulation Set 1 and Senate Simulation Set 2), I compared the 2017 Senate Plan's districts within a particular county grouping to the entire distribution of computer-simulated districts produced within the same grouping. As described in detail later in this report, I found that the 2017 Senate plan contains partisan outlier districts within the following seven Senate county groupings:

1. The Alamance-Guilford-Randolph County grouping

2. The Bladen-Brunswick-New Hanover-Pender County grouping

3. The Buncombe-Henderson-Transylvania County grouping

4. The Davie-Forsythe County grouping

5. The Duplin-Harnett-Johnston-Lee-Nash-Sampson County grouping

6. The Franklin-Wake County grouping; and

7. The Mecklenburg County grouping.

In summary, I found many county groupings across North Carolina in which the 2017 House Plan and the 2017 Senate Plan contain partisan outlier districts when compared to computer-simulated plans that emerge from a partisan-neutral simulation algorithm. Furthermore, I found that a map-drawing process protecting the maximum possible number of incumbents within these county groupings, while otherwise adhering to non-partisan districting criteria, does not cause or explain the enacted plans' many partisan outlier districts in these 15

county groupings in the 2017 House Plan or in these seven county groupings in the 2017 Senate Plan.

Finally, to evaluate the partisan effect of the 2017 House Plan and the 2017 Senate Plan on individual plaintiffs in this litigation, I evaluate plaintiffs' districts, both in the computer-simulated plans produced for this report and in the 2017 House Plan and 2017 Senate Plan. Specifically, I compare the partisanship of plaintiffs' districts under the 2017 House and 2017 Senate Plan to the partisanship of plaintiffs' districts under the computer-simulated House and Senate plans. As described near the end of this report, I find that many individual plaintiffs live in House and/or Senate districts that are extreme outliers in their partisan composition compared to the districts those plaintiffs would live in under the computer-simulated plans.

The Logic of Districting Simulations

Once a districting plan has been drawn, academics and judges face a challenge in assessing the intent of the map-drawers, especially regarding partisan motivations. The central problem is that the mere presence of partisan bias may tell us very little about the intentions of those drawing the districts. Whenever political representation is based on winner-take-all districts, asymmetries between votes and seats can emerge merely because one party's supporters are more clustered in space than those of the other party. When this happens, the party with a more concentrated support base achieves a smaller seat share because it racks up large numbers of "surplus" votes in the districts it wins, while falling just short of the winning threshold in many of the districts it loses. This phenomenon, which I have described in my academic work,[1] can happen quite naturally in cities due to such factors as racial segregation, housing and labor markets, transportation infrastructure, and residential sorting by income and lifestyle.

In creating the 2017 Plans, the General Assembly announced that it would rely on ten statewide elections from 2010-2016, including statewide elections for US President, US Senator, Governor, Lieutenant Governor, and Attorney General. Tallying the results of these ten elections across the state shows that Democratic candidates won 47.92% of the overall two-party votes in these ten statewide contests. Yet, tallying the results of these same ten statewide election contests

[1] Jowei Chen and Jonathan Rodden, 2013. "Unintentional Gerrymandering: Political Geography and Electoral Bias in Legislatures" *Quarterly Journal of Political Science*, 8(3): 239-269; Jowei Chen and David Cottrell, 2016. "Evaluating Partisan Gains from Congressional Gerrymandering: Using Computer Simulations to Estimate the Effect of Gerrymandering in the U.S. House." *Electoral Studies*, Vol. 44, No. 4: 329-430.

district by district, Democratic candidates received more votes than Republican candidates in only 18 of 50 districts (36%) in the 2017 Senate Plan and in only 42 of 120 districts (35%) in the 2017 House Plan. In other words, the percentage of districts that are Democratic-favoring in each enacted plan is significantly lower than the Democrats' share of the statewide two-party vote in recent elections.

The crucial question is whether this skewed distribution of partisan outcomes created by the 2017 House Plan and the 2017 Senate Plan could have plausibly emerged from a non-partisan redistricting process and thus could be explained by non-partisan factors, such as a clustering of Democratic voters in large cities. To assess this question, one must compare the General Assembly's enacted districting plans to a standard based on a neutral districting process that follows the non-partisan redistricting criteria specified in the 2017 Adopted Criteria.

The computer simulations I conducted for this report have been created expressly for the purpose of developing such a standard. Conducting computer simulations of the districting process is the most statistically accurate strategy for generating a baseline against which to compare an enacted districting plan, such as the 2017 House and Senate Plans. The computer simulation process ignores any data regarding partisanship or racial demographics. Instead, the computer algorithm generates a large number of complete districting plans adhering strictly to the non-partisan portions of the 2017 Adopted Criteria. The districting simulation process uses precisely the same Census geographies and population data that the map-drawer used in creating the enacted districts. In this way, the districting plans that emerge from these computer simulations are based on, and thus account for, the very same population patterns and political boundaries across North Carolina that the General Assembly faced when drawing the 2017 Plans. If the geographic and population patterns of North Carolina voters naturally favor one party over the other, then the simulated plans would capture such inherent geographic and demographic bias.

I use the computer algorithm described above to generate 1,000 simulated House plans and 1,000 Senate plans in Simulation Set 1, adhering strictly to the non-partisan portions of the 2017 Adopted Criteria. Each simulated plan combines North Carolina's census geographies together in a different way, but always in compliance with the non-partisan districting criteria that the computer has been programmed to follow. The simulations thus produce a large distribution of non-partisan districting plans drawn solely on the basis of the non-partisan

portions of the 2017 Adopted Criteria. Later, I generate an additional 1,000 simulated House plans and 1,000 Senate plans in Simulation Set 2 by maximizing the protection of incumbents within each county grouping while otherwise adhering to the non-partisan portions of the 2017 Adopted Criteria.

To measure partisan performance under each of these computer-simulated plans, I used actual election results from statewide elections in North Carolina. During the 2017 redistricting process, Representative David Lewis announced at the House Redistricting Committee's August 10, 2017 meeting that the General Assembly would use the following ten statewide elections in creating the 2017 Plans: The 2010 US Senate election, the 2012 US President, Governor, and Lieutenant Governor elections, the 2014 US Senate election, and the 2016 US President, US Senate, Governor, Lieutenant Governor, and Attorney General elections.

I obtained an electronic file detailing the results of these ten 2010-2016 election contests at the census block level. I aggregated these block-level election results to the district level within each simulated plan, and I calculated the number of districts that would have been won by Democrats and Republicans under each districting plan. I use these calculations to measure the partisan performance of each simulated plan analyzed in this report. In other words, I look at the census blocks that would comprise a particular district in a given simulation and, using the actual election results from those census blocks, I calculate whether voters in that simulated district collectively cast more votes for Democratic or Republican candidates in the 2010-2016 statewide election contests. I performed such calculations for each district under each simulated plan to measure the number of districts Democrats or Republicans would win under that particular simulated districting map.

I also performed the same calculations for the enacted 2017 House Plan and the enacted 2017 Senate Plan. In other words, I aggregated the block-level results from the 2010-2016 statewide elections to the level of the 2017 House and Senate districts and determined how many districts Republicans and Democrats were expected to win under the enacted plans, based on these past statewide election results. As a statistical matter, if an enacted plan had been drawn without partisanship as its predominant consideration, the enacted plan’s partisan breakdown of seats would fall somewhere roughly within the normal range of the distribution of simulated, non-partisan plans. If the enacted plan is in the far tail end of the distribution, or lies outside the distribution altogether—meaning that it favors a particular party more than in the vast majority

or all of the simulated plans—then such a finding is a strong indication that the enacted plan was drawn with an overriding partisan intent to favor that political party, rather than to follow non-partisan, traditional districting criteria.

By randomly drawing districting plans with a process designed to strictly follow non-partisan districting criteria, the computer simulation process thus gives us a precise indication of the range of districting plans that plausibly and likely emerge when map-drawers are not motivated primarily by partisan goals. By comparing the enacted plans against the range of simulated plans with respect to partisan measurements, I am able to determine the extent to which a map-drawer's subordination of non-partisan districting criteria, such as geographic compactness and following municipal and precinct boundaries, was motivated by partisan goals.

These computer simulation methods are widely used by academic scholars to analyze districting maps. For over a decade, political scientists have used such computer-simulated districting techniques to make inferences about the racial and partisan intent of legislative map-drawers.[2] In recent years, a number of courts have also relied upon computer simulations to assess partisan bias in enacted districting plans.[3]

Non-Partisan Districting Criteria for North Carolina's Legislative Districts

In programming the computer simulation algorithm to produce House and Senate districting plans for North Carolina, I strictly followed the non-partisan portions of the 2017 Adopted Criteria, as adopted by the General Assembly's Joint Select Committee on Redistricting on August 10, 2017. Below, I describe these seven non-partisan districting criteria in detail and explain how each criterion is implemented by the computer algorithm to produce simulated plans for North Carolina's House and Senate districts:

1) *Population Equality:* The Adopted Criteria require legislative districts to contain populations within a 5% deviation of the ideal district population, as calculated using 2010 federal decennial census data. North Carolina's 2010 Census population was 9,535,483, so

[2] E.g., Carmen Cirincione, Thomas A. Darling, Timothy G. O'Rourke. "Assessing South Carolina's 1990s Congressional Districting," Political Geography 19 (2000) 189–211; Jowei Chen, "The Impact of Political Geography on Wisconsin Redistricting: An Analysis of Wisconsin's Act 43 Assembly Districting Plan." Election Law Journal

[3] *See, e.g.*, *League of Women Voters of Pa. v. Commonwealth*, 178 A. 3d 737, 818-21 (Pa. 2018); *Raleigh Wake Citizens Association v. Wake County Board of Elections*, 827 F.3d 333, 344-45 (4th Cir. 2016); *City of Greensboro v. Guilford County Board of Elections*, No. 1:15-CV-599, 2017 WL 1229736 (M.D.N.C. Apr 3, 2017); *Common Cause v. Robert A. Rucho*, No. 1:16-CV-1164 (M.D.N.C. Jan 11, 2018).

districts in the 120-member House have an ideal district population of 79,462, with an permissible range of 75,489 (95% of the ideal population) to 83,435 (105% of the ideal population). Each of the 50 Senate districts has an ideal district population of 190,710, with an permissible range of 181,174 (95% of the ideal population) to 200,245 (105% of the ideal population).

2) ***Contiguity***: The computer simulation algorithm requires districts to be geographically contiguous, with contiguity by water permitted.

3) County Groupings: The 2017 Adopted Criteria requires that all House and Senate districts remain fully within a single county grouping. In applying this requirement, the computer simulation algorithm uses exactly the same county groupings as are used by the 2017 House Plan and the 2017 Senate Plan, producing districts that each lie fully within one of the existing county groupings. Because the computer follows the same county groupings as the enacted plans, the simulated plans essentially freeze those enacted House and Senate districts located in county groupings that contain only a single district, as there are no alternative ways to draw those districts within the contours of the existing county groupings. Within each county grouping, the number of districts in each simulated plan (including both frozen districts and computer-simulated districts) is identical to the number of districts in the enacted 2017 House Plan and the 2017 Senate Plan.

Specifically, the enacted 2017 House Plan divides North Carolina's 100 counties into 41 county groupings. These 41 county groupings are listed and described in detail in Table 1. Thirteen of the county groupings in the House Plan contain only a single district, while the remaining 28 groupings contain two or more districts. In the 13 county groupings that contain only a single House district, the computer simulation algorithm simply freezes the single district contained within each of these groupings, since there are no alternative ways to draw these districts (because the district merely comprises one or more whole counties). These frozen districts are listed in the final column in Table 1. Thus, the simulation algorithm does not create any additional district lines or districts within these single-district county groupings. The final column of Table 1 also lists the number of computer-simulated districts within each of the House county groupings.

Meanwhile, the Senate Plan contains 29 county groupings, and 17 of these county groupings contain only a single district, while the remaining 12 groupings contain two or more

districts. In the 17 county groupings that contain only a single Senate district, the computer simulation algorithm simply freezes the single district contained within each grouping; these frozen districts are listed in the final column in Table 2. The final column of Table 2 also lists the number of computer-simulated districts within each of the Senate county groupings.

4) ***Minimizing County Traversals:*** The 2017 Adopted Criteria requires the minimization of county traversals by legislative districts. In order to comply with this criterion, I counted the total number of county traversals in each plan by counting, for each district, the number of county borders that must be crossed to traverse all parts of the district. If a district includes two, non-contiguous portions of a single county, then such a scenario would involve two county traversals. As an example, consider the Cabarrus-Davie-Montgomery-Richmond-Rowan-Stanly County grouping in the House. The 2017 House Plan creates five total county traversals in this county grouping: one in HD-77 (from Davie to Rowan County), one in HD-83 (from Rowan to Cabarrus County), one in HD-67 (from Cabarrus to Stanly County), and two in HD-66 (from Stanly to Montgomery County and then from Montgomery to Richmond County).

To comply with the county traversal requirement, the simulation algorithm guarantees that each county grouping contains only the minimum possible number of county traversals. As a result, each computer-simulated House plan contains exactly as many county traversals as the 2017 House Plan, while each computer-simulated Senate plan contains exactly as many county traversals as the 2017 Senate Plan. Within each county grouping, the simulation algorithm allows districts to cross county boundaries only when necessary to equalize district populations, with no double traversals permitted, and this restriction effectively minimizes the number of county traversals.

Additionally, minimizing county traversals in every single simulated House and Senate plan also resulted in plans that contain exactly the same number of split counties as the 2017 House Plan and 2017 Senate Plan. After producing the simulated plans in House Simulation Set 1 and 2 and Senate Simulation Sets 1 and 2, I re-analyzed these 4,000 computer-simulated plans to verify that each one contains exactly the same number of split counties and county traversals as the 2017 House Plan and the 2017 Senate Plan.

Table 1: County Groupings Used for the 2017 House Plan and All Computer-Simulated House Plans

County Grouping:	Counties Included:	2017 House Plan Districts:	Number of Computer-Simulated Districts in Grouping:
1	(1) Alamance	HD-63; HD-64	2
2	(6) Alexander; Alleghany; Rockingham; Stokes; Surry; Wilkes	HD-65; HD-90; HD-91; HD-94	4
3	(2) Anson; Union	HD-55; HD-68; HD-69	3
4	(2) Ashe; Watauga	HD-93	none (HD-93 is frozen)
5	(3) Avery; McDowell; Mitchell	HD-85	none (HD-85 is frozen)
6	(2) Beaufort; Craven	HD-3; HD-79	2
7	(6) Bertie; Camden; Chowan; Perquimans; Tyrrell; Washington	HD-1	none (HD-1 is frozen)
8	(7) Bladen; Greene; Harnett; Johnston; Lee; Sampson; Wayne	HD-10; HD-21; HD-22; HD-26; HD-28; HD-51; HD-53	5 (Additionally, Special Master Districts HD-21 and HD-22 are frozen)
9	(2) Brunswick; New Hanover	HD-17; HD-18; HD-19; HD-20	4
10	(1) Buncombe	HD-114; HD-115; HD-116	3
11	(2) Burke; Rutherford	HD-86; HD-112	2
12	(6) Cabarrus; Davie; Montgomery; Richmond; Rowan; Stanly	HD-66; HD-67; HD-76; HD-77; HD-82; HD-83	6
13	(1) Caldwell	HD-87	none (HD-87 is frozen)
14	(2) Carteret; Jones	HD-13	none (HD-13 is frozen)
15	(2) Caswell; Orange	HD-50; HD-56	2
16	(1) Catawba	HD-89; HD-96	2
17	(2) Chatham; Durham	HD-29; HD-30; HD-31; HD-54	4
18	(4) Cherokee; Clay; Graham; Macon	HD-120	none (HD-120 is frozen)
19	(2) Cleveland; Gaston	HD-108; HD-109; HD-110; HD-111	4
20	(3) Columbus; Pender; Robeson	HD-16; HD-46; HD-47	3
21	(1) Cumberland	HD-42; HD-43; HD-44; HD-45	4
22	(4) Currituck; Dare; Hyde; Pamlico	HD-6	none (HD-6 is frozen)
23	(1) Davidson	HD-80; HD-81	2
24	(2) Duplin; Onslow	HD-4; HD-14; HD-15	3
25	(2) Edgecombe; Martin	HD-23	none (HD-23 is frozen)
26	(2) Forsyth; Yadkin	HD-71; HD-72; HD-73; HD-74; HD-75	5
27	(2) Franklin; Nash	HD-7; HD-25	2
28	(3) Gates; Hertford; Pasquotank	HD-5	none (HD-5 is frozen)
29	(4) Granville; Person; Vance; Warren	HD-2; HD-32	2

30	(1) Guilford	HD-57; HD-58; HD-59; HD-60; HD-61; HD-62	3 (Additionally, Special Master Districts HD-57, HD-61, and HD-62 are frozen)
31	(2) Halifax; Northampton	HD-27	none (HD-27 is frozen)
32	(5) Haywood; Jackson; Madison; Swain; Yancey	HD-118; HD-119	2
33	(3) Henderson; Polk; Transylvania	HD-113; HD-117	2
34	(2) Hoke; Scotland	HD-48	none (HD-48 is frozen)
35	(1) Iredell	HD-84; HD-95	2
36	(2) Lenoir; Pitt	HD-8; HD-9; HD-12	3
37	(1) Lincoln	HD-97	none (HD-97 is frozen)
38	(1) Mecklenburg	HD-88; HD-92; HD-98; HD-99; HD-100; HD-101; HD-102; HD-103; HD-104; HD-105; HD-106; HD-107	12
39	(2) Moore; Randolph	HD-52; HD-70; HD-78	3
40	(1) Wake	HD-11; HD-33; HD-34; HD-35; HD-36; HD-37; HD-38; HD-39; HD-40; HD-41; HD-49	11
41	(1) Wilson	HD-24	none (HD-24 is frozen)

Note: In the final column of this table, House districts from the 2017 House Plan that are 'frozen' are automatically drawn in every computer-simulated House plan, without any altering or redrawing by the simulation algorithm. Frozen districts include: 1) House districts materially redrawn in 2017 by the Special Master; and 2) 2017 House Plan districts in county groupings that contain only a single district.

Table 2: County Groupings Used for the 2017 Senate Plan and All Computer-Simulated Senate Plans

County Grouping:	Counties Included:	2017 Senate Plan Districts:	Number of Computer-Simulated Districts in Grouping:
1	(3) Alamance; Guilford; Randolph	SD-24; SD-26; SD-27; SD-28	2 (Special Master Districts SD-24 and SD-28 are frozen)
2	(2) Alexander; Catawba	SD-42	none (SD-42 is frozen)
3	(8) Alleghany; Ashe; Caswell; Rockingham; Stokes; Surry; Watauga; Wilkes	SD-30; SD-45	2
4	(4) Anson; Moore; Richmond; Scotland	SD-25	none (SD-25 is frozen)
5	(3) Avery; Burke; Caldwell	SD-46	none (SD-46 is frozen)
6	(6) Beaufort; Bertie; Martin; Northampton; Vance; Warren	SD-3	none (SD-3 is frozen)
7	(4) Bladen; Brunswick; New Hanover; Pender	SD-8; SD-9	2
8	(3) Buncombe; Henderson; Transylvania	SD-48; SD-49	2
9	(2) Cabarrus; Union	SD-35; SD-36	2
10	(11) Camden; Chowan; Currituck; Dare; Gates; Hertford; Hyde; Pasquotank; Perquimans; Tyrrell; Washington	SD-1	none (SD-1 is frozen)
11	(3) Carteret; Craven; Pamlico	SD-2	none (SD-2 is frozen)
12	(2) Chatham; Orange	SD-23	none (SD-23 is frozen)
13	(7) Cherokee; Clay; Graham; Haywood; Jackson; Macon; Swain	SD-50	none (SD-50 is frozen)
14	(3) Cleveland; Gaston; Lincoln	SD-43; SD-44	2
15	(2) Columbus; Robeson	SD-13	none (SD-13 is frozen)
16	(2) Cumberland; Hoke	SD-19; SD-21	none (Special Master Districts SD-19 and SD-21 are frozen)
17	(2) Davidson; Montgomery	SD-29	none (SD-29 is frozen)
18	(2) Davie; Forsyth	SD-31; SD-32	2
19	(6) Duplin; Harnett; Johnston; Lee; Nash; Sampson	SD-10; SD-11; SD-12	3
20	(3) Durham; Granville; Person	SD-20; SD-22	2
21	(3) Edgecombe; Halifax; Wilson	SD-4	none (SD-4 is frozen)
22	(2) Franklin; Wake	SD-14; SD-15; SD-16; SD-17; SD-18	5
23	(2) Greene; Pitt	SD-5	none (SD-5 is frozen)
24	(2) Iredell; Yadkin	SD-34	none (SD-34 is frozen)
25	(2) Jones; Onslow	SD-6	none (SD-6 is frozen)
26	(2) Lenoir; Wayne	SD-7	none (SD-7 is frozen)
27	(6) McDowell; Madison; Mitchell; Polk; Rutherford; Yancey	SD-47	none (SD-47 is frozen)
28	(1) Mecklenburg	SD-37; SD-38; SD-39; SD-40; SD-41	5
29	(2) Rowan; Stanly	SD-33	none (SD-33 is frozen)

Note: Senate districts that are 'frozen' are automatically drawn in every computer-simulated Senate plan.

5) ***Geographic Compactness***: The 2017 Adopted Criteria mandates the consideration of geographic compactness in the drawing of legislative districts, specifying two commonly-used measures of district compactness: The Reock score and the Polsby-Popper score.

The computer simulation algorithm thus attempts to draw geographically compact districts whenever doing so does not violate any of the aforementioned criteria. After completing the computer simulations, I then compare the compactness of the simulated plans and the enacted plans using the two measures of compactness specified by the 2017 Adopted Criteria:

First, I calculate the average Reock score of the districts within each plan. The Reock score for each individual district is calculated as the ratio of the district's area to the area of the smallest bounding circle that can be drawn to completely contain the district; thus, higher Reock score indicate more geographically compact districts. The 2017 House Plan has an average Reock score of 0.4124 across its 120 districts, while the 2017 Senate Plan has an average Reock score of 0.4267 across its 50 districts. As detailed later in this report, every one of the 2,000 computer-simulated House plans in House Simulation Sets 1 and 2 is significantly more compact than the 2017 House Plan, as measured by average Reock score. Similarly, every one of the 2,000 simulated Senate plans in Senate Simulation Sets 1 and 2 is significantly more compact than the 2017 Senate Plan, as measured by average Reock score.

Second, I calculate the average Polsby-Popper score of each plan's districts. The Polsby-Popper score for each individual district is calculated as the ratio of the district's area to the area of a hypothetical circle whose circumference is identical to the length of the district's perimeter; thus, higher Polsby-Popper scores indicate greater district compactness. The 2017 House Plan has an average Polsby-Popper score of 0.3206 across its 120 districts, while the 2017 Senate Plan has an average Polsby-Popper score of 0.3480 across its 50 districts. As described later, every single one of the 2,000 computer-simulated House plans in this report has a higher Polsby-Popper score than the 2017 House Plan, and every single one of the 2,000 simulated Senate plans has a higher Polsby-Popper score than the 2017 Senate Plan.

6) ***Minimizing Split Precincts***: North Carolina is divided into 2,692 Voting Tabulation Districts ("VTDs"), which is the generic term used by the US Census Bureau to describe North Carolina's precincts in maps depicting census geographies. Although the 2017 Adopted Criteria uses the term "precincts," the General Assembly's Reference Data used during the 2017 redistricting process use the term "VTD." Additionally, the General Assembly's Stat Pack

documents analyzing its House and Senate plans during the 2017 redistricting process also use the term "Split VTDs."[4] I therefore follow the General Assembly's practice by using Census VTD boundaries in analyzing each simulated plan and the enacted plans.

Avoiding the splitting of precincts is a traditional districting criterion as well as a consideration mandated by the 2017 Adopted Criteria. The computer simulation algorithm thus attempts to keep VTDs intact and not split them into multiple districts. In calculating the number of split municipalities in each districting plan, I rely upon the VTD boundary maps included in the geographic Reference Data used and made available by the General Assembly in its various rounds of redistricting during the current decade.[5] I use these VTD boundary maps, rather than any of the precinct maps compiled and produced by the State Board of Elections, because the General Assembly produced and used these data during its own redistricting. I count a VTD as split only if a populated portion of a VTD is assigned to a different district than the remainder of the VTD. Hence, I do not count a VTD as split if only an unpopulated portion of a VTD is assigned to a different district than the remainder of the VTD.

Overall, the 2017 House Plan splits 48 VTDs, while the 2017 Senate Plan splits 5 VTDs. As described later in this report, all 2,000 of the computer simulated House maps and all 2,000 of the simulated Senate maps produced in this report split fewer VTDs than the 2017 House Plan and the 2017 Senate Plan, respectively. The computer-simulated House plans split from 6 to 20 VTDs in each plan, while the computer-simulated Senate plans split from 0 to 3 VTDs in each plan.

7) *Following Municipal Boundaries:* A traditional districting principle in the drawing of districting plans is the avoidance of splitting municipalities. Following municipal boundaries is also explicitly mentioned as a consideration in the 2017 Adopted Criteria. North Carolina contains 553 incorporated municipalities, including both cities and townships. The computer simulation algorithm attempts to keep these municipalities intact and not split them into multiple districts.

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[4] The House plan Stat Pack was downloaded from:
https://www.ncleg.net/Sessions/2017/h927maps/H927%20Plan%20A2%20HBK-25%20-%20dc2016GE_StatPack.pdf
The Senate plan Stat Pack was downloaded from:
https://www.ncleg.gov/Sessions/2017/s691maps/S691%204th%20Ed.Combined.pdf

[5] Downloaded from: https://www.ncleg.gov/RnR/Redistricting/BaseData2011.

For the purpose of counting municipal splits, I treat a municipality that is divided across two counties as two separate municipalities. Hence, a municipality that partially lies within two counties, each of which is assigned to a separate district, does not count as a split municipality. Additionally, a municipality that primarily lies within one district but has an unpopulated area assigned to a different district is not counted as a split municipality.

Overall, the 2017 House Plan splits 79 municipalities, while the 2017 Senate Plan splits 25 municipalities. As described later in this report, all 2,000 of the computer-simulated House maps and the 2,000 of the simulated Senate maps produced in this report split far fewer municipalities than the 2017 House Plan and the 2017 Senate Plan, respectively.

Freezing Districts Drawn by the Special Master: In the *Covington* litigation, Special Master Nathaniel Persily redrew two House districts (HD-21 and HD-57) and two Senate districts (SD-21 and SD-28) that the federal court had found to be racially gerrymandered. In redrawing those districts, to equalize population, the Special Master also made material changes to HD-22, HD-61, and HD-62 in the House, and SD-19, SD-24, and SD-27 in the Senate. With one exception described below, I freeze these Special Master-drawn districts in all computer-simulated House and Senate plans produced for this report.

In every computer-simulated House plan in House Simulation Set 1 and Set 2, I freeze all five of the above-listed Special Master-drawn House districts. These frozen districts are HD-21, HD-22, HD-57, HD-61, and HD-62, and they appear in every House simulated plan exactly as drawn in the enacted 2017 House Plan.

In every computer-simulated Senate plan in Senate Simulation Set 1 and Set 2, I freeze four of the five Special Master-drawn Senate districts. These four frozen Senate districts are SD-19, SD-21, SD-24, and SD-28, and they appear in every Senate simulated plan exactly as drawn in the enacted 2017 Senate Plan. The fifth Senate district drawn by the Special Master, SD-27 (Guilford County), is not frozen in any of the simulated plans. Freezing SD-27 along with SD-24 and SD-28, combined with the existing boundaries of the Alamance-Guilford-Randolph county grouping, would effectively also freeze the boundaries of the remaining district in this county grouping, SD-26, which the Special Master did not alter at all in 2017. Instead of freezing SD-27, the computer algorithm produces two computer-simulated Senate districts in the area currently occupied by SD-26 and SD-27 in the 2017 Senate Plan, following the non-partisan redistricting criteria outlined above. Because my algorithm freezes SD-24 and SD-28 from the

2017 Senate Plan, the only portions of this county grouping that my simulations change from the 2017 Senate Plan are the district borders between SD-26 and SD-27 in southern Guilford County. To be clear, the simulations make no changes to SD-28, which is the actual district that the Special Master was tasked with redrawing because it had been previously found racially gerrymandered.

No Consideration of Partisan or Racial Data: The simulation algorithm makes no use of any racial data, and no such data is made available to the algorithm. Additionally, no political or partisan data is used by the simulation algorithm, aside from the consideration of incumbent legislators' home addresses in House Simulation Set 2 and Senate Simulation Set 2, as described later in this report.

Uniqueness of Each Computer-Simulated Districting Plan: Because the simulation algorithm randomly draws district borders, each statewide House or Senate plan produced by the algorithm is different. After the algorithm created 4,000 districting plans (in House Simulation Sets 1 and 2 and Senate Simulation Sets 1 and 2), I examined each of these 4,000 statewide plans and verified that no two computer-simulated plans are identical to one another.

Measuring the Partisanship of Districting Plans

I use actual election results from recent, statewide election races in North Carolina to assess the partisan performance of the simulated and enacted districting plans analyzed in this report. Overlaying these past election results onto a districting plan enables me to calculate the number of Republican- and Democratic-leaning districts within each simulated plan and within the 2017 House and 2017 Senate Plans. These calculations thus allow me to directly compare the partisanship of the enacted plan and the simulated plans. These partisan comparisons allow me to determine whether or not the partisan distribution of seats in the enacted plan could reasonably have arisen from a districting process respecting the non-partisan traditional districting criteria. Past voting history in federal and statewide elections is a strong predictor of future voting history. Mapmakers thus can and do use past voting history to identify the class of voters, at a precinct-by-precinct level, who are likely to vote for Democratic (or Republican) candidates for the state legislature.

In general, the most reliable method of comparing the partisanship of different legislative districts within a state is to consider whether these districts have tended to favor Republican or

Democratic candidates in recent, competitive *statewide* elections, such as the Presidential, Gubernatorial, Attorney General, and US Senate elections. Recent statewide elections provide the most reliable bases for comparisons of different precincts' partisan tendencies because in any statewide election, the anomalous candidate-specific effects that shape the election outcome are equally present in all precincts across the state. Statewide elections are thus a better basis for comparison than the results of legislative elections because the particular outcome of any legislative election may deviate from the long-term partisan voting trends of that precinct, due to factors idiosyncratic to the legislative district as currently constructed. Such factors can include the presence or absence of a quality challenger, anomalous difference between the candidates in campaign efforts or campaign finances, incumbency advantage, candidate scandals, and coattail effects.[6] Because these idiosyncratic factors would change if the legislative district were drawn differently, it is particularly unsuitable to use election results from an existing legislative district when comparing the partisanship of an existing district to a simulated district that would have different boundaries.

Indeed, in both the 2011 and 2017 rounds of redistricting the North Carolina House and Senate, the General Assembly publicly disclosed that it was relying solely on recent statewide elections in measuring the partisanship of the state legislative districts being created.

The 2010-2016 Statewide Election Results: The 2017 Adopted Criteria describe the use of "elections results data" during the drawing of the 2017 House and Senate plans. Furthermore, during the August 10, 2017 meeting of the Joint Select Committee on Redistricting, Representative David Lewis specified the ten past statewide elections whose results would be considered by the Committee in drawing the 2017 legislative plan districts. These ten statewide elections contests are: The 2010 US Senate election, the 2012 US President, Governor, and Lieutenant Governor elections, the 2014 US Senate election, and the 2016 US President, US Senate, Governor, Lieutenant Governor, and Attorney General elections.

In this report, I primarily use this same set of ten election results to measure the partisan performance of the enacted and computer-simulated districting plans I analyze. These election results enable me to calculate the number of Republican- and Democratic-leaning districts within each plan, thus allowing me to determine whether or not the partisan distribution of seats in the

[6] E.g., Alan Abramowitz, Brad Alexander, and Matthew Gunning. "Incumbency, Redistricting, and the Decline of Competition in U.S. House Elections." *The Journal of Politics.* Vol. 68, No. 1 (February 2006): 75-88.

enacted plan could reasonably have arisen from a districting process respecting the various traditional criteria set forth in the Adopted Criteria.

Specifically, I evaluate the partisanship of legislative districts in North Carolina by counting up the total number of Republican and Democratic votes cast in these ten statewide elections. I weigh each election equally and calculate, within each district, the Democratic and Republican share of the two-party votes (i.e., votes for the Democratic and Republican candidates) aggregated across all ten of these elections. I also count whether each district contains more Republican or Democratic voters, aggregated over all of these ten elections. I find that, using the results of these ten elections, total Republican votes outnumbered total Democratic votes in 78 districts in the 2017 House Plan and in 32 districts in the 2017 Senate Plan. Throughout this report, except where otherwise noted, I apply this same formula for evaluating all of the simulated districting plans, allowing for a direct comparison of the partisanship of the enacted and the simulated plans. I refer to the aggregated election results from these ten statewide elections as the "2010-2016 Statewide Election Composite."

Table 3 illustrates an example of how the 2010-2016 Statewide Election Composite is used to measure the partisanship of individual districts throughout this report. This Table reports the number of votes for the Democratic and Republican candidates in each of the ten statewide elections for HD-1 and HD-5 in the 2017 House Plan. Tallying the results of the ten statewide elections in HD-1, Democrats received a total of 164,682 votes, while Republicans received 165,368 total votes. Thus, Democrats' share of the two-party vote in HD-1 across these ten elections was 49.90%, and I therefore classify this district as a Republican-favoring district using the 2010-2016 Statewide Election Composite. On the other hand, voters in HD-5 cast a total of 174,448 Democratic votes and 122,275 Republican votes across the ten elections, giving Democrats a two-party vote share of 58.79%. I therefore classify HD-5 as a Democratic-favoring district using the 2010-2016 Statewide Election Composite. Throughout this report, except where otherwise noted, I measure the partisanship of every district using the 2010-2016 Statewide Election Composite when producing statewide comparisons of the computer-simulated plans and to the 2017 House and Senate Plans.

The 2004-2010 Statewide Election Results: The 2017 House Plan and the 2017 Senate Plan both include some districts that remained unchanged from the General Assembly's previous legislative districting plans enacted in 2011. Specifically, 41 districts in the 2017 House Plan and

15 districts in the 2017 Senate Plan were left unaltered from the previous districting plans enacted in 2011. Because the General Assembly originally drew these districts in 2011, in order to assess the General Assembly's intent at the time of drawing these districts, I use the pre-2011 election data available to and used by the General Assembly when I evaluate the county groupings containing these districts that were drawn in 2011 and not altered in 2017.

Table 3:
The Calculation of District-Level Partisanship Using the 2010-2016 Statewide Election Composite:

	House District 1 (2017 House Plan):		House District 5 (2017 House Plan):	
Election Contest:	**Democratic Votes**	**Republican Votes**	**Democratic Votes**	**Republican Votes**
2010 US Senate	11,572	12,798	10,791	8,307
2012 US President	19,188	17,761	20,871	13,179
2012 Governor	19,104	16,908	20,700	12,290
2012 Lieutenant Governor	20,570	15,314	21,685	11,591
2014 US Senate	12,208	11,858	11,521	7,987
2016 US President	16,455	18,589	17,840	14,071
2016 US Senate	16,040	18,358	17,542	13,942
2016 Governor	16,170	18,855	17,723	14,115
2016 Lieutenant Governor	16,328	17,778	17,580	13,598
2016 Attorney General	17,047	17,149	18,195	13,195
Total Votes:	**164,682**	**165,368**	**174,448**	**122,275**
Democratic Vote Share, measured using 2010-2016 Statewide Election Composite:	**49.90%**		**58.79%**	

Specifically, during the 2011 redistricting cycle, the General Assembly's "2011 Redistricting Database" contained the results from 15 statewide elections held during 2004-2010. These 15 statewide elections contests are: The 2004 US President, US Senate, Governor, and Auditor elections, the 2008 US President, US Senator, Governor, Lieutenant Governor, Attorney General, Auditor, Commissioner of Agriculture, Commissioner of Insurance, Commissioner of Labor, and Superindendent of Public Instruction elections, and the 2010 US Senate election. Thus, when analyzing specific county groupings from the 2017 House and 2017 Senate Plans

containing 2011-drawn districts, I measure the partisanship of these 2011-drawn districts by counting up the total number of Republican and Democratic votes cast within these districts in these 15 pre-2011 statewide elections. As before, I weigh each election equally and calculate, within each district, the Democratic and Republican share of the two-party votes aggregated across all 15 of these elections. This aggregated set of 15 pre-2011 election results was the data available to the General Assembly when it enacted the 2011-drawn districts, and this pre-2011 partisanship measure is hereinafter referred to as the "2004-2010 Statewide Election Composite."

Table 4 illustrates an example of how the 2004-2010 Statewide Election Composite is used to measure the partisanship of the 2011-drawn districts that remained unchanged in the 2017 House and 2017 Senate Plans. The General Assembly originally drew the boundaries of HD-63 and HD-64 in Alamance County in the 2011 House Plan, and the boundaries of these two districts remained unchanged in the 2017 House Plan. Therefore, when I evaluate the partisanship of House districts in the Alamance County grouping, I use the 2004-2010 Statewide Election Composite. Table 4 reports the number of votes for the Democratic and Republican candidates in each of the 15 statewide elections for HD-63 and HD-64. Tallying the results of these 15 statewide elections in HD-63, Democrats received a total of 191,146 votes, while Republicans received 202,805 total votes. Thus, Democrats' share of the two-party vote in HD-63 across these 15 elections was 48.52%, and I therefore describe this district as a having a 48.52% Democratic vote share using the 2004-2010 Statewide Election Composite in my county grouping-by-grouping analysis later in this report. Similarly, HD-64 cast a total of 166,385 Democratic votes and 190,719 Republican votes across these 15 elections, giving Democrats a two-party vote share of 46.59%, using the 2004-2010 Statewide Election Composite.

Note that throughout this report, I use the 2004-2010 Statewide Election Composite only in my county grouping-level analysis of specific groupings containing districts that were originally drawn in 2011. This county grouping-by-grouping analysis is illustrated in Figures 25 to 94 and is described in detail later in this report. I do not use the 2004-2010 Statewide Election Composite in any of my statewide comparisons of the computer-simulated plans and the 2017 enacted plans (which appear in Tables 5 and 6 and Figures 1 to 24 and is described in detail later in this report). For all statewide comparisons of simulated and enacted districting plans, I use 2010-2016 statewide elections to measure the partisanship of each plan.

Table 4:
Calculating the Partisanship of Districts Originally Drawn in 2011
Using the 2004-2010 Statewide Election Composite:

	House District 63 (2017 House Plan):		House District 64 (2017 House Plan):	
Election Contest:	**Democratic Votes**	**Republican Votes**	**Democratic Votes**	**Republican Votes**
2004 Auditor	6,917	8,204	6,496	8,089
2004 Governor	8,598	7,320	7,986	7,314
2004 US President	6,390	9,805	5,934	9,563
2004 US Senate	7,048	8,891	6,512	8,774
2008 Attorney General	19,822	13,147	16,803	12,668
2008 Auditor	16,380	15,702	14,036	14,637
2008 Commissioner of Agriculture	13,804	18,814	11,569	17,726
2008 Commissioner of Insurance	15,721	15,394	13,356	14,456
2008 Commissioner of Labor	14,245	18,164	12,284	16,671
2008 Governor	16,195	16,257	14,261	14,824
2008 Lieutenant Governor	15,600	16,241	13,454	15,095
2008 US President	15,506	18,093	13,412	16,766
2008 Superindendent of Public Instruction	9,856	7,744	8,799	7,509
2008 US Senate	16,582	15,998	14,519	14,646
2010 US Senate	8,482	13,031	6,964	11,981
Total Votes:	191,146	202,805	166,385	190,719
Democratic Vote Share, measured using 2004-2010 Statewide Election Composite:	48.52%		46.59%	

***Statewide Measures of a Districting Plan's Partisan Bias*:** In this report, I present three different measures of the partisanship of each enacted and computer-simulated districting plan analyzed:

Number of Democratic and Republican Districts: First, using the 2010-2016 Statewide Election Composite, I count the number of Republican- and Democratic-leaning districts in each plan. A district is classified as Republican if the total sum of Republican votes in the district across all of the 2010-2016 elections (or, where relevant, the 2004-2010 elections) exceeds the total sum of Democratic votes; otherwise, the district is classified as Democratic. Under this measure, every district in a plan is classified as either Democratic or Republican, and I use this

measure to compare the partisanship of each enacted plan to the computer-simulated plans for each legislative chamber.

Uniform Swing Adjustments: Second, I apply a series of uniform swing adjustments to the 2010-2016 Statewide Election Composite, and I calculate the number of Democratic-favoring districts in each enacted plan and the computer-simulated plans under these different uniform swing adjustments. I apply various alternative uniform swings to the 2010-2016 Statewide Election Composite, ranging from -6% to +6% (at intervals of 0.5%). The use of uniform swing calculations is useful because it reveals and compares how the enacted plans and the computer-simulated plans would likely perform under varying electoral conditions (e.g., in a Republican-favorable election, a Democratic-favorable election, or a relatively even election).

Note that the 2010-2016 Statewide Election Composite produced an overall 47.92% Democratic vote share statewide. Therefore, a +0% uniform swing condition corresponds to a 47.92% statewide Democratic vote share, a +6% uniform swing corresponds to a 53.92% statewide Democratic vote share, and a -6% uniform swing corresponds to a 41.92% statewide Democratic vote share. Under each of these 25 uniform swing conditions (ranging from -6% to +6%), I calculate each computer-simulated plan's number of Democratic-favoring districts, as measured using the 2010-2016 Statewide Election Composite and adjusting for the uniform swing. I then compare these simulation calculations to the same calculations for the 2017 House Plan and the 2017 Senate Plan.

The Mean-Median Difference: Third, I calculate each districting plan's Mean-Median Difference, which is another accepted method that redistricting scholars commonly use for comparing the relative partisan bias of different districting plans. The Mean-Median Difference for any given plan is calculated as the mean district-level Democratic vote share, minus the median district-level Democratic vote share. For any House districting plan, the mean is simply calculated as the average of the Democratic vote shares in each of the 120 districts. For any House plan, the median is the Democratic vote share in the district where Democrats performed the middle-best, which is the district that Democrats would need to win to secure a majority of the chamber. Since a House plan contains 120 districts, all 120 districts are lined up in order from lowest to highest Democratic vote share, and the median district is calculated as the average of the Democratic vote share in the districts where Democrats performed the 60th and 61st-best across the state. Using the 2010-2016 Statewide Election Composite to measure partisanship, the

districts in the 2017 House Plan have a mean Democratic vote share of 47.84%, while the median district has a Democratic vote share of 42.50%. Thus, the 2017 House Plan has a Mean-Median Difference of +5.33%, indicating that the median district is skewed significantly more Republican than the plan's average district. This Mean-Median Difference suggests that, assuming uniform swings in the vote across the state, Democrats would need to win an average of 55.33% of the vote across all districts statewide in order to win the median district, and hence in order to win a majority of House seats in the General Assembly under the enacted 2017 House Plan. The Mean-Median Difference thus indicates that the enacted plan distributes voters across districts in such a way that most districts are significantly more Republican-leaning than the average North Carolina House district, while Democratic voters are more heavily concentrated in a minority of the 2017 enacted House districts. Similarly, in the enacted 2017 Senate Plan, I calculate a Mean-Median Difference of +3.4%. These skews in the enacted plans create a significant partisan advantage for Republicans by giving them stronger control over the median districts in each chamber. I perform the same calculation on all computer-simulated plans in order to determine whether this partisan skew in the median House and Senate districts could have resulted naturally from North Carolina's political geography and the application of partisan-neutral districting criteria.

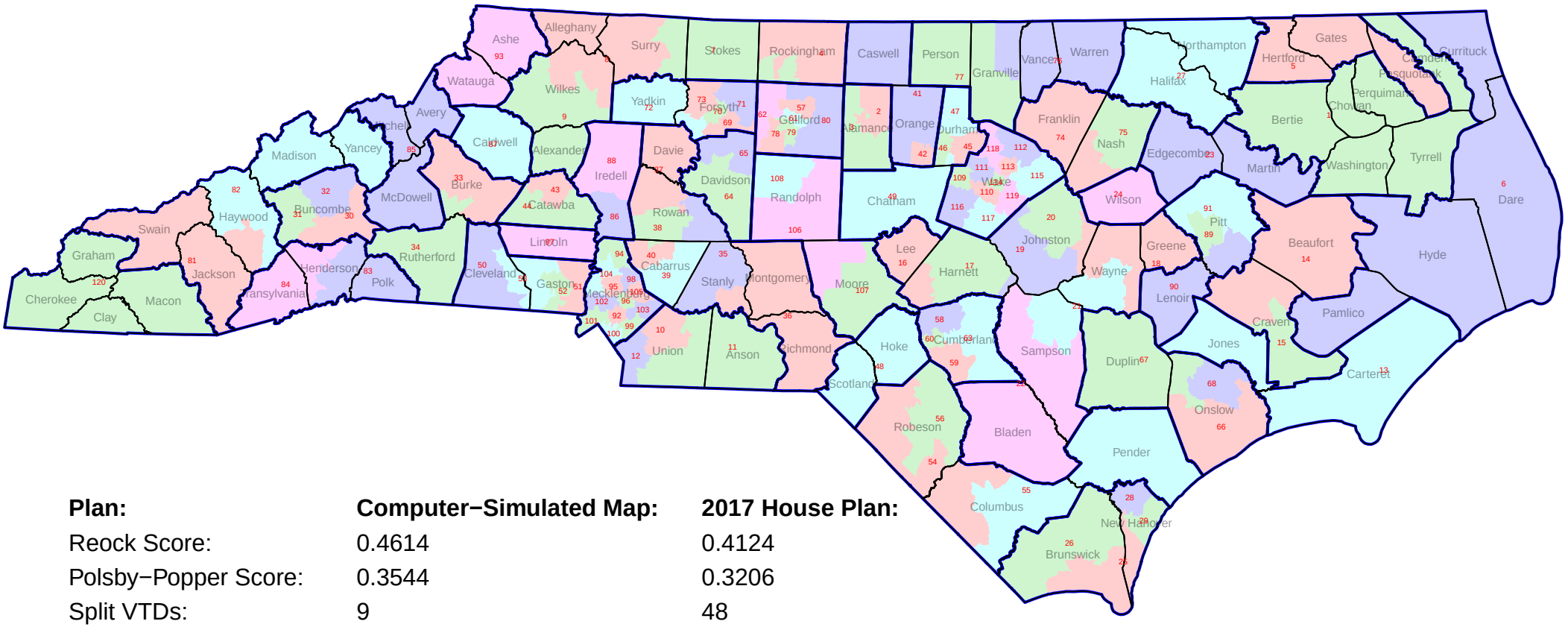
House Simulation Set 1:
Following Traditional Districting Criteria with No Incumbent Protection

I conducted a first set of 1,000 computer simulations in which plans were drawn to optimize on the seven non-partisan, traditional districting criteria described previously: population equality, contiguity, following county groupings, avoiding county splits and traversals, geographic compactness, avoiding precinct splits, and avoiding municipal splits. Table 5 details how the 2017 House Plan compares to the simulated plans in House Simulation Set 1 and Set 2 with respect to these various districting criteria. (House Simulation Set 2 is discussed in further detail below). As an example of a computer-simulated map, Figure 1 illustrates the final of the 1,000 simulated districting plans produced by the computer algorithm in House Simulation Set 1.

Table 5: Summary of the Enacted 2017 House Plan and House Simulation Sets 1 and 2:

	2017 House Plan:	House Simulation Set 1:	House Simulation Set 2:
Description:	Current Enacted Plan	Simulated House maps following only non-partisan traditional districting criteria	Simulated House maps that: 1) Protect the maximum number of incumbents in each grouping; 2) Protect at least the same incumbents who were protected in the 2017 House Plan; and 3) Otherwise follow non-partisan traditional districting criteria.
Total Number of Simulated Plans:		1,000 simulated maps	1,000 simulated maps
Number of Split Municipalities*:	79	38 to 55	44 to 61
Number of Split VTDs*:	48	6 to 18	7 to 20
Average Reock Score (Compactness):	0.412	0.444 to 0.474	0.439 to 0.465
Average Polsby-Popper Score (Compactness):	0.321	0.348 to 0.384	0.336 to 0.371
Mean-Median Difference:	+0.053	+0.015 to +0.038	+0.012 to +0.040
Democratic Districts (using 2010-2016 Statewide Election Composite, which corresponds to a 47.92% statewide Democratic vote share):	42 (out of 120 districts)	43 (6 simulation) 44 (48 simulations) 45 (172 simulations) 46 (284 simulations) 47 (278 simulations) 48 (132 simulations) 49 (58 simulations) 50 (20 simulations) 51 (2 simulations)	43 (1 simulation) 44 (21 simulations) 45 (88 simulations) 46 (222 simulations) 47 (319 simulations) 48 (210 simulations) 49 (99 simulations) 50 (28 simulations) 51 (12 simulations)

Figure 1:
Example of a Computer−Simulated House Map
From House Simulation Set 1 (Following Only Non−Partisan Redistricting Criteria)



Plan:	**Computer−Simulated Map:**	**2017 House Plan:**
Reock Score:	0.4614	0.4124
Polsby−Popper Score:	0.3544	0.3206
Split VTDs:	9	48
Split Municipalities:	44	79
Mean−Median Difference:	+2.95%	+5.33%
Democratic Districts:	46	42

(District partisanship is measured using the 2010−2016 Statewide Election Composite, which produces a 47.92% statewide Democratic vote share.)

Legend:

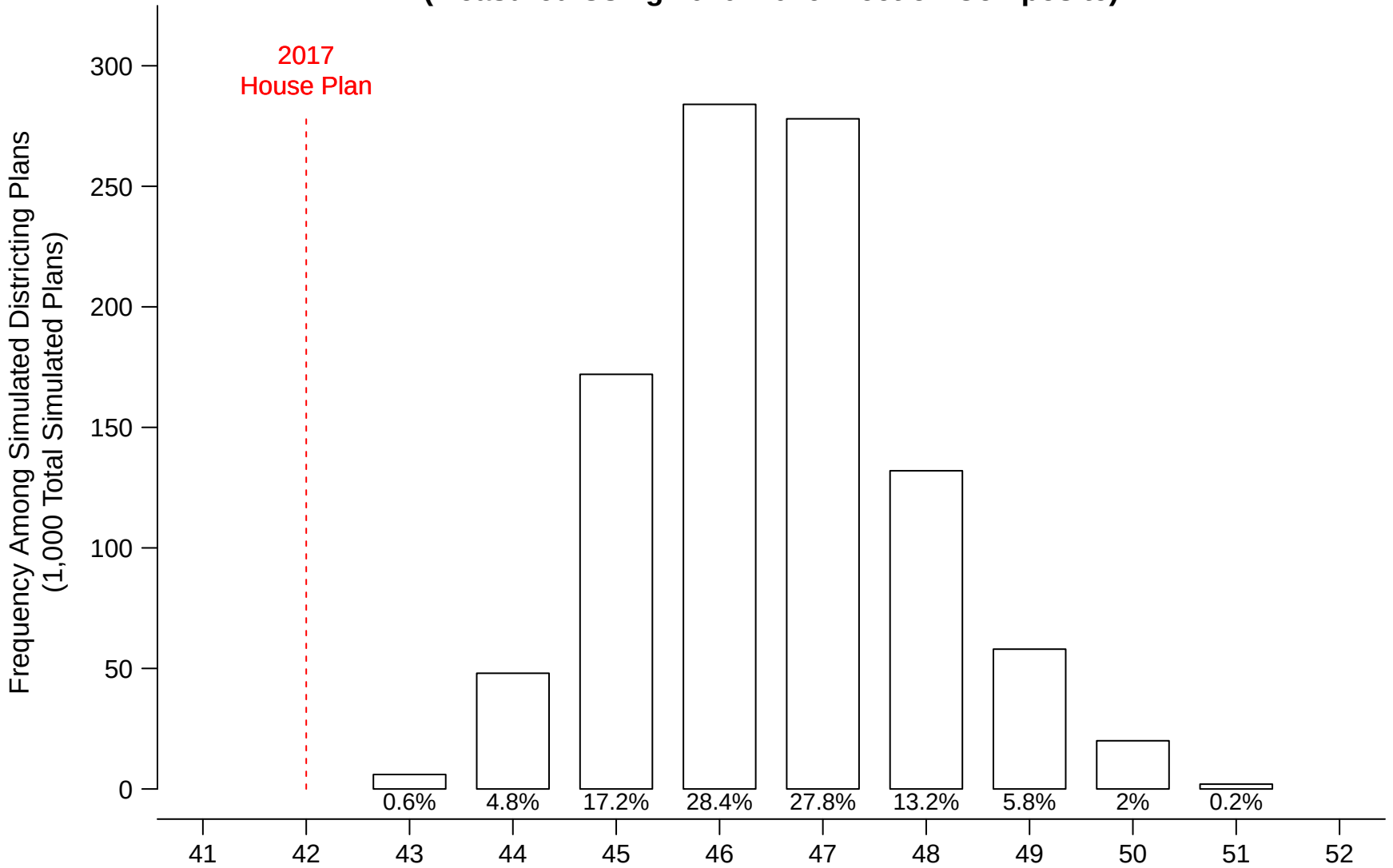
County Grouping Boundaries
County Boundaries
Computer−Simulated House Districts (Including frozen districts from the 2017 House Plan) Numbered from 1 to 120

Number of Democratic and Republican Districts: Figure 2 compares the partisan breakdown of the simulated plans to the partisanship of the 2017 House Plan. Specifically, Figure 2 uses the 2010-2016 Statewide Election Composite to measure the number of Democratic-leaning districts created in each of the 1,000 simulated plans. As measured by these election results, which produce to a 47.92% statewide Democratic vote share, the vast majority of the simulated plans create from 45 to 48 Democratic districts out of 120 total districts using the ten statewide elections in the 2010-2016 Statewide Election Composite.

Using the 2010-2016 Statewide Election Composite, the most common outcome among the simulations is a plan containing 46 or 47 Democratic districts. In contrast, the projected number of Democratic districts under the enacted 2017 House plan is 42 seats using the 2010-2016 Statewide Election Composite, which is 4 to 5 fewer Democratic seats than under most of the computer-simulated plans. The 1,000 simulations do not produce a single plan that results in only 42 Democratic districts, the outcome observed in the 2017 House Plan. I thus conclude with extremely high statistical certainty that the enacted plan created a pro-Republican partisan outcome that would not have occurred under a districting process adhering to non-partisan traditional criteria.

Notably, the ten elections included in the 2010-2016 Statewide Election Composite generally occurred in election years and in electoral environments that were relatively favorable to Republicans across the country (in particular, 2010, 2014, and 2016). Hence, the projected number of Democratic seats would be even greater in the computer-simulated plans if one measured district partisanship using a statewide election whose outcome was more partisan-balanced or even favorable to Democrats. Indeed, in Appendix A, I present the projected number of Democratic seats across all of the House simulations using just the 2016 Attorney General election, which was a near-tied statewide election (Democrat Josh Stein and Republican Buck Newton each received approximately 50% of the two-party vote). Using the 2016 Attorney General election to measure district partisanship, the enacted 2017 House Plan contains 44 Democratic-favoring districts out of 120 total districts, while the computer-simulated plans most commonly contain 51 to 53 Democratic districts. Hence, using the 2016 Attorney General election results, the 2017 House Plan contains 7 to 9 fewer Democratic-leaning districts than most of the simulated plans.

Figure 2:
House Simulation Set 1 (Following Only Non−Partisan Redistricting Criteria):
Democratic−Favoring Districts in 2017 House Plan Versus 1,000 Simulated Plans
(Measured Using 2010−2016 Election Composite)



Uniform Swing Adjustments: Similarly, in Figures U1 to U3, I compare the partisanship of the 2017 House Plan and the 1,000 computer-simulated plans using various uniform swings. To create these Figures, I applied various alternative uniform swings to the 2010-2016 Statewide Election Composite, ranging from -6% to +6% (at intervals of 0.5%). Under each of these 25 uniform swing conditions, I calculate each House plan's number of Democratic-favoring House districts, as measured using the 2010-2016 Statewide Election Composite and adjusting for the uniform swing.

Figure U1 thus contains 25 rows, corresponding to these 25 different alternative uniform swings (e.g., +6%, +5.5%, +5.0%, etc.). As explained earlier, the 2010-2016 Statewide Election Composite produced an overall 47.92% Democratic vote share statewide. Therefore, a +0% uniform swing condition corresponds to a 47.92% statewide Democratic vote share, a +6% uniform swing corresponds to a 53.92% statewide Democratic vote share, and a -6% uniform swing corresponds to a 41.92% statewide Democratic vote share. The rows in Figure U1 are labeled with the statewide Democratic vote share that corresponds to the uniform swing applied in each row. The middle (13th from top) row in Figure U1 applies a +0% uniform swing, which corresponds to a 47.92% statewide Democratic vote share. Each row moving upward from this row depicts an additional +0.5% in the uniform swing applied, and each row moving downward depicts a decrease of 0.5% in the uniform swing applied. Therefore, the bottom row in figure U1 applies a -6% uniform swing, which corresponds to a 41.92% statewide Democratic vote share, and the top row applies a +6% uniform swing, which corresponds to a 53.92% statewide Democratic vote share.

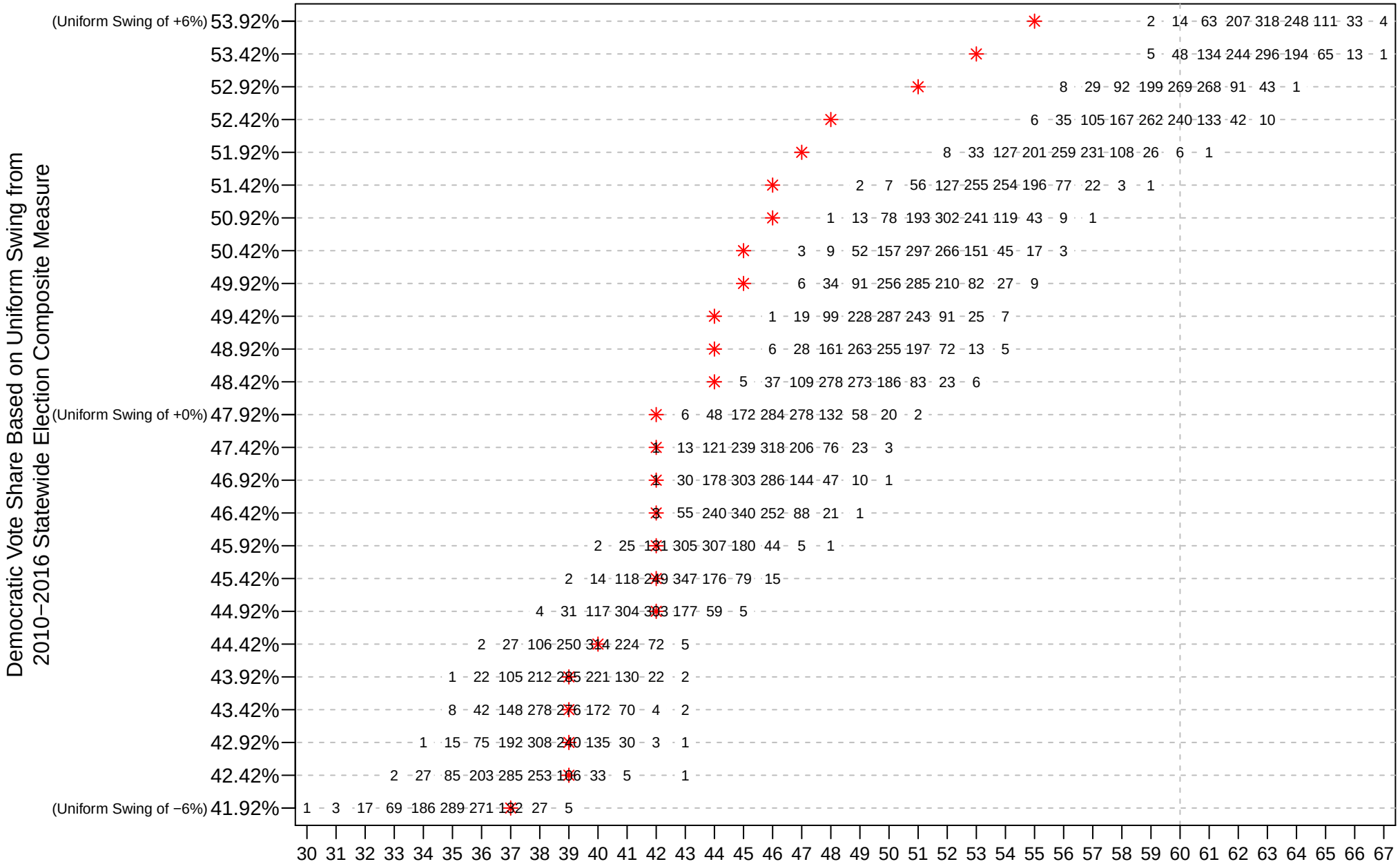
I applied the uniform swings in each row as follows: A uniform swing adjustment of +4.5%, for example, means that I calculated each district's Democratic vote share using the 2010-2016 Statewide Election Composite and added +4.5% to each district's vote share. I made this same uniform swing adjustment for both the 2017 House Plan as well as for all 1,000 computer-simulated plans. I then identified the number of House districts in each plan with over a 50% Democratic vote share, after accounting for the uniform swing adjustment.

Figure U1 displays these calculations under each of the 25 different alternative uniform swings. The top row of Figure U1, which applies a uniform swing of +6% (corresponding to a 53.92% statewide Democratic vote share), reports the number of Democratic-favoring districts in each of the 1,000 simulated plans, as measured using the 2010-2016 Statewide Election

Composite with a +6% uniform swing. This row contains a series of numbers, corresponding to the horizontal axis, reporting the number of computer-simulated plans (out of 1,000) that contain a particular number of Democratic-favoring districts. Specifically, this top row reports 2 simulated plans containing 59 Democratic districts, 14 simulated plans containing 60 Democratic districts, 63 simulated plans containing 61 Democratic districts, and 207 simulated plans containing 62 Democratic districts, and so on. Hence, the numbers in Figure U1 report the number of simulated plans that would contain a particular number of Democratic districts, as listed along the horizontal axis of the Figure. The red star in each row of Figure U1 denotes the number of Democratic districts for the 2017 House Plan under each uniform swing adjustment.

Figure U1 reveals the uniform swing conditions under which the computer-simulated plans would create 60 or more Democratic-favoring districts. With a uniform swing of +5.0%, which corresponds to a 52.92% statewide Democratic vote share, 67.2% of the simulated plans in House Simulation Set 1 would create 60 or more Democratic-favoring districts. Meanwhile, under this same uniform swing condition, the 2017 House Plan would contain only 51 Democratic districts. Similarly, with a uniform swing of +4.5%, which corresponds to a 52.42% statewide Democratic vote share, 42.5% of the simulated plans in House Simulation Set 1 would create 60 or more Democratic-favoring districts, but the 2017 House Plan would contain only 48 Democratic districts. Figure U2 displays the calculations of each plan's number of Democratic districts under a uniform swing of +4.5%, which corresponds to a 52.42% statewide Democratic vote share. Figure U3 displays the calculations of each plan's number of Democratic districts under a uniform swing of +5.0%, which corresponds to a 52.92% statewide Democratic vote share.

Figure U1: Number of Democratic Districts Under Alternative Uniform Swings in House Simulation Set 1 Plans



(Numbers in this figure report the number of simulated plans (out of 1,000) that would contain a particular number of Democratic districts (listed along the horizontal axis) under each uniform swing condition (listed in the left margin). Red stars denote calculations for the 2017 House Plan.)

Figure U2:
Number of Democratic House Districts Measured Using the 2010−2016 Election Composite With a +4.5% Uniform Swing, Corresponding to a 52.42% Statewide Democratic Vote Share (House Simulation Set 1)

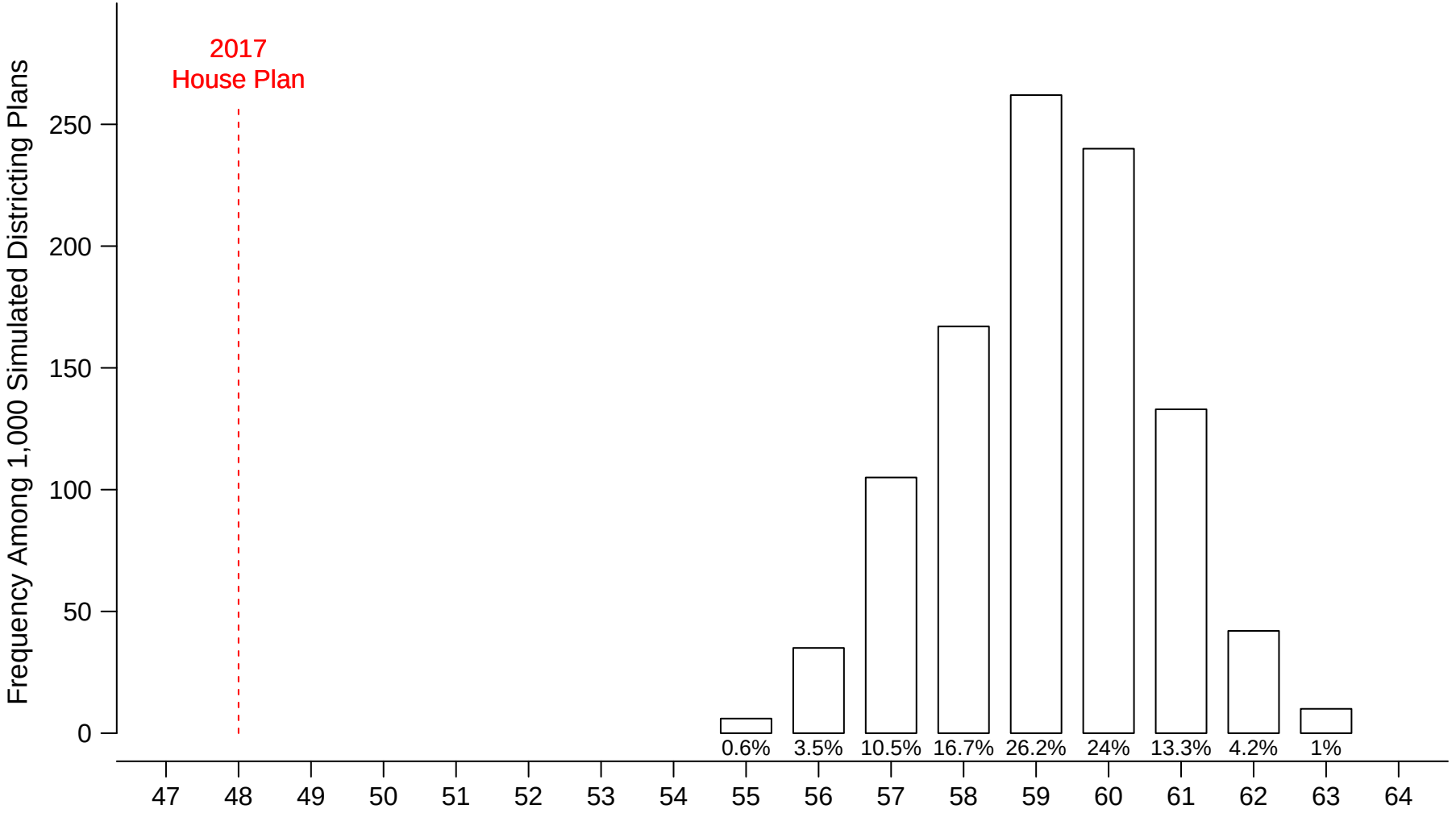
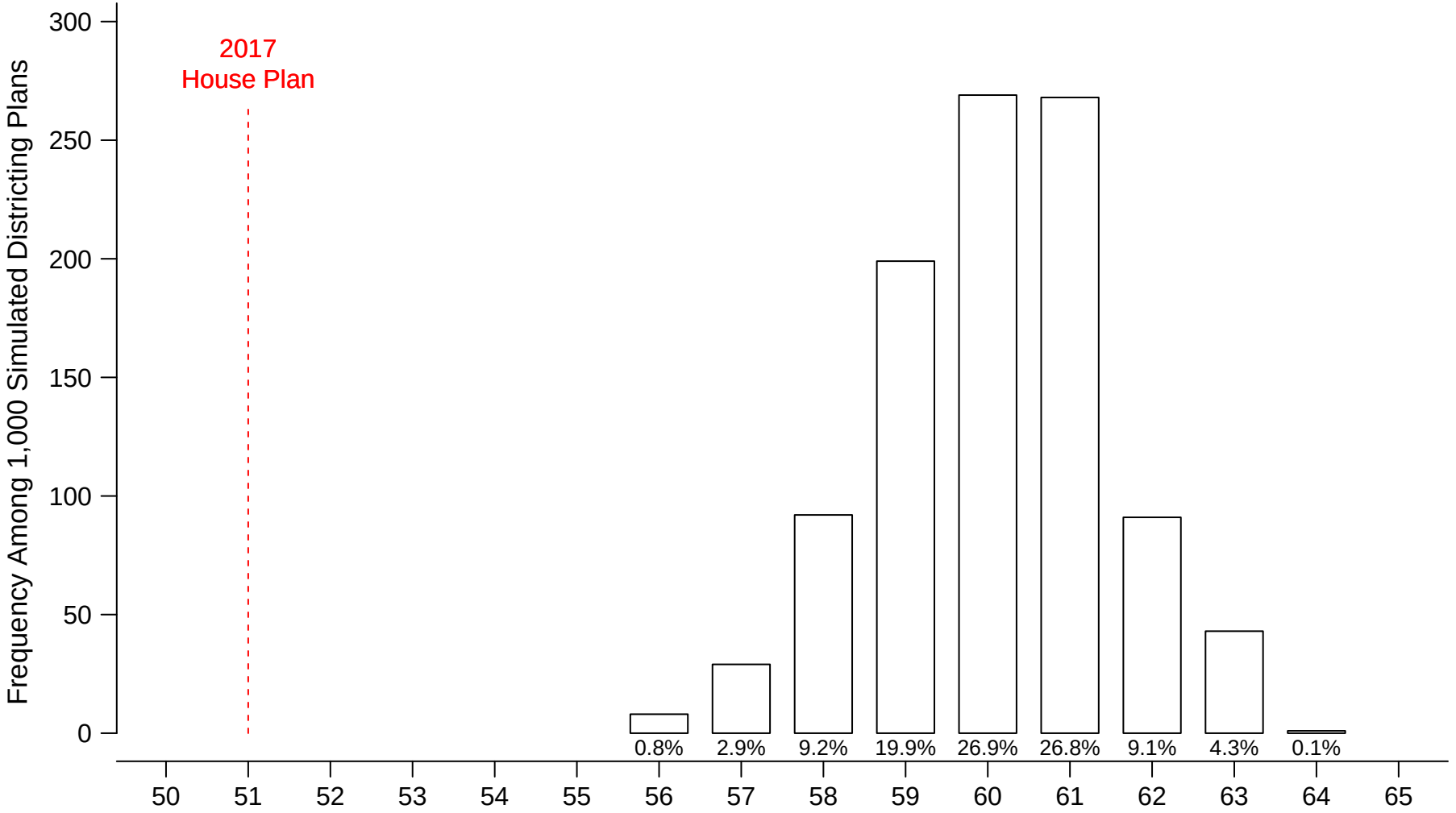


Figure U3:
Number of Democratic House Districts Measured Using the 2010−2016 Election Composite With a +5% Uniform Swing, Corresponding to a 52.92% Statewide Democratic Vote Share (House Simulation Set 1)

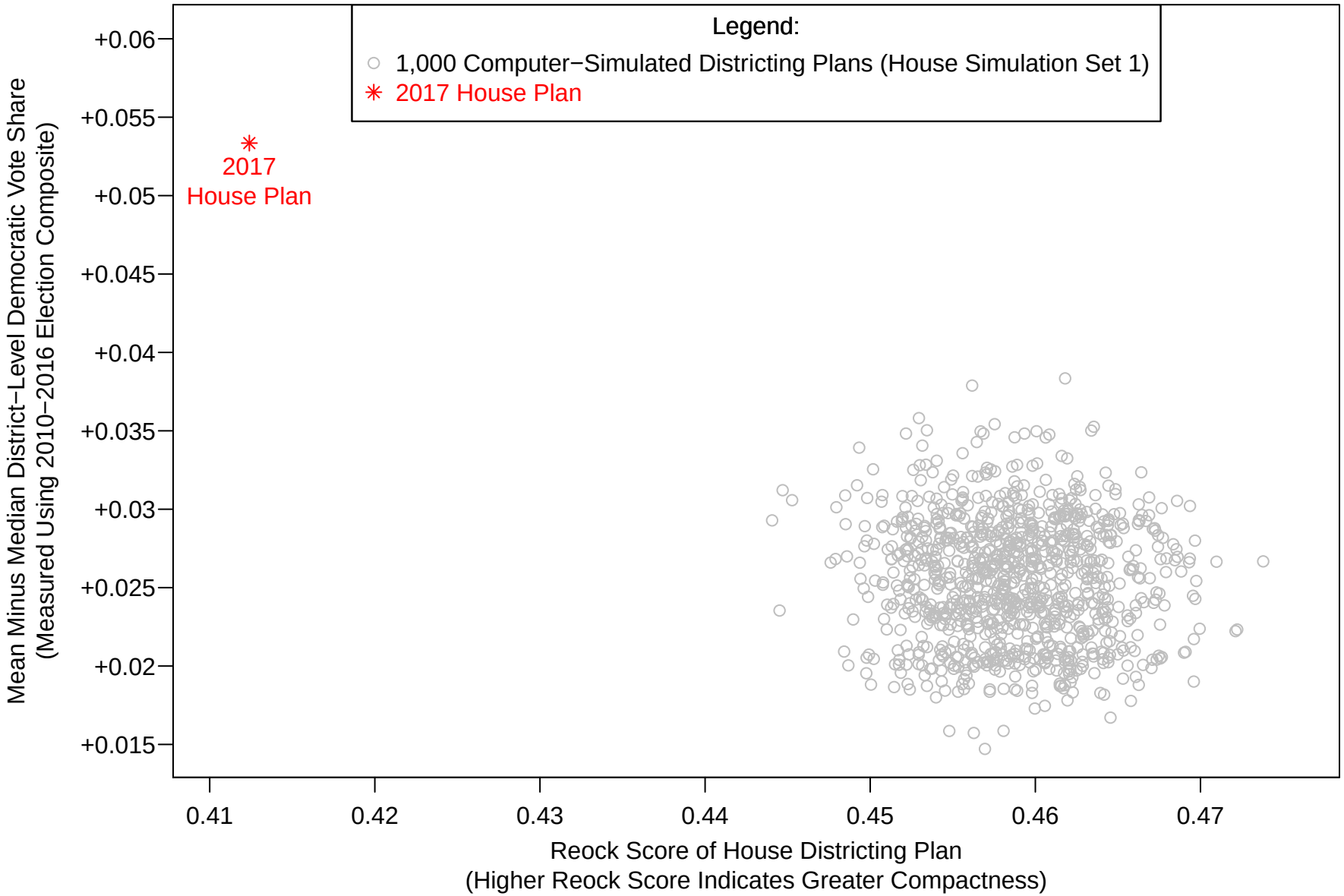


Mean-Median Difference: Analysis of the Mean-Median Difference confirms the partisan-outlying nature of the 2017 House Plan when compared to the computer-drawn plans in House Simulation Set 1. In Figure 3, the vertical axis measures the Mean-Median Difference of the 2017 House Plan and each simulated plan using the 2010-2016 Statewide Election Composite, while the horizontal axis measures the average Reock score of the districts within each plan, with higher Reock scores indicating more compact districts. In this Figure, each of the gray circles represents one of the 1,000 computer-simulated plans in House Simulation Set 1, while the red star represents the 2017 House Plan. Figure 3 illustrates that the 2017 House Plan's Mean-Median Difference is +5.3%, indicating that the median district is skewed significantly more Republican than the plan's average district. Figure 3 further indicates that this difference is an extreme statistical outlier compared to the 1,000 simulations in House Simulation Set 1. Indeed, the 2017 House Plan's +5.3% Mean-Median Difference is an outcome never observed across these 1,000 simulated plans. The 1,000 simulated plans all exhibit Mean-Median Differences ranging from +1.5% to +3.8%. In fact, the middle 50% of these computer-simulated plans have Mean-Median Differences ranging from +2.3% to +2.8%, indicating a much smaller degree of skew in the median district than occurs in the 2017 House Plan.

The fact that the 1,000 simulated plans in Figure 3 all produce a small, positive Mean-Median Difference certainly indicates that voter geography is modestly skewed in a manner that slightly benefits the Republicans in North Carolina House districting. This modest skew in the simulated districting plans may result partially from Democratic voters' tendency to cluster in large, urban areas of North Carolina, as I have explained in my previous academic research.[7] The modest skew may also result from the county groupings that the General Assembly created under the 2017 House Plan, as my simulation algorithm simply follows the same county grouping boundaries used in the enacted plan. But more importantly, the range of this skew in the simulated plans, as shown in Figure 3, is always much smaller than the extreme +5.3% Mean-Median Difference observed in the 2017 House Plan. Hence, these results confirm the main finding that the 2017 House Plan creates an extreme partisan outcome that cannot be explained

[7] Jowei Chen and Jonathan Rodden, 2013. "Unintentional Gerrymandering: Political Geography and Electoral Bias in Legislatures" *Quarterly Journal of Political Science*, 8(3): 239-269; Jowei Chen and David Cottrell, 2016. "Evaluating Partisan Gains from Congressional Gerrymandering: Using Computer Simulations to Estimate the Effect of Gerrymandering in the U.S. House." *Electoral Studies*, Vol. 44, No. 4: 329-430.

Figure 3:
House Simulation Set 1 (Following Only Non−Partisan Redistricting Criteria):
Comparison of 2017 House Plan to 1,000 Simulated Plans on Compactness and Mean−Median Difference



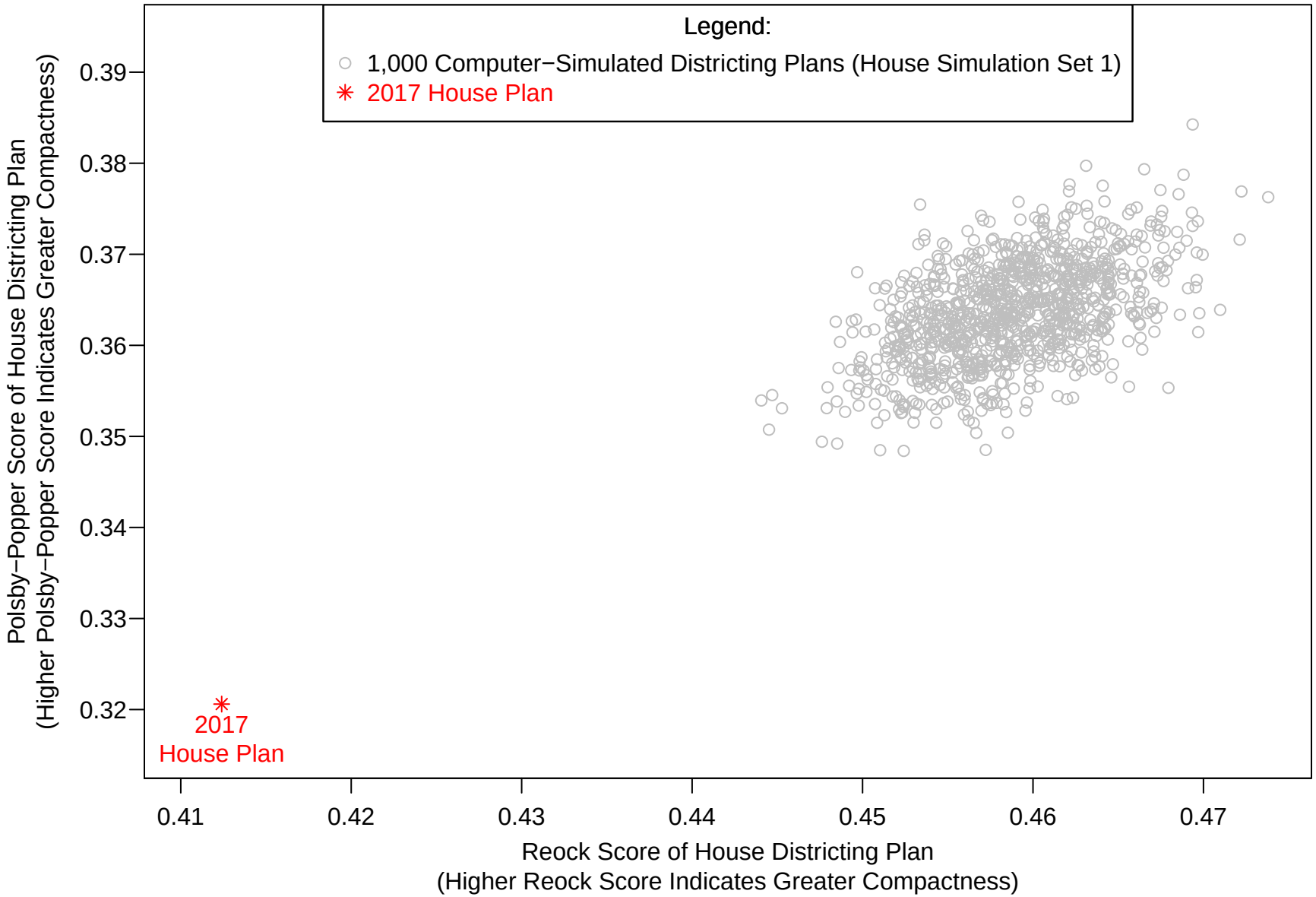
by North Carolina's voter geography or by the application the non-partisan districting criteria listed in the 2017 Adopted Criteria.

Was the 2017 House Plan produced with reasonable effort to draw compact districts? Figure 4 illustrates the compactness of the 1,000 simulated plans, compared against the compactness of the enacted 2017 House Plan. In this diagram, the horizontal axis depicts the average Reock score of the districts within each plan, while the vertical axis depicts the average Polsby-Popper score. Higher Reock scores and higher Polsby-Popper scores both indicate greater geographic compactness. Each gray circle in this diagram represents one of the 1,000 simulated plans, while the red star denotes the enacted 2017 House Plan. Figure 4 illustrates that the 2017 House Plan is significantly less geographically compact than every single one of the simulated plans in House Simulation Set 1, whether measured by average Reock or average Polsby-Popper scores. The simulated plans contain Reock scores ranging from 0.444 to 0.474, while the 2017 House Plan produces a Reock score of only 0.412. Similarly, the simulated plans have Polsby-Popper scores ranging from 0.348 to 0.384, while the 2017 House Plan produces a Polsby-Popper score of only 0.321. Hence, it is clear that the 2017 House Plan did not seek to draw districts that were as geographically compact as reasonably possible.

Did the 2017 House Plan make reasonable efforts to pursue any of the other non-partisan districting criteria outlined in the 2017 Adopted Criteria? Once again, the computer simulations are illuminating because they offer insight into the type and range of plans that would have emerged had reasonable efforts been made to adhere to the non-partisan portions of the 2017 Adopted Criteria. As detailed in Figure 5, the 2017 House Plan split far more municipalities than was reasonably necessary: The 1,000 computer-simulated plans split from 38 to 55 municipalities, while the 2017 House Plan splits 79 municipalities. Furthermore, as Figure 6 illustrates, the 2017 House Plan also split far more VTDs than was reasonably necessary: The 1,000 computer-simulated plans split from 6 to 18 VTDs, while the 2017 House Plan split 48 VTDs. Hence, it is clear that the 2017 House Plan did not seek to split as few municipalities and VTDs as reasonably possible.

Why did the 2017 House Plan so significantly subordinate these non-partisan criteria of geographic compactness and minimizing VTD and municipality splits? The 2017 House Plan is entirely outside the range of the simulated maps with respect to both the partisan distribution of seats (Figures 2 and 3) and geographic compactness (Figures 3 and 4), in addition to splitting far

Figure 4:
House Simulation Set 1 (Following Only Non−Partisan Redistricting Criteria):
Comparison of 2017 House Plan Versus 1,000 Simulated Plans on Compactness



more municipalities (Figure 5) and VTDs (Figure 6) than would have occurred if the map-drawer had simply followed the non-partisan portions of the 2017 Adopted Criteria. Collectively, these findings suggest that the 2017 House Plan was drawn under a process in which a partisan goal – the skewing of districts in a pro-Republican direction and the creation of additional Republican districts – predominated over adherence to the non-partisan districting criteria described in the 2017 Adopted Criteria. The predominance of this extreme partisan goal subordinated the non-partisan, traditional districting considerations of minimizing VTD splits, following municipal boundaries, and drawing geographically compact districts.

Figure 5:
House Simulation Set 1 (Following Only Non−Partisan Redistricting Criteria):
Split Municipalities in 2017 House Plan Versus 1,000 Simulated Plans

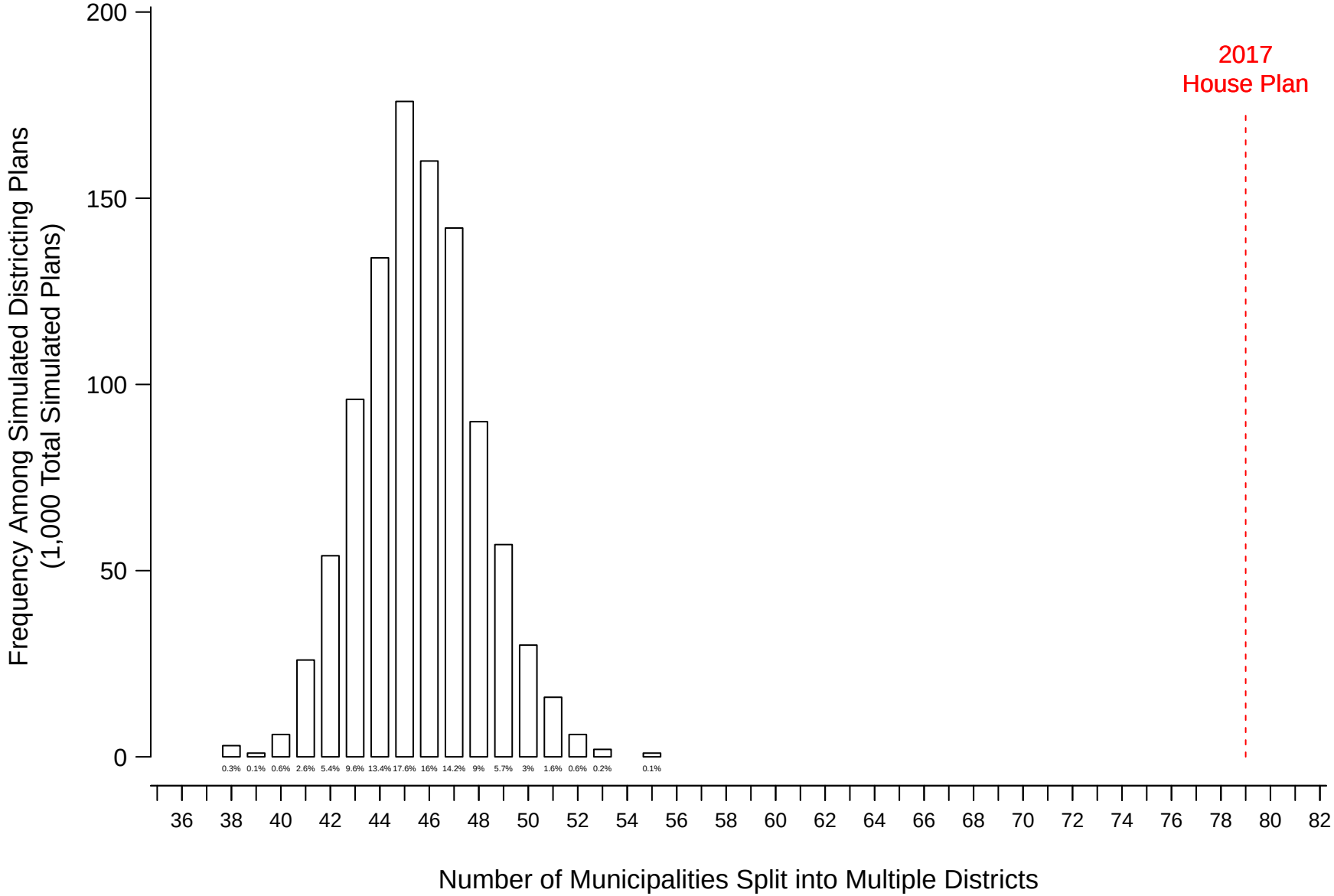
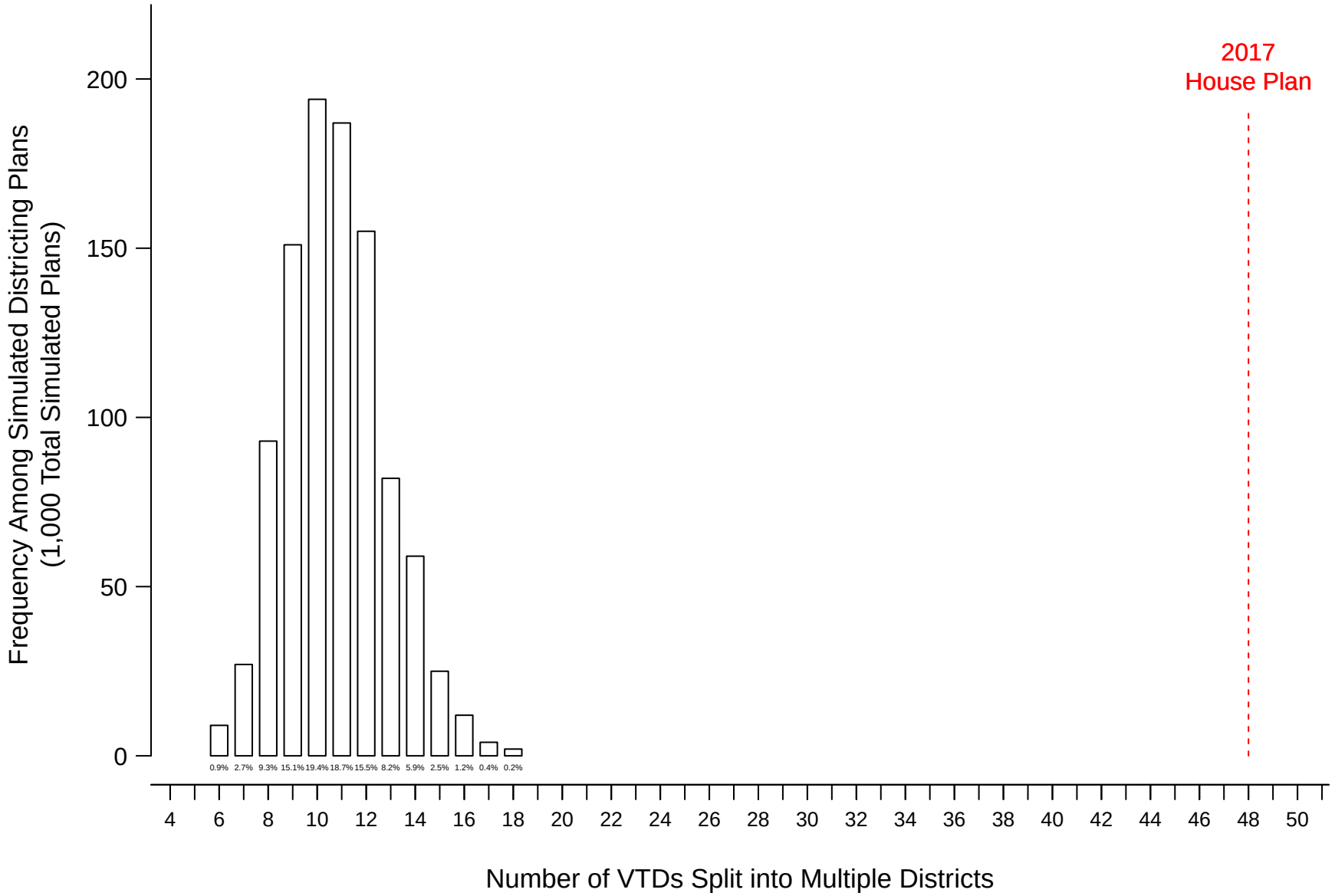


Figure 6:
House Simulation Set 1 (Following Only Non−Partisan Redistricting Criteria):
Split VTDs in 2017 House Plan Versus 1,000 Simulated Plans



House Simulation Set 2:

Following Traditional Districting Criteria While Protecting Incumbent Representatives

In producing House Simulation Set 1, the computer algorithm ignored any considerations regarding the protection of incumbent House members or the pairing of incumbents within the same district. I initially ignored this portion of the 2017 Adopted Criteria because the intentional protection of incumbent House members during the redistricting process could cause indirect partisan consequences.

Among the 116 relevant incumbents holding office at the time of the original drawing of each of the 2017 House Plan districts, 68 incumbents (or 59%) were Republican, while only 48 incumbents were Democrats. These incumbents were elected from previous versions of North Carolina's House districts. As this slate of incumbents is heavily Republican and was elected from previous versions of North Carolina's House districts, an attempt to protect all incumbents would, in general, encourage the drawing of a plan with districts somewhat similar to the pre-enacted districts from which these incumbents had been previously elected, thus indirectly distorting the partisan distribution of voters across districts. Hence, I conducted the first set of simulations (House Simulation Set 1) with no efforts at incumbency protection in order to analyze the range of plans that could emerge from strict adherence to the non-partisan portions of the 2017 Adopted Criteria.

Nevertheless, I also sought to analyze whether the significant Republican bias created by the enacted 2017 House Plan could have simply resulted from an effort to protect the incumbent members of North Carolina's House of Representatives by not pairing two or more of them into the same district. I analyzed and evaluated this possible explanation by conducting a second set of districting simulations (House Simulation Set 2) that intentionally protect exactly as many incumbents as is mathematically possible within each county grouping while otherwise adhering to the same traditional districting criteria described earlier. Moreover, the computer algorithm was even instructed to protect the very same incumbents that are protected under the 2017 House Plan's districts, meaning that my simulations did not double-bunk any incumbent who was not double-bunked under the enacted plan. I found that even a districting process that intentionally protects as many incumbents as is possible (while also protecting the specific incumbents protected by the 2017 House Plan) does not explain the extreme Republican advantage created by the 2017 House Plan.

I began by identifying the 2017 House Plan districts that were drawn in a manner that protected incumbent House members from being paired with another incumbent. Specifically, I identified these protected House incumbents in the following three ways: First, within the House districts that were redrawn in 2017, I analyzed those House incumbents who were holding office when the General Assembly drew the 2017 House map. Second, Plaintiffs' counsel provided me with a list of those incumbents who had publicly announced their retirements before the enactment of the 2017 House Plan, and I removed these incumbents from consideration in my analysis. Furthermore, some House districts that were originally drawn in 2011 were not altered in the 2017 House Plan. Within these unaltered districts, I identified the incumbents holding office as of the 2011 redistricting process, since those were the incumbents whom the General Assembly would have been attempting to protect at the time those districts were drawn. In other words, for those House districts in the 2017 House Plan that were originally drawn in 2011 and not redrawn in 2017, I analyzed whether the incumbents holding office in 2011 were protected in those districts. In summary, the incumbents I considered in this analysis were only those Representatives who were holding office (and had not announced retirement plans) when their respective districts were originally drawn, which was either in 2011 or in 2017.

For the House districts drawn in 2011 and unchanged in 2017, there were 39 incumbents meeting the aforementioned criteria, and for the House districts redrawn in 2017, there were 77 incumbents meeting the aforementioned criteria. Thus, in total, I identified 116 House incumbents that the computer algorithm considered in producing House Simulation Set 2. Among these 116 total House incumbents, the relevant districts enacted in 2011 and 2017 protected 108 of the incumbents; the remaining eight incumbents were paired in districts containing more than one incumbent.

Having identified the 116 relevant incumbents for the House districts, I then conducted a second, separate set of simulations. House Simulation Set 2 prioritizes the protection of incumbents while otherwise pursuing the same non-partisan districting criteria as House Simulation Set 1. Specifically, I programmed the computer algorithm to guarantee the protection of the mathematically maximum possible number of incumbents within each county grouping. Additionally, I also required that the algorithm produce districts that protect, at a minimum, the same set of incumbents as the ones protected by the 2017 House Plan districts. In other words, the simulation algorithm attempted to protect even more total incumbents than the 2017 House

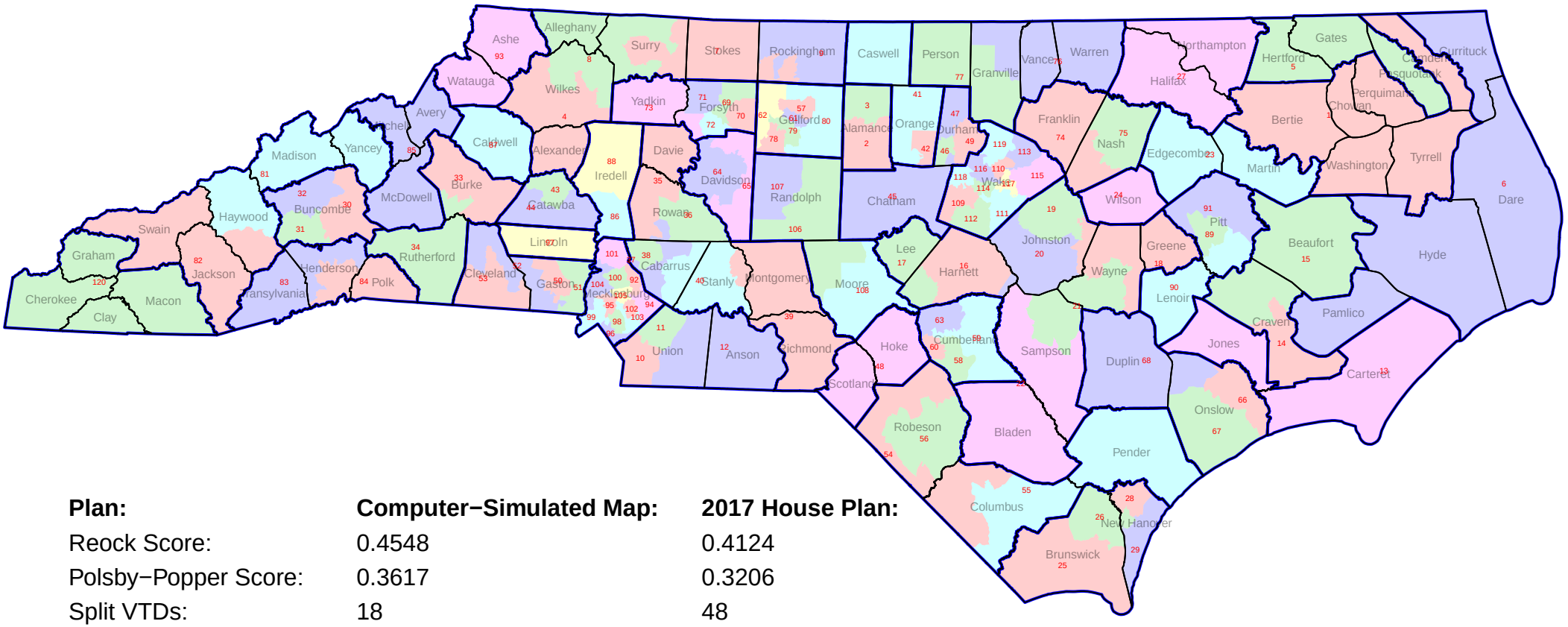
Plan did, but the algorithm was also required to protect, at minimum, the same 108 incumbents that were protected in the 2017 House Plan.

As an illustration of these two incumbency-protection requirements in House Simulation Set 2, consider the 2017 House Plan's districts 66, 67, 76, 77, 82, and 83 (all redrawn in 2017), which comprise the county grouping that includes Cabarrus, Davie, Montgomery, Richmond, Rowan, and Stanly Counties. This county grouping contained seven incumbents, but only six districts. Hence, not every incumbent could be protected. The mathematically maximum possible number of protected incumbents is five, with two remaining non-protected incumbents being paired together in a single district. The 2017 House Plan paired together Carl Ford and Larry Pittman in HD 83, while protecting five other incumbents: Representatives Barr (HD 67), Goodman (HD 66), Howard (HD 77), Johnson (82), and Warren (HD 76). Hence, in every simulated plan in House Simulation Set 2, the computer algorithm requires that: 1) At least five incumbents must be protected in this county grouping; and 2) those five incumbents must include Representatives Barr, Goodman, Howard, Johnson, and Warren. Effectively, in this case, these requirements imply that Representatives Ford and Pittman must be paired together in a single district, just as they are paired under the 2017 House Plan. This approach to protecting incumbents is an extremely conservative one because it not only maximizes the protection of incumbents, but it also defers to the enacted plans in terms of the precise set of incumbents who are protected.

Aside from these two requirements, the computer algorithm gives no consideration to the partisanship of the incumbents that are protected or not protected under each simulated plan. And beyond this intentional protection of incumbents, House Simulation Set 2 otherwise prioritizes the same seven non-partisan traditional districting criteria followed in the first set of simulations while again ignoring any other political considerations beyond incumbent protection.

As an example of the maps produced by this algorithm, Figure 7 illustrates the final of the 1,000 simulated districting plans produced by the computer algorithm in House Simulation Set 2. Descriptions of the 1,000 simulated maps in House Simulation Set 2 appear in the third column of Table 5. In addition to protecting the same 108 incumbents protected by the enacted plan, all 1,000 of these simulated plans also protect two additional House incumbents in Buncombe County who were not protected by the enacted plans: Susan Fisher (Democrat) and Patsy Keever (Democrat). Representatives Fisher and Keever were paired into HD 114 in 2011

Figure 7:
Example of a Computer−Simulated House Map
From House Simulation Set 2 (Following Non−Partisan Redistricting Criteria and Avoiding Incumbent Pairings)



Plan:	**Computer−Simulated Map:**	**2017 House Plan:**
Reock Score:	0.4548	0.4124
Polsby−Popper Score:	0.3617	0.3206
Split VTDs:	18	48
Split Municipalities:	49	79
Mean−Median Difference:	+2.26%	+5.33%
Democratic Districts:	49	42

(District partisanship is measured using the 2010−2016 Statewide Election Composite)

Legend:

County Grouping Boundaries

County Boundaries

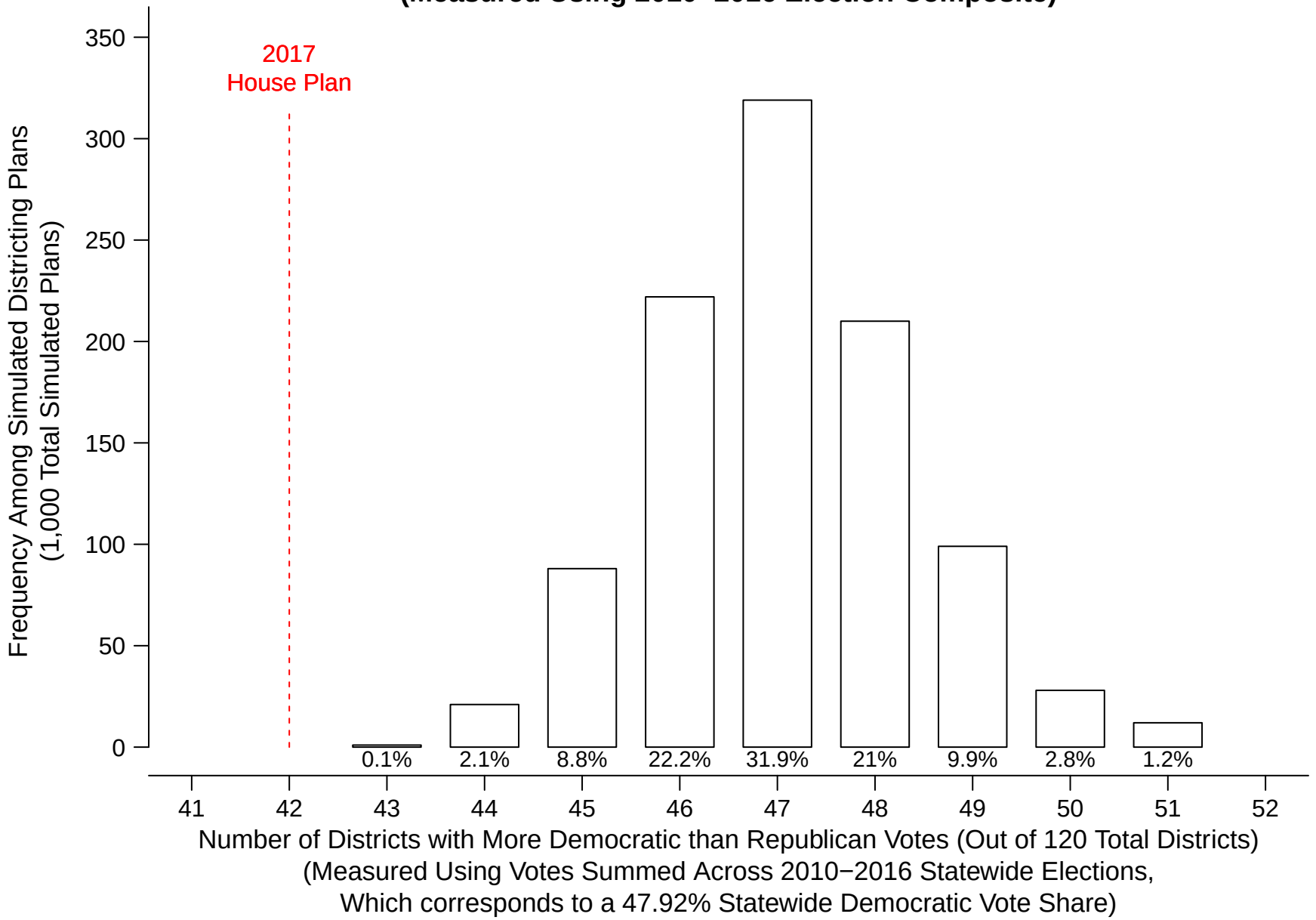
Computer−Simulated House Districts (Including frozen districts from the 2017 House Plan) Numbered from 1 to 120

(this district was unchanged in 2017), but all 1,000 simulations in House Simulation Set 2 place them into separate districts with no pairing of any other incumbent in Buncombe County. Moreover, these 1,000 simulations also produced significantly more compact districts (whether measured using Reock or Polsby-Popper Score) while splitting significantly fewer VTDs than the 2017 House Plan's districts in Buncombe County. Together, these findings suggest that the General Assembly unnecessarily paired the two Democratic representatives (Fisher and Keever) together in drawing the three enacted House districts in Buncombe County.

Moreover, the protection of the maximum possible number of incumbents in House Simulation Set 2 was achieved without any increase in the number of county traversals, with only slight increases in the number of split municipalities (Figure 11) and split VTDs (Figure 12) and with only very slight decreases in the geographic compactness of the simulated districts (Figure 10). Figure 10 illustrates that the 2017 House Plan is still significantly less compact than every single one of the 1,000 simulations in House Simulation Set 2, using both the Reock and Polsby-Popper measures of compactness. Figure 11 illustrates that the 2017 House Plan's splitting of 79 municipalities is significantly more than in every single one of the 1,000 simulated plans, which only split from 44 to 61 municipalities. Figure 12 illustrates that the 2017 House Plan's splitting of 48 VTDs is significantly more than in every single one of the 1,000 simulated plans, which only split from 7 to 20 VTDs. Altogether, these simulation results illustrate that the 2017 Adopted Criteria criterion of not pairing multiple incumbents can be achieved without significantly subordinating any of the non-partisan traditional districting criteria listed in the Adopted Criteria. The 2017 House Plan, however, clearly subordinated the non-partisan districting criteria of geographic compactness, avoiding VTD splits, and avoiding municipality splits.

Does the protection of House incumbents make the 2017 House Plan's Republican partisan bias an outcome that could have plausibly emerged from a redistricting process adhering to non-partisan criteria? Figure 8 illustrates the distribution of partisan seats across the 1,000 simulated plans, with partisanship measured using the 2010-2016 Statewide Election Composite. This Figure illustrates that the partisan distribution of seats in plans under House Simulation Set 2 is nearly identical to the partisan distribution of House Simulation Set 1, which ignored incumbency protection. When the maximum possible number of incumbents is protected, the simulation algorithm still produces plans that mostly range from 46 to 48 Democratic districts

Figure 8:
House Simulation Set 2 (Following Non−Partisan Redistricting Criteria and Avoiding Incumbent Pairings): Democratic−Favoring Districts in 2017 House Plan Versus 1,000 Simulated Plans (Measured Using 2010−2016 Election Composite)



(with a full range of 43 to 51 Democratic districts), as measured by the 2010-2016 Statewide Election Composite. The 2017 House Plan's creation of only 42 Democratic districts is an outcome never achieved in House Simulation Set 2. Nor is the 2017 House Plan's creation of a +5.53% Mean-Median Difference an outcome ever observed in a single one of these 1,000 simulations (Figure 9). Figures U4, U5, and U6 also perform the same uniform swing calculations as presented earlier for House Simulation Set 1; these uniform swing calculations confirm that under uniform swings that would allow Democrats to win 60 or more House districts in the computer-simulated plans, the 2017 House Plan would contain significantly fewer than 60 Democratic districts.

Hence, we are able to conclude with extremely high statistical certainty that even the strictest adherence to the 2017 Adopted Criteria's mandate of protecting incumbents, combined with adherence to the other non-partisan portions of the 2017 Adopted Criteria, does not cause or explain the extreme degree of Republican advantage exhibited by the 2017 House Plan. Instead, the 2017 House Plan was drawn under a process in which a partisan goal – the skewing of districts in a pro-Republican direction and the creation of additional Republican districts – predominated over adherence to the non-partisan districting criteria described in the 2017 Adopted Criteria.

Figure 9:
House Simulation Set 2 (Following Non−Partisan Redistricting Criteria and Avoiding Incumbent Pairings): Comparison of 2017 House Plan to 1,000 Simulated Plans on Compactness and Mean−Median Difference

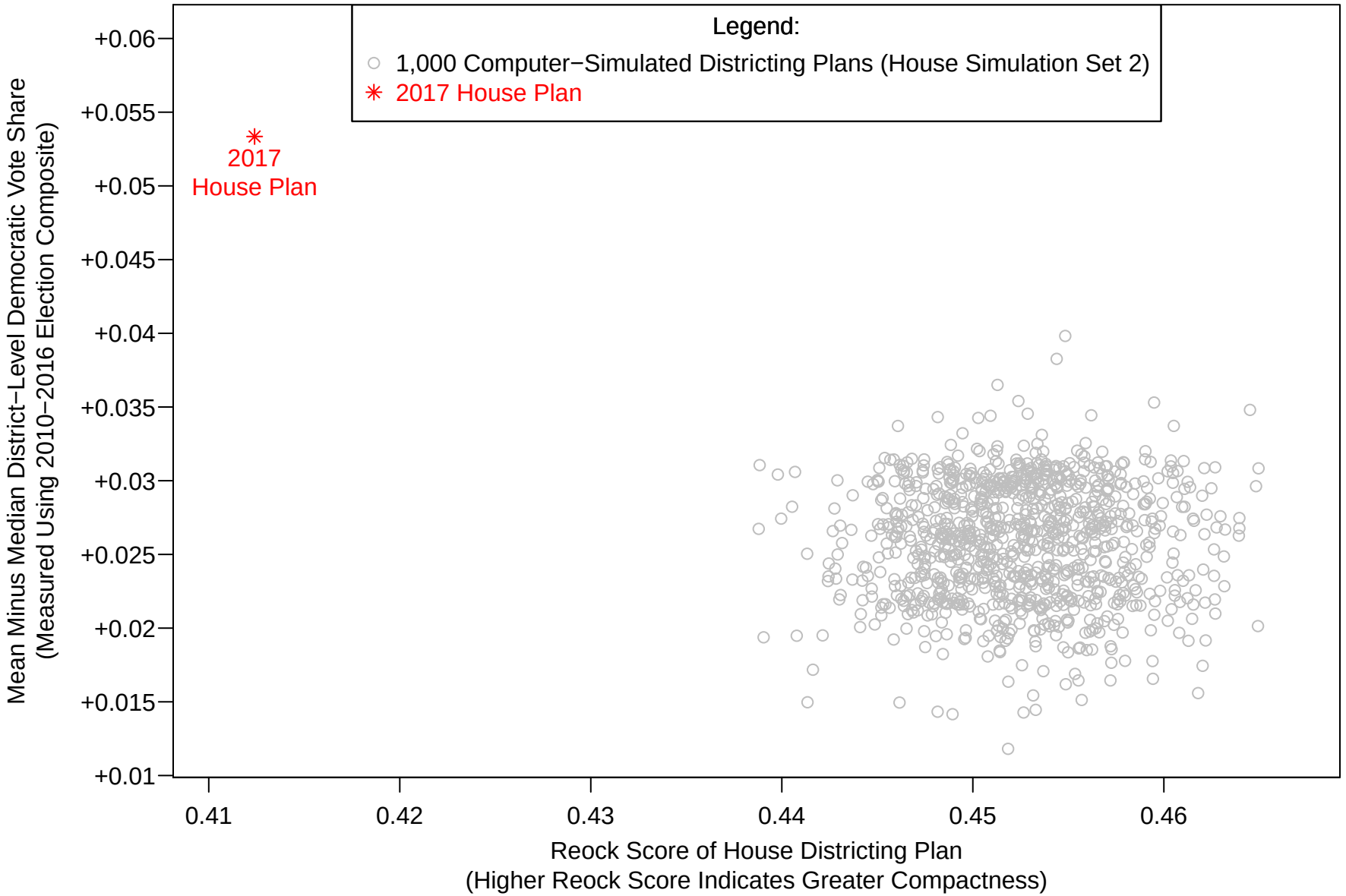


Figure 10:
House Simulation Set 2 (Following Non−Partisan Redistricting Criteria and Avoiding Incumbent Pairings): Comparison of 2017 House Plan Versus 1,000 Simulated Plans on Compactness

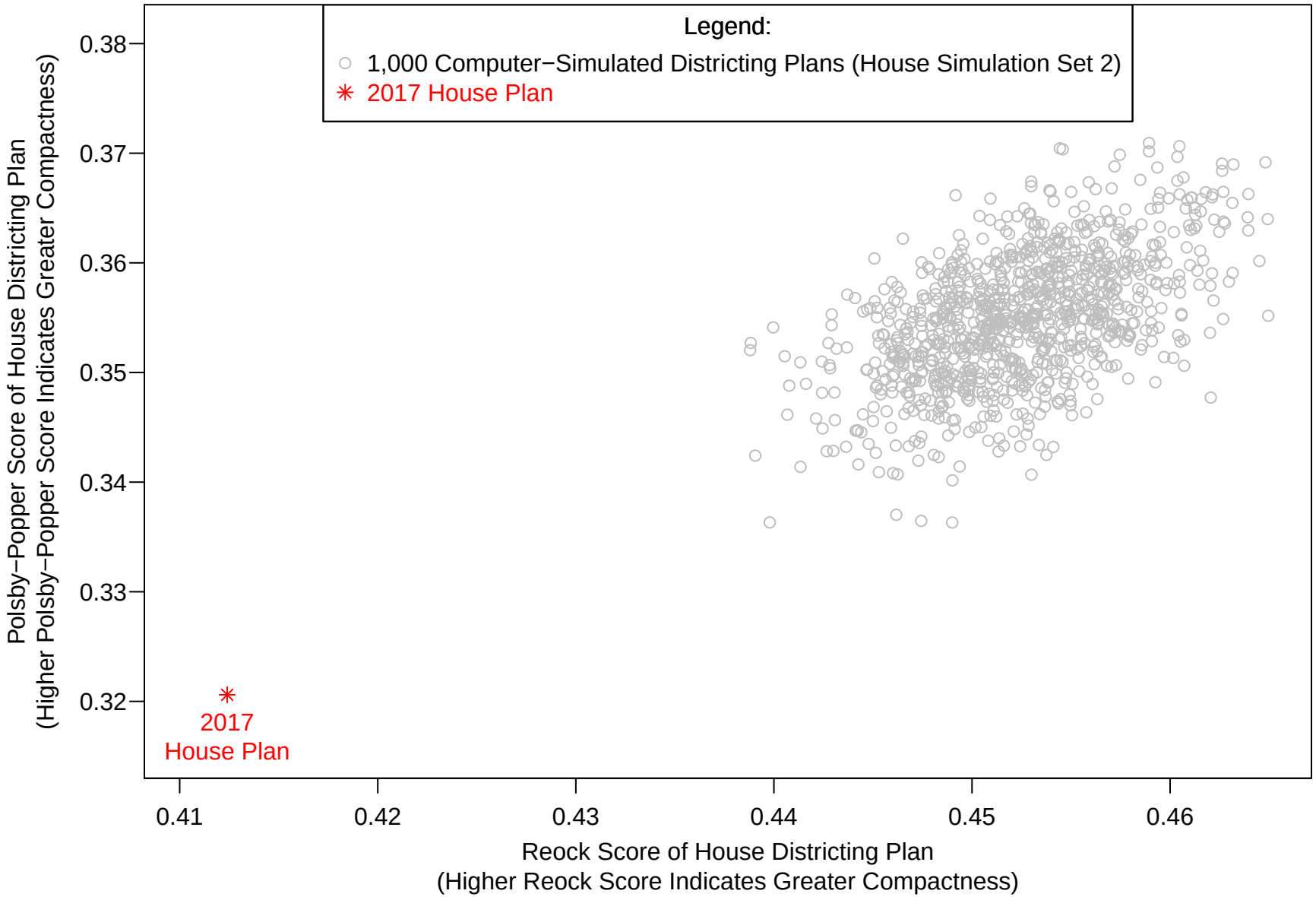


Figure 11:
House Simulation Set 2 (Following Non−Partisan Redistricting Criteria and Avoiding Incumbent Pairings):
Split Municipalities in 2017 House Plan Versus 1,000 Simulated Plans

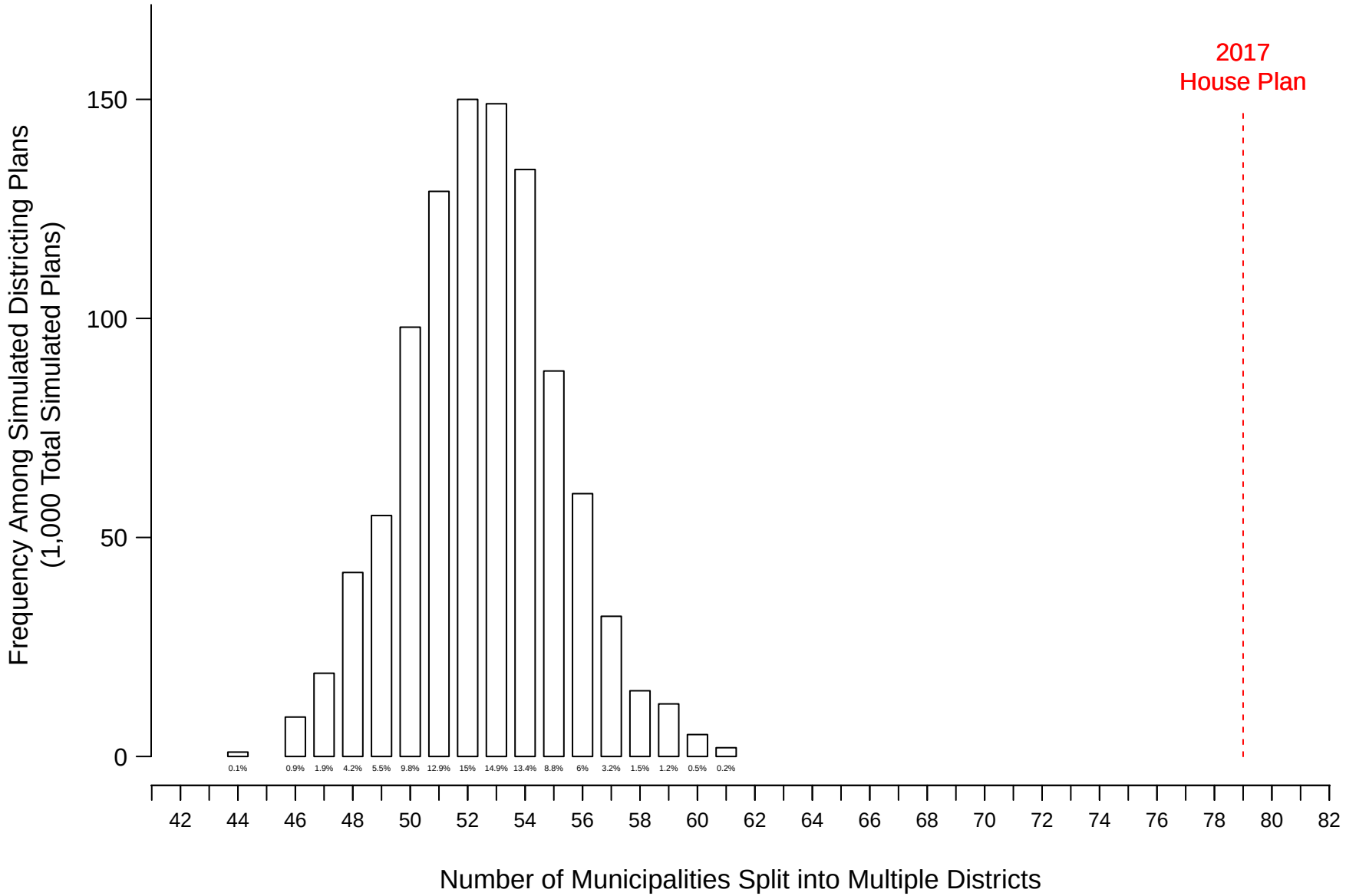


Figure 12:
House Simulation Set 2 (Following Non−Partisan Redistricting Criteria and Avoiding Incumbent Pairings):
Split VTDs in 2017 House Plan Versus 1,000 Simulated Plans

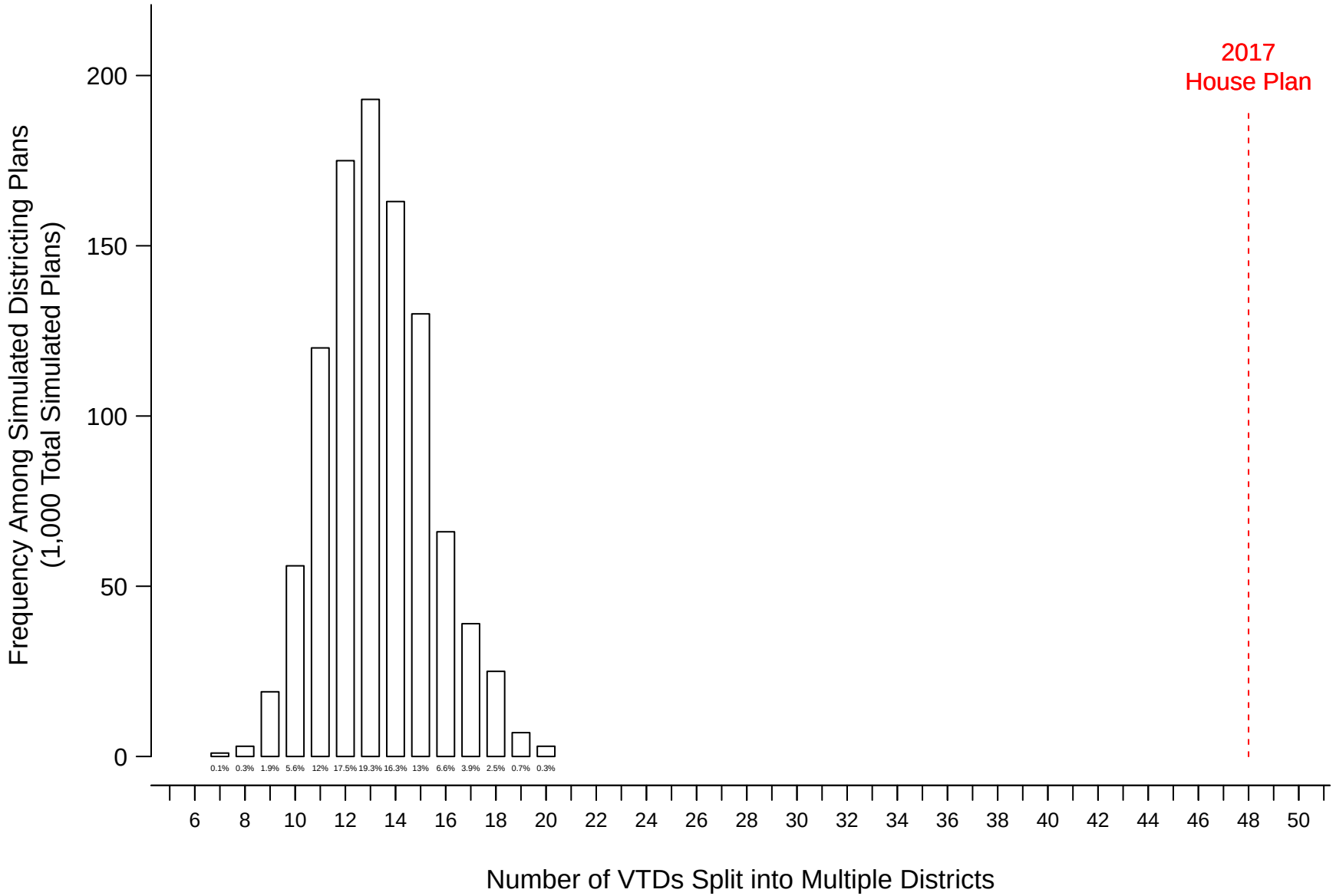
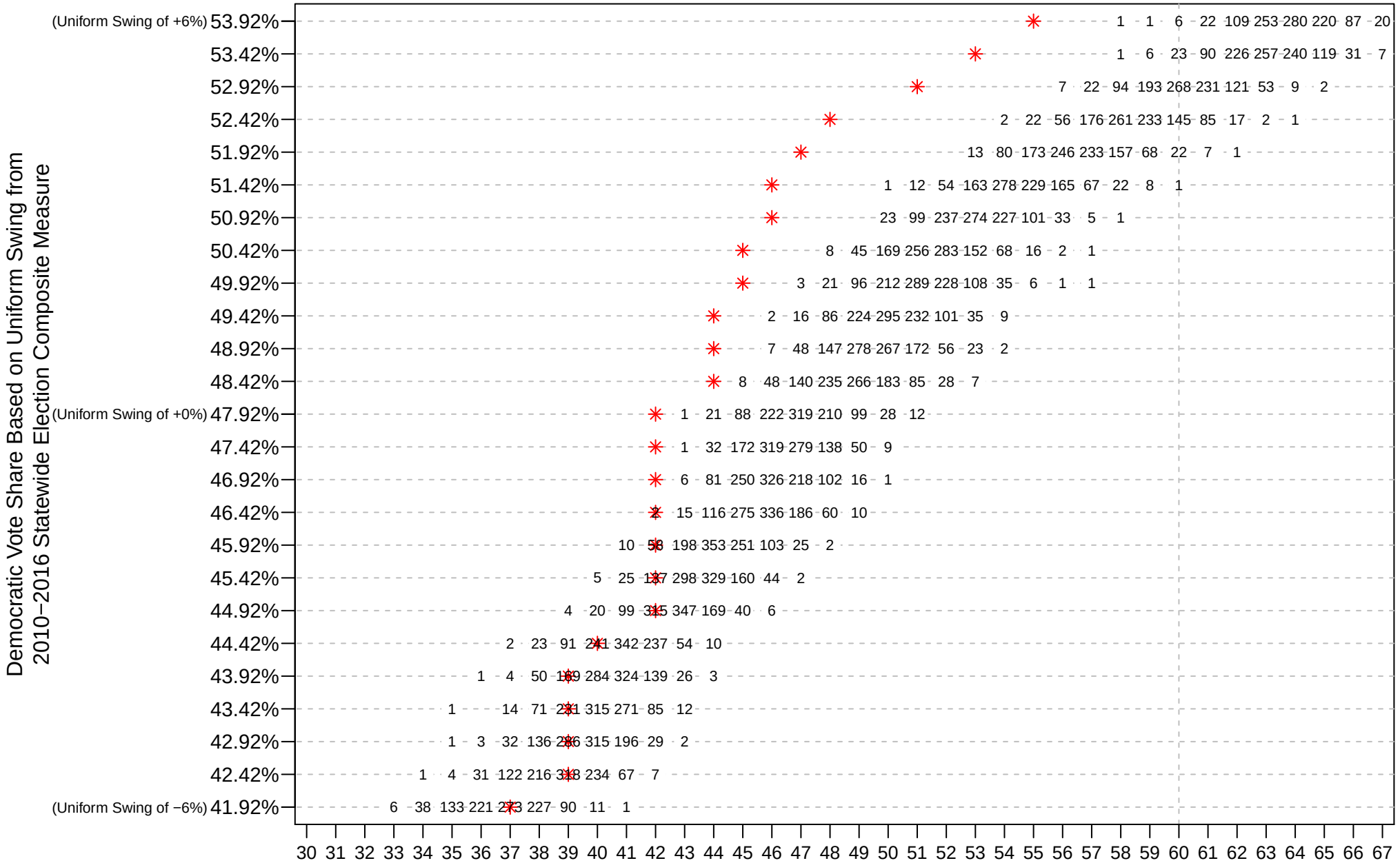


Figure U4: Number of Democratic Districts Under Alternative Uniform Swings in House Simulation Set 2 Plans



(Numbers in this figure report the number of simulated plans (out of 1,000) that would contain a particular number of Democratic districts (listed along the horizontal axis) under each uniform swing condition (listed in the left margin). Red stars denote calculations for the 2017 House Plan.)

Figure U5:
Number of Democratic House Districts Measured Using the 2010−2016 Election Composite With a +4.5% Uniform Swing, Corresponding to a 52.42% Statewide Democratic Vote Share (House Simulation Set 2)

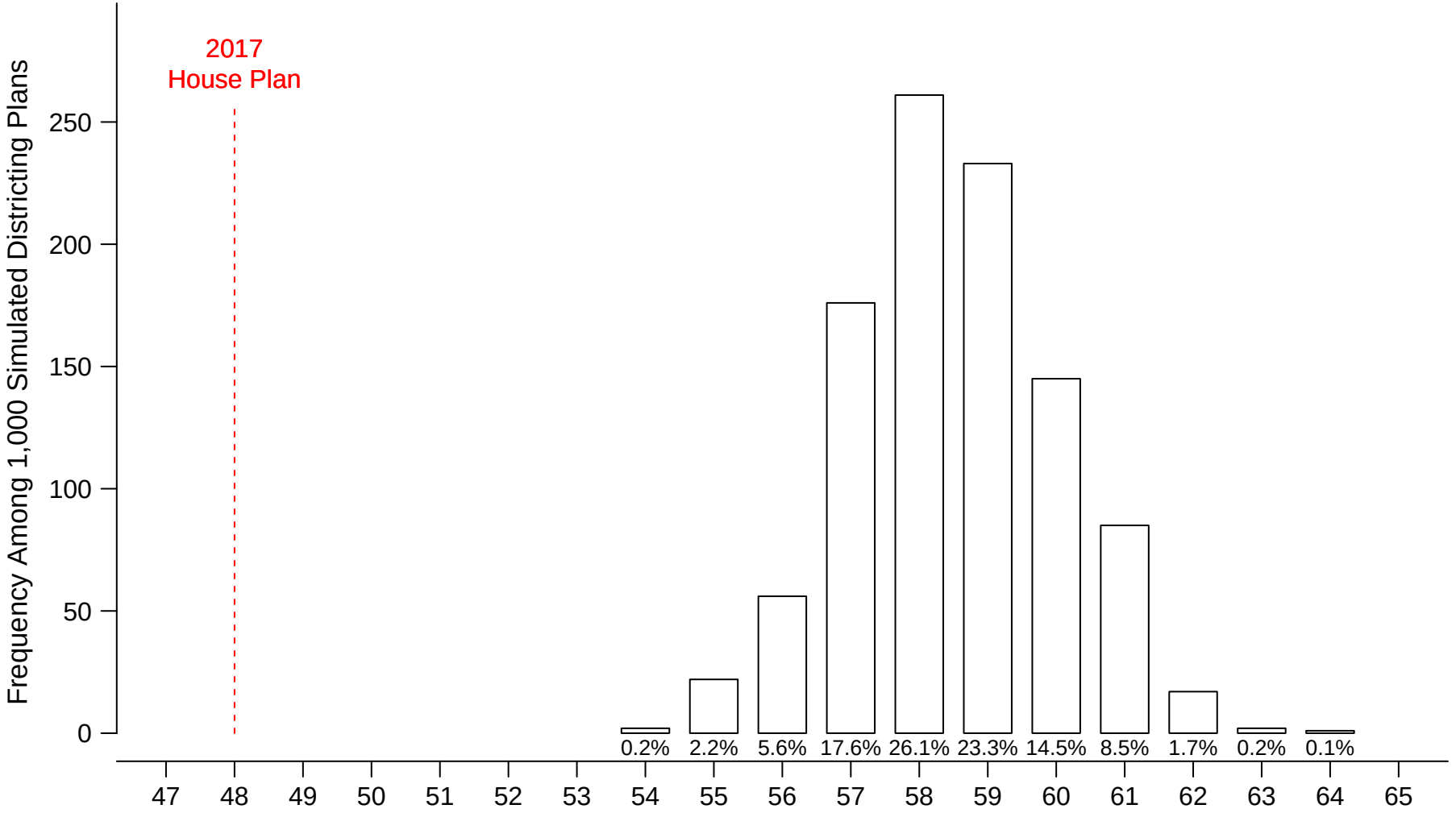
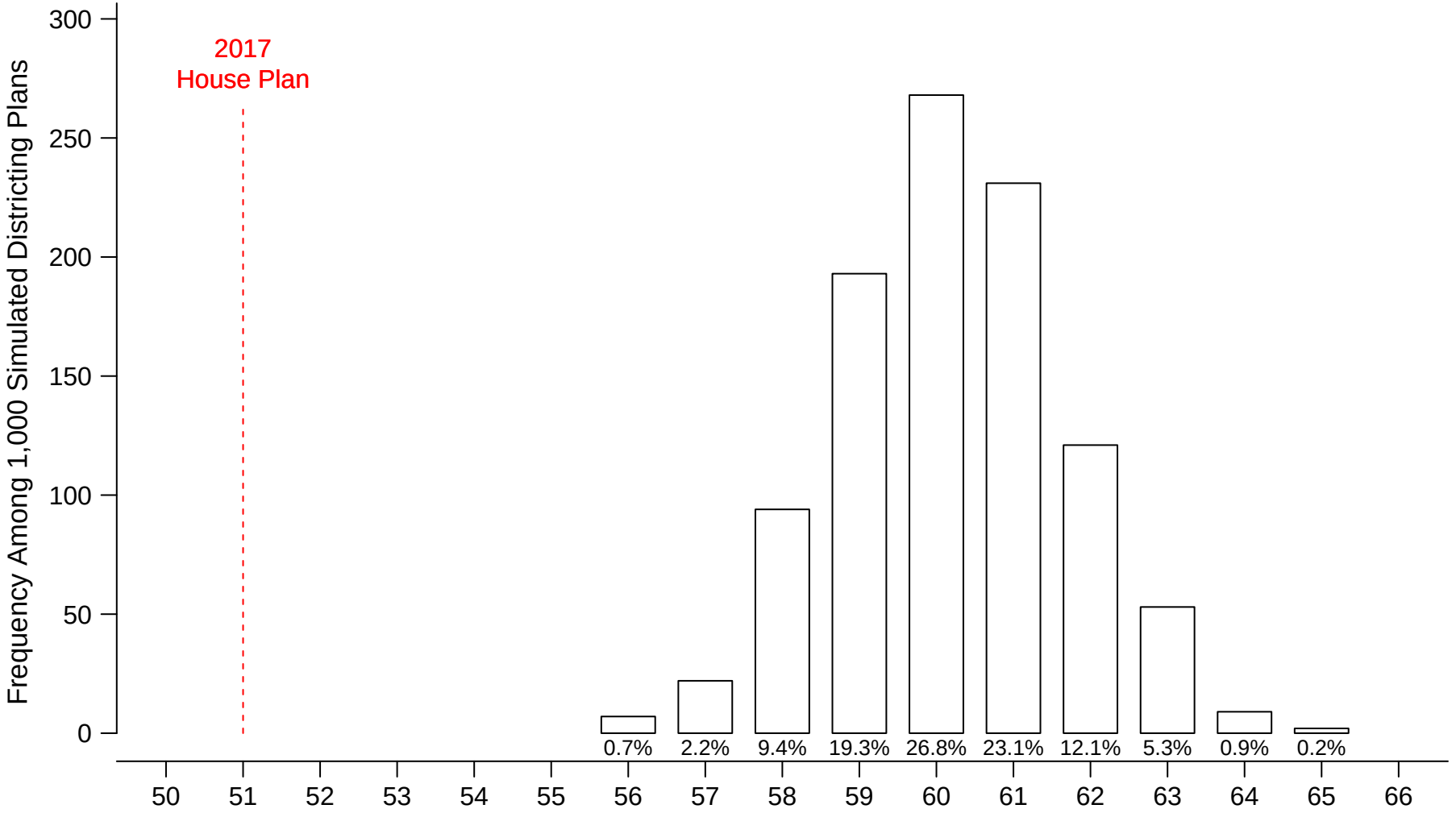


Figure U6:
Number of Democratic House Districts Measured Using the 2010−2016 Election Composite With a +5% Uniform Swing, Corresponding to a 52.92% Statewide Democratic Vote Share (House Simulation Set 2)



Senate Simulation Set 1:
Following Traditional Districting Criteria with No Incumbent Protection

I analyzed the 2017 Senate Plan using the same methodology I used to analyze the 2017 House Plan. I generated two sets of 1,000 simulated plans and compared the 2017 Senate Plan to each of these two sets of simulated plans.

To create Senate Simulation Set 1, I conducted a first set of 1,000 simulations in which North Carolina Senate plans were drawn to optimize on the seven non-partisan, traditional districting criteria described previously: population equality, contiguity, following county groupings, avoiding county splits and traversals, geographic compactness, avoiding VTD splits, and avoiding municipal splits. Table 6 details how the 2017 Senate Plan compares to the simulated plans in Senate Simulation Set 1 and Set 2 with respect to these various districting criteria (Senate Simulation Set 2 is discussed in further detail below). Figure 13 illustrates the final of the 1,000 simulated Senate districting plans produced by the computer algorithm in Senate Simulation Set 1.

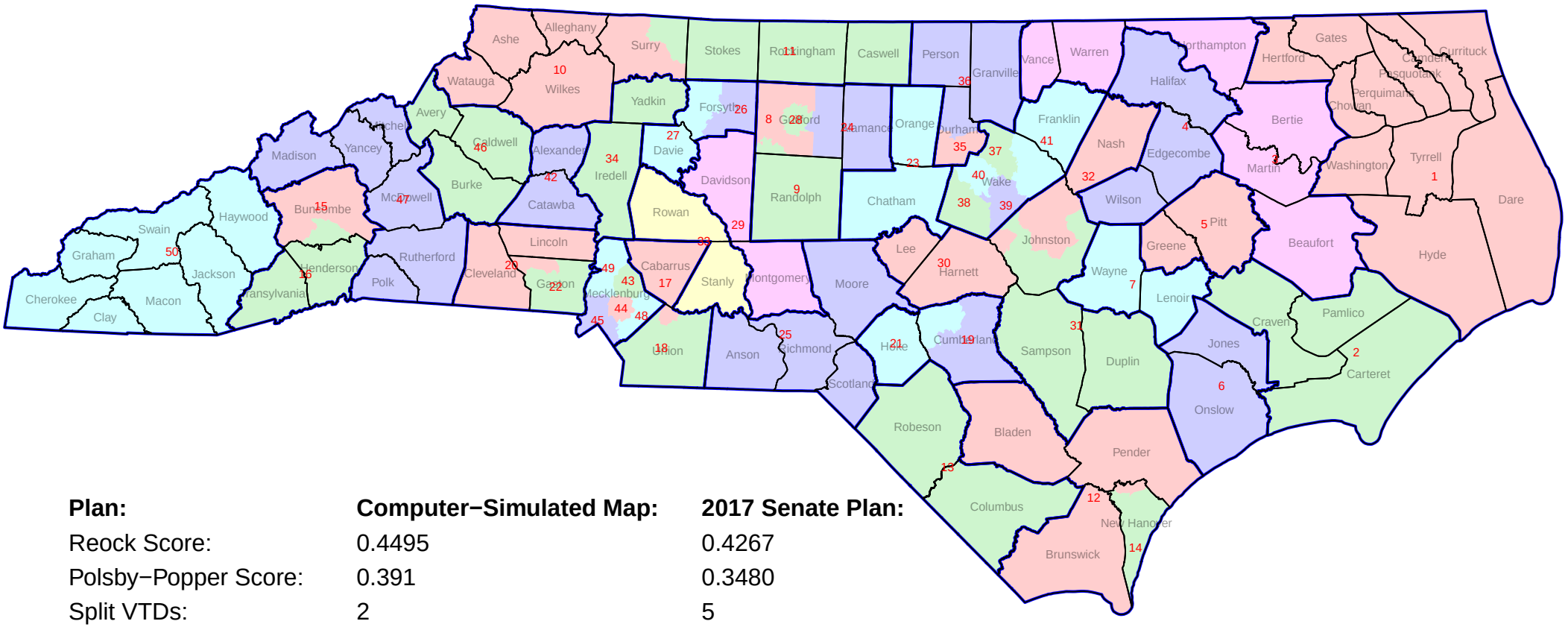
Number of Democratic and Republican Districts: Figure 14 compares the partisan breakdown of the simulated plans to that of the 2017 Senate Plan. Specifically, Figure 14 uses the 2010-2016 Statewide Election Composite, which corresponds to a 47.92% statewide Democratic vote share, to measure the number of Democratic-leaning districts created in each of the 1,000 simulated plans. As measured using the 2010-2016 Statewide Election Composite, every one of the simulated plans create from 19 to 21 Democratic districts out of 50 total districts. In contrast, the enacted 2017 Senate plan contains only 18 Democratic districts, using the same 2010-2016 Statewide Election Composite. The 1,000 simulations do not produce a single plan that results in only 18 Democratic districts, the outcome observed in the 2017 Senate Plan. I thus conclude with extremely high statistical certainty that the enacted Senate plan created a pro-Republican partisan outcome that would have been extremely unlikely to occur under a districting process adhering to non-partisan traditional criteria.

As noted earlier, the ten elections included in the 2010-2016 Statewide Election Composite generally occurred in election years and in electoral environments that were relatively favorable to Republicans across the country (in particular, 2010, 2014, and 2016). Hence, the projected number of Democratic seats would be greater in the computer-simulated plans if one analyzed results from a statewide election whose outcome was more partisan-balanced or even

Table 6: Summary of the Enacted 2017 Senate Plan and Senate Simulation Sets 1 and 2:

	2017 Senate Plan:	Senate Simulation Set 1:	Senate Simulation Set 2:
Description:	Current Enacted Plan	Simulated Senate maps following only traditional districting criteria	Simulated Senate maps that: 1) Protect the maximum number of incumbents in each grouping; 2) Protect at least the same incumbents who were protected in the 2017 Senate Plan; and 3) Otherwise follow non-partisan traditional districting criteria.
Total Number of Simulated Plans:		1,000 simulated maps	1,000 simulated maps
Number of Split Municipalities:	25	8 to 12	10 to 16
Number of Split VTDs:	5	0 to 3	0 to 3
Average Reock Score (Compactness):	0.427	0.438 to 0.460	0.433 to 0.458
Average Polsby-Popper Score (Compactness):	0.348	0.365 to 0.398	0.357 to 0.389
Mean-Median Difference:	+0.034	+0.010 to +0.029	+0.008 to 0.028
Democratic Districts (using 2010-2016 Statewide Election Composite, which corresponds to a 47.92% statewide Democratic vote share):	18 (out of 50 districts)	19 (321 simulation) 20 (508 simulations) 21 (171 simulations)	19 (250 simulation) 20 (647 simulations) 21 (98 simulations) 22 (5 simulations)

Figure 13:
Example of a Computer−Simulated Senate Map
From Senate Simulation Set 1 (Following Only Non−Partisan Redistricting Criteria)



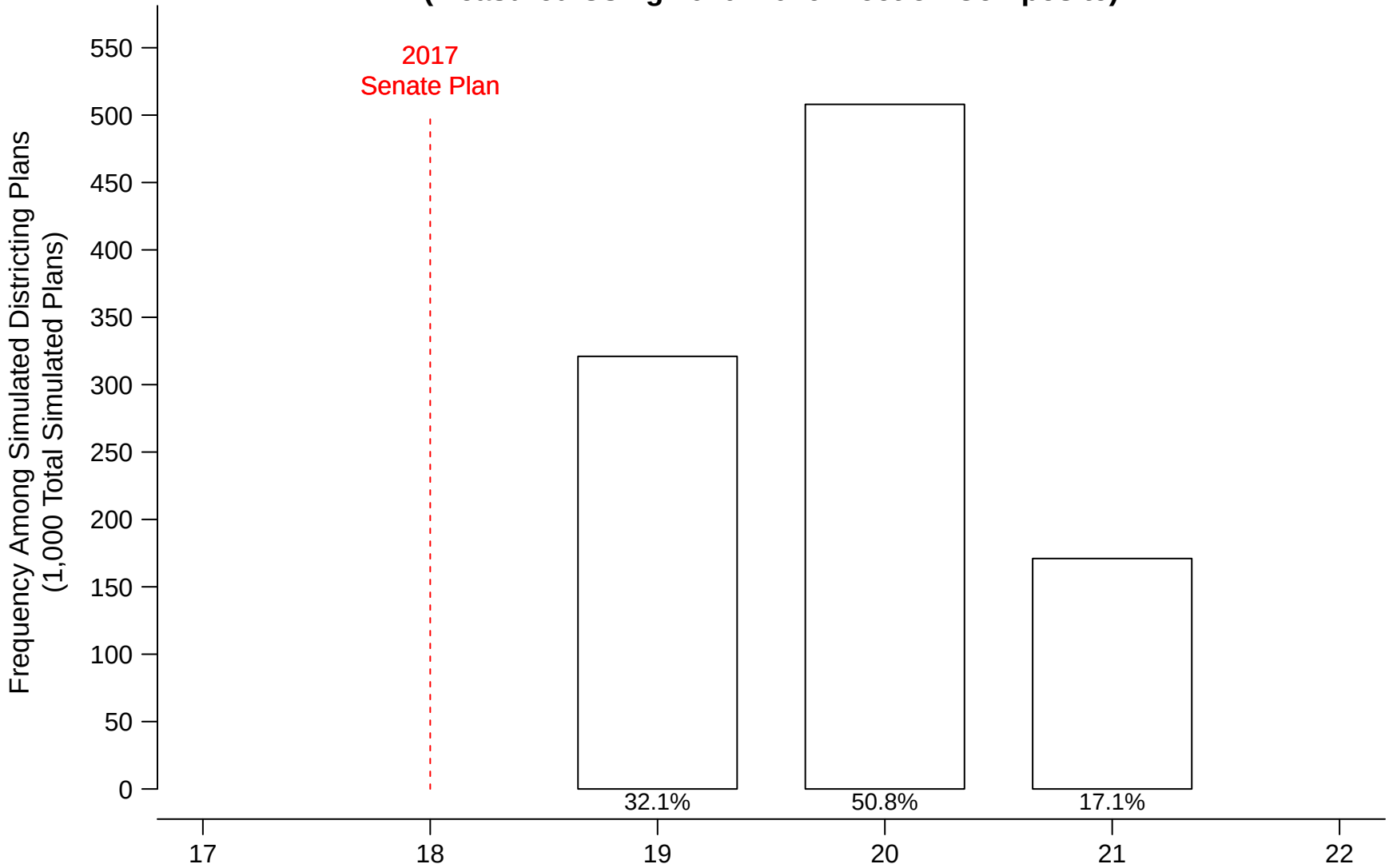
Plan:	**Computer−Simulated Map:**	**2017 Senate Plan:**
Reock Score:	0.4495	0.4267
Polsby−Popper Score:	0.391	0.3480
Split VTDs:	2	5
Split Municipalities:	10	25
Mean−Median Difference:	+1.62%	+3.4%
Democratic Districts:	20	18

(District partisanship is measured using the 2010−2016 Statewide Election Composite, which produces a 47.92% statewide Democratic vote share.)

Legend:

County Grouping Boundaries
County Boundaries
Computer−Simulated Senate Districts (Including frozen districts from the 2017 Senate Plan) Numbered from 1 to 50

Figure 14:
Senate Simulation Set 1 (Following Only Non−Partisan Redistricting Criteria):
Democratic−Favoring Districts in 2017 Senate Plan Versus 1,000 Simulated Plans
(Measured Using 2010−2016 Election Composite)



favorable to Democrats. In Appendix A, I present the projected number of Democratic seats across all of the Senate simulations using just the 2016 Attorney General election, which was a near-tied statewide election. Using the 2016 Attorney General election to measure district partisanship, the enacted 2017 Senate Plan contains 20 Democratic-favoring districts out of 50 total districts, while 99.9% of the computer-simulated plans contain 22 to 24 Democratic districts.

Uniform Swing Adjustments: I perform uniform swing calculations in the same way as I did earlier for the House simulations. In Figures U7 to U9, I compare the partisanship of the 2017 Senate Plan and the 1,000 computer-simulated plans in Senate Simulation Set 1 using various uniform swings. To create these Figures, I applied various alternative uniform swings to the 2010-2016 Statewide Election Composite, ranging from -6% to +6% (at intervals of 0.5%). Under each of these 25 uniform swing conditions, I calculate each Senate plan's number of Democratic-favoring Senate districts, as measured using the 2010-2016 Statewide Election Composite and adjusting for the uniform swing.

Figure U7 thus contains 25 rows, corresponding to these 25 different alternative uniform swings (e.g., +6%, +5.5%, +5.0%, etc.). As explained earlier, the 2010-2016 Statewide Election Composite produced an overall 47.92% Democratic vote share statewide. Therefore, a +0% uniform swing condition corresponds to a 47.92% statewide Democratic vote share, a +6% uniform swing corresponds to a 53.92% statewide Democratic vote share, and a -6% uniform swing corresponds to a 41.92% statewide Democratic vote share. The rows in Figure U7 are labeled with the statewide Democratic vote share that corresponds to the uniform swing applied in each row. The middle (13th from top) row in Figure U7 applies a +0% uniform swing, which corresponds to a 47.92% statewide Democratic vote share. Each row moving upward from this row depicts an additional +0.5% in the uniform swing applied, and each row moving downward depicts a decrease of 0.5% in the uniform swing applied. Therefore, the bottom row in figure U7 applies a -6% uniform swing, which corresponds to a 41.92% statewide Democratic vote share, and the top row applies a +6% uniform swing, which corresponds to a 53.92% statewide Democratic vote share.

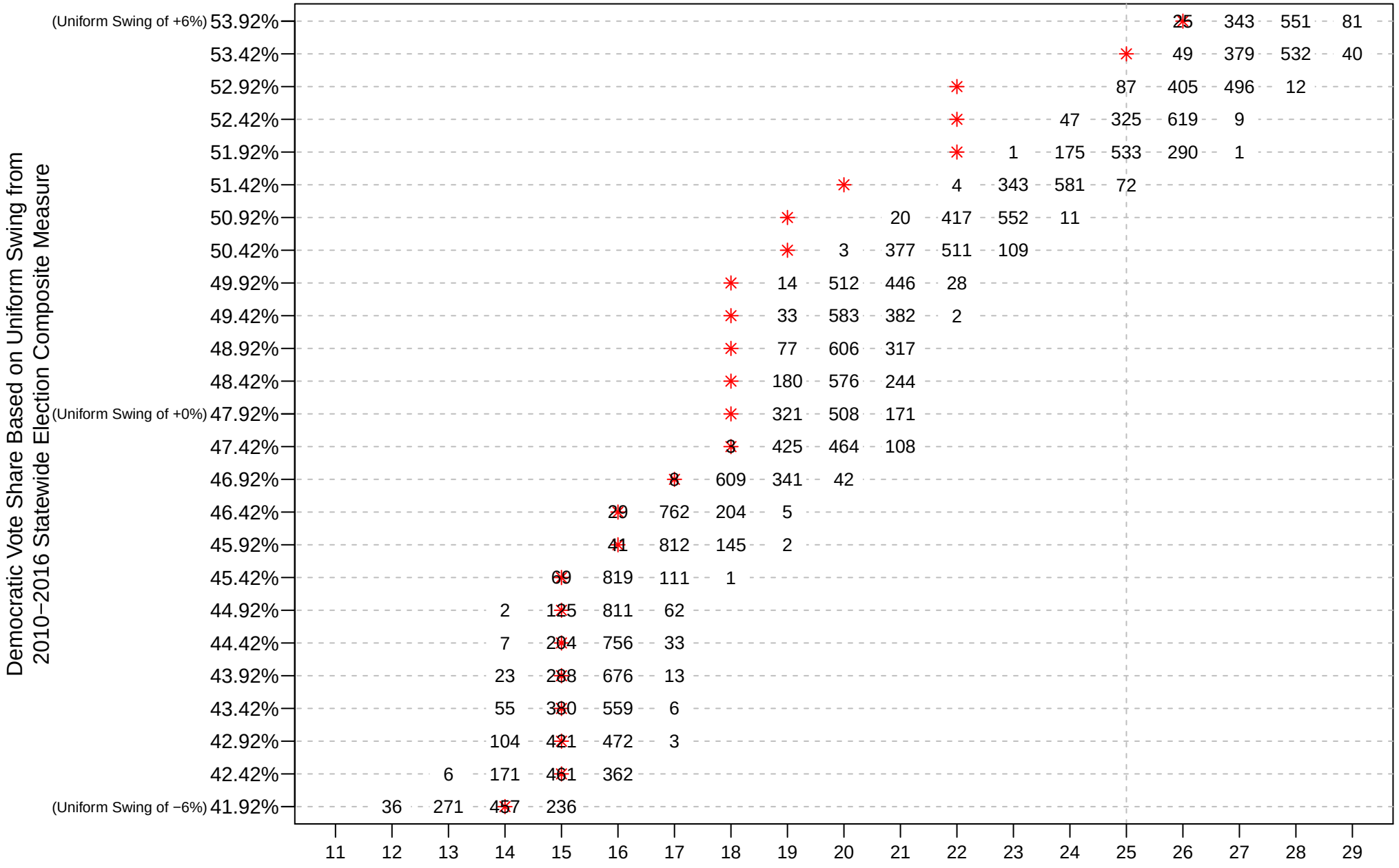
I applied the uniform swings in each row as follows: A uniform swing adjustment of +4.5%, for example, means that I calculated each district's Democratic vote share using the 2010-2016 Statewide Election Composite and added +4.5% to each district's vote share. I made

this same uniform swing adjustment for both the 2017 Senate Plan as well as for all 1,000 computer-simulated plans. I then identified the number of districts in each plan with over a 50% Democratic vote share, after accounting for the uniform swing adjustment.

Figure U7 displays these calculations under each of the 25 different alternative uniform swings. The top row of Figure U7, which applies a uniform swing of +6% (corresponding to a 53.92% statewide Democratic vote share), reports the number of Democratic-favoring districts in each of the 1,000 simulated plans, as measured using the 2010-2016 Statewide Election Composite with a +6% uniform swing. This row contains a series of numbers, corresponding to the horizontal axis, reporting the number of computer-simulated plans (out of 1,000) that contain a particular number of Democratic-favoring districts. Specifically, this top row reports 25 simulated plans containing 26 Democratic districts, 343 simulated plans containing 27 Democratic districts, 551 simulated plans containing 28 Democratic districts, and so on. Hence, the numbers in Figure U7 report the number of simulated plans that would contain a particular number of Democratic districts, as listed along the horizontal axis of the Figure. The red star in each row of Figure U7 denotes the number of Democratic districts for the 2017 Senate Plan under each uniform swing adjustment.

Figure U7 reveals the uniform swing conditions under which the computer-simulated plans would create 25 or more Democratic-favoring Senate districts. With a uniform swing of +4.0%, which corresponds to a 51.92% statewide Democratic vote share, 82.4% of the simulated plans in Senate Simulation Set 1 would create 25 or more Democratic-favoring districts. Meanwhile, under this same uniform swing condition, the 2017 Senate Plan would contain only 22 Democratic districts. Similarly, with a uniform swing of +4.5%, which corresponds to a 52.42% statewide Democratic vote share, 95.3% of the simulated plans in Senate Simulation Set 1 would create 25 or more Democratic-favoring districts, but the 2017 Senate Plan would again contain only 22 Democratic districts. Figure U8 displays the calculations of each plan's number of Democratic districts under a uniform swing of +4%, which corresponds to a 51.92% statewide Democratic vote share. Figure U9 displays the calculations of each plan's number of Democratic districts under a uniform swing of +4.5%, which corresponds to a 52.42% statewide Democratic vote share.

Figure U7: Number of Democratic Districts Under Alternative Uniform Swings in Senate Simulation Set 1 Plans



(Numbers in this figure report the number of simulated plans (out of 1,000) that would contain a particular number of Democratic districts (listed along the horizontal axis) under each uniform swing condition (listed in the left margin). Red stars denote calculations for the 2017 Senate Plan.)

Figure U8:
Number of Democratic Senate Districts Measured Using the 2010−2016 Election Composite With a +4% Uniform Swing, Corresponding to a 51.92% Statewide Democratic Vote Share (Senate Simulation Set 1)

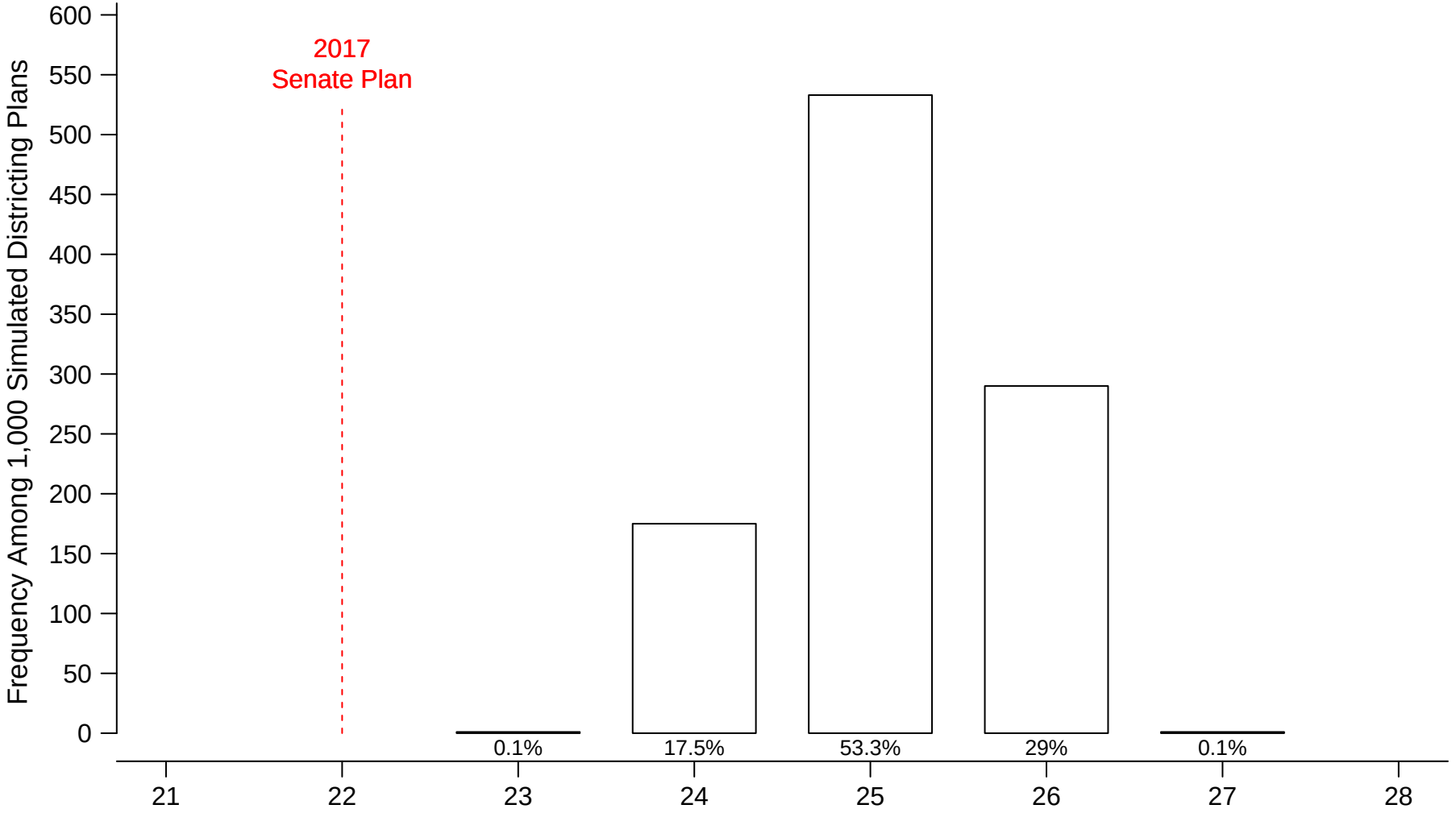
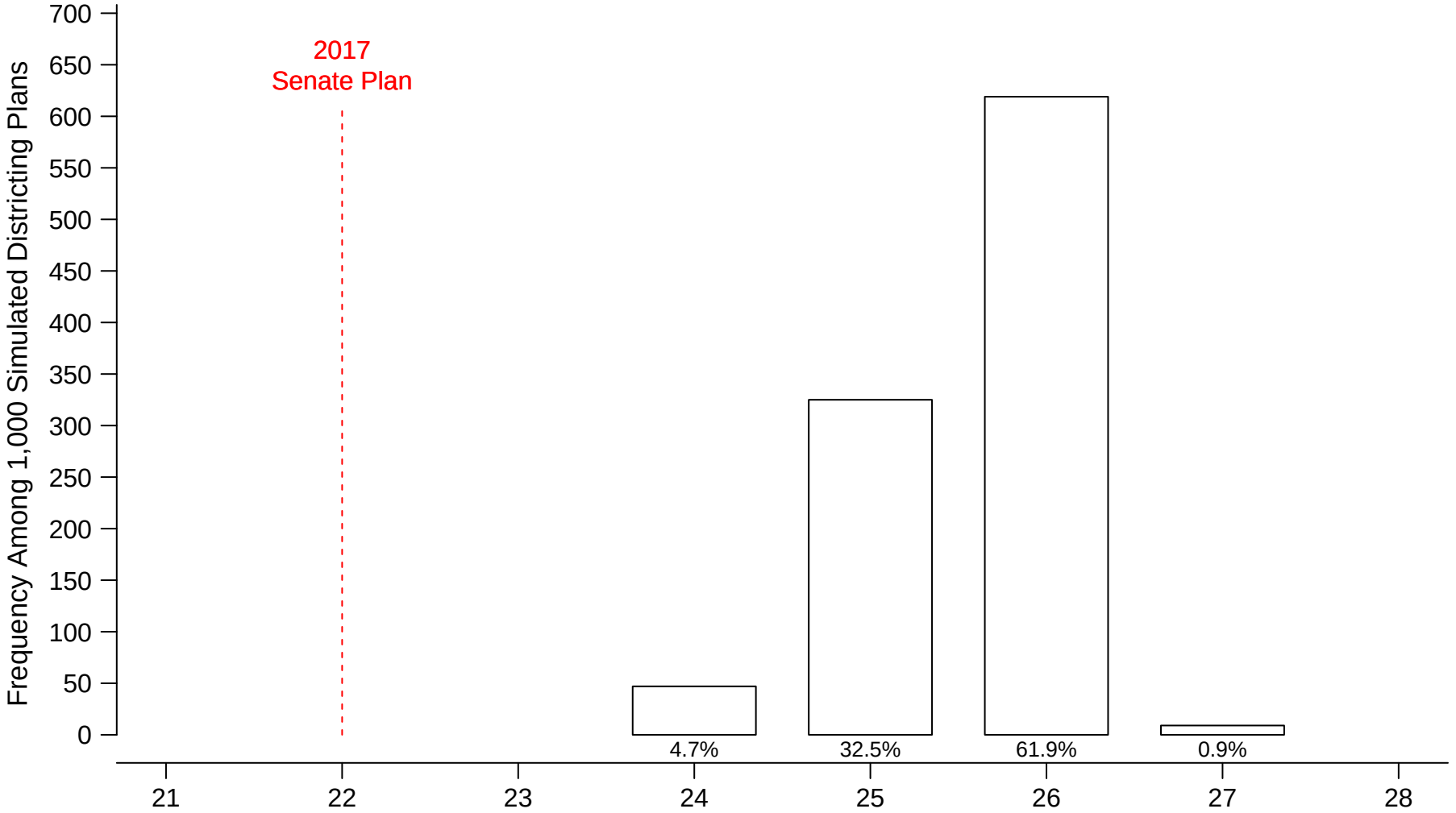


Figure U9:
Number of Democratic Senate Districts Measured Using the 2010−2016 Election Composite With a +4.5% Uniform Swing, Corresponding to a 52.42% Statewide Democratic Vote Share (Senate Simulation Set 1)



Mean-Median Difference: Analysis of the Mean-Median Difference confirms the partisan-outlying nature of the 2017 Senate Plan when compared to the computer-drawn plans in Senate Simulation Set 1. In Figure 15, the vertical axis measures the Mean-Median Difference of the 2017 Senate Plan and each simulated plan using the 2010-2016 Statewide Election Composite, while the horizontal axis measures the average Reock score of the districts within each plan, with higher Reock scores indicating more compact districts. In this Figure, each of the gray circles represents one of the 1,000 computer-simulated plans in Senate Simulation Set 1, while the red star represents the 2017 Senate Plan. Figure 15 illustrates that the 2017 Senate Plan's Mean-Median Difference in +3.4%, indicating that the median district is skewed significantly more Republican than the plan's average district. Figure 15 further illustrates that this difference is an extreme statistical outlier compared to the 1,000 simulations in Senate Simulation Set 1. Indeed, the 2017 Senate Plan's +3.4% Mean-Median Difference is an outcome never observed in these 1,000 simulated plans. The 1,000 simulated plans all exhibit Mean-Median Differences ranging from +1.0% to +2.9%. In fact, the middle 50% of these computer-simulated plans have Mean-Median Differences ranging from +1.5% to +1.9%, indicating a much smaller degree of skew in the median district than occurs in the 2017 Senate Plan.

The fact that the 1,000 simulated plans in Figure 15 all produce a small, positive Mean-Median Difference indicates that voter geography may be modestly skewed in a manner that slightly benefits the Republicans in North Carolina Senate districting. This modest skew in the simulated districting plans may result partially from Democratic voters' tendency to cluster in large, urban areas of North Carolina. Additionally, the modest skew may partially result from the county groupings that the General Assembly created under the 2017 Senate Plan, as my simulation algorithm simply follows the same county grouping boundaries used in the enacted plan. But more importantly, the range of this natural skew, as shown in Figure 15, is always much smaller than the extreme +3.4% Mean-Median Difference observed in the 2017 Senate Plan. Hence, these results confirm the main finding that the 2017 Senate Plan creates an extreme partisan outcome that cannot be explained by North Carolina's voter geography or by the application of the non-partisan districting criteria listed in the 2017 Adopted Criteria.

Was the 2017 Senate Plan produced with reasonable efforts to draw compact districts? Figure 16 illustrates the compactness of the 1,000 simulated plans, compared against the compactness of the enacted 2017 Senate Plan. In this Figure, the horizontal axis depicts the

Figure 15:
Senate Simulation Set 1 (Following Only Non−Partisan Redistricting Criteria):
Comparison of 2017 Senate Plan to 1,000 Simulated Plans on Compactness and Mean−Median Difference

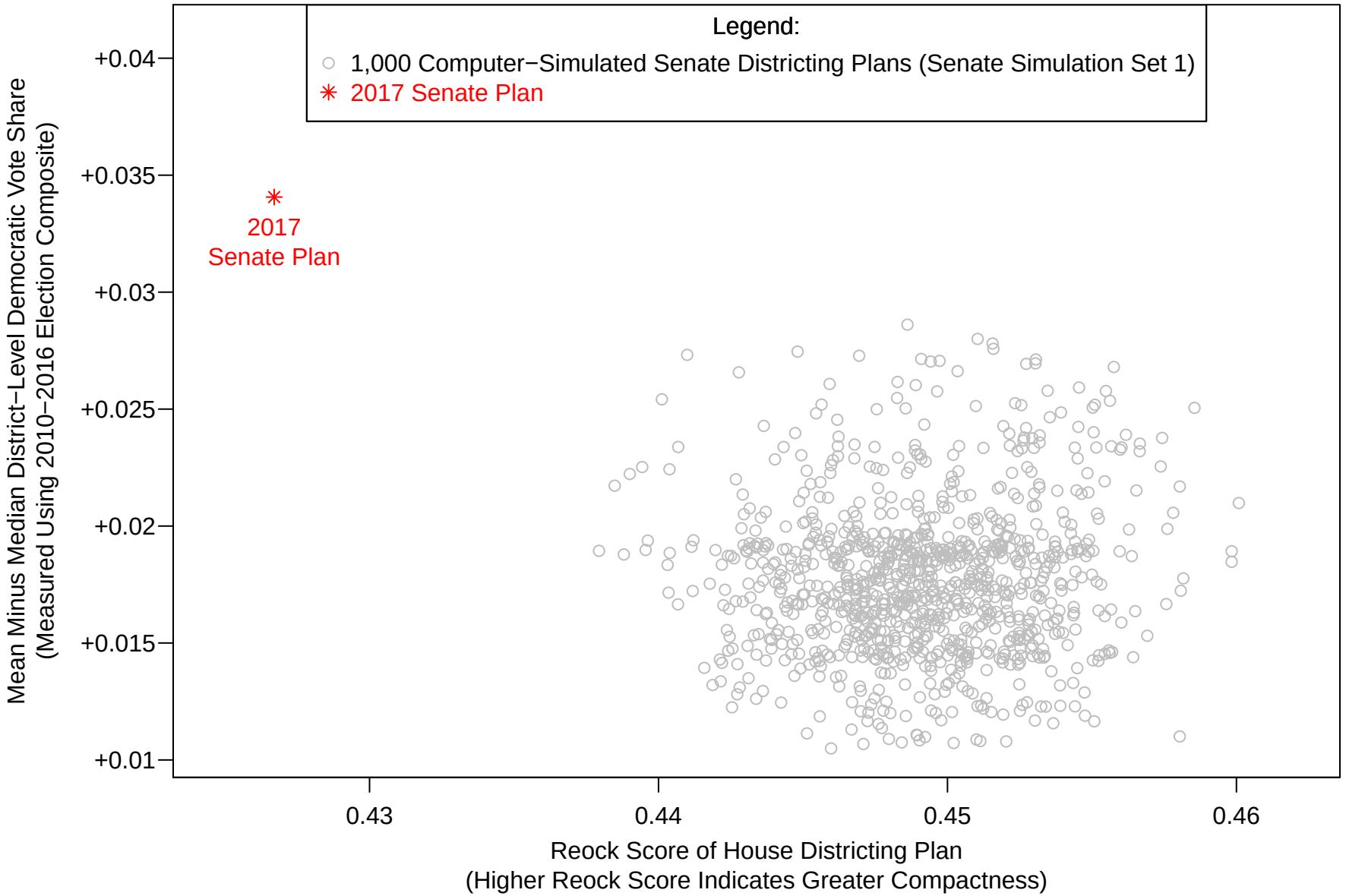
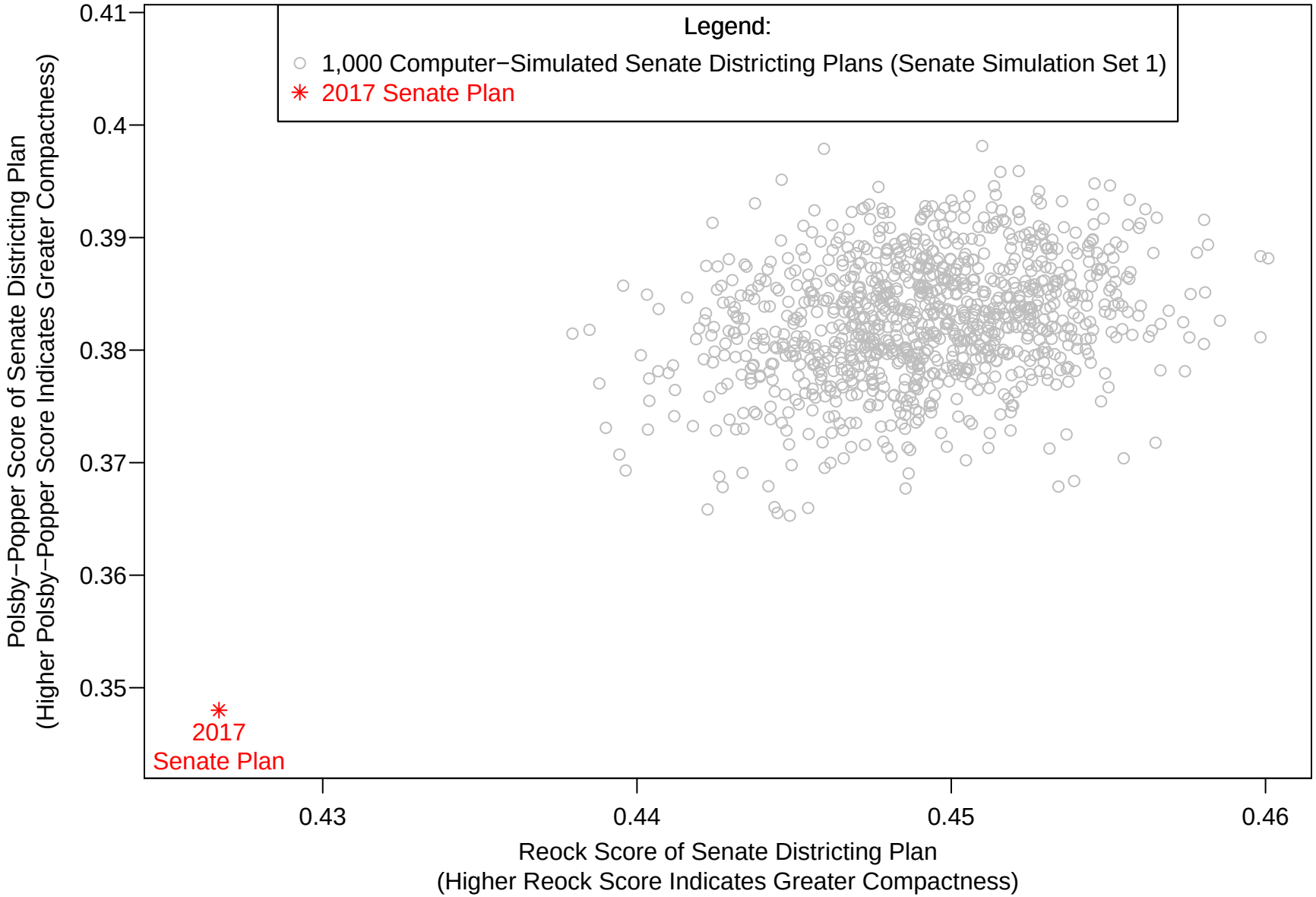


Figure 16:
Senate Simulation Set 1 (Following Only Non−Partisan Redistricting Criteria):
Comparison of 2017 Senate Plan Versus 1,000 Simulated Plans on Compactness



average Reock score of the districts within each plan, while the vertical axis depicts the average Polsby-Popper score. Higher Reock scores and higher Polsby-Popper scores both indicate greater geographic compactness. Each gray circle in this Figure represents one of the 1,000 simulated plans, while the red star denotes the enacted 2017 Senate Plan. Figure 16 illustrates that the 2017 Senate Plan is significantly less geographically compact than every single one of the simulated plans in Senate Simulation Set 1, whether measured by average Reock or average Polsby-Popper scores. The simulated plans contain Reock scores ranging from 0.438 to 0.460, while the 2017 Senate Plan produces a Reock score of only 0.427. Similarly, the simulated plans have Polsby-Popper scores ranging from 0.365 to 0.398, while the 2017 Senate Plan produces a Polsby-Popper score of only 0.348. Hence, it is clear that the 2017 Senate Plan was not drawn with an effort to create districts that are as geographically compact as reasonably possible.

Was the 2017 Senate Plan produced with reasonable efforts to pursue any of the other non-partisan districting criteria outlined in the 2017 Adopted Criteria? Once again, the computer simulations offer insight into the type and range of plans that would have emerged had reasonable efforts been made to adhere to the non-partisan portions of the 2017 Adopted Criteria. As detailed in Figure 17, the 2017 Senate Plan split far more municipalities than was reasonably necessary: The 1,000 computer-simulated plans split from 8 to 12 municipalities, while the 2017 Senate Plan splits 25 municipalities. Furthermore, as Figure 18 illustrates, the 2017 Senate Plan also split more VTDs than was reasonably necessary: The 1,000 computer-simulated plans split between 0 to 3 VTDs, while the 2017 Senate Plan split 5 VTDs. Hence, it is clear that the 2017 Senate Plan did not seek to split as few municipalities and VTDs as reasonably possible.

Why did the 2017 Senate Plan so significantly subordinate these non-partisan criteria of geographic compactness and minimizing VTD and municipality splits? The 2017 Senate Plan is entirely outside the range of the 1,000 simulated maps with respect to both the partisan distribution of seats (Figure 14 and 15) and geographic compactness (Figure 15 and 16), in addition to splitting far more municipalities (Figure 17) and VTDs (Figure 18) than would have occurred if the map-drawer had simply followed the non-partisan portions of the 2017 Adopted Criteria. Collectively, these findings suggest that the 2017 Senate Plan was drawn under a process in which a partisan goal – the skewing of districts in a pro-Republican direction and the creation of additional Republican districts – predominated over adherence to the non-partisan districting criteria described in the 2017 Adopted Criteria. The predominance of this extreme

partisan goal subordinated the non-partisan, traditional districting considerations of minimizing VTD splits, following municipal boundaries, and drawing geographically compact districts.

Figure 17:
Senate Simulation Set 1 (Following Only Non−Partisan Redistricting Criteria):
Split Municipalities in 2017 Senate Plan Versus 1,000 Simulated Plans

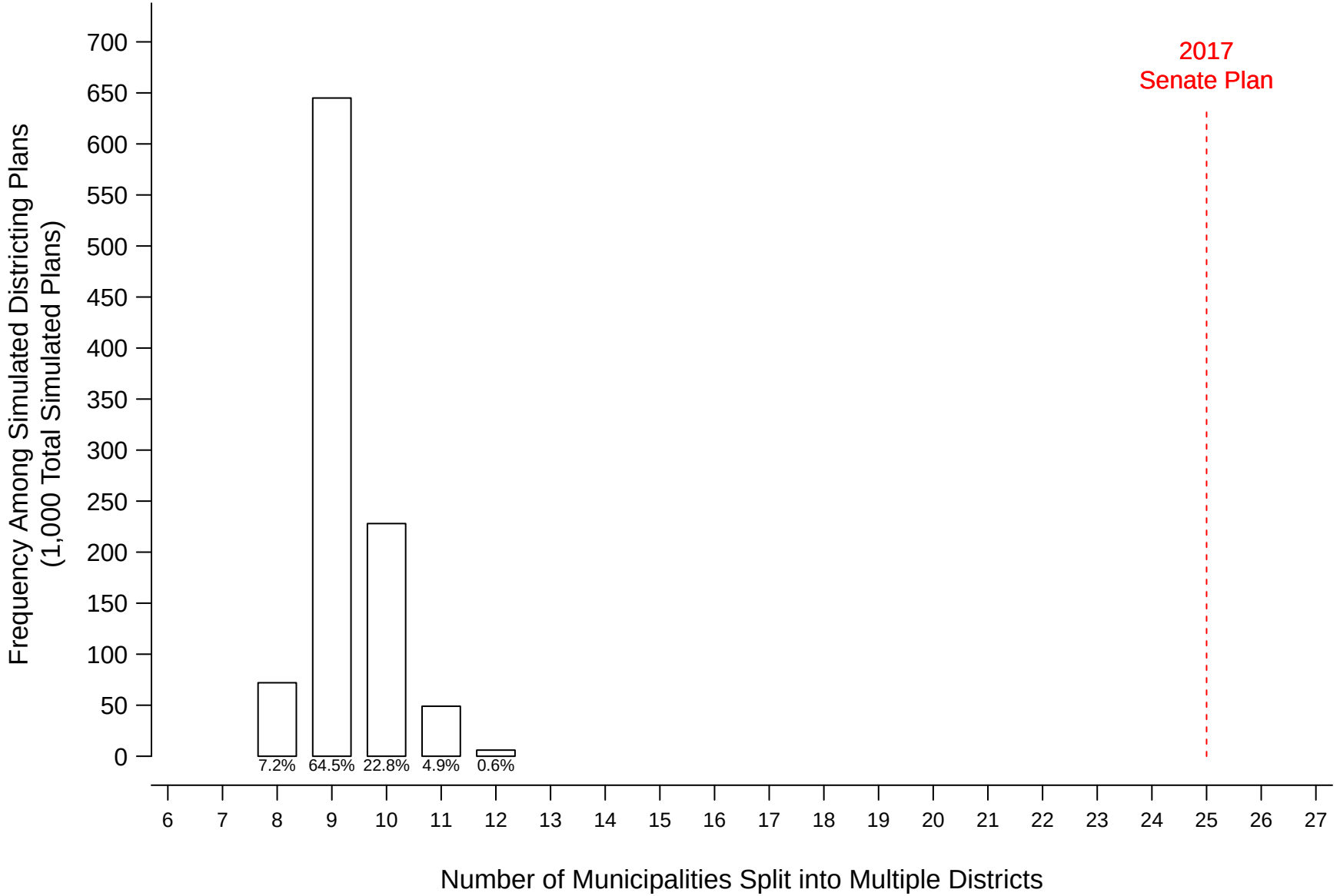
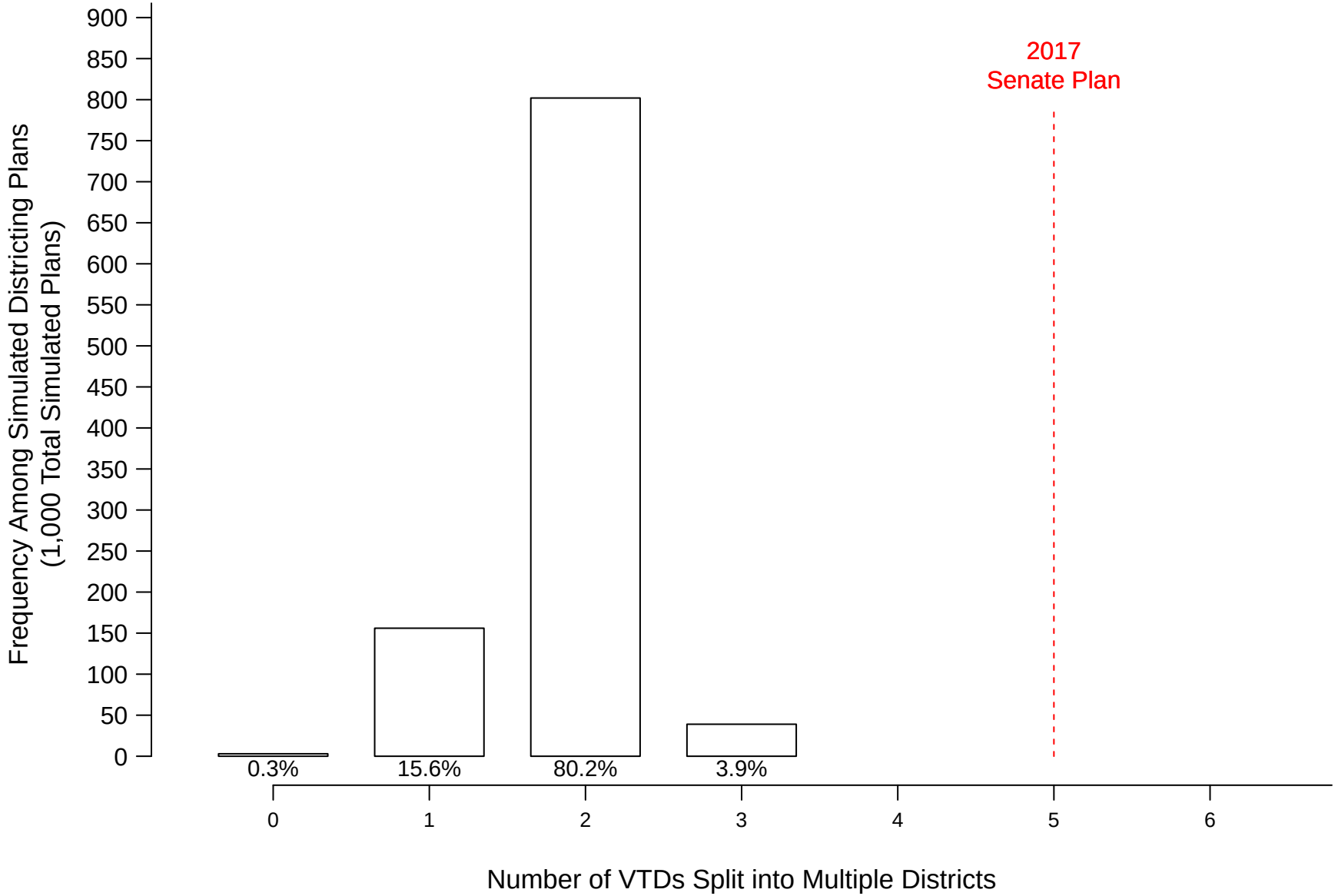


Figure 18:
Senate Simulation Set 1 (Following Only Non−Partisan Redistricting Criteria):
Split VTDs in 2017 Senate Plan Versus 1,000 Simulated Plans



Senate Simulation Set 2:

Following Traditional Districting Criteria While Protecting Incumbent Representatives

In producing Senate Simulation Set 1, the computer algorithm ignored any considerations regarding the protection of incumbent Senators or the pairing of incumbents within the same district. Just as I did with House Simulation Set 1, I initially ignored this portion of the 2017 Adopted Criteria because the protection of incumbent Senators during the redistricting process could cause indirect partisan consequences.

Among the 48 relevant incumbents holding office at the time of the original drawing of each of the current districts, 30 incumbents (or 64%) were Republican, while only 17 incumbents were Democrats. These incumbents were elected from previous versions of North Carolina's Senate districts. As this slate of incumbents was heavily Republican and was elected from previous versions of North Carolina's Senate districts, an attempt to protect all incumbents would, in general, encourage the drawing of a plan with districts somewhat similar to the previous districts from which the incumbents had been previously elected, thus indirectly distorting the partisan distribution of voters across districts. Hence, I conducted the first set of simulations (Senate Simulation Set 1) with no efforts at incumbency protection in order to analyze the range of plans that could emerge from strict adherence to the non-partisan portions of the 2017 Adopted Criteria.

Nevertheless, I also analyzed whether the significant Republican bias created by the enacted 2017 Senate Plan could have simply resulted from an effort to protect the incumbent members of North Carolina's Senate by not pairing two or more of them into the same district. I evaluated this possible explanation by conducting a second set of districting simulations (Senate Simulation Set 2) designed to intentionally protect exactly as many incumbents as is mathematically possible within each county grouping while otherwise adhering to the traditional districting criteria described earlier. Moreover, the computer algorithm was instructed to protect the very same incumbents that are protected under the 2017 Senate Plan's districts, meaning that my simulations did not double-bunk any incumbent who was not double-bunked under the enacted plan. I found that even a districting process that intentionally protects as many incumbents as is mathematically possible (while also protecting the specific incumbents protected by the 2017 Senate Plan) does not explain the extreme Republican advantage created by the 2017 Senate Plan.

I began by identifying the 2017 Senate Plan districts that were drawn in a manner that protected incumbent Senators from being paired with another incumbent. Specifically, I identified these protected incumbent Senators in the following three ways: First, within the Senate districts that were redrawn in 2017, I analyzed those Senate incumbents who were holding office when the General Assembly drew the 2017 Senate map. Second, Plaintiffs' counsel provided me with a list of those incumbents who had publicly announced their retirements before the enactment of the 2017 Senate Plan, and I removed these incumbents from consideration in my analysis. Furthermore, some Senate districts that were originally drawn in 2011 were not altered in the 2017 Senate Plan. Within these unaltered districts, I identified the incumbents holding office as of the 2011 redistricting process, since those were the incumbents whom the General Assembly would have been attempting to protect at the time those districts were drawn. In other words, for those Senate districts in the 2017 Senate Plan that were originally drawn in 2011 and not redrawn in 2017, I analyzed whether the incumbents holding office in 2011 were protected in those districts. In summary, the incumbents I considered in this analysis were only those Senators who were holding office (and had not announced retirement plans) when their respective districts were originally drawn, which was either in 2011 or in 2017.

For the Senate districts drawn in 2011 and unchanged in 2017, there were 17 incumbents meeting the criteria laid out above, and for the Senate districts redrawn in 2017, there were 31 incumbents meeting the criteria laid out above. Thus, in total, I identified 48 incumbent Senators relevant to my simulations in Simulation Set 2. Among these 48 total incumbent Senators, the relevant districts enacted in 2011 and 2017 protected 38 of the incumbents.

Having identified the 48 total relevant incumbents for the Senate districts, I then conducted a second, separate set of simulations. Senate Simulation Set 2 prioritizes the protection of incumbents while otherwise pursuing the same non-partisan districting criteria as Senate Simulation Set 1. Specifically, I programmed the computer algorithm to guarantee the protection of the mathematically maximum possible number of incumbents within each county grouping. Additionally, I also required that the algorithm produce districts that protect, at a minimum, the same set of incumbent Senators as the ones protected by the 2017 Senate Plan districts. In other words, the simulation algorithm guaranteed the protection of at least as many total incumbents as the 2017 Senate Plan protected, and the algorithm was also required to protect, at minimum, the same 38 incumbents that were protected in the 2017 Senate Plan.

This approach to protecting incumbents is an extremely conservative one because it not only maximizes the protection of incumbents, but it also defers to the enacted plans in terms of the precise set of incumbent Senators who are protected.

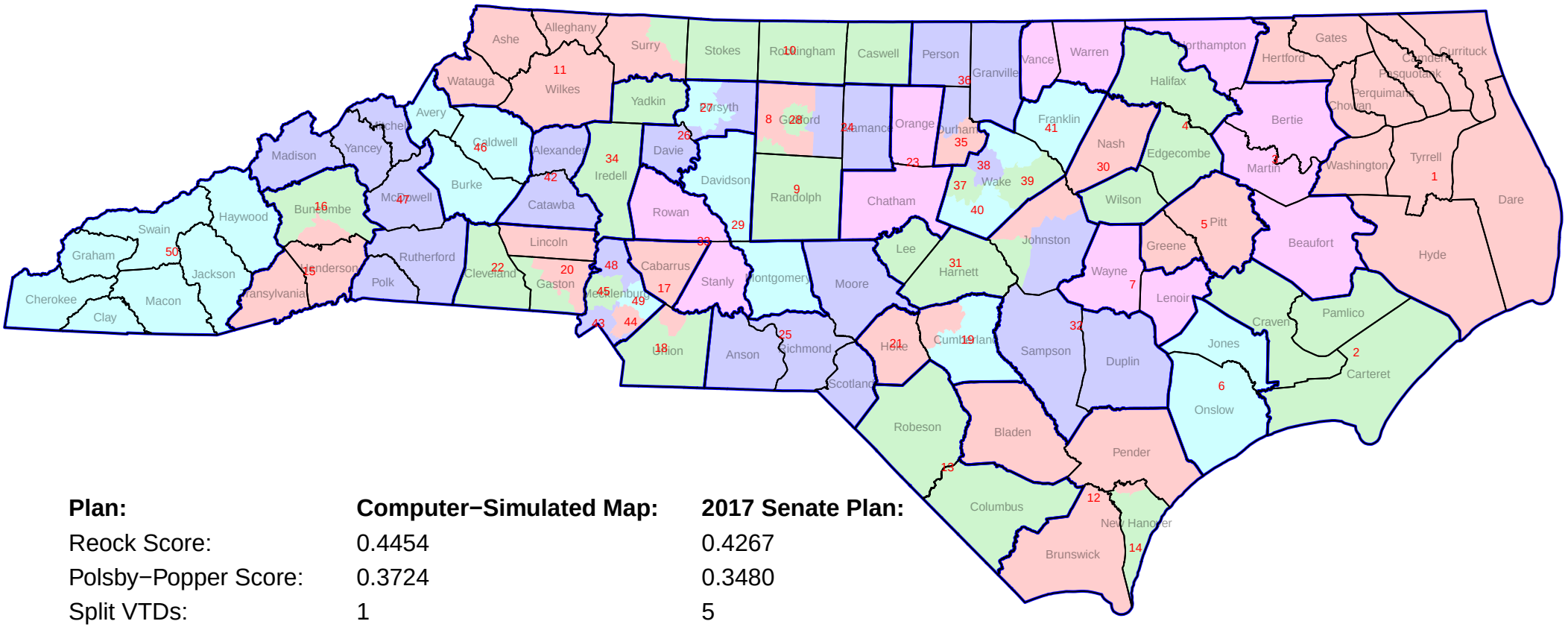
Aside from these two requirements, the computer algorithm gives no consideration to the partisanship of the incumbents that are protected or not protected under each simulated plan. And beyond this intentional protection of incumbents, Senate Simulation Set 2 otherwise prioritizes the same seven non-partisan traditional districting criteria followed in the first set of simulations while again ignoring any other political considerations beyond incumbent protection.

As an example of the maps produced by this algorithm, Figure 19 illustrates the final of the 1,000 simulated districting plans produced by the computer algorithm in Senate Simulation Set 2. Descriptions of the 1,000 simulated maps in Senate Simulation Set 2 appear in the third column of Table 6.

The protection of the maximum possible number of incumbents in Senate Simulation Set 2 was achieved without any increase in the number of county traversals, or split VTDs (Figure 24) and with only very slight decreases in the geographic compactness of the simulated districts (Figure 22) and a slight increase in split municipalities (Figure 23). Figure 22 illustrates that the 2017 Senate Plan is still significantly less compact than every single one of the 1,000 of the simulations in Senate Simulation Set 2, using both the Reock and Popper-Polsby measures of compactness. Figure 23 illustrates that the 2017 Senate Plan's splitting of 25 municipalities is significantly more than in every single one of the 1,000 simulated plans, which each split from 10 to 16 municipalities. Figure 24 illustrates that the 2017 Senate Plan's splitting of 5 VTDs is still more than in every single one of the 1,000 simulated plans, which each split from 0 to 3 VTDs. Altogether, these simulation results illustrate that the 2017 Adopted Criteria criterion of not pairing multiple incumbents can be achieved without significantly subordinating any of the non-partisan traditional districting criteria listed in the 2017 Adopted Criteria. The 2017 Senate Plan, however, clearly subordinated the non-partisan districting criteria of geographic compactness, avoiding VTD splits, and avoiding municipality splits.

Does the protection of Senate incumbents make the 2017 Senate Plan's Republican partisan bias a plausible outcome that could have emerged from a redistricting process adhering to non-partisan criteria? Figure 20 illustrates the distribution of partisan seats across the 1,000 simulated Senate plans, with partisanship measured using the 2010-2016 Statewide Election

Figure 19:
Example of a Computer−Simulated Senate Map
From Senate Simulation Set 2 (Following Non−Partisan Redistricting Criteria and Protecting Incumbents)



Plan:	Computer−Simulated Map:	2017 Senate Plan:
Reock Score:	0.4454	0.4267
Polsby−Popper Score:	0.3724	0.3480
Split VTDs:	1	5
Split Municipalities:	13	25
Mean−Median Difference:	+1.98%	+3.4%
Democratic Districts:	20	18

(District partisanship is measured using the 2010−2016 Statewide Election Composite, which produces a 47.92% statewide Democratic vote share.)

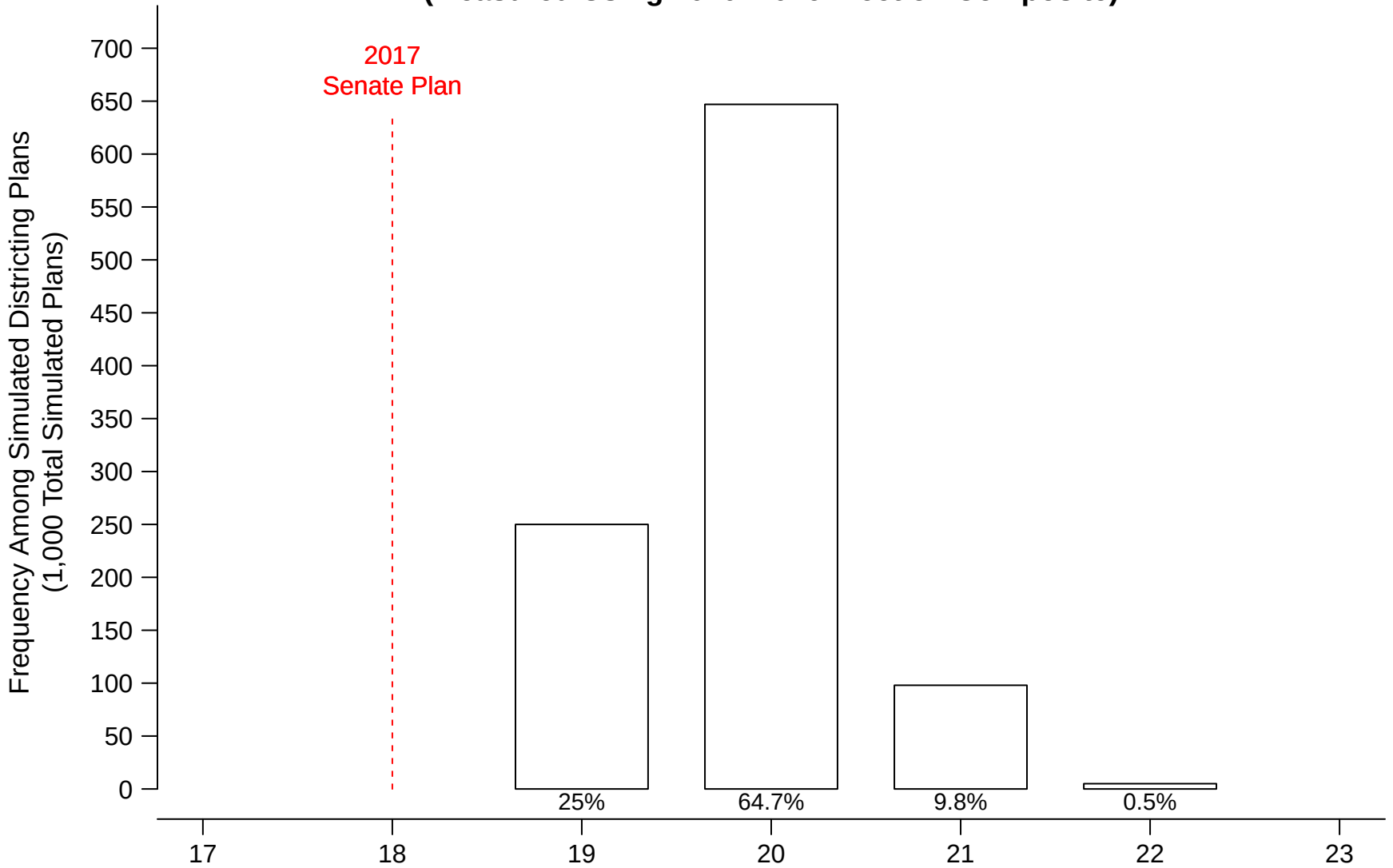
Legend:

County Grouping Boundaries

County Boundaries

Computer−Simulated Senate Districts (Including frozen districts from the 2017 Senate Plan) Numbered from 1 to 50

Figure 20:
Senate Simulation Set 2 (Following Non−Partisan Redistricting Criteria and Protecting Incumbents): Democratic−Favoring Districts in Enacted Senate Plan Versus 1,000 Simulated Plans (Measured Using 2010−2016 Election Composite)



composite. This Figure illustrates that the partisan distribution of seats in plans under Senate Simulation Set 2 is nearly identical to the partisan distribution of Senate Simulation Set 1, which ignored incumbency protection. When the maximum possible number of incumbents is protected, the simulation algorithm still continues to produce plans that range from 19 to 22 Democratic districts, as measured by the 2010-2016 Statewide Election composite. The 2017 Senate Plan's creation of only 18 Democratic districts is an outcome never achieved in Senate Simulation Set 2. Nor is the 2017 Senate Plan's creation of a +3.4% Mean-Median Difference an outcome ever observed in a single one of these 1,000 simulations (Figure 21). Finally, Figures U10, U11, and U12 also perform the same uniform swing calculations as presented earlier for Senate Simulation Set 1; these uniform swing calculations confirm that under uniform swings that would allow Democrats to win 25 or more Senate districts in the computer-simulated plans, the 2017 Senate Plan would contain significantly fewer than 25 Democratic districts.

Hence, we are able to conclude with extremely high statistical certainty that even the strictest adherence to the 2017 Adopted Criteria's mandate of protecting incumbents, combined with adherence to the other non-partisan portions of the 2017 Adopted Criteria, does not cause or explain the extreme degree of Republican advantage exhibited by the 2017 Senate Plan. Instead, the 2017 Senate Plan was drawn under a process in which a partisan goal – the skewing of districts in a pro-Republican direction and the creation of additional Republican districts – predominated over adherence to the non-partisan districting criteria described in the 2017 Adopted Criteria.

Figure 21:
Senate Simulation Set 2 (Following Non−Partisan Redistricting Criteria and Protecting Incumbents):
Comparison of 2017 Senate Plan Versus 1,000 Simulated Plans on Compactness and Mean−Median Difference

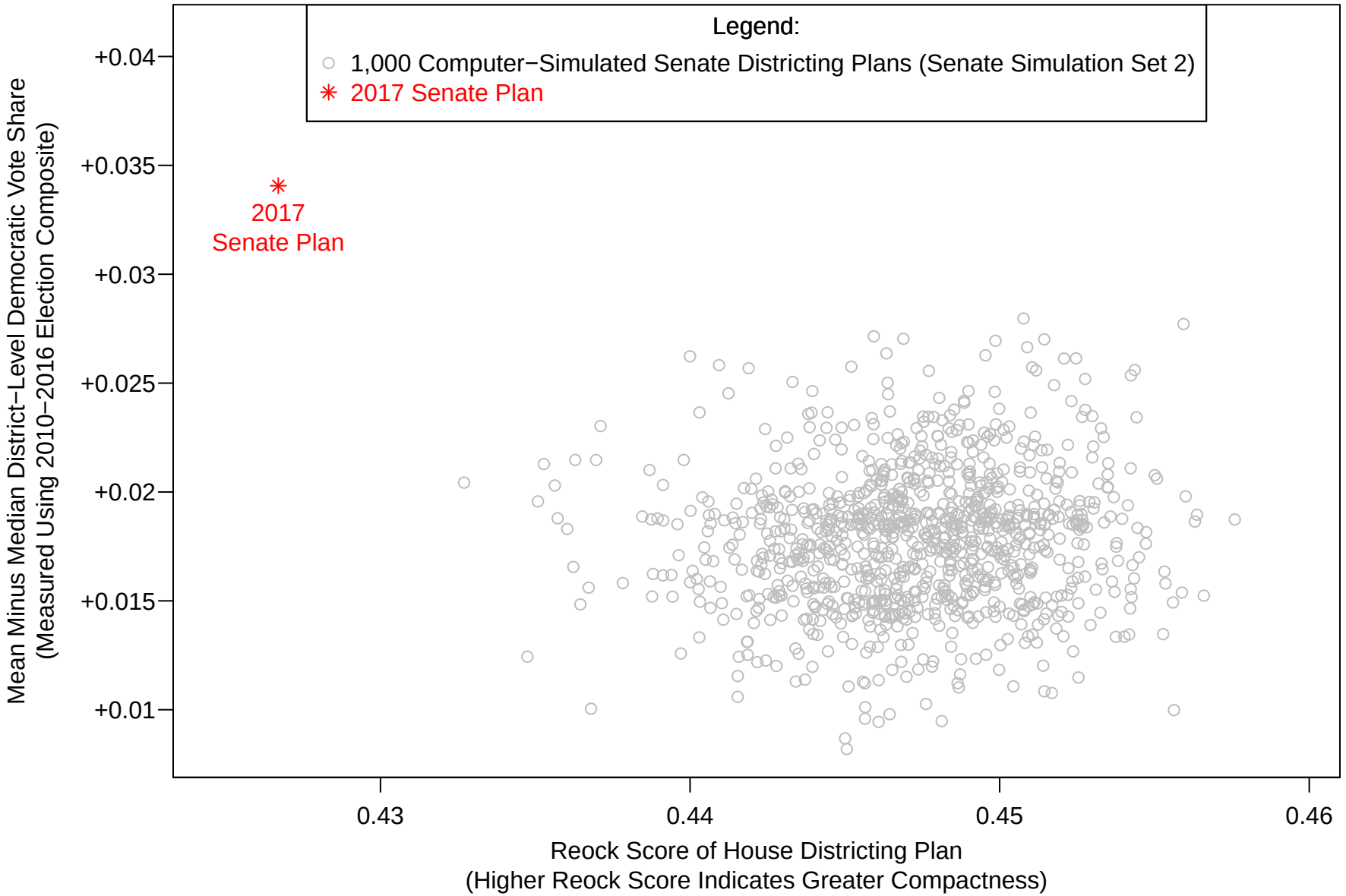


Figure 22:
Senate Simulation Set 2 (Following Non−Partisan Redistricting Criteria and Protecting Incumbents):
Comparison of Enacted Plan Versus 1,000 Simulated Plans on Compactness

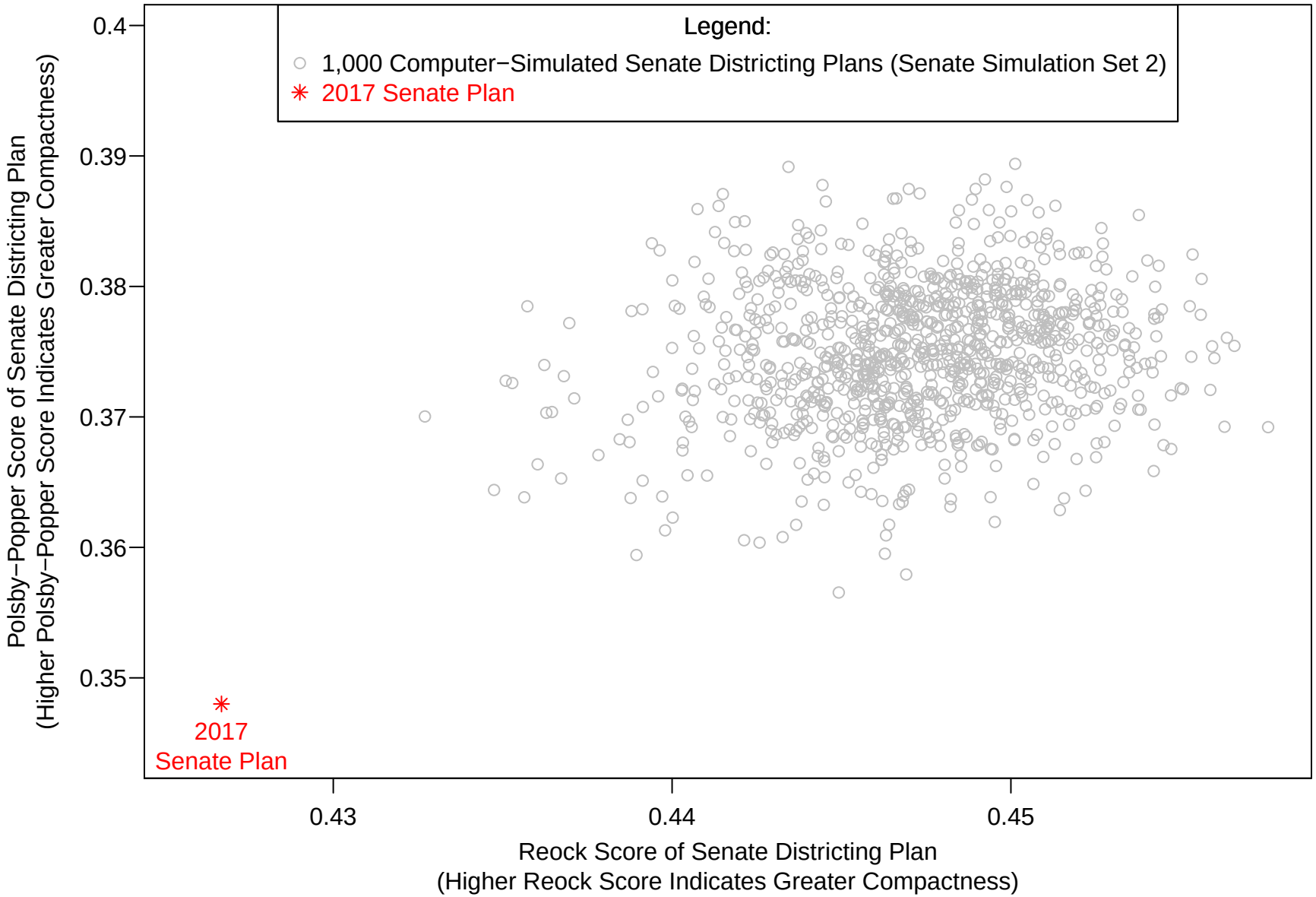


Figure 23:
Senate Simulation Set 2 (Following Non−Partisan Redistricting Criteria and Protecting Incumbents):
Split Municipalities in Enacted Plan Versus 1,000 Simulated Plans

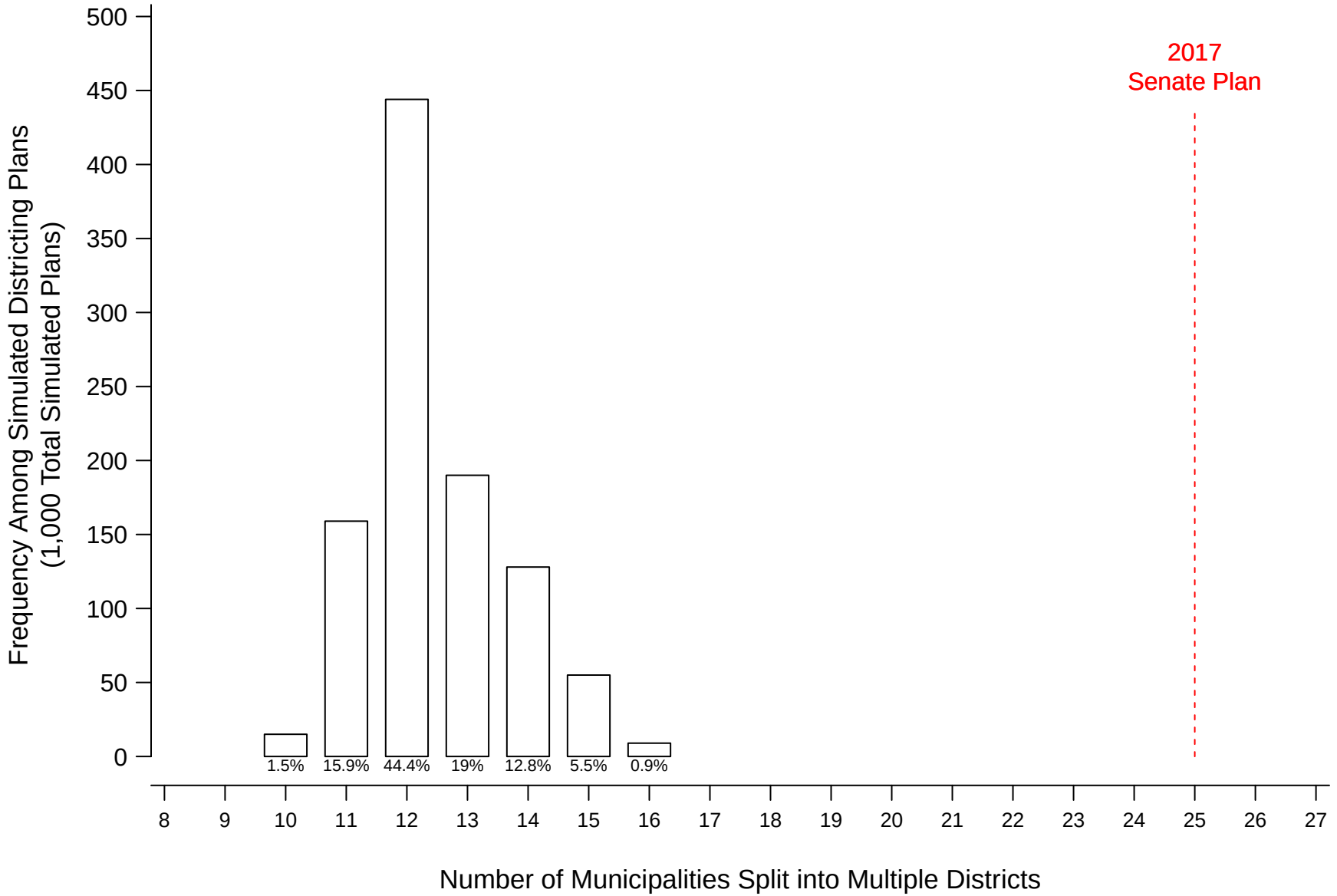


Figure 24:
Senate Simulation Set 2 (Following Non−Partisan Redistricting Criteria and Protecting Incumbents):
Split VTDs in Enacted Plan Versus 1,000 Simulated Plans

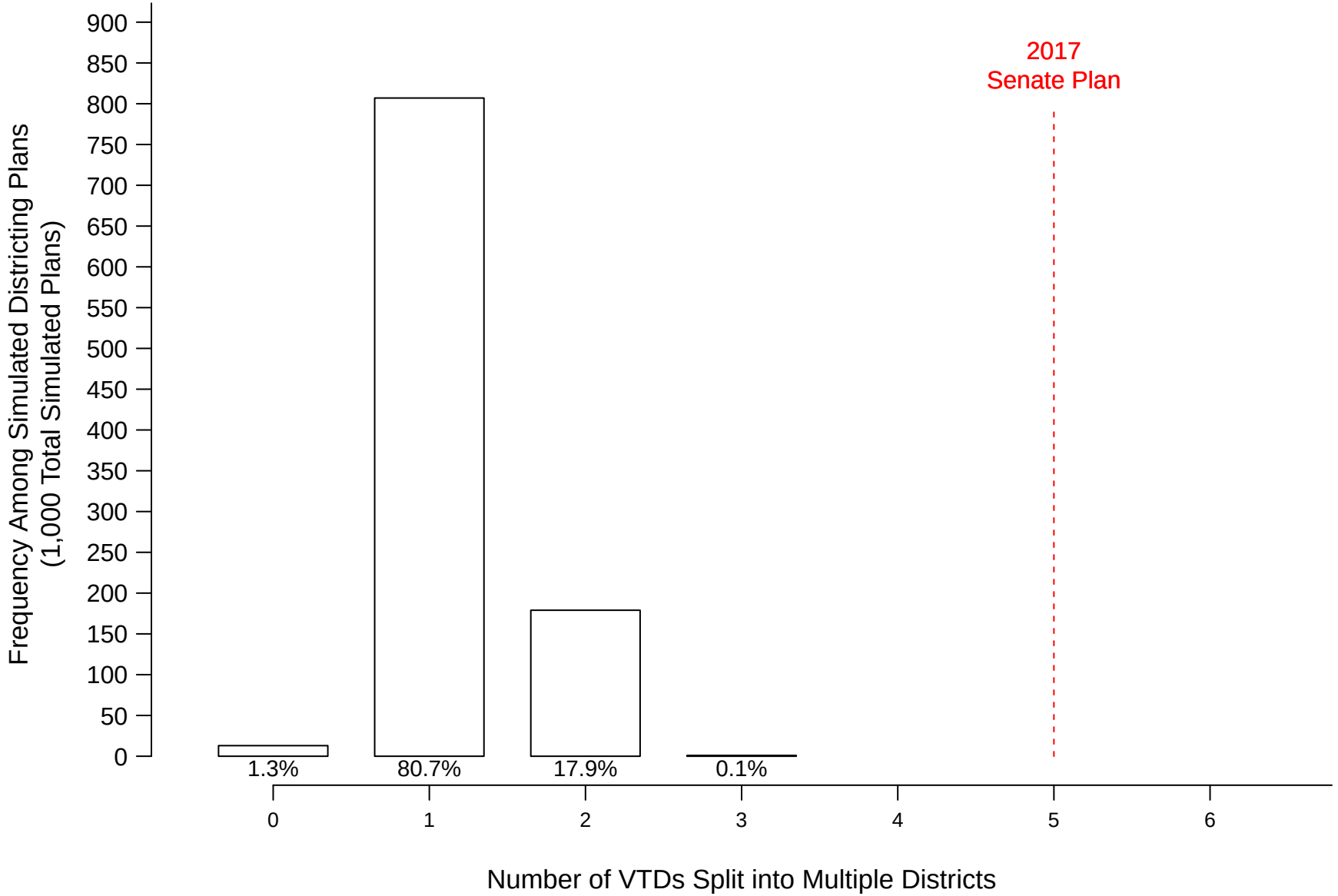
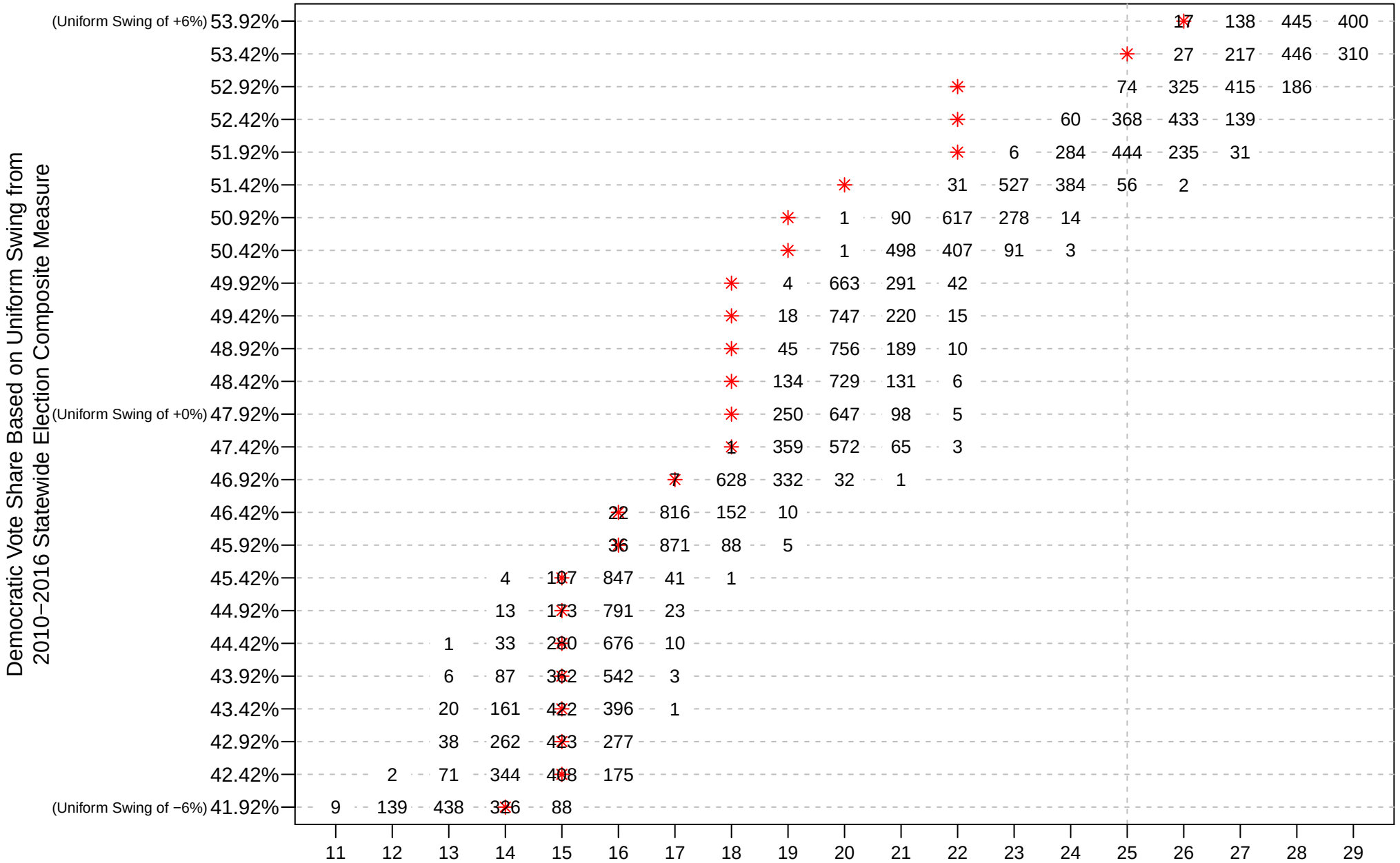


Figure U10: Number of Democratic Districts Under Alternative Uniform Swings in Senate Simulation Set 2 Plans



(Numbers in this figure report the number of simulated plans (out of 1,000) that would contain a particular number of Democratic districts (listed along the horizontal axis) under each uniform swing condition (listed in the left margin). Red stars denote calculations for the 2017 Senate Plan.)

Figure U11:
Number of Democratic Senate Districts Measured Using the 2010−2016 Election Composite With a +4% Uniform Swing, Corresponding to a 51.92% Statewide Democratic Vote Share (Senate Simulation Set 2)

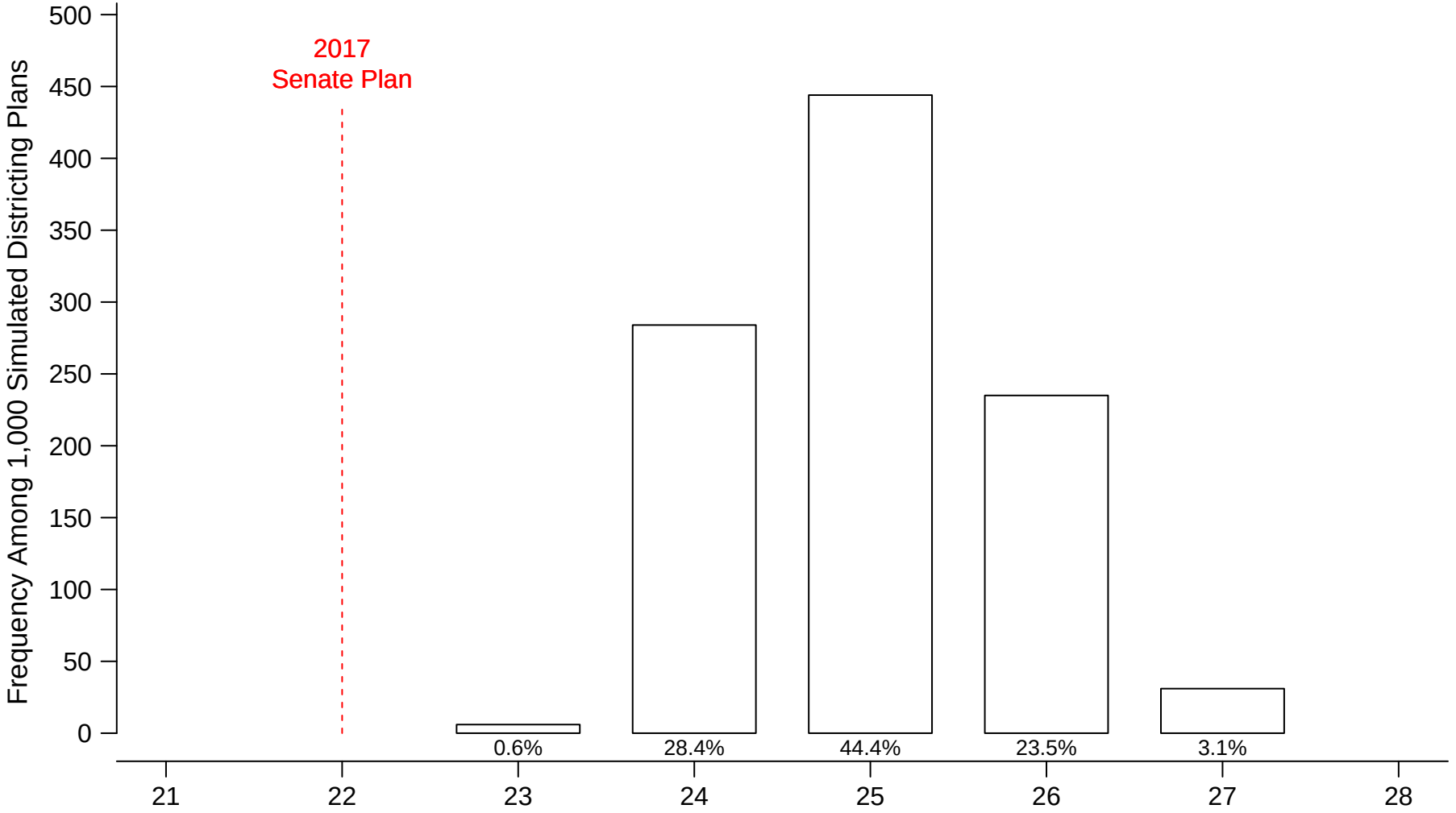
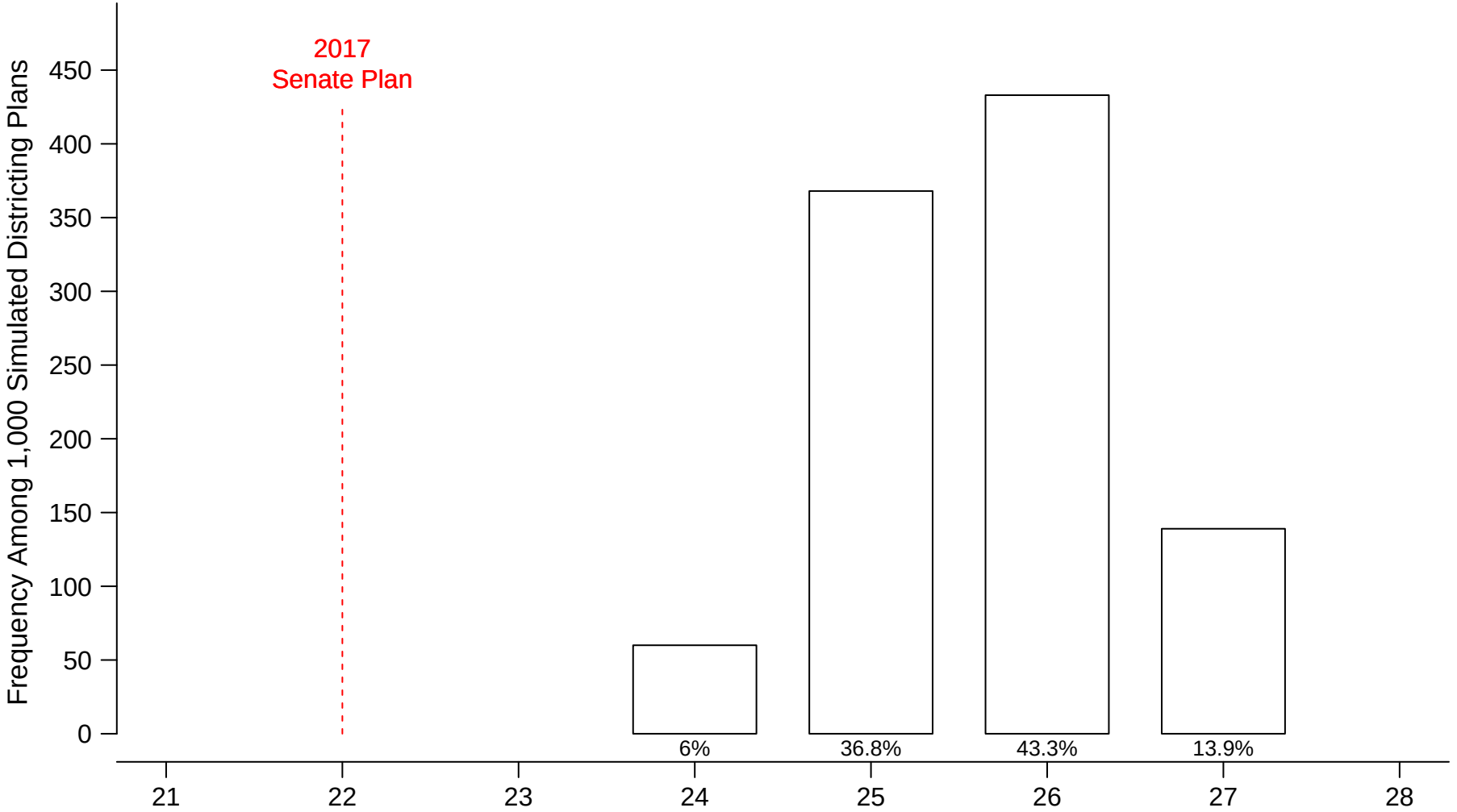


Figure U12:
Number of Democratic Senate Districts Measured Using the 2010−2016 Election Composite With a +4.5% Uniform Swing, Corresponding to a 52.42% Statewide Democratic Vote Share (Senate Simulation Set 2)



County Grouping-by-Grouping Analysis of the 2017 House Plan:

In addition to the plan-wide analysis described earlier, I also evaluated the extent to which partisan intent predominated in the drawing of individual county groupings in the 2017 House Plan. Specifically, I conducted an analysis of selected county groupings in the enacted plan using all of the computer-simulated House plans produced for this report. Using the two sets of 1,000 simulated House plans described earlier in this report (House Simulation Set 1 and Set 2), I compared the 2017 House Plan's version of districts within each county grouping to the entire distribution of computer-simulated districts in that same grouping. These comparisons allowed me to identify individual groupings in the 2017 House Plan that are partisan outliers compared to different versions of that grouping that emerged under the computer simulations. Within each county grouping, I compare the 2017 House Plan to the computer-simulated House plans using the following two approaches:

1) Within each county grouping, I directly compare the partisan distribution of districts in that grouping in the 2017 House Plan to the partisan distribution of districts in that grouping in each computer-simulated plan; and

2) Within each county grouping, I consider all of the 2017 House Plan districts in the grouping that are Republican-leaning (above 50% Republican vote share), and I identify the most minimally Republican-leaning of these enacted districts. For both the 2017 House Plan and each of the computer-simulated plans, I then compare the number of districts within the grouping that are at least as Republican-leaning as the most minimally Republican-leaning district within that grouping in the 2017 House Plan.

Comparing the Partisan Distribution of Districts in the Enacted and Simulated Plans:

Within each county grouping, I directly compare the partisan distribution of districts in the 2017 House Plan to the partisan distribution of districts in each computer-simulated plan. I first order the 2017 House Plan's districts within the county grouping from the most to the least-Democratic district, as measured by Democratic vote share using the 2010-2016 Statewide Election Composite. Next, I analyze each simulated plan from the set of 1,000 simulations and similarly order the simulated plan's districts within the same county grouping from the most to the least-Democratic district. I then directly compare the most-Democratic 2017 House Plan district within the county grouping to the most-Democratic simulated district within the same

grouping from each of the 1,000 computer-simulated plans. In other words, I compare one district from the 2017 House Plan to 1,000 computer-simulated districts, and I compare these districts with respect to their Democratic vote share. I then directly compare the second-most-Democratic district in the county grouping from the enacted plan to the second-most-Democratic district within the same grouping from each of the 1,000 simulated plans. I conduct the same comparison for each district in the 2017 House Plan within the grouping, comparing the enacted district to its computer-simulated counterparts from each of the 1,000 simulated plans.

Figure 27 provides a visual illustration of this analysis for the 2017 House Plan's county grouping that contains Columbus, Pender, and Robeson Counties. This county grouping contains three districts in the 2017 House Plan, so Figure 27 contains three separate rows. The top row of this Figure directly compares the partisanship of the most-Democratic 2017 House Plan district within the county grouping to the partisanship of the most-Democratic district within the same county grouping from each of the 1,000 simulated plans in House Simulation Set 1. The two percentages (in parentheses) in the right margin of this Figure report the percentage of these 1,000 simulated districts that are less Democratic than and more Democratic than the enacted plan district. Similarly, the second row of this Figure compares the second-most-Democratic district within the grouping from each plan, and the third row compares the third-most-Democratic district within the grouping from each plan. In each row of this Figure, the 2017 House Plan's district is depicted with a red star and labeled in red with its district number (e.g., HD-47); meanwhile, the 1,000 computer-simulated districts are depicted with gray circles.

As the top row of Figure 27 illustrates, the most-Democratic district in the 2017 House Plan (HD-47) is more heavily Democratic than all 1,000 of the most-Democratic districts within this grouping from each of the 1,000 computer-simulated plans. This calculation is also numerically reported in the right margin of the Figure. HD-47 is at least five percentage points more heavily Democratic than the most heavily Democratic district in the Columbus-Pender-Robeson County grouping in nearly all of the 1,000 plans in House Simulation Set 1. The vast majority of the computer-simulated counterpart districts would have been much more moderate in terms of partisanship: HD-47 exhibits a Democratic vote share of 59.65%, while all of the most-Democratic computer-simulated districts in this grouping would have exhibited a lower Democratic vote share, and over 96% of these simulated districts had a Democratic vote share between 52.3% to 55%. Therefore, I identify HD-47 as a partisan outlier when compared to its

1,000 computer-simulated counterparts, using a standard threshold test of 95% for statistical significance.

I use this same methodology to analyze each 2017 House Plan district within different county groupings. Figures 25 to 40 illustrate my grouping-by-grouping analysis for different county groupings using House Simulation Set 1 as a baseline for comparison and for identifying partisan outliers. Similarly, Figures 41 to 56 provide grouping-by-grouping analysis for the 2017 House Plan districts using House Simulation Set 2 as a baseline for comparison and for identifying partisan outliers. For county groupings containing districts that were originally drawn in 2011 and remained unchanged in the 2017 redistricting process, I used the 2004-2010 Statewide Election Composite to measure district partisanship in these Figures, since the 2004-2010 statewide elections represent the elections data available to and used by the General Assembly during the 2011 redistricting process.

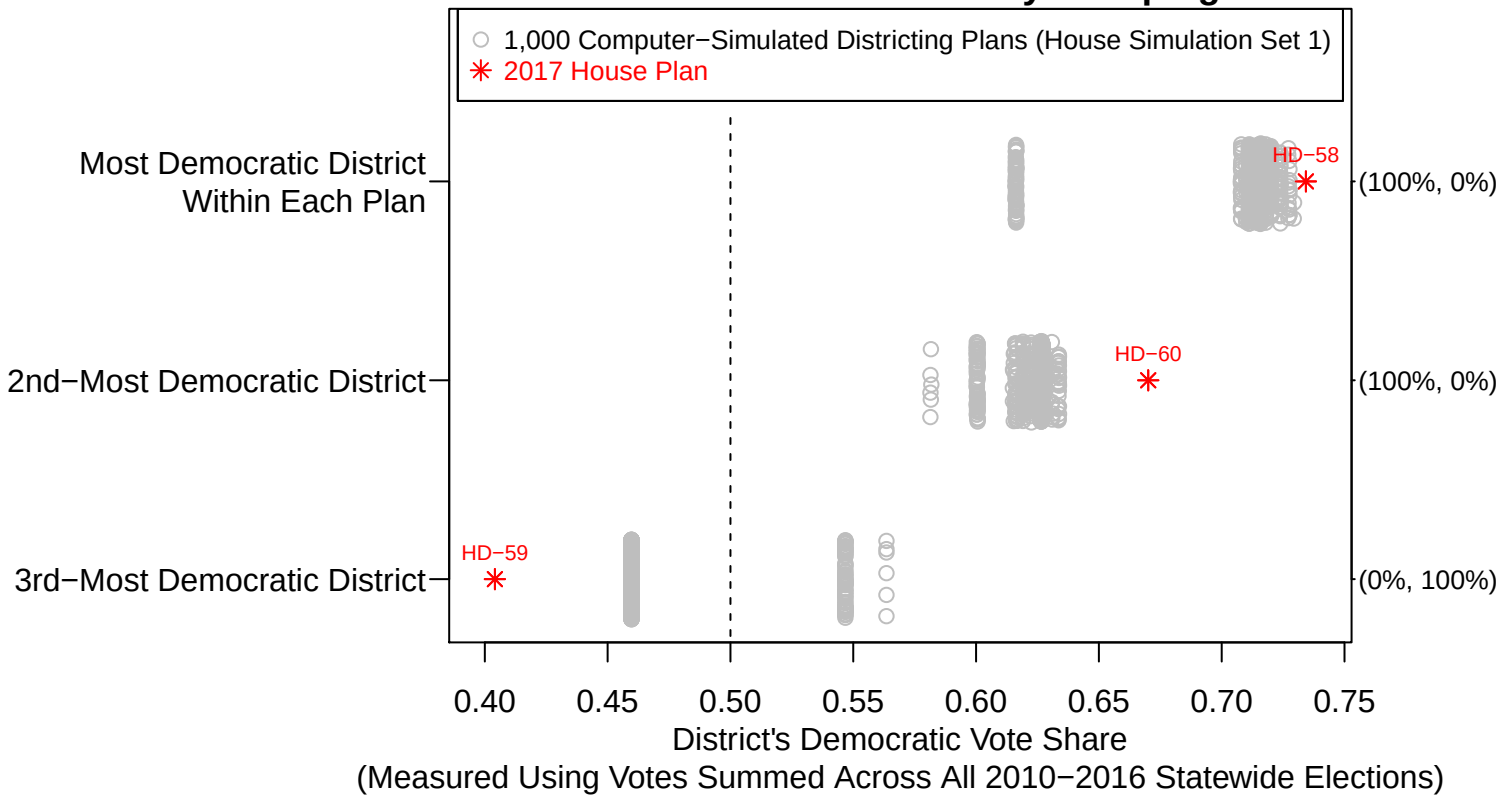
Finally, in the Guilford County grouping (whose results appear in Figures 25 and 41), which contains six total districts, note that three of the 2017 House Plan districts within Guilford County were materially redrawn by Special Master Nathaniel Persily and are frozen in all simulated plans in House Simulation Set 1 and Set 2. Therefore, these Special Master districts are not included in my analysis of the Guilford County grouping. Instead, Figures 25 and 41 show results only for the three other districts that are not frozen across all simulated plans (HD-58, HD-59, and HD-60). Hence, these two Figures contain only three rows, rather than six.

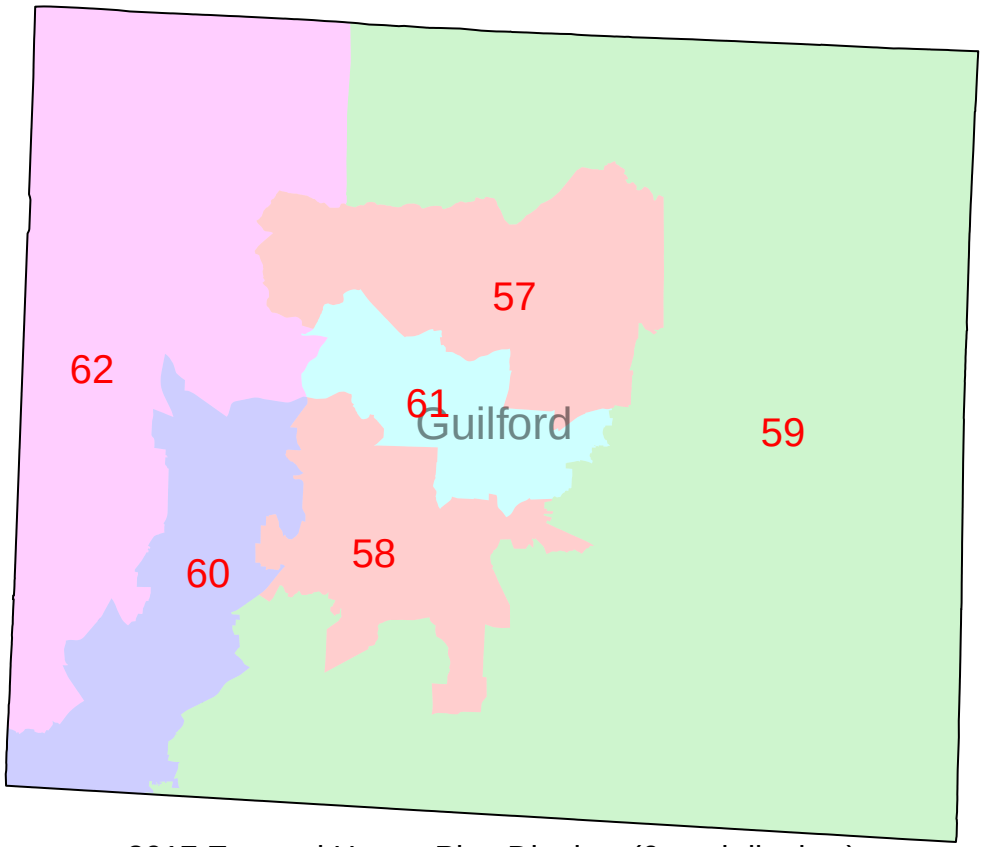
Overall, using this grouping-by-grouping comparison methodology, I found that the 2017 House plan contains partisan outlier districts within the following 15 House county groupings:

1. The Alamance County grouping (Figures 35 and 51).
2. The Anson-Union County grouping (Figures 36 and 52).
3. The Brunswick-New Hanover County grouping (Figures 37 and 53).
4. The Buncombe County grouping (Figures 38 and 54).
5. The Cabarrus-Davie-Montgomery-Richmond-Rowan-Stanly County grouping (Figures 26 and 42).
6. The Cleveland-Gaston County grouping (Figures 39 and 55).
7. The Columbus-Pender- Robeson County grouping (Figures 27 and 43).
8. The Cumberland County grouping (Figures 28 and 44).
9. The Duplin-Onslow County grouping (Figures 40 and 56).

10. The Forsyth-Yadkin County grouping (Figures 29 and 45).
11. The Franklin-Nash County grouping (Figures 30 and 46).
12. The Guilford County grouping (Figures 25 and 41).
13. The Lenoir-Pitt County grouping (Figures 32 and 48).
14. The Mecklenburg County grouping (Figures 33 and 49).
15. The Wake County grouping (Figures 34 and 50).

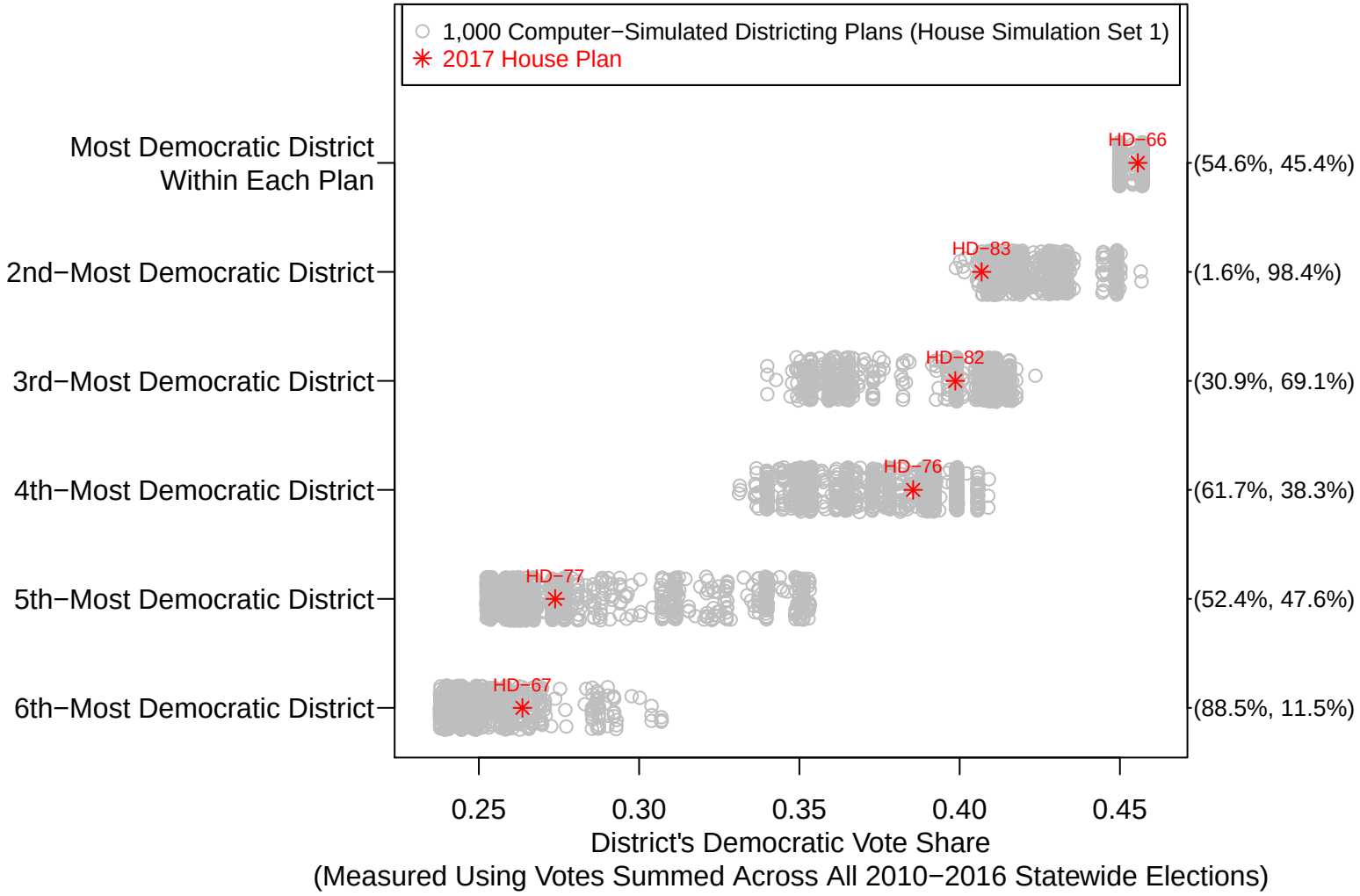
Figure 25: House Simulation Set 1: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Guilford County Grouping

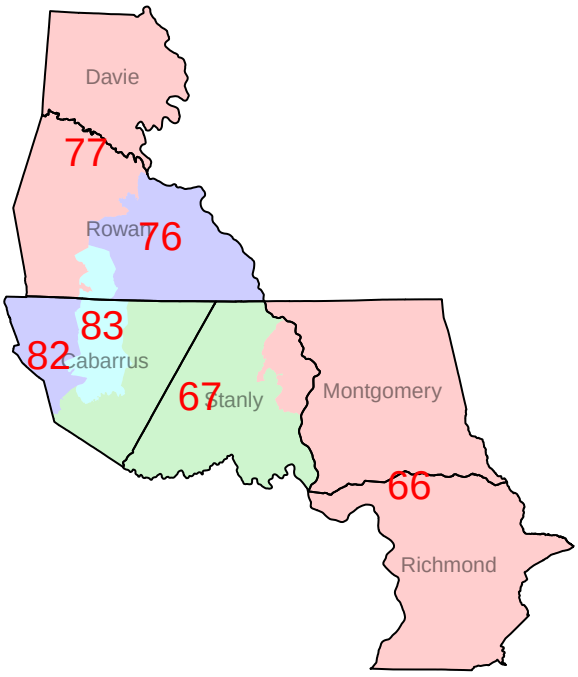




2017 Enacted House Plan Districts (6 total districts)
(This county grouping includes 3 Special Master Districts (HD−57, HD−61, and HD−62) that are frozen in all simulated plans and not included in the above Figure)

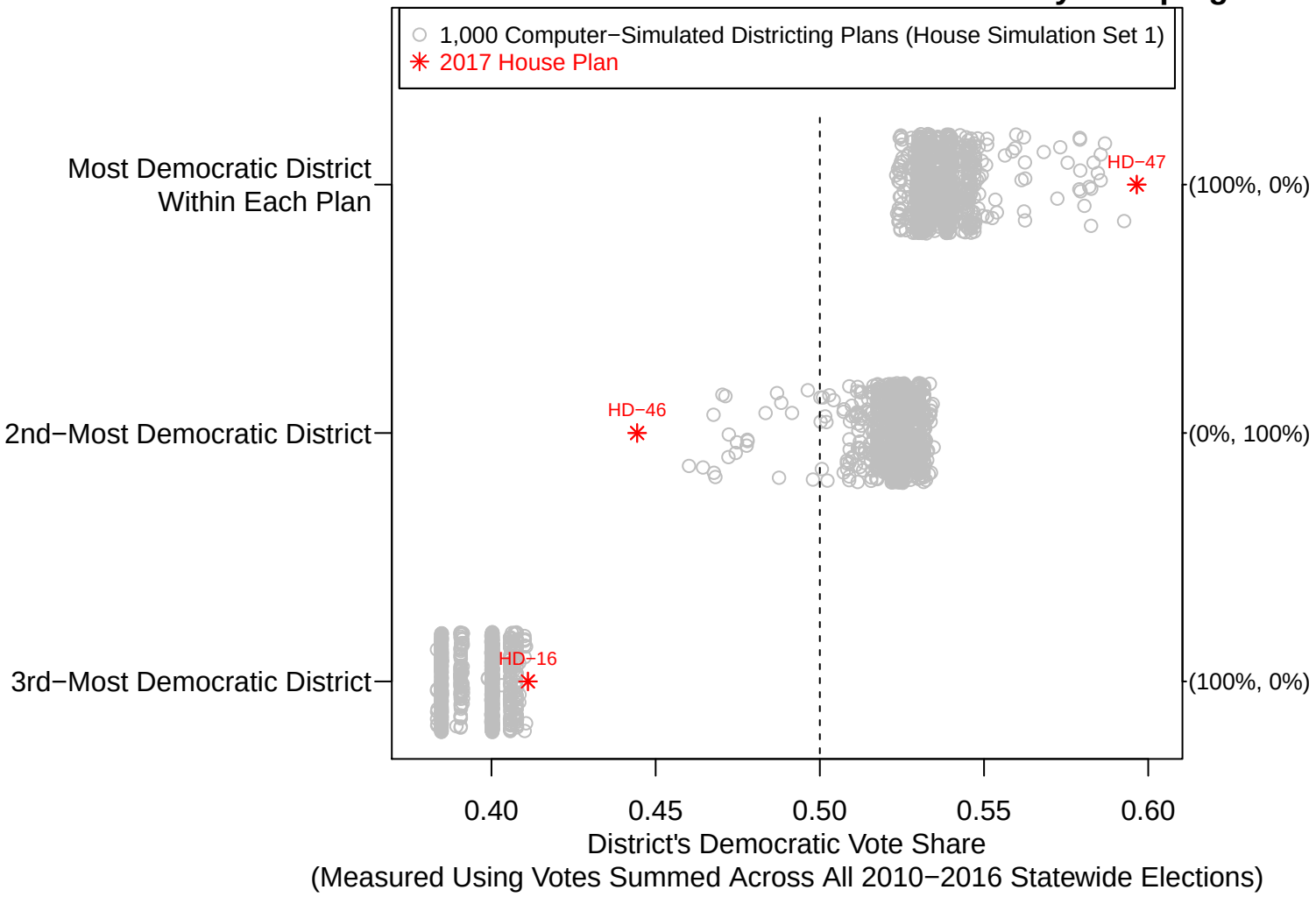
Figure 26: House Simulation Set 1:
Democratic Vote Share of the Enacted and Computer−Simulated Districts
Within the Cabarrus−Davie−Montgomery−Richmond−Rowan−Stanly County Grouping

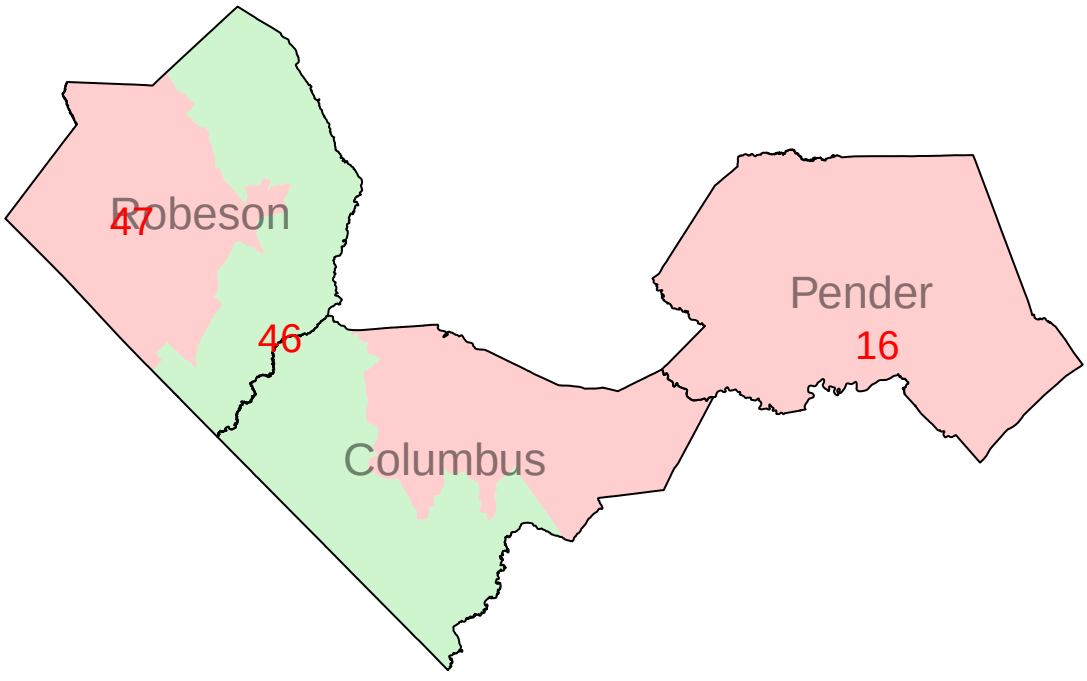




2017 Enacted House Plan Districts (6 Districts)

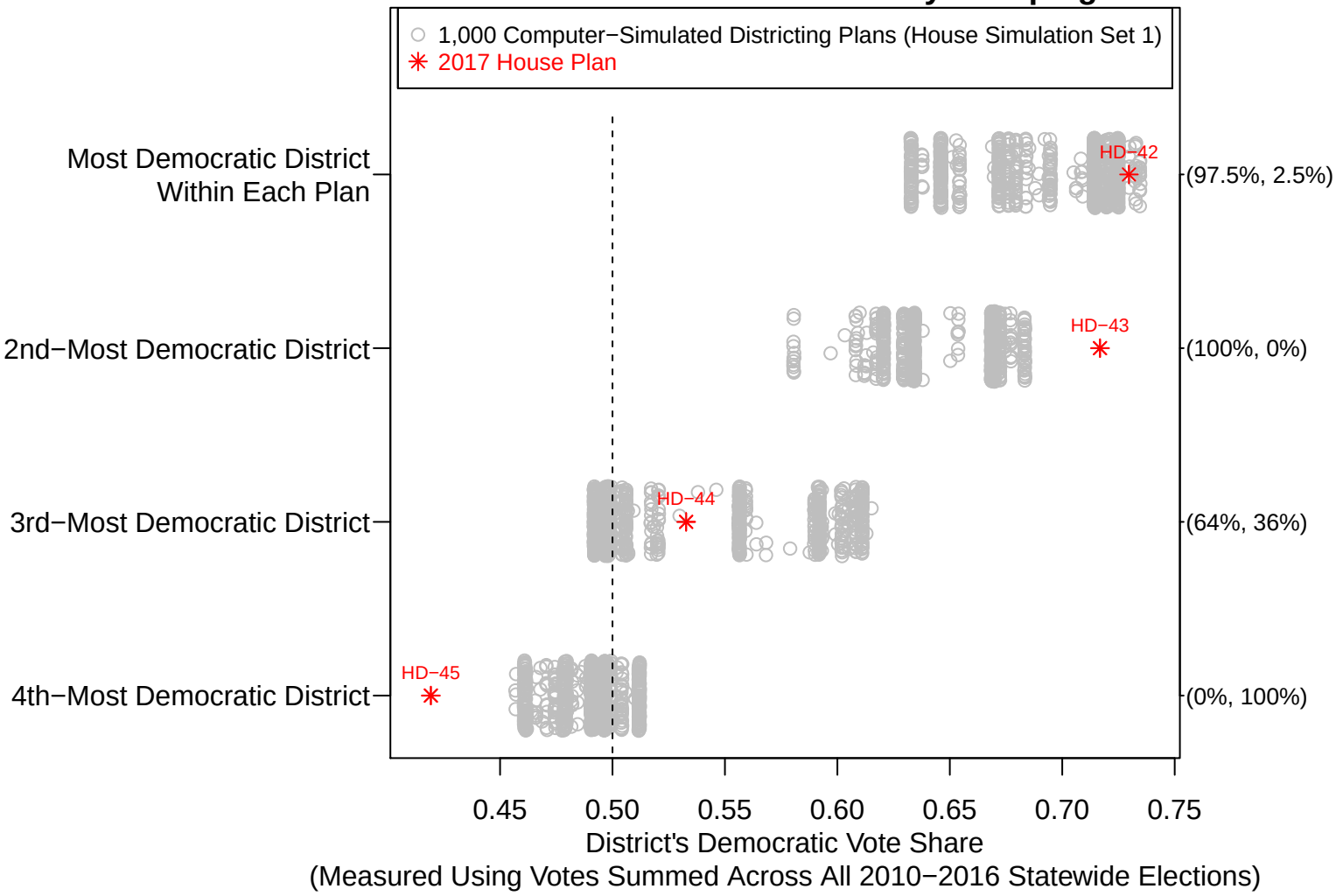
Figure 27: House Simulation Set 1: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Columbus−Pender−Robeson County Grouping

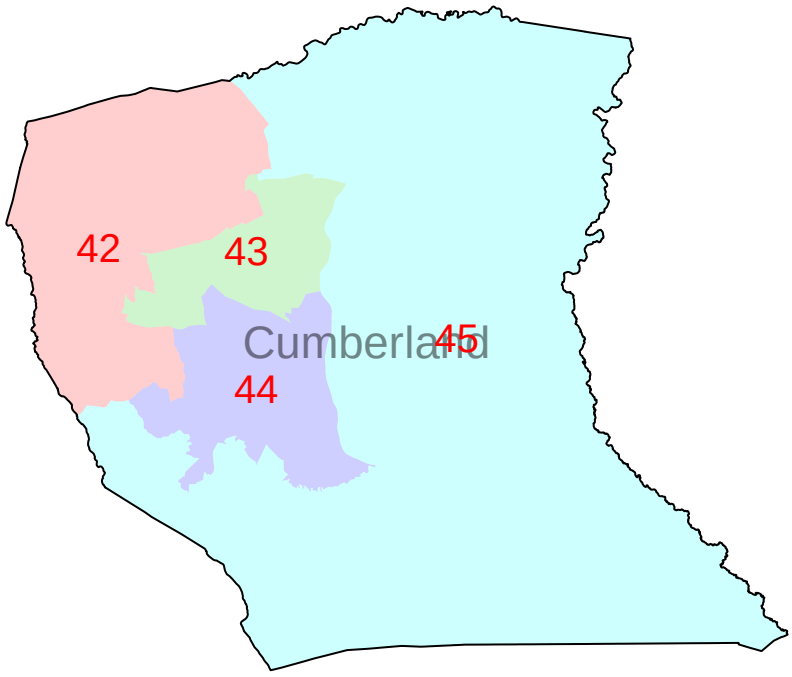




2017 Enacted House Plan Districts (3 Districts)

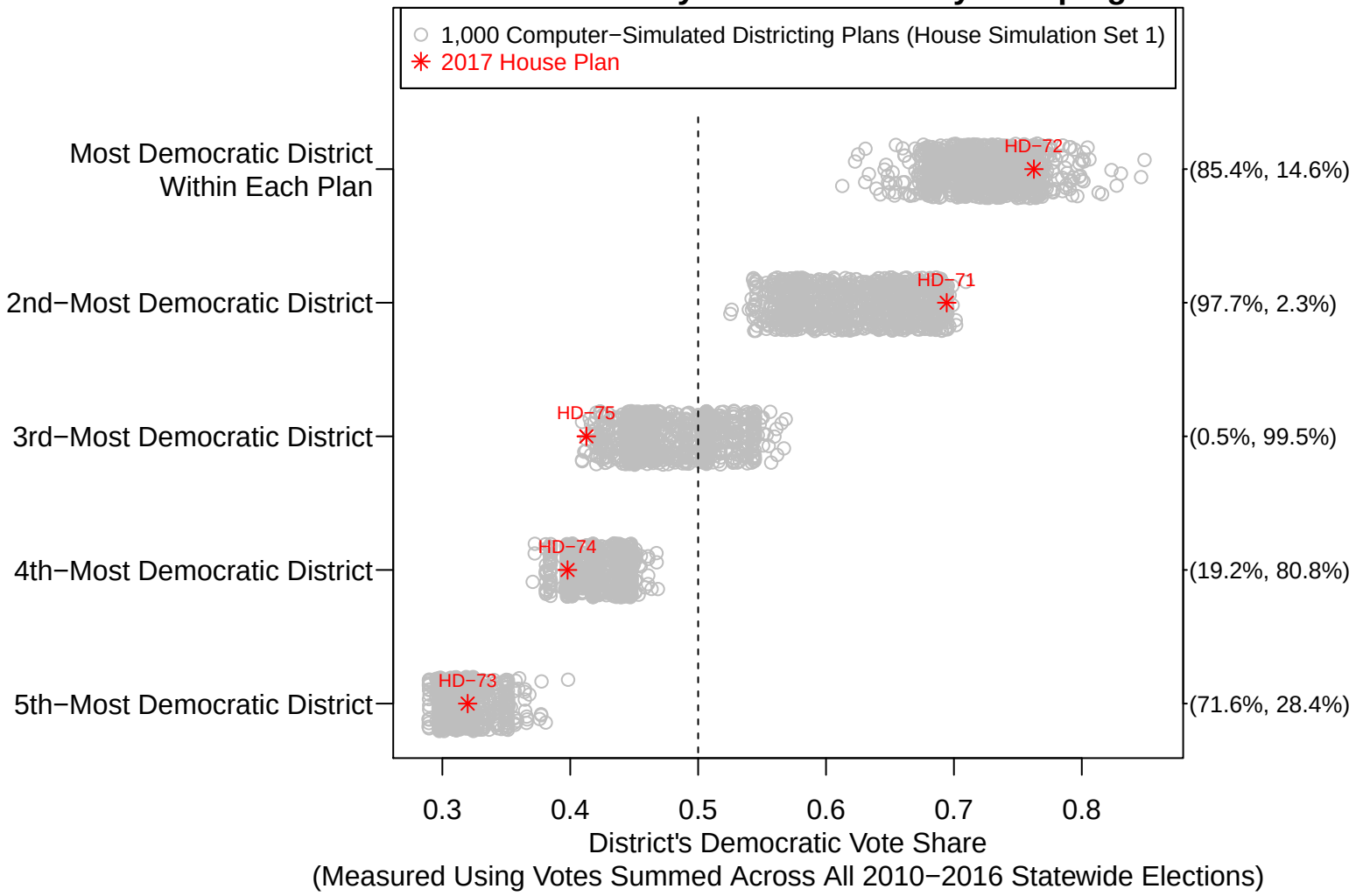
Figure 28: House Simulation Set 1: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Cumberland County Grouping

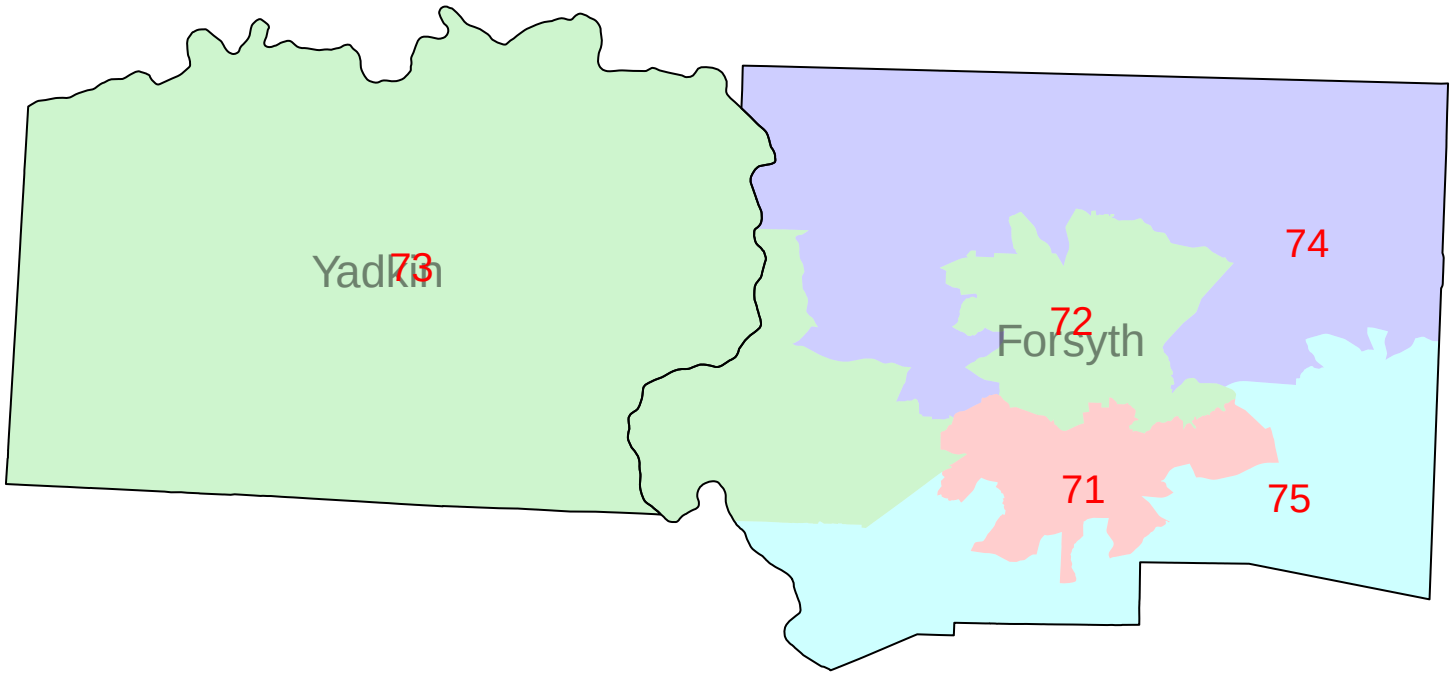




2017 Enacted House Plan Districts (4 Districts)

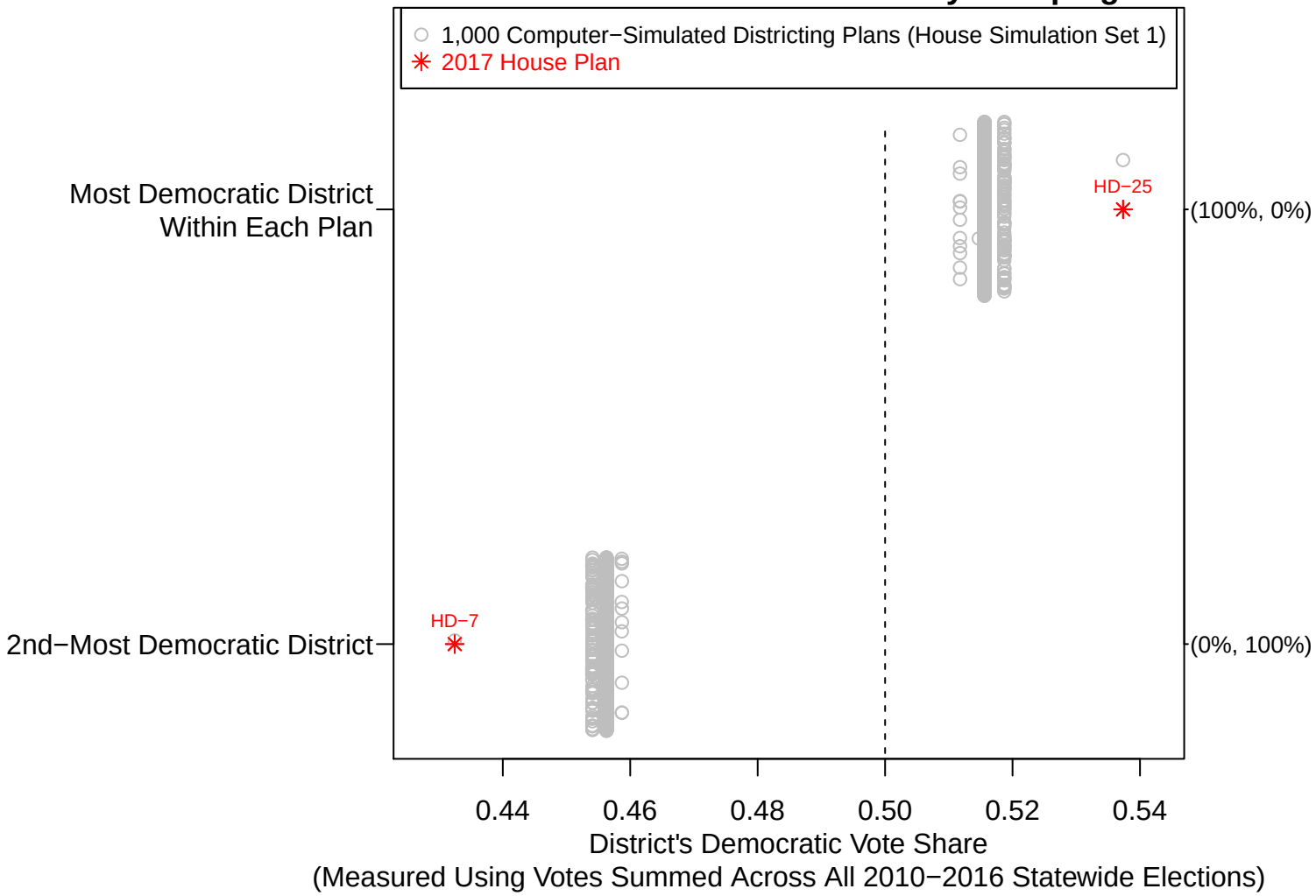
Figure 29: House Simulation Set 1: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Forsyth−Yadkin County Grouping

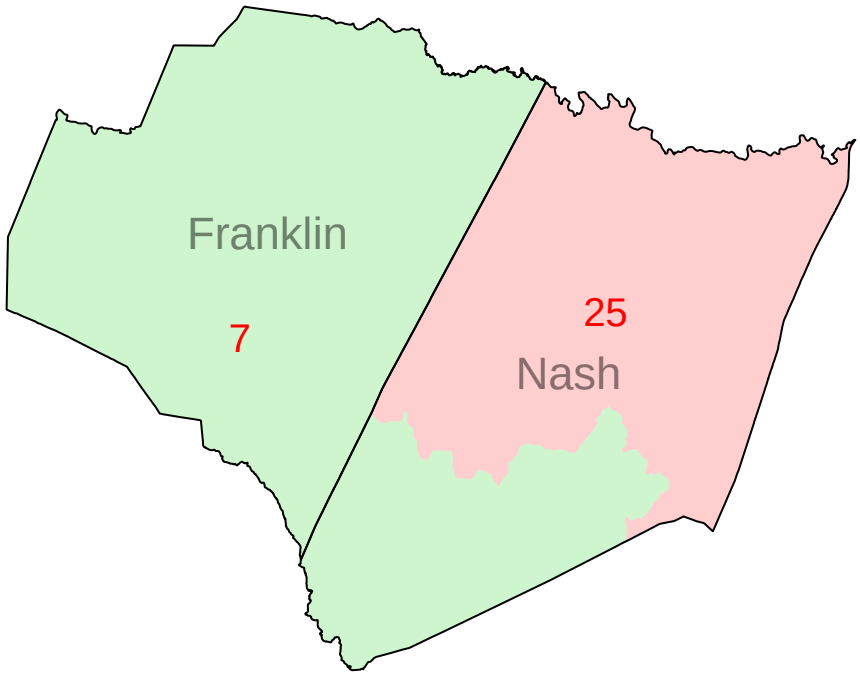




2017 Enacted House Plan Districts (5 Districts)

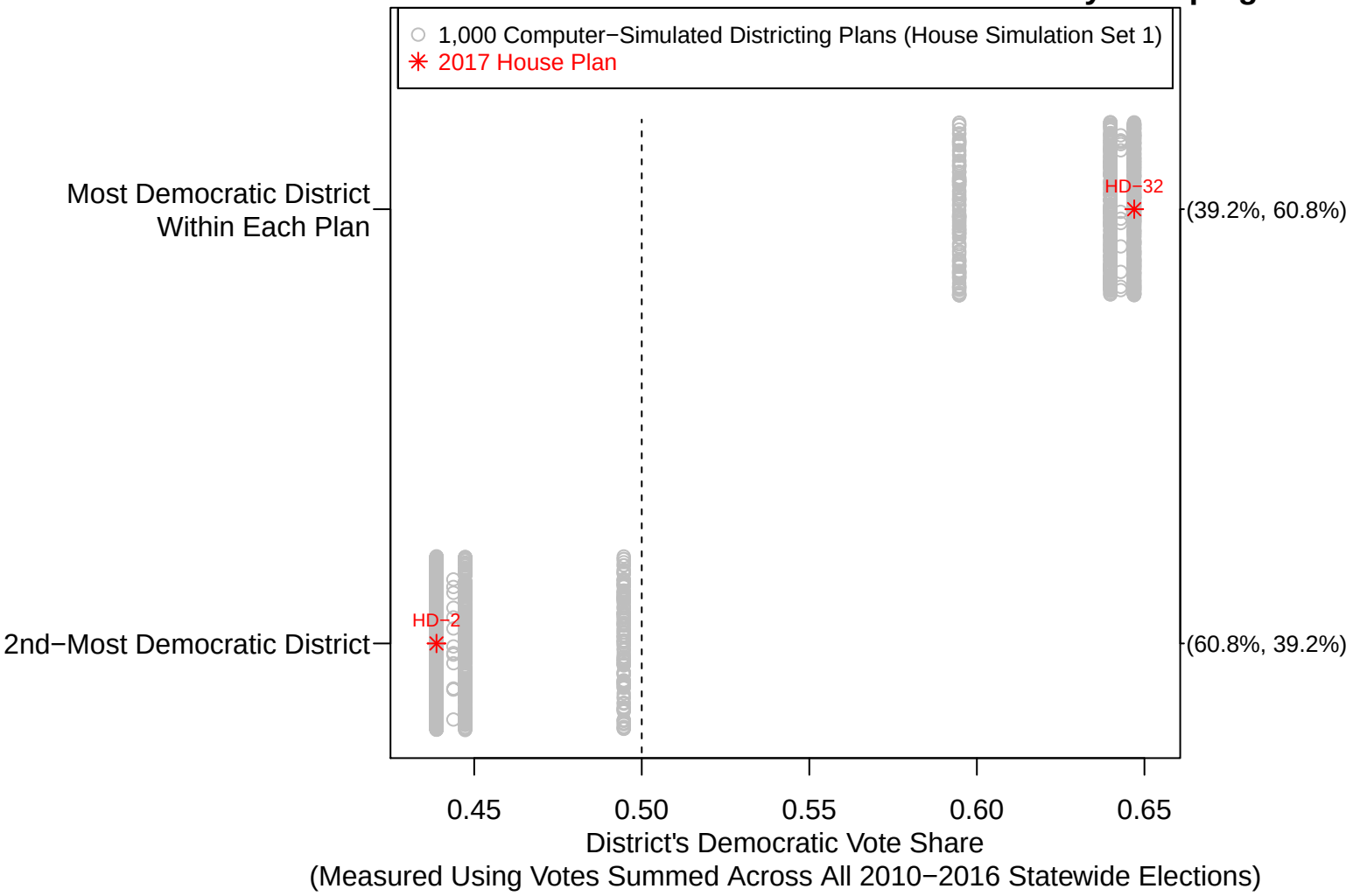
Figure 30: House Simulation Set 1: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Franklin−Nash County Grouping

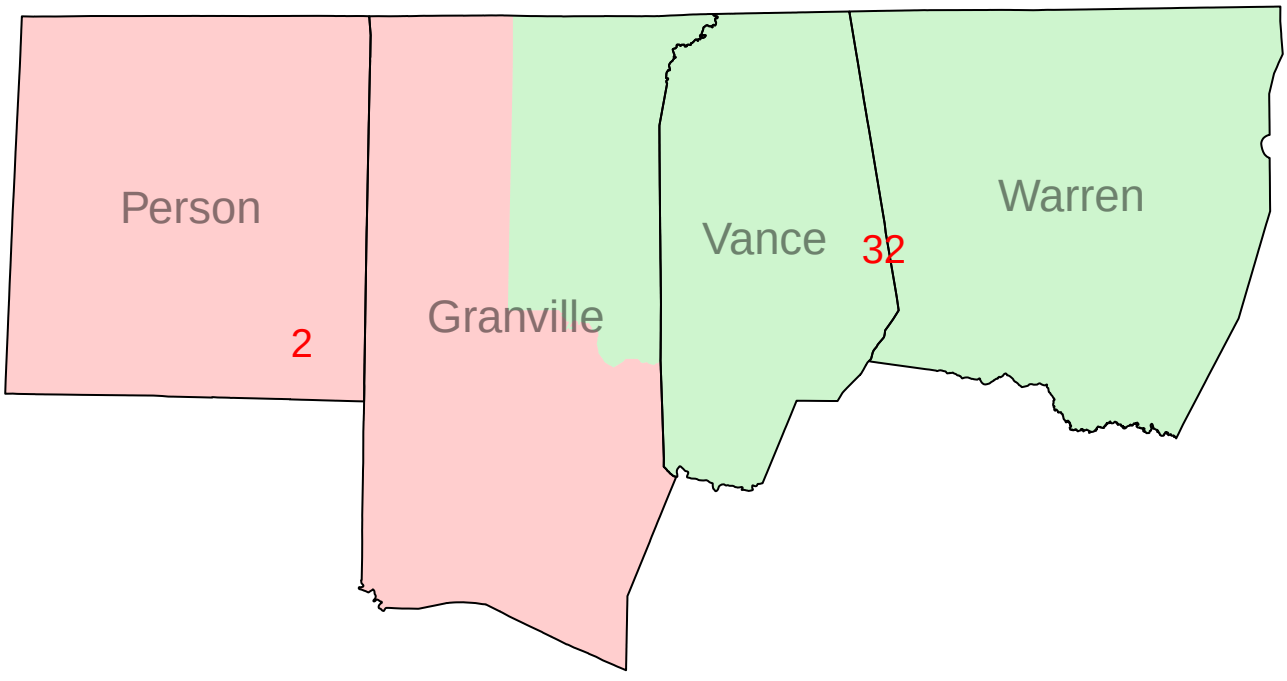




2017 Enacted House Plan Districts (2 Districts)

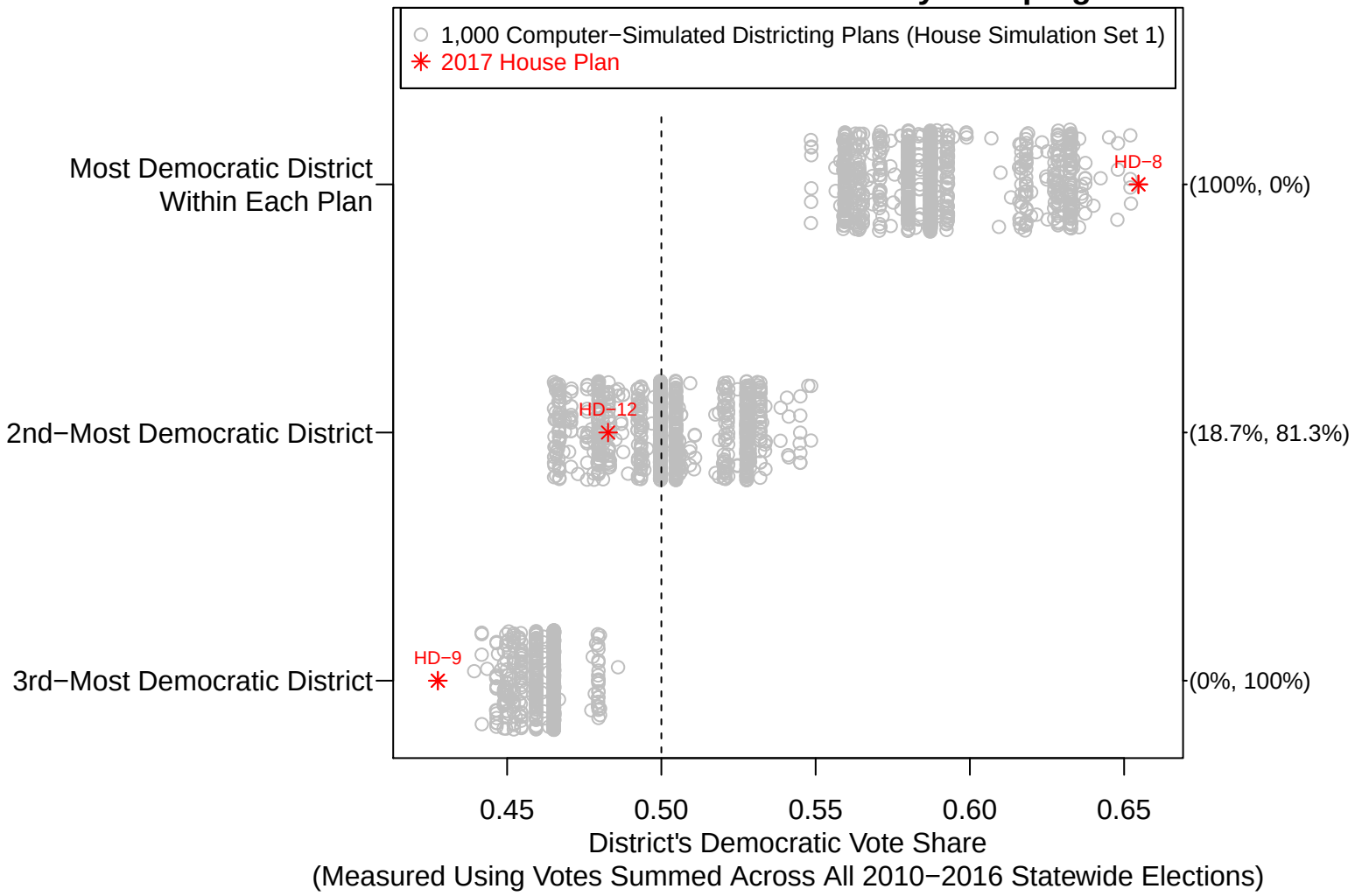
Figure 31: House Simulation Set 1: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Granville−Person−Vance−Warren County Grouping

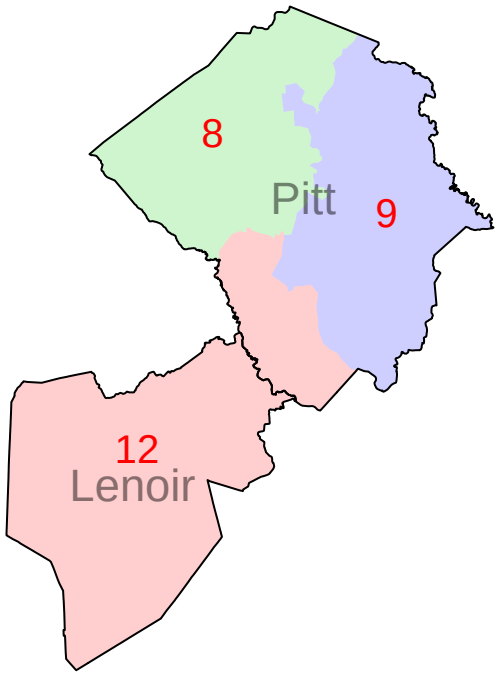




2017 Enacted House Plan Districts (2 Districts)

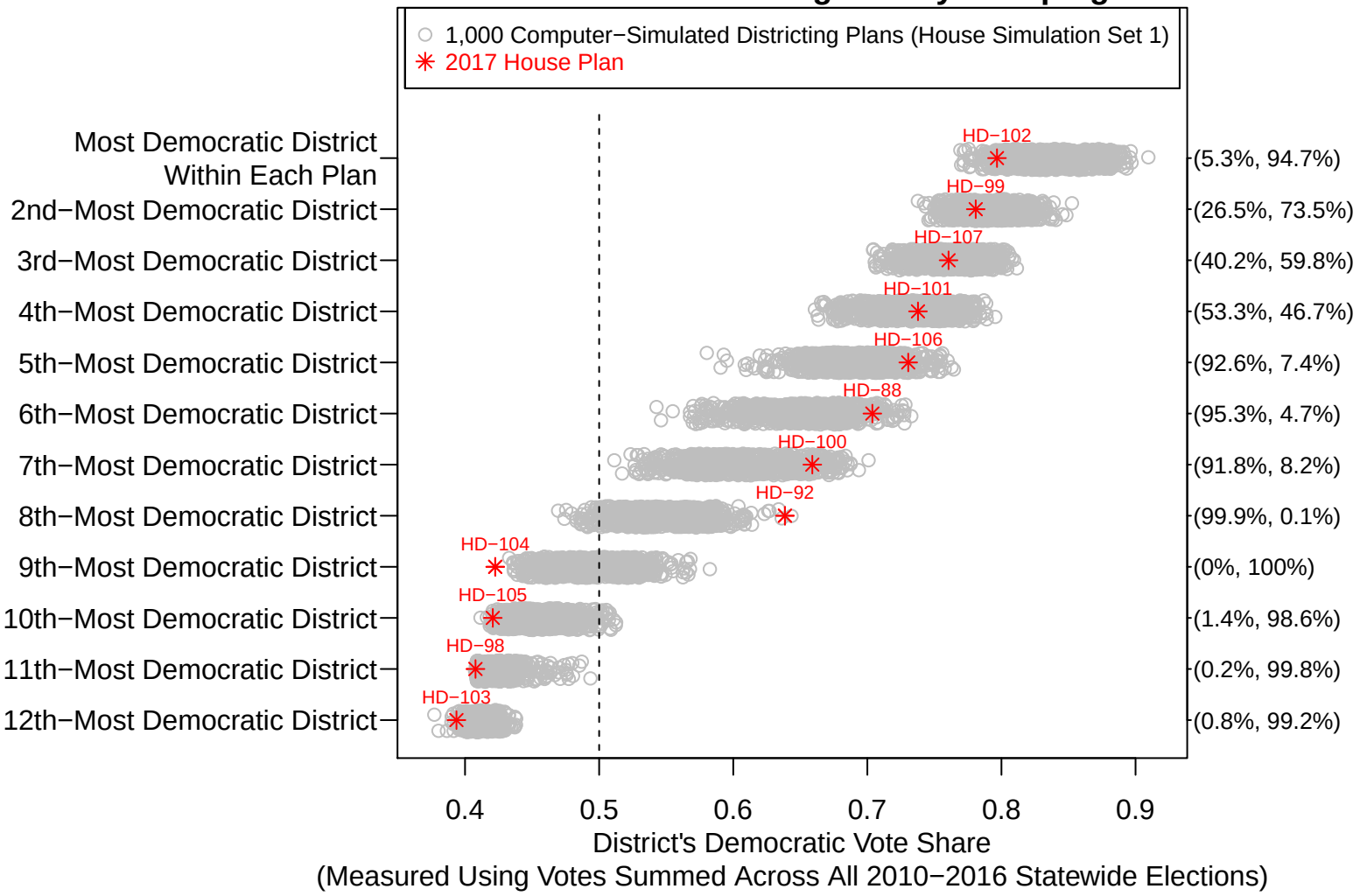
Figure 32: House Simulation Set 1: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Lenoir−Pitt County Grouping

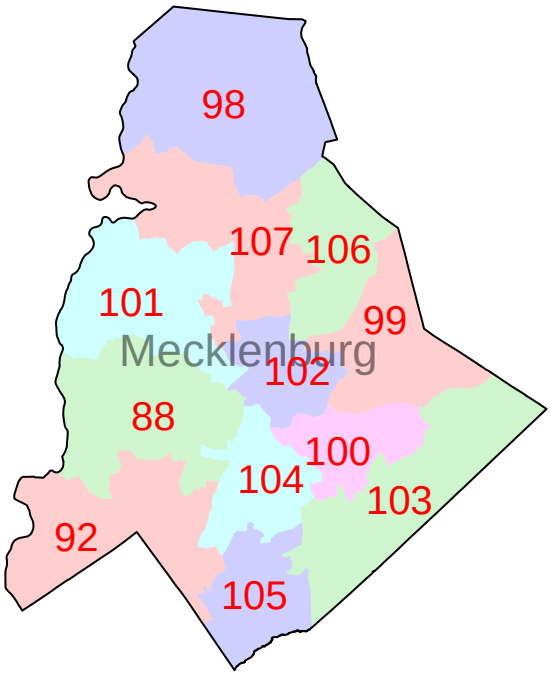




2017 Enacted House Plan Districts (3 Districts)

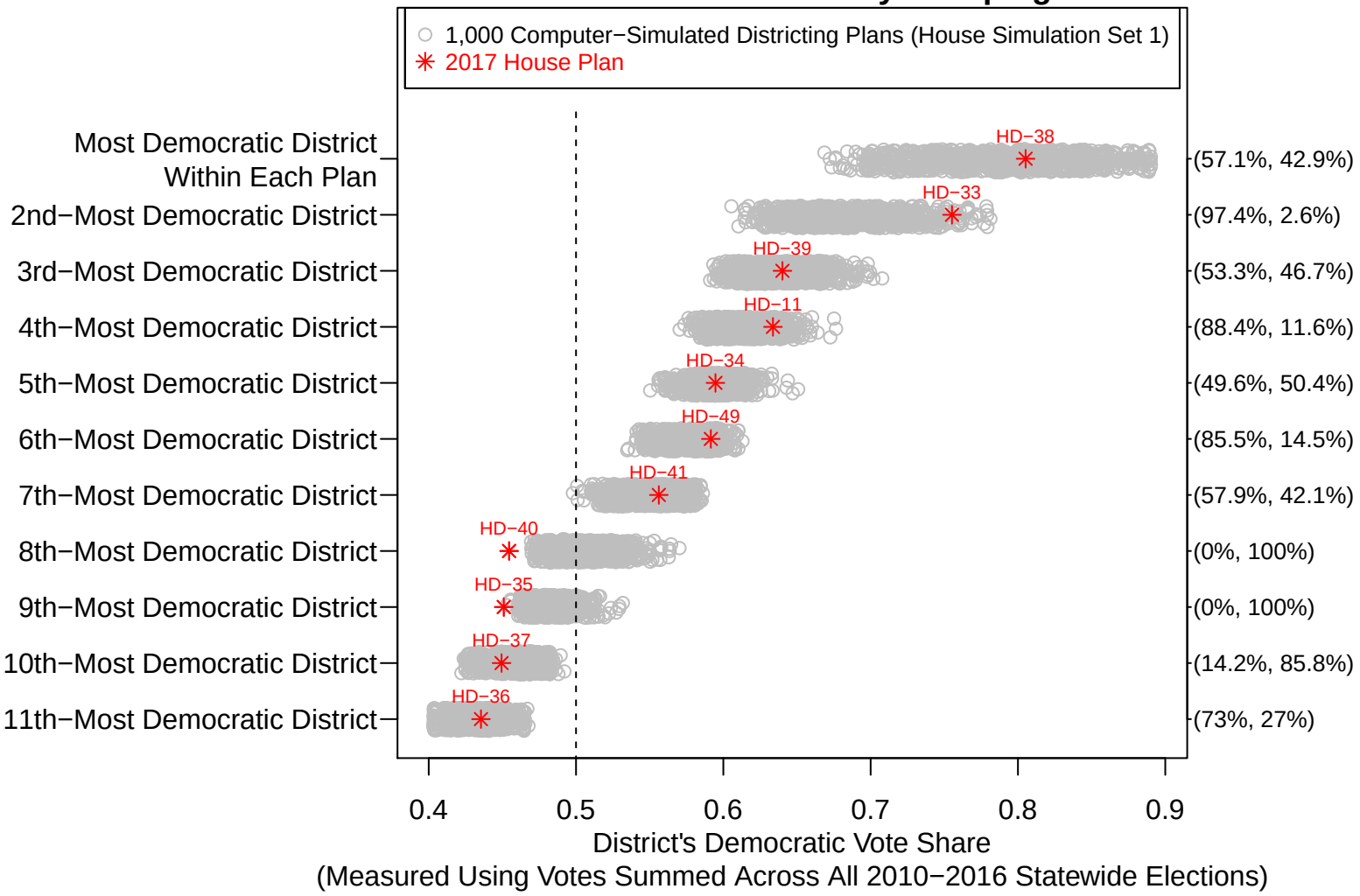
Figure 33: House Simulation Set 1: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Mecklenburg County Grouping

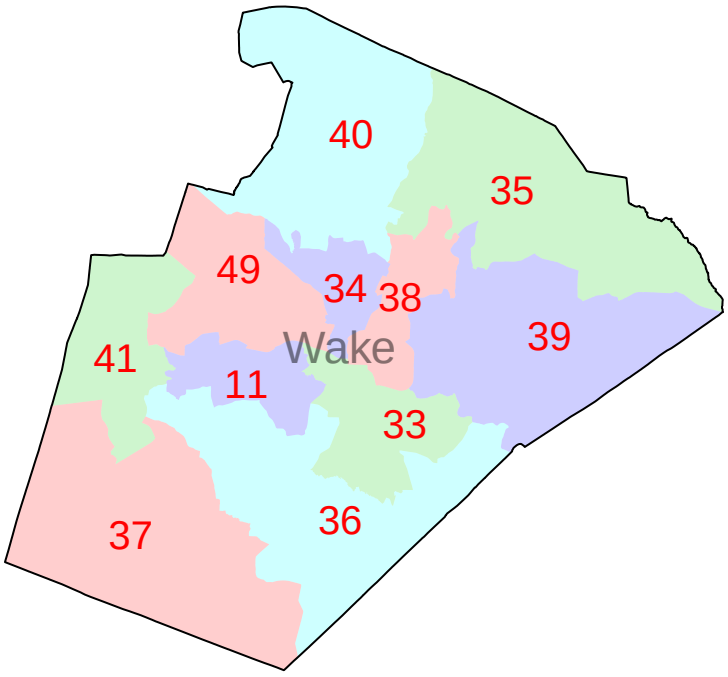




2017 Enacted House Plan Districts (12 Districts)

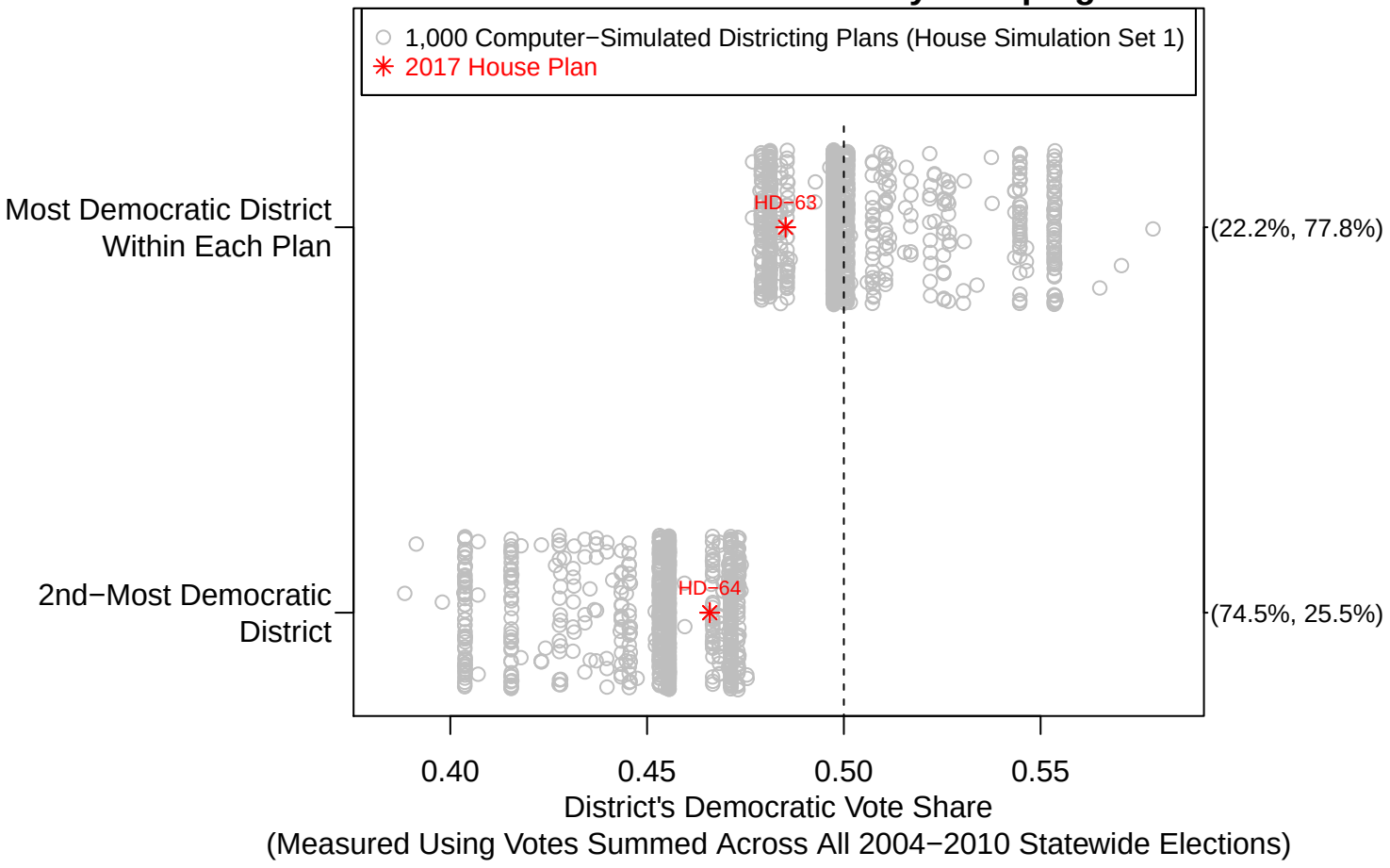
Figure 34: House Simulation Set 1: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Wake County Grouping

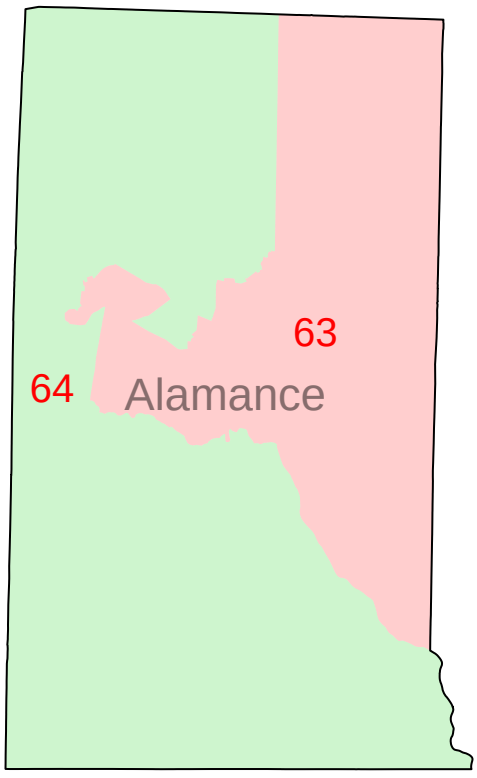




2017 Enacted House Plan Districts (11 Districts)

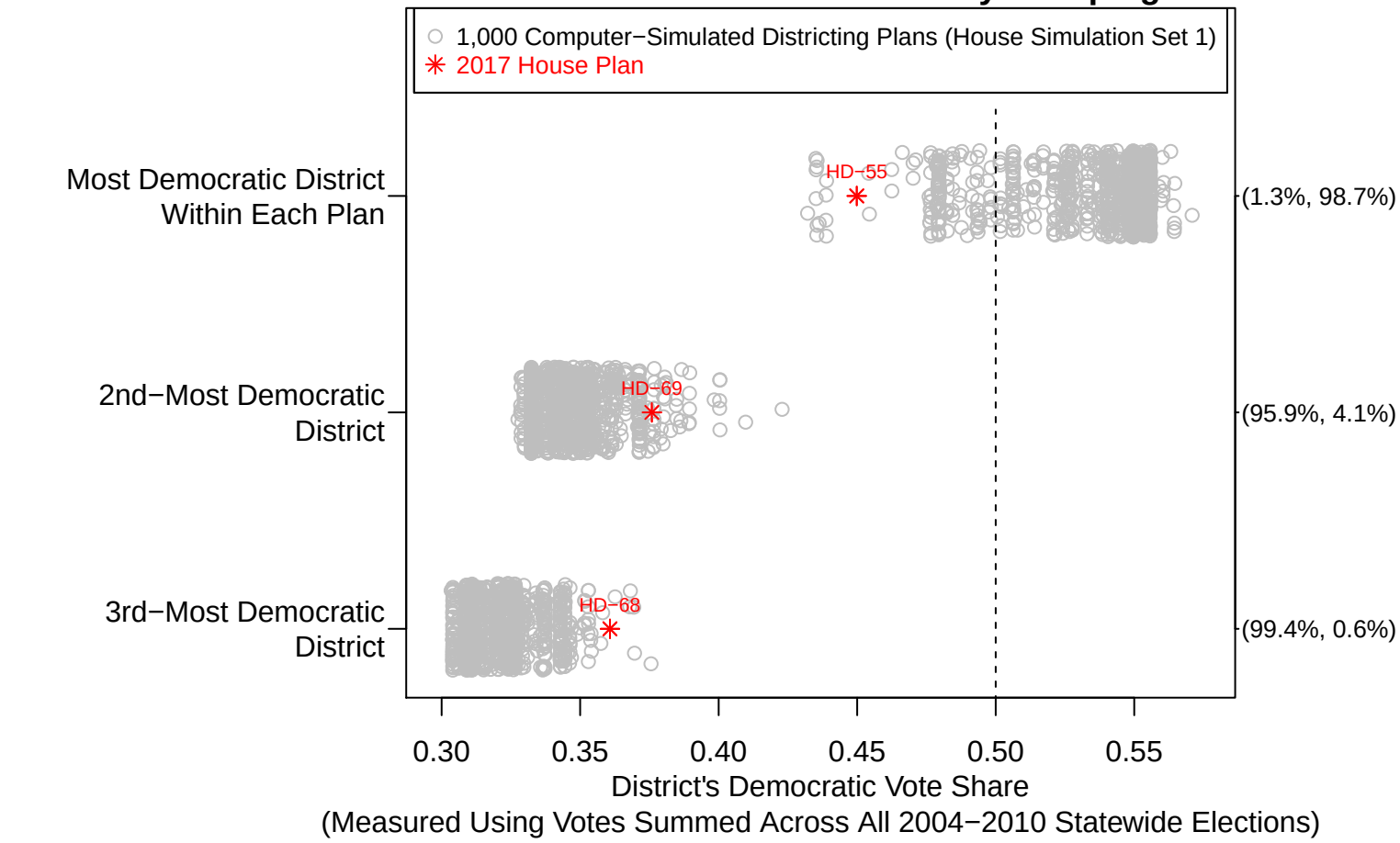
Figure 35: House Simulation Set 1: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Alamance County Grouping

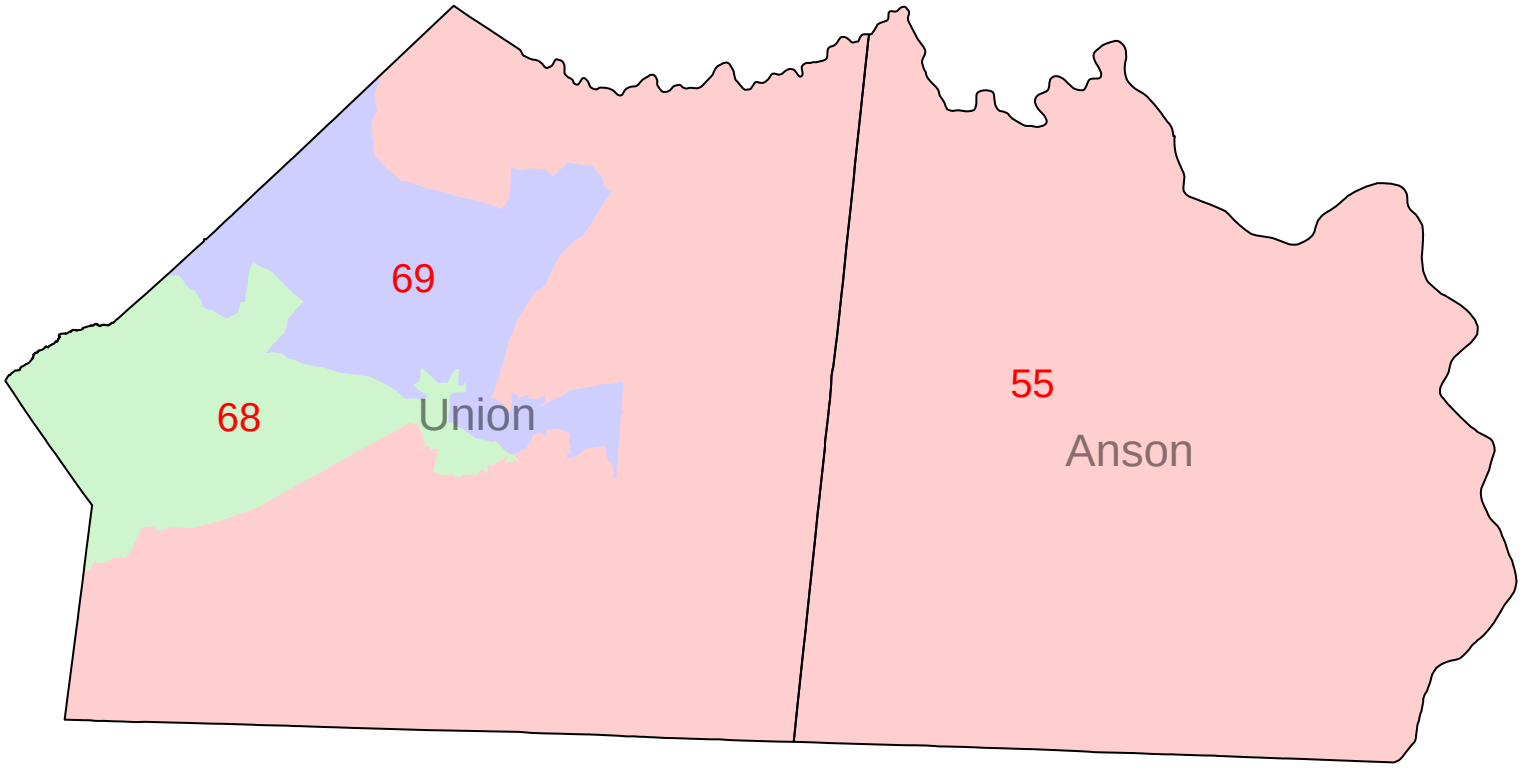




2017 Enacted House Plan Districts (2 Districts)

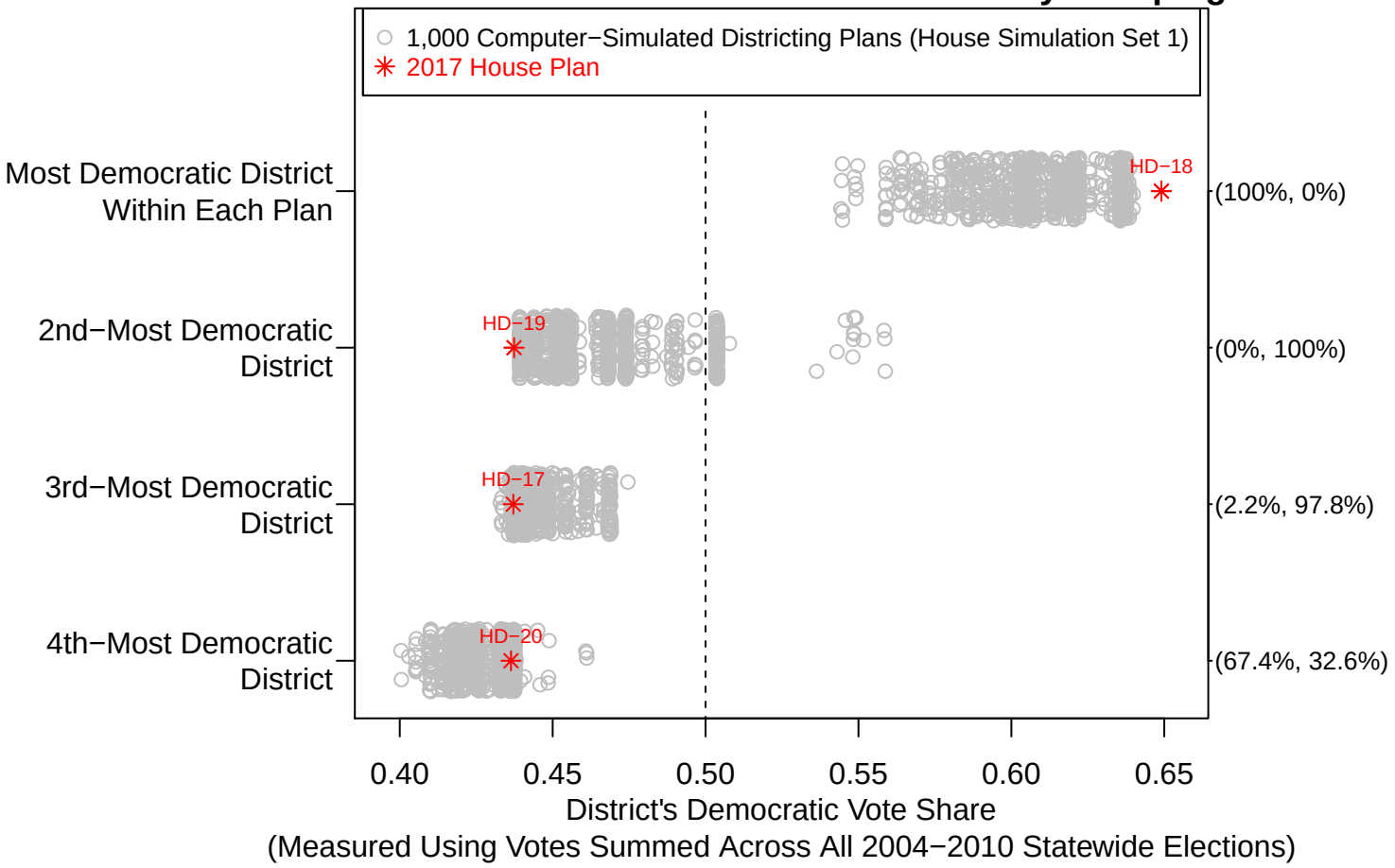
Figure 36: House Simulation Set 1: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Anson−Union County Grouping

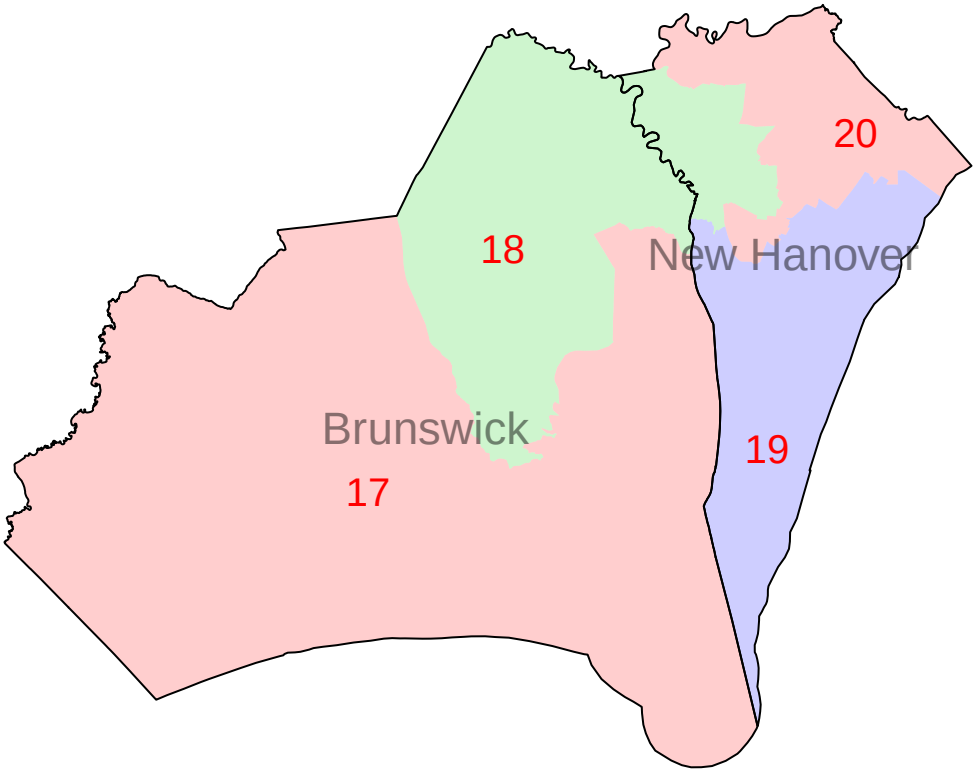




2017 Enacted House Plan Districts (3 Districts)

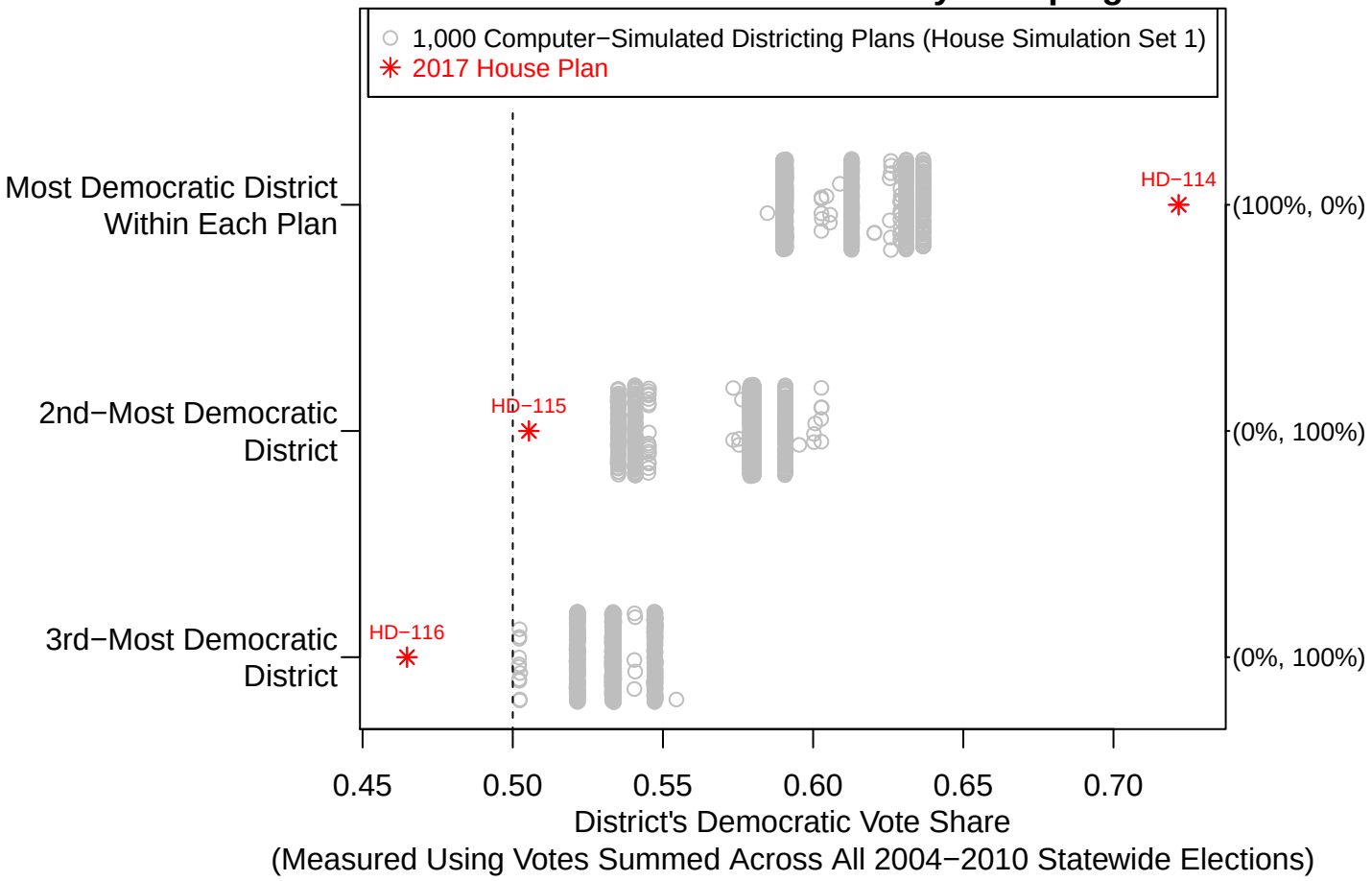
Figure 37: House Simulation Set 1: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Brunswick−New Hanover County Grouping

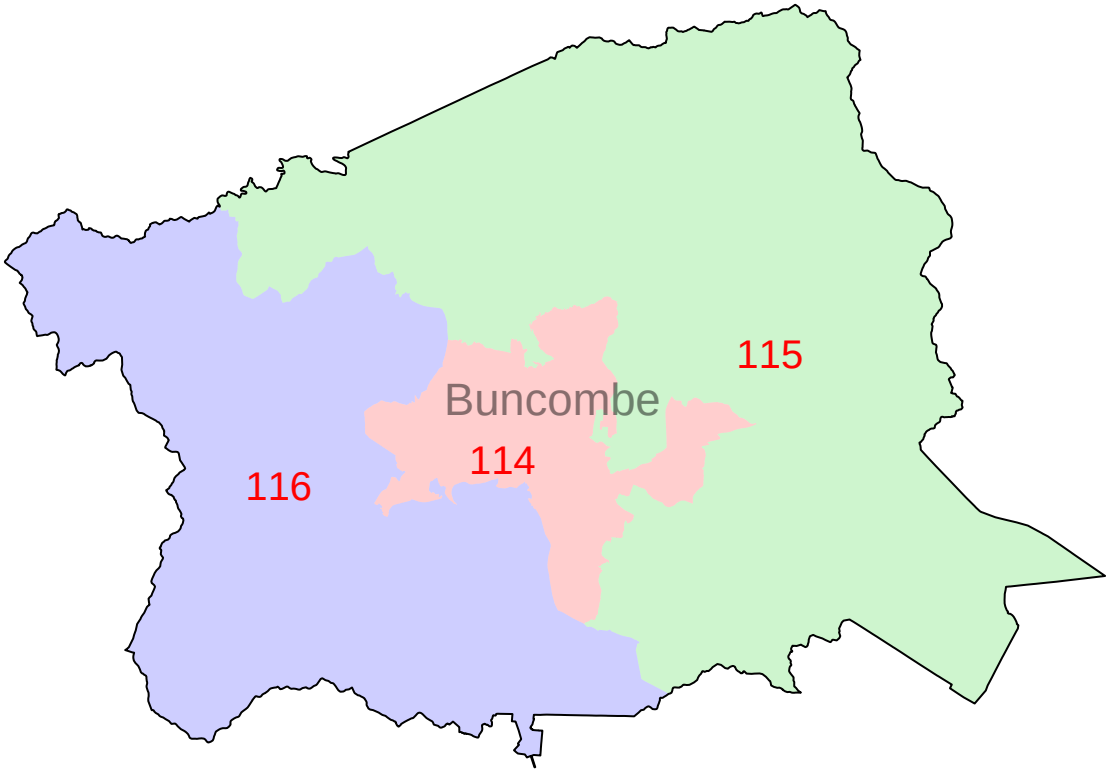




2017 Enacted House Plan Districts (4 Districts)

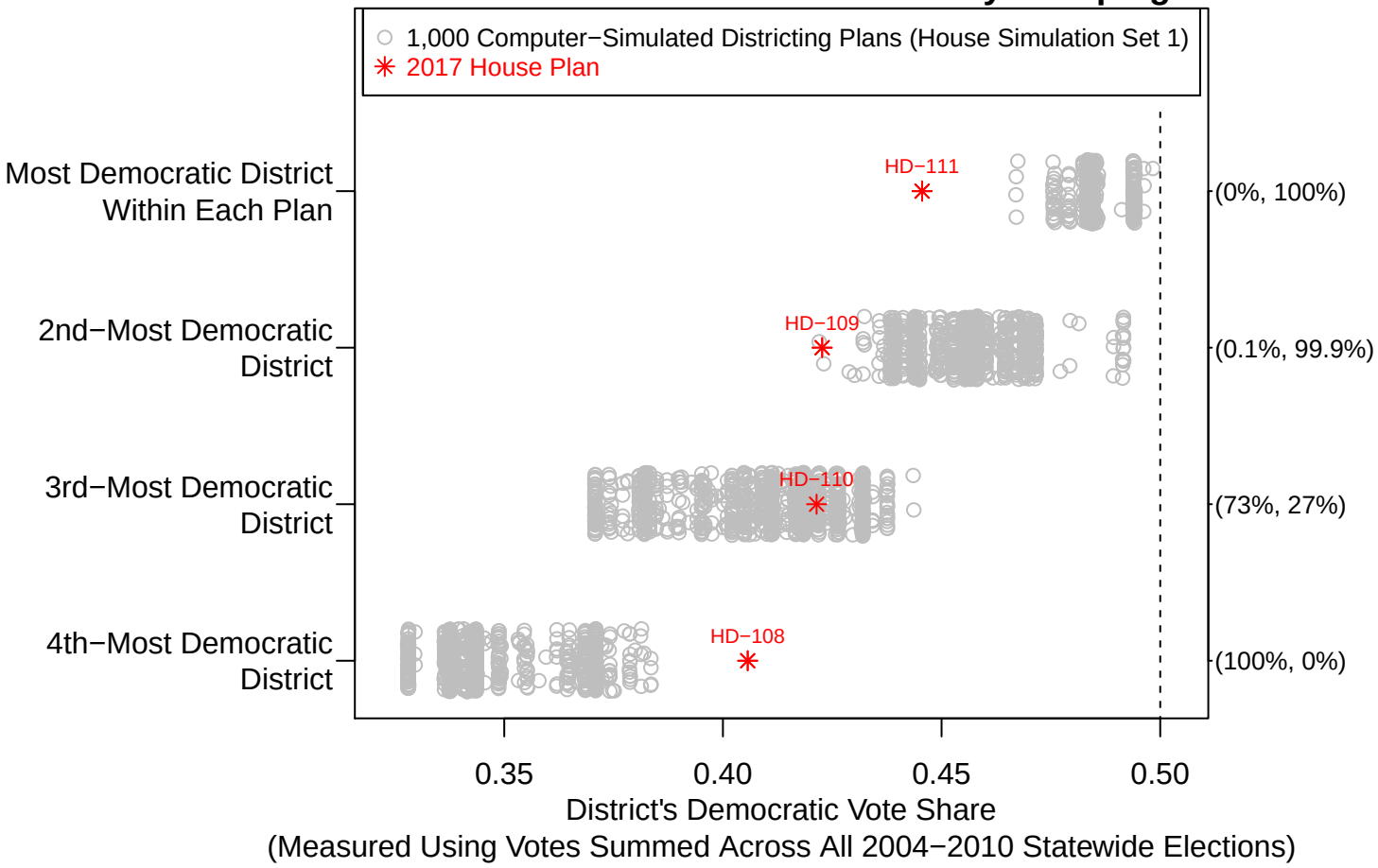
Figure 38: House Simulation Set 1: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Buncombe County Grouping

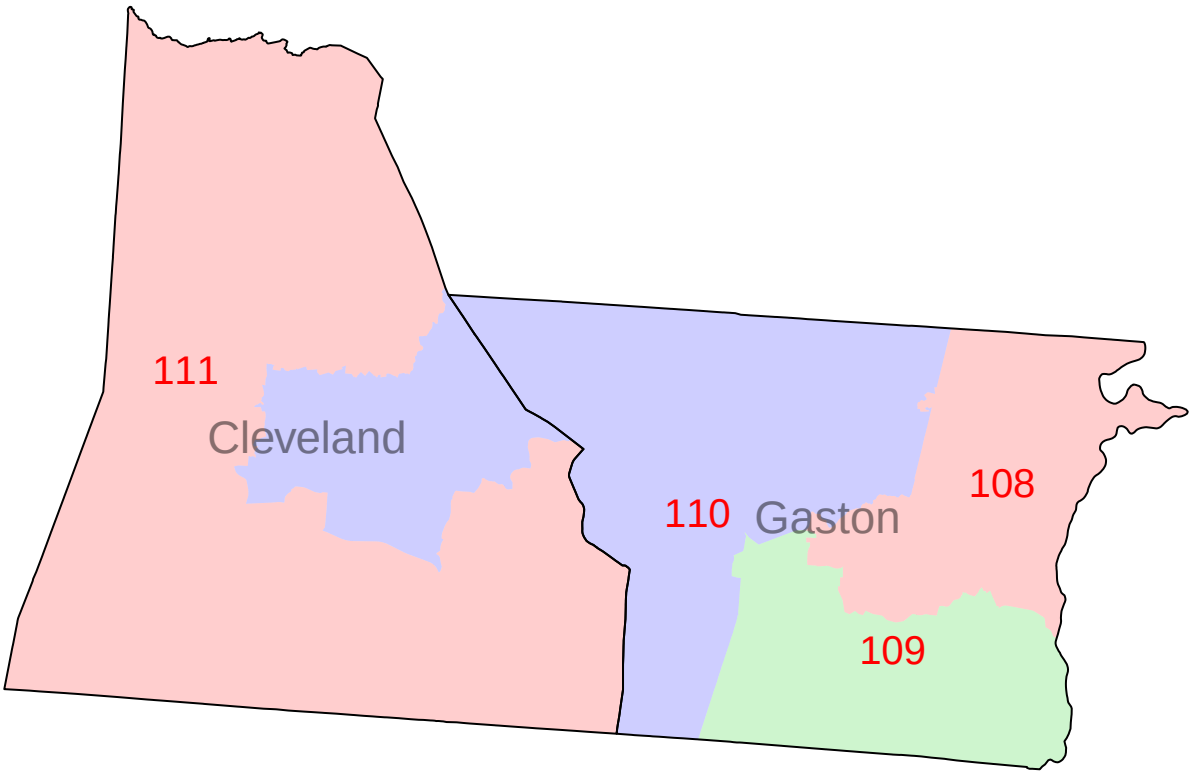




2017 Enacted House Plan Districts (3 Districts)

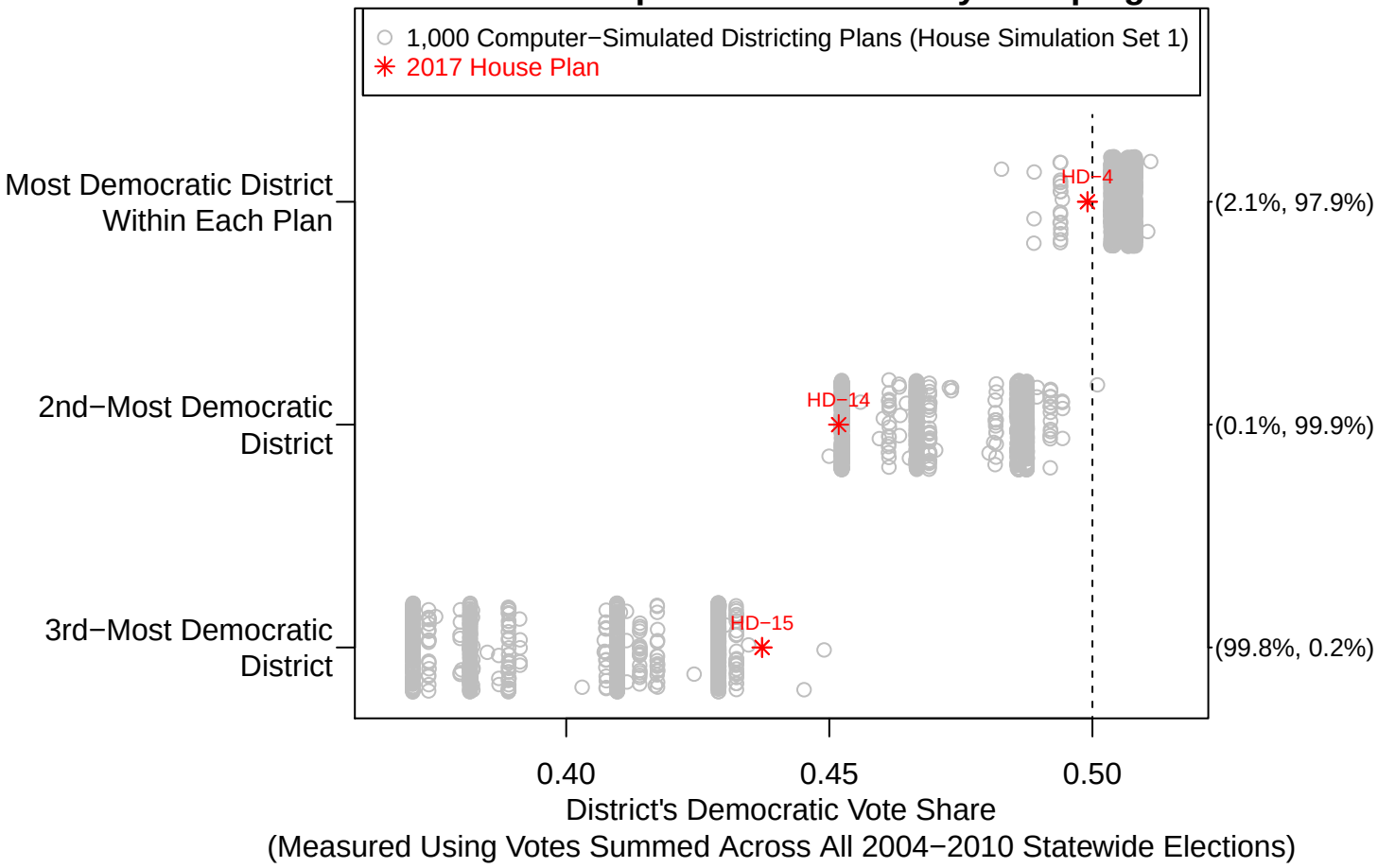
Figure 39: House Simulation Set 1: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Cleveland−Gaston County Grouping

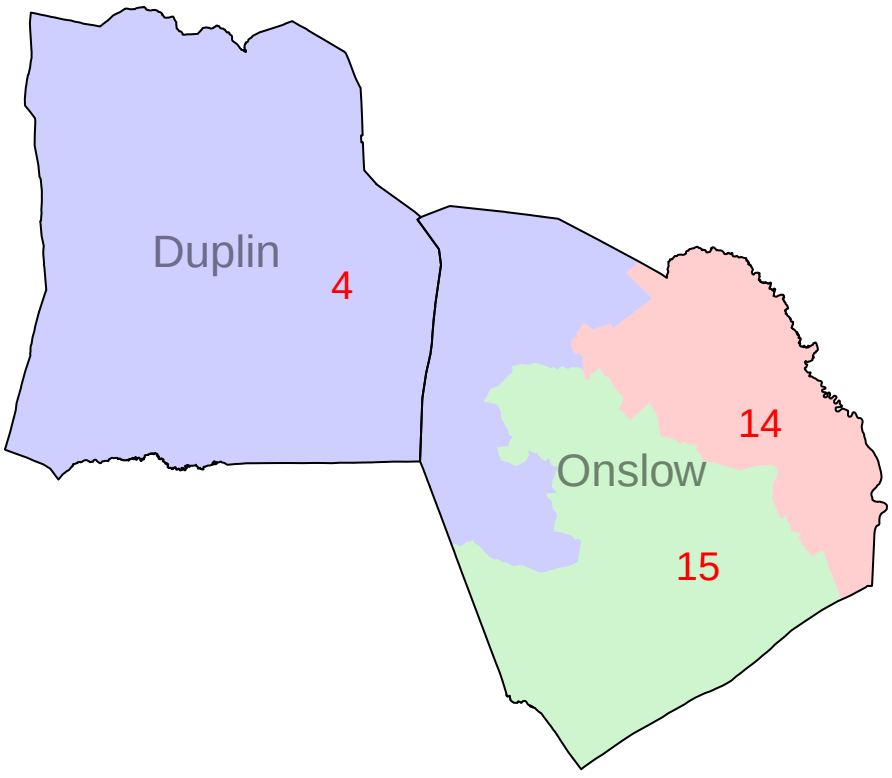




2017 Enacted House Plan Districts (4 Districts)

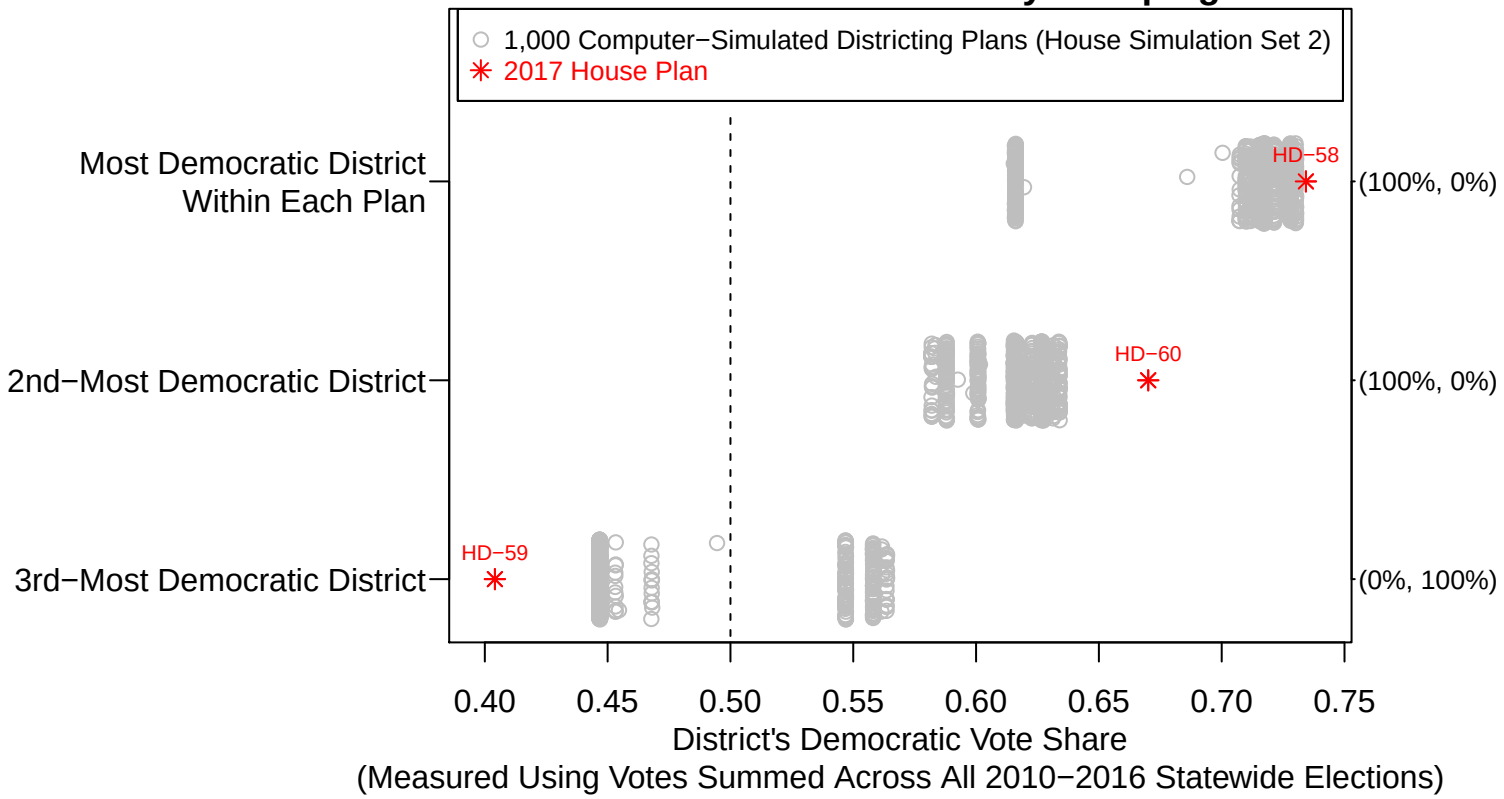
Figure 40: House Simulation Set 1: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Duplin−Onslow County Grouping

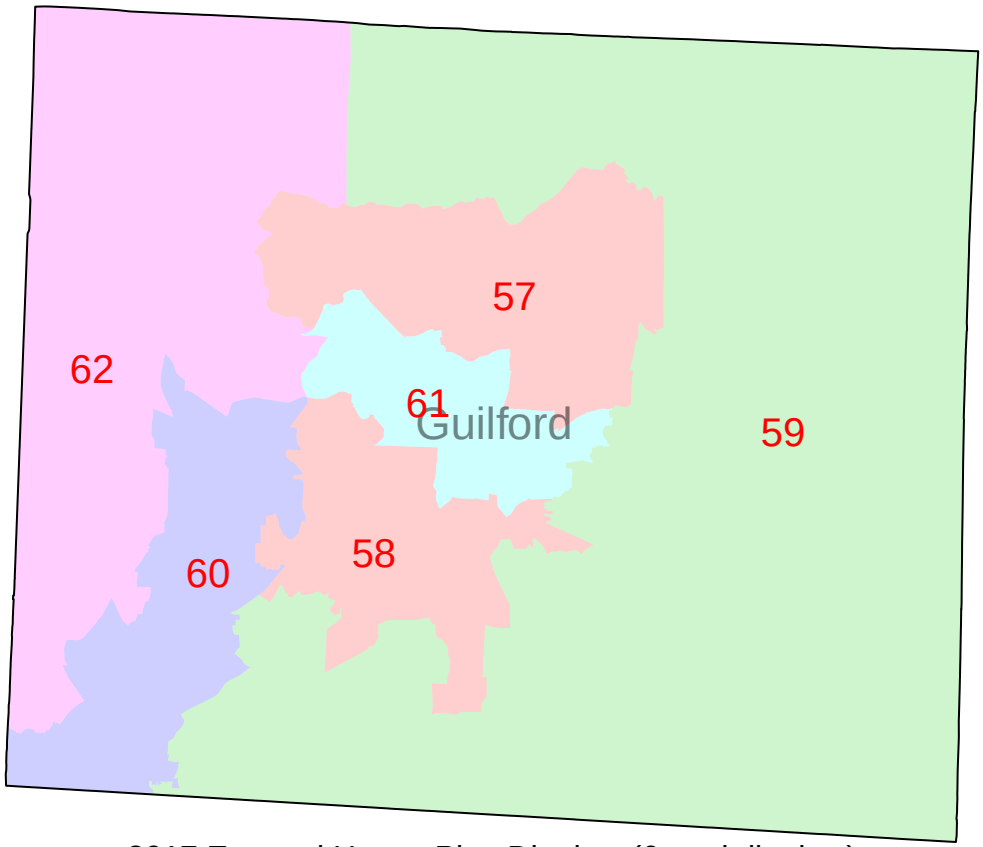




2017 Enacted House Plan Districts (3 Districts)

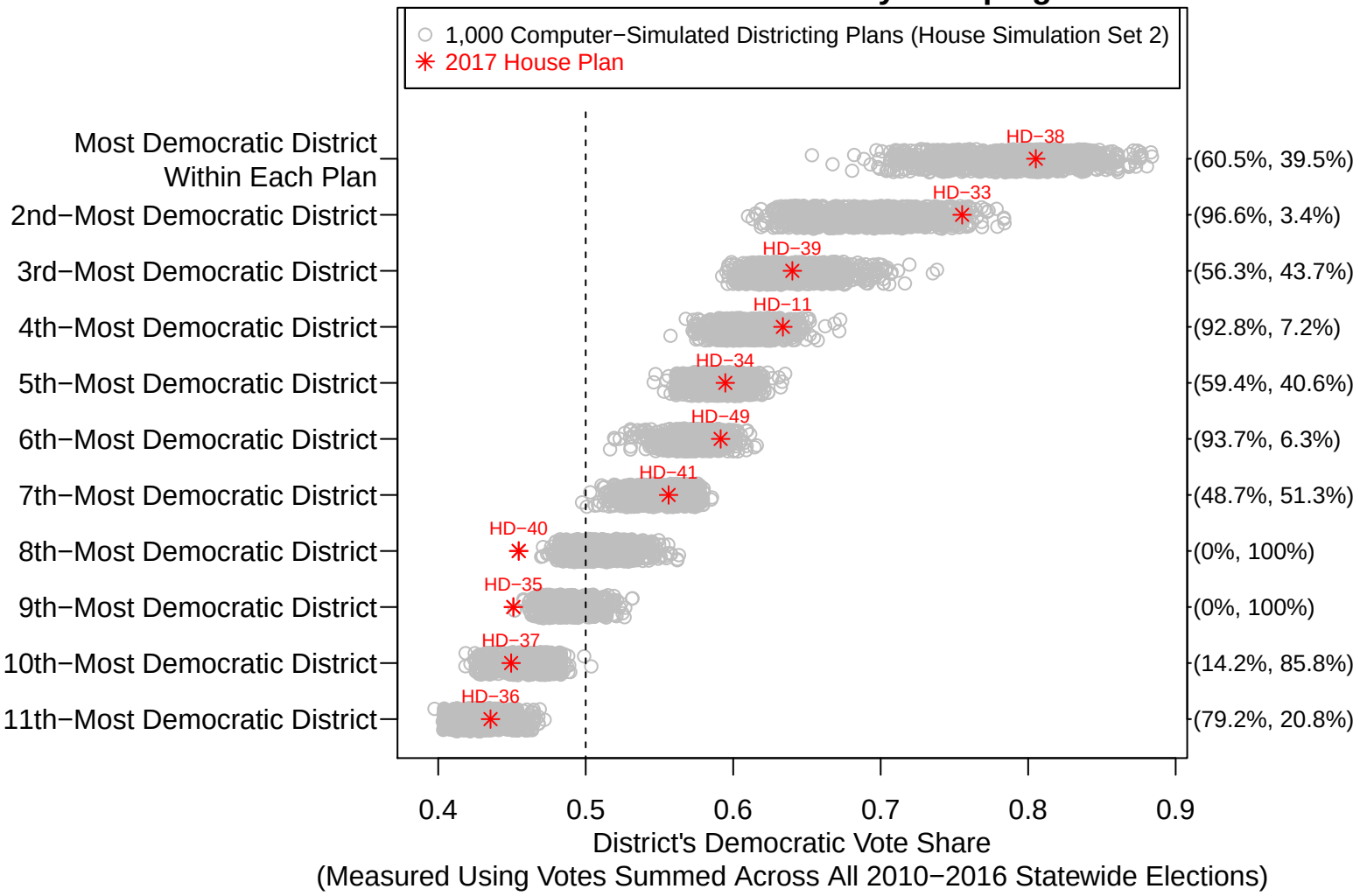
Figure 41: House Simulation Set 2: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Guilford County Grouping

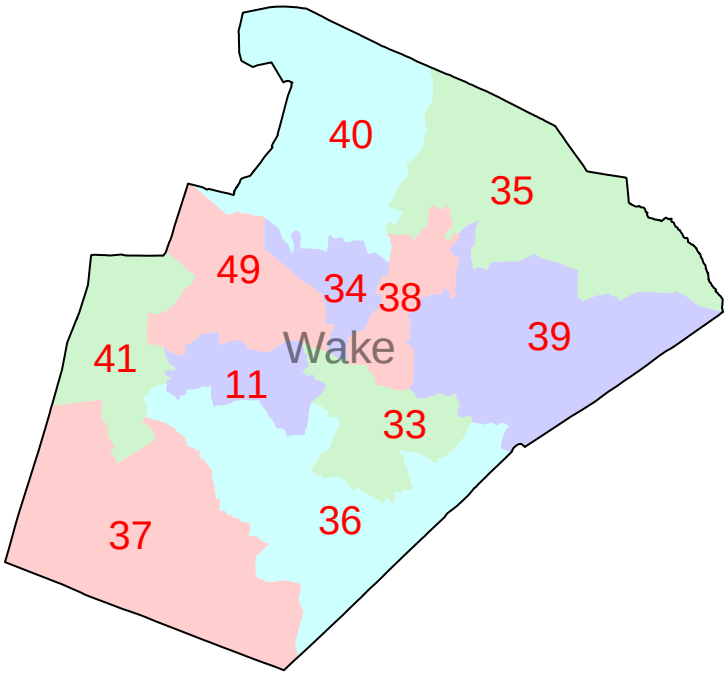




2017 Enacted House Plan Districts (6 total districts)
(This county grouping includes 3 Special Master Districts (HD−57, HD−61, and HD−62) that are frozen in all simulated plans and not included in the above Figure)

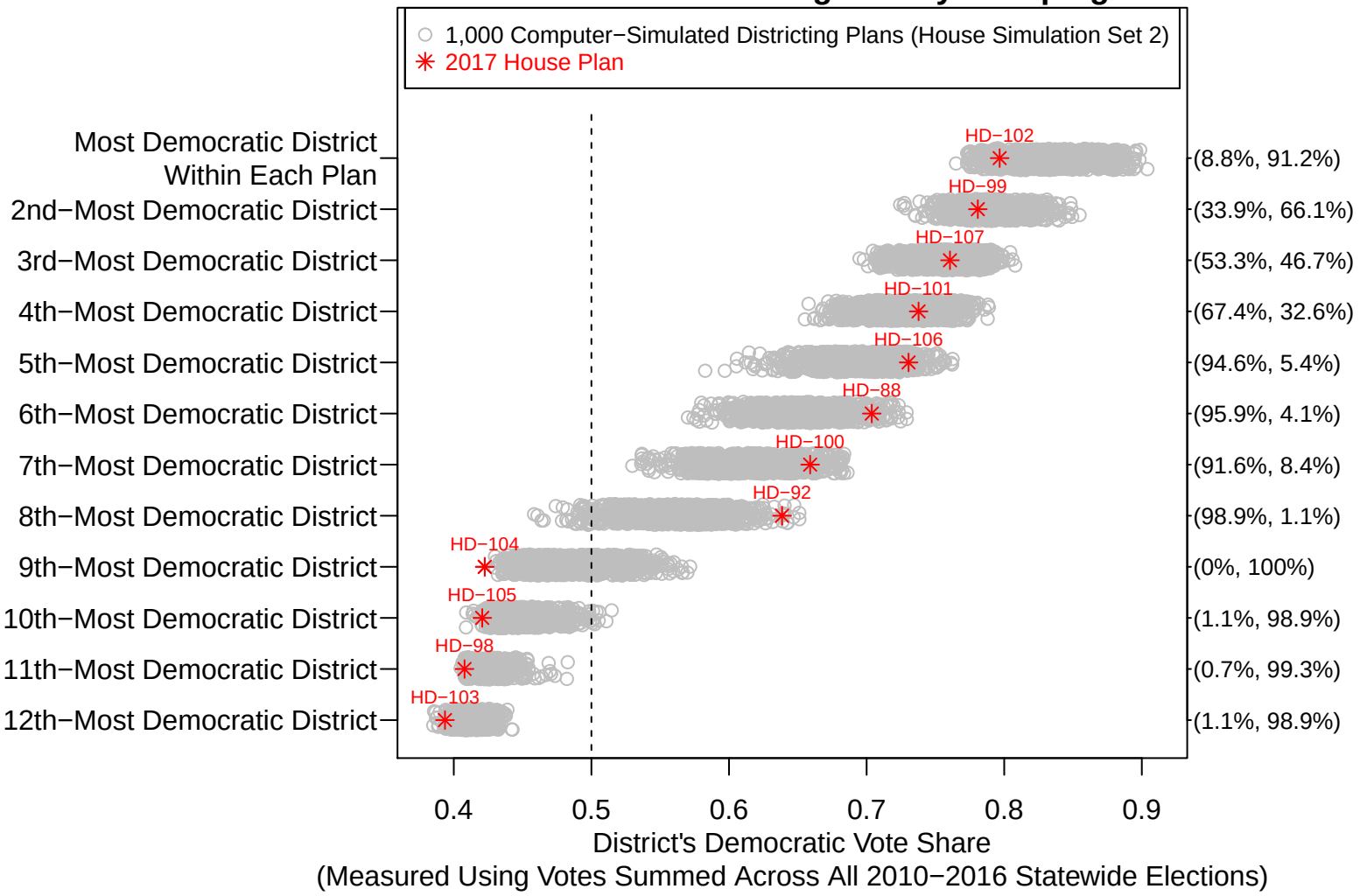
Figure 42: House Simulation Set 2: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Wake County Grouping

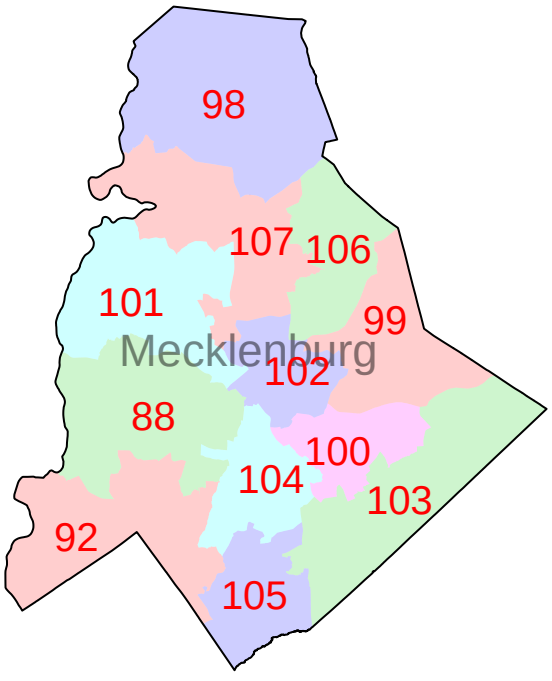




2017 Enacted House Plan Districts (11 Districts)

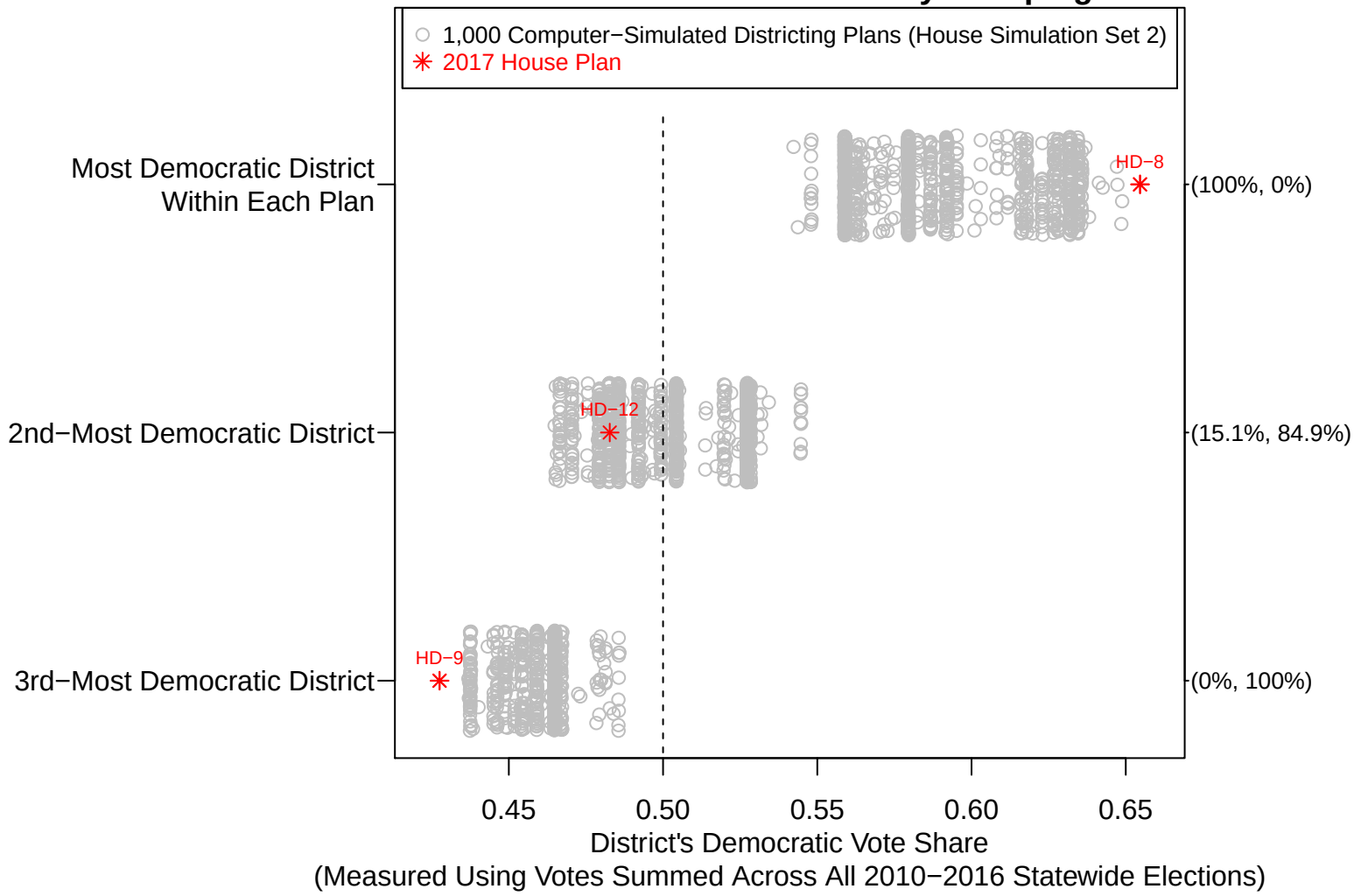
Figure 43: House Simulation Set 2: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Mecklenburg County Grouping

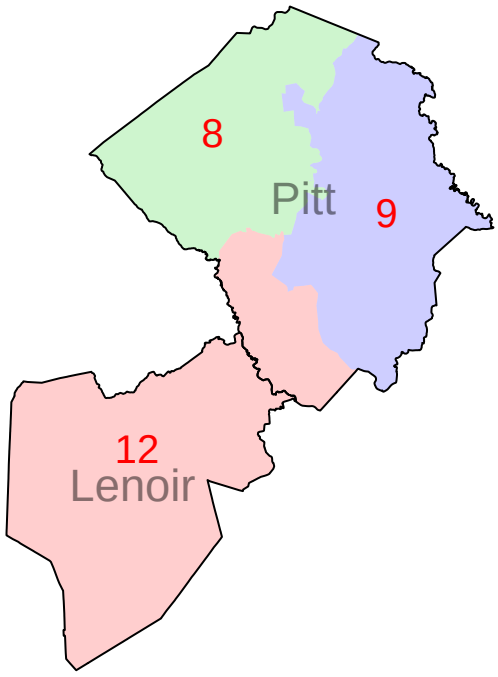




2017 Enacted House Plan Districts (12 Districts)

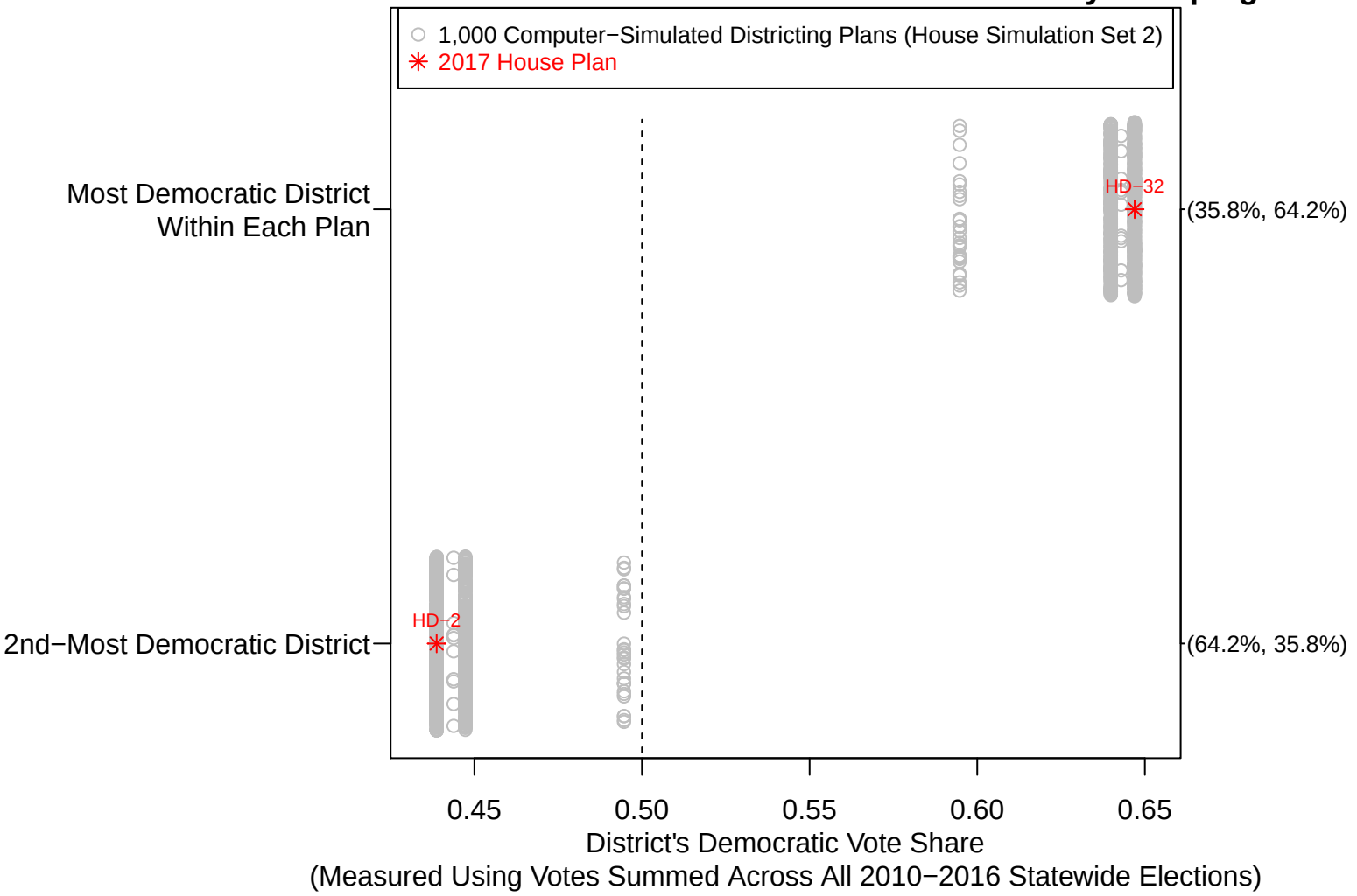
Figure 44: House Simulation Set 2: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Lenoir−Pitt County Grouping

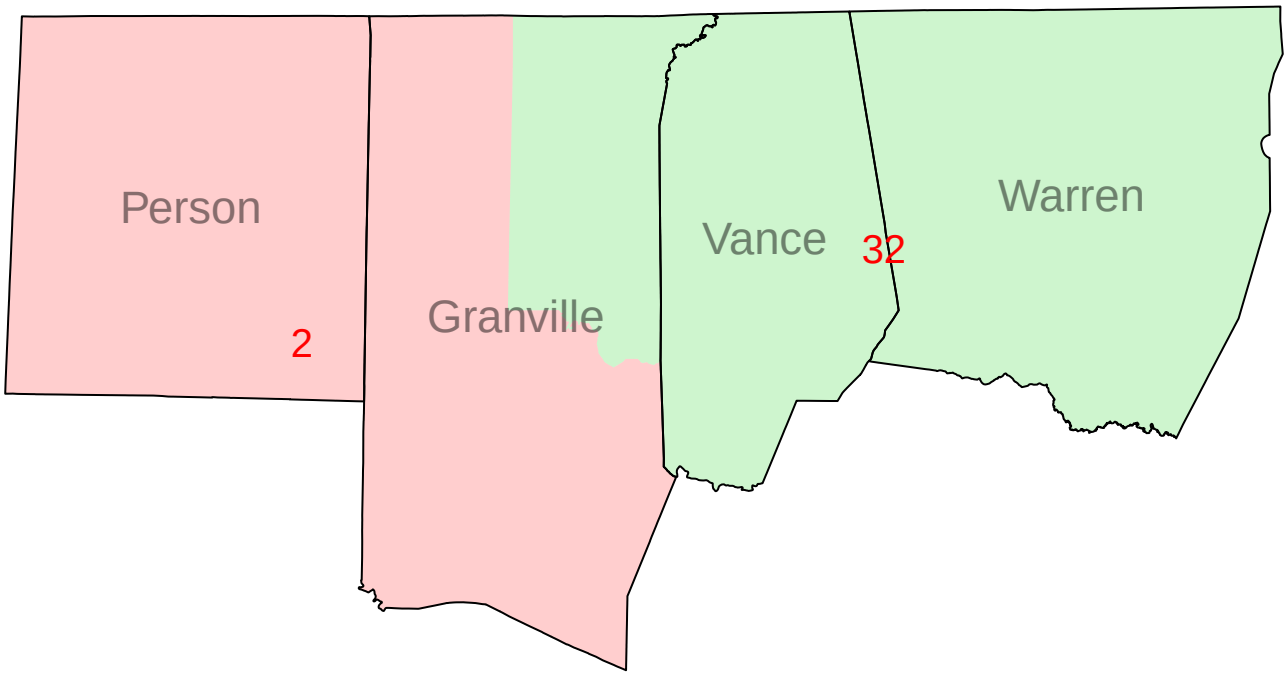




2017 Enacted House Plan Districts (3 Districts)

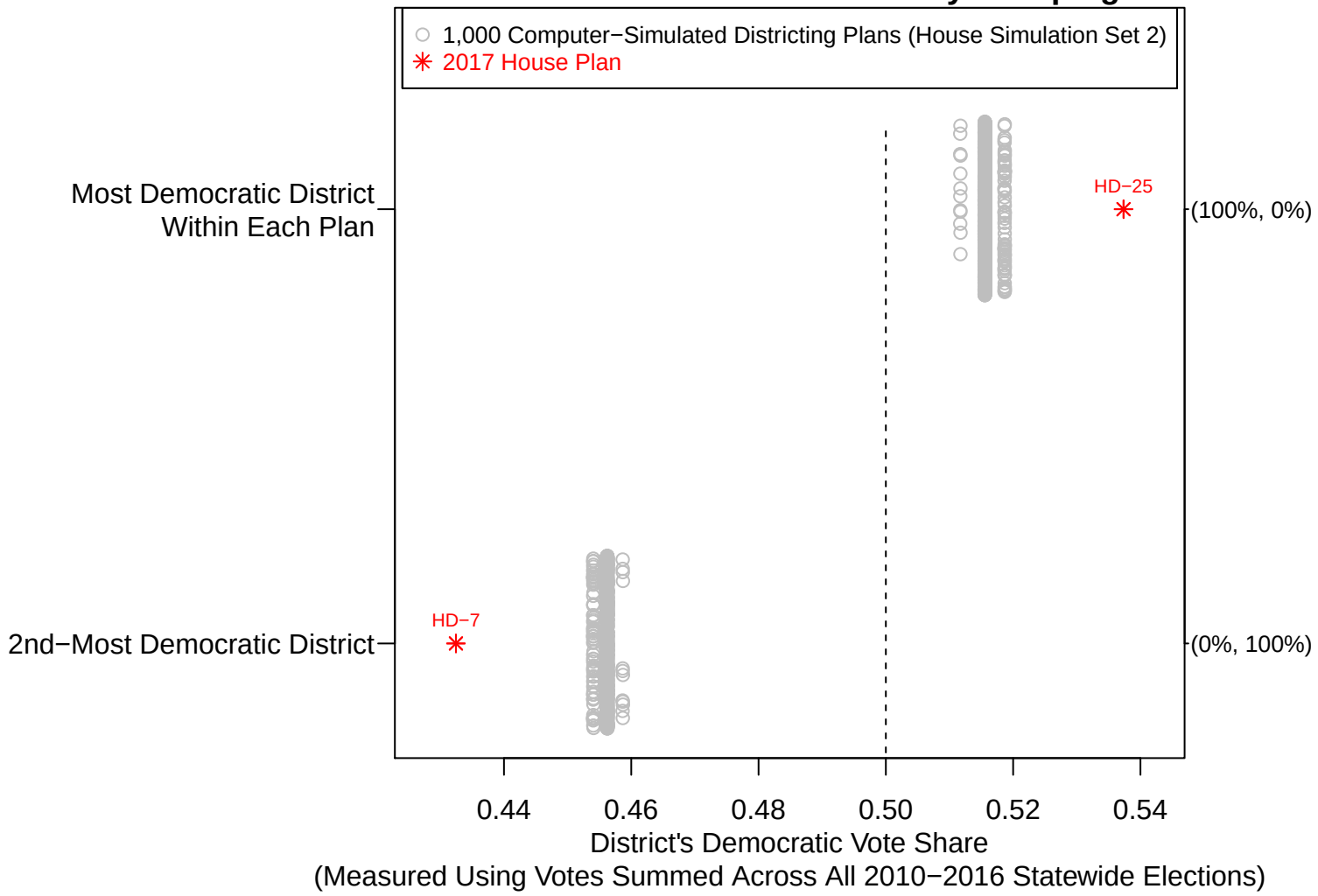
Figure 45: House Simulation Set 2: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Granville−Person−Vance−Warren County Grouping

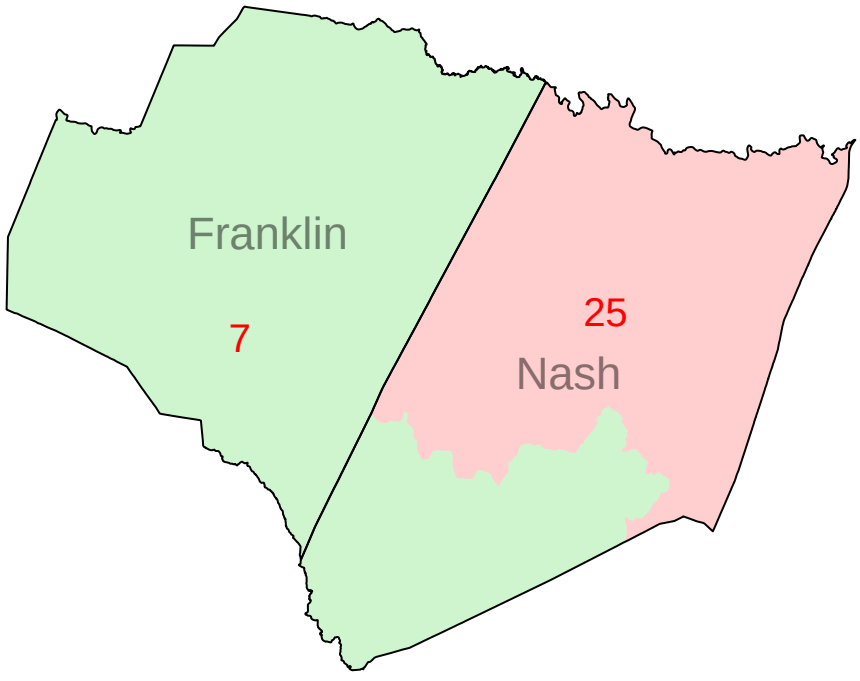




2017 Enacted House Plan Districts (2 Districts)

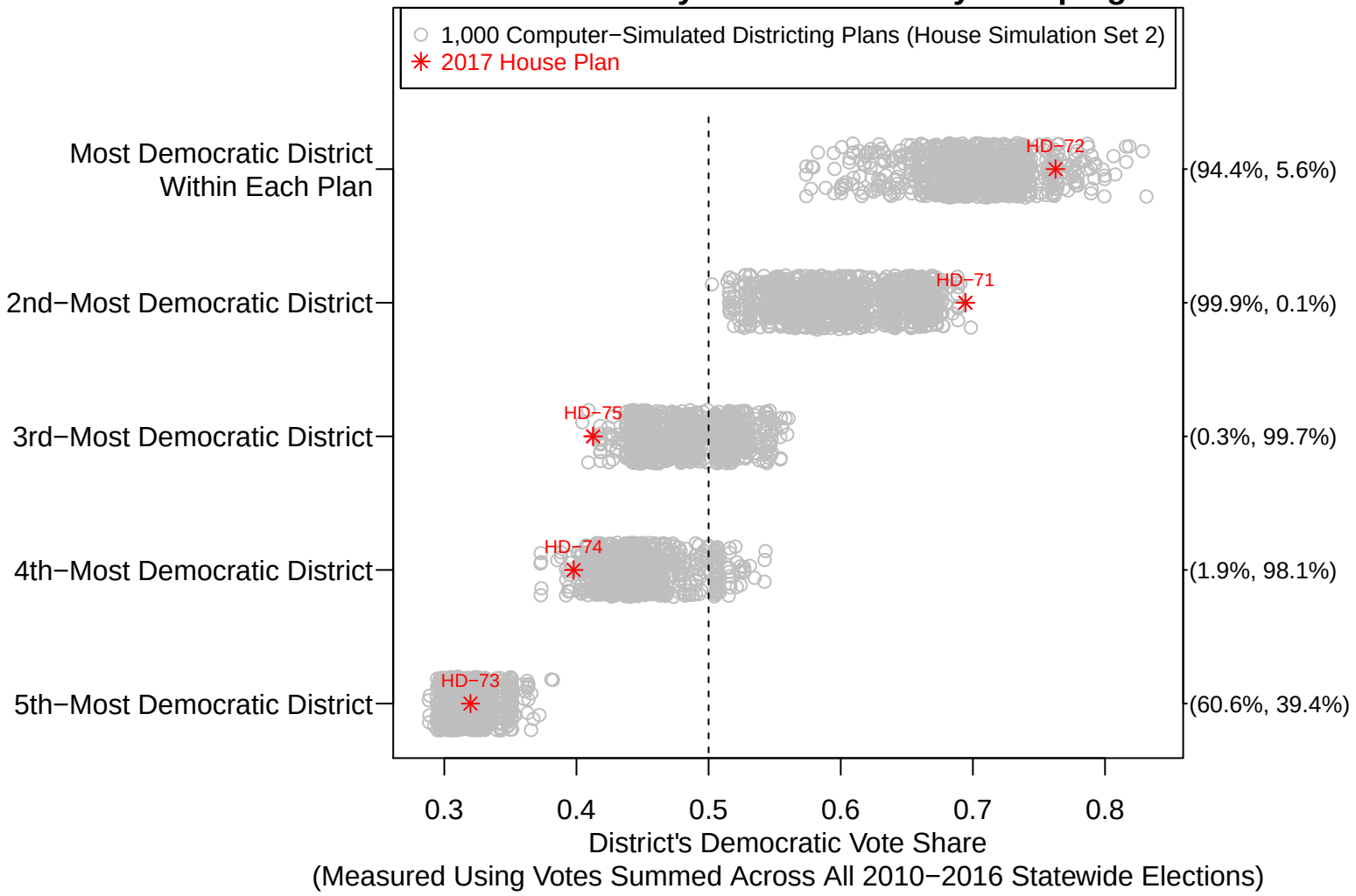
Figure 46: House Simulation Set 2: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Franklin−Nash County Grouping

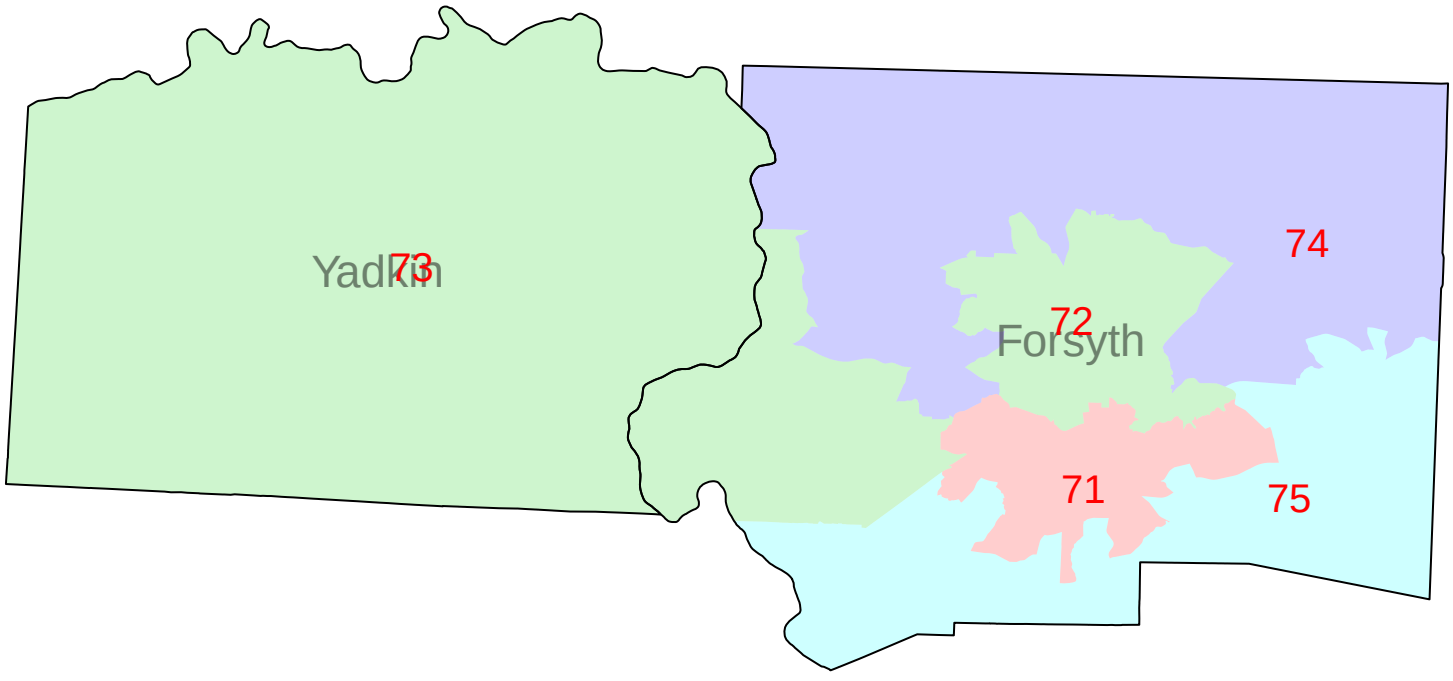




2017 Enacted House Plan Districts (2 Districts)

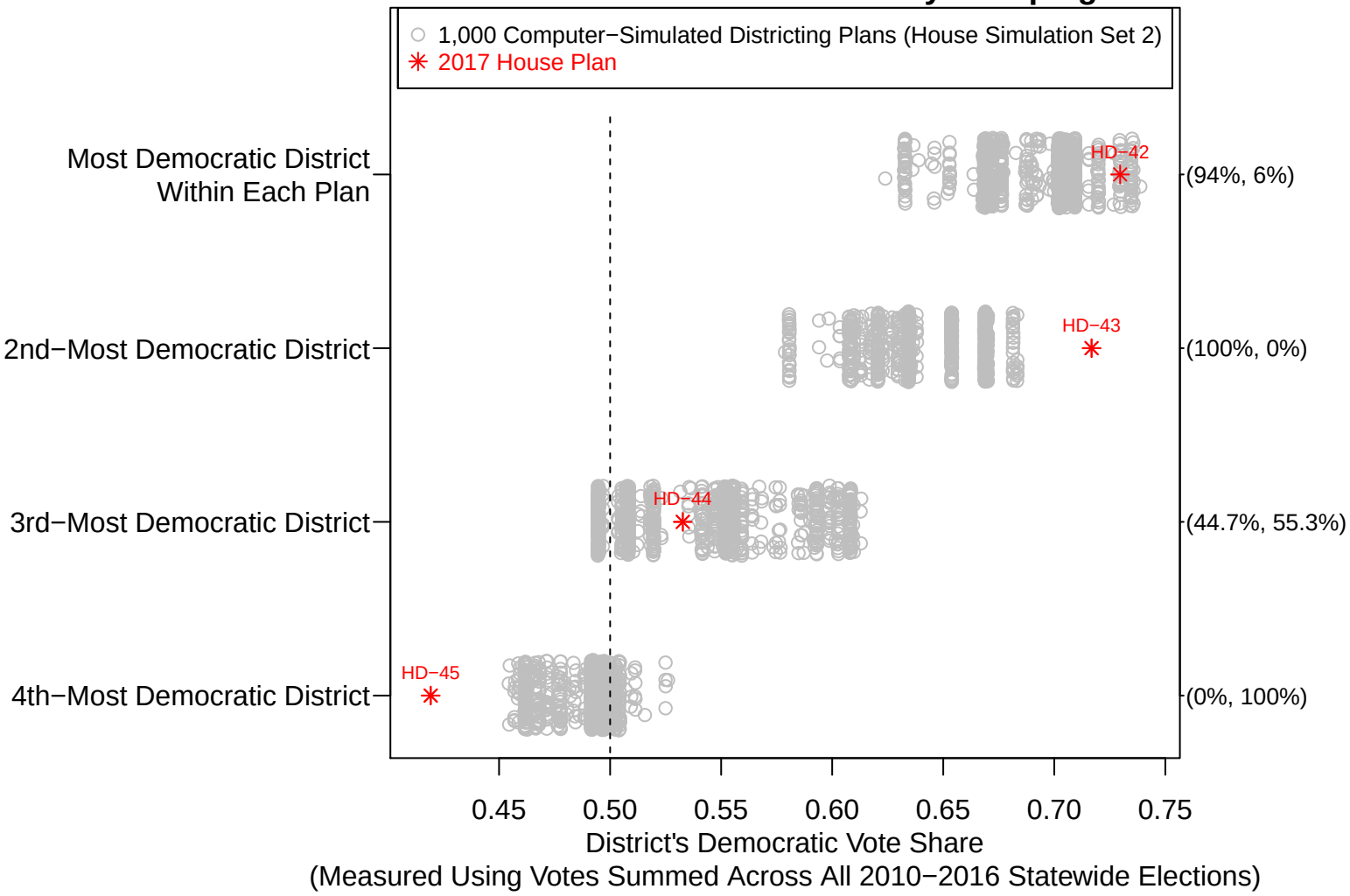
Figure 47: House Simulation Set 2: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Forsyth−Yadkin County Grouping

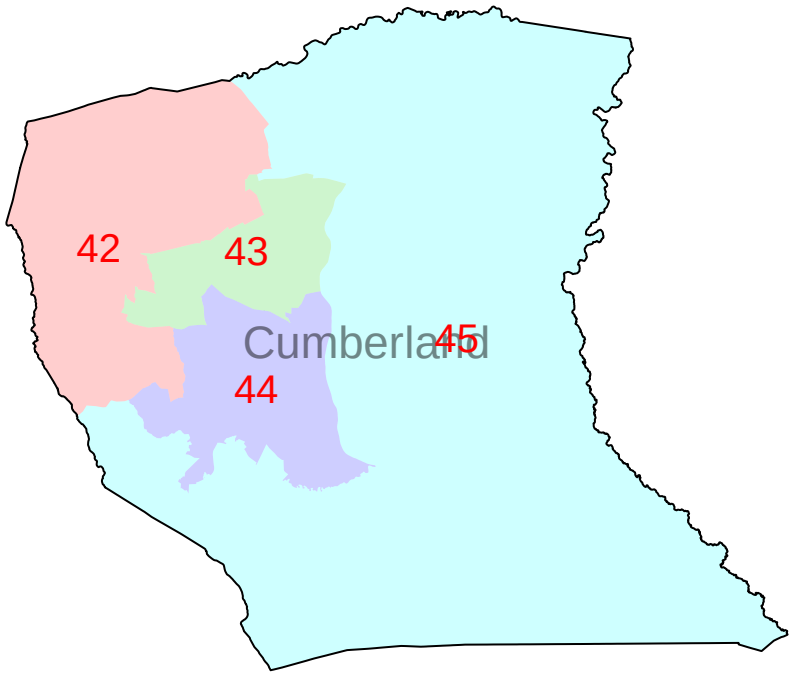




2017 Enacted House Plan Districts (5 Districts)

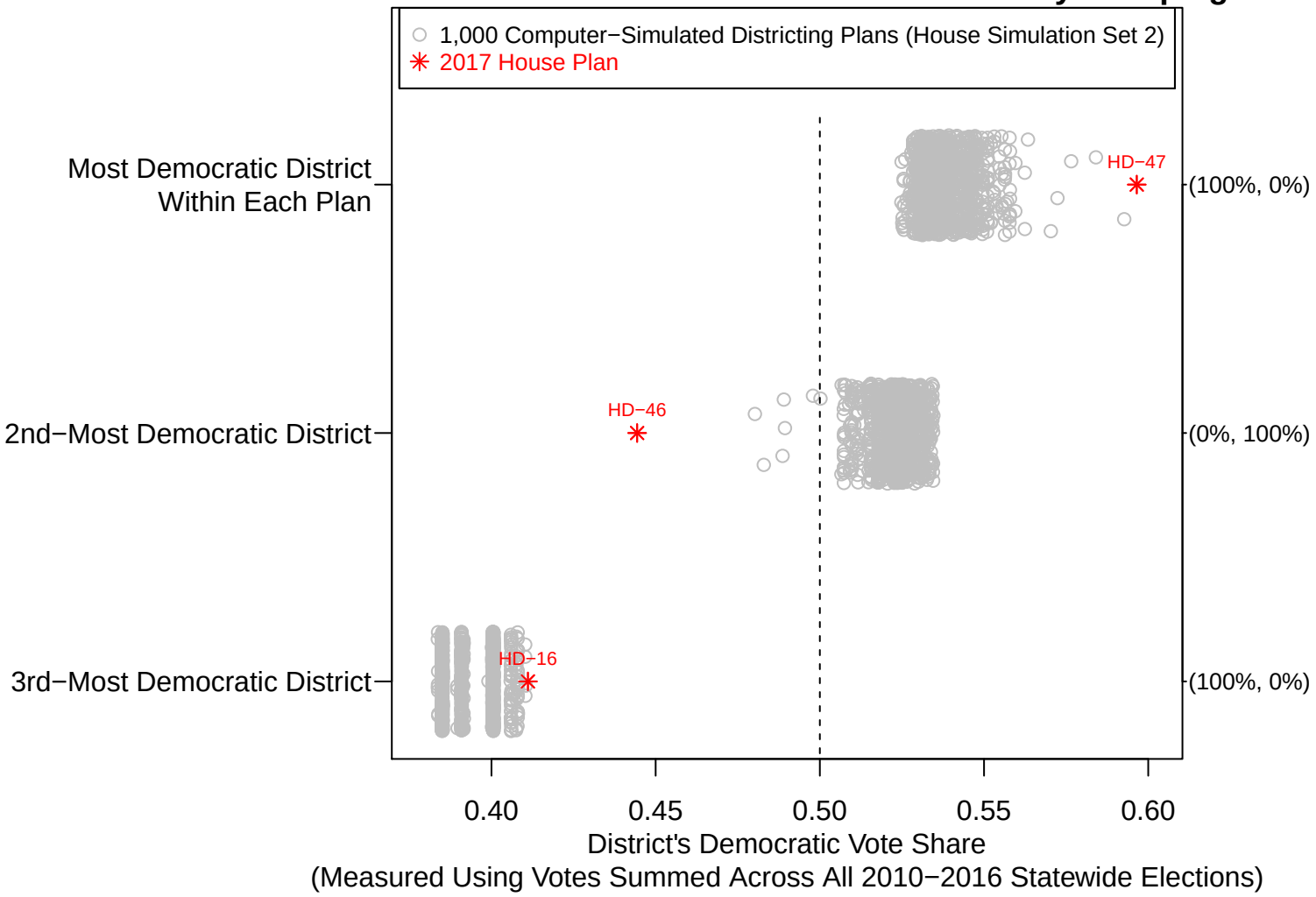
Figure 48: House Simulation Set 2: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Cumberland County Grouping

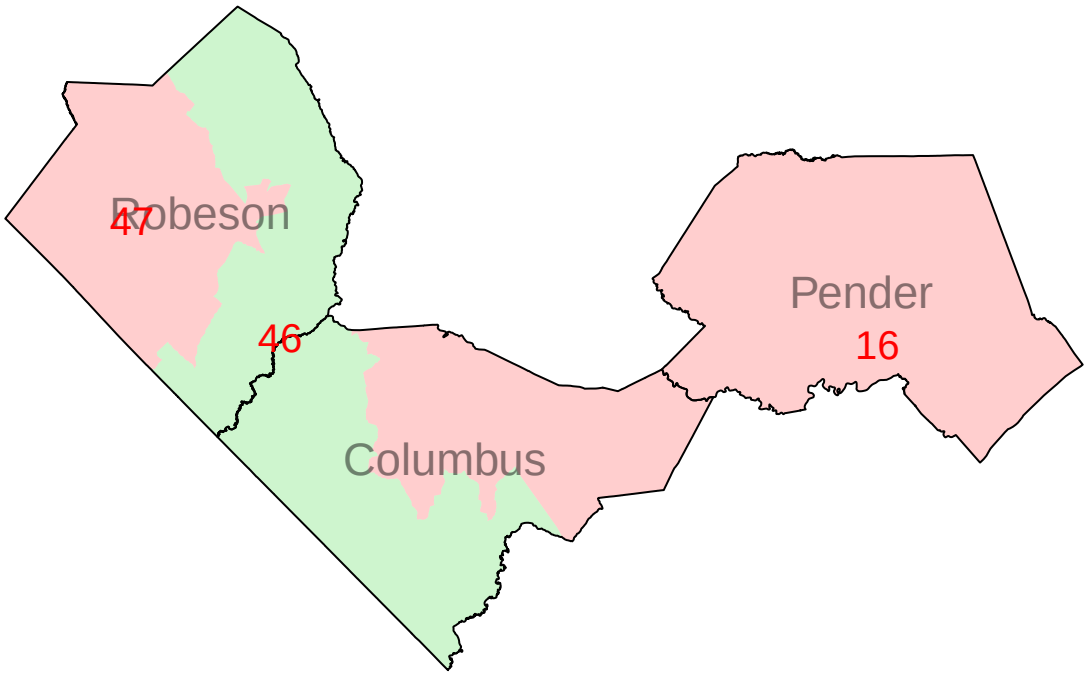




2017 Enacted House Plan Districts (4 Districts)

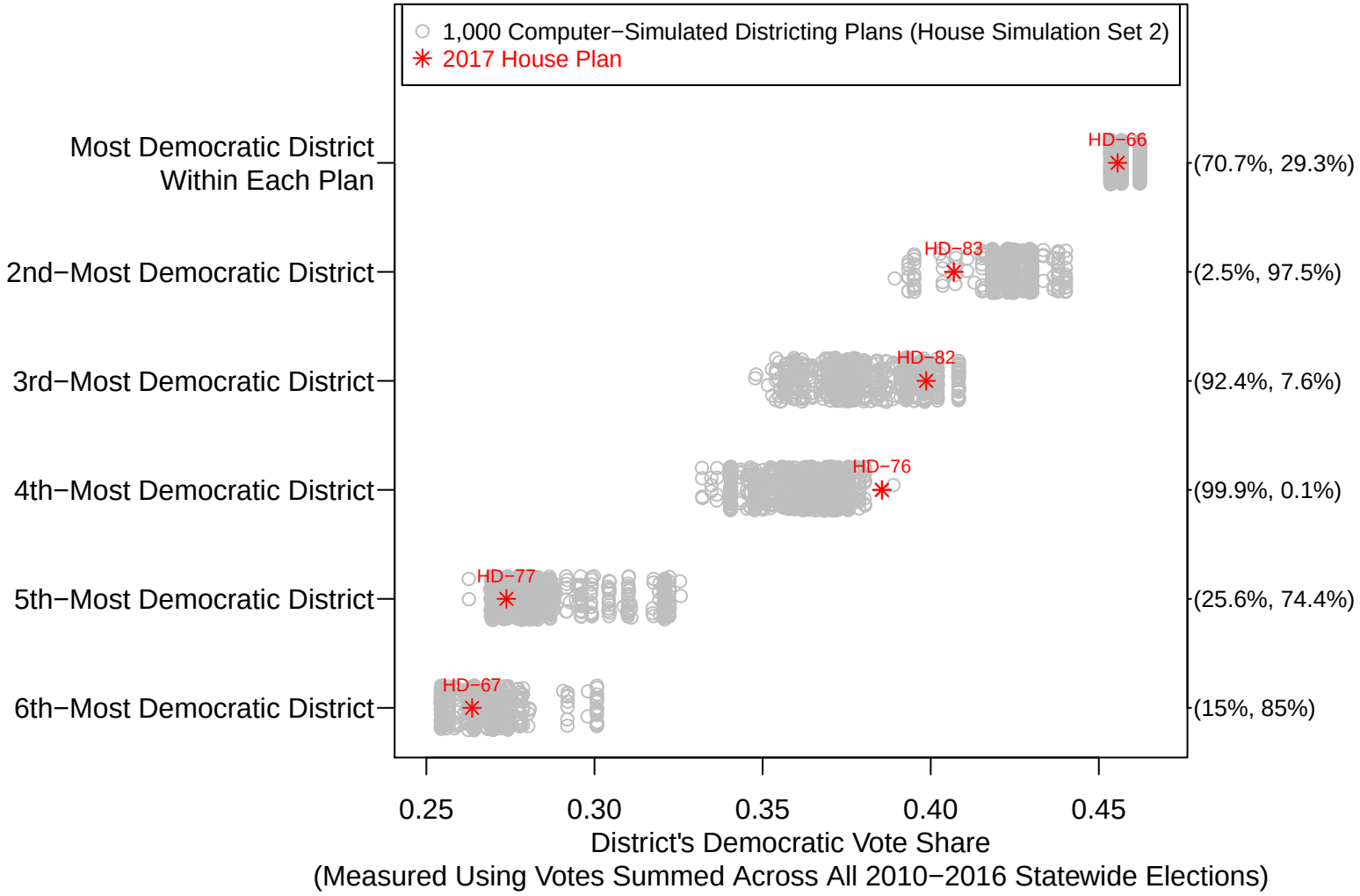
Figure 49: House Simulation Set 2: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Columbus−Pender−Robeson County Grouping

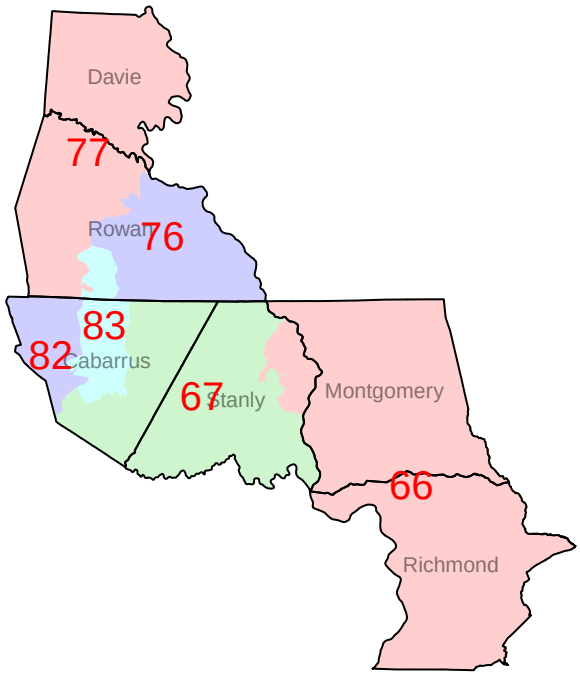




2017 Enacted House Plan Districts (3 Districts)

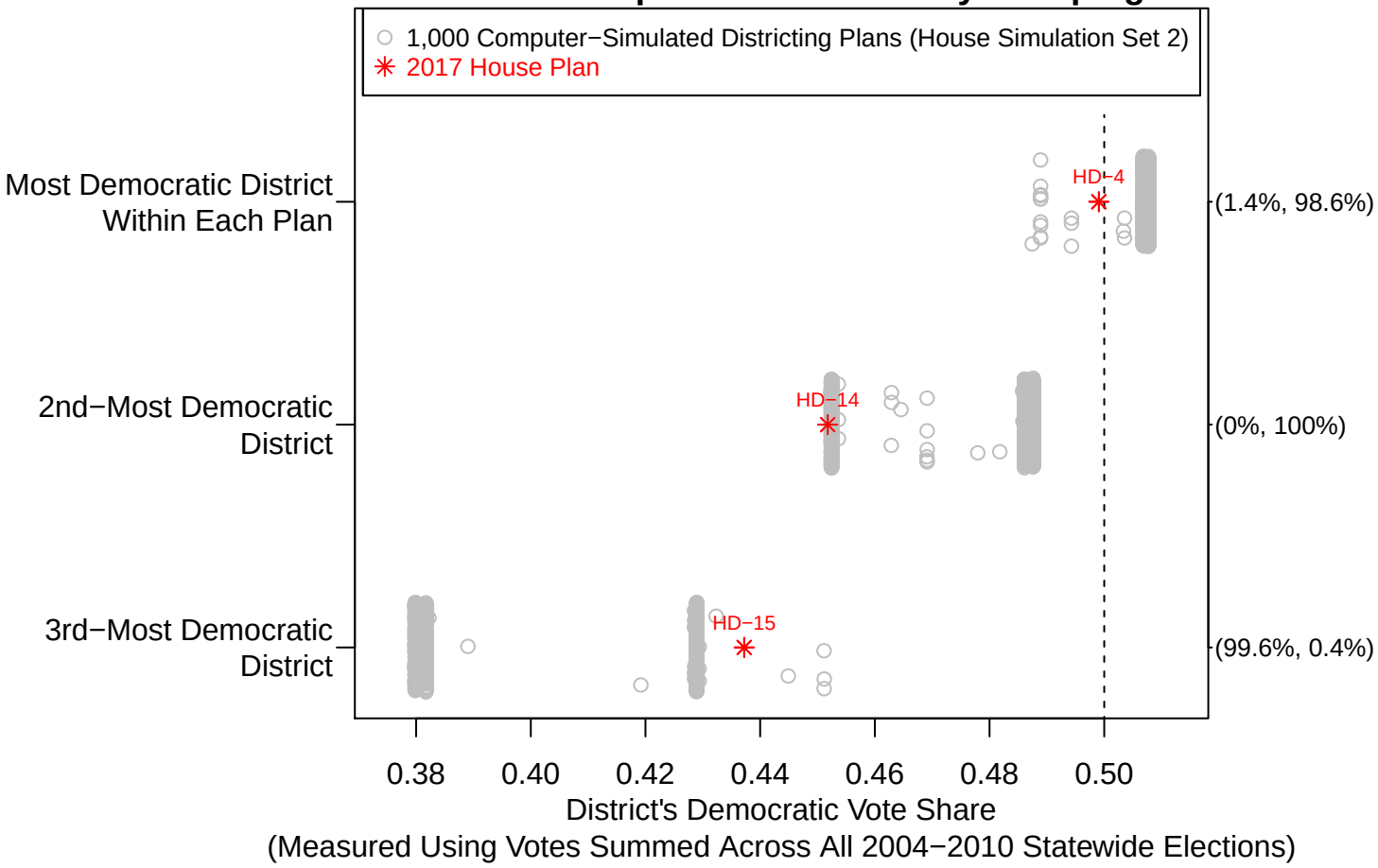
Figure 50: House Simulation Set 2:
Democratic Vote Share of the Enacted and Computer−Simulated Districts
Within the Cabarrus−Davie−Montgomery−Richmond−Rowan−Stanly County Grouping

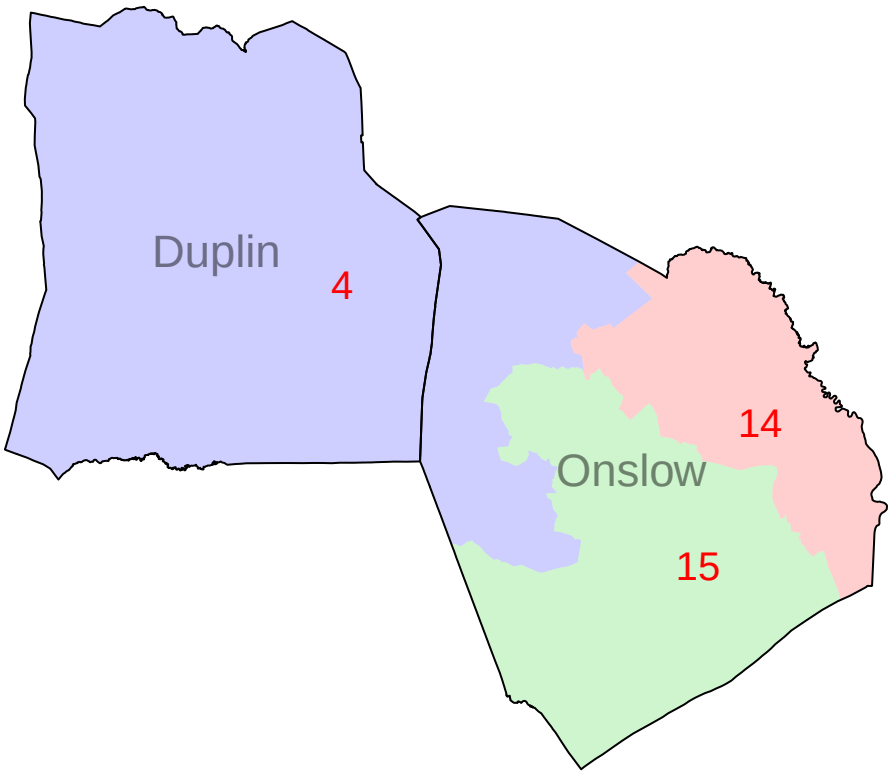




2017 Enacted House Plan Districts (6 Districts)

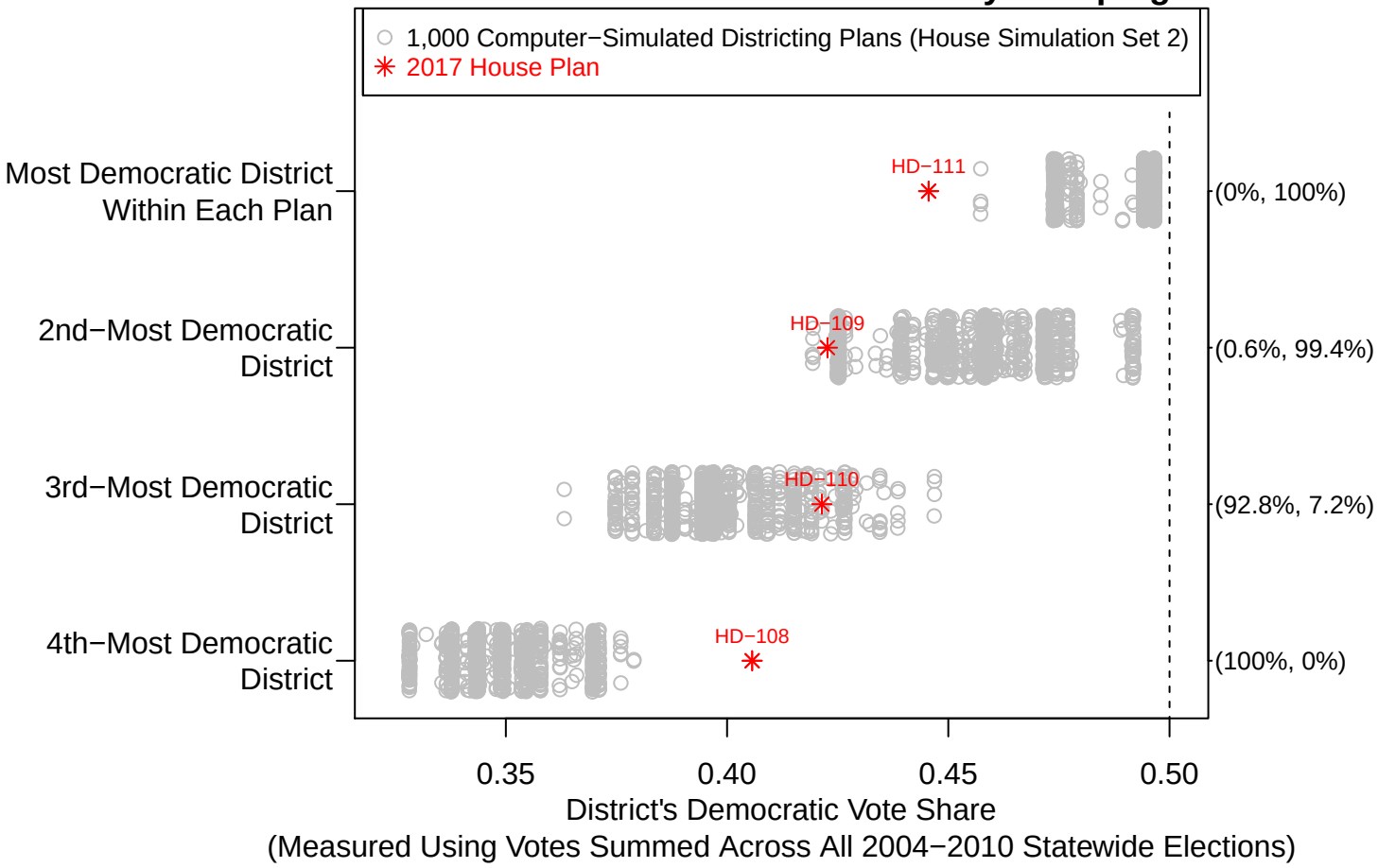
Figure 51: House Simulation Set 2: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Duplin−Onslow County Grouping

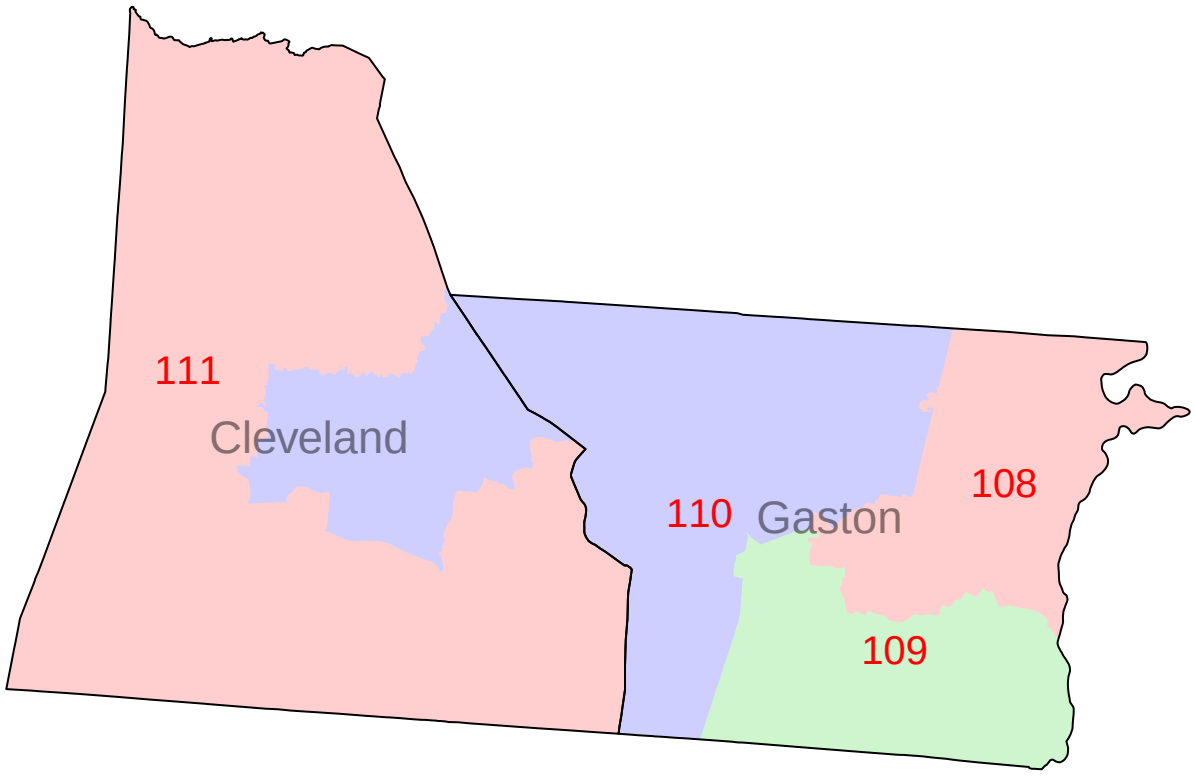




2017 Enacted House Plan Districts (3 Districts)

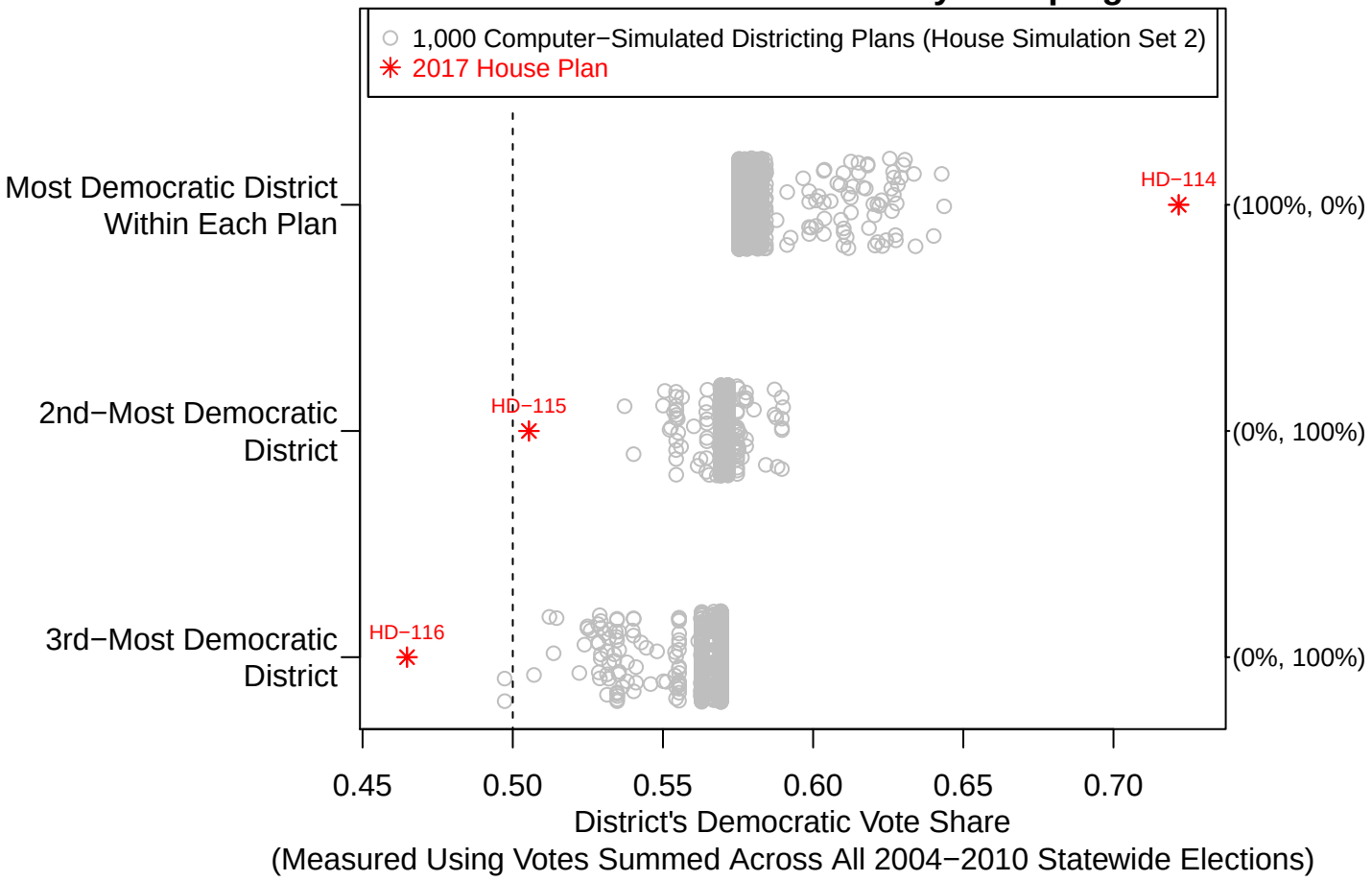
Figure 52: House Simulation Set 2: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Cleveland−Gaston County Grouping

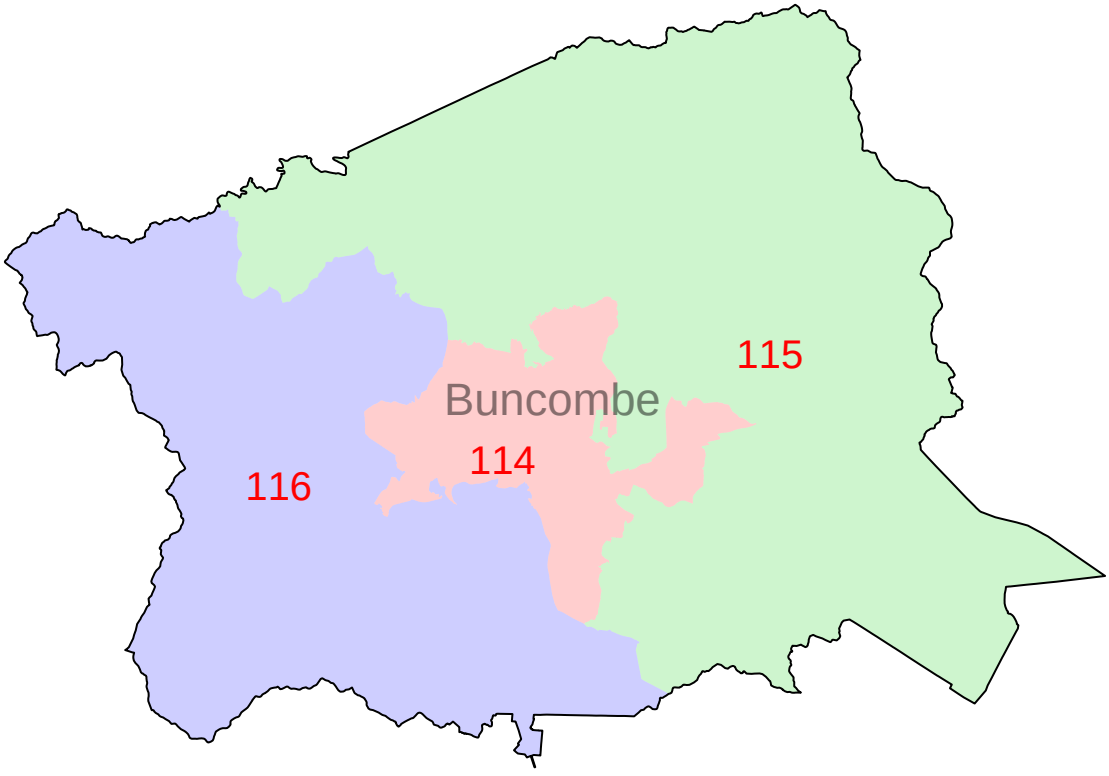




2017 Enacted House Plan Districts (4 Districts)

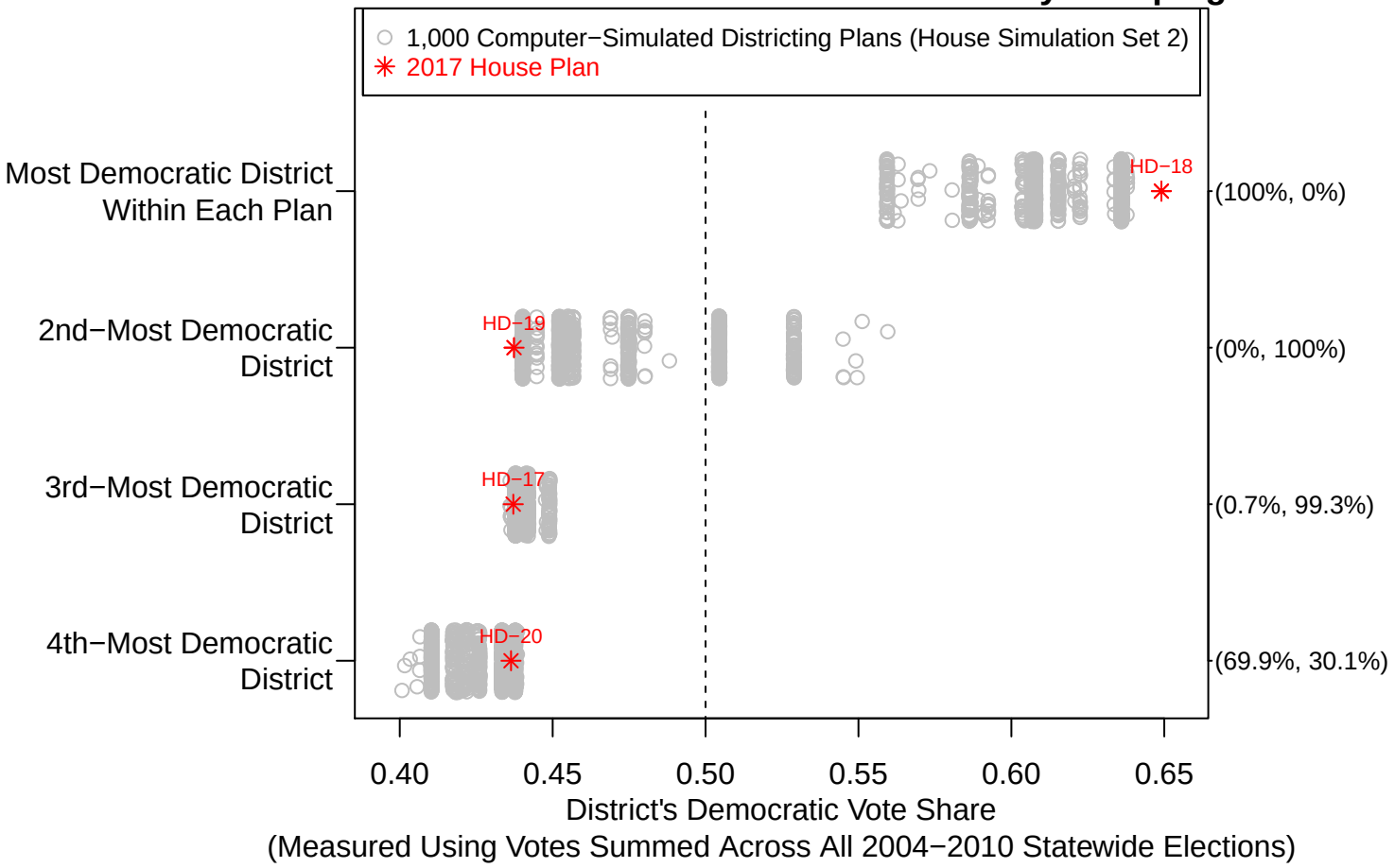
Figure 53: House Simulation Set 2: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Buncombe County Grouping

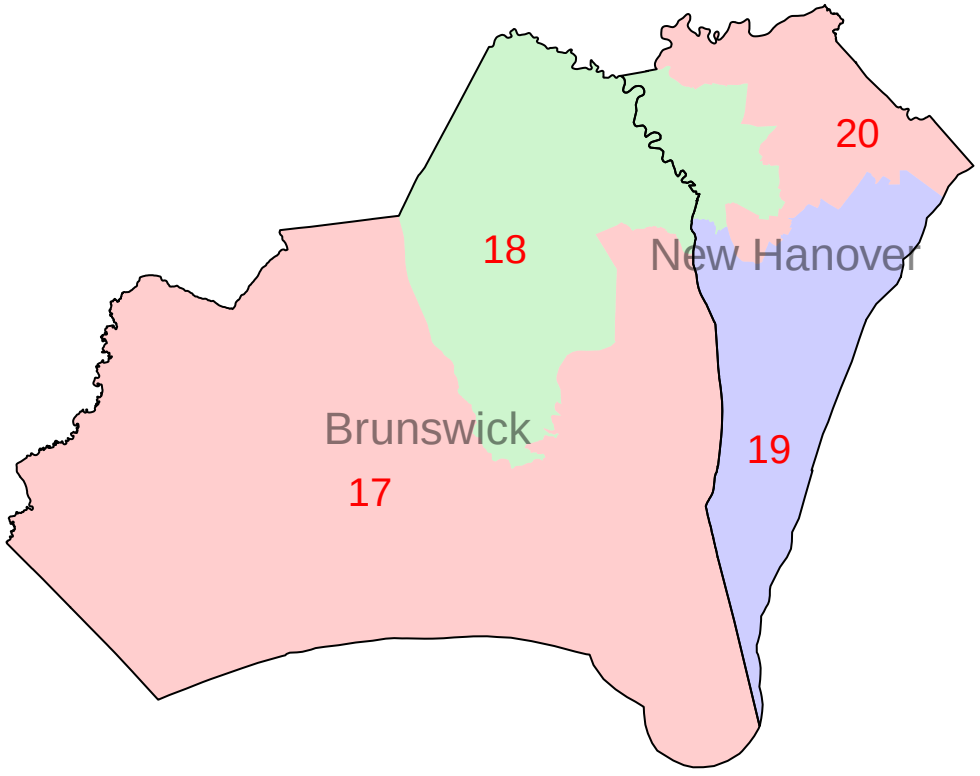




2017 Enacted House Plan Districts (3 Districts)

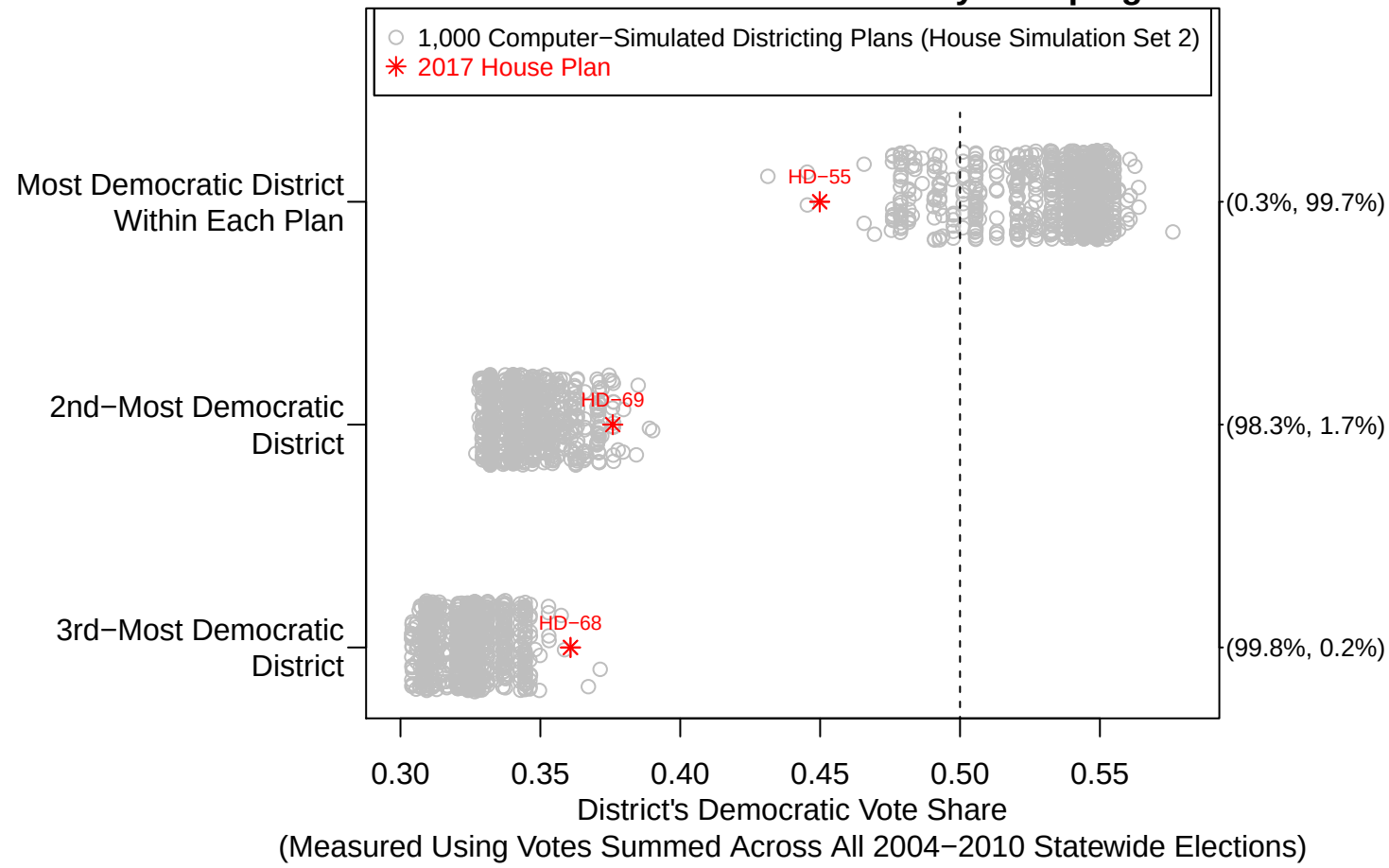
Figure 54: House Simulation Set 2: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Brunswick−New Hanover County Grouping

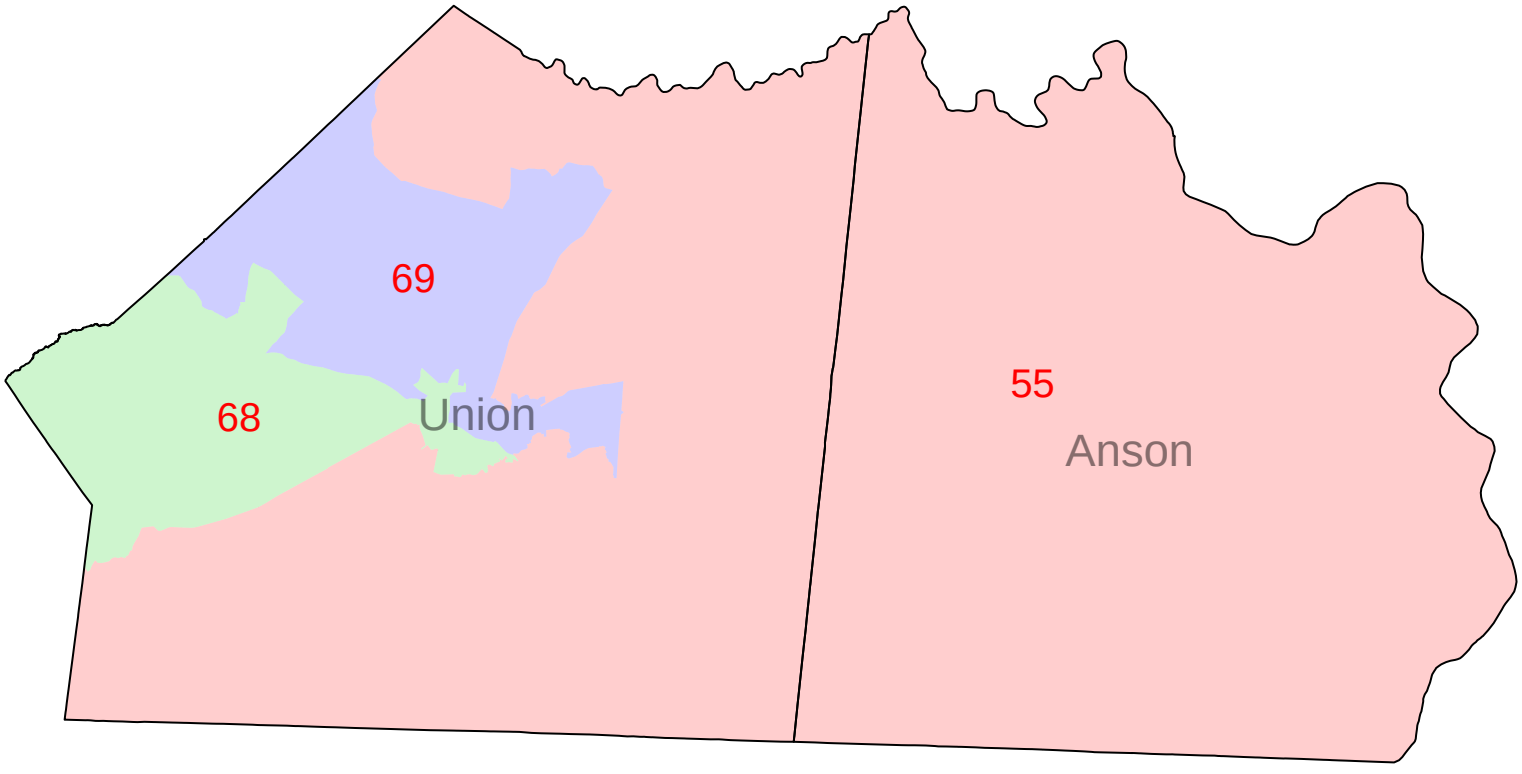




2017 Enacted House Plan Districts (4 Districts)

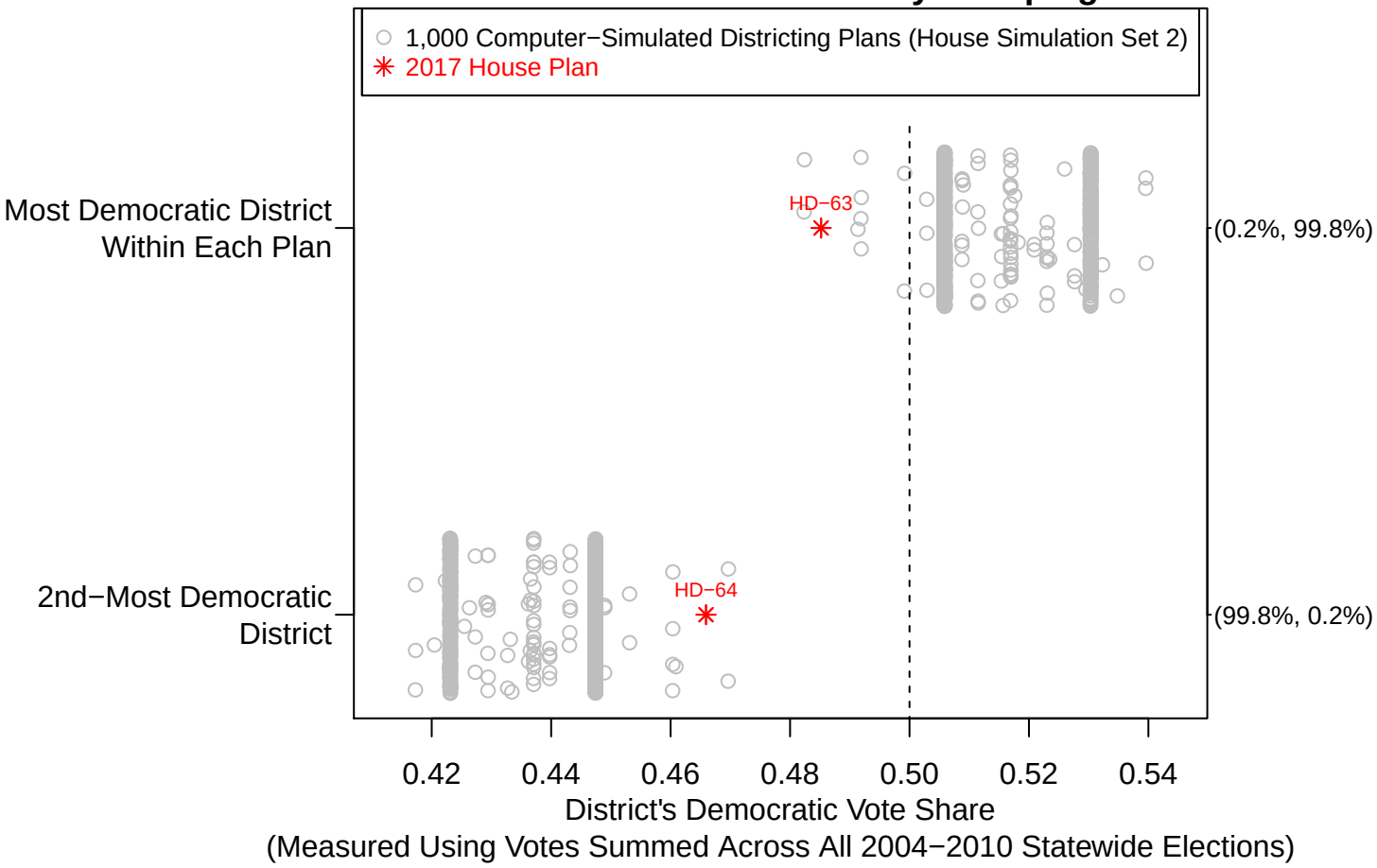
Figure 55: House Simulation Set 2: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Anson−Union County Grouping

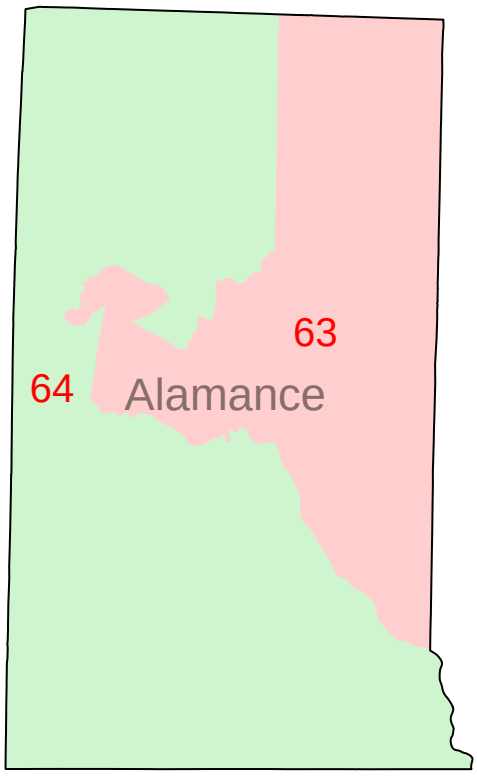




2017 Enacted House Plan Districts (3 Districts)

Figure 56: House Simulation Set 2: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Alamance County Grouping





2017 Enacted House Plan Districts (2 Districts)

Comparing the Number of Threshold-Level Republican Districts in the Enacted and Simulated Plans: The second approach I use is as follows: Within each county grouping, I consider all of the 2017 House Plan districts in the grouping that are Republican-leaning (with over a 50% Republican vote share), and I identify the most minimally Republican-leaning of these enacted districts. For both the 2017 House Plan and each of the computer-simulated plans, I then compare the number of districts within the grouping that are at least as Republican-leaning as the most minimally Republican-leaning district within that grouping in the 2017 House Plan.

For each grouping in the 2017 House Plan, the most minimally Republican-leaning district is the district with the lowest Republican vote share that is still above 50%. In other words, this approach is asking: Within a particular county grouping, how many districts does each plan create that are as Republican-leaning as the 2017 House Plan's least-Republican-leaning district within the grouping? The intuition of this approach is to measure the extent to which the 2017 House Plan attempted to maximize the total number of Republican-leaning districts in the grouping that had at least as much "cushion" as the most minimally-Republican-leaning district in that grouping.

Figure 59 illustrates an example of this approach, analyzing the Columbus, Pender, and Robeson County grouping in the 2017 House Plan, which contains three districts (HD 16, HD-46, and HD-47). Two of these three districts are Republican-leaning, as measured using the 2010-2016 Statewide Election Composite. Among these two Republican-leaning districts, HD-46, with a Republican vote share of 55.56%, is the most minimally Republican-leaning of these districts. Therefore, I use this 55.56% Republican vote share threshold, and I count the number of districts in the 2017 House Plan and in the computer-simulated plans within this county grouping that are at least as heavily Republican as HD-46's Republican vote share of 55.56%.

The two histograms in Figure 59 illustrate the results of this analysis of the Columbus, Pender, and Robeson County grouping. The 2017 House Plan contains two districts (HD-46 and HD-16) that are at least as Republican as HD-46's Republican vote share of 55.56%. The left histogram in Figure 59 reveals that every single one of the 1,000 simulated plans in House Simulation Set 1 contains only one district in this county grouping with at least a 55.56% Republican vote share. Similarly, the right histogram in Figure 59 also illustrates that every one of the 1,000 simulated plans in House Simulation Set 2 contains only one district in this county grouping with at least a 55.56% Republican vote share. Not a single one of these 2,000

computer-simulated plans contains two such Republican districts. Therefore, the 2017 House Plan is a statistical outlier within the Columbus-Pender-Robeson County grouping in its creation of two Republican districts with at least a 55.56% Republican vote share.

I use this same approach to analyze each 2017 House Plan district within different county groupings. Figures 57 to 73 each focus on a single county grouping, with the left histogram analyzing House Simulation Set 1 plans and the right histogram analyzing House Simulation Set 2. As before, for county groupings containing districts that were originally drawn in 2011 and remained unchanged in the 2017 redistricting process, I used the 2004-2010 Statewide Election Composite to measure district partisanship in these Figures, since the 2004-2010 statewide elections represent the elections data available to and used by the General Assembly during the 2011 redistricting process. Finally, in the Guilford County grouping (Figure 64), which contains six total districts, note that three of the 2017 House Plan districts within Guilford County were materially redrawn by Special Master Nathaniel Persily and are frozen in all simulated plans in House Simulation Set 1 and Set 2. Therefore, these Special Master districts are not included in my analysis of the Guilford County grouping. Instead, Figure 64 shows results only for the three other districts that are not frozen across all simulated plans (HD-58, HD-59, and HD-60).

For the Cabarrus, Davie, Montgomery, Richmond, Rowan, and Stanly County grouping, I found that the least-Republican-leaning district (HD-66) generally has little geographic variation across the 2,000 simulated House plans and the 2017 House Plan. Because of the long, narrow geographic shape of this county grouping, the least-Republican-leaning district generally lies at the southern end of this grouping, covering all of Richmond and Montgomery Counties and a small, eastern portion of Stanly County. As a result, this least-Republican-leaning district exhibits little partisan variation across the 2,000 House simulations and the 2017 House Plan.

Therefore, for the Cabarrus, Davie, Montgomery, Richmond, Rowan, and Stanly County grouping, I performed the following additional analysis: In Figure 57, I first analyzed the number of districts in the grouping that are at least as Republican as the least-Republican-leaning district in the 2017 House Plan (HD-66). And then in Figure 58, I analyzed the number of districts in the grouping that are at least as Republican as the second-least-Republican-leaning district in the 2017 House Plan (HD-83, which contains a Republican vote share of 59.31%). Figure 58 illustrates that the 2017 House Plan contains five such districts (HD-67, HD-76, HD-77, HD-82, and HD-83), while over 95% of the simulated plans in House Simulation Set 1 and Set 2 contain

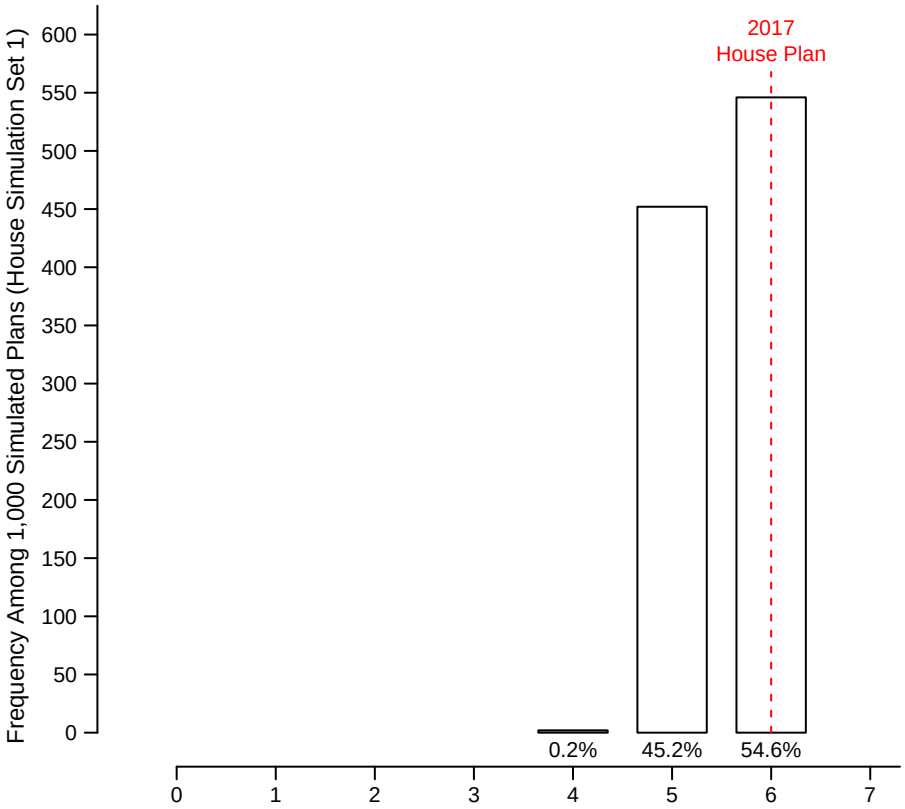
only three or four such Republican districts. Thus, I found that the 2017 House Plan is a statistical outlier in its creation of five Republican-leaning districts with a vote share of at least 59.31%.

Overall, using this partisan threshold methodology, I found that the 2017 House plan creates partisan outliers within the following 14 House county groupings:

1. The Alamance County grouping (Figure 68).
2. The Anson-Union County grouping (Figure 69).
3. The Brunswick-New Hanover County grouping (Figure 70).
4. The Buncombe County grouping (Figure 71).
5. The Cabarrus-Davie-Montgomery-Richmond-Rowan-Stanly County grouping (Figure 58).
6. The Cleveland-Gaston County grouping (Figure 72).
7. The Columbus-Pender- Robeson County grouping (Figure 59).
8. The Cumberland County grouping (Figure 60).
9. The Duplin-Onslow County grouping (Figure 73).
10. The Forsyth-Yadkin County grouping (Figure 61).
11. The Franklin-Nash County grouping (Figure 62).
12. The Guilford County grouping (Figure 64).
13. The Mecklenburg County grouping (Figure 66).
14. The Wake County grouping (Figure 67).

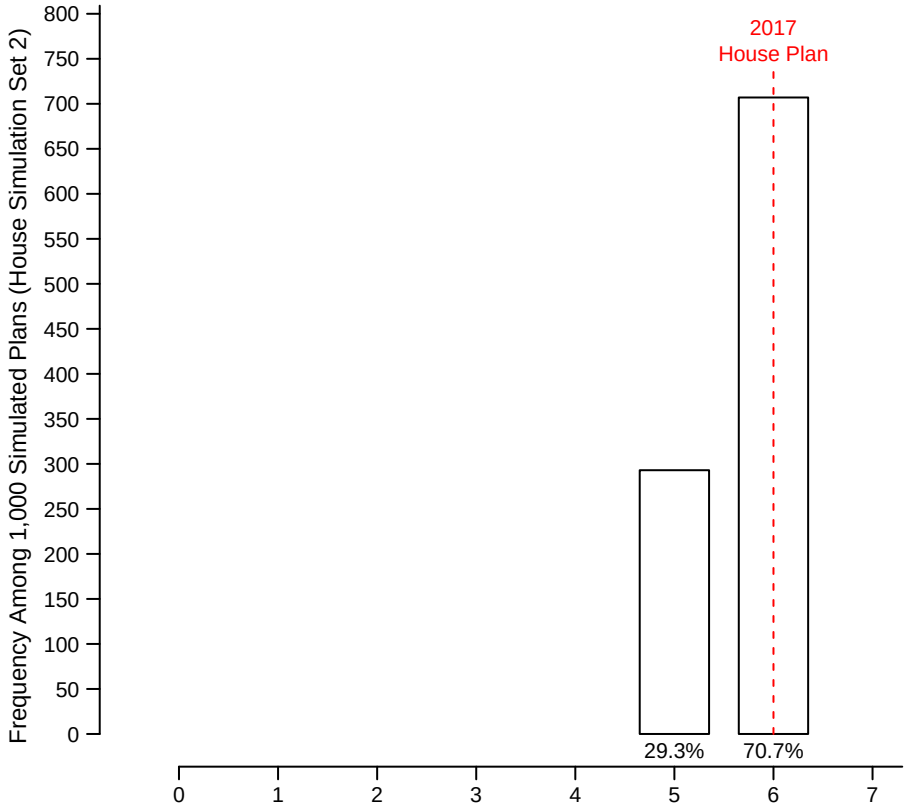
Figure 57:
Number of House Districts With At Least HD−66's Republican Vote Share of 54.44% in the Cabarrus−Davie−Montgomery−Richmond−Rowan−Stanly County Grouping

Simulation Set 1



Number of Districts With At Least HD−66's Republican Vote Share of 54.44% in the Cabarrus−Davie−Montgomery−Richmond−Rowan−Stanly County Grouping (Measured Using Votes Summed Across 2010−2016 Statewide Elections)

Simulation Set 2

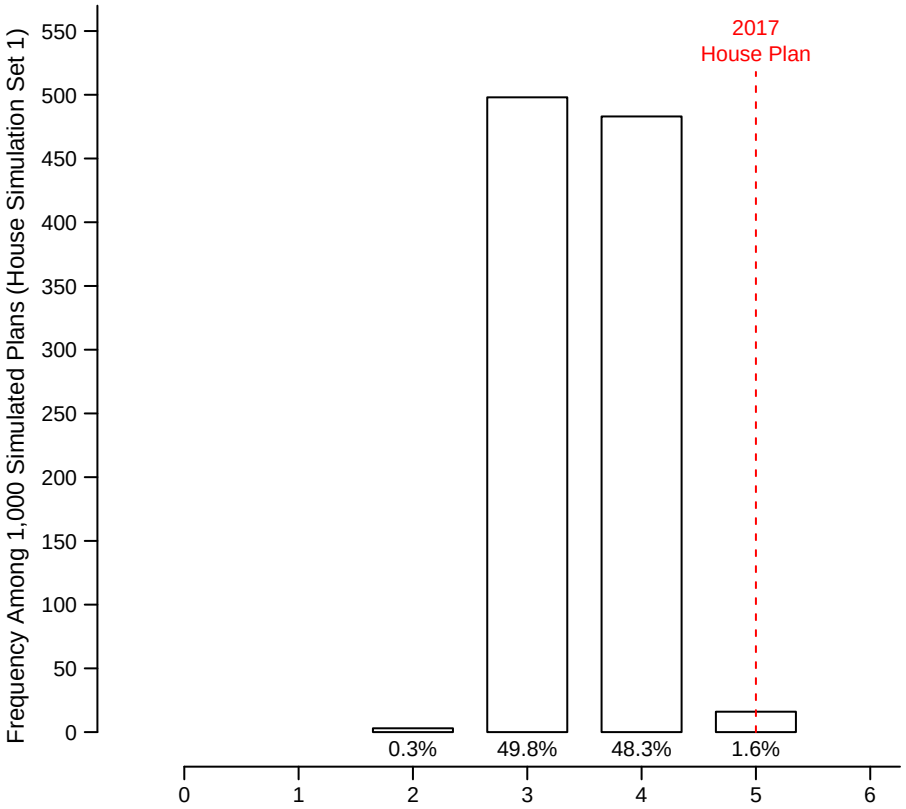


Number of Districts With At Least HD−66's Republican Vote Share of 54.44% in the Cabarrus−Davie−Montgomery−Richmond−Rowan−Stanly County Grouping (Measured Using Votes Summed Across 2010−2016 Statewide Elections)

Note: The Cabarrus−Davie−Montgomery−Richmond−Rowan−Stanly County Grouping includes the following 2017 House Plan districts: 66; 67; 76; 77; 82; 83

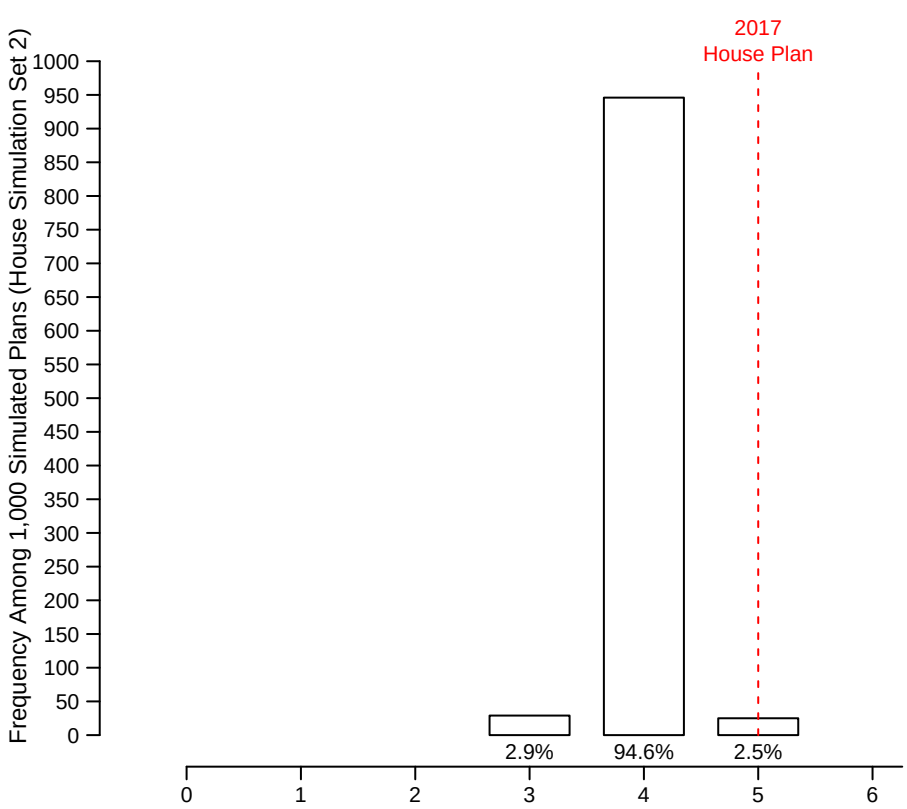
Figure 58:
Number of House Districts With At Least HD−83's Republican Vote Share of 59.31% in the Cabarrus−Davie−Montgomery−Richmond−Rowan−Stanly County Grouping

Simulation Set 1



Number of Districts With At Least HD−83's Republican Vote Share of 59.31% in the Cabarrus−Davie−Montgomery−Richmond−Rowan−Stanly County Grouping (Measured Using Votes Summed Across 2010−2016 Statewide Elections)

Simulation Set 2

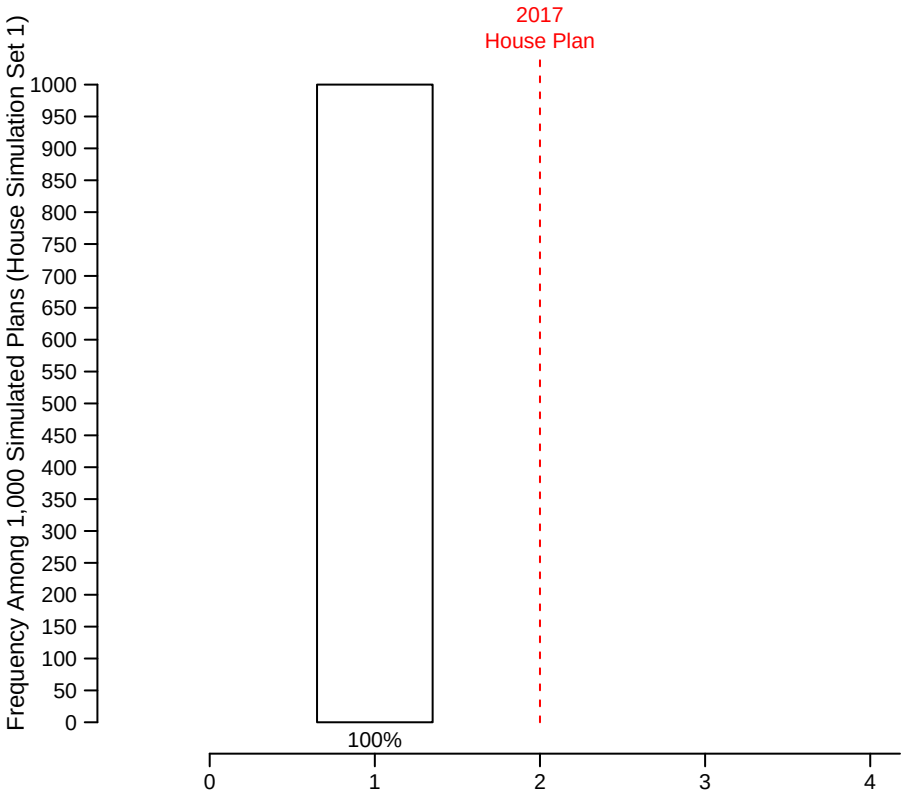


Number of Districts With At Least HD−83's Republican Vote Share of 59.31% in the Cabarrus−Davie−Montgomery−Richmond−Rowan−Stanly County Grouping (Measured Using Votes Summed Across 2010−2016 Statewide Elections)

Note: The Cabarrus−Davie−Montgomery−Richmond−Rowan−Stanly County Grouping includes the following 2017 House Plan districts: 66; 67; 76; 77; 82; 83

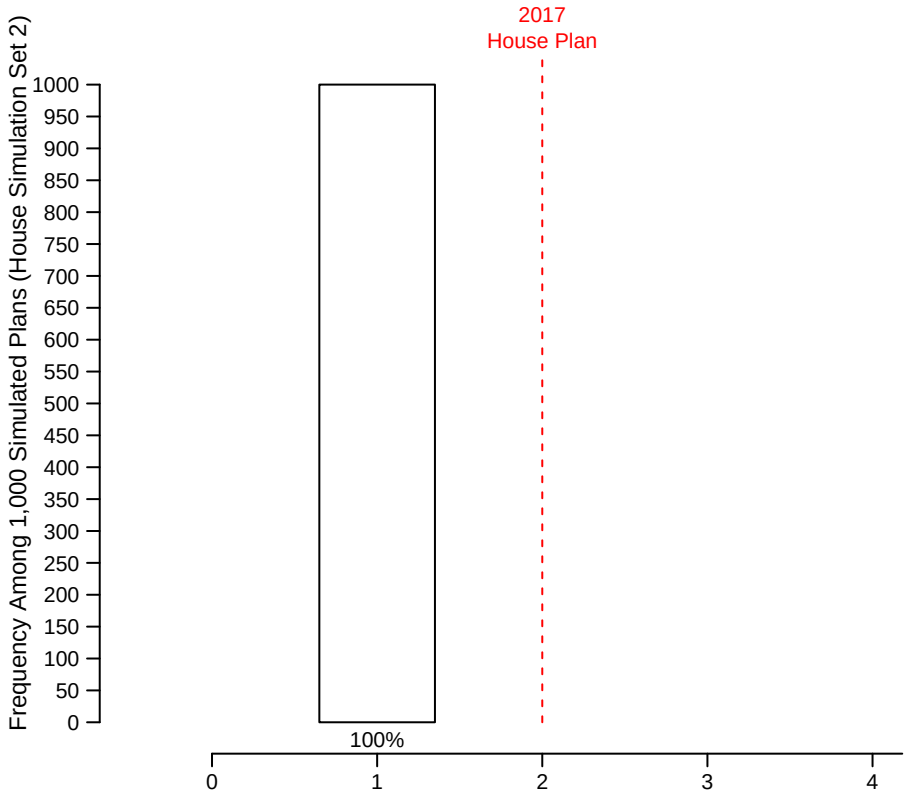
Figure 59:
Number of House Districts With At Least HD−46's Republican Vote Share of 55.56% in the Columbus−Pender−Robeson County Grouping

Simulation Set 1



Number of Districts With At Least HD−46's Republican Vote Share of 55.56% in the Columbus−Pender−Robeson County Grouping
(Measured Using Votes Summed Across 2010−2016 Statewide Elections)

Simulation Set 2

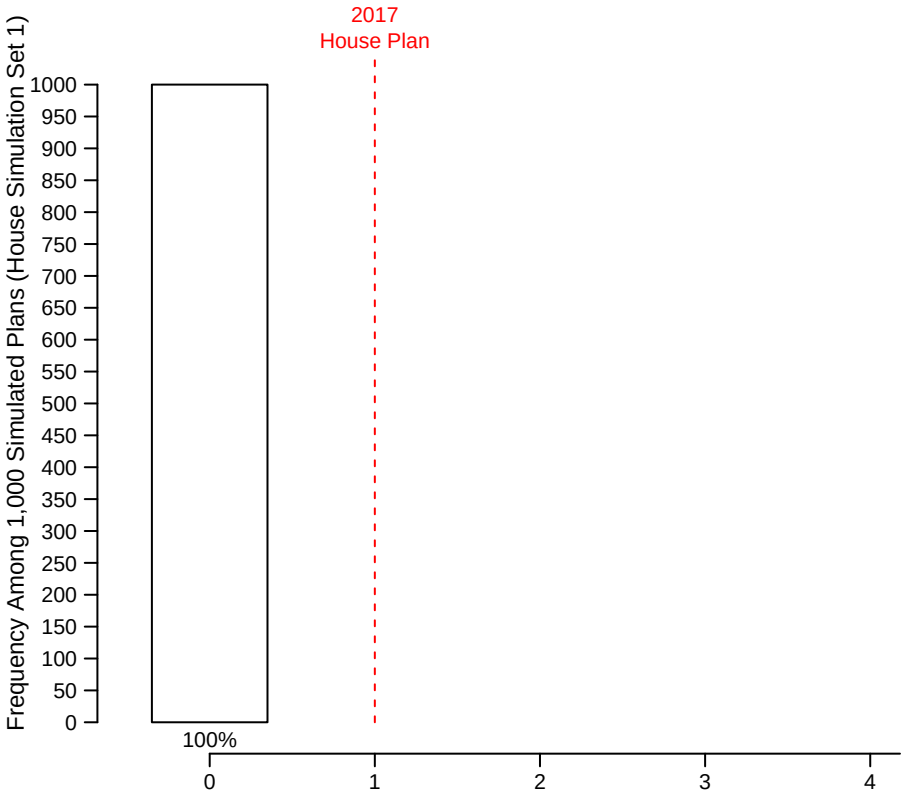


Number of Districts With At Least HD−46's Republican Vote Share of 55.56% in the Columbus−Pender−Robeson County Grouping
(Measured Using Votes Summed Across 2010−2016 Statewide Elections)

Note: The Columbus−Pender−Robeson County Grouping includes the following 2017 House Plan districts: 16; 46; 47

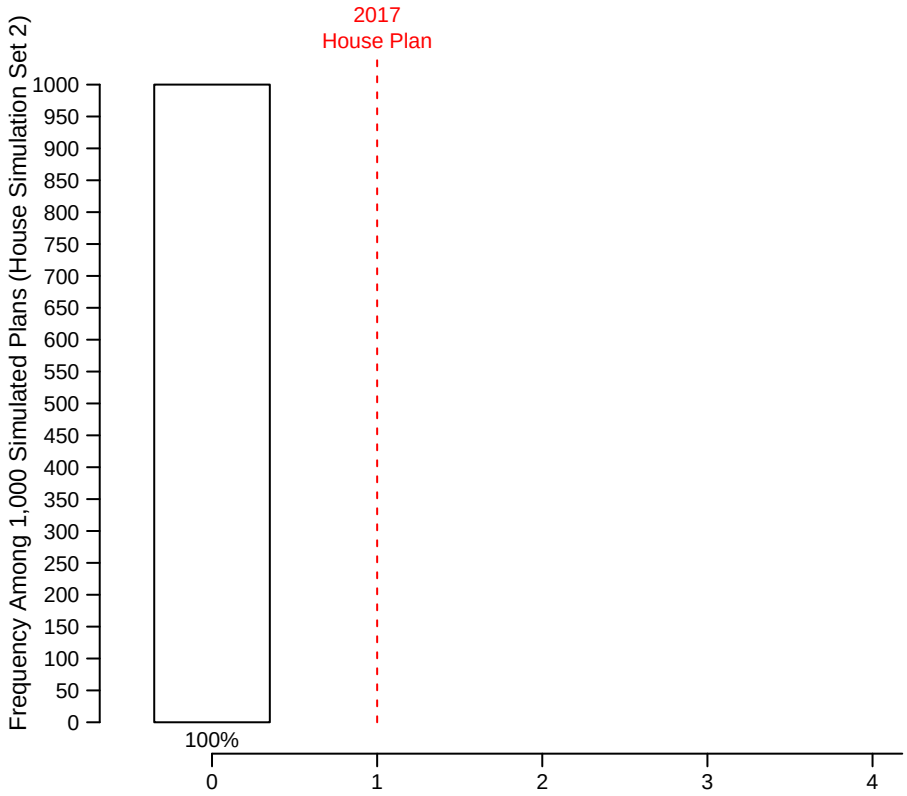
Figure 60:
Number of House Districts With At Least HD−45's Republican Vote Share of 58.08% in the Cumberland County Grouping

Simulation Set 1



Number of Districts With At Least HD−45's Republican Vote Share of 58.08% in the Cumberland County Grouping
(Measured Using Votes Summed Across 2010−2016 Statewide Elections)

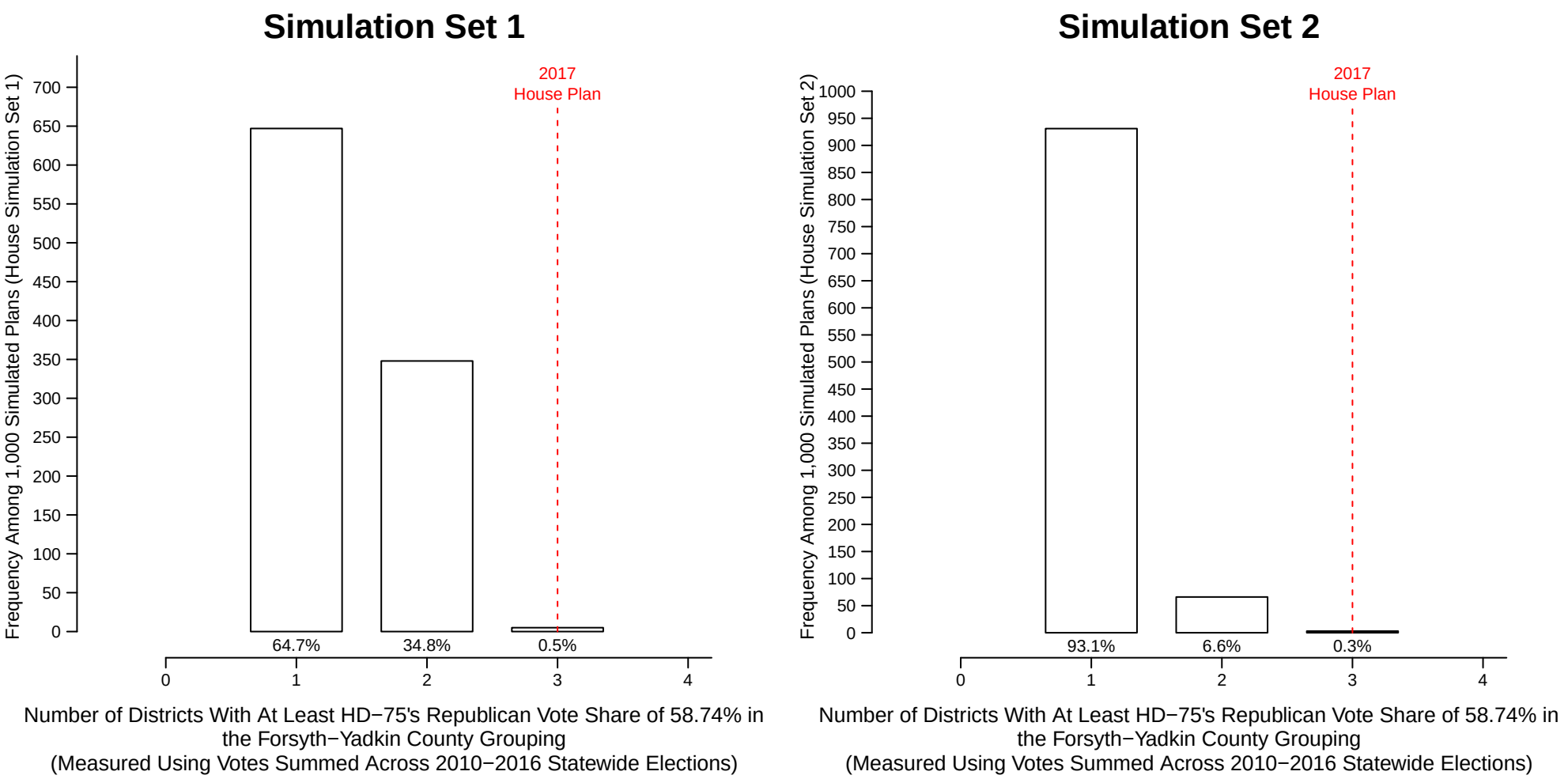
Simulation Set 2



Number of Districts With At Least HD−45's Republican Vote Share of 58.08% in the Cumberland County Grouping
(Measured Using Votes Summed Across 2010−2016 Statewide Elections)

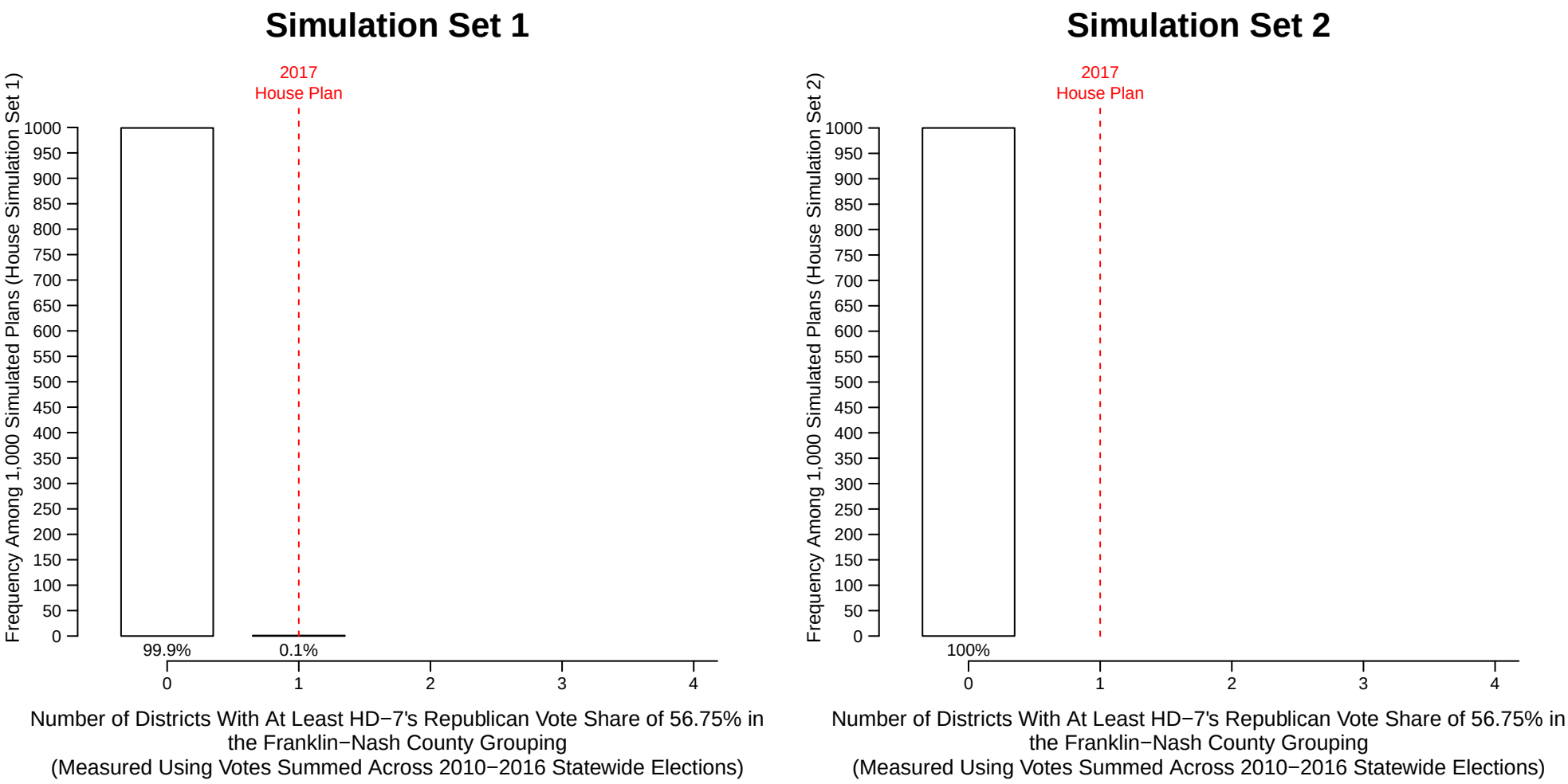
Note: The Cumberland County Grouping includes the following 2017 House Plan districts: 42; 43; 44; 45

Figure 61:
Number of House Districts With At Least HD−75's Republican Vote Share of 58.74% in the Forsyth−Yadkin County Grouping



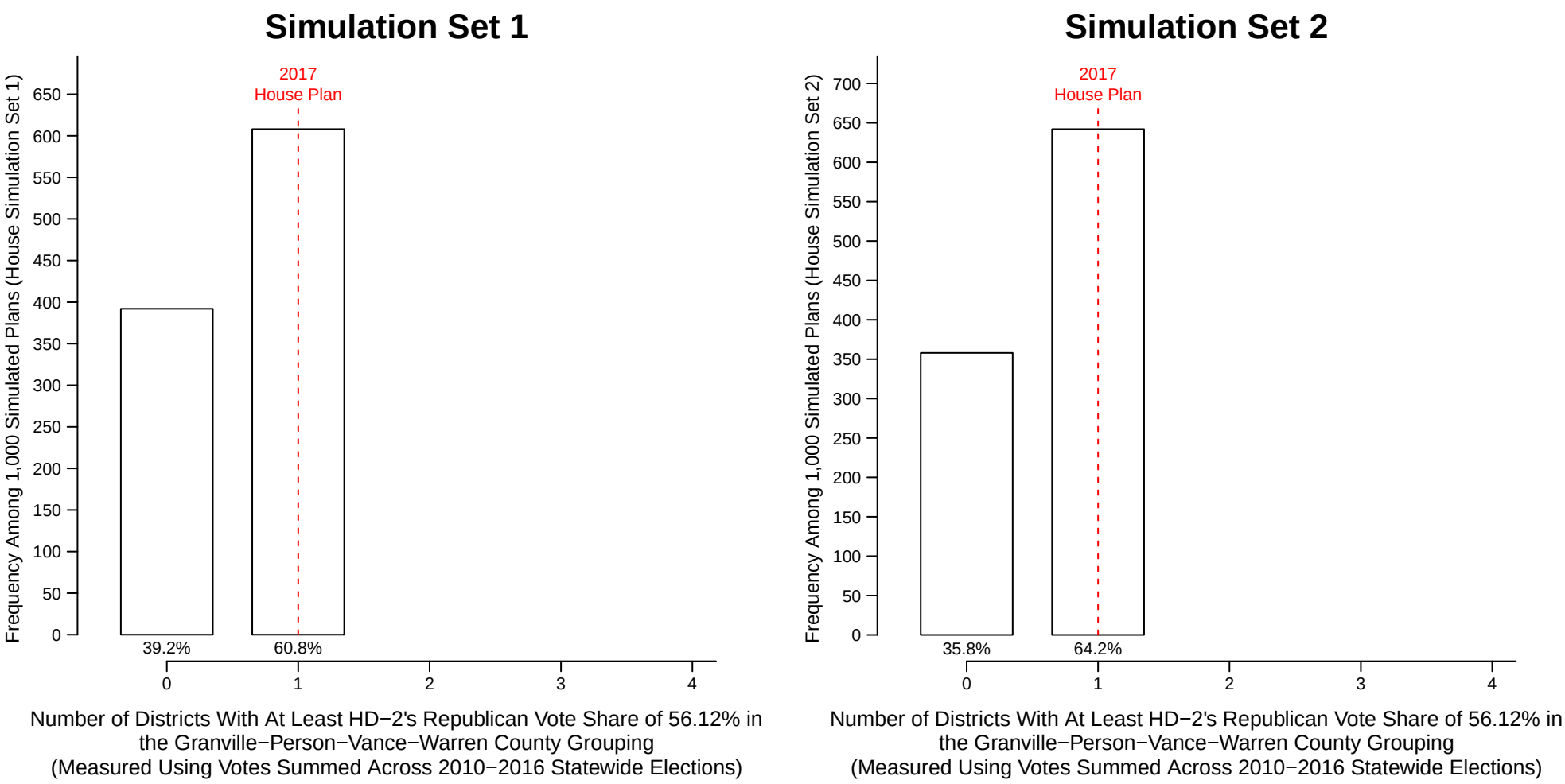
Note: The Forsyth−Yadkin County Grouping includes the following 2017 House Plan districts: 71; 72; 73; 74; 75

Figure 62:
Number of House Districts With At Least HD−7's Republican Vote Share of 56.75% in the Franklin−Nash County Grouping



Note: The Franklin−Nash County Grouping includes the following 2017 House Plan districts: 7; 25

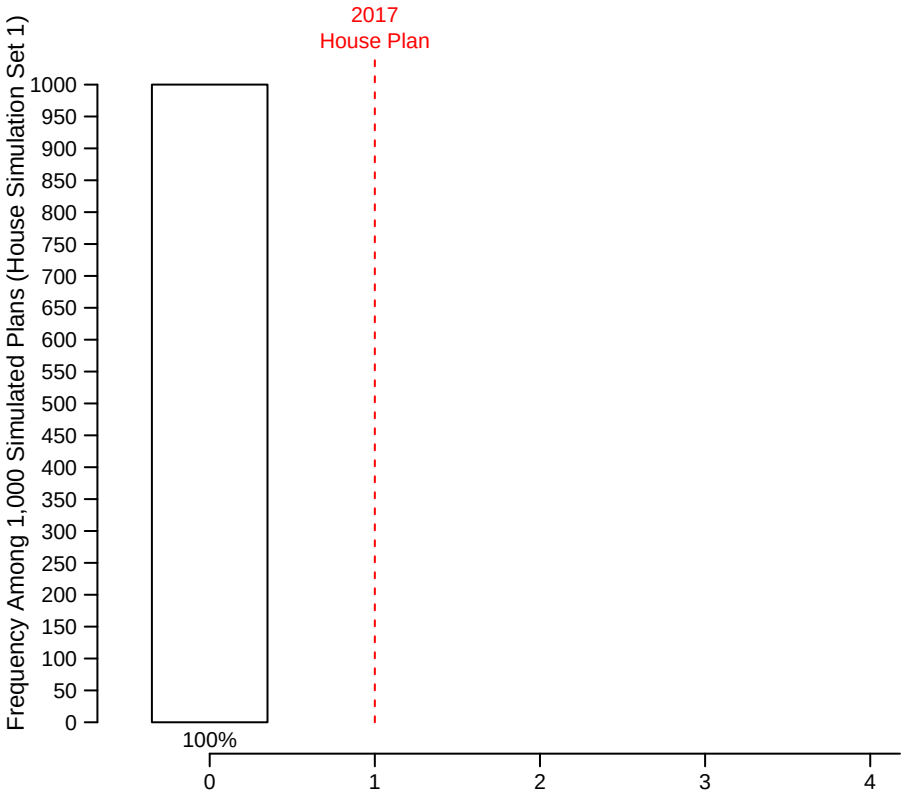
Figure 63:
Number of House Districts With At Least HD−2's Republican Vote Share of 56.12% in the Granville−Person−Vance−Warren County Grouping



Note: The Granville−Person−Vance−Warren County Grouping includes the following 2017 House Plan districts: 2; 32

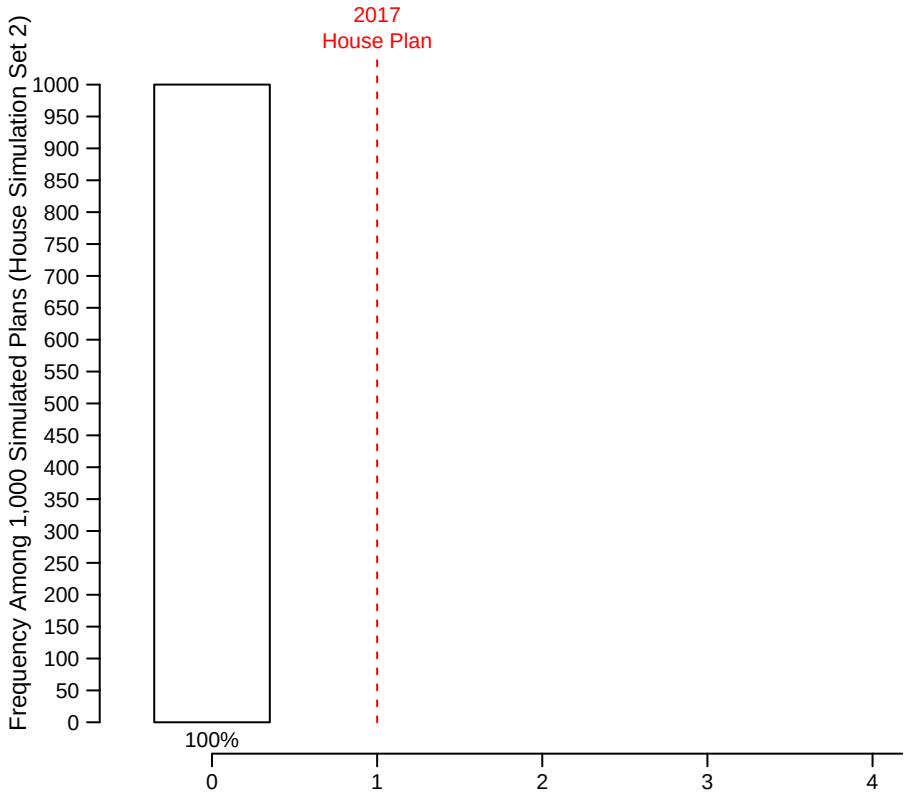
Figure 64:
Number of House Districts With At Least HD−59's Republican Vote Share of 59.59% in the Guilford County Grouping

Simulation Set 1



Number of Districts With At Least HD−59's Republican Vote Share of 59.59% in the Guilford County Grouping
(Measured Using Votes Summed Across 2010−2016 Statewide Elections)

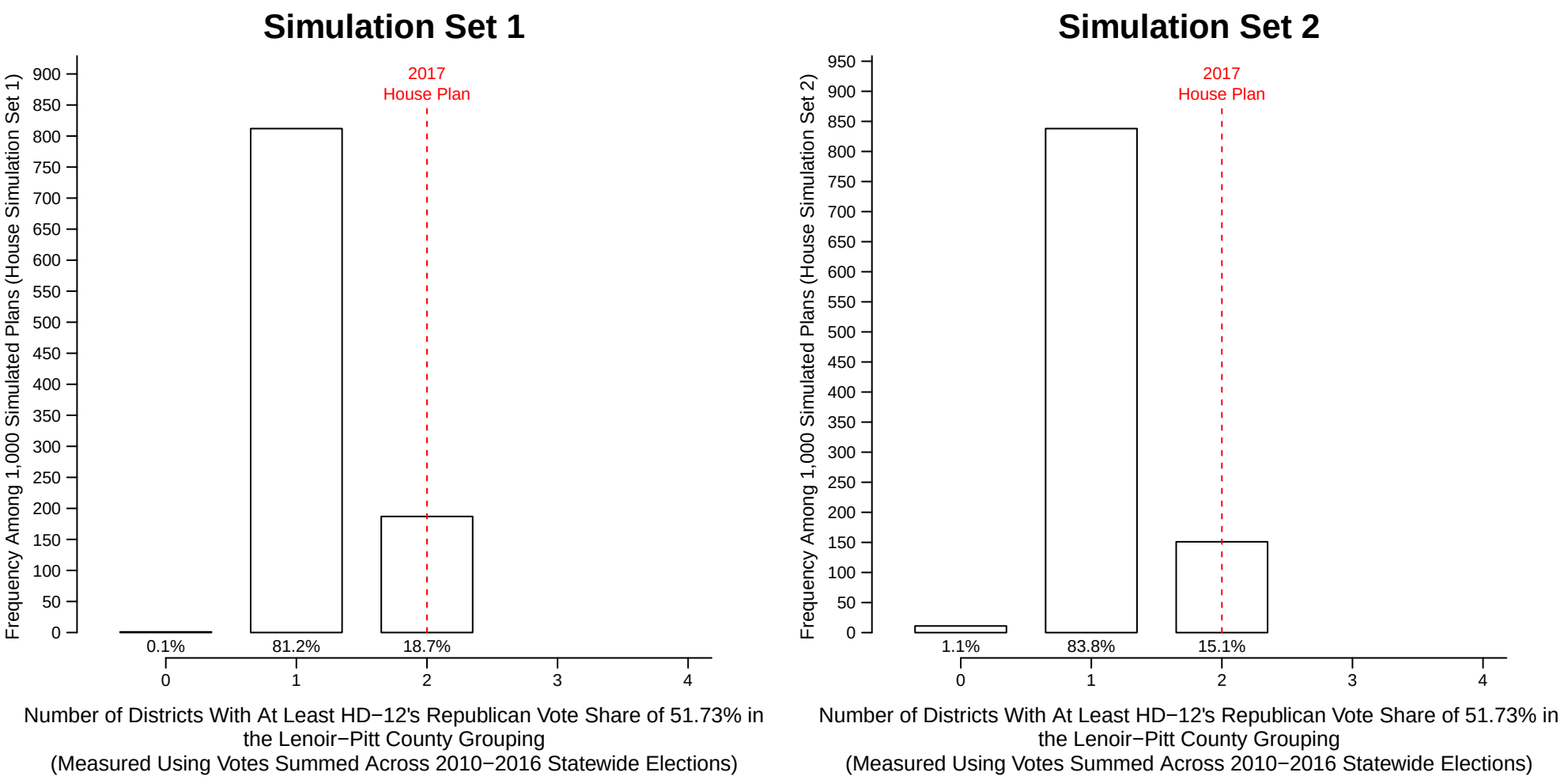
Simulation Set 2



Number of Districts With At Least HD−59's Republican Vote Share of 59.59% in the Guilford County Grouping
(Measured Using Votes Summed Across 2010−2016 Statewide Elections)

Note: The Guilford County Grouping includes the following 2017 House Plan districts: 57; 58; 59; 60; 61; 62
The Special Master−drawn districts (HD−57, HD−61, HD62) in Guilford County are excluded from the 2017 House Plan and simulation calculations in this Figure.

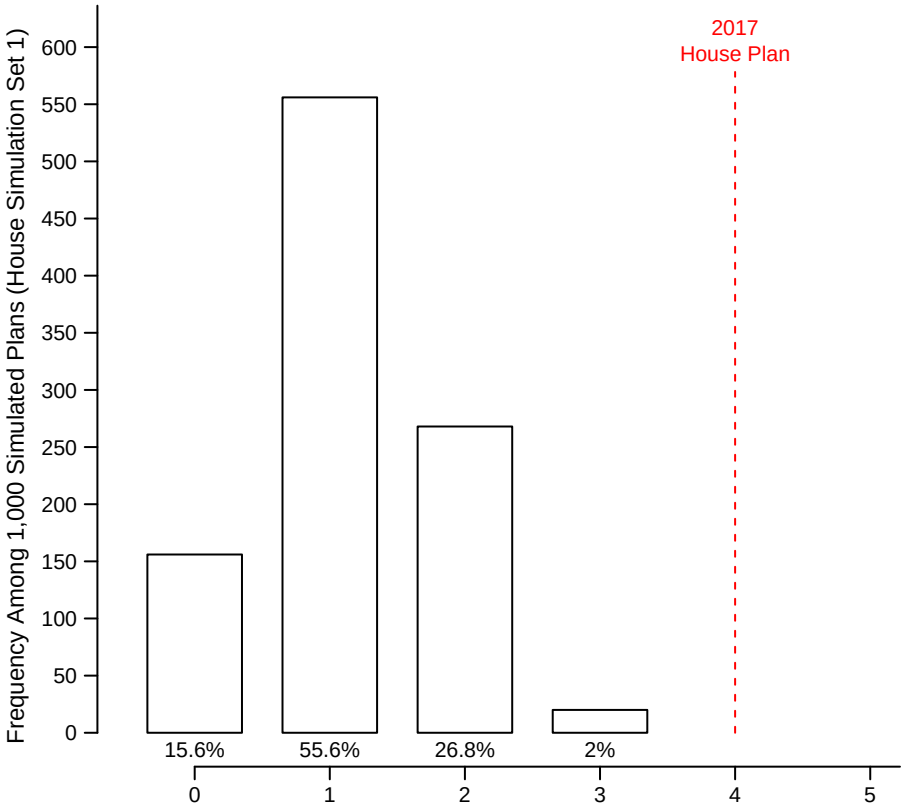
Figure 65:
Number of House Districts With At Least HD−12's Republican Vote Share of 51.73% in the Lenoir−Pitt County Grouping



Note: The Lenoir−Pitt County Grouping includes the following 2017 House Plan districts: 8; 9; 12

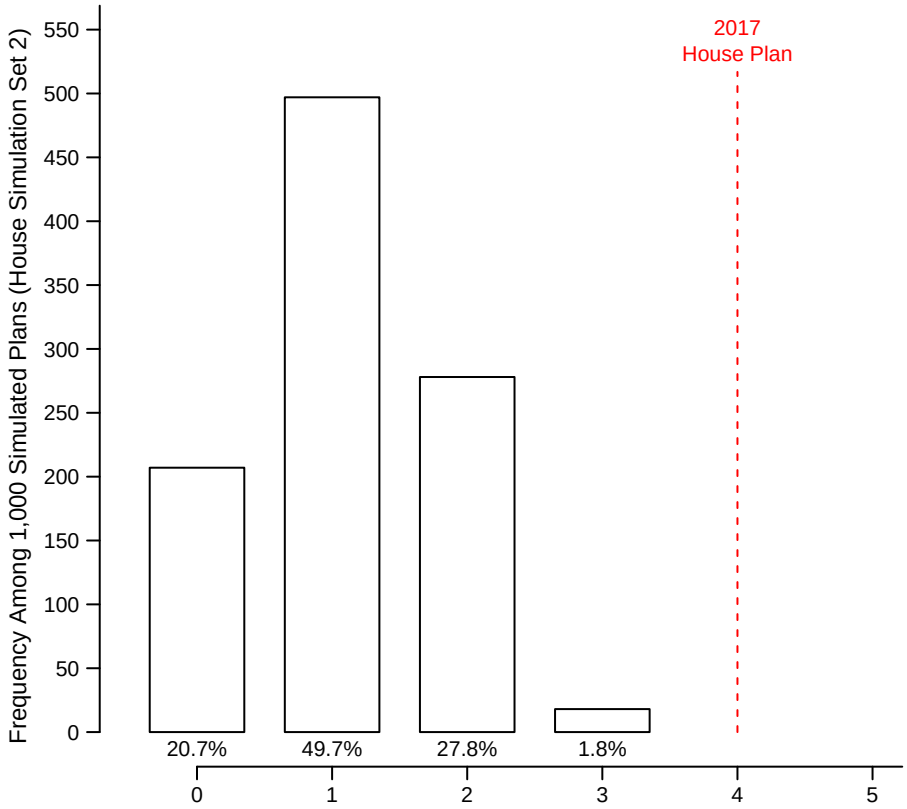
Figure 66:
Number of House Districts With At Least HD−104's Republican Vote Share of 57.75% in the Mecklenburg County Grouping

Simulation Set 1



Number of Districts With At Least HD−104's Republican Vote Share of 57.75% in the Mecklenburg County Grouping
(Measured Using Votes Summed Across 2010−2016 Statewide Elections)

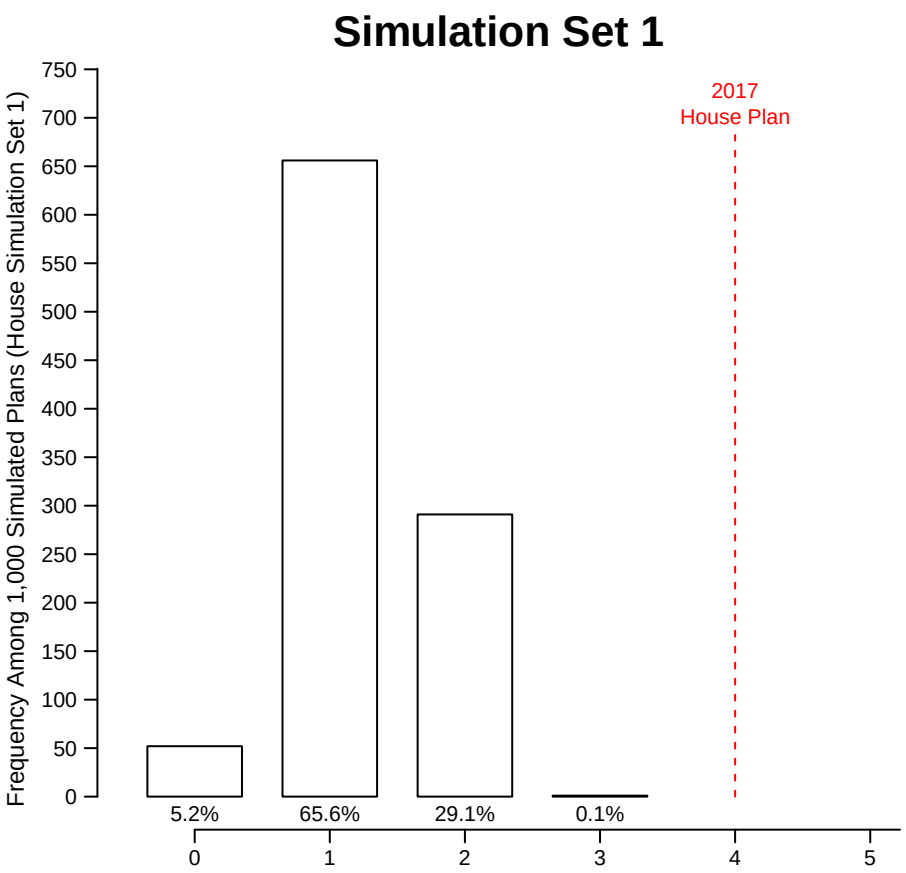
Simulation Set 2

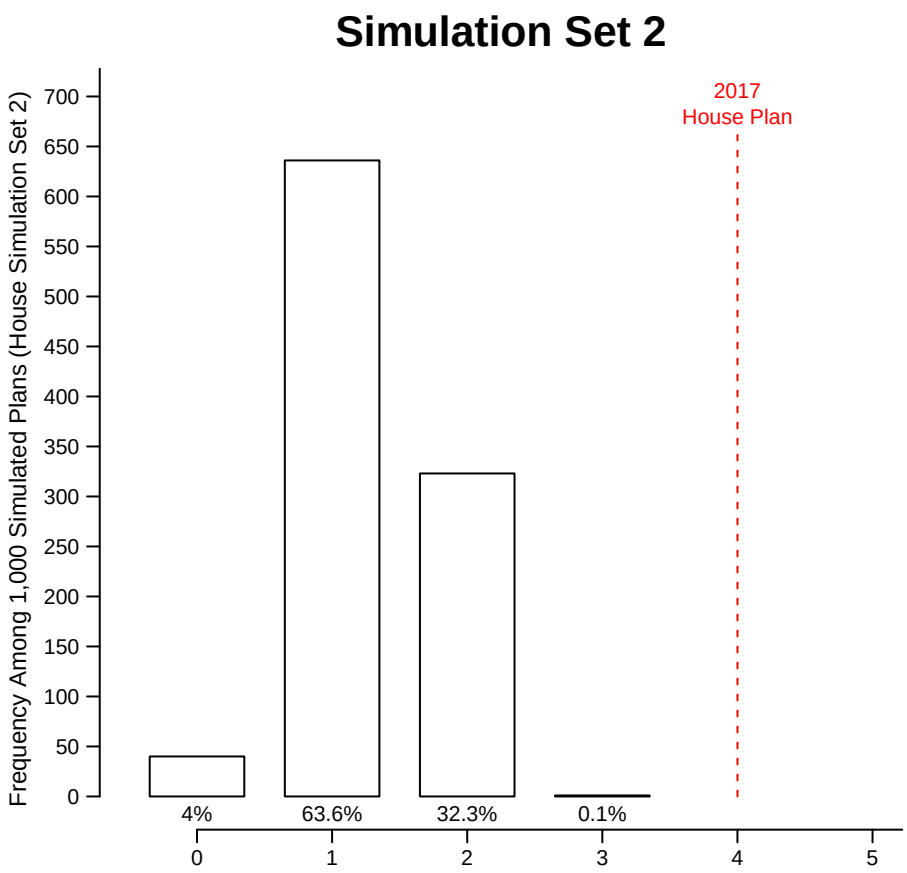


Number of Districts With At Least HD−104's Republican Vote Share of 57.75% in the Mecklenburg County Grouping
(Measured Using Votes Summed Across 2010−2016 Statewide Elections)

Note: The Mecklenburg County Grouping includes the following 2017 House Plan districts: 88; 92; 98; 99; 100; 101; 102; 103; 104; 105; 106; 107

Figure 67:
Number of House Districts With At Least HD−40's Republican Vote Share of 54.54% in the Wake County Grouping

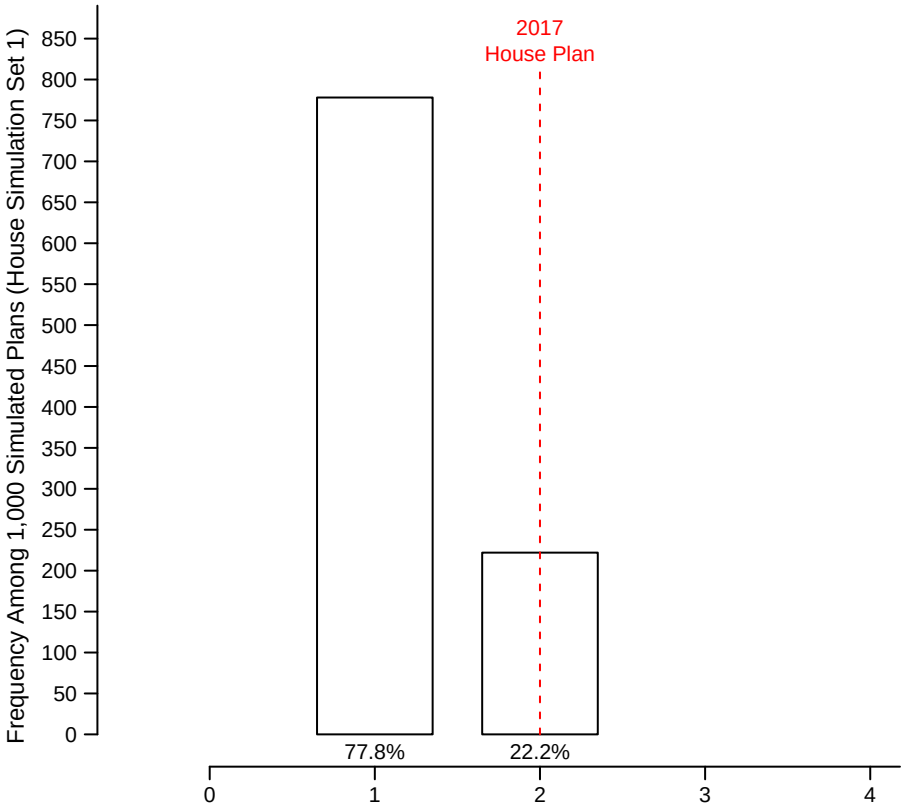




Note: The Wake County Grouping includes the following 2017 House Plan districts: 11; 33; 34; 35; 36; 37; 38; 39; 40; 41; 49

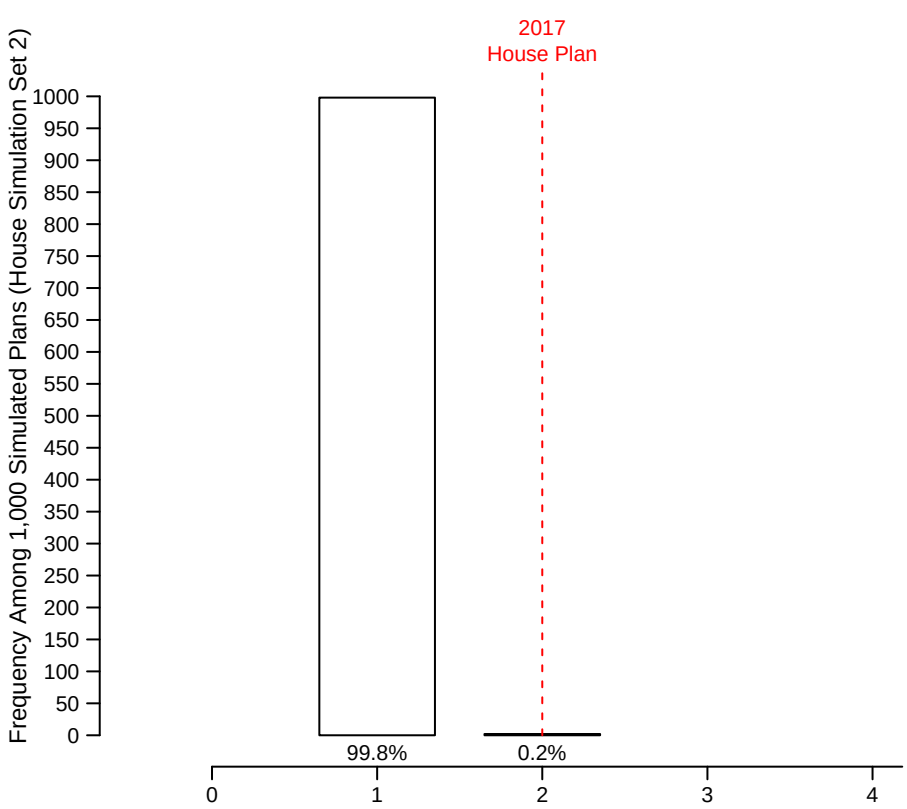
Figure 68:
Number of House Districts With At Least HD−63's Republican Vote Share of 51.48% in the Alamance County Grouping

Simulation Set 1



Number of Districts With At Least HD−63's Republican Vote Share of 51.48% in the Alamance County Grouping
(Measured Using Votes Summed Across 2004−2010 Statewide Elections)

Simulation Set 2

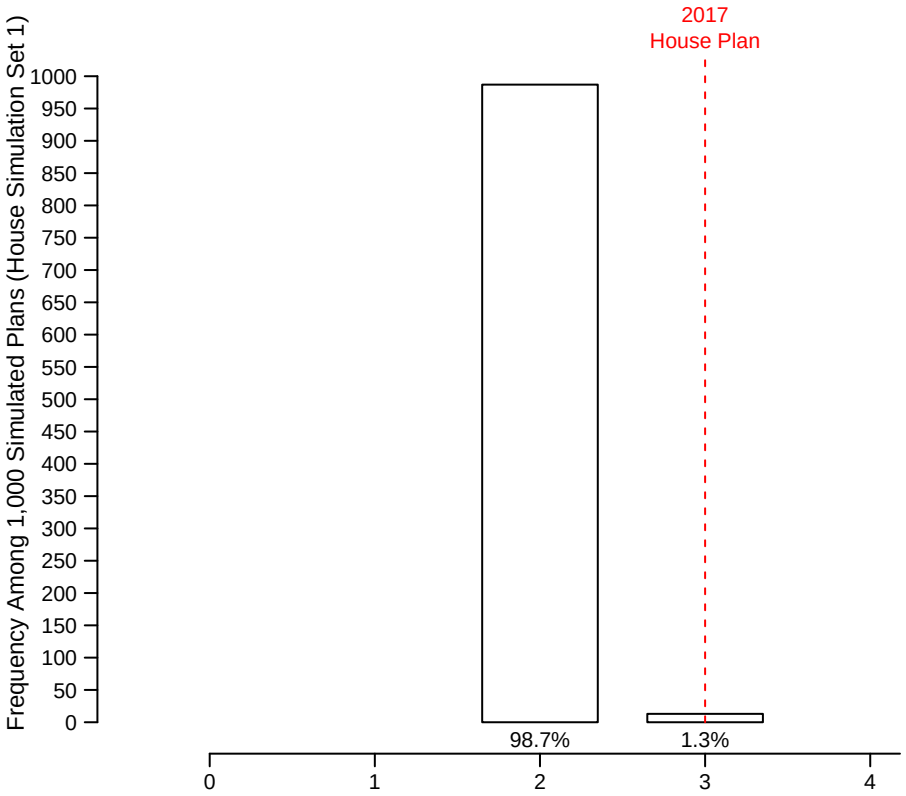


Number of Districts With At Least HD−63's Republican Vote Share of 51.48% in the Alamance County Grouping
(Measured Using Votes Summed Across 2004−2010 Statewide Elections)

Note: The Alamance County Grouping includes the following 2017 House Plan districts: 63; 64

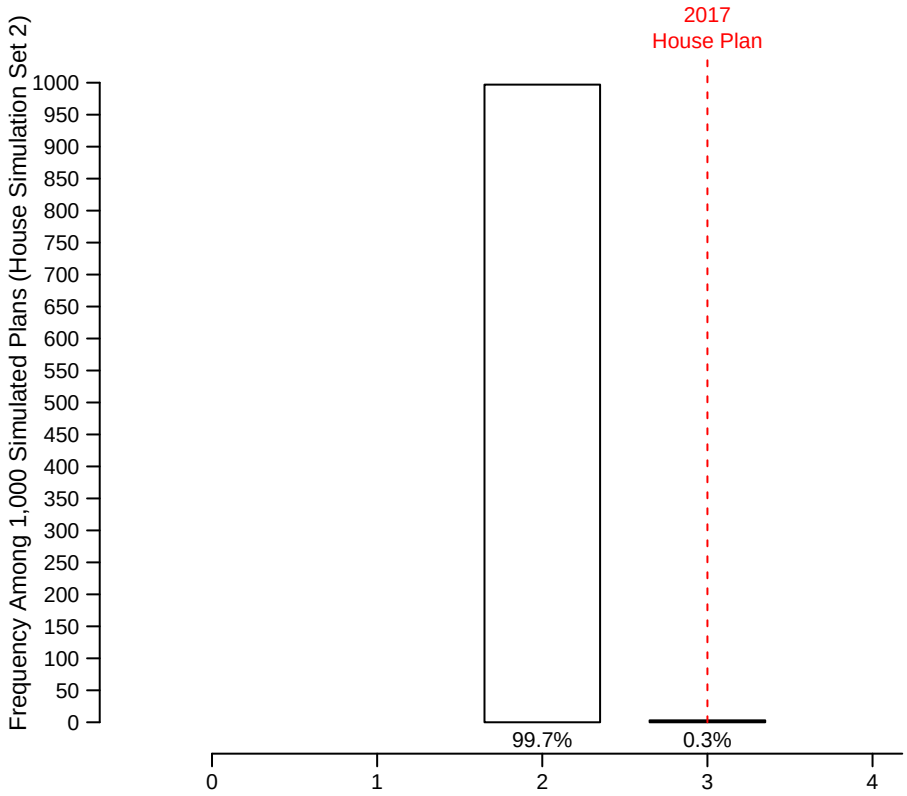
Figure 69:
Number of House Districts With At Least HD−55's Republican Vote Share of 55.02% in the Anson−Union County Grouping

Simulation Set 1



Number of Districts With At Least HD−55's Republican Vote Share of 55.02% in the Anson−Union County Grouping
(Measured Using Votes Summed Across 2004−2010 Statewide Elections)

Simulation Set 2

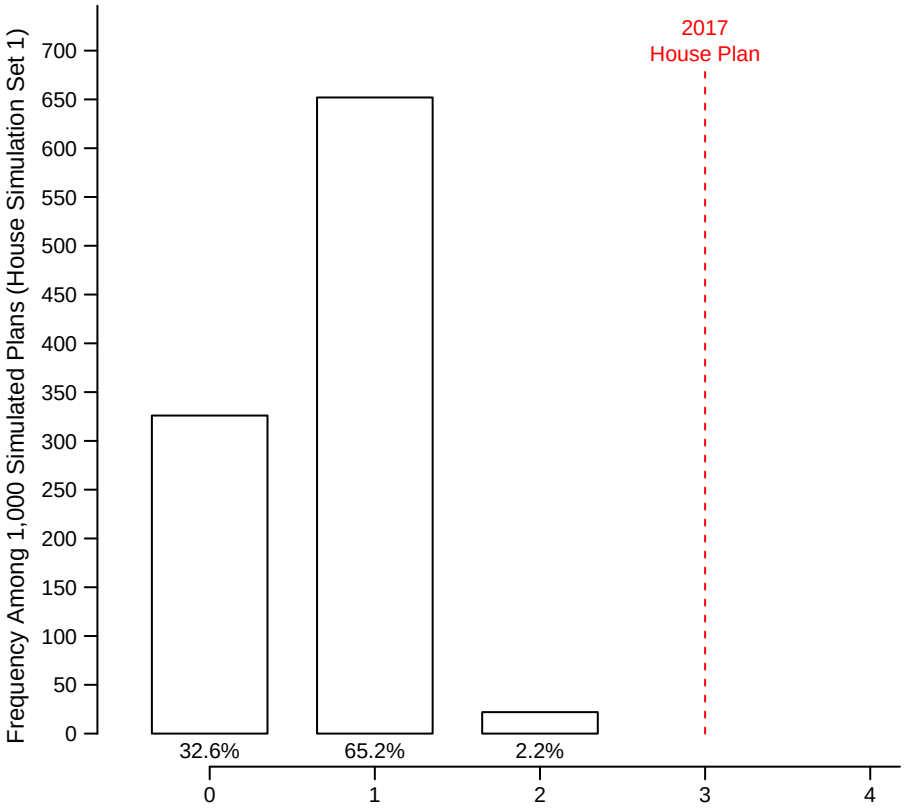


Number of Districts With At Least HD−55's Republican Vote Share of 55.02% in the Anson−Union County Grouping
(Measured Using Votes Summed Across 2004−2010 Statewide Elections)

Note: The Anson−Union County Grouping includes the following 2017 House Plan districts: 55; 68; 69

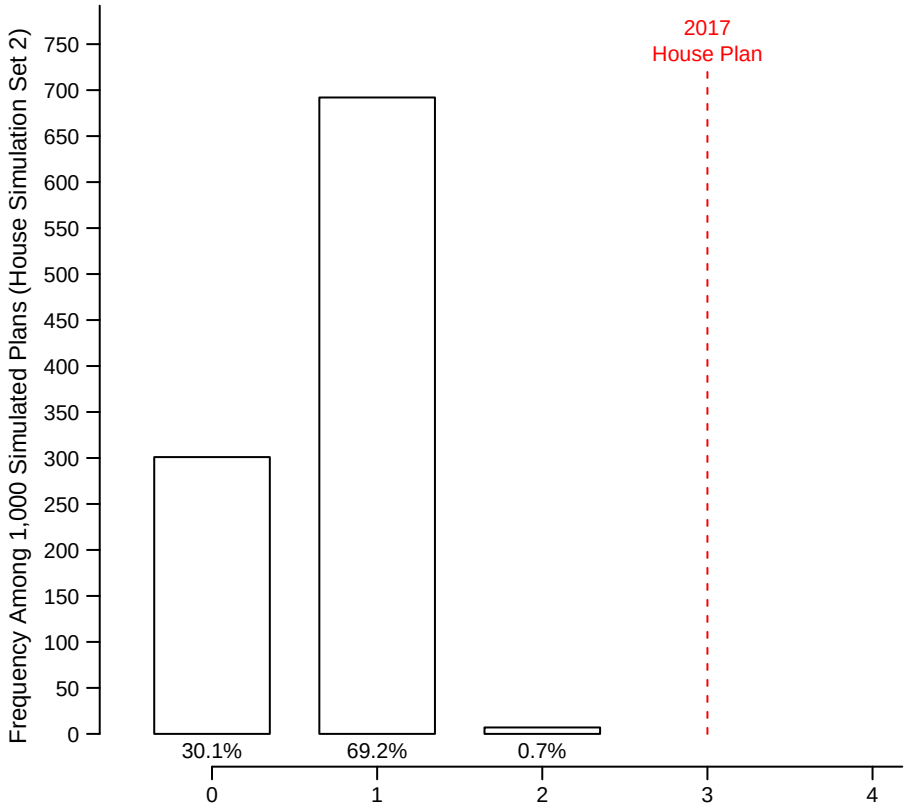
Figure 70:
Number of House Districts With At Least HD−19's Republican Vote Share of 56.26% in the Brunswick−New Hanover County Grouping

Simulation Set 1



Number of Districts With At Least HD−19's Republican Vote Share of 56.26% in the Brunswick−New Hanover County Grouping
(Measured Using Votes Summed Across 2004−2010 Statewide Elections)

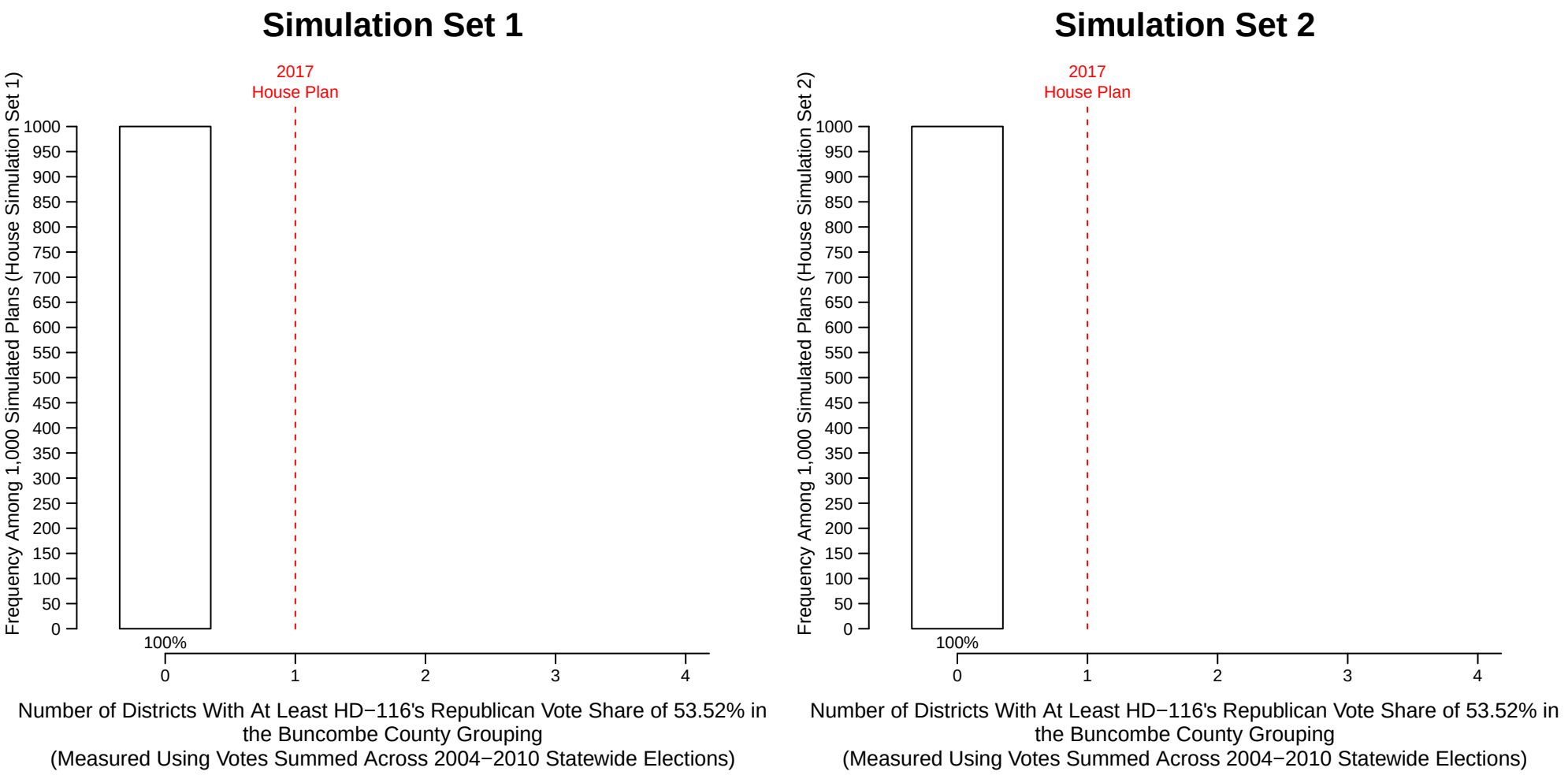
Simulation Set 2



Number of Districts With At Least HD−19's Republican Vote Share of 56.26% in the Brunswick−New Hanover County Grouping
(Measured Using Votes Summed Across 2004−2010 Statewide Elections)

Note: The Brunswick−New Hanover County Grouping includes the following 2017 House Plan districts: 17; 18; 19; 20

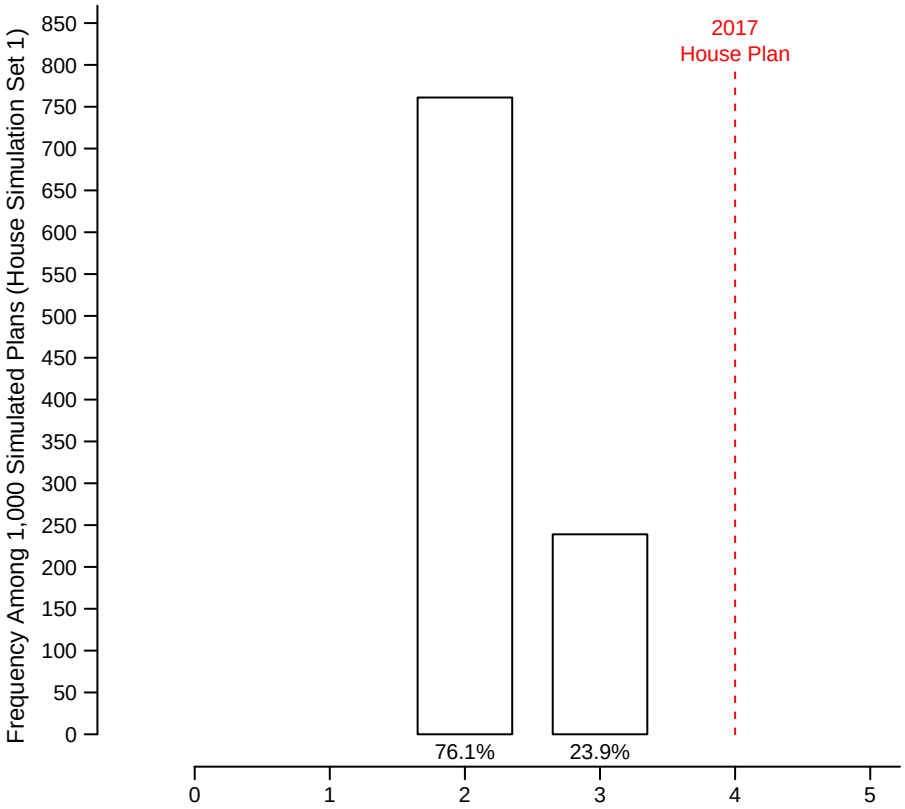
Figure 71:
Number of House Districts With At Least HD−116's Republican Vote Share of 53.52% in the Buncombe County Grouping



Note: The Buncombe County Grouping includes the following 2017 House Plan districts: 114; 115; 116

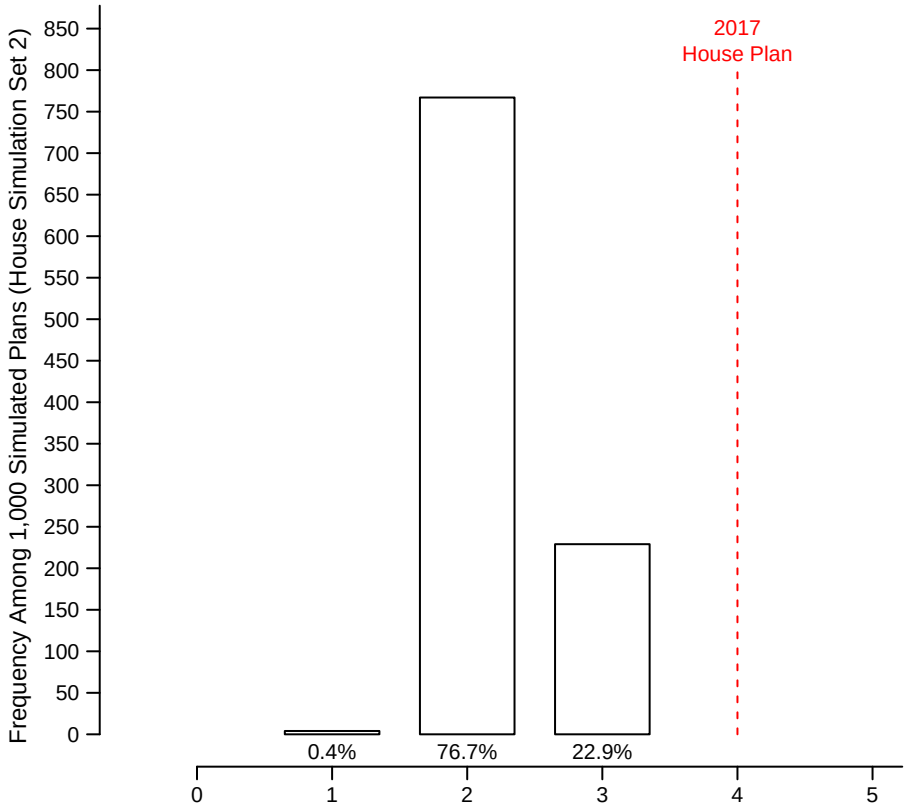
Figure 72:
Number of House Districts With At Least HD−111's Republican Vote Share of 55.44% in the Cleveland−Gaston County Grouping

Simulation Set 1



Number of Districts With At Least HD−111's Republican Vote Share of 55.44% in the Cleveland−Gaston County Grouping
(Measured Using Votes Summed Across 2004−2010 Statewide Elections)

Simulation Set 2

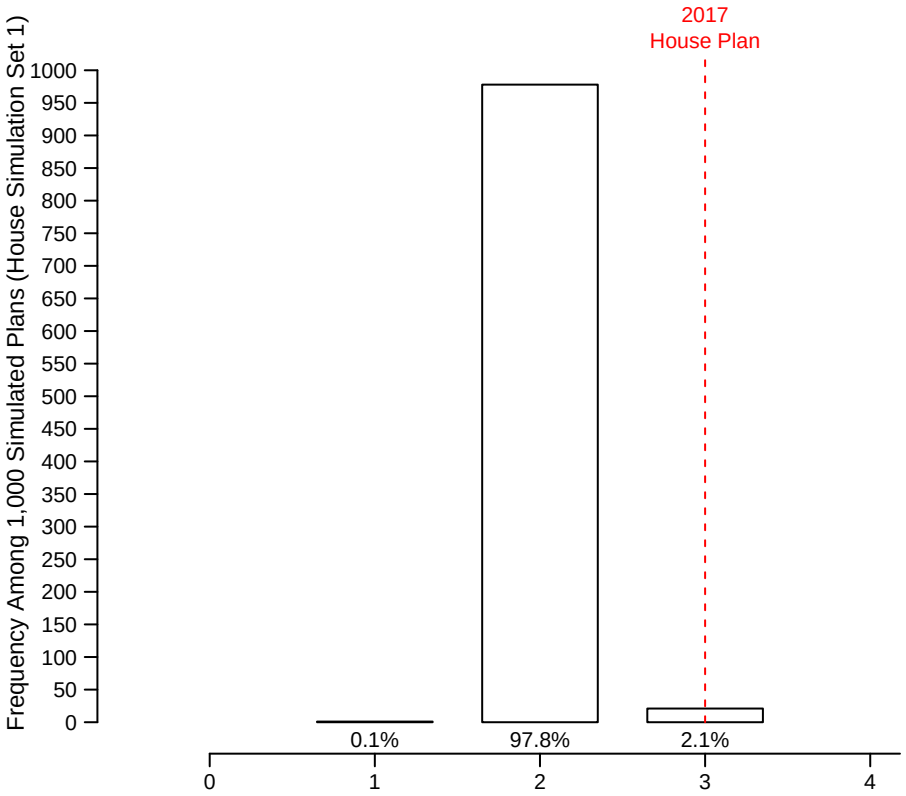


Number of Districts With At Least HD−111's Republican Vote Share of 55.44% in the Cleveland−Gaston County Grouping
(Measured Using Votes Summed Across 2004−2010 Statewide Elections)

Note: The Cleveland−Gaston County Grouping includes the following 2017 House Plan districts: 108; 109; 110; 111

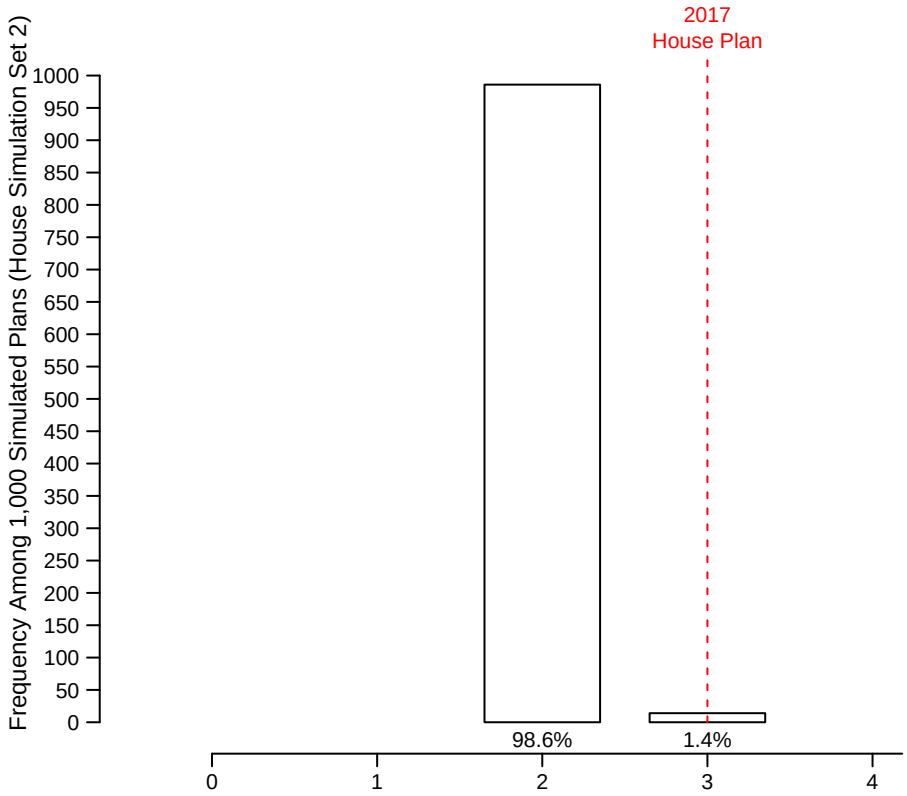
Figure 73:
Number of House Districts With At Least HD−4's Republican Vote Share of 50.09% in the Duplin−Onslow County Grouping

Simulation Set 1



Number of Districts With At Least HD−4's Republican Vote Share of 50.09% in the Duplin−Onslow County Grouping
(Measured Using Votes Summed Across 2004−2010 Statewide Elections)

Simulation Set 2



Number of Districts With At Least HD−4's Republican Vote Share of 50.09% in the Duplin−Onslow County Grouping
(Measured Using Votes Summed Across 2004−2010 Statewide Elections)

Note: The Duplin−Onslow County Grouping includes the following 2017 House Plan districts: 4; 14; 15

Grouping-by-Grouping Analysis Within County Groupings of the 2017 Senate Plan:

Using the same methodology as used for the House, I conducted a similar grouping-by-grouping analysis of the 2017 Senate Plan's districts using all of the computer-simulated Senate plans produced for this report. First, using the two sets of 1,000 simulated Senate plans described earlier in this report (Senate Simulation Set 1 and Set 2), I compared the 2017 Senate Plan's districts within each county grouping to the entire distribution of computer-simulated districts produced within the same grouping. I also compared the 2017 Senate Plan to the computer-simulated Senate plans using the same Republican threshold approach described above in my analysis of the House plans. These comparisons allowed me to identify county groupings in the 2017 Senate Plan that are partisan outliers compared to different versions of that same grouping that emerged under the computer simulations. Within each county grouping, I analyze individual districts using the same two approaches as described earlier for the grouping-by-grouping analysis of the 2017 House Plan county groupings.

Comparing the Partisan Distribution of Districts in the Enacted and Simulated Plans:

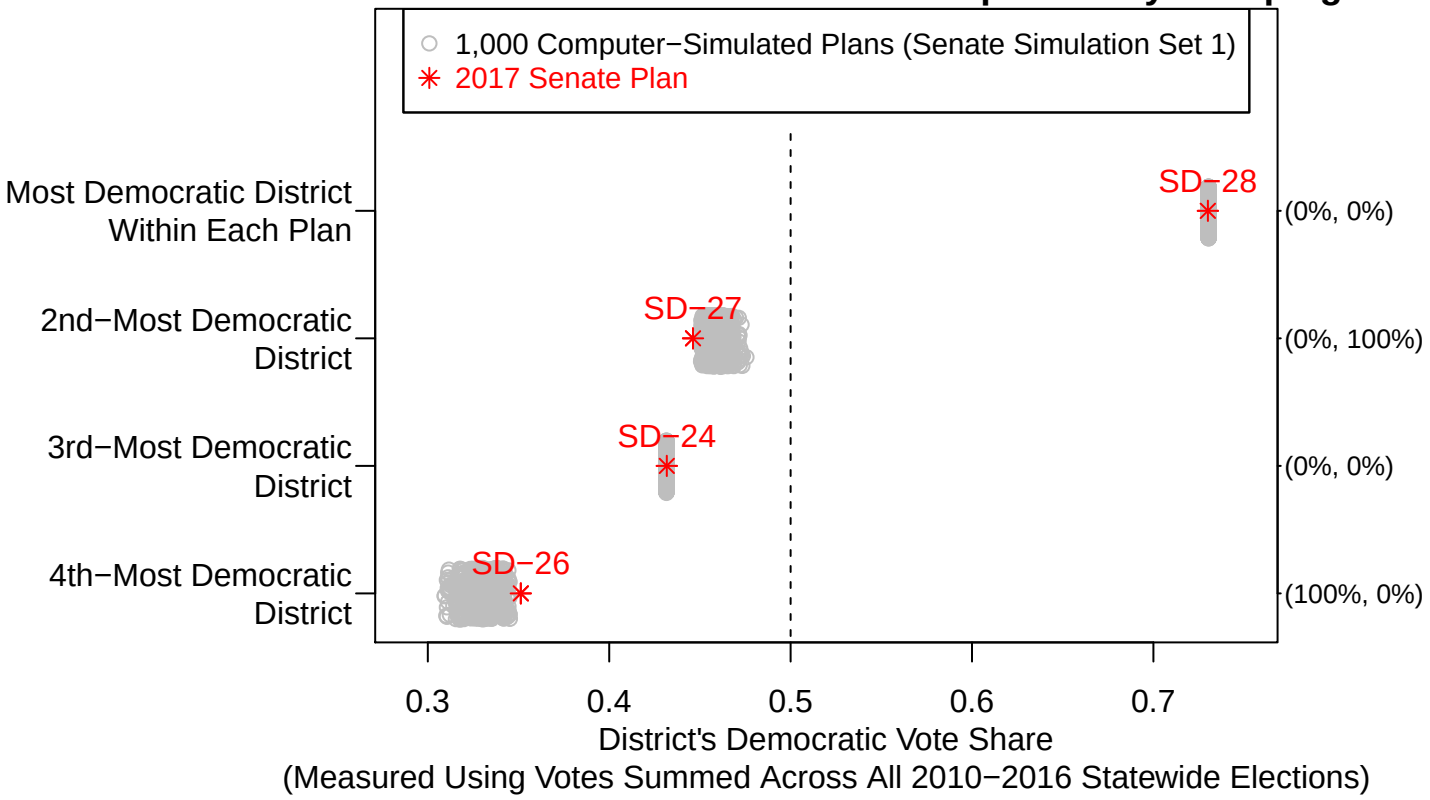
Figures 74 to 80 illustrate the grouping-by-grouping analysis for different county groupings using Senate Simulation Set 1 as a baseline for comparison and for identifying partisan outliers. Similarly, Figures 81 to 87 provide district-by-district analysis for the 2017 Senate Plan districts using Senate Simulation Set 2 as a baseline for comparison and for identifying partisan outlier districts. For county groupings containing districts that were originally drawn in 2011 and remained unchanged in the 2017 redistricting process, I used the 2004-2010 Statewide Election Composite to measure district partisanship in these Figures, since the 2004-2010 statewide elections represent the elections data available to and used by the General Assembly during the 2011 redistricting process.

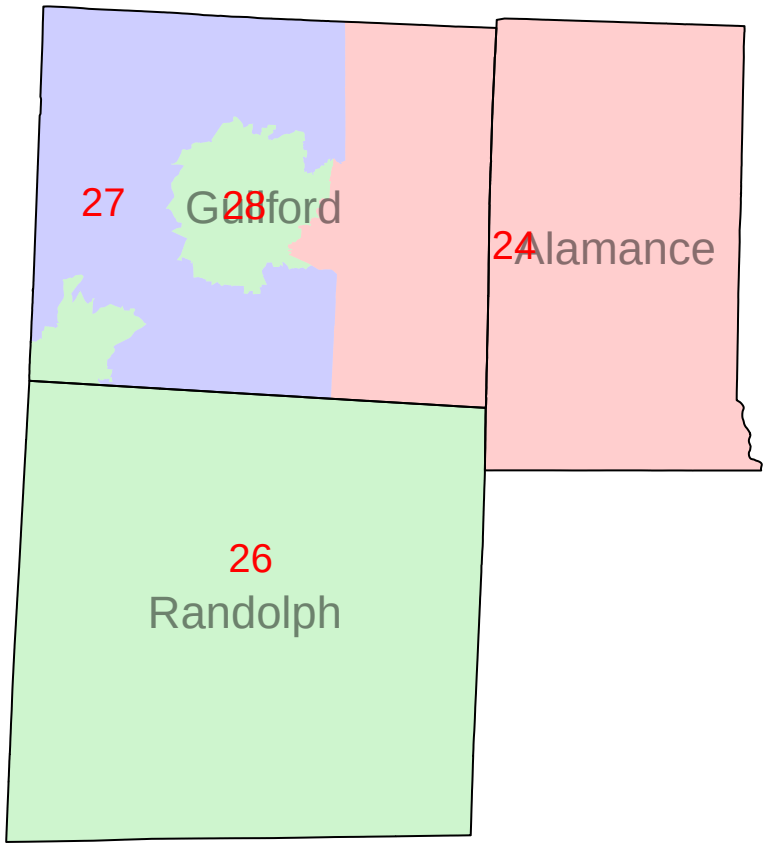
Overall, using this grouping-by-grouping comparison methodology, I found that the 2017 Senate plan contains partisan outlier districts within the following seven Senate county groupings:

1. The Alamance-Guilford-Randolph County grouping (Figures 74 and 81).
2. The Bladen-Brunswick-New Hanover -Pender County grouping (Figures 80 and 87).
3. The Buncombe-Henderson-Transylvania County grouping (Figures 79 and 86).
4. The Davie-Forsythe County grouping (Figures 75 and 82).

5. The Duplin-Harnett-Johnston-Lee-Nash-Sampson County grouping (Figures 76 and 83).
6. The Franklin-Wake County grouping (Figures 77 and 84).
7. The Mecklenburg County grouping (Figures 78 and 85).

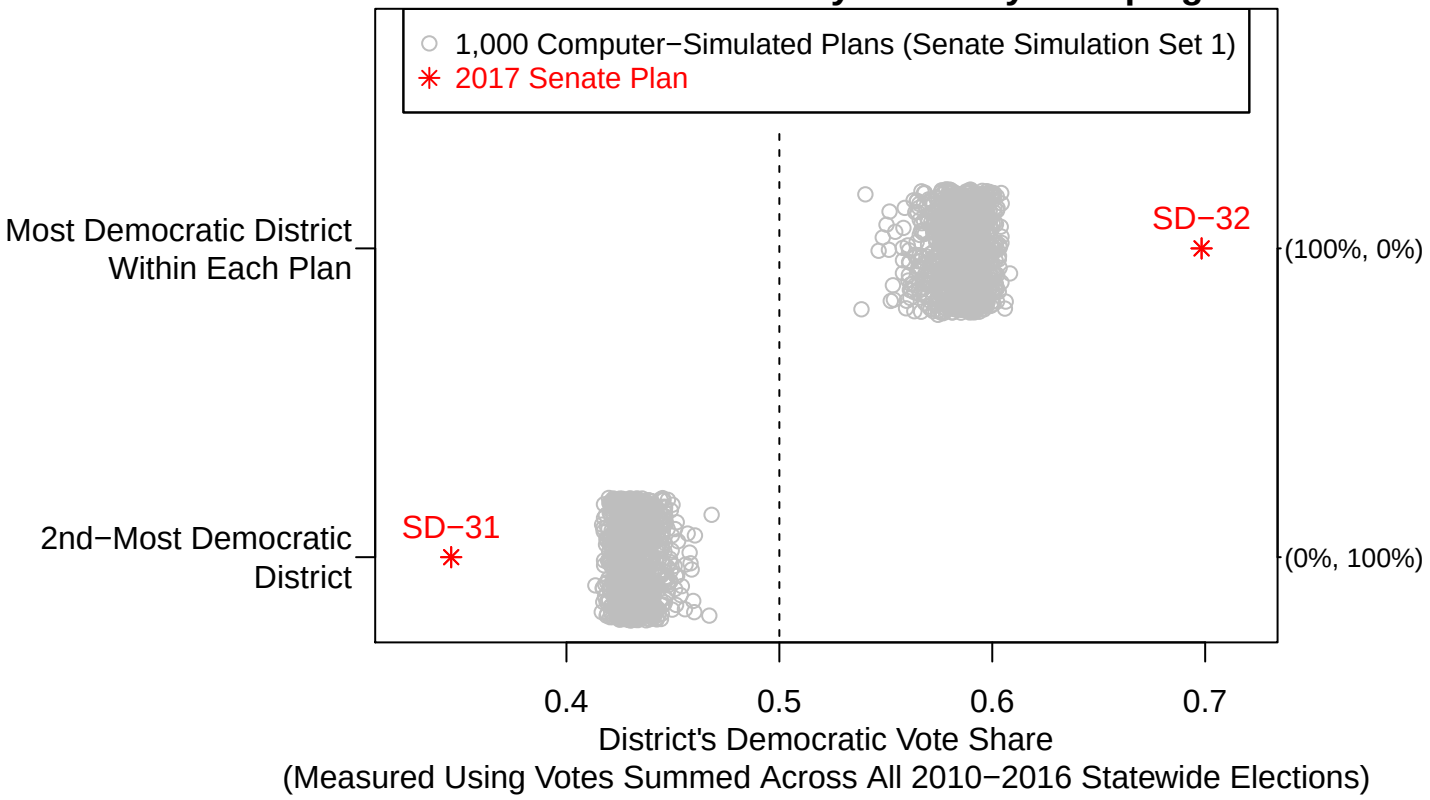
Figure 74: Senate Simulation Set 1: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Alamance−Guilford−Randolph County Grouping

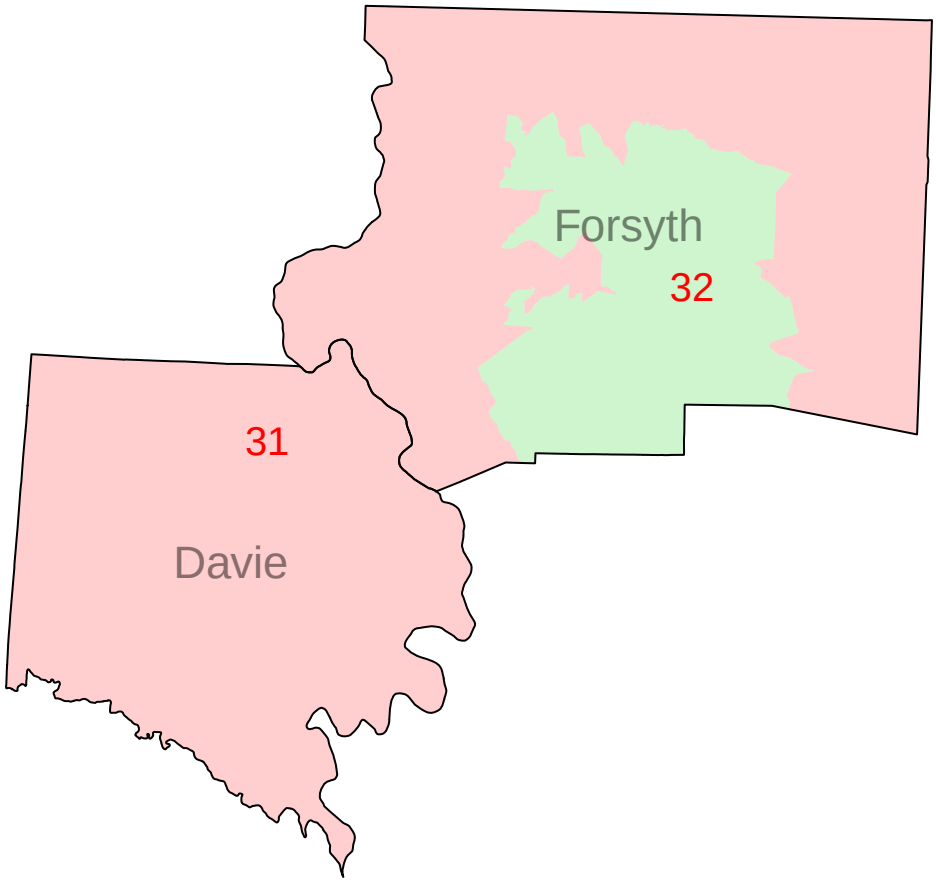




2017 Enacted Senate Plan Districts Within County Grouping 1
(Contains 4 districts, including 2 Special Master Districts (SD−24 and SD−28)
that are frozen in all simulated plans and included in the above Figure)

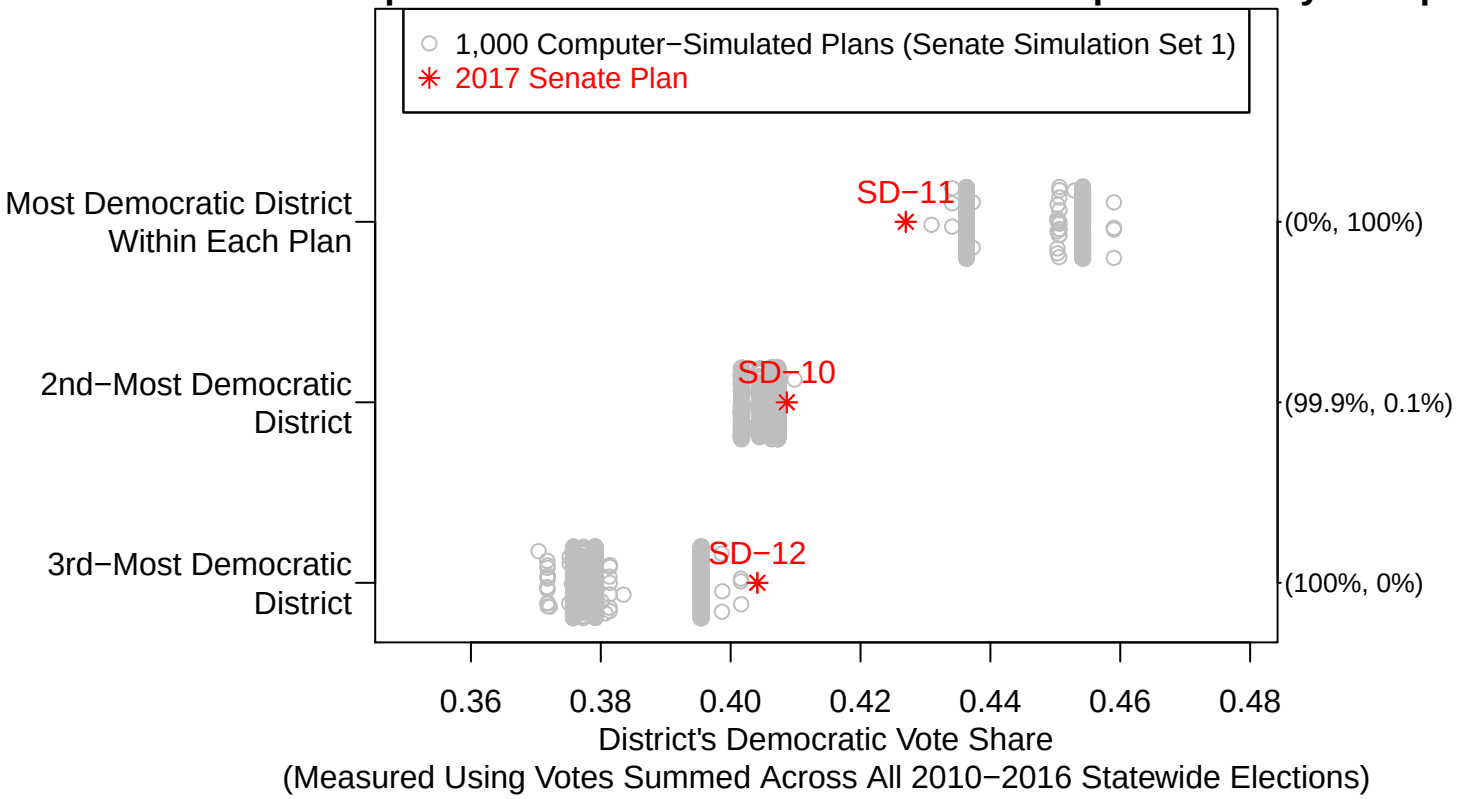
Figure 75: Senate Simulation Set 1: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Davie−Forsyth County Grouping

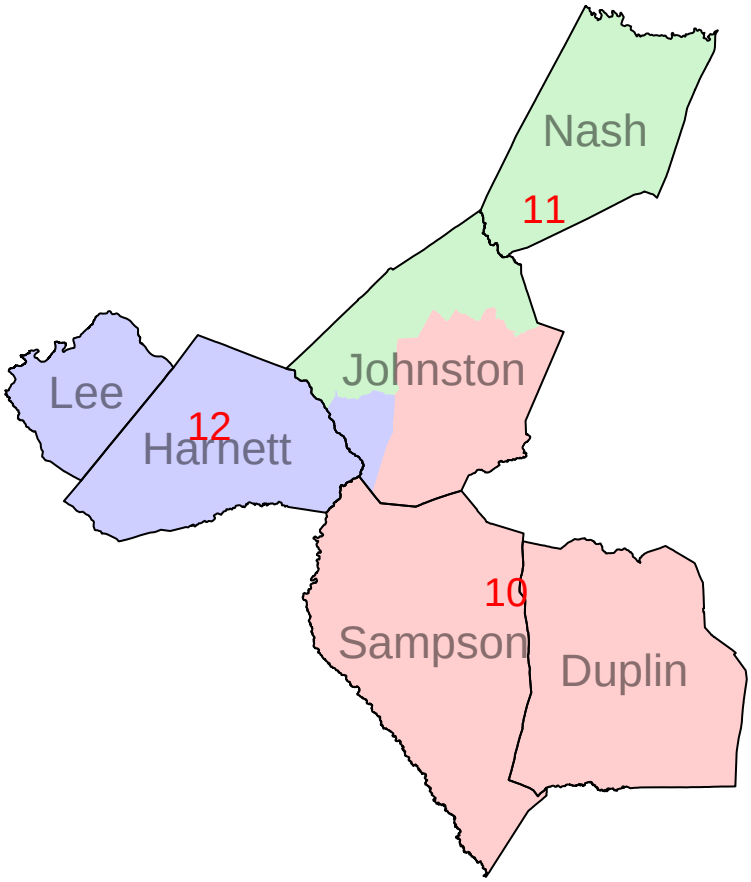




2017 Enacted Senate Plan Districts Within County Grouping 18 (Contains 2 Districts)

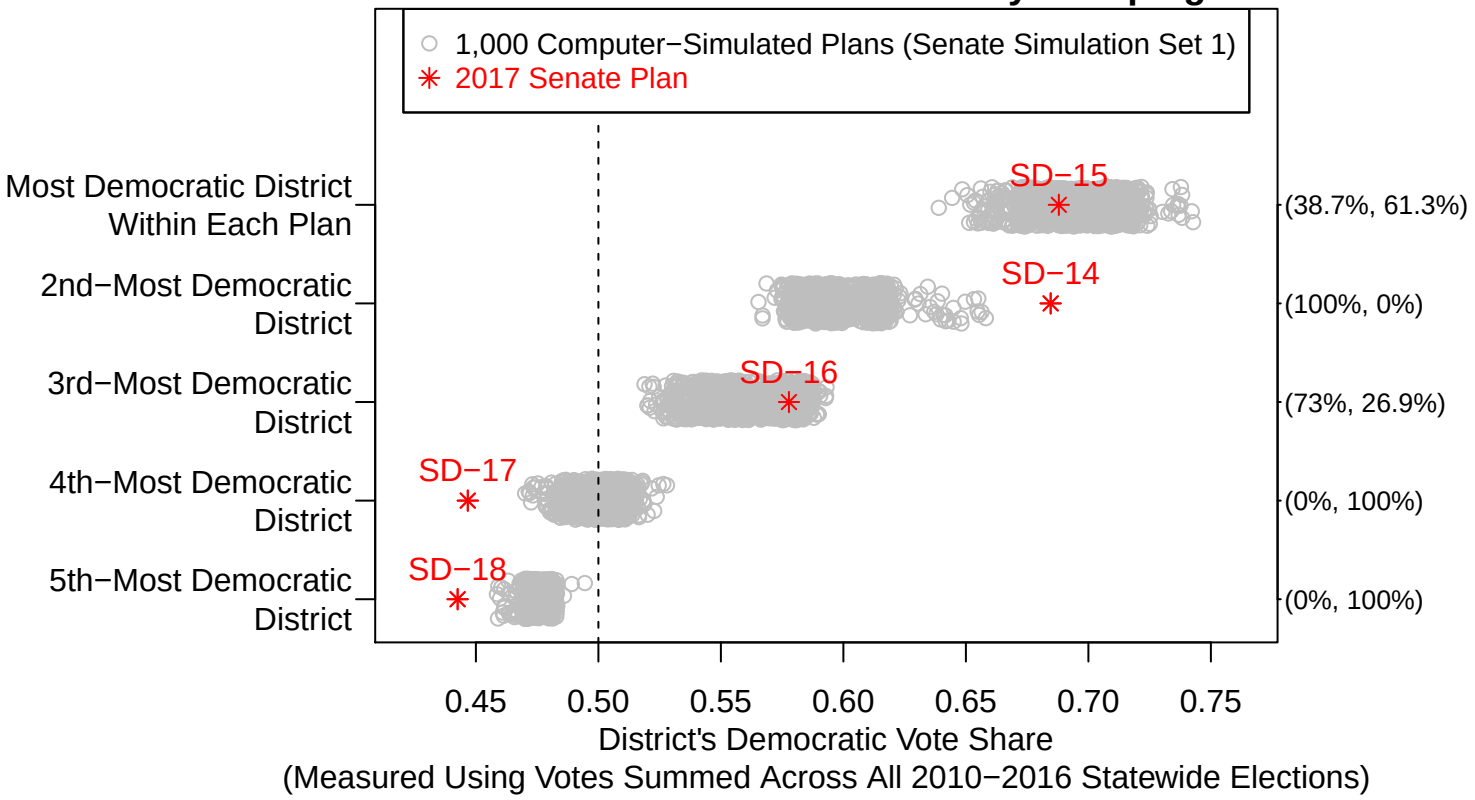
Figure 76: Senate Simulation Set 1: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Duplin−Harnett−Johnston−Lee−Nash−Sampson County Grouping

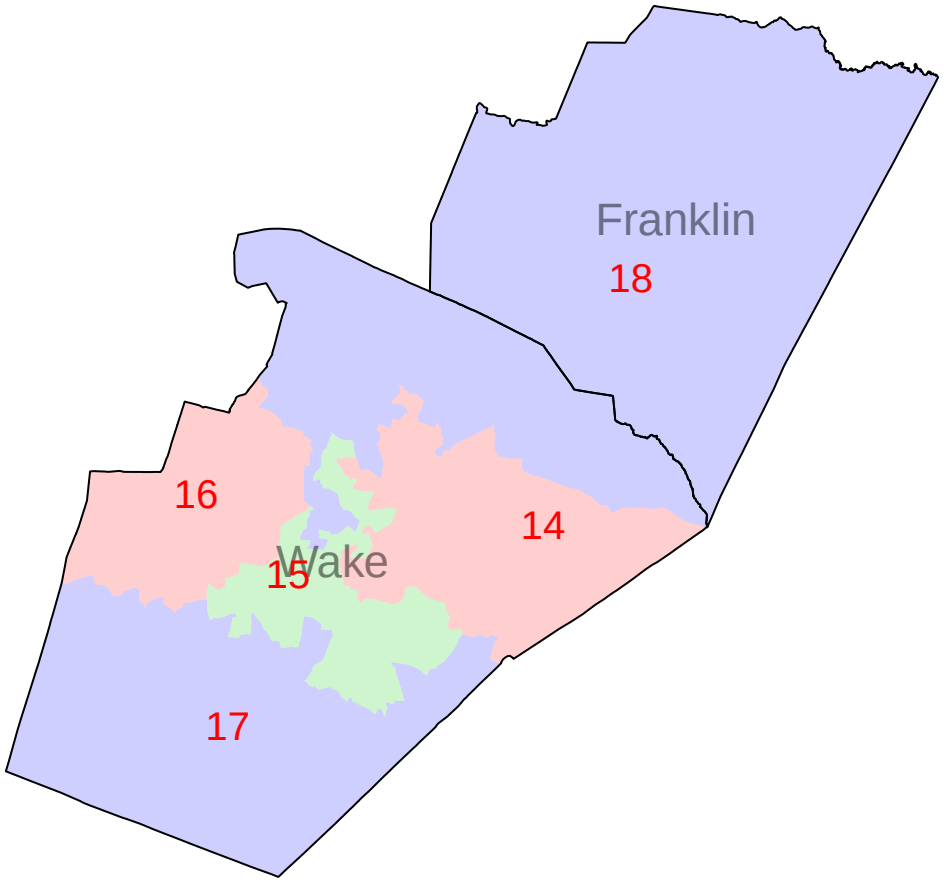




2017 Enacted Senate Plan Districts Within County Grouping 19 (Contains 3 Districts)

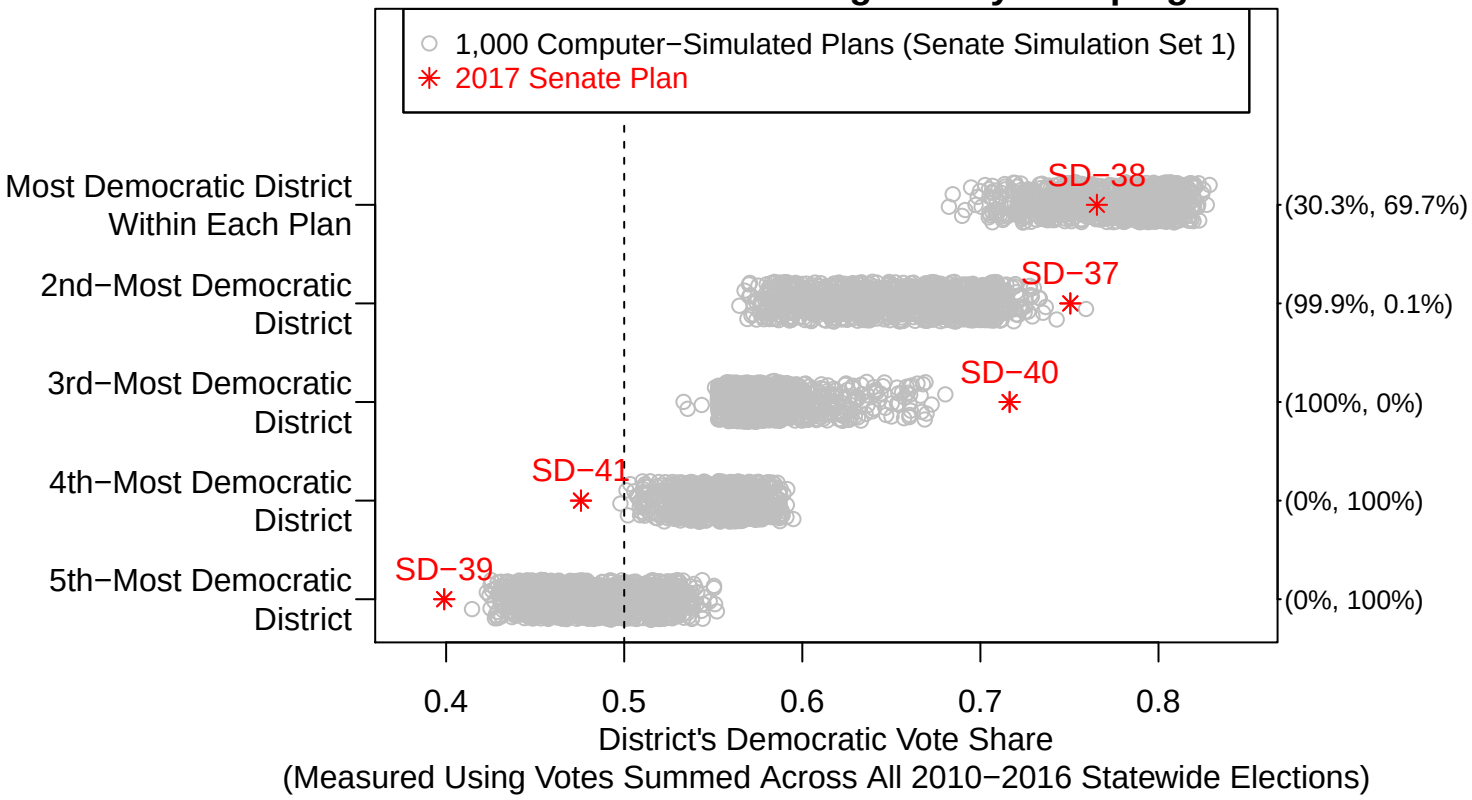
Figure 77: Senate Simulation Set 1: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Franklin−Wake County Grouping

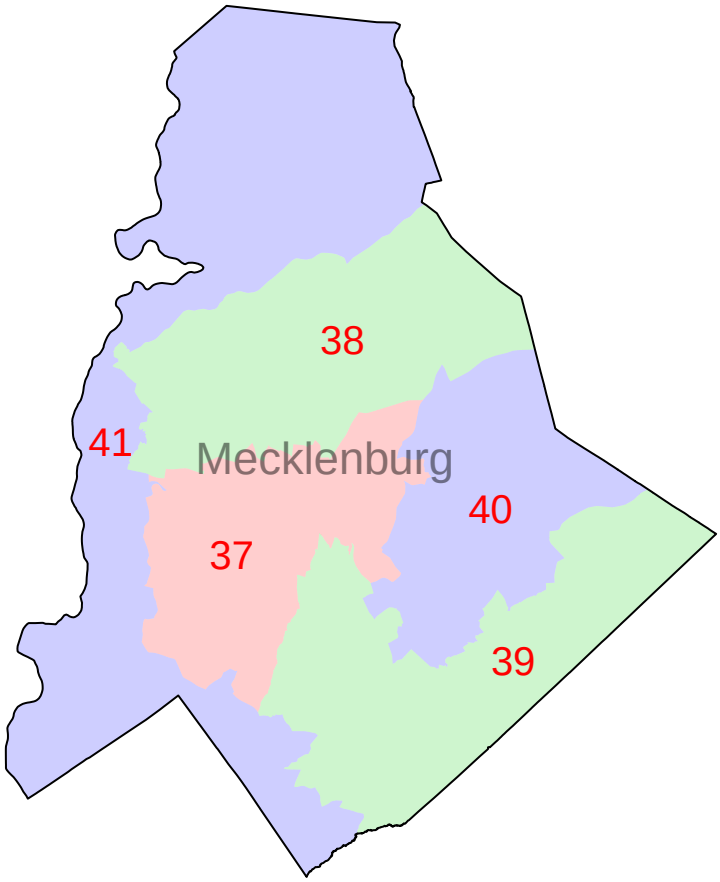




2017 Enacted Senate Plan Districts Within County Grouping 22 (Contains 5 Districts)

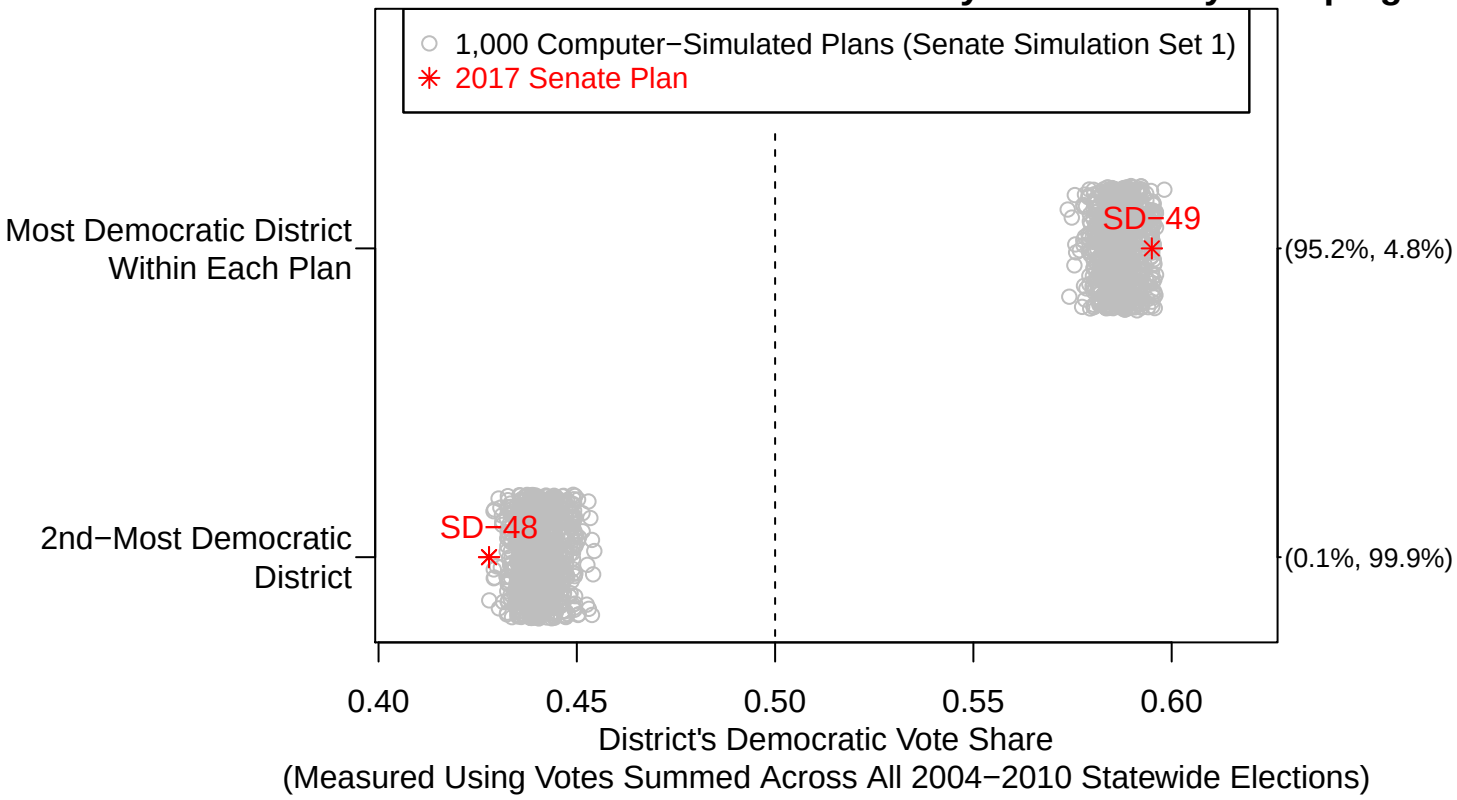
Figure 78: Senate Simulation Set 1: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Mecklenburg County Grouping

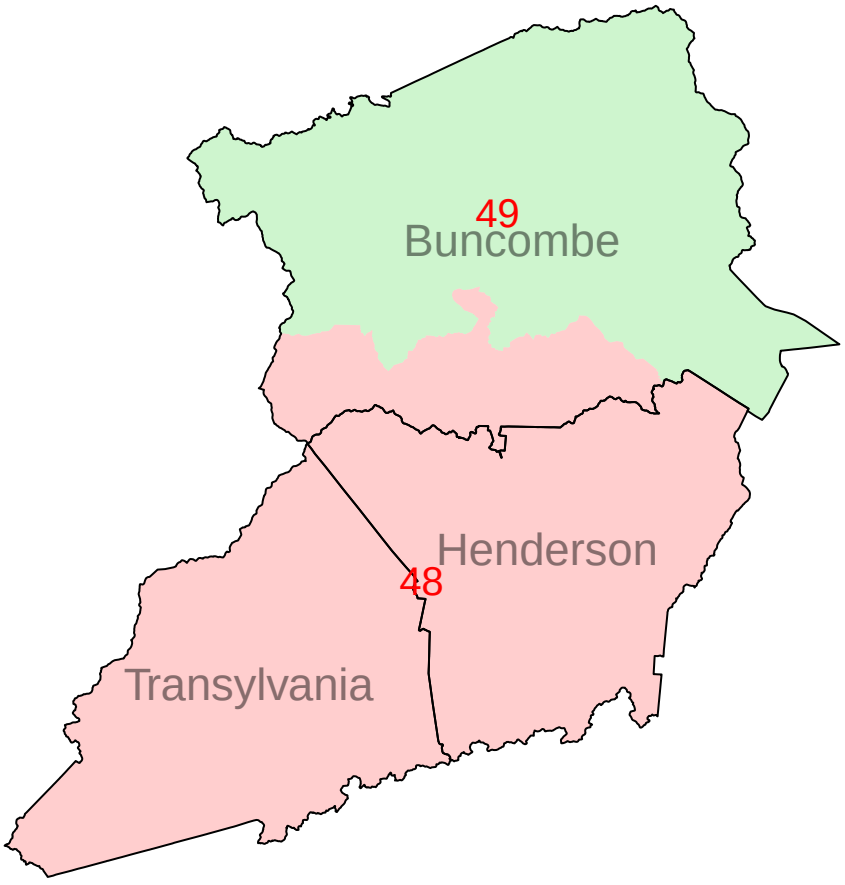




2017 Enacted Senate Plan Districts Within County Grouping 28 (Contains 5 Districts)

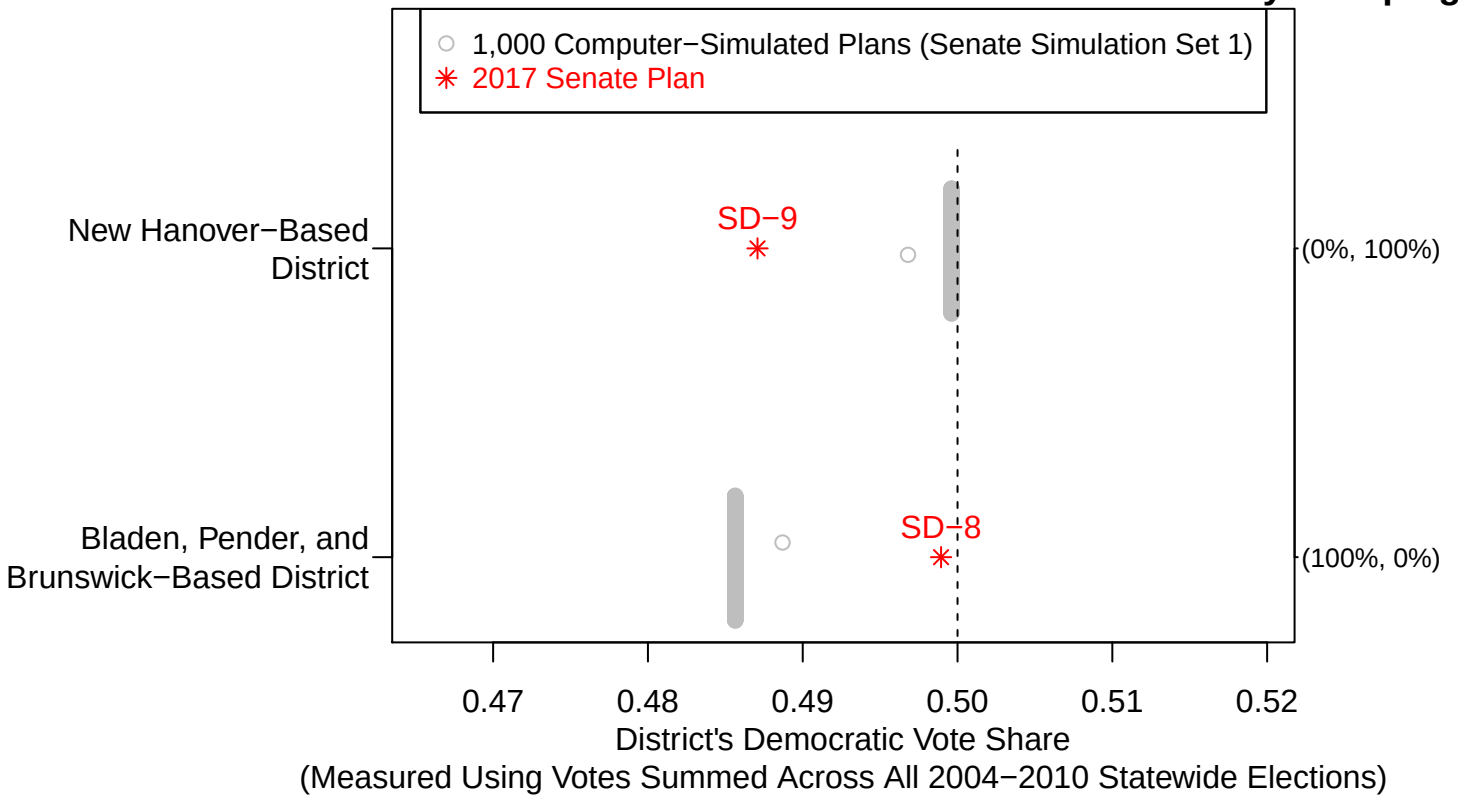
Figure 79: Senate Simulation Set 1:
Democratic Vote Share of the Enacted and Computer−Simulated Districts
Within the Buncombe−Henderson−Transylvania County Grouping

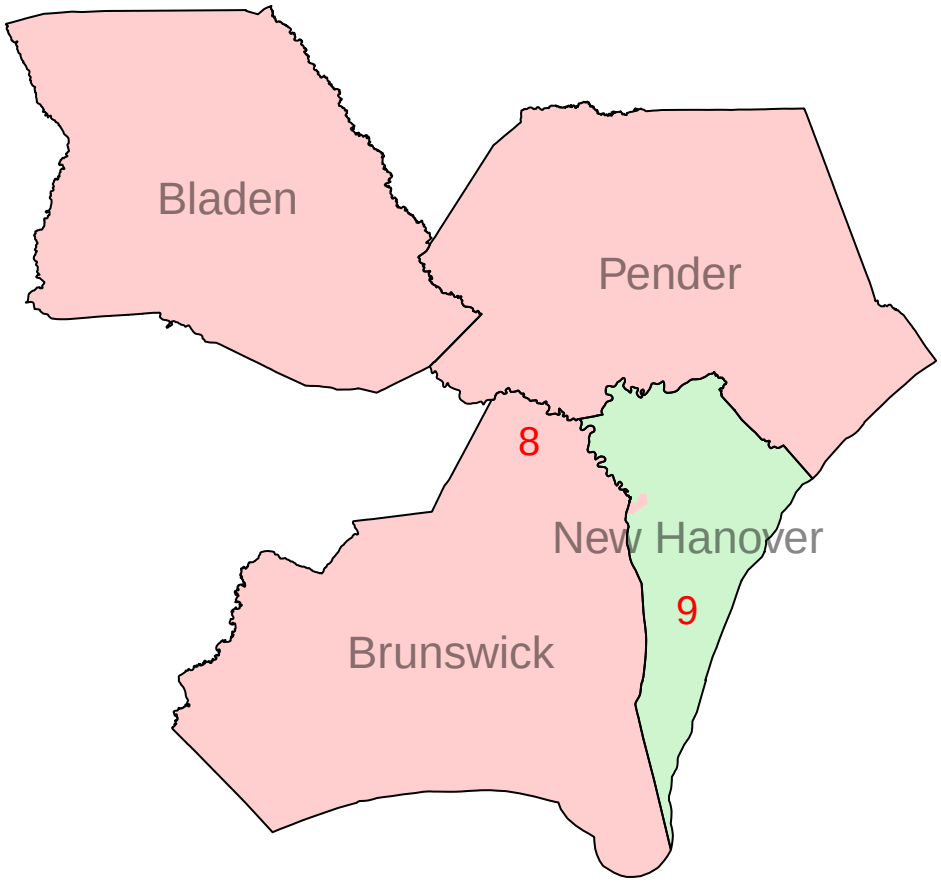




2017 Enacted Senate Plan Districts (2 Districts)

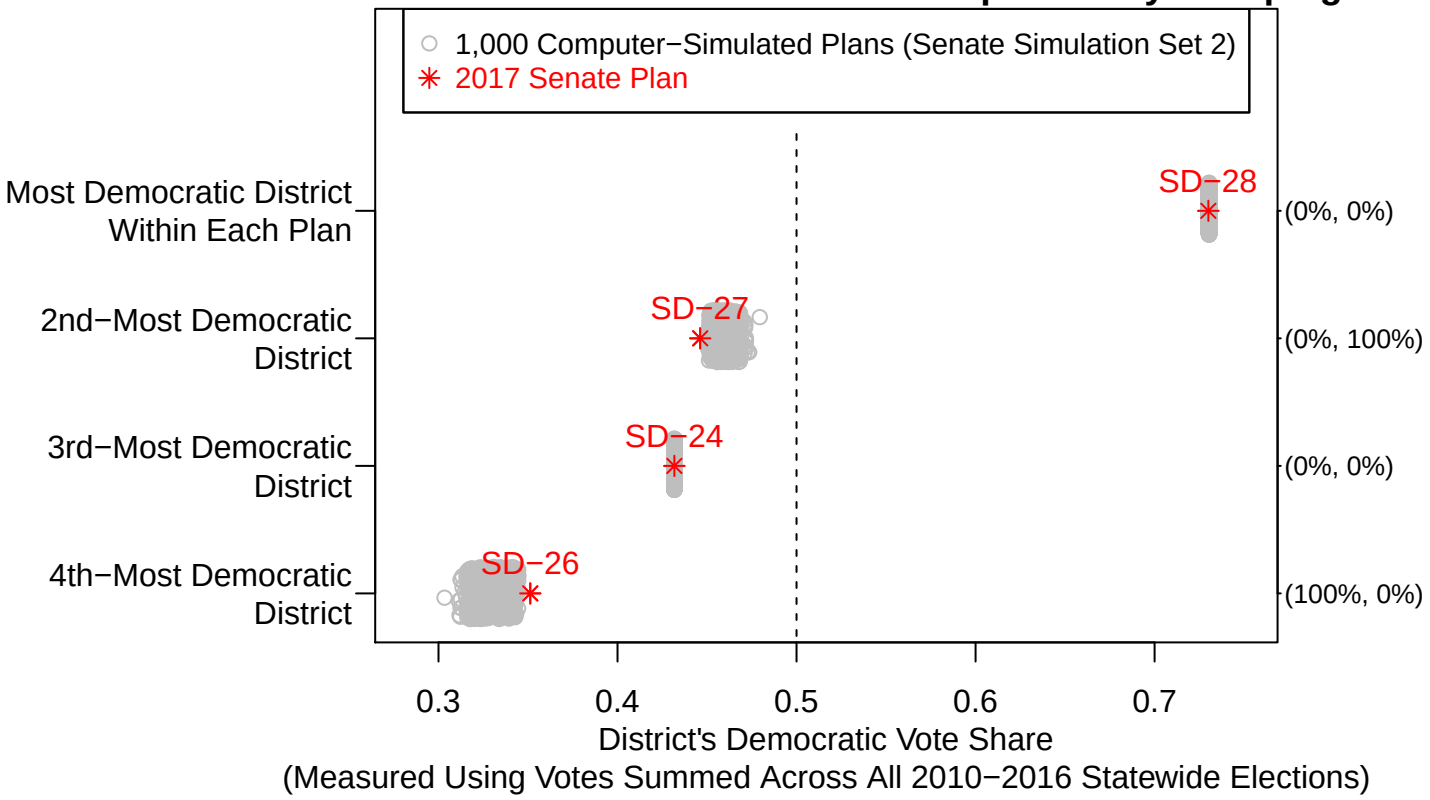
Figure 80: Senate Simulation Set 1: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Bladen−Brunswick−New Hanover−Pender County Grouping

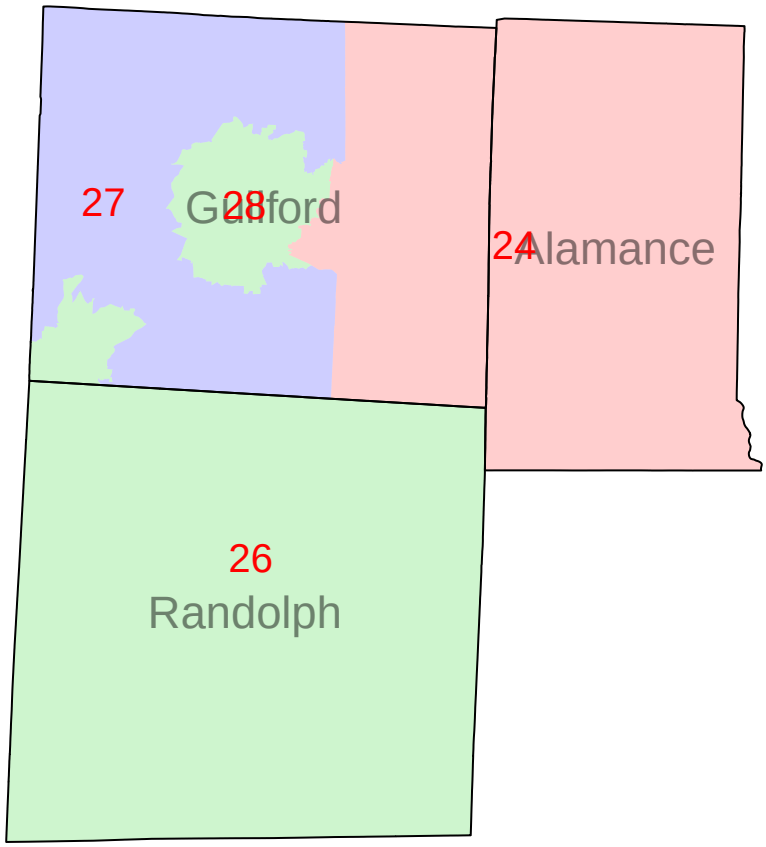




2017 Enacted Senate Plan Districts (2 Districts)

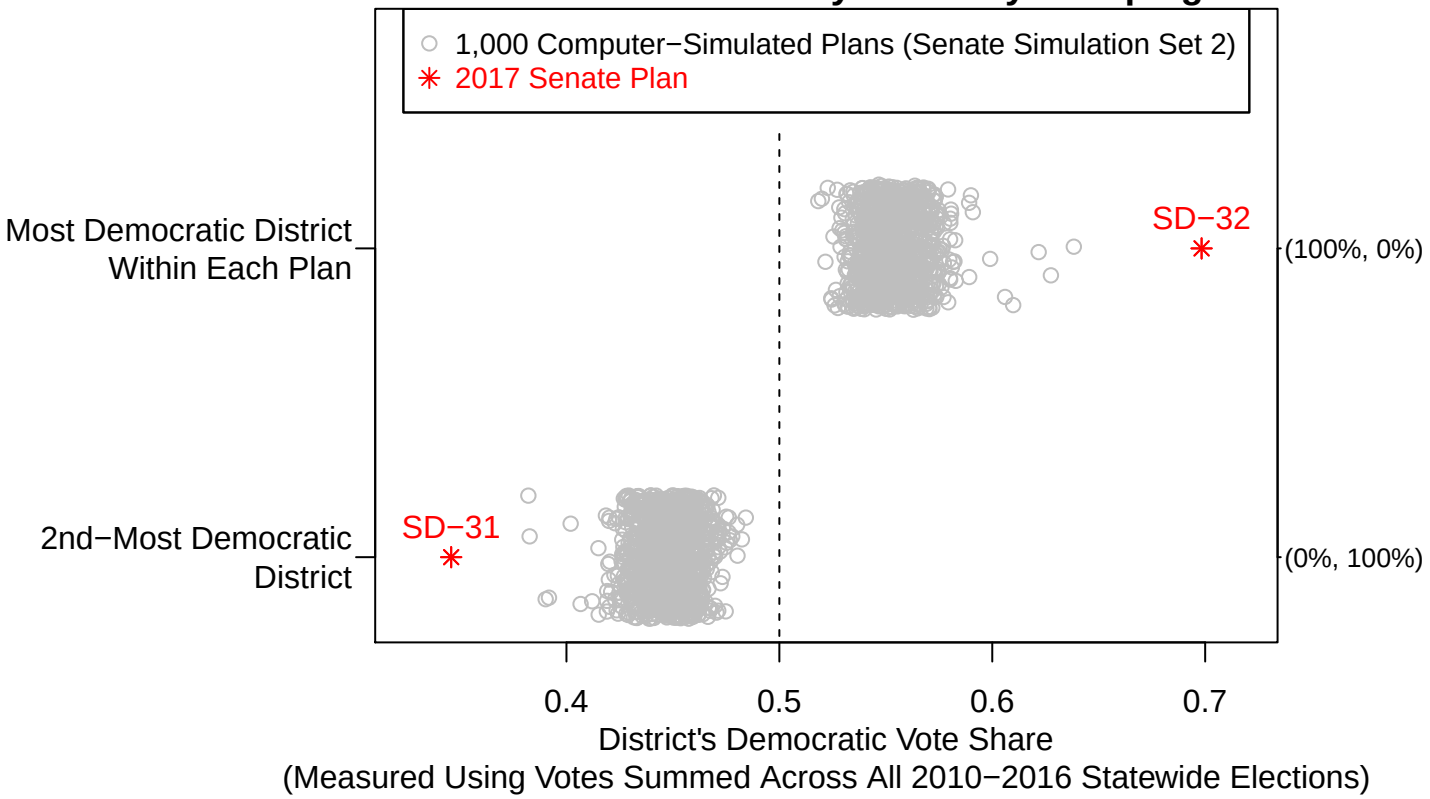
Figure 81: Senate Simulation Set 2: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Alamance−Guilford−Randolph County Grouping

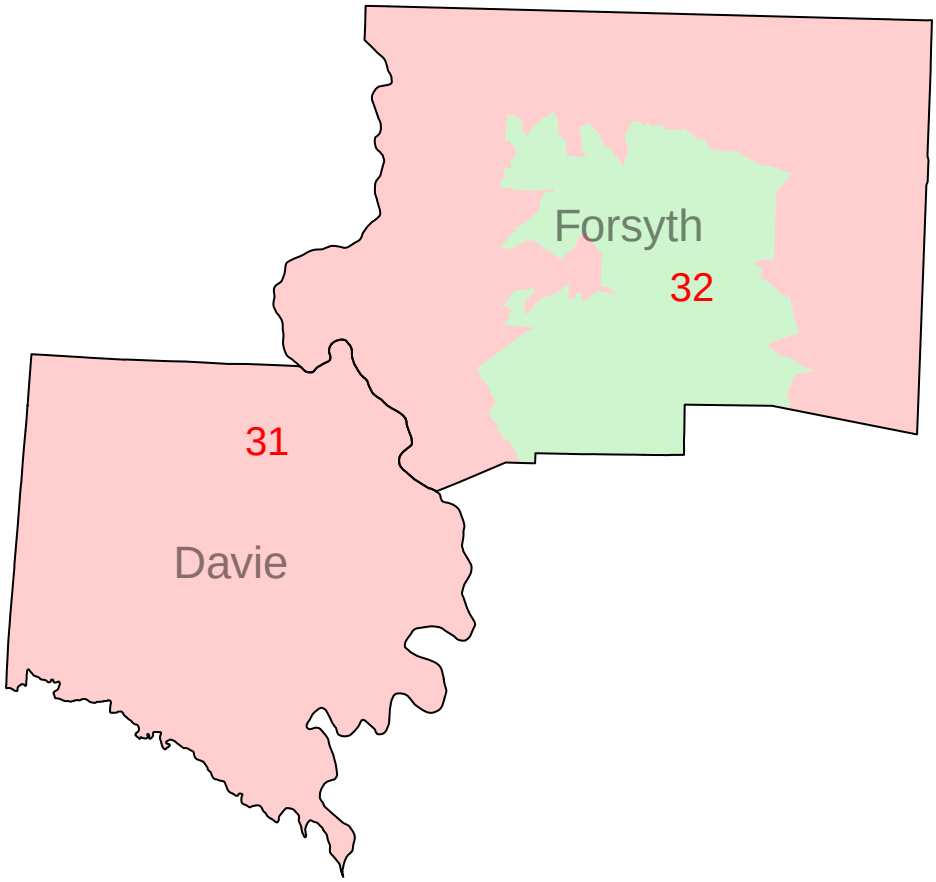




2017 Enacted Senate Plan Districts Within County Grouping 1
(Contains 4 districts, including 2 Special Master Districts (SD−24 and SD−28)
that are frozen in all simulated plans and included in the above Figure)

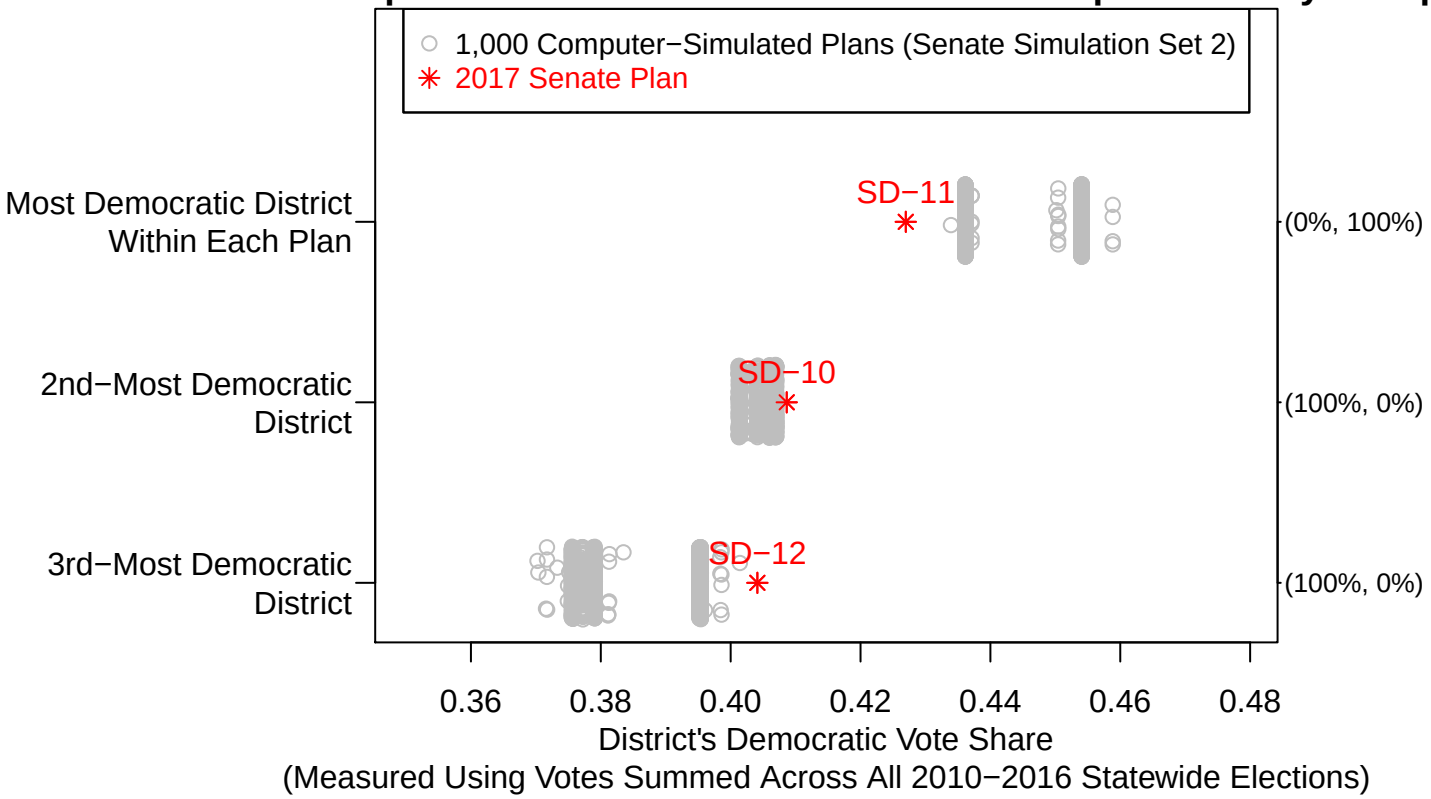
Figure 82: Senate Simulation Set 2: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Davie−Forsyth County Grouping

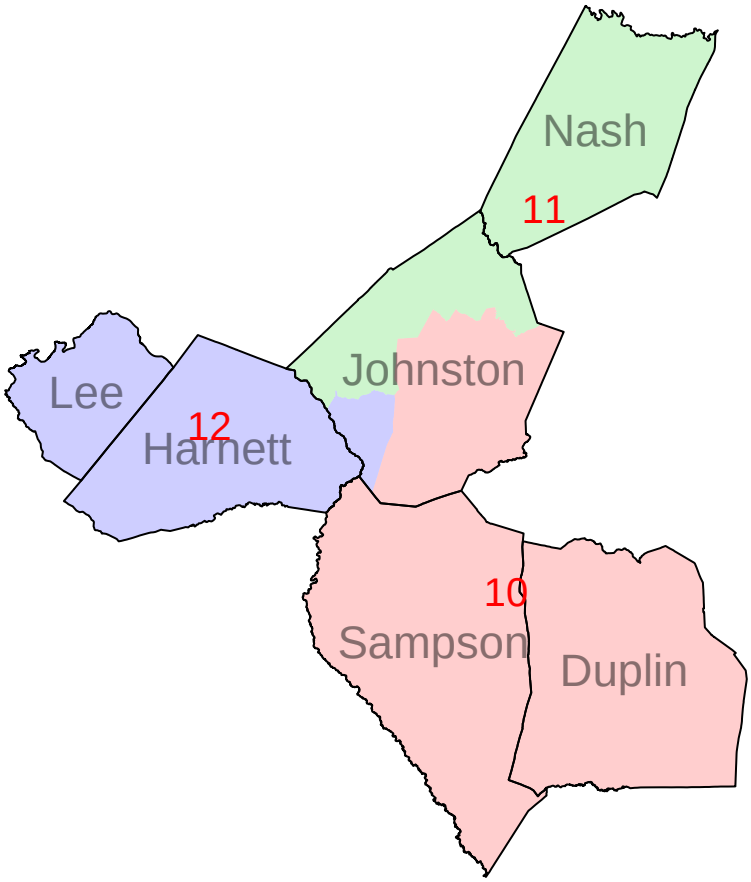




2017 Enacted Senate Plan Districts Within County Grouping 18 (Contains 2 Districts)

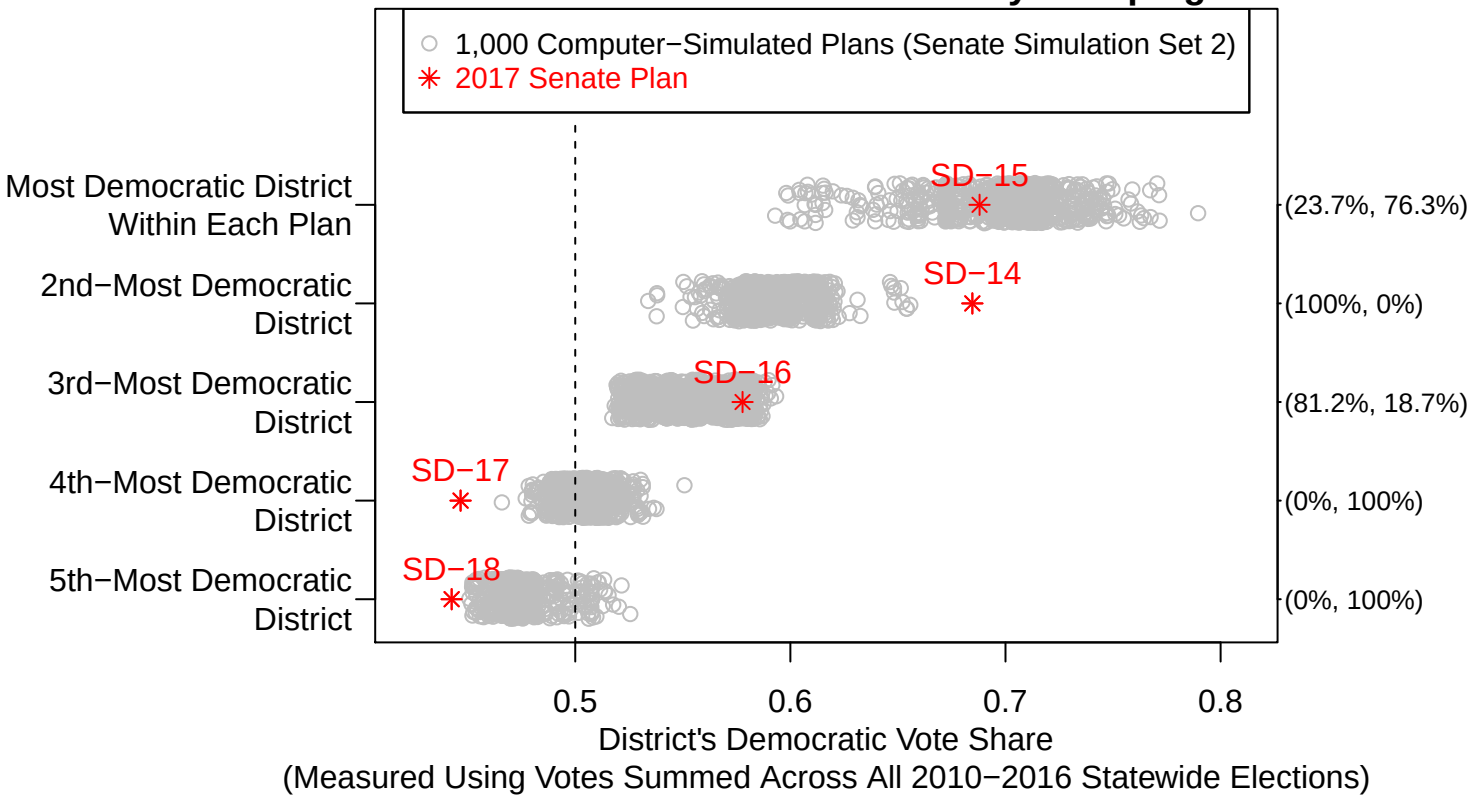
Figure 83: Senate Simulation Set 2: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Duplin−Harnett−Johnston−Lee−Nash−Sampson County Grouping

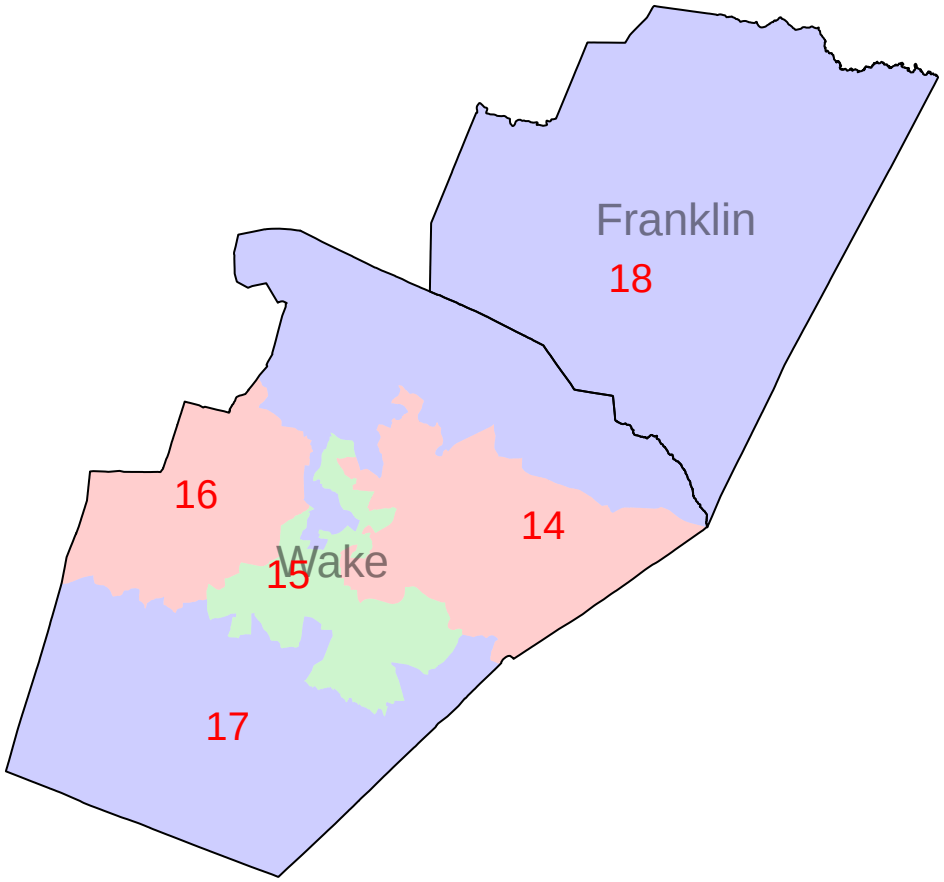




2017 Enacted Senate Plan Districts Within County Grouping 19 (Contains 3 Districts)

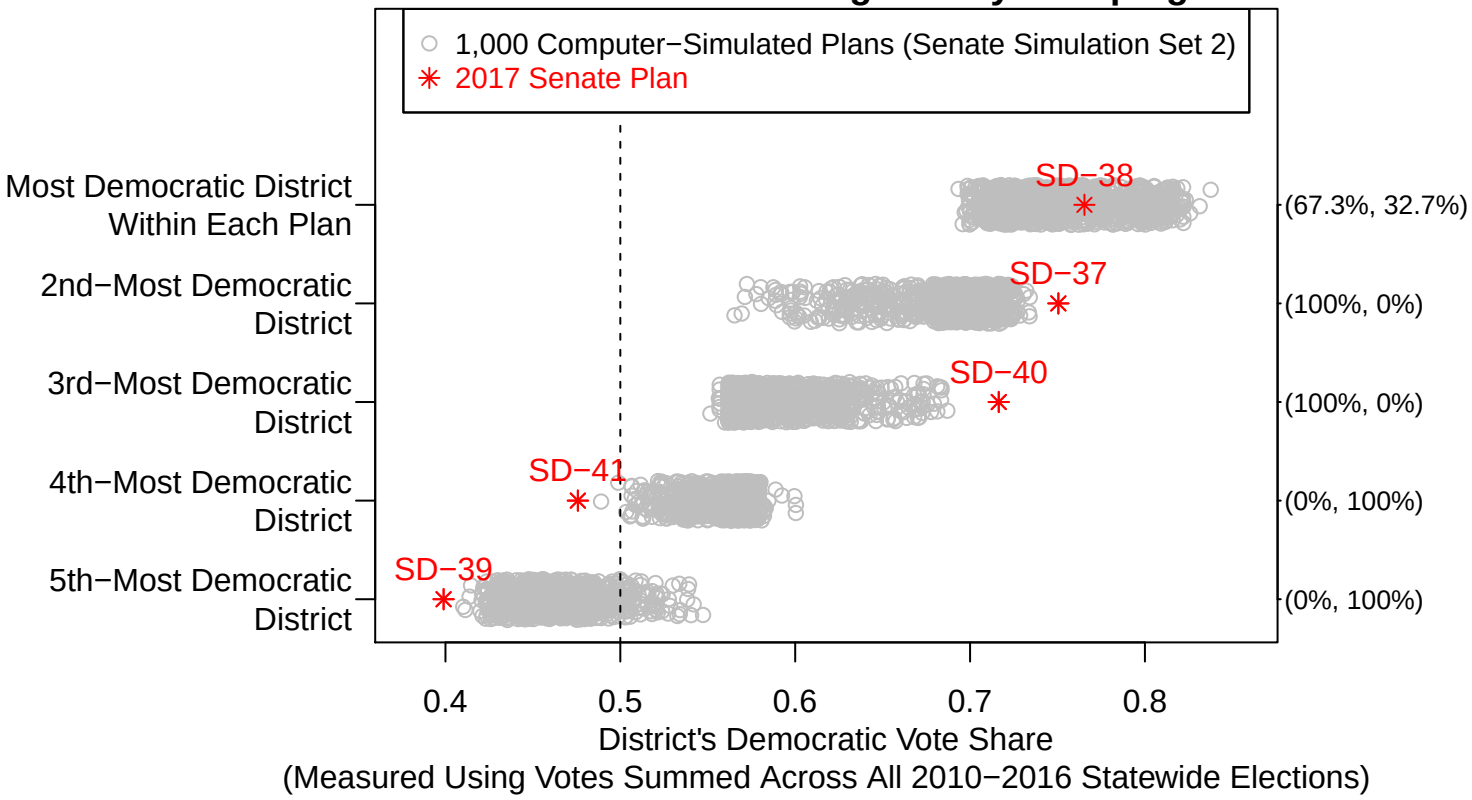
Figure 84: Senate Simulation Set 2: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Franklin−Wake County Grouping

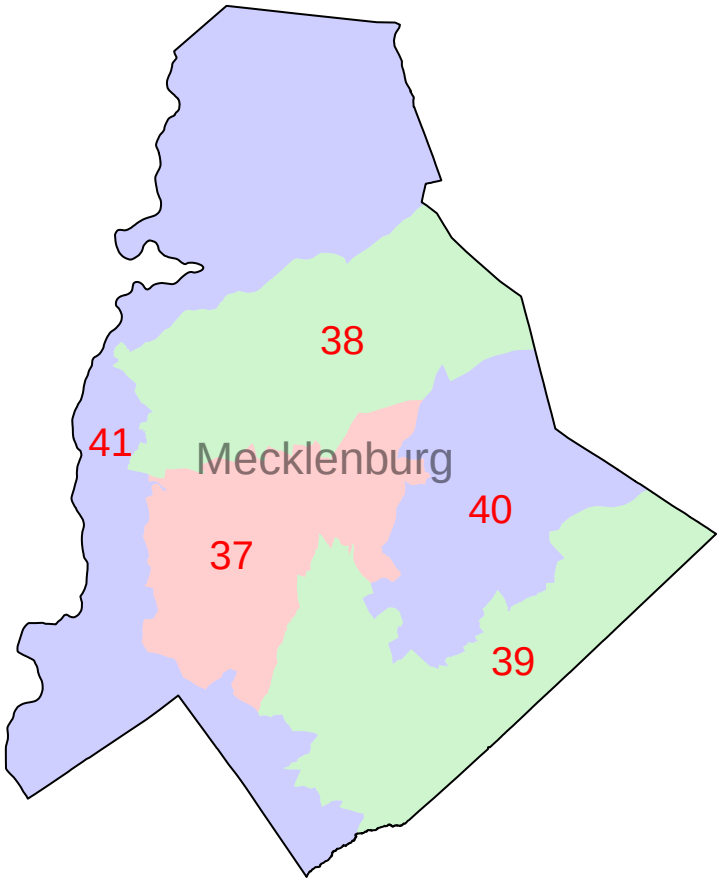




2017 Enacted Senate Plan Districts Within County Grouping 22 (Contains 5 Districts)

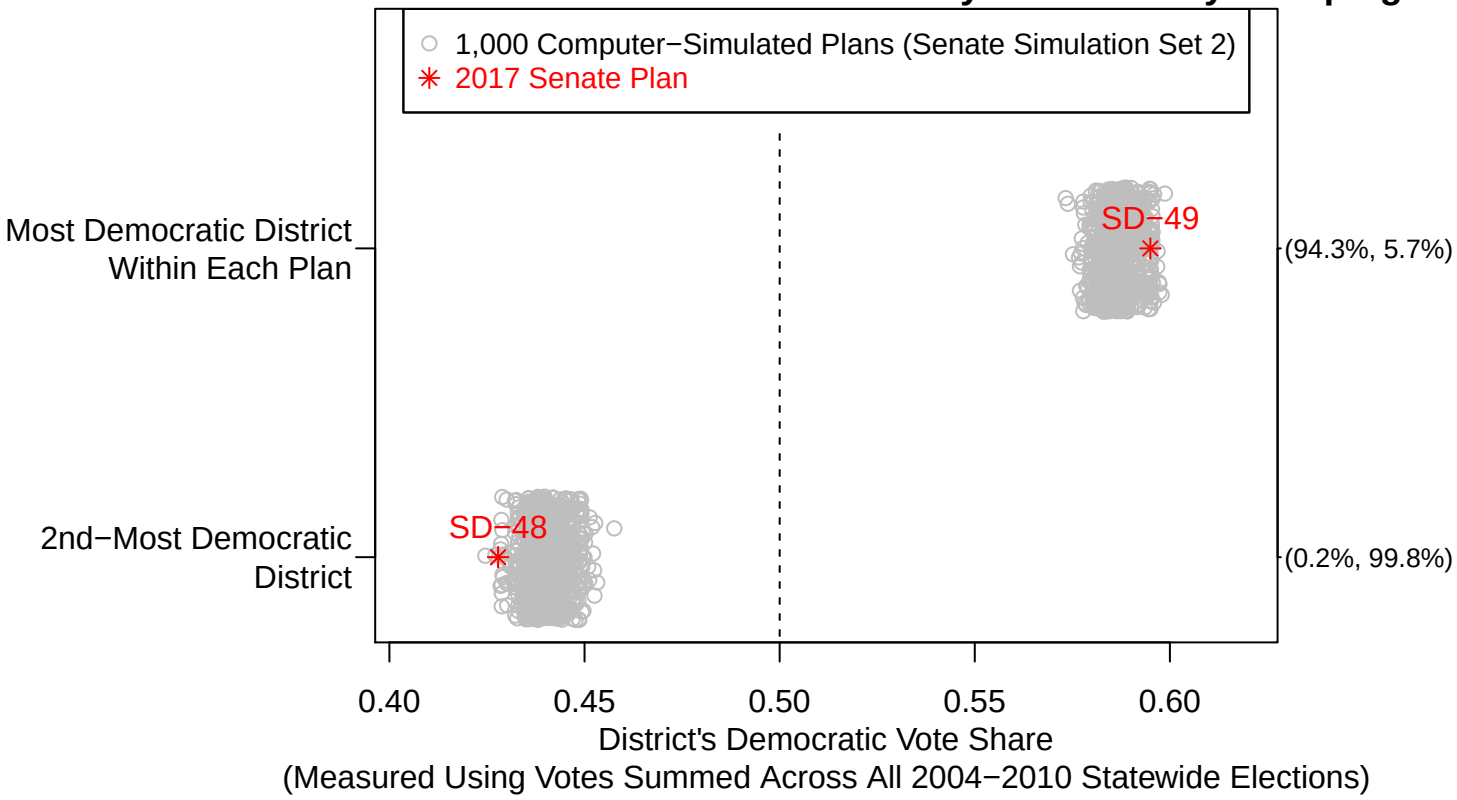
Figure 85: Senate Simulation Set 2: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Mecklenburg County Grouping

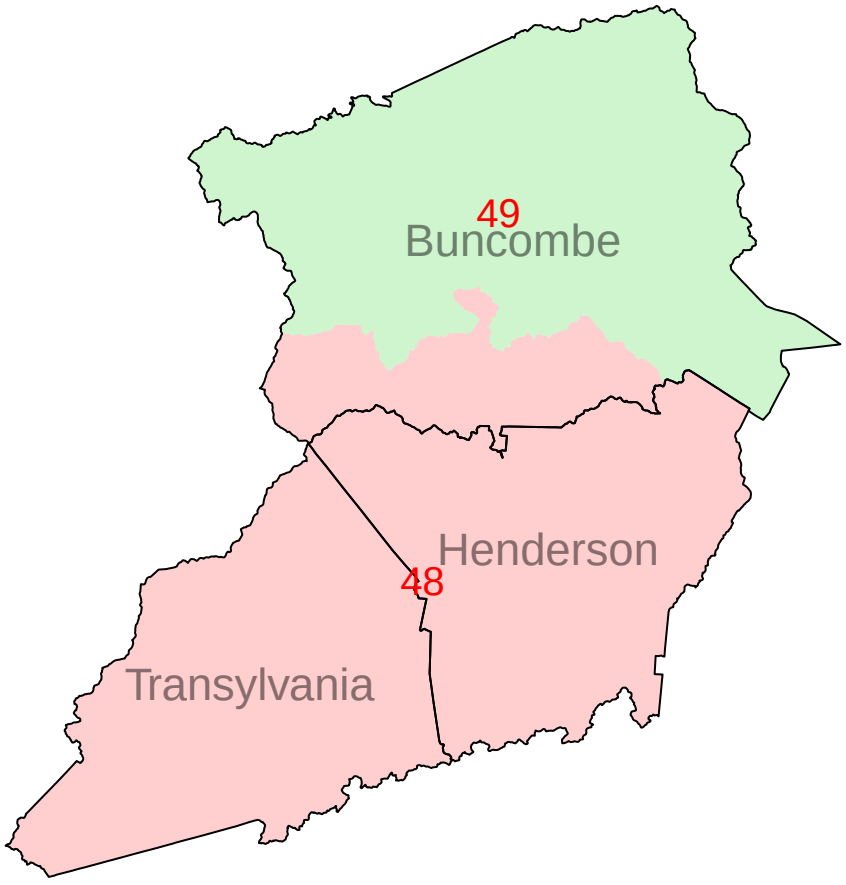




2017 Enacted Senate Plan Districts Within County Grouping 28 (Contains 5 Districts)

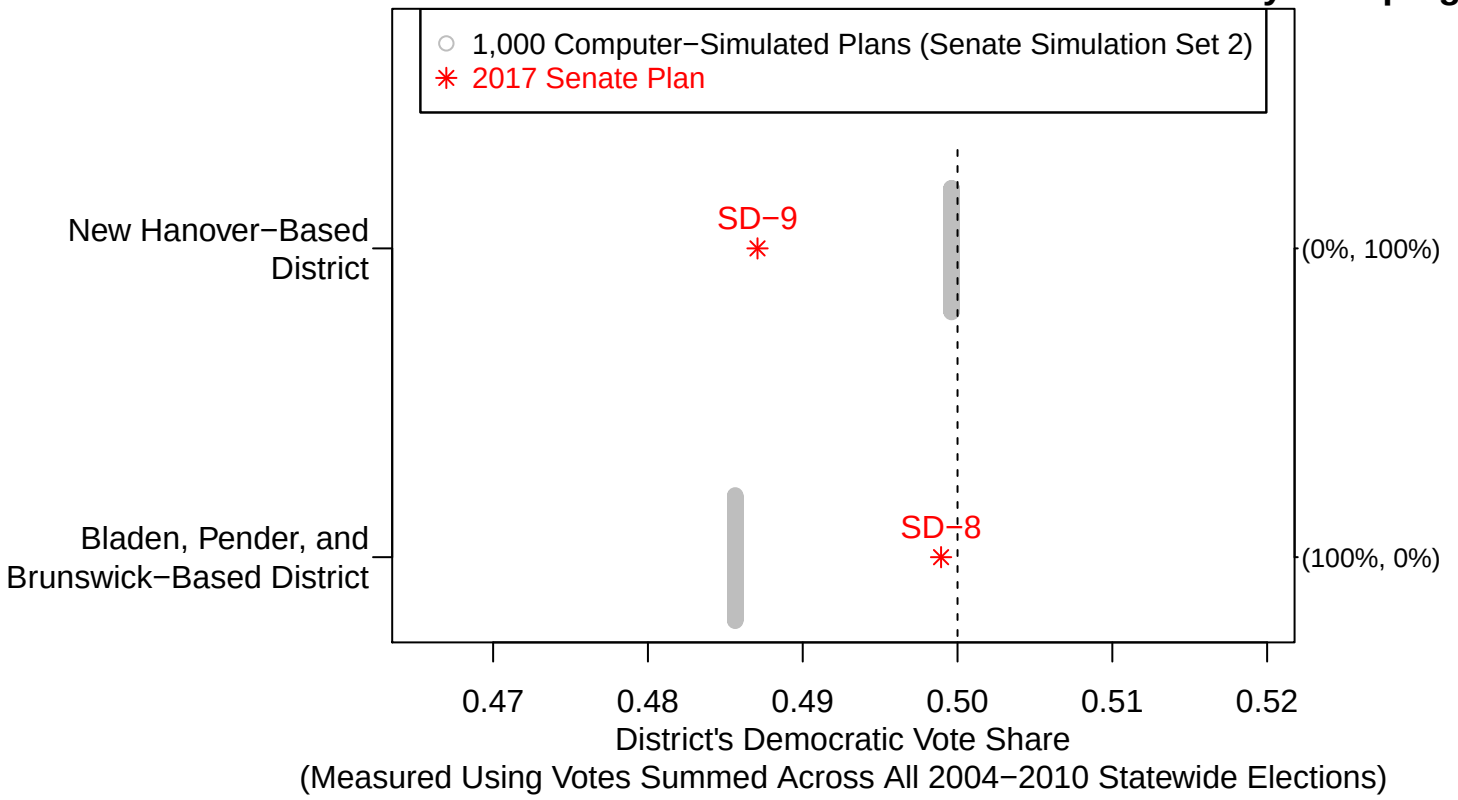
Figure 86: Senate Simulation Set 2: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Buncombe−Henderson−Transylvania County Grouping

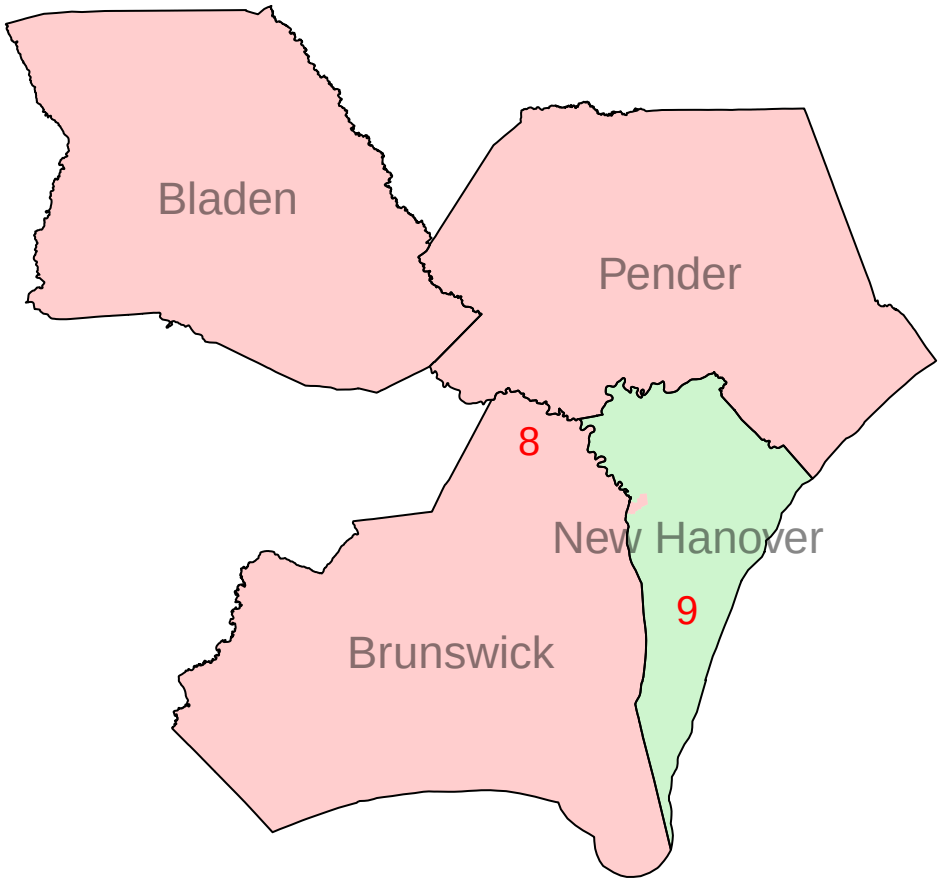




2017 Enacted Senate Plan Districts Within County Grouping 8 (Contains 2 Districts)

Figure 87: Senate Simulation Set 2: Democratic Vote Share of the Enacted and Computer−Simulated Districts Within the Bladen−Brunswick−New Hanover−Pender County Grouping





2017 Enacted Senate Plan Districts Within County Grouping 7 (Contains 2 Districts)

Comparing the Number of Threshold-Level Republican Districts in the Enacted and Simulated Plans: The second approach I use is the same as the second approach used for the House: Within each county grouping, I consider all of the 2017 Senate Plan districts in the grouping that are Republican-leaning (with over a 50% Republican vote share), and I identify the most minimally Republican-leaning of these enacted districts. For both the 2017 Senate Plan and each of the computer-simulated Senate plans, I then compare the number of districts within the grouping that are at least as Republican-leaning as the most minimally Republican-leaning district within that grouping in the 2017 Senate Plan.

Figure 91 illustrates an example of this approach, analyzing the Franklin and Wake County grouping in the 2017 Senate Plan, which contains three districts (SD-14, SD-15, SD-16, SD-17, and SD-18). Two of these five districts are Republican-leaning, as measured using the 2010-2016 Statewide Election Composite. Among these two Republican-leaning districts, SD-17, with a Republican vote share of 55.33%, is the most minimally Republican-leaning of these districts. Therefore, I use this 55.33% Republican vote share threshold, and I count the number of districts in the 2017 Senate Plan and in the computer-simulated plans within this county grouping that are at least as heavily Republican as SD-17's Republican vote share of 55.33%.

The two histograms in Figure 91 illustrate the results of this analysis of the Franklin and Wake County grouping. The 2017 Senate Plan contains two districts (SD-17 and SD-18) that are at least as Republican as SD-17's Republican vote share of 55.33%. The left histogram in Figure 91 reveals that every single one of the 1,000 simulated plans in Senate Simulation Set 1 contains zero districts in this county grouping with at least a 55.33% Republican vote share. Similarly, the right histogram in Figure 91 also illustrates that every one of the 1,000 simulated plans in Senate Simulation Set 2 contains zero districts in this county grouping with at least a 55.33% Republican vote share. Not a single one of these 2,000 computer-simulated plans contains two such Republican districts. Therefore, the 2017 Senate Plan is a statistical outlier within the Franklin and Wake County grouping in its creation of two Republican districts with at least a 55.33% Republican vote share.

I use this same approach to analyze each 2017 Senate Plan districts within different county groupings. Figures 88 to 94 each focus on a single county grouping, with the left histogram analyzing Senate Simulation Set 1 plans and the right histogram analyzing Senate Simulation Set 2. As before, for county groupings containing districts that were originally drawn

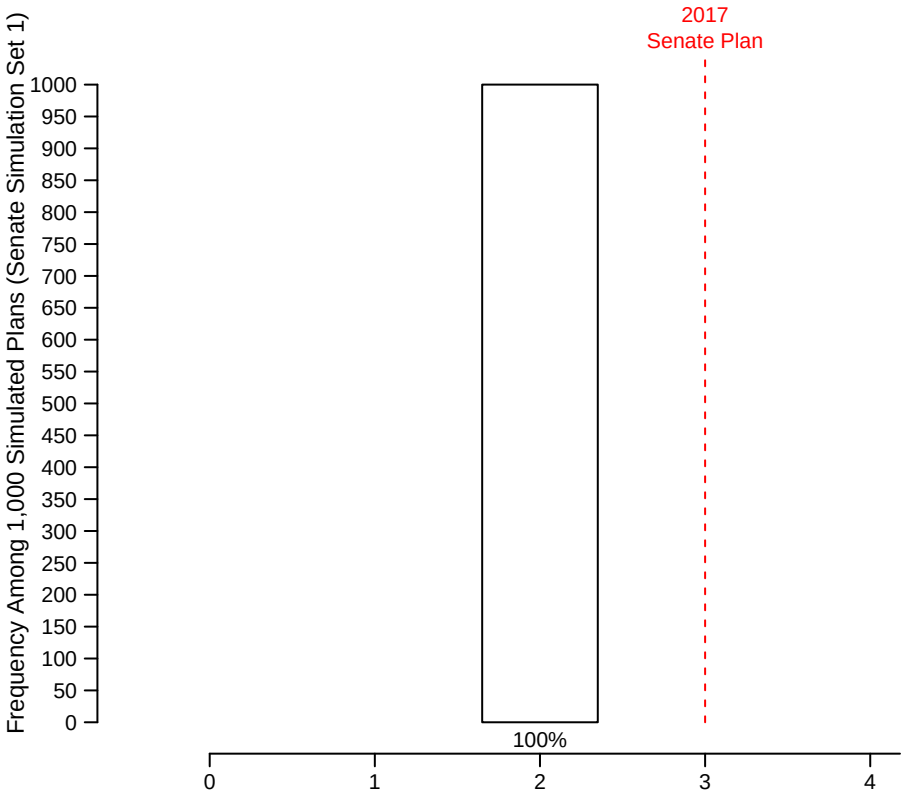
in 2011 and remained unchanged in the 2017 redistricting process, I used the 2004-2010 Statewide Election Composite to measure district partisanship in these Figures, since the 2004-2010 statewide elections represent the elections data available to and used by the General Assembly during the 2011 redistricting process.

Overall, using this partisan threshold methodology, I found that the 2017 Senate plan creates partisan outliers within the following seven Senate county groupings:

1. The Alamance-Guilford-Randolph County grouping (Figure 88).
2. The Bladen-Brunswick-New Hanover -Pender County grouping (Figure 93).
3. The Buncombe-Henderson-Transylvania County grouping (Figure 94).
4. The Davie-Forsythe County grouping (Figure 89).
5. The Duplin-Harnett-Johnston-Lee-Nash-Sampson County grouping (Figure 90).
6. The Franklin-Wake County grouping (Figure 91).
7. The Mecklenburg County grouping (Figure 92).

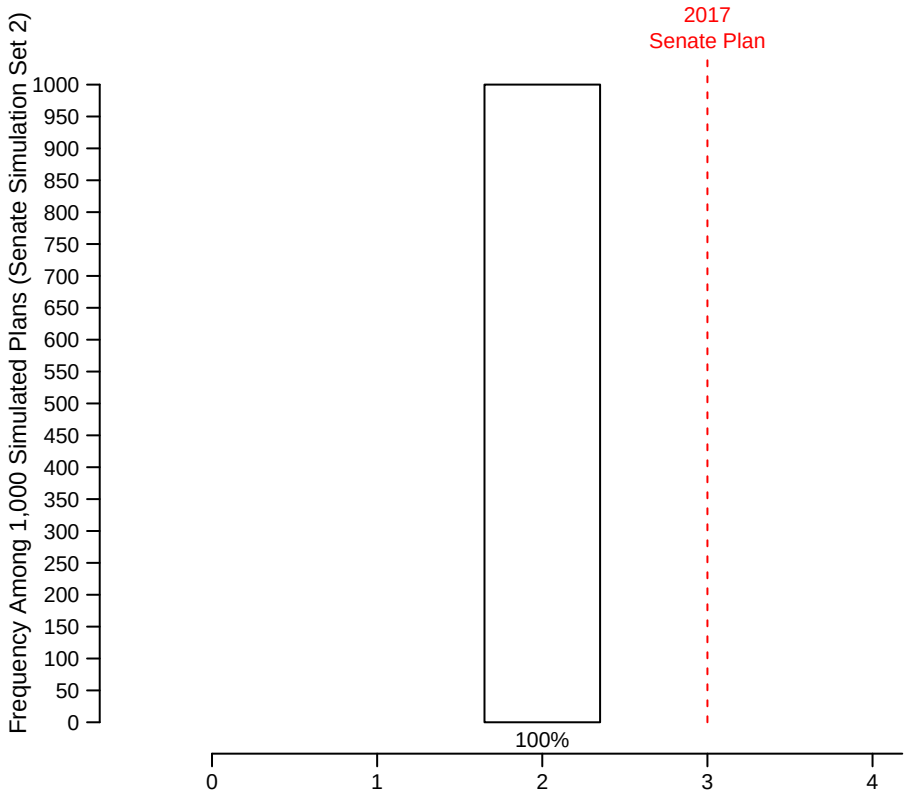
Figure 88:
Number of Senate Districts With At Least SD−27's Republican Vote Share of 55.38% in the Alamance−Guilford−Randolph County Grouping

Simulation Set 1



Number of Districts With At Least SD−27's Republican Vote Share of 55.38% in the Alamance−Guilford−Randolph County Grouping
(Measured Using Votes Summed Across 2010−2016 Statewide Elections)

Simulation Set 2

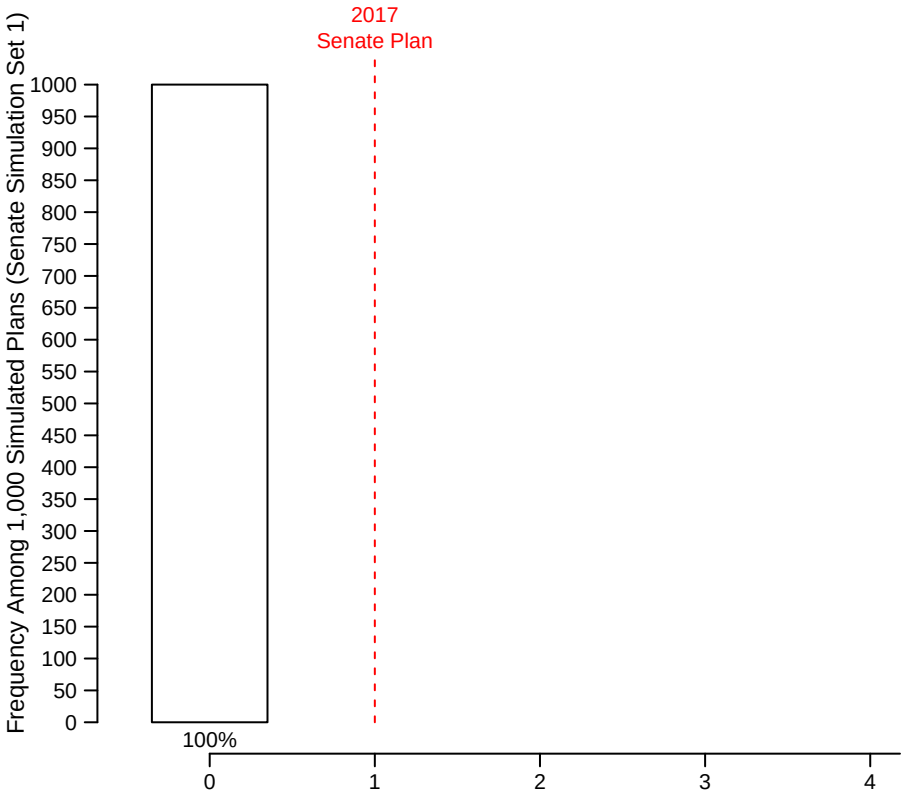


Number of Districts With At Least SD−27's Republican Vote Share of 55.38% in the Alamance−Guilford−Randolph County Grouping
(Measured Using Votes Summed Across 2010−2016 Statewide Elections)

Note: The Alamance−Guilford−Randolph County Grouping includes the following 2017 Senate Plan districts: 24; 26; 27; 28
The Special Master−drawn districts are INCLUDED in this Figure (Including SD−24, a 56.8% Republican district).

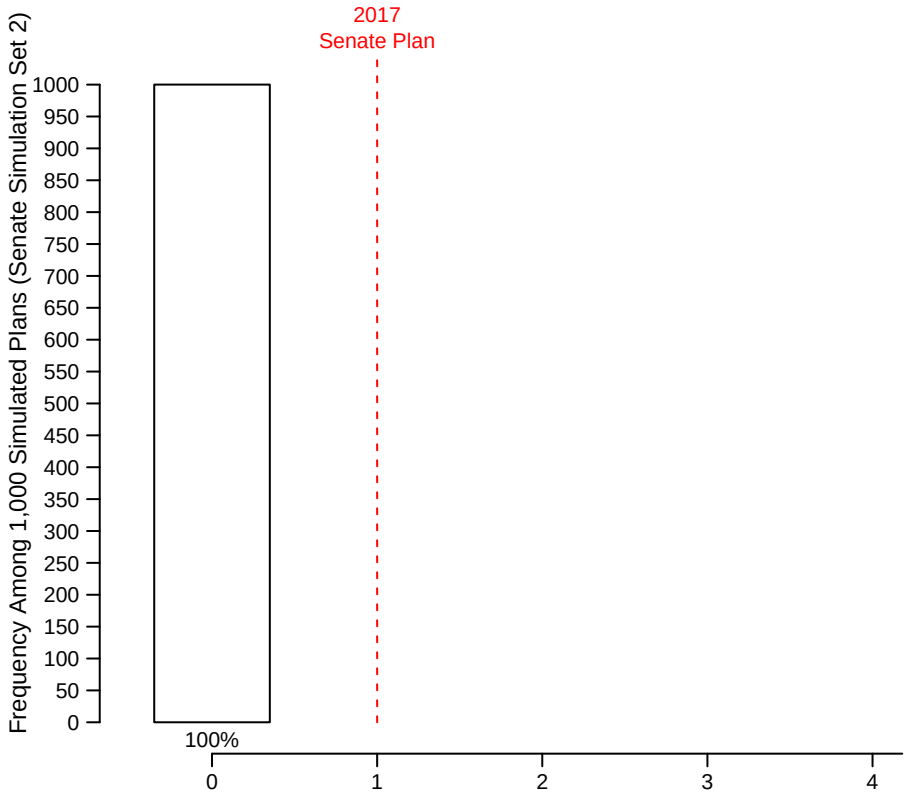
Figure 89:
Number of Senate Districts With At Least SD−31's Republican Vote Share of 65.41% in the Davie−Forsyth County Grouping

Simulation Set 1



Number of Districts With At Least SD−31's Republican Vote Share of 65.41% in the Davie−Forsyth County Grouping
(Measured Using Votes Summed Across 2010−2016 Statewide Elections)

Simulation Set 2

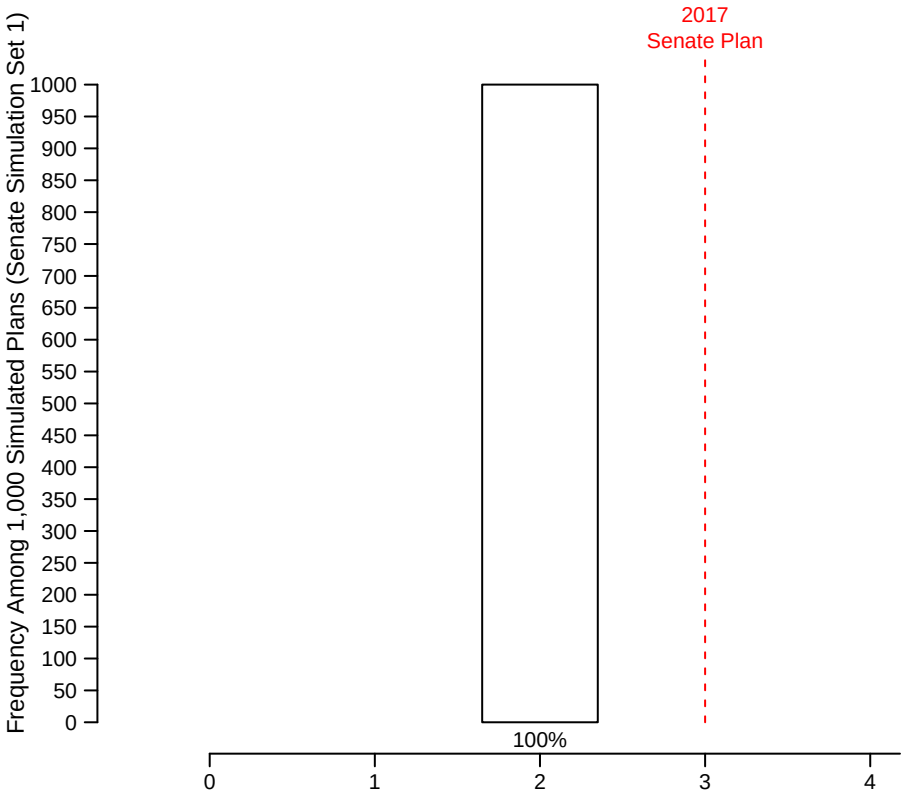


Number of Districts With At Least SD−31's Republican Vote Share of 65.41% in the Davie−Forsyth County Grouping
(Measured Using Votes Summed Across 2010−2016 Statewide Elections)

Note: The Davie−Forsyth County Grouping includes the following 2017 Senate Plan districts: 31; 32

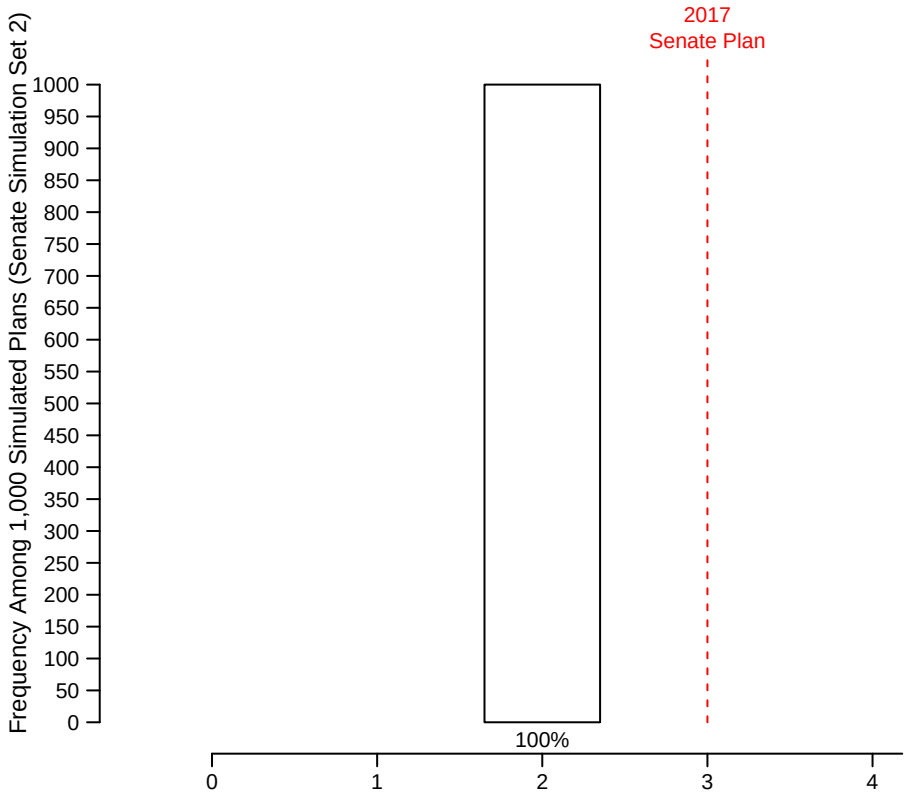
Figure 90:
Number of Senate Districts With At Least SD−11's Republican Vote Share of 57.3% in the Duplin−Harnett−Johnston−Lee−Nash−Sampson County Grouping

Simulation Set 1



Number of Districts With At Least SD−11's Republican Vote Share of 57.3% in the Duplin−Harnett−Johnston−Lee−Nash−Sampson County Grouping (Measured Using Votes Summed Across 2010−2016 Statewide Elections)

Simulation Set 2

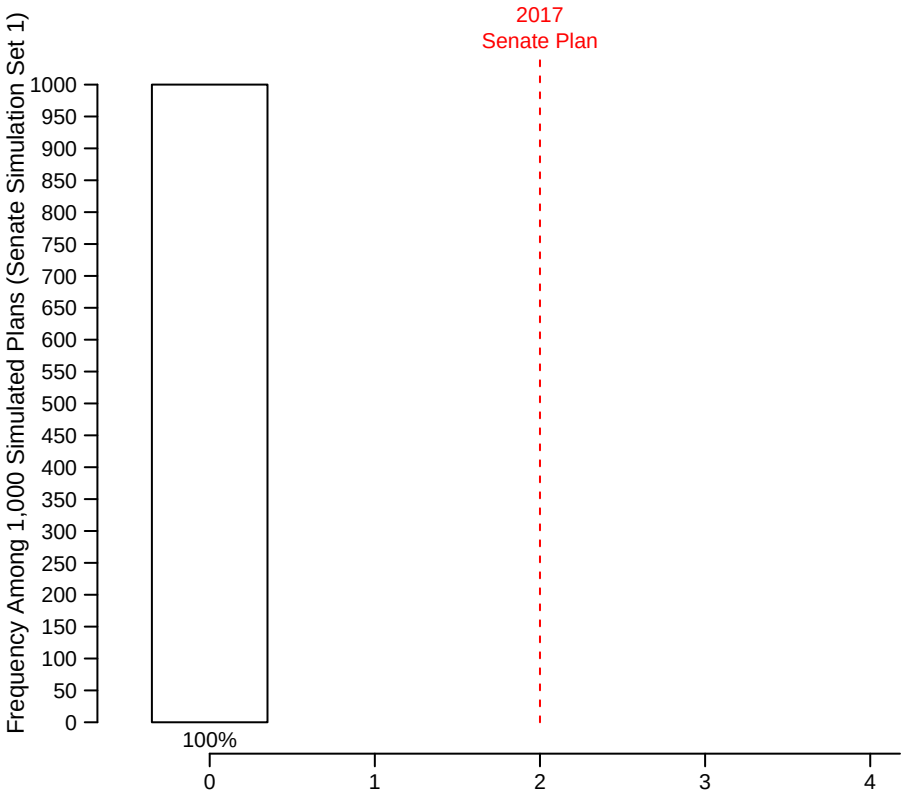


Number of Districts With At Least SD−11's Republican Vote Share of 57.3% in the Duplin−Harnett−Johnston−Lee−Nash−Sampson County Grouping (Measured Using Votes Summed Across 2010−2016 Statewide Elections)

Note: The Duplin−Harnett−Johnston−Lee−Nash−Sampson County Grouping includes the following 2017 Senate Plan districts: 10; 11; 12

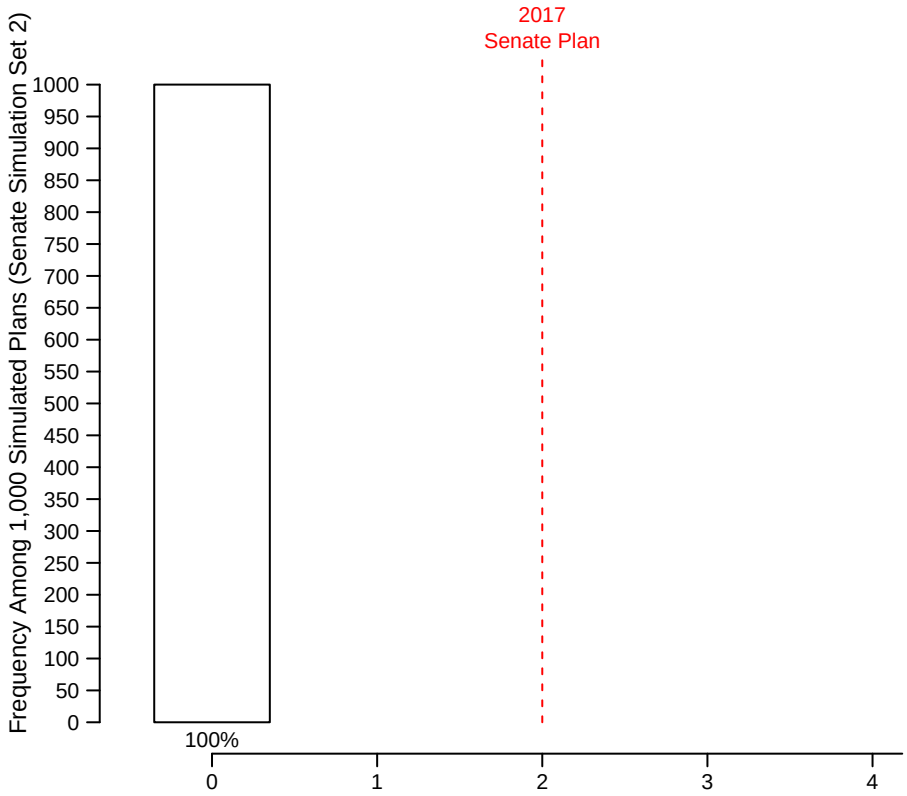
Figure 91:
Number of Senate Districts With At Least SD−17's Republican Vote Share of 55.33% in the Franklin−Wake County Grouping

Simulation Set 1



Number of Districts With At Least SD−17's Republican Vote Share of 55.33% in the Franklin−Wake County Grouping
(Measured Using Votes Summed Across 2010−2016 Statewide Elections)

Simulation Set 2

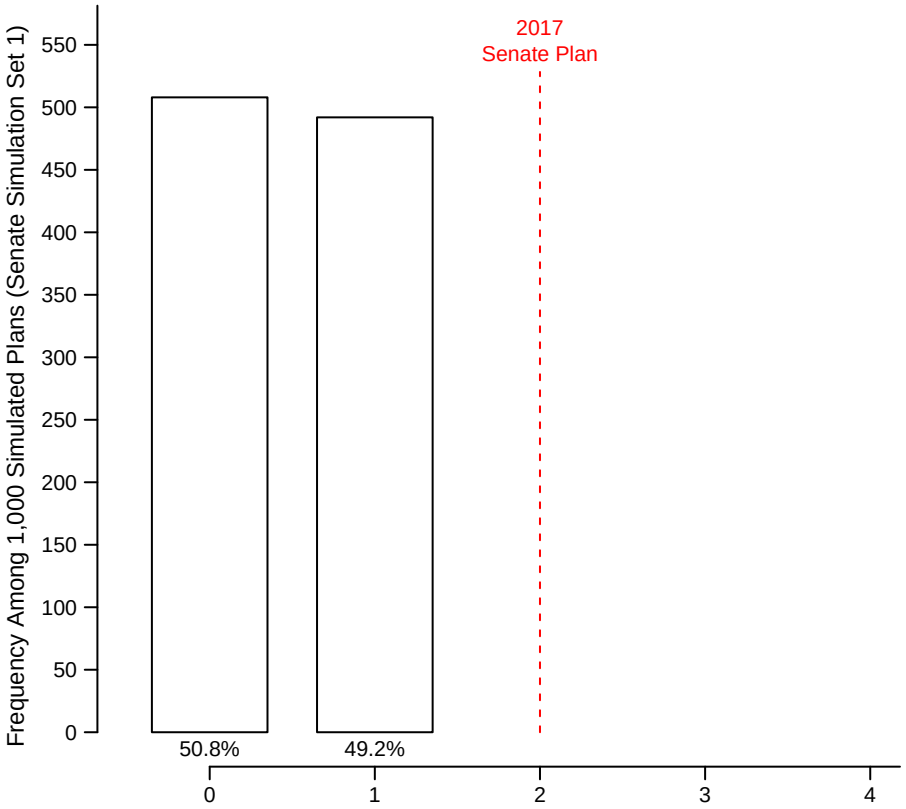


Number of Districts With At Least SD−17's Republican Vote Share of 55.33% in the Franklin−Wake County Grouping
(Measured Using Votes Summed Across 2010−2016 Statewide Elections)

Note: The Franklin−Wake County Grouping includes the following 2017 Senate Plan districts: 14; 15; 16; 17; 18

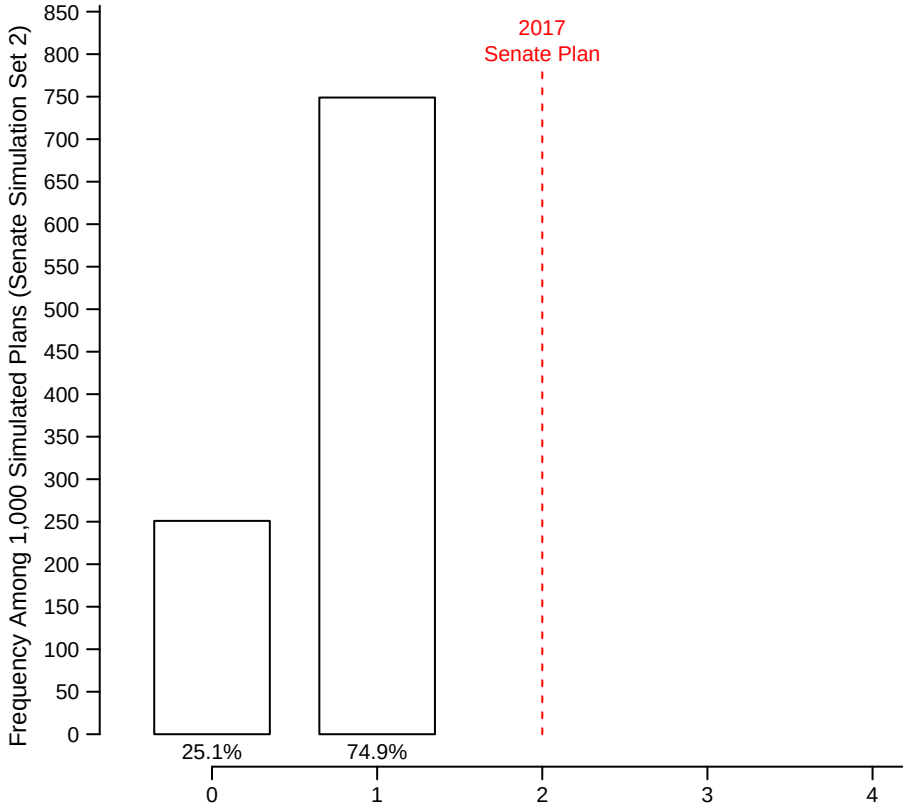
Figure 92:
Number of Senate Districts With At Least SD−41's Republican Vote Share of 52.43% in the Mecklenburg County Grouping

Simulation Set 1



Number of Districts With At Least SD−41's Republican Vote Share of 52.43% in the Mecklenburg County Grouping
(Measured Using Votes Summed Across 2010−2016 Statewide Elections)

Simulation Set 2

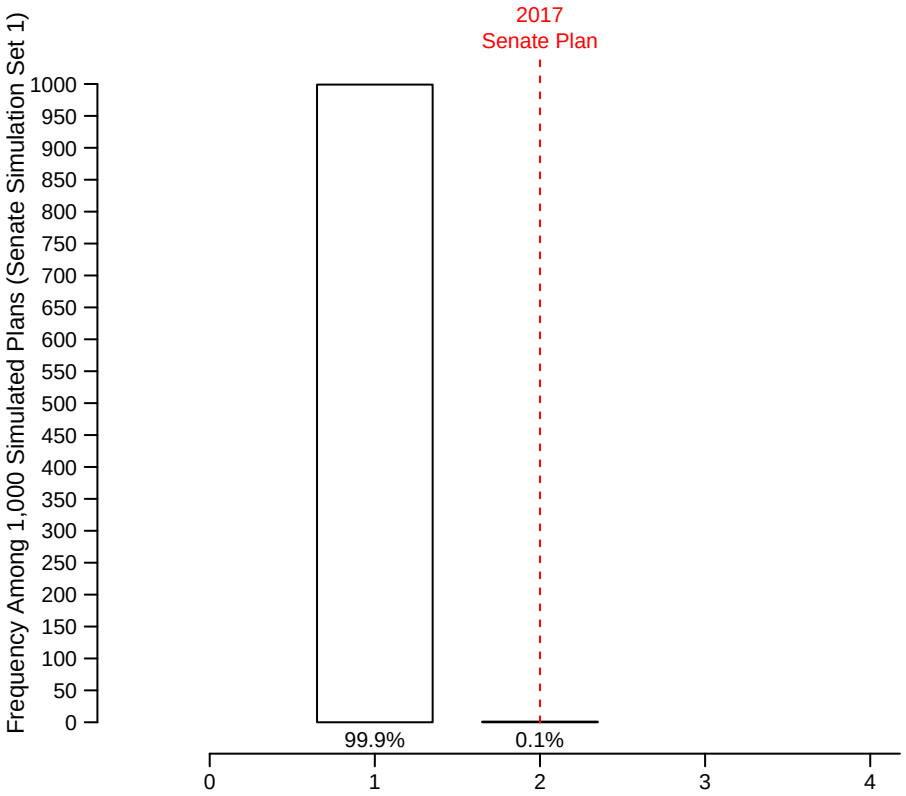


Number of Districts With At Least SD−41's Republican Vote Share of 52.43% in the Mecklenburg County Grouping
(Measured Using Votes Summed Across 2010−2016 Statewide Elections)

Note: The Mecklenburg County Grouping includes the following 2017 Senate Plan districts: 37; 38; 39; 40; 41

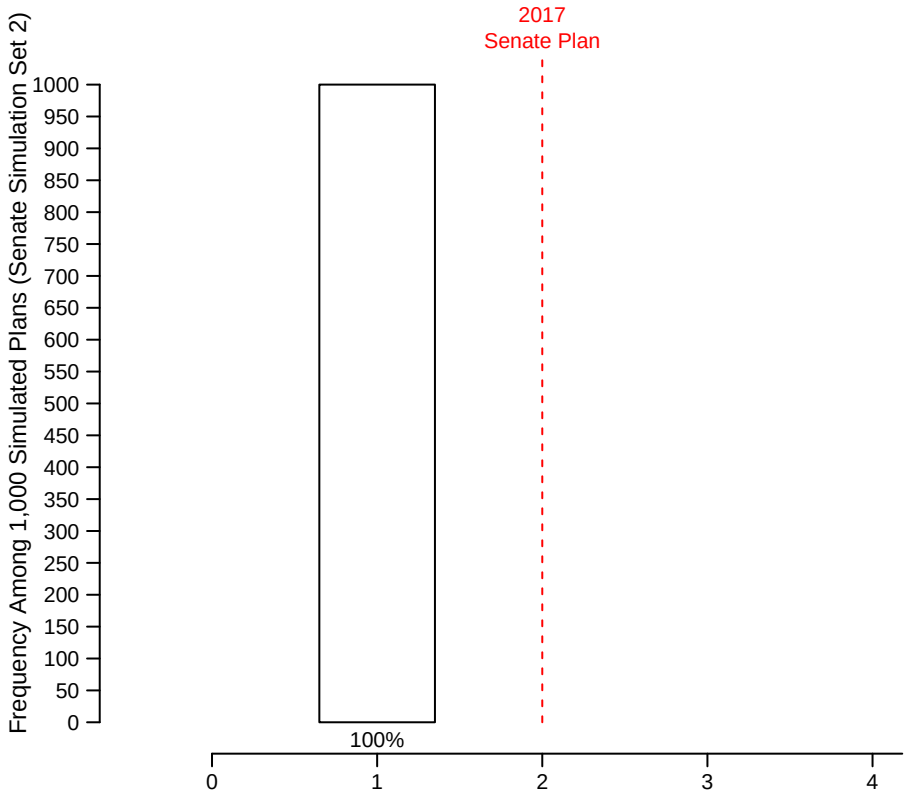
Figure 93:
Number of Senate Districts With At Least SD−8's Republican Vote Share of 50.11% in the Bladen−Brunswick−New Hanover−Pender County Grouping

Simulation Set 1



Number of Districts With At Least SD−8's Republican Vote Share of 50.11% in the Bladen−Brunswick−New Hanover−Pender County Grouping (Measured Using Votes Summed Across 2004−2010 Statewide Elections)

Simulation Set 2

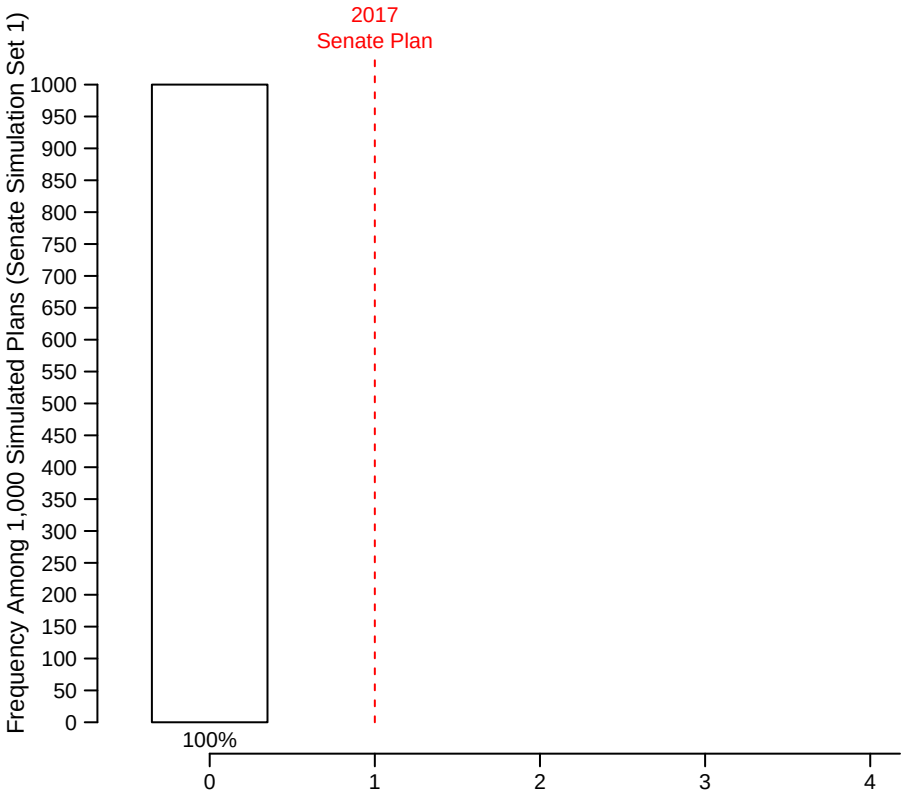


Number of Districts With At Least SD−8's Republican Vote Share of 50.11% in the Bladen−Brunswick−New Hanover−Pender County Grouping (Measured Using Votes Summed Across 2004−2010 Statewide Elections)

Note: The Bladen−Brunswick−New Hanover−Pender County Grouping includes the following 2017 Senate Plan districts: 8; 9

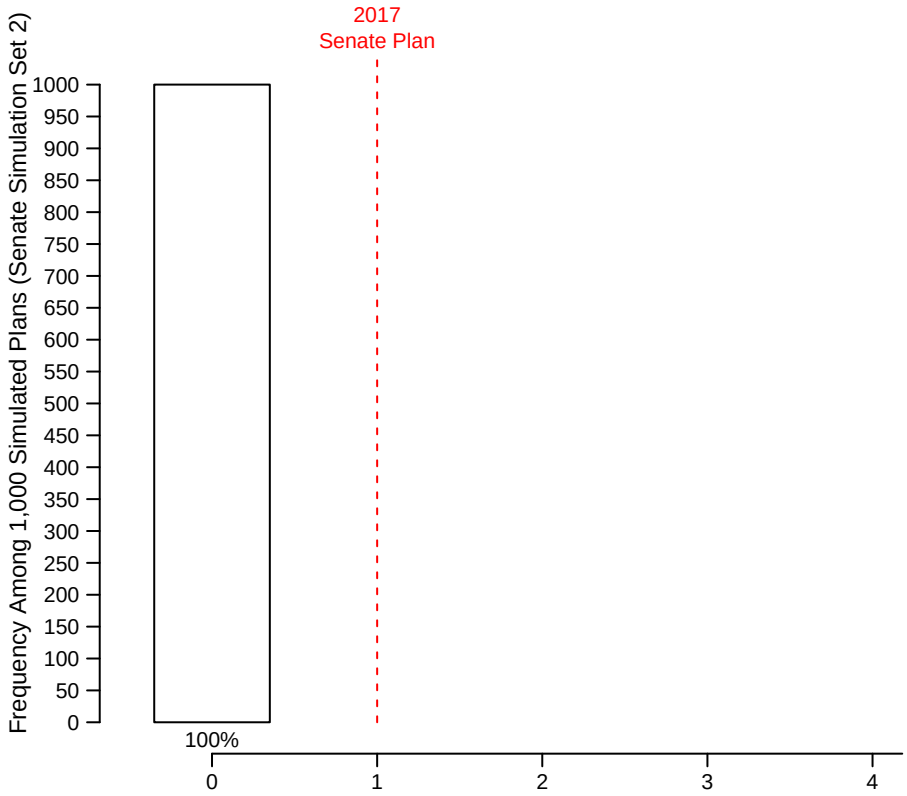
Figure 94:
Number of Senate Districts With At Least SD−48's Republican Vote Share of 57.21% in the Buncombe−Henderson−Transylvania County Grouping

Simulation Set 1



Number of Districts With At Least SD−48's Republican Vote Share of 57.21% in the Buncombe−Henderson−Transylvania County Grouping
(Measured Using Votes Summed Across 2004−2010 Statewide Elections)

Simulation Set 2



Number of Districts With At Least SD−48's Republican Vote Share of 57.21% in the Buncombe−Henderson−Transylvania County Grouping
(Measured Using Votes Summed Across 2004−2010 Statewide Elections)

Note: The Buncombe−Henderson−Transylvania County Grouping includes the following 2017 Senate Plan districts: 48; 49

Analysis of Plaintiffs' Districts in the Enacted Plans and the Computer-Simulated Plans

As an additional method of evaluating the actual partisan effect of the 2017 House Plan and the 2017 Senate Plan on the individual plaintiffs in this case, I evaluate the sort of House and Senate districts each plaintiff would have been placed into under the 4,000 computer-simulated plans, compared to the plaintiffs' actual districts under the enacted 2017 House and Senate Plans. Plaintiffs' counsel provided to me a list of the individual plaintiffs, along with their respective geocoded residential addresses. I used these addresses in order to identify the specific district that each plaintiff would have been located in under each computer-simulated plan, as well as under the 2017 House Plan and 2017 Senate Plan. For those plaintiffs who live in House or Senate districts that are within the selected county groupings I analyzed above, I analyze the partisan characteristics of the districts each plaintiff would typically have been districted into under the simulated plans. Figures 95 to 98 present the results of this analysis. These Figures each list the individual plaintiffs and describe the partisanship of each plaintiff's district of residence in the 2017 House Plan or Senate Plan, as well as in one of the sets of 1,000 simulated districting plans presented in this report. Specifically, Figure 95 describes each plaintiff's district of residence in the 2017 House Plan and compares it to the district the plaintiff would have resided in under each of the 1,000 simulated plans in House Simulation Set 1. Figure 96 describes each plaintiff's district of residence in the 2017 House Plan and compares it to the district the plaintiff would have resided in under each of the 1,000 simulated plans in House Simulation Set 2. Figure 97 describes each plaintiff's district of residence in the 2017 Senate Plan and compares it to the district the plaintiff would have resided in under each of the 1,000 simulated plans in Senate Simulation Set 1. And finally, Figure 98 describes each plaintiff's district of residence in the 2017 Senate Plan and compares it to the district the plaintiff would have resided in under each of the 1,000 simulated plans in Senate Simulation Set 2.

To explain these analyses with an example, Figure 95, which compares plaintiffs' districts in the 2017 House Plan to their districts under House Simulation Set 1 plans, is organized as follows: Each row in Figure 95 corresponds to a particular individual plaintiff. In the second row, describing plaintiff Vinod Thomas, the red star depicts the partisanship of the plaintiff's 2017 House Plan district (HD-98), as measured by Democratic vote share using the 2010-2016 Statewide Election Composite. The plaintiff's 2017 House Plan district numbered is also labeled in red, just above this red star. Finally, the 1,000 gray circles on this row depict the Democratic

vote share of each of the 1,000 simulated districts in which the plaintiff would have resided in each of the 1,000 simulated plans in House Simulation Set 1, based on that plaintiff's current home address. In the far right margin, to the right of each row, I list in parentheses how many of the 1,000 simulated plans would place the plaintiff in a more Republican-leaning district (on the left) and how many of the 1,000 simulations would place the plaintiff in a more Democratic-leaning district (on the right) than the plaintiff's 2017 House Plan district. Thus, for example, the second row of Figure 95 reports that 99.4% of the 1,000 computer-simulated plans in House Simulation Set 1 would have placed plaintiff Vinod Thomas in a more Democratic-leaning district than his actual 2017 House Plan district (HD-98). Only 0.6% of the simulations would have placed Vinod Thomas in a more Republican-leaning district. Therefore, using a standard threshold test of 95% for statistical significance, I can conclude that Vinod Thomas' 2017 House Plan district is a partisan statistical outlier when compared to Vinod Thomas' district under the 1,000 House Simulation Set 1 plans.

Hence, this Figure allows me to identify plaintiffs whose 2017 House Plan districts are partisan outliers compared to the computer-simulated districts in which the plaintiff would have been placed under House Simulation Set 1. I am also able to identify how the partisanship of the plaintiffs' districts would have been different under the simulated plans, as compared to under the 2017 House Plan.

In Figures 97 and 98, I perform the same analysis for the Senate districts that individual plaintiffs' would be placed into under the simulated Senate plans in Senate Simulation Set 1 and Senate Simulation Set 2. I compare the partisanship of the plaintiffs' districts under the 2017 Senate Plan to the partisanship of plaintiffs' districts under the 1,000 simulated plans in Senate Simulation Set 1 (Figure 97) and the 1,000 simulated plans in Senate Simulation Set 2 (Figure 98).

Figure 95:
House Simulation Set 1

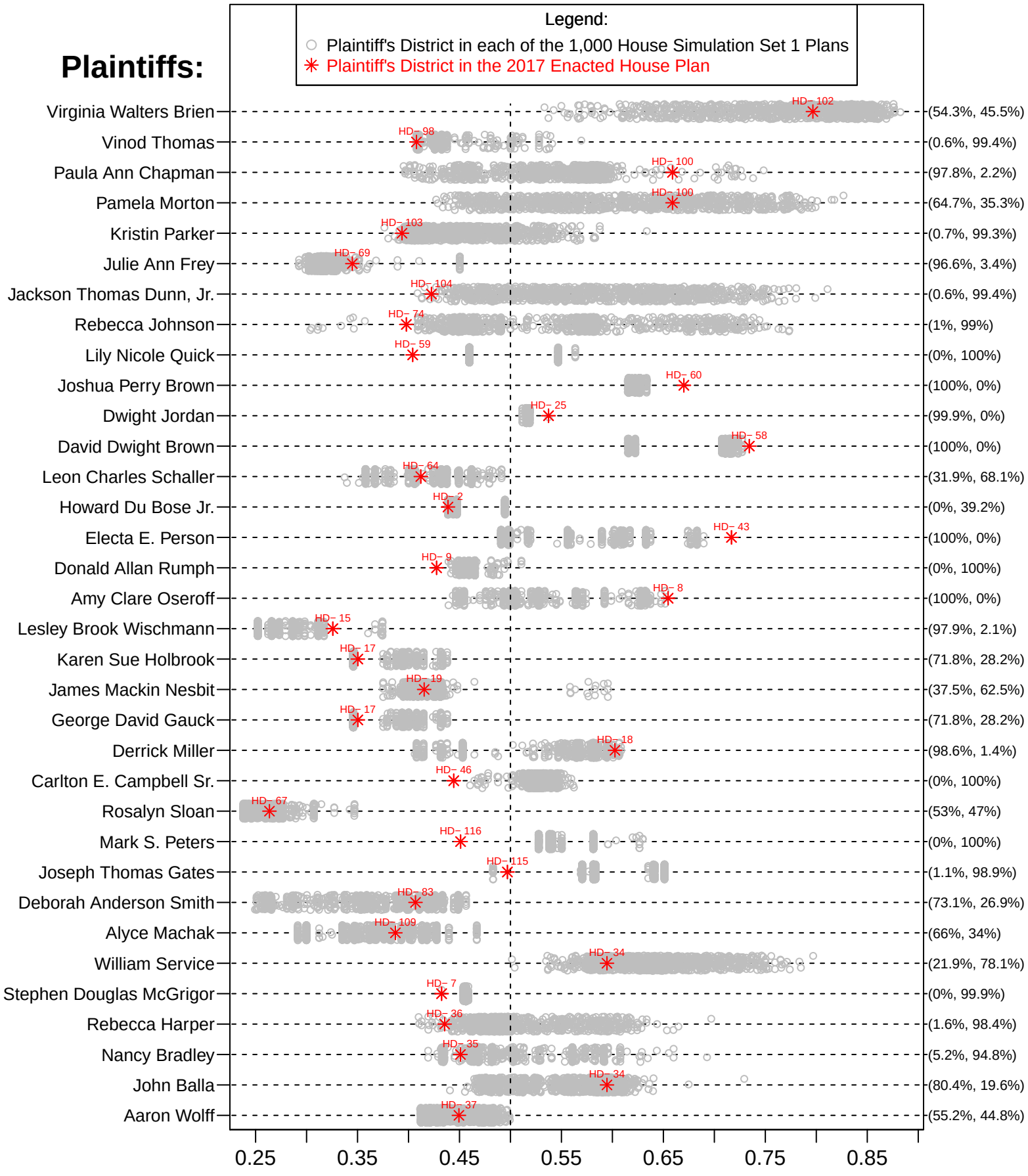


Figure 96:
House Simulation Set 2

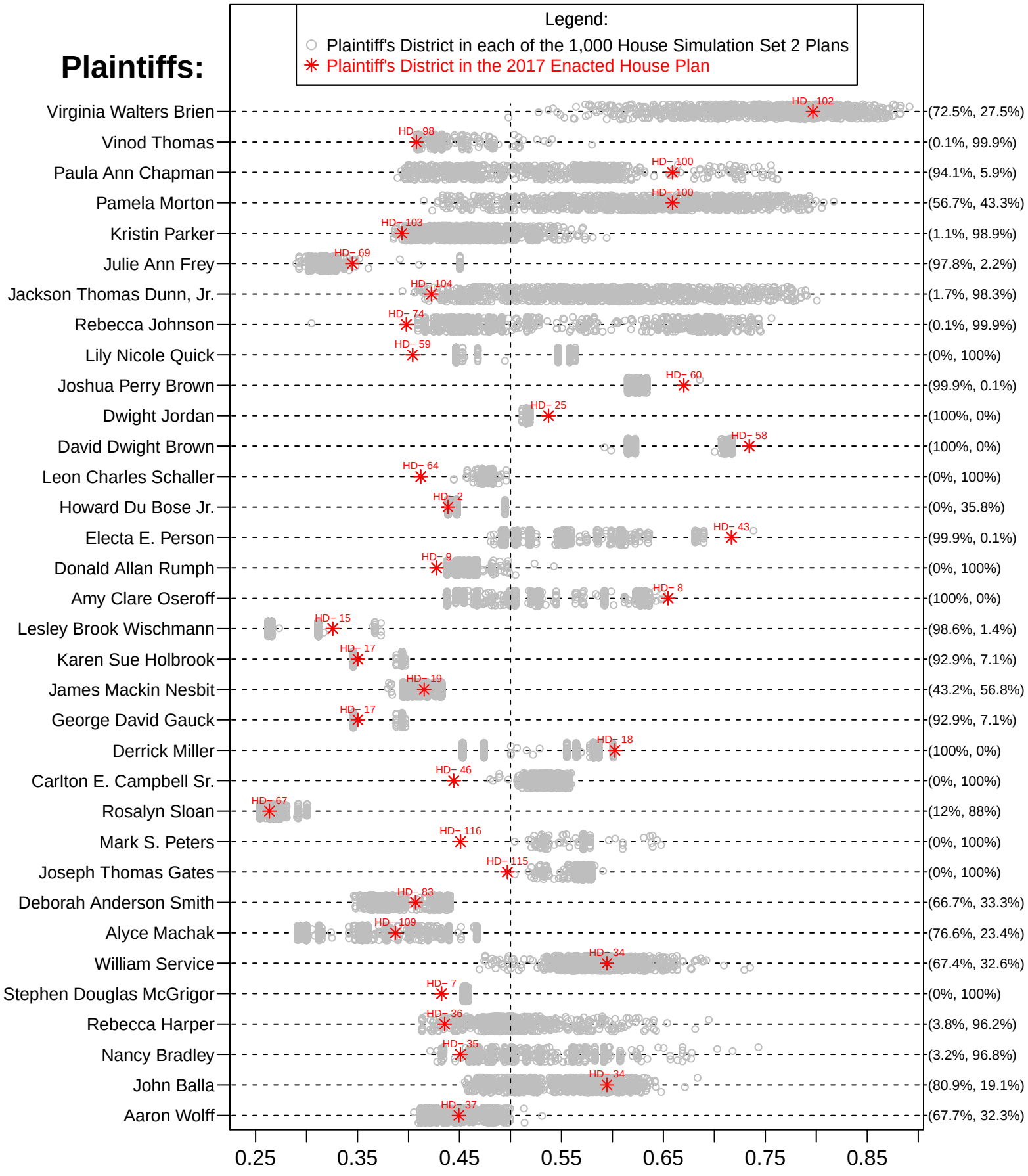


Figure 97:
Senate Simulation Set 1

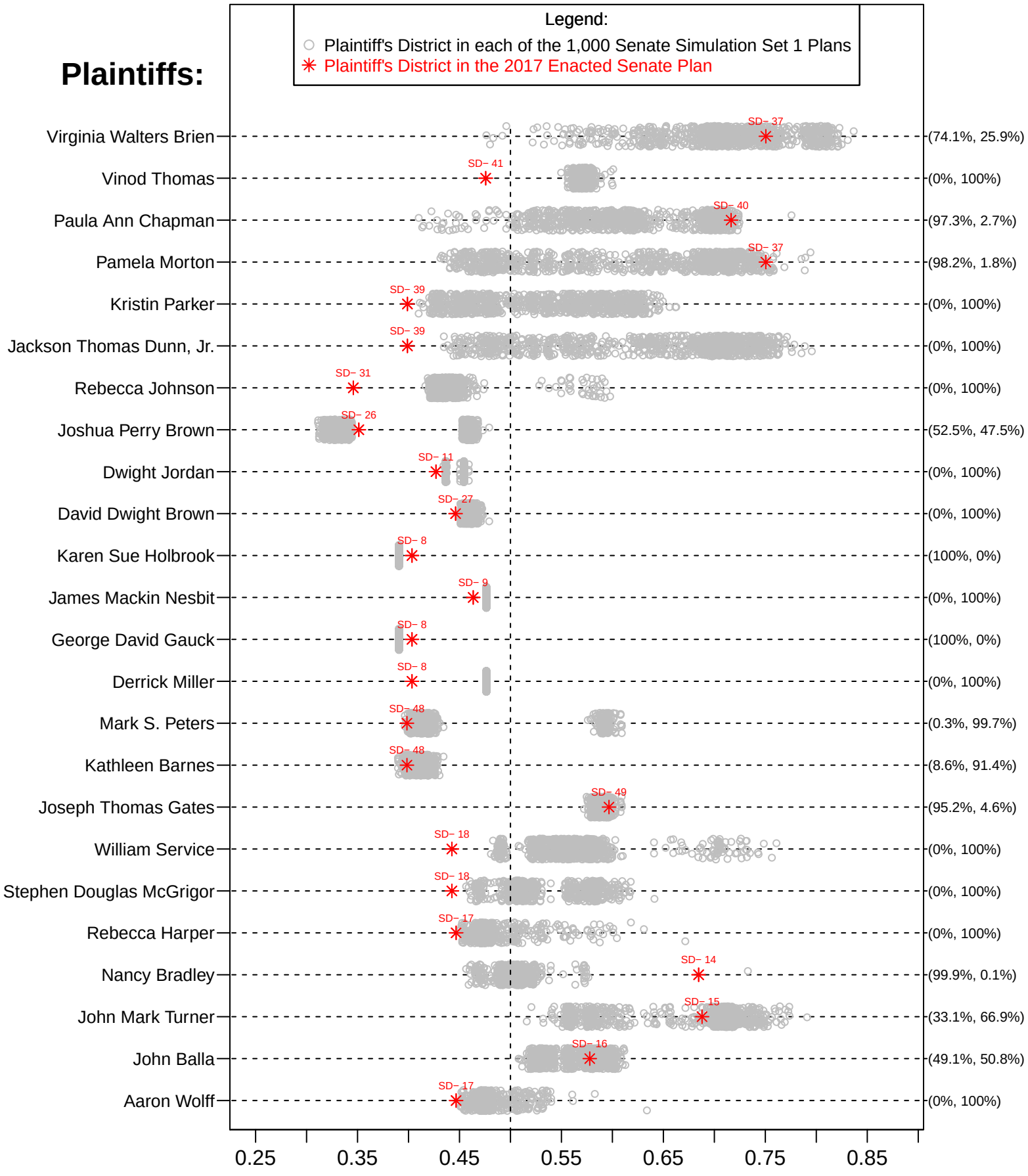
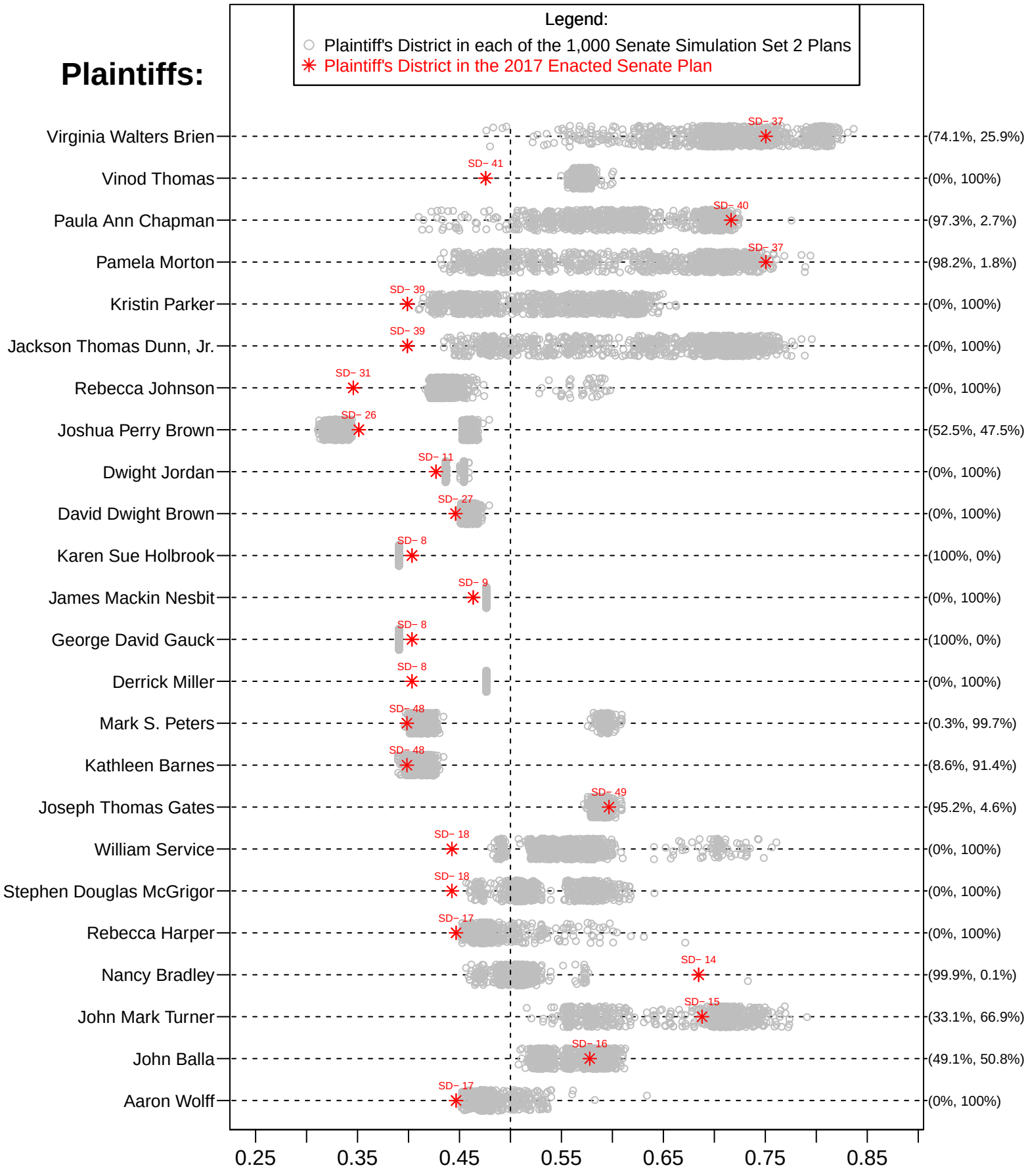


Figure 98:
Senate Simulation Set 2

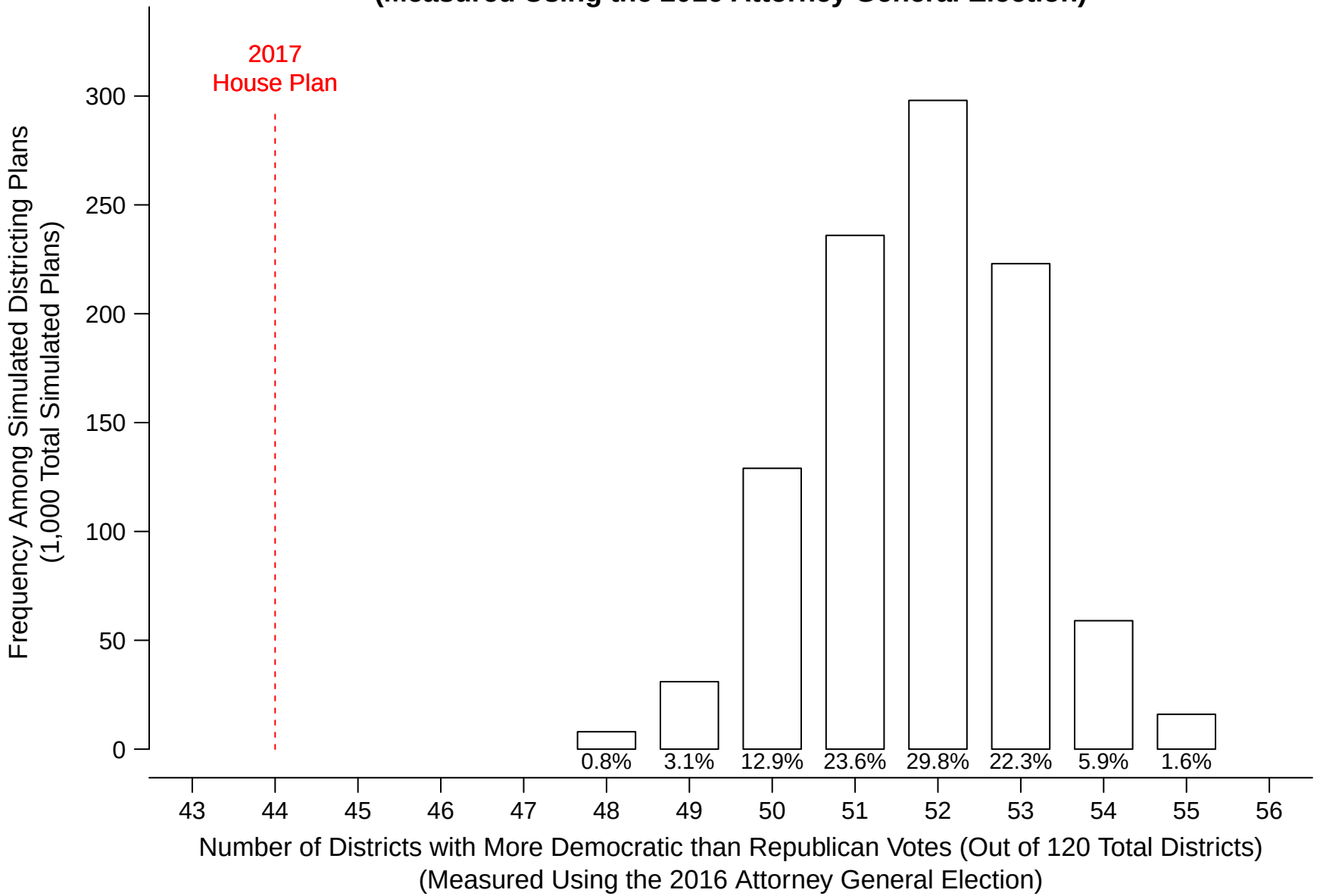


I declare under penalty of perjury under the laws of the United States that the foregoing is true and correct to the best of my knowledge.

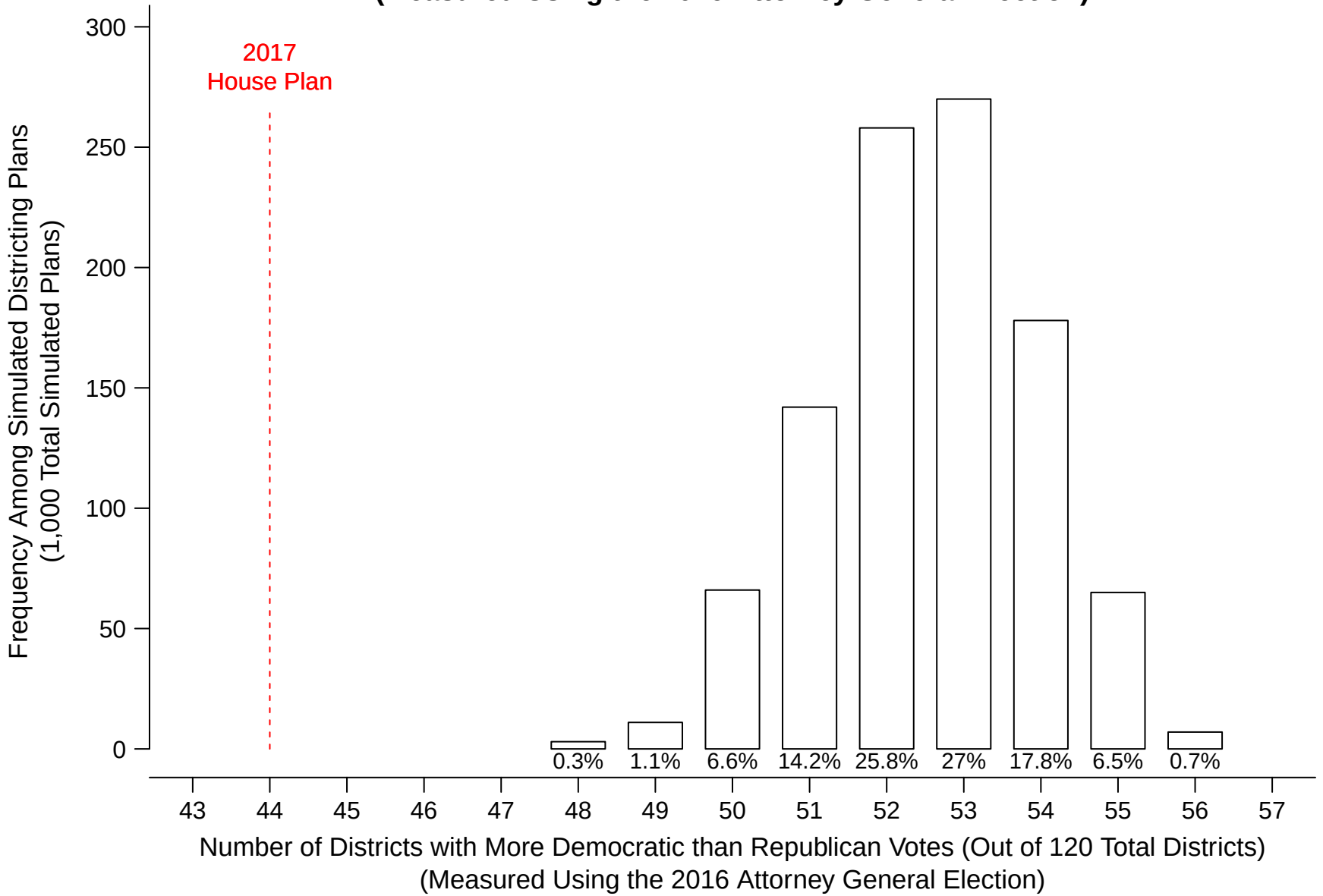
This 8th day of April, 2019.

Jowei Chen

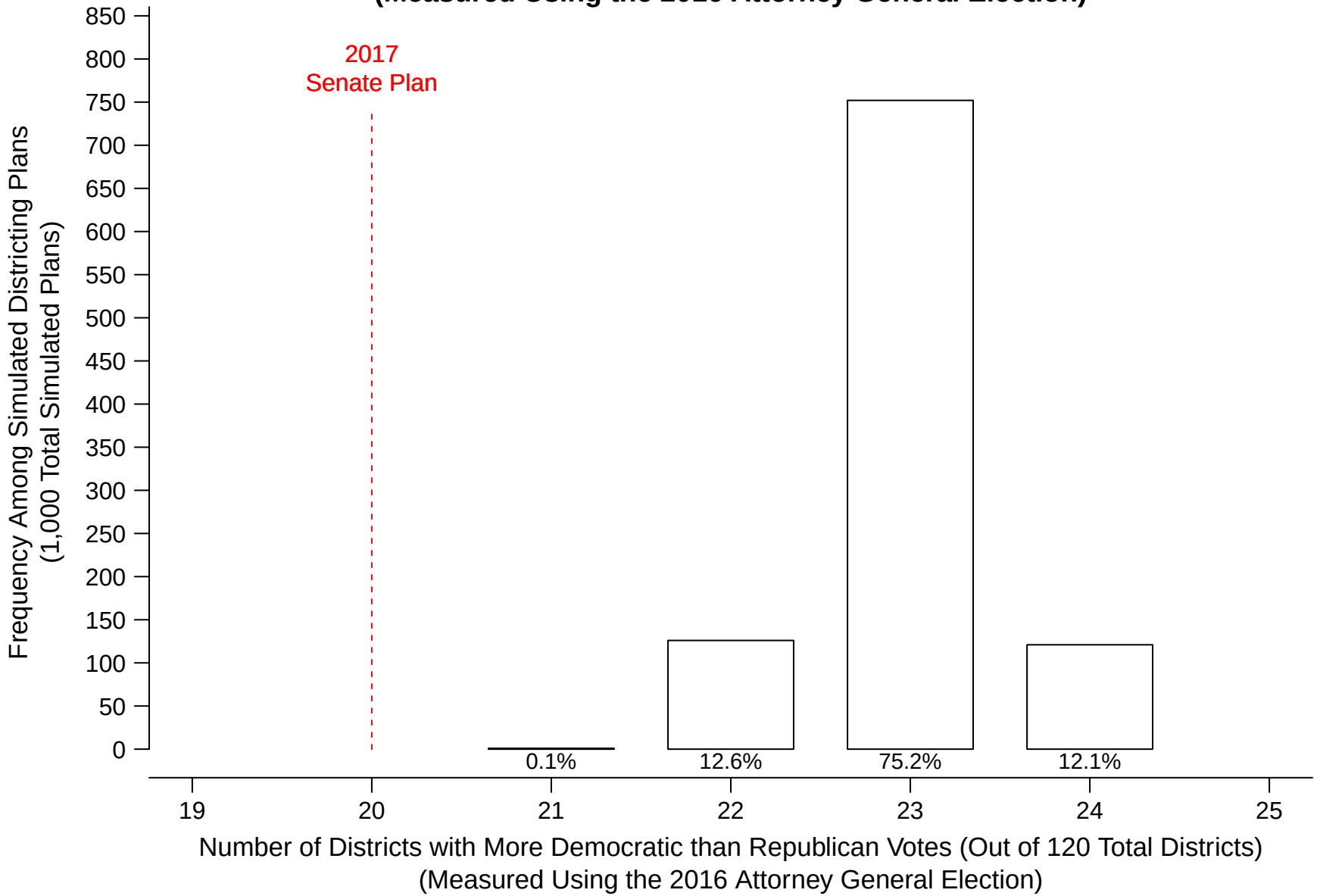
Appendix A, Figure A1:
House Simulation Set 1 (Following Only Non−Partisan Redistricting Criteria):
Democratic−Favoring Districts in 2017 House Plan Versus 1,000 Simulated Plans
(Measured Using the 2016 Attorney General Election)



Appendix A, Figure A2:
House Simulation Set 2 (Following Non−Partisan Redistricting Criteria and Avoiding Incumbent Pairings):
Democratic−Favoring Districts in 2017 House Plan Versus 1,000 Simulated Plans
(Measured Using the 2016 Attorney General Election)



Appendix A, Figure A3:
Senate Simulation Set 1 (Following Only Non−Partisan Redistricting Criteria):
Democratic−Favoring Districts in 2017 Senate Plan Versus 1,000 Simulated Plans
(Measured Using the 2016 Attorney General Election)



Appendix A, Figure A4:
Senate Simulation Set 2 (Following Non−Partisan Redistricting Criteria and Avoiding Incumbent Pairings): Democratic−Favoring Districts in 2017 Senate Plan Versus 1,000 Simulated Plans (Measured Using the 2016 Attorney General Election)

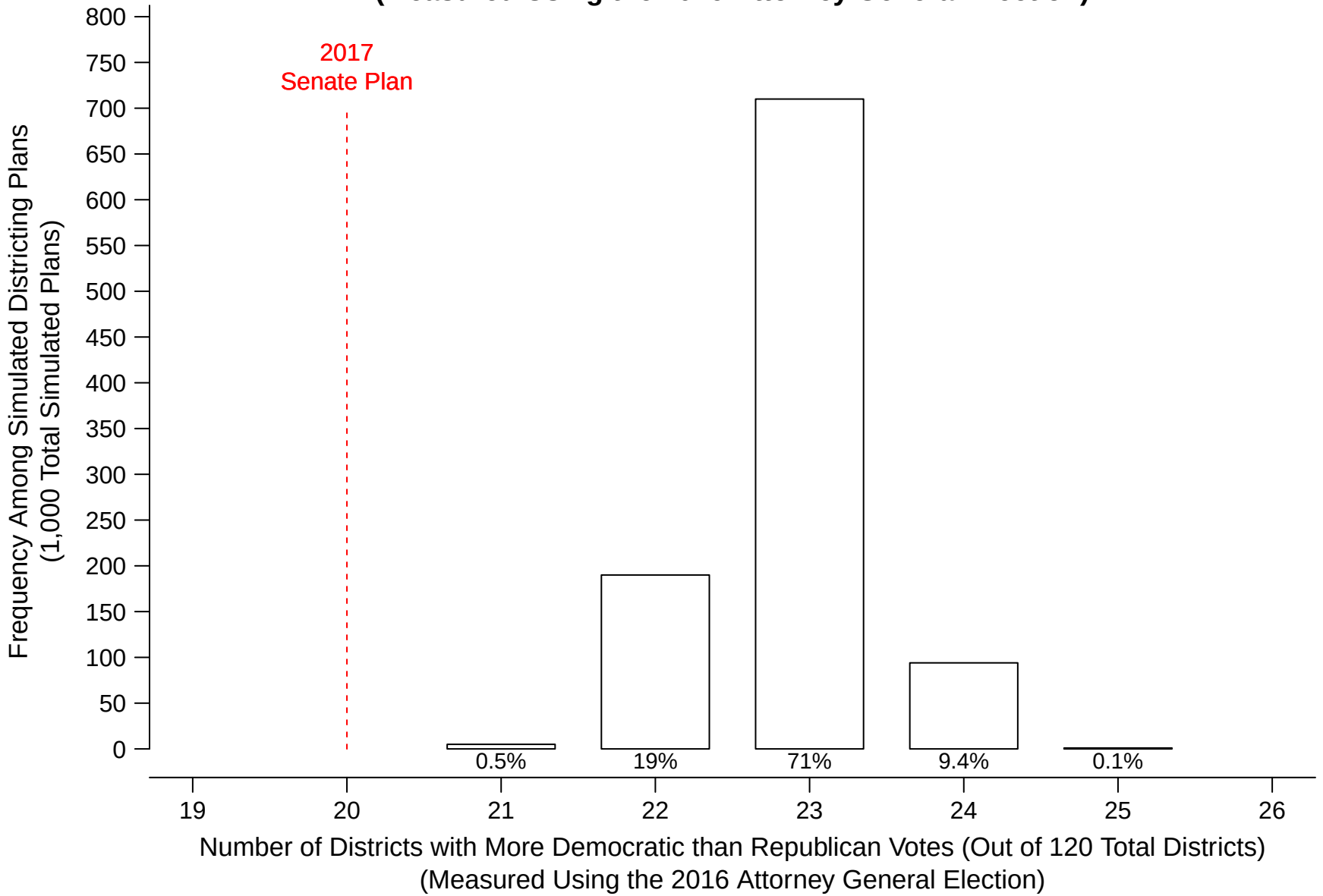


EXHIBIT A

Jowei Chen
Curriculum Vitae

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Academic Positions:
Associate Professor (2015-present), Assistant Professor (2009-2015), Department of Political Science, University of Michigan.
Faculty Associate, Center for Political Studies, University of Michigan, 2009 – Present.
W. Glenn Campbell and Rita Ricardo-Campbell National Fellow, Hoover Institution, Stanford University, 2013.
Principal Investigator and Senior Research Fellow, Center for Governance and Public Policy Research, Willamette University, 2013 – Present.

Education:
Ph.D., Political Science, Stanford University (June 2009)
M.S., Statistics, Stanford University (January 2007)
B.A., Ethics, Politics, and Economics, Yale University (May 2004)

Publications:

Chen, Jowei and Neil Malhotra. 2007. "The Law of k/n: The Effect of Chamber Size on Government Spending in Bicameral Legislatures."
***American Political Science Review*. 101(4): 657-676.**

Chen, Jowei, 2010. "The Effect of Electoral Geography on Pork Barreling in Bicameral Legislatures."
***American Journal of Political Science*. 54(2): 301-322.**

Chen, Jowei, 2013. "Voter Partisanship and the Effect of Distributive Spending on Political Participation."
***American Journal of Political Science*. 57(1): 200-217.**

Chen, Jowei and Jonathan Rodden, 2013. "Unintentional Gerrymandering: Political Geography and Electoral Bias in Legislatures"
***Quarterly Journal of Political Science*, 8(3): 239-269.**

Bradley, Katharine and Jowei Chen, 2014. "Participation Without Representation? Senior Opinion, Legislative Behavior, and Federal Health Reform."

***Journal of Health Politics, Policy and Law*. 39(2), 263-293.**

Chen, Jowei and Tim Johnson, 2015. "Federal Employee Unionization and Presidential Control of the Bureaucracy: Estimating and Explaining Ideological Change in Executive Agencies."
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Bonica, Adam, Jowei Chen, and Tim Johnson, 2015. "Senate Gate-Keeping, Presidential Staffing of 'Inferior Offices' and the Ideological Composition of Appointments to the Public Bureaucracy."
***Quarterly Journal of Political Science*. Volume 10, No. 1: 5-40.**

Chen, Jowei and Jonathan Rodden, 2015. "Redistricting Simulations and the Detection Cutting through the Thicket: of Partisan Gerrymanders."
***Election Law Journal*. Volume 14, Number 4: 331-345.**

Chen, Jowei and David Cottrell, 2016. "Evaluating Partisan Gains from Congressional Gerrymandering: Using Computer Simulations to Estimate the Effect of Gerrymandering in the U.S. House."
***Electoral Studies*. Volume 44 (December 2016): 329-340.**

Chen, Jowei, 2017. "Analysis of Computer-Simulated Districting Maps for the Wisconsin State Assembly."
Forthcoming 2017, *Election Law Journal*.

Non-Peer-Reviewed Publication:

Chen, Jowei and Tim Johnson. 2017. "Political Ideology in the Bureaucracy."
***Global Encyclopedia of Public Administration, Public Policy, and Governance*.**

Chen, Jowei. October 4, 2017. Time Magazine Op-Ed.
http://time.com/4965673/wisconsin-supreme-court-gerrymandering-research/

Chen, Jowei and Jonathan Rodden. January 2014. New York Times Op-Ed.
https://www.nytimes.com/2014/01/26/opinion/sunday/its-the-geography-stupid.html

Research Grants:

Principal Investigator. National Science Foundation Grant SES-1459459, September 2015 – August 2018 ($165,008). "The Political Control of U.S. Federal Agencies and Bureaucratic Political Behavior."

"Economic Disparity and Federal Investments in Detroit," (with Brian Min) 2011. Graham Institute, University of Michigan ($30,000).

"The Partisan Effect of OSHA Enforcement on Workplace Injuries," (with Connor Raso) 2009. John M. Olin Law and Economics Research Grant ($4,410).

Invited Talks:

September, 2011. University of Virginia, American Politics Workshop.
October 2011. Massachusetts Institute of Technology, American Politics Conference.
January 2012. University of Chicago, Political Economy/American Politics Seminar.
February 2012. Harvard University, Positive Political Economy Seminar.
September 2012. Emory University, Political Institutions and Methodology Colloquium.
November 2012. University of Wisconsin, Madison, American Politics Workshop.
September 2013. Stanford University, Graduate School of Business, Political Economy Workshop.
February 2014. Princeton University, Center for the Study of Democratic Politics Workshop.
November 2014. Yale University, American Politics and Public Policy Workshop.
December 2014. American Constitution Society for Law & Policy Conference: Building the Evidence to Win Voting Rights Cases.
February 2015. University of Rochester, American Politics Working Group.
March 2015. Harvard University, Voting Rights Act Workshop.
May 2015. Harvard University, Conference on Political Geography.
Octoer 2015. George Washington University School of Law, Conference on Redistricting Reform.
September 2016. Harvard University Center for Governmental and International Studies, Voting Rights Institute Conference.
March 2017. Duke University, Sanford School of Public Policy, Redistricting Reform Conference.
October 2017. Willamette University, Center for Governance and Public Policy Research
October 2017, University of Wisconsin, Madison. Geometry of Redistricting Conference.

Conference Service:

Section Chair, 2017 APSA (Chicago, IL), Political Methodology Section
Discussant, 2014 Political Methodology Conference (University of Georgia)
Section Chair, 2012 MPSA (Chicago, IL), Political Geography Section.
Discussant, 2011 MPSA (Chicago, IL) "Presidential-Congressional Interaction."
Discussant, 2008 APSA (Boston, MA) "Congressional Appropriations."
Chair and Discussant, 2008 MPSA (Chicago, IL) "Distributive Politics: Parties and Pork."

Reviewer Service:

American Journal of Political Science
American Political Science Review
Journal of Politics
Quarterly Journal of Political Science

American Politics Research
Legislative Studies Quarterly
State Politics and Policy Quarterly
Journal of Public Policy
Journal of Empirical Legal Studies
Political Behavior
Political Research Quarterly
Political Analysis
Public Choice
Applied Geography

Exhibit 2

Expert Report on North Carolina's General Assembly Districts

Christopher A. Cooper

April 8, 2019

Introduction

My name is Christopher A. Cooper. I have been retained to analyze data and provide my expert opinions related to North Carolina politics and geography, as it pertains to the current General Assembly districting plans in North Carolina enacted in 2017 and used in the 2018 election.

I am currently Professor and Department Head of Political Science and Public Affairs at Western Carolina University in Cullowhee, North Carolina, a university that I have served since 2002. I hold a PhD and MA in Political Science from the University of Tennessee, Knoxville and a BA in Political Science and Sociology from Winthrop University. My academic research focuses on state politics and policy, and southern politics—particularly in North Carolina. To date, I have published over 50 academic journal articles and scholarly book chapters, co-edited one book and co-authored another (both with the University of North Carolina Press). I teach courses on state and local politics, political parties, campaigns and elections, southern politics, and research methods. In 2013, I was named North Carolina Professor of the Year by the Carnegie Foundation for the Advancement of Teaching and I have received Western Carolina University's highest awards in teaching (Board of Governors Teaching Award) and scholarship (University Scholar).

Much of my academic research relates directly to North Carolina politics and policy, including my co-edited book, *The New Politics of North Carolina*, and my co-authored book chapters, "North Carolina: Still Swingin' in the South," "The Bluest Red State in America: Exploring North Carolina's Political Past, Present, and Future" (both of which appeared in editions of *Presidential Swing States: Why Only Ten States Matter*) as well as "The People's Branch: Reassessing the N.C. General Assembly," "Traditionalism and Progressivism in North Carolina," and "Rethinking Progressivism and Governance in North Carolina" (all three of which appeared in *The New Politics of North Carolina*).

I have been quoted and interviewed for a variety of state and national media outlets about North Carolina politics including *The New York Times*, *The Washington Post*, *Politico*, CNN, *The News and Observer* (Raleigh), *The Charlotte Observer*, and National Public Radio (national,

as well as outlets in Asheville, Charlotte, and Chapel Hill). I have also written 87 op-eds for media outlets including CNN.com, *The News and Observer* (Raleigh), *The Charlotte Observer*, and *The Asheville Citizen-Times* and have given dozens of talks about North Carolina politics and policy to groups ranging from the North Carolina City and County Management Association, to the North Carolina Government Finance Officers Association. I have also given talks about redistricting and gerrymandering in North Carolina to a variety of groups in the state, including the Asheville Chamber of Commerce. I have not testified as an expert witness in any prior cases. My Curriculum Vitae is attached as Exhibit A to this report.

I am being compensated at a rate of $220 per hour by the firm Arnold & Porter Kaye Scholer LLP.

North Carolina is a state defined by ideologically moderate, two-party politics among its voters and in most of its elected offices. Since the 2010 election, however, the partisan composition of the North Carolina General Assembly has stood in stark contrast to these other offices and in contrast to the will of the voters. For the first time since Reconstruction, Republicans took over majority control of the General Assembly in 2010 and, in the first election following the 2011 redistricting cycle, increased that majority to a supermajority in 2012. These changes made the General Assembly a rarity in North Carolina politics—an elected institution where Democrats have virtually no chance of electoral parity. After considering aggregate and district level data and the geographic boundaries of the districts, I have concluded that this radical shift in the partisan balance of the General Assembly is due, in large part, to partisan gerrymandering. These effects were initially felt following the 2011 round of redistricting and have continued with the new maps instituted in 2017. This gerrymandering has produced a state where the citizens (who are, on average, politically moderate) are represented by a state legislature that produces consistently conservative policies.

Summary of Key Findings

- In the aggregate, North Carolinians are best described as ideologically moderate. The state includes similar numbers of liberal, Democratic-leaning voters and conservative, Republican-leaning voters.

- North Carolina has consistently experienced competitive elections for statewide offices and North Carolinians have elected both Democrats and Republicans to statewide offices in recent years.

- At the same time, the North Carolina General Assembly remains dominated by the Republican Party.

- The current General Assembly districts “pack” Democratic leaning voters into a small number of districts, thus producing a few Democratic districts with large electoral margins. The current district lines “crack” the remaining Democratic voters across the remaining districts, so that Democratic voters cannot comprise a majority of any of those

districts. Conversely, the current maps are drawn so Republican voters are distributed more evenly and efficiently across districts. These practices ultimately result in large Republican advantages in seats in the General Assembly—advantages that far outweigh the Republicans' share of the aggregate vote between the two parties. These maps have led to a General Assembly that does not represent the will of the people of the state.

- The current General Assembly districts unnecessarily split municipalities, VTDs,[1] and communities of interest in order to reduce the voice of Democrats in the General Assembly.

- The gap in representation between public opinion of the people and policies passed by North Carolina's state government is among the largest in the country.

North Carolina's Political Moderation

North Carolina has long been known for political moderation and two-party politics, particularly when compared to the rest of the American South. In 1960, political scientist V.O. Key described North Carolina as a "progressive plutocracy," with a mood that is "at odds with the rest of the South." Key continued by noting that North Carolina "enjoys a reputation for progressive outlook and action in many phases of life."[2] This reputation for progressivism and the promise of two-party politics seemed to be borne out a half century later. On the precipice of the 21st century, North Carolina journalist Rob Christensen and Wake Forest University political science Professor Jack D. Fleer noted that the state enjoys "two strong and competitive parties." Christensen and Fleer then prognosticated that "for the foreseeable future, control of political power is most likely to alternate irregularly between them as both short-and long-term forces buttress ongoing political change in the Tar Heel State."[3] More recent work examining the state's politics reinforces this notion of strong two-party competition. J. Michael Bitzer and Charles

[1] A "VTD" is the generic term used by the Census Bureau to refer to a "voting tabulation district," which may "include a wide variety of small polling areas, such as election districts, precincts, or wards."

[2] Key, V.O., Jr., *Southern Politics in State and Nation* (Knoxville: University of Tennessee Press, 1960), 205.

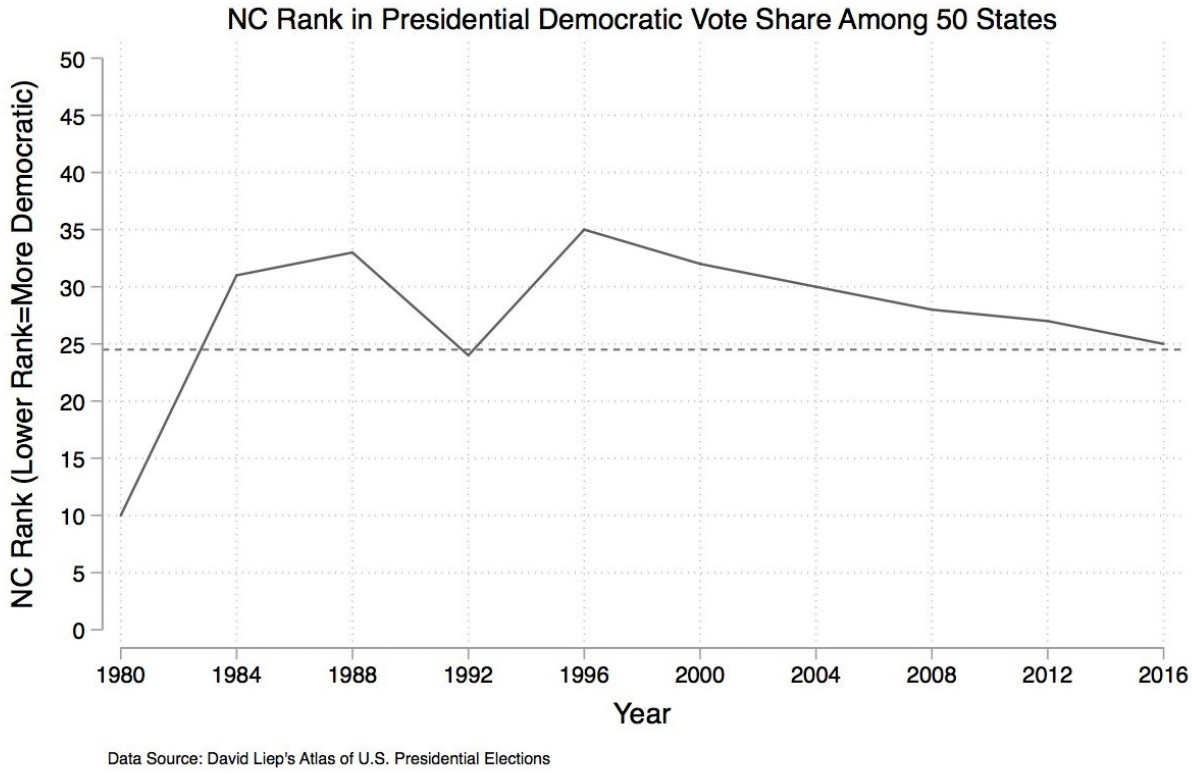
[3] Christensen, Rob, and Jack D. Fleer, "North Carolina: Between Helms and Hunt No Majority Emerges," in Alexander P. Lamis, ed. *Southern Politics in the 1990s* (Baton Rouge: Louisiana State University Press, 1999), 106.

Prysby note that "North Carolina elections have been very competitive in the twenty-first century. Either party appears quite capable of winning majority statewide races."[4]

Moderation in Presidential Vote

One way to gauge the state's relative moderation is simply to look at electoral results from races where gerrymandering is not possible—races where people are elected at the state level, rather than by districts that are subject to gerrymandering. The most prominent example of such an election is the U.S. presidential election. Examining which candidate won or lost is helpful, but it does not account for nationwide trends that may contribute to the result, and it can overstate small shifts (for example, the shift between 2008, when North Carolina voted for Democrat Barack Obama by a small margin, and 2012, when North Carolina supported Republican Mitt Romney by a similarly small margin). To avoid these problems, the figure below plots North Carolina's presidential election results as ranked alongside those from other states, ranging from the state where the Democratic candidate received the largest vote share (1) to the state where the Democratic candidate received the smallest vote share (50). Here we see that North Carolina is best described as a competitive state populated by citizens who, on average, make fairly moderate electoral choices. In 2000, North Carolina had the 32nd highest vote share for the Democratic candidate for president. In 2004, Democratic presidential candidate John Kerry received his 30th highest vote share in North Carolina. In 2008, then-presidential candidate Barack Obama's vote share in North Carolina was 28th highest in the country. In 2012, incumbent President Obama's vote share in North Carolina was 27th highest in the country. Finally, in the 2016 presidential election, North Carolina had the 26th highest Democratic vote share in the country.

[4] Bitzer, J. Michael, and Charles Prysby, "North Carolina: A Growing Political Divide," in *The New Politics of the Old South: An Introduction to Southern Politics* (Washington DC: CQ Press, 2018), 192.



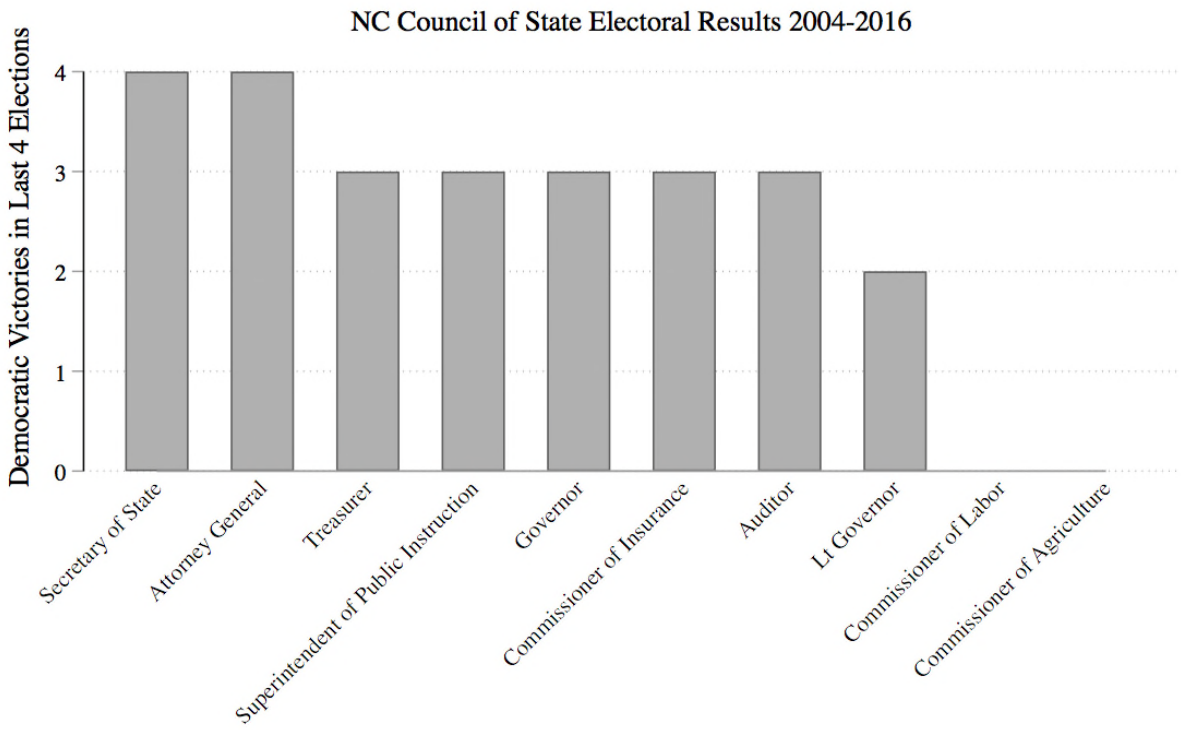
Moderation at the Council of State

North Carolina has two sets of executive branch officials—the Cabinet and the Council of State. While the Cabinet is made up solely of gubernatorial appointments, the Council of State consists of the heads of ten executive branch departments, all of whom are elected by the citizens in statewide partisan elections, conducted every four years. These Council of State officials include the Governor, Lieutenant Governor, Secretary of State, State Auditor, State Treasurer, Superintendent of Public Instruction, Attorney General, Commissioner of Agriculture, Commissioner of Labor, and Commissioner of Insurance. With the exception of the Governor and Lieutenant Governor, these offices are not particularly well-known[5] and thus can serve as a good proxy for voter intent.

The results of recent Council of State elections demonstrate once again that North Carolina voters have fairly moderate preferences and do not favor either party by a large share.

[5] While this is generally true, there is a case to be made that the Commissioner of Labor, Cherie Berry, has greater name recognition than the rest of the Council of State due to her picture appearing on every elevator in the state of North Carolina. Smith, Jacob F.H., and Neil Weinberg, "The Elevator Effect: Advertising, Priming, and the Rise of Cherie Berry," *American Politics Research* 4, no. 3 (2016): 496-522.

In fact, the last two cycles of Council of State elections (2016 and 2012) resulted in ten Republican wins and ten Democratic wins. Combining these results with the two previous election cycles (2008 and 2004) yields a total of 25 Democratic victories and 15 Republican victories. The figure below displays these results for each office in the Council of State over the last four elections. As you can see, only the Commissioner of Labor and Commissioner of Agriculture races have been dominated by Republicans. Both parties have split the Lt. Governor elections in the last four election cycles, whereas the Democrats have won three out of the last four elections for Superintendent of Public Instruction, State Treasurer, Governor, Commissioner of Insurance, and State Auditor. Democrats have also won all of the last four elections for Secretary of State and Attorney General.

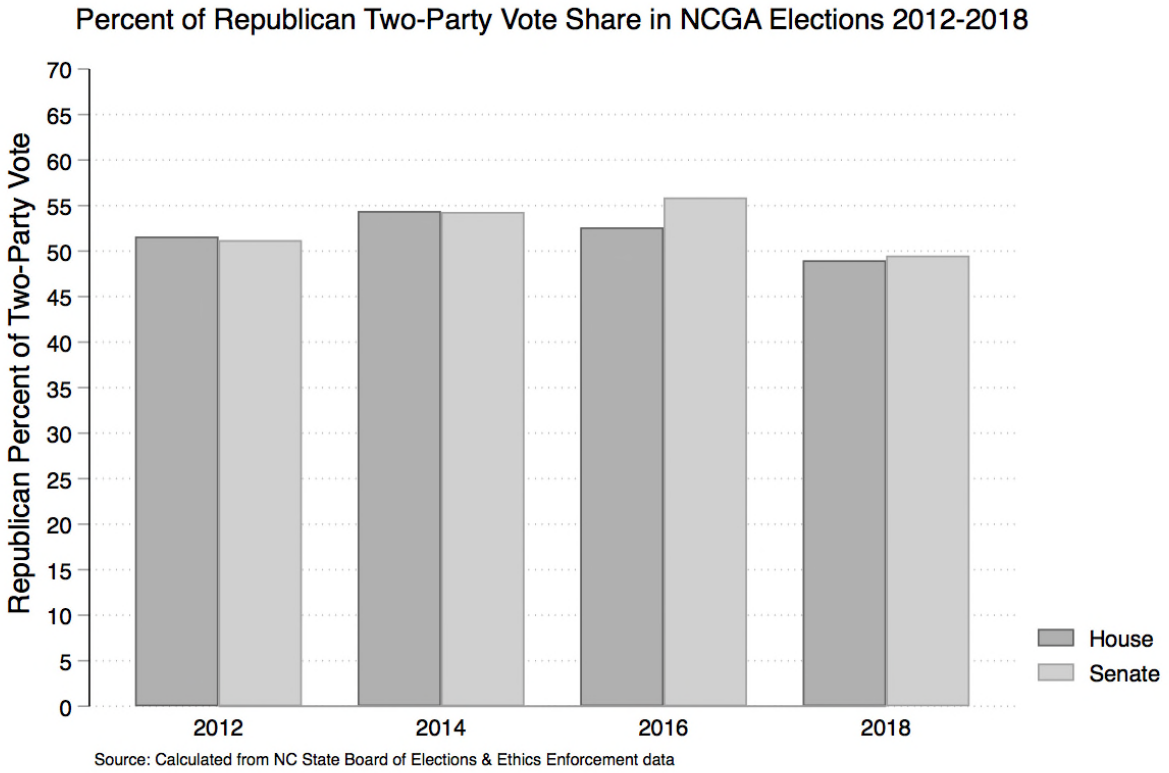


Notes: Calculated from NC State Board of Elections & Ethics Enforcement data. Council of State elections take place every four years.

General Assembly Votes in the Aggregate

Although General Assembly election results are counted at the district rather than the statewide level, aggregating the votes across all General Assembly districts provides another view of the relative moderation of North Carolina voters, considered on the whole. In the last four election cycles, Republicans have garnered an average of 51.9% of the total two-party votes

for North Carolina's 120 House of Representatives seats (51.6% in 2012, 54.4% in 2014, 52.7% in 2016 and 48.9% in 2018) and 52.7% of the total votes for North Carolina's 50 Senate seats (51.2% in 2012, 54.3% in 2014, 55.9% in 2016 and 49.5% in 2018).



These results do not clearly lean in one direction or the other and portray a North Carolina citizenry that is, on average, fairly moderate. In fact, the support for General Assembly candidates has been even closer than depicted in the statistics and figure above. These statistics include the results of elections where one of the two major parties did not field a candidate, and thus where one candidate received 100% of the two-party vote. From 2012-2018, Republican candidates won 31 uncontested elections for the state Senate and 93 for the state House, compared to 27 uncontested Senate elections and 86 uncontested House elections won by Democrats. This greater number of uncontested elections won by Republican candidates makes their statewide vote share over this period appear higher than their actual level of support among voters.

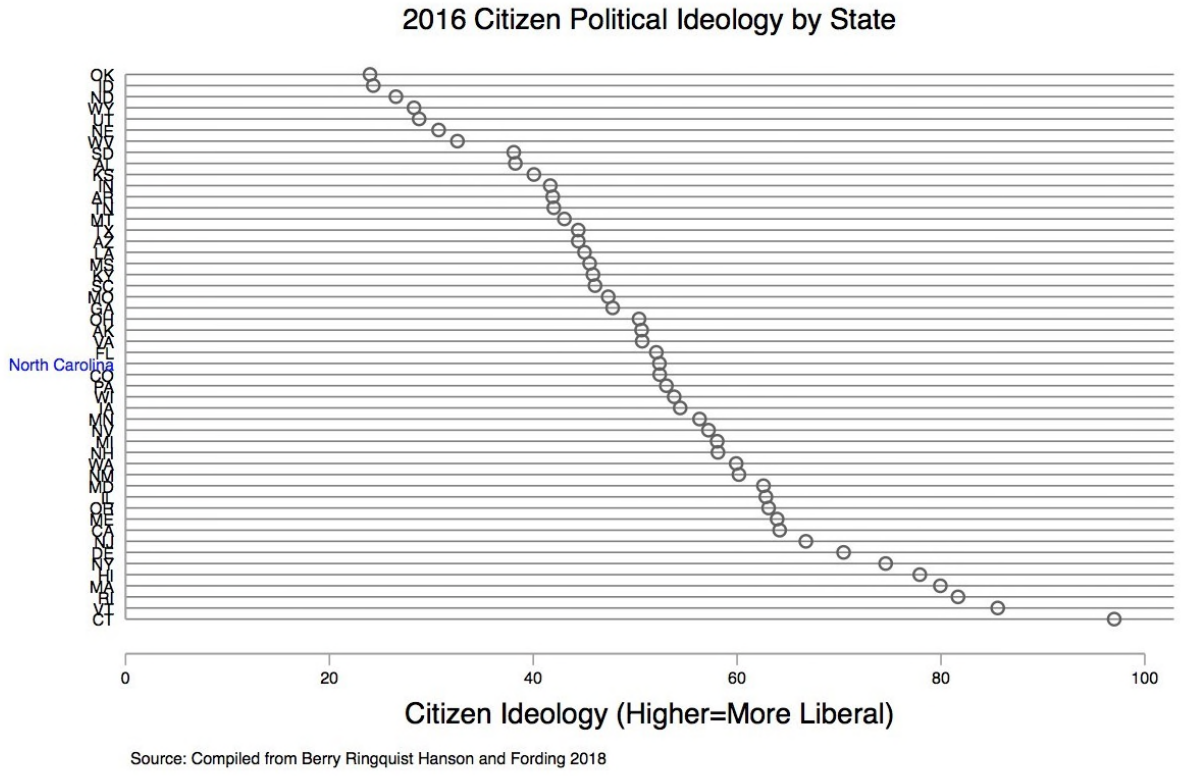
Ideological Moderation

Partisan identification can be a misleading indicator of voter intention—both at the state level and at the district level—and for that reason political scientists have developed a series of alternative measures of the aggregate ideological leanings of a state's citizenry. Most of these measures estimate political ideology on a left (liberal) to right (conservative) dimension. While the specifics of each of these sources vary, all essentially rely on an aggregation of numerous public opinion polls into one overall measure of political ideology in the state.

One of the most common measures of state-level public opinion was developed by political scientists William Berry, Evan Ringquist, Russell Hanson, and Richard Fording, and places each state on a liberal-conservative scale with conservative states on the low end and liberal states on the high end.[6] As the figure below suggests, using this measure, North Carolina citizens fell near the middle of the distribution in 2016 (the 27th most conservative or the 24th most liberal state of the country). Using the arithmetic average instead of a rank order produces a similar sign of moderation—North Carolina has a score of 52.38, virtually identical to the average score of 52.33. A similar measure produced by political scientists Chris Tausanovitch and Christopher Warsaw,[7] comes to a similar conclusion; according to their measure, North Carolina is the 25th most liberal state in the country.

[6] For details on the development of the measure, *see* Berry, William D., Evan J. Ringquist, Richard C. Fording, and Russell L. Hanson, "Measuring Citizen and Government Ideology in the American States, 1960-93," *American Journal of Political Science* 42 (1998): 327-48. Raw data are available at https://rcfording.wordpress.com/state-ideology-data/.

[7] For details on the development of the measure, *see* Tausanovitch, Chris, and Christopher Warshaw, "Measuring Constituent Policy Preferences in Congress, State Legislatures, and Cities," *The Journal of Politics* 75, no. 2 (2013): 330-342. *See* http://www.americanideologyproject.com/ for these data.

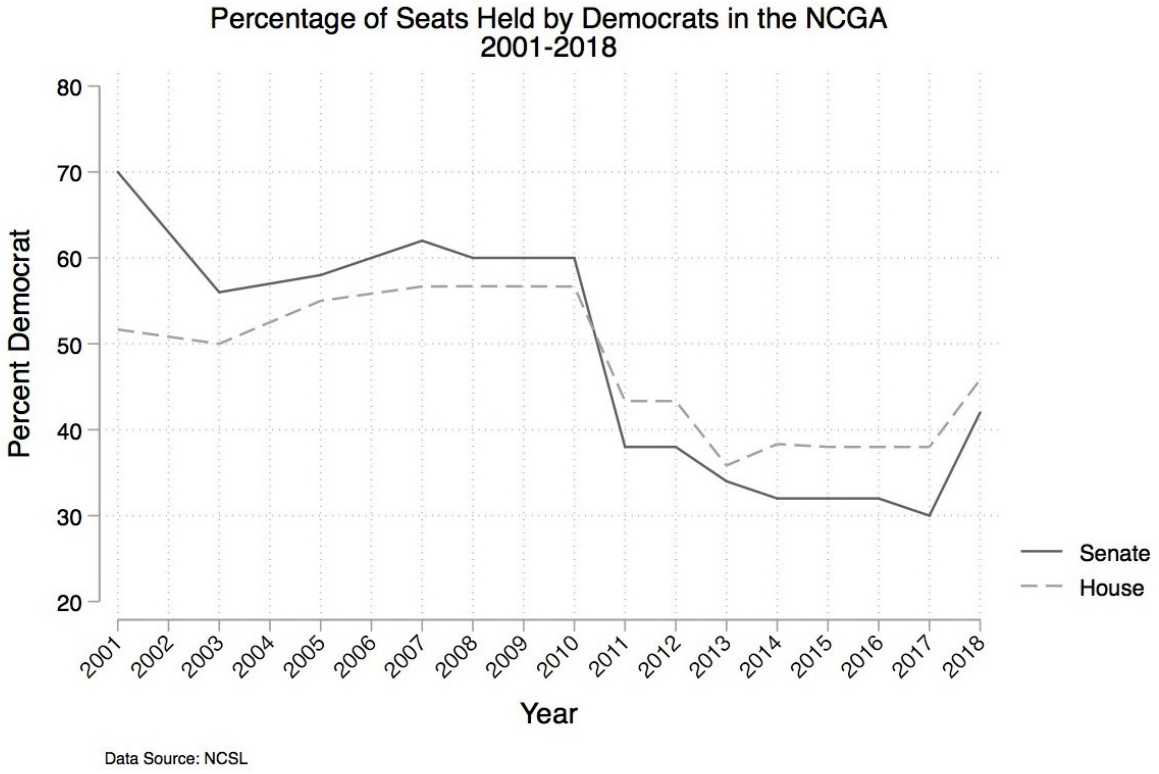


Taken together, these estimates suggest that North Carolina is certainly not a liberal state, but nor is it a conservative one. In fact, the Berry et al. data suggest that compared to other states, the North Carolina electorate has gotten steadily *more* liberal over time. Indeed, North Carolina was the 4th most conservative state in the country in 1960. From 1960 to 1999, North Carolinians steadily became more liberal until 1999, when they became the definition of moderation. Contrary to what one might expect, immediately following North Carolina's creeping ideological movement away from conservatism, the North Carolina General Assembly moved the opposite direction and flipped to Republican control for the first time in more than a century.

Lack of General Assembly Moderation

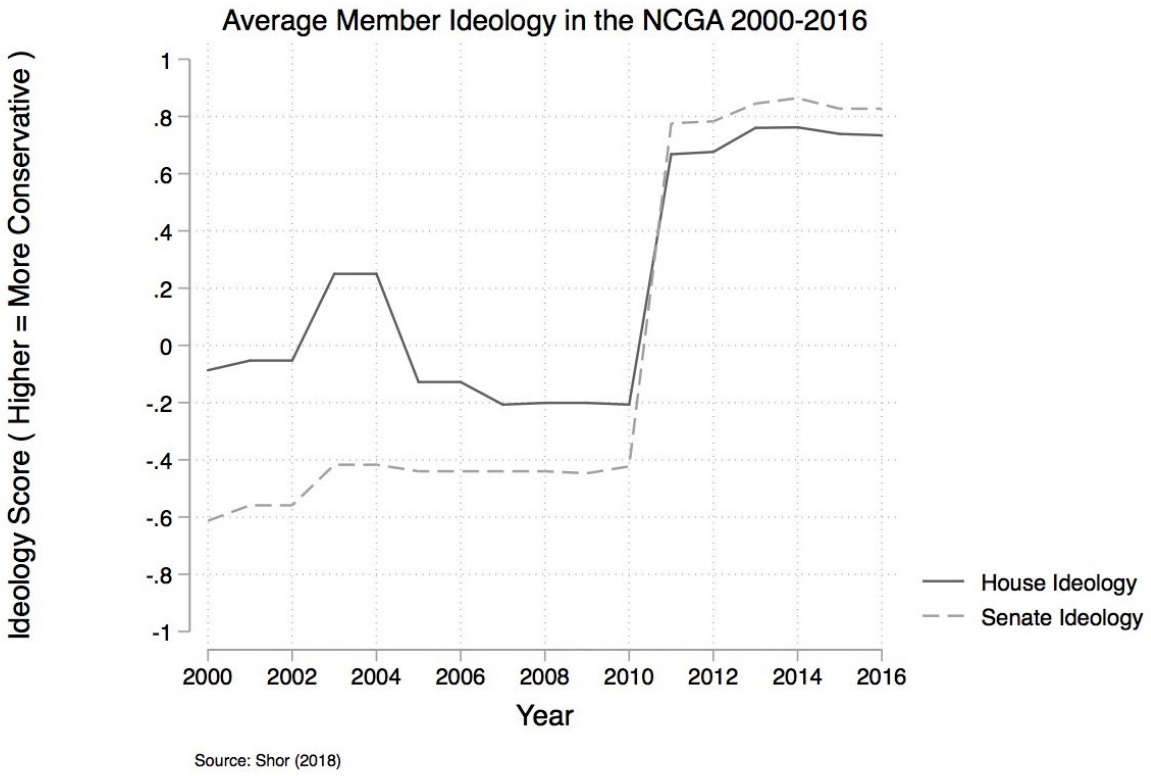
In contrast to the results of other indications of the will of North Carolina voters, General Assembly and Congressional election results in North Carolina have consistently and overwhelmingly favored Republicans since 2010. As the figure below demonstrates, during the first decade of the 2000s, the General Assembly featured two-party competition, highlighted by the 2003-2004 legislative session when Democrat Jim Black and Republican Richard Morgan served as co-speakers of the North Carolina House of Representatives. The North Carolina

Republican Party gained a large number of seats in the 2010 elections and soon redrew the state legislative district lines, allowing Republican candidates to gain an even larger margin in subsequent elections. The effect of this redistricting was particularly acute following the 2016 election, when Democratic Governor Roy Cooper faced Republican supermajority control of the General Assembly, but the ramifications were also felt in the 2018 election. Even with the well-documented "blue wave" of 2018—in which Democrats won even more aggregate votes across North Carolina in state House and state Senate elections than in 2016—Republicans retained comfortable majorities in both chambers of the General Assembly. Specifically, Democratic candidates won 51.1% of the two-party statewide vote in 2018 state House elections, but won only 55 of 120 seats (45.8%). Democratic candidates won 51.2% of the two-party statewide vote in 2018 state Senate elections, but won only 21 of 50 seats (42%).



Not surprisingly, the entrenched Republican majorities and supermajorities since 2010 have had an enormous impact on the ideology of the members of the General Assembly. The figure below charts the average ideology of the North Carolina General Assembly since the late

1990s, using a measure developed by political scientists Boris Shor and Nolan McCarty.[8] Their measure takes every roll call vote taken in a state legislature, scales these votes for individual legislators, and then places them on a single left-right continuum. These scores are similar to the well-established "Nominate Scores" developed for members of Congress.[9] A score of 0 on Shor and McCarty's scale represents an ideologically-moderate legislature; higher numbers are associated with a more conservative legislature (the most conservative of all states scores 1.228 for its state House and 1.242 for its state Senate) and lower numbers are associated with a more liberal legislature (the most liberal of all states scores -1.465 for its state House and -1.449 for its state Senate). Thus, scores with a greater absolute value are associated with more ideological extremism. As the figure below indicates, the 2010 redistricting cycle was followed by the marked increase in conservative ideology among North Carolina's General Assembly members.

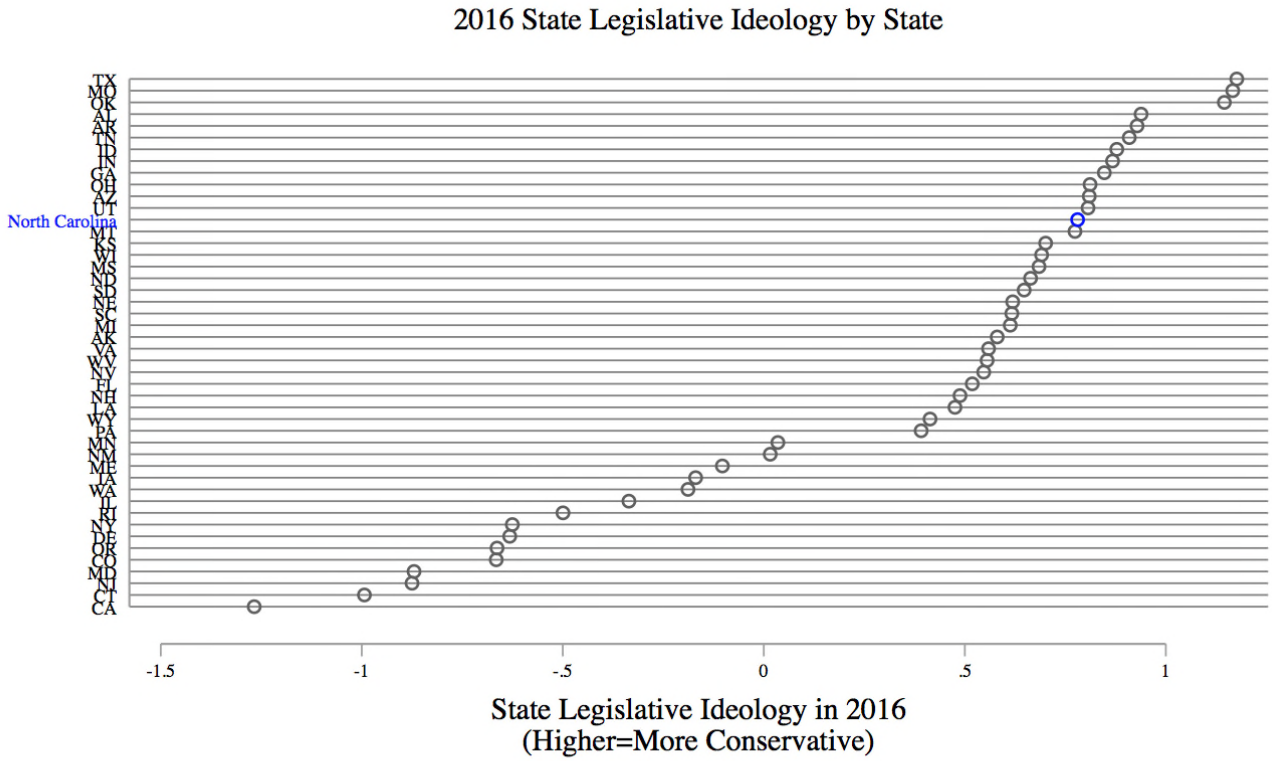


[8] Shor, Boris, "Aggregate State Legislator Shor-McCarty Ideology Data, May 2018 Update," https://doi.org/10.7910/DVN/BSLEFD, Harvard Dataverse, V2

[9] Nominate data can be found at https://voteview.com/

Gap Between Voter Ideology and Government Ideology

The North Carolina General Assembly does not reflect the partisan and ideological preferences of the average North Carolinian. This disjunction is particularly prominent in North Carolina in comparison to all other states. The figure below displays the average political ideology of both chambers of each state's legislature using the Shor data described above. States are arrayed from the most conservative (on the top) to the most liberal (on the bottom) of the figure.



Note: Estimates are not available for HI, KY, MA, VT

Source: Compiled from Shor 2018

As the figure illustrates, the North Carolina General Assembly ranks among the most conservative in the country. In fact, this graph suggests that the NC General Assembly in 2016 was ideologically adjacent to the state legislature in Utah. Recall that in the Berry et al. data, public opinion in North Carolina was the 27th most conservative in the country, while public opinion in Utah was the 5th most conservative. In sum, while North Carolinians are, on average, quite moderate, North Carolina's General Assembly is not.

What This Means

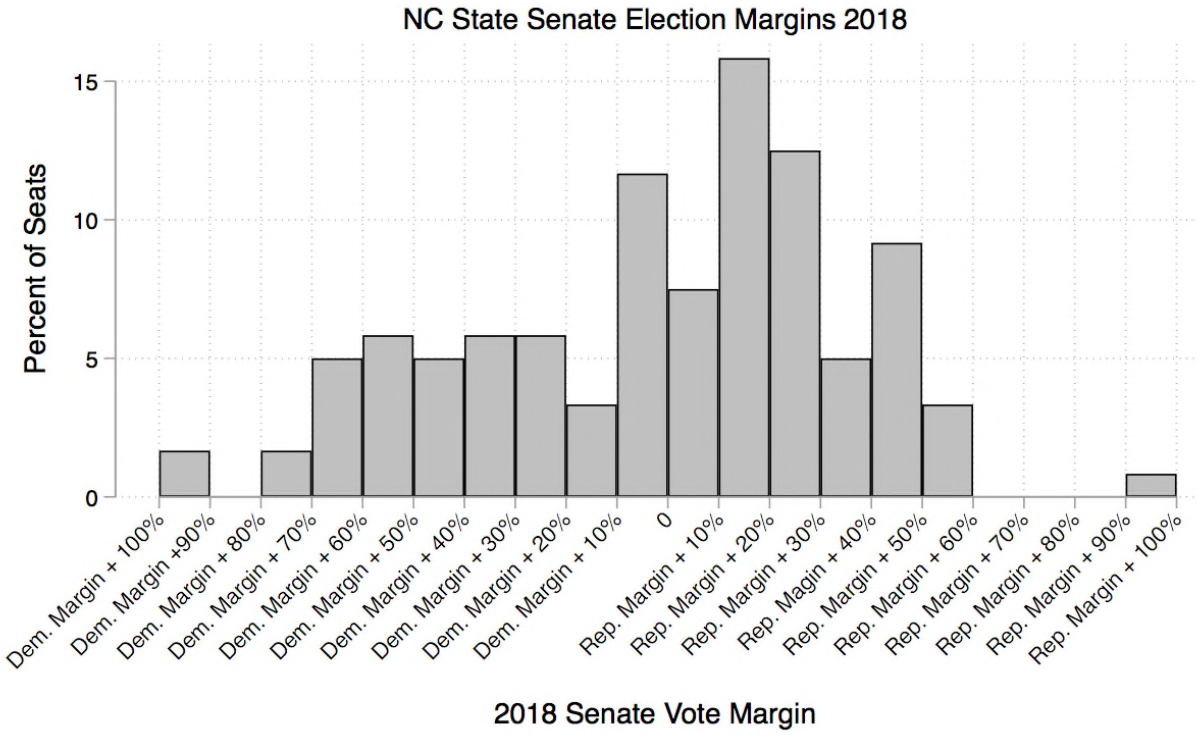
North Carolina has historically been known as a moderate state, particularly within the context of the American South. It was never as Democratic-leaning as its neighbors during the one-party Democratic South of the mid-twentieth century and it did not shift to Republican control as swiftly or as completely as its Southern neighbors. In most ways, North Carolina holds onto that reputation of two-party, moderate politics today. The state falls near the median state in terms of the political ideology of the public, falls near the median state in terms of presidential vote share for the Democratic candidate, supports Democratic and Republican members of the Council of State in similar numbers, and has elected Democrats and Republicans in recent statewide elections.

Following the 2010 redistricting cycle, however, two groups of elected officials subject to the effects of gerrymandering—the General Assembly and the congressional delegation—began to deviate sharply from this story of moderation. Following this change, the North Carolina General Assembly became more ideologically extreme and the fit between citizen opinion and government policy became considerably weaker.

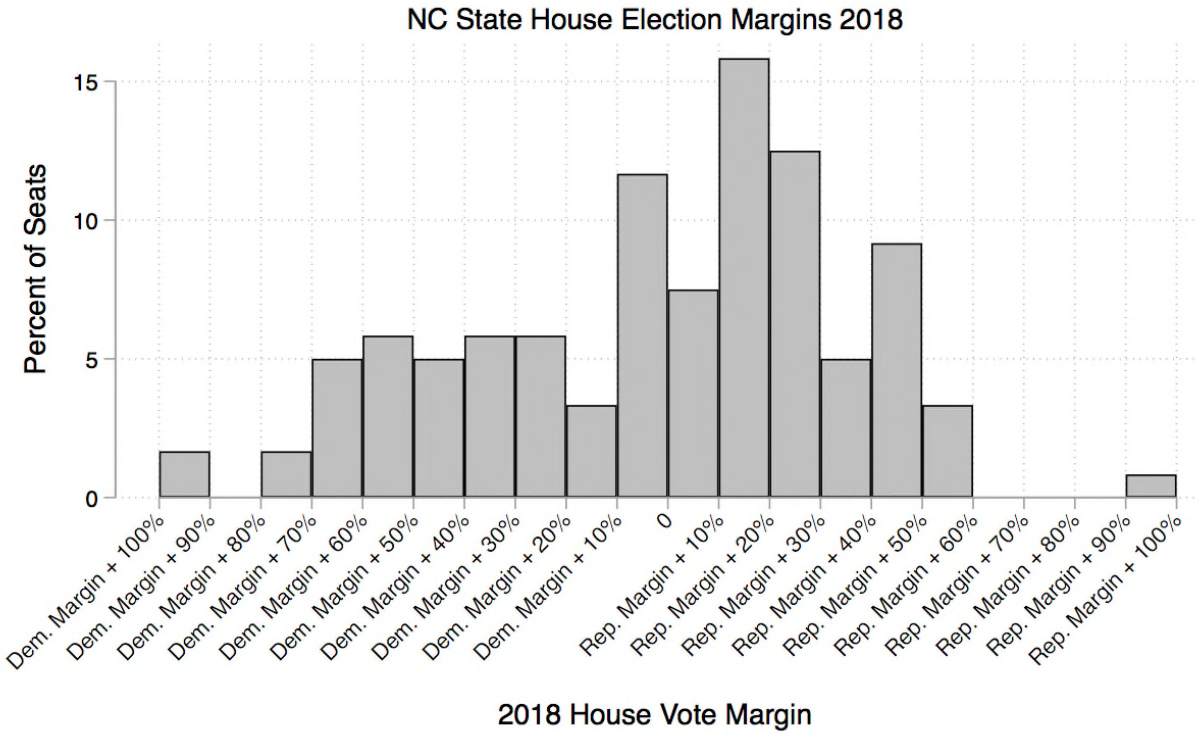
This gap has continued through the 2018 election cycle. Despite the fact that the 2018 elections featured two-party contestation for almost every General Assembly seat[10] and a well-documented blue wave that gave Democratic candidates a boost in 2018, the General Assembly is still controlled by Republicans—and is likely to remain that way without judicial intervention.

As the graphs below demonstrate, the 2018 election results have highlighted the tendency under the current district lines for Democrats to win by large margins, with Democratic voters distributed less efficiently than their Republican counterparts. In the state Senate, the average Republican won by 23 percentage points while the average Democrat won by 32 percentage points. Similarly, in the North Carolina House of Representatives, Democratic candidates won by an average of 30 percentage points, versus Republican candidates who won by an average of 21.78 percentage points.

[10] Only two state House districts did not feature two-party contestation in 2018: HD-24 did not have a Republican candidate running and HD-13 did not have a Democrat in the race. This represents a marked change from the 2016 election where over 45% of state legislative seats in North Carolina did not have two-party competition.



Source: NC State Board of Elections



Source: NC State Board of Elections

This inefficient distribution of Democratic voters is underscored by the fact that there are consistently more votes cast for Democratic state legislative candidates than there are Democratic representatives elected to the General Assembly. As the table below illustrates, even in the blue wave year of 2018, Democrats won almost nine percentage points more votes in the Senate than they occupied seats. Similarly, in the House, Democrats won over five percentage points more votes than they occupied seats.

Percent of Democratic Votes and Seats in the NC General Assembly 2012-2018

	Senate		House	
	% of Two-Party Votes	% of Seats	% of Two-Party Votes	% of Seats
2012	48.8	34	48.4	36
2014	45.7	32	45.6	38
2016	44.1	32	47.3	38
2018	50.5	42	51.1	46

Sources: Vote data are from NCSBE; Seats are from the National Conference of State Legislatures.

To take the majority in the Senate (26 seats) in 2018, the Democrats would have needed to win five additional districts. The five seats that Democrats came closest to winning but did not were Senate Districts 18, 39, 1, 24, and 7. To win the least competitive of these (SD-7), meaning the seat that Democrats would have needed for a majority, the Democratic candidate (in this case, David B. Bradley) would have needed to garner an additional 3.91% of the total votes cast in that district. Assuming that the vote share across the state would uniformly swing by that amount, this means that Democratic candidates would have to win 54.41% of the statewide vote (50.5% + 3.91%) to garner a simple majority of the Senate seats. To win the majority of House of Representatives seats (61), Democrats would have had to win an additional six districts in the 2018 election (House Districts 63, 20, 82, 83, 51, and 75). To win the least competitive of these (HD-75), meaning the seat Democrats would have needed for a majority, Democrats would have needed to win an additional 3.1% of the votes in that district. Assuming that the vote share across the state would uniformly swing by that amount, Democrats would need to secure 54.2% of the statewide votes (51.1% + 3.1%) to regain a simple majority of seats in the state House of Representatives.

Given the stark difference between aggregate-level vote shares and partisan control of the General Assembly, it should be of little surprise that North Carolina citizens appear to have little

faith in the redistricting system as it is employed in the state. A 2018 Elon University Poll revealed that only 10% of registered voters in North Carolina (only about 21% of Republicans, 7% of Independents, and 4% of Democrats) believe that the current redistricting system is "mostly fair." [11]

Analyzing Individual County Clusters

The next section of this report analyzes the composition of the current districting plans enacted by the General Assembly in 2017. In particular, I analyze certain county clusters under the 2017 plans, and how the district boundaries within these clusters maximize partisan advantage for Republicans. To analyze each county cluster and the effects of where and how district lines are drawn, I rely on several data sources described below.[12] Note that these data sources are in addition to some of the metrics used in the state-level analysis described previously in this report.

- **VTD-level results from the StatPack that accompanied the 2017 redistricting**: This "stat pack" was used to draw the last round of state legislative district maps, and therefore provides a readily-available, previously agreed-upon source of data that includes election results by VTD for a variety of statewide races. The maps and much of the analysis to follow relies on the results of the 2016 Attorney General election that pitted Democrat Josh Stein against Republican Buck Newton. Stein ultimately won the election by 6,042 votes. The average VTD favored Stein by 6.9 votes while the VTD differentials ranged from a 3,566 margin for Newton to a 5,136 margin for Stein. 95% of the VTDs fell

[11] The results from the poll can be found here: https://www.elon.edu/u/elon-poll/wp-content/uploads/sites/819/2019/02/Elon-Poll-Report-022318.pdf. The question wording asked about "congressional" redistricting, but since the process is identical for congressional and state legislative redistricting, there is little reason to believe that public opinion would be any different with respect to redistricting at the state legislative level.

[12] While I do at times rely on analysis of partisan identification as evidence about particularly egregious examples of gerrymandering, I generally avoid the use of partisan identification to demonstrate the effects of gerrymandering. People generally change their voting pattern before changing their partisan identification, making Party ID a lagging indicator of how an individual voter or voters in a geographic area may lean. Consider Columbus County—a county where 60% of voters supported Republican Donald Trump, yet Democrats still hold a clear partisan registration edge (57% of voters in Columbus County are registered Democrats). North Carolina contains many counties like Columbus. In addition, North Carolina, like many other states, has witnessed a massive increase in the proportion of voters who are registered as unaffiliated. In fact, as of September 2017, there were more unaffiliated voters than Republican voters in the state. Of course, most of these unaffiliated voters have partisan preferences; they just choose not to reveal them through their party registration. Thus, examining party identification as the primary indicator of voter preference is fraught with problems.

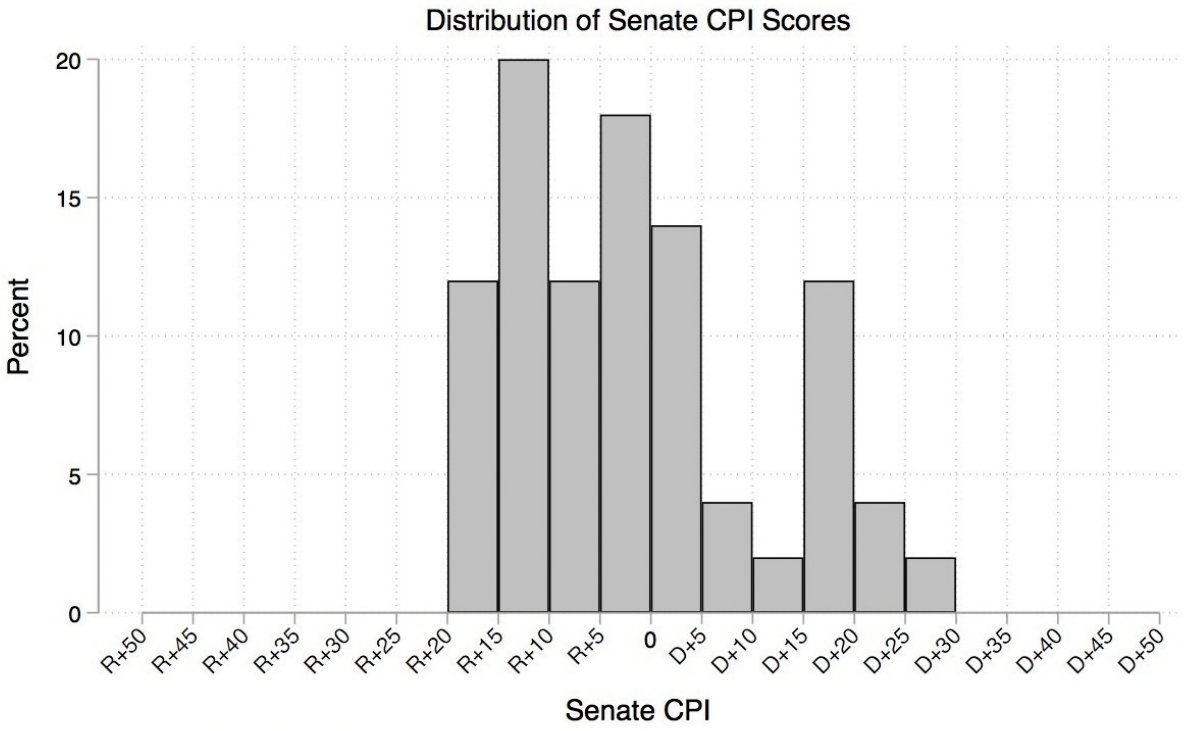
between a 1,507 margin for Newton and a 1,520 margin for Stein. The outcome of this election at the county-level is also highly correlated with other recent elections, including that for State Auditor (r=.9916), Agricultural Commissioner (r=.9830), Commissioner of Insurance (r=.9828), Commissioner of Labor (r=.9877), Secretary of State (r=.9920), Superintendent of Public Instruction (r=.9918), State Treasurer (r=.9948), and the recent vote for voter ID legislation (r=.9444). In sum, while the analysis is focused on the 2016 Attorney General election, the results would not change were one to substitute any number of recent statewide elections.

- **District level election results from the NC State Board of Elections (NCSBE)**: These data, available in a variety of formats on the NCSBE web site, form the basis of all conclusions that follow about the district-wide and county-wide results of General Assembly races.
- **Partisanship of County Commissions**: To better understand the political leaning of individual counties, I also supplement results from the aforementioned 2016 Attorney General election with data on the partisanship of county commissions, as reported by the North Carolina Association of County Commissioners. These data are available from 2002 to 2018; all analysis of county commission results thus begins in 2002.
- **Civitas Partisan Index (CPI)**: Prior to each election, Civitas Institute, a "Raleigh, NC-based, 501(c)(3) nonprofit policy organization" that "fights to remove barriers to freedom" and promises to "hold[] elected officials accountable when they support liberal policies…" produces the CPI,[13] a measurement that "reveals which districts lean Republican or Democratic, and may illuminate significant trends." Civitas calculates this measure by aggregating results from prior Council of State votes and placing each district on a scale from D+1 (representing a district that has a slight Democratic tilt) to D+36 (a district with an overwhelming Democratic tilt) and from R+1 (a district that has a slight Republican tilt) to R+26 (a district that leans heavily Republican).[14] A district that is rated "0" has no discernable partisan lean. In this report, I use the CPI ratings for the

[13] "Civitas Partisan Index," accessed April 8, 2019, https://www.nccivitas.org/2018/civitas-partisan-index-2016/.

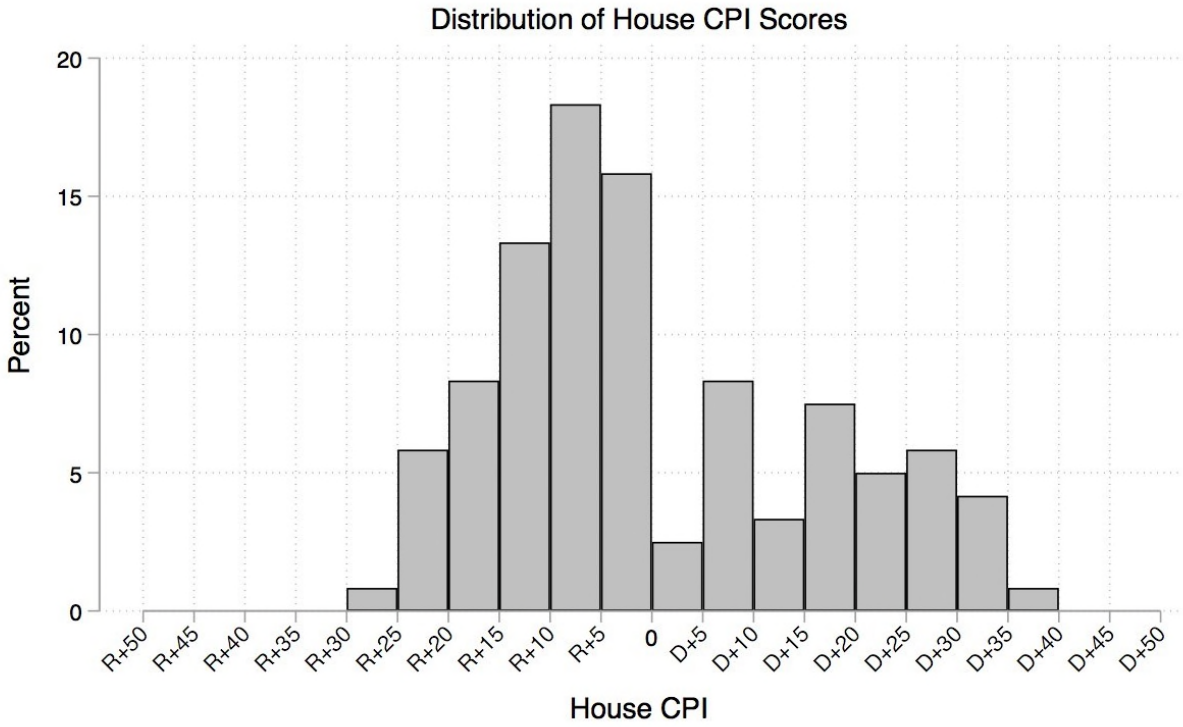
[14] The theoretical limit of these scores is much higher; D+36 and R+26 are just the highest values recorded in the 2016 data.

current district lines, which Civitas released in 2018.[15] As Civitas explains, these ratings are not meant to predict elections, as election results are often the result of candidate quality, fundraising, and other non-constituency-related factors. Because these ratings do not take into account the timing of elections or characteristics of the candidates, they can provide a clear window into the partisan leanings of each district, considered without other factors. The distribution of the House and Senate CPI scores are presented below.



Source: Citivas Partisan Index

[15] Although Civitas refers to this dataset as its 2016 ratings, Civitas explains on its website that these ratings are based on the current district lines.



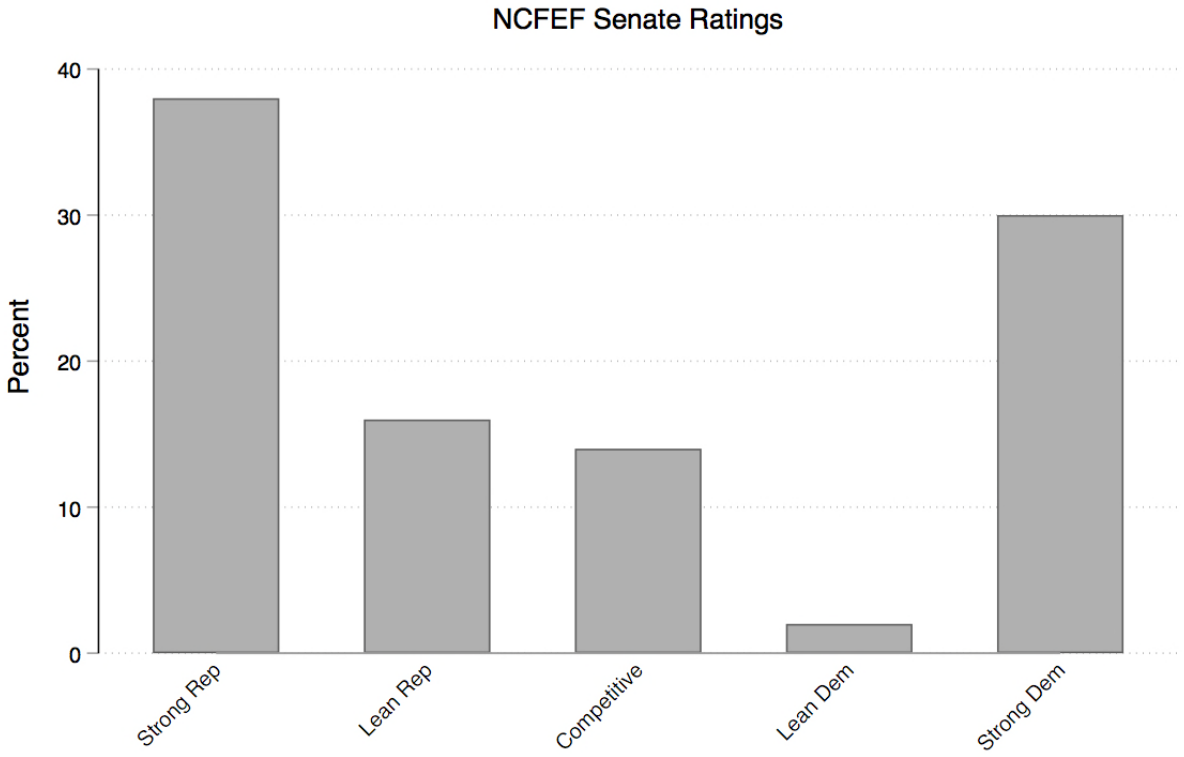
Source: Citivas Partisan Index

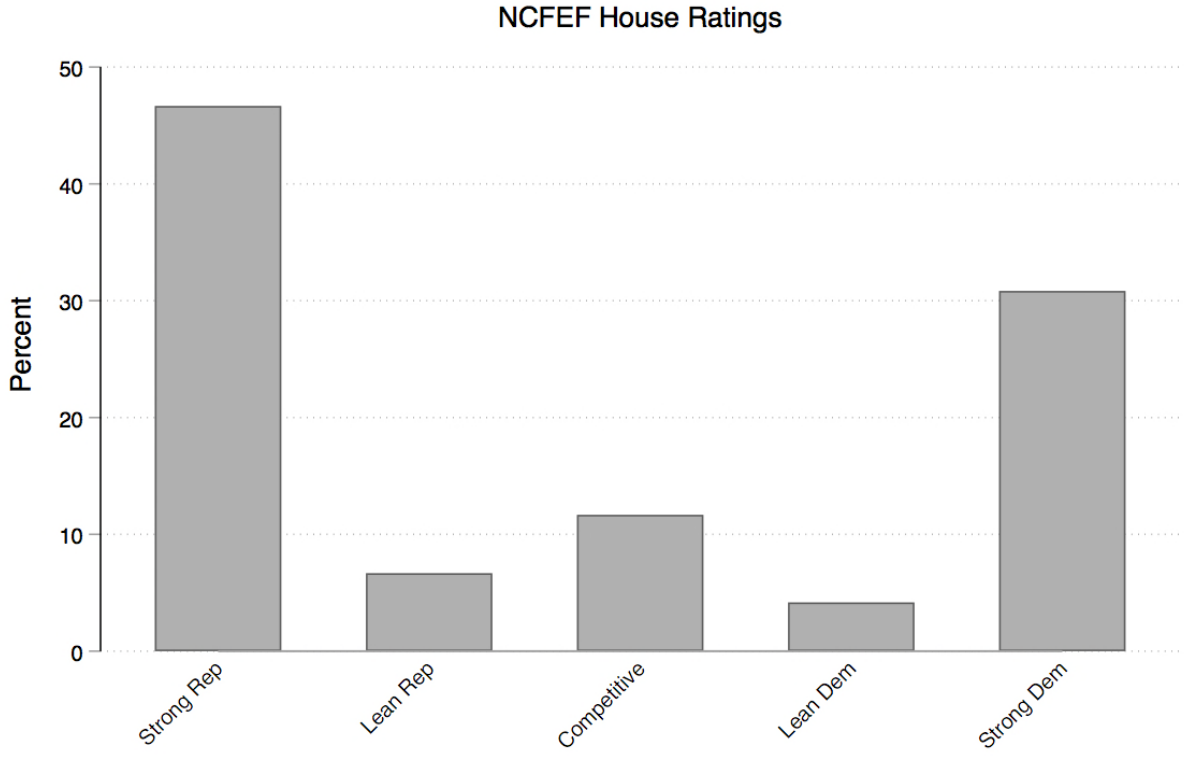
Apart from their usefulness in illustrating how individual districts lean politically, taken as an aggregate, these CPI ratings also reveal the broader impact of current district lines to create a playing field that advantages Republican candidates statewide, while simultaneously making it more difficult for Democrats to gain power. In the state Senate, only 17.7% of the Democratic-leaning Senate districts (with CPI scores greater than 0) have CPI scores in the single-digits, while 82.4% of Democratic-leaning Senate districts have CPI scores in the double-digits. Conversely, 48.4% of Republican-leaning Senate districts have CPI scores in the single digits, and only 51.6% of Republican-leaning Senate districts have CPI scores in the double-digits. This suggests that under the current Senate boundaries, Democrats are likely to "waste" many Democratic votes in Senate districts where Democrats are favored—and win—by relatively large margins, whereas Republicans are more likely to win by smaller margins, wasting fewer votes and producing a more efficient transfer of votes to seats. The mean CPI scores reflect a similar trend—of all Democratic-leaning districts, the average CPI score is D+16.25 compared to an average CPI score of R+9.90 for Republican-leaning districts.

The CPI scores from the state House reinforce the conclusion that, all else being equal, the current House district lines advantage Republican candidates and disadvantage Democrats. While 50.7% of Republican-leaning CPIs in the House are defined with CPIs of less than 10, only 29% of Democratic-leaning House CPIs fall in this category. Similarly, the average Democratic-leaning district in the House has a CPI of D+17.6, whereas the average Republican-leaning district has a CPI of R+10.5.

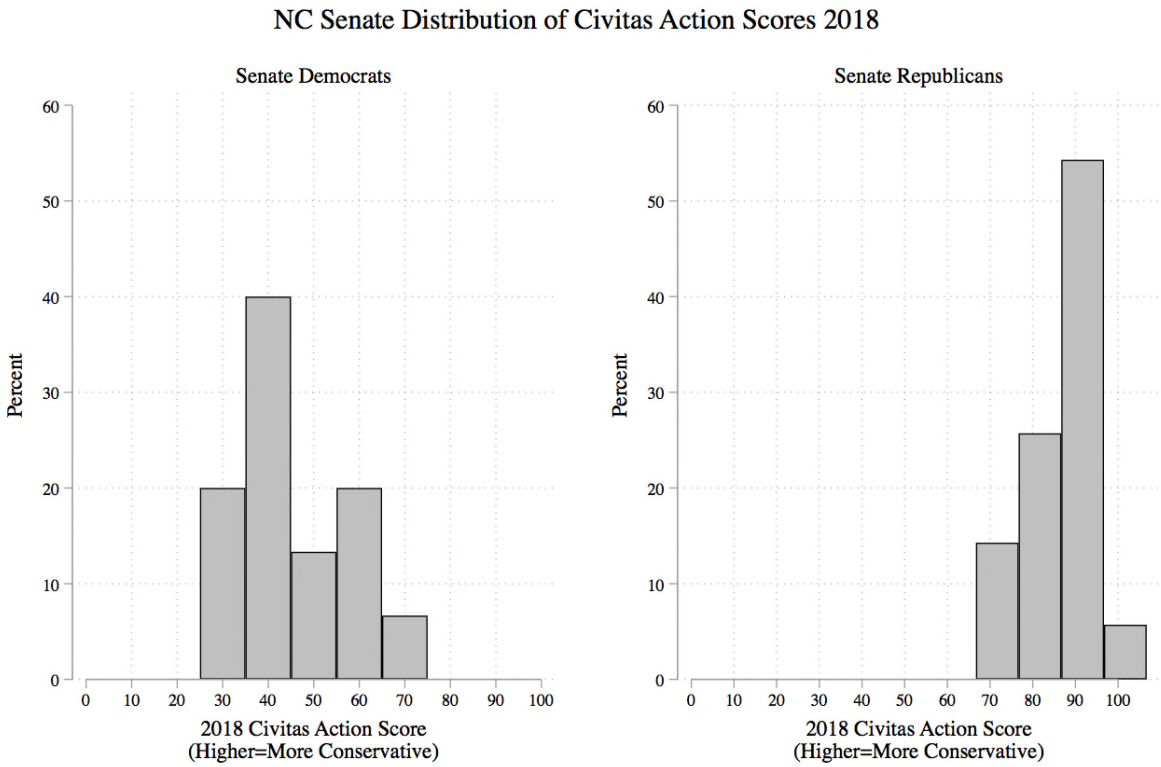
- **North Carolina Free Enterprise Foundation (NCFEF) Partisan District Ratings**: Similar to the CPI, the NCFEF produces a rating of the partisanship of each of North Carolina's 120 House and 50 Senate districts.[16] These ratings are estimated from past statewide elections and are produced independent of the candidates and the mood of the country. These are meant to provide an unbiased estimate of the partisan leanings of North Carolina's General Assembly districts, and do not necessarily predict election outcomes. These scores are analogous to the well-known Cook Political Report estimates of district partisanship for congressional districts. Like the Cook Political Report, the NCFEF rating categories are "Strong Democratic," "Lean Democratic," "Competitive," "Lean Republican," and "Strong Republican." I use the 2018 scores in this report. Distributions from these scores are presented below for reference.

[16] NCFEF Partisan District Ratings available at https://www.ncfef.org/copy-of-research-analysis

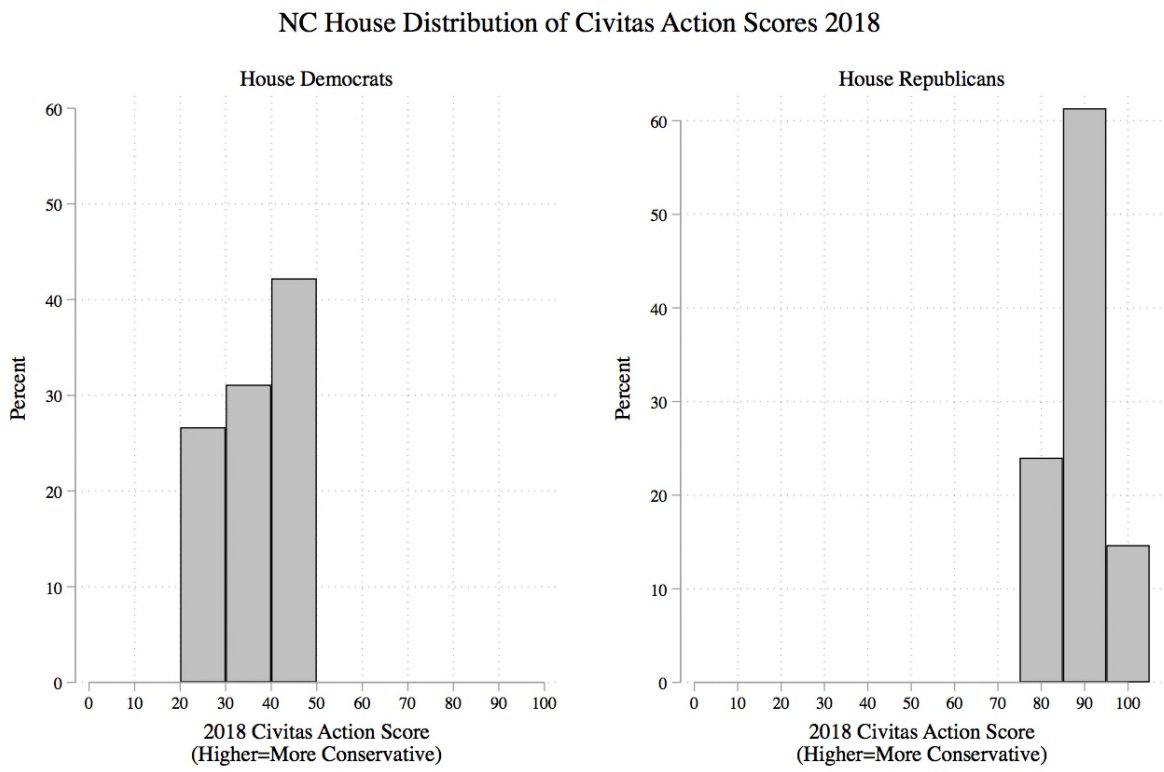

NCFEF Senate Ratings
Percent
40
30
20
10
0
Strong Rep
Lean Rep
Competitive
Lean Dem
Strong Dem


NCFEF House Ratings
Percent
50
40
30
20
10
0
Strong Rep
Lean Rep
Competitive
Lean Dem
Strong Dem

- **Civitas Action Scores**: The Civitas Action Scores, also called the "N.C. Freedom Rankings," place all North Carolina General Assembly members on a liberal-conservative continuum where 100 represents the most conservative legislator and 0 represents the most liberal legislator, according to those legislators' votes on 50 bills, amendments, and motions deemed important by Civitas Action.[17] In analyzing individual clusters, I use these scores whenever referring to the relative ideological position of a member of the North Carolina General Assembly. The graphs below illustrate the distribution of North Carolina General Assembly members in 2018, according to the Civitas Action Scores. As you can see, while Democrats in both chambers tend to be clustered close to the middle of the scale, Republican legislators tend to be distributed closer to the ideological extreme.



[17] Civitas Action is a 501(c)(4) non-profit affiliated with the Civitas Institute. Civitas Action Scores can be found at http://civitasaction.org/fullranking.php?session=2018.

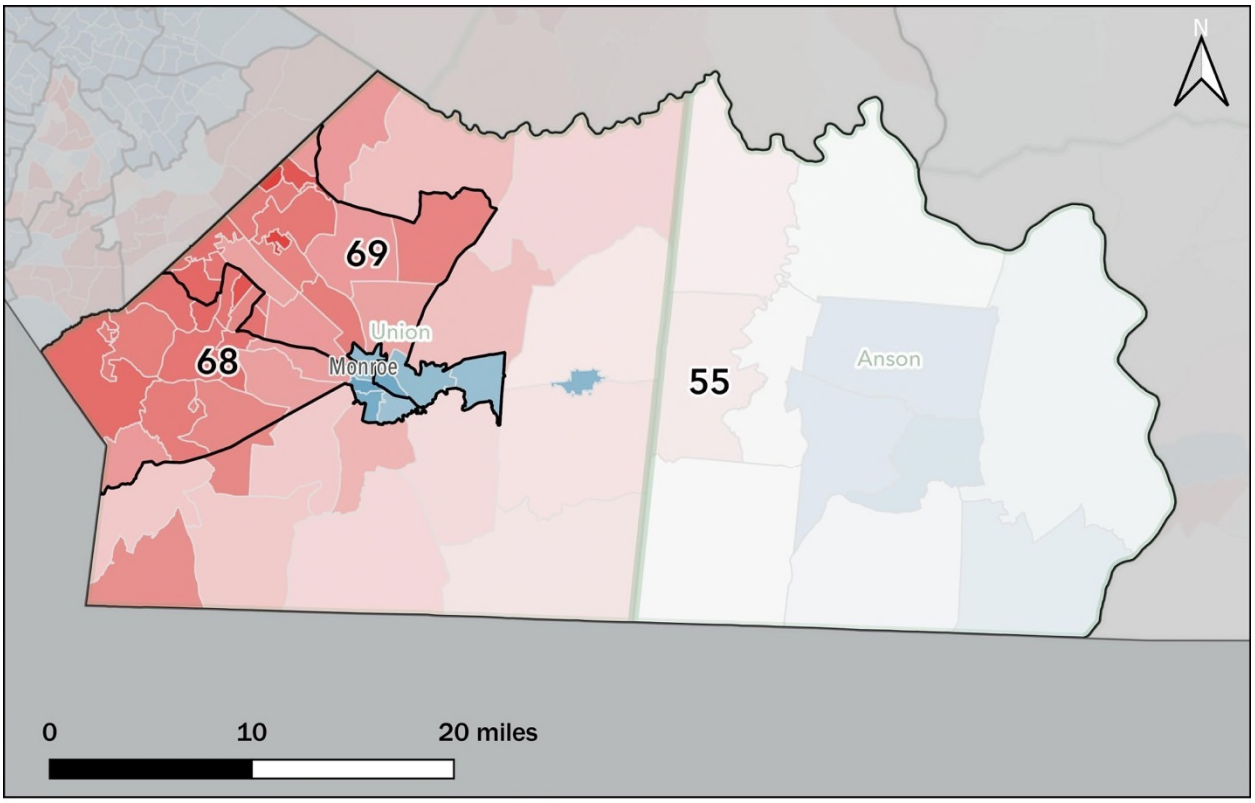


Each district cluster below includes at least one and as many as five maps. The maps to follow were completed by Blake Esselstyn, a consulting expert to Plaintiffs, under my direction using an open-source geographic information system, QGIS, and employing the data from the aforementioned stat pack. In the first map for each cluster (the "area maps"), legislative boundaries are shown in black, while VTD boundaries (which are generally identical to precincts) are outlined in a lighter tone. Municipalities mentioned in the Plaintiffs' amended complaint are included in the maps (in dark gray). County names are shown in green. The red and blue shading represents the relative vote margin in the 2016 Attorney General election in a single VTD, with darker blue shading representing larger Democratic vote margins and darker shades of red indicating larger Republican vote margins (both normalized by acreage). By using actual vote differentials, rather than percentage differentials, we can more easily see the effects of small shifts in district lines on the ultimate outcomes. A legend for these "area maps" is on the page that follows.

Some of the cluster analyses to follow also include additional "detailed maps" that are intended to display specific issues in that cluster. While sometimes these detailed maps display

the effects of VTD splits, other times they show municipality splits, and other times they display details of particularly egregious examples of gerrymandering. As they vary in content, there is no single legend that guides these detailed maps.

Legend for Area Maps



Legislative districts (number shown in black)

Counties (names shown in green)

Area outside North Carolina

VTD boundaries, shaded by results of 2016 AG election: color reflects vote margin, normalized by acreage →

Municipality names shown in dark gray

Vote margin per acre

(D) 6 4 2 0 2 4 6 (R)

All map data obtained from the North Carolina General Assembly

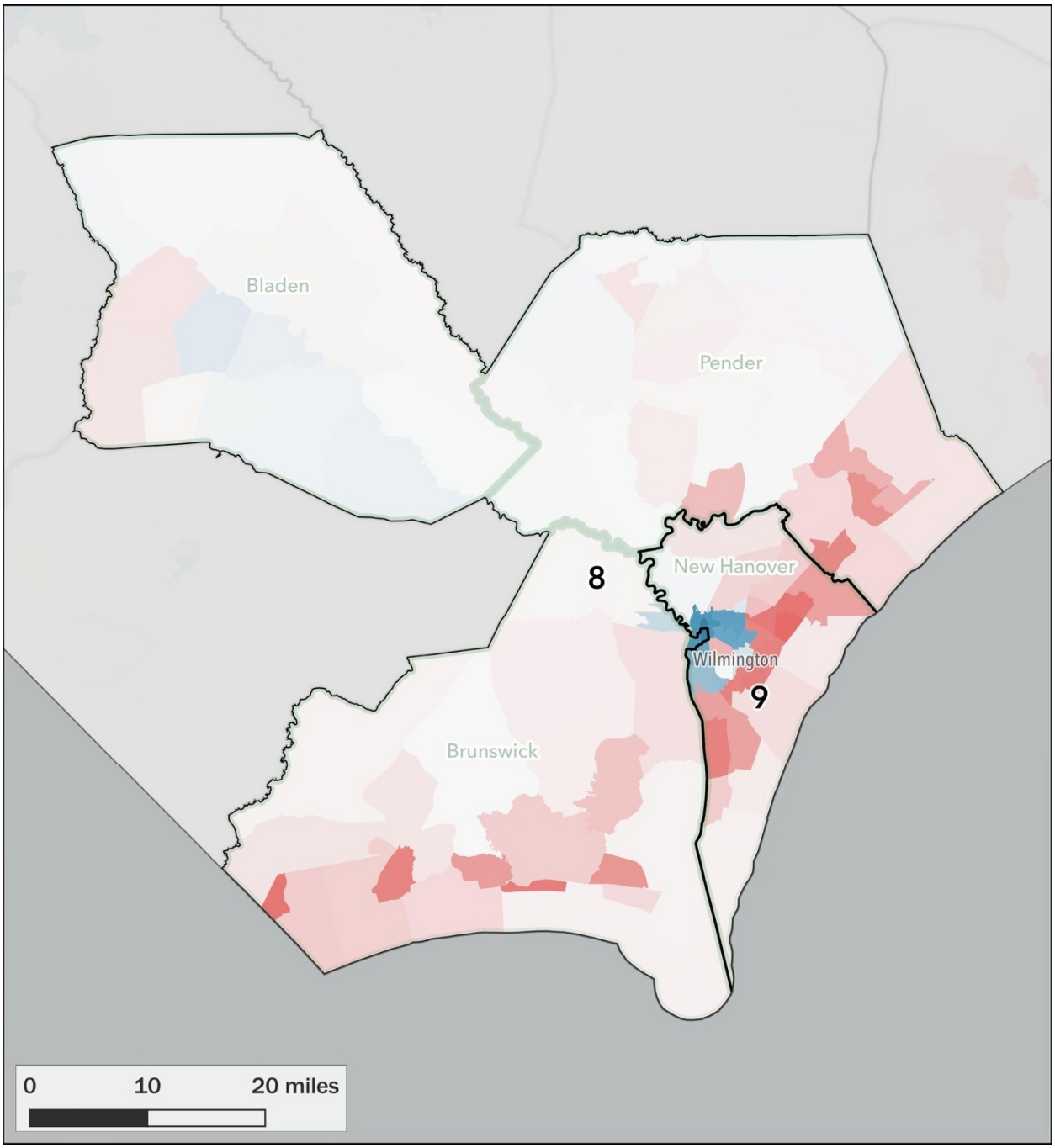
Boundaries obtained from
https://www.ncleg.gov/RnR/Redistricting/Main
and
https://www.ncleg.gov/RnR/Redistricting/Archives

2016 Election data obtained via public records request to NCGA's Paul Coble.
Request sent 10/9/2017; response sent 12/6/2017.

Senate Districts

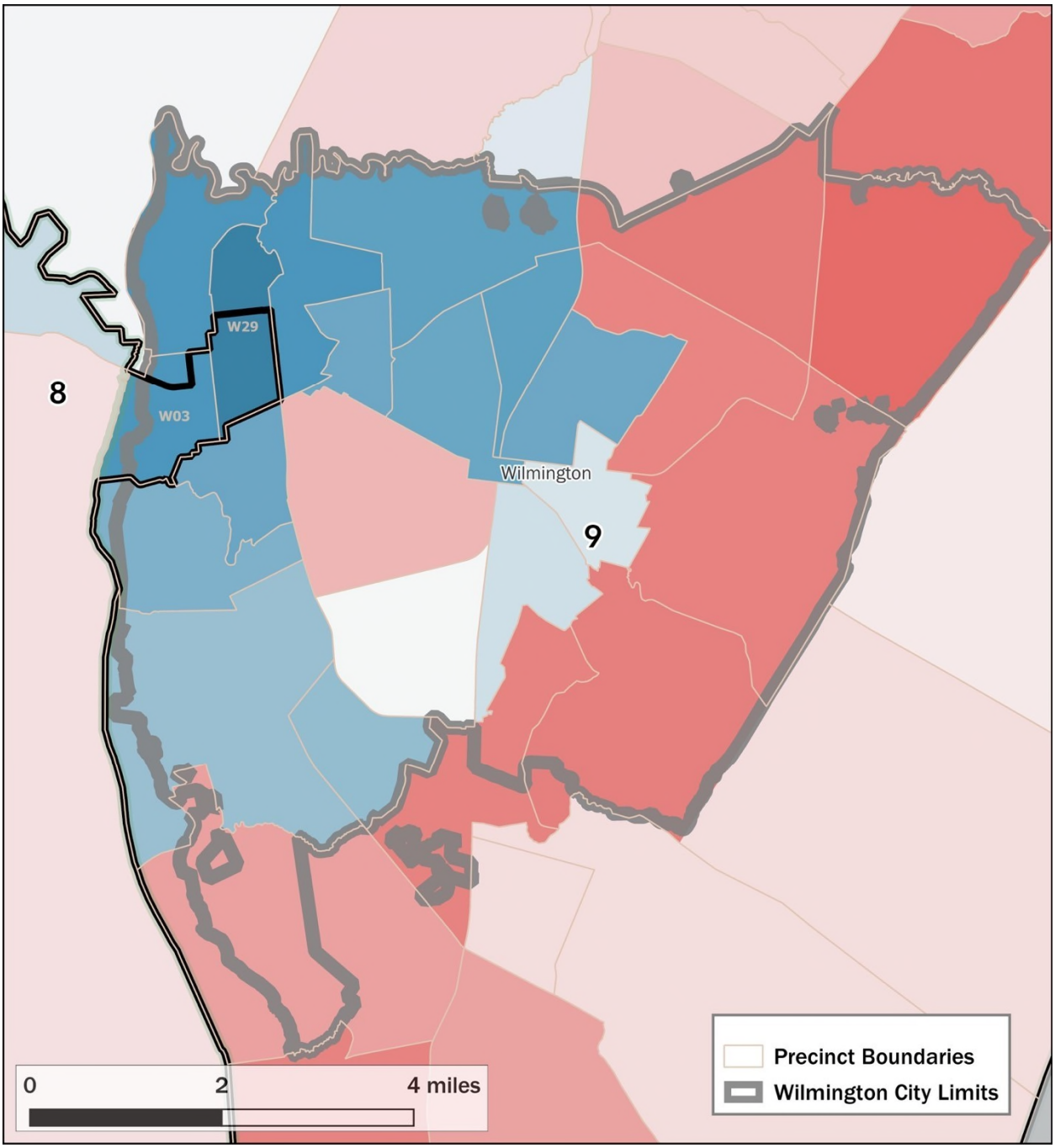
I begin my cluster-by-cluster analysis with Senate districts.

Senate Districts 8 and 9



Senate Districts 8 and 9 are located in the southeast corner of North Carolina. SD-8 includes all of Bladen, Pender, and Brunswick Counties, and a tiny portion of New Hanover County. Pender and Brunswick counties are overwhelmingly Republican; both counties' commissions are comprised completely of Republicans and the Republicans have held majorities on the county commissions since 2002. Any district plan that groups these two counties together will lean towards the Republican Party. Bladen, on the other hand, is much more competitive (the county commission is comprised of five Democrats and four Republicans), and New Hanover County is among the most competitive in North Carolina. The New Hanover County Commission has three Republicans and two Democrats, and in the 2016 election, New Hanover was one of only four counties that supported Republican Donald Trump for President and Democratic Roy Cooper for Governor. These districts have been in place since the 2011 maps were enacted, meaning that the election results from 2012-2016 reflect the current plan.

New Hanover has slightly too many people to constitute just one Senate district, so the architects of the current Senate plan had to place a small proportion of New Hanover County into District 8. Rather than placing more competitive or Republican-leaning VTDs of New Hanover County into the adjacent district, the current North Carolina Senate plan places an extremely Democratic-leaning sliver of the county containing parts of two VTDs (W03 and W29) (the "Wilmington Notch") into SD-8. See the map below for a depiction of the Wilmington Notch in relation to these two Senate districts.

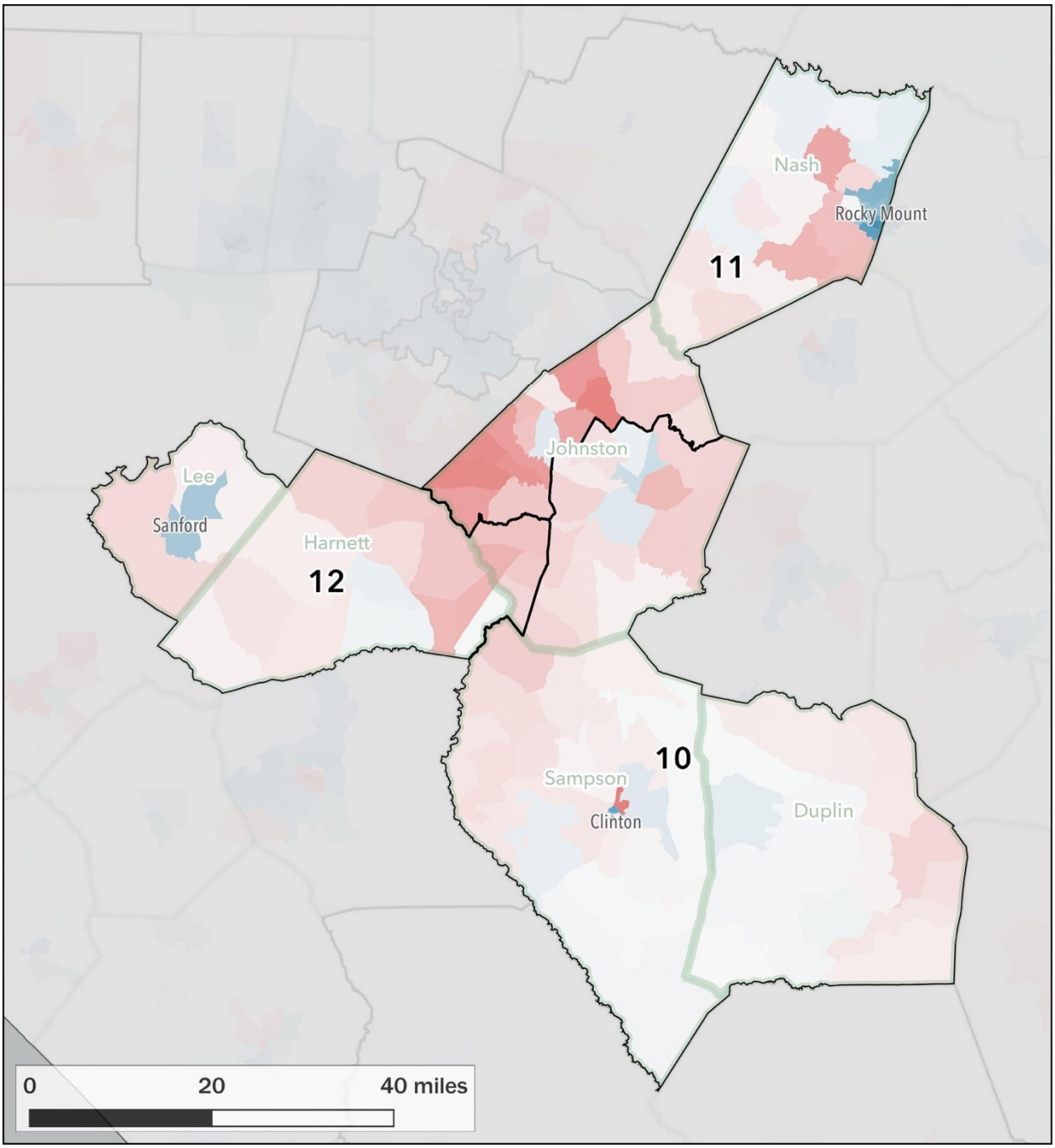


Only 6.55% of the voters in these two VTDs are registered as Republicans, compared to 32% in the rest of SD-9. The VTDs that are included in the Wilmington Notch are also younger than the rest of SD-9 (average age of 45.6 v. 49.1) and much more racially diverse (63% of registered voters in the notch are African American, compared to 11% in the rest of the county). Vote totals show similarly clear partisan trends—Democrat Josh Stein received 86% of the vote total in the W03 VTD (a difference of 1,043 votes) and 93% in the W029 VTD (a difference of

1,852 votes). There can be no doubt that the effect of the Wilmington Notch is to split Democratic voters across two districts and dilute the Democratic vote, thereby increasing the probability of Republicans winning SD-9.

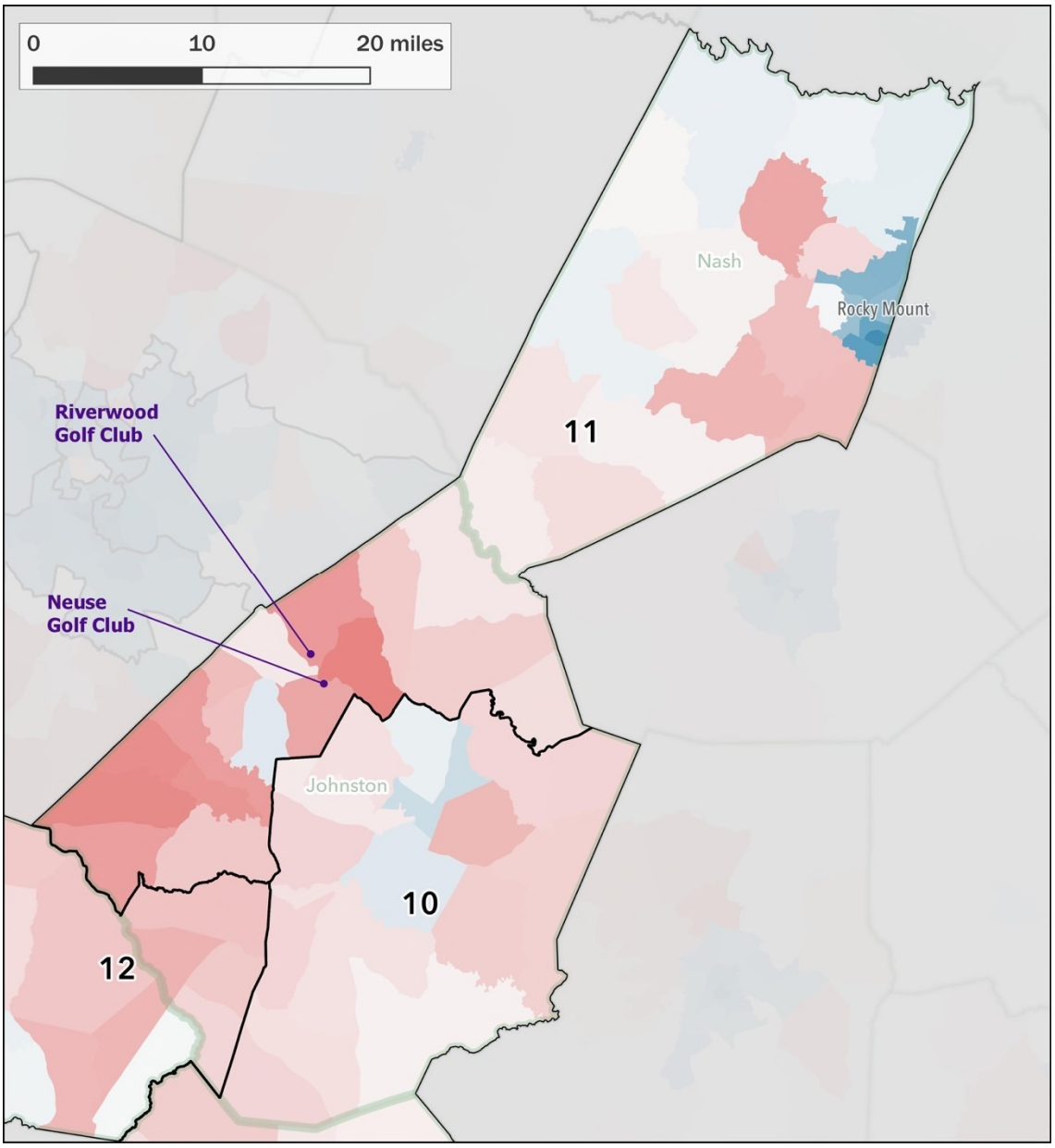
Data from the Civitas Institute confirm the effects of this gerrymandering. SD-8 was rated as R+8 and SD-9 was rated as D+1 prior to the 2018 elections. NCFEF had offered a similar analysis, rating SD-8 "Lean Republican" and SD-9 "Competitive." Recent election results also reinforce this conclusion; Republican William Rabon (tied for the 3rd most conservative member of the NC Senate by Civitas Action) won SD-8 in 2012, 2014, 2016, and 2018 by at least 14 percentage points each year. A Republican candidate also won SD-9 in three of the last four election cycles. In the lone Democratic victory over the last four election cycles, Democrat Harper Peterson beat Republican Michael Lee by under three tenths of a percentage point in 2018.

Senate Districts 10, 11, and 12



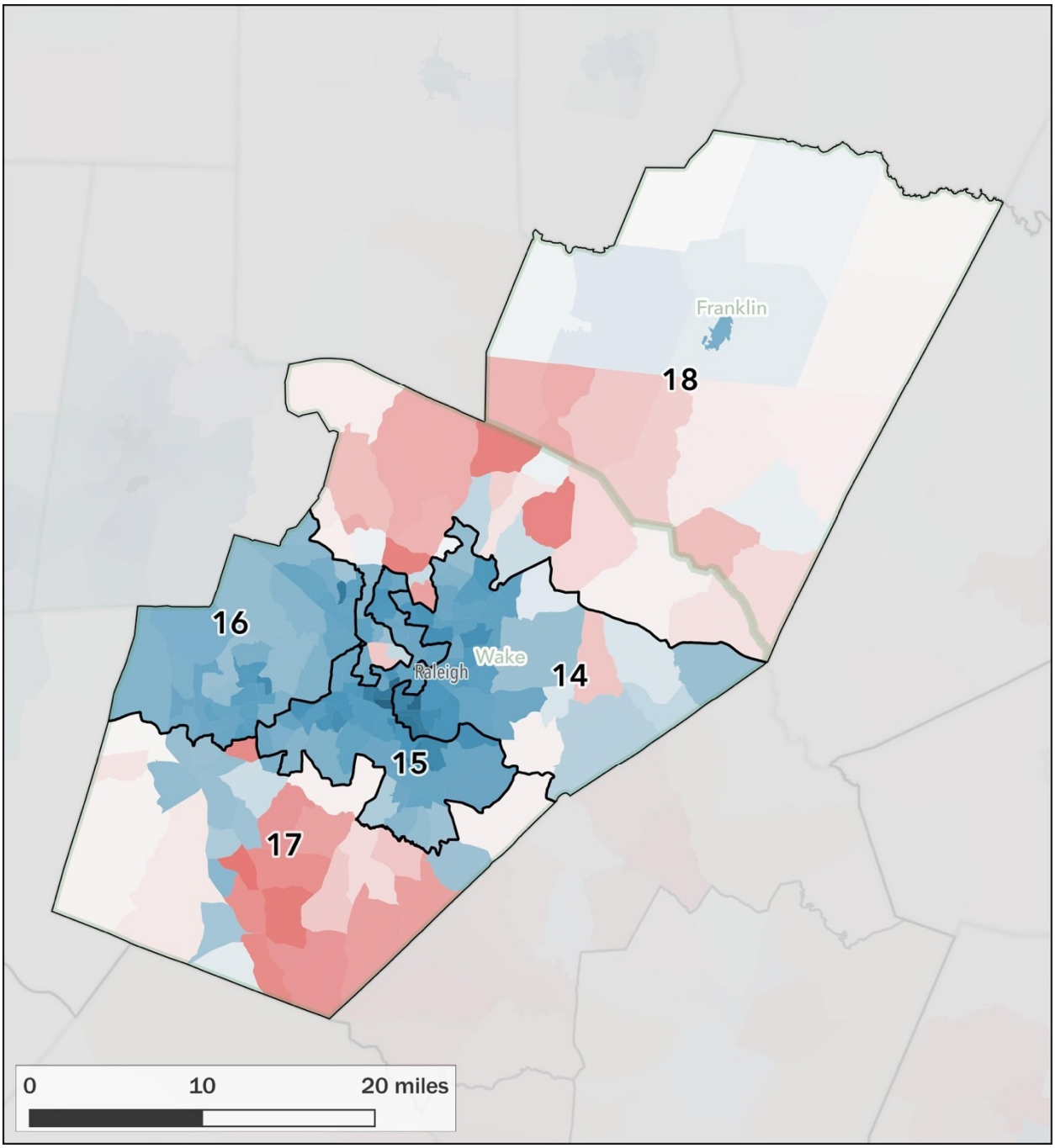
Senate Districts 10, 11, and 12 span an area that sits to the south and east of Raleigh and includes six counties including Sampson, Duplin, Johnston, Lee, Nash, and Harnett. Johnston County leans heavily Republican (the Republicans hold unanimous control of their county commission and Stein's vote in 2016 was the 66th highest in the state as ranked among all 100 of North Carolina's counties), Harnett County leans to the right (57th highest vote share for Stein, and a county commission that has been under majority Republican control since 2002). Duplin and Sampson Counties are towards the middle of the ideological spectrum of counties in North Carolina by most metrics (50th and 49th highest vote share for Stein, respectively, and county commissions that each have one more Republican than Democratic member). Lee County leans towards the liberal/Democratic end of the distribution of counties in North Carolina (with a Democratically-controlled county commission since 2002 and the 39th highest vote share for Stein in 2016). Nash County is similarly positioned towards the Democratic-end of the scale (30th highest for Stein and a Democratically controlled county commission in seven of the last nine elections).

While this cluster should have at least one relatively competitive district given the partisan make-up of its counties, all three districts in the cluster are dominated by Republicans. The General Assembly accomplished this goal by ensuring that the most Democratic VTDs in this six-county region were split across the three separate districts. For example, SD-11 pairs the largest population of Democratic voters in the cluster (in and around Rocky Mount) with an area of Republican strongholds in Johnston County that includes the Neuse and Riverwood Golf Clubs, all while avoiding Democratic pockets of Johnston County.



These maps have been effective in achieving partisan goals. Republicans won all three districts in 2018 by comfortable margins. Extant district ratings confirm this partisan tendency, with Civitas ranking SD-10, SD-11, and SD-12 as R+7, R+4, and R+7, respectively. Similarly, the NCFEF rated all three districts as "Lean Republican" prior to the 2018 elections. The incumbent legislators in these three districts sit at the ideological extreme—all three senators earned Civitas Action scores of 87.5 (which places them tied among each other as the third most conservative senators in North Carolina).

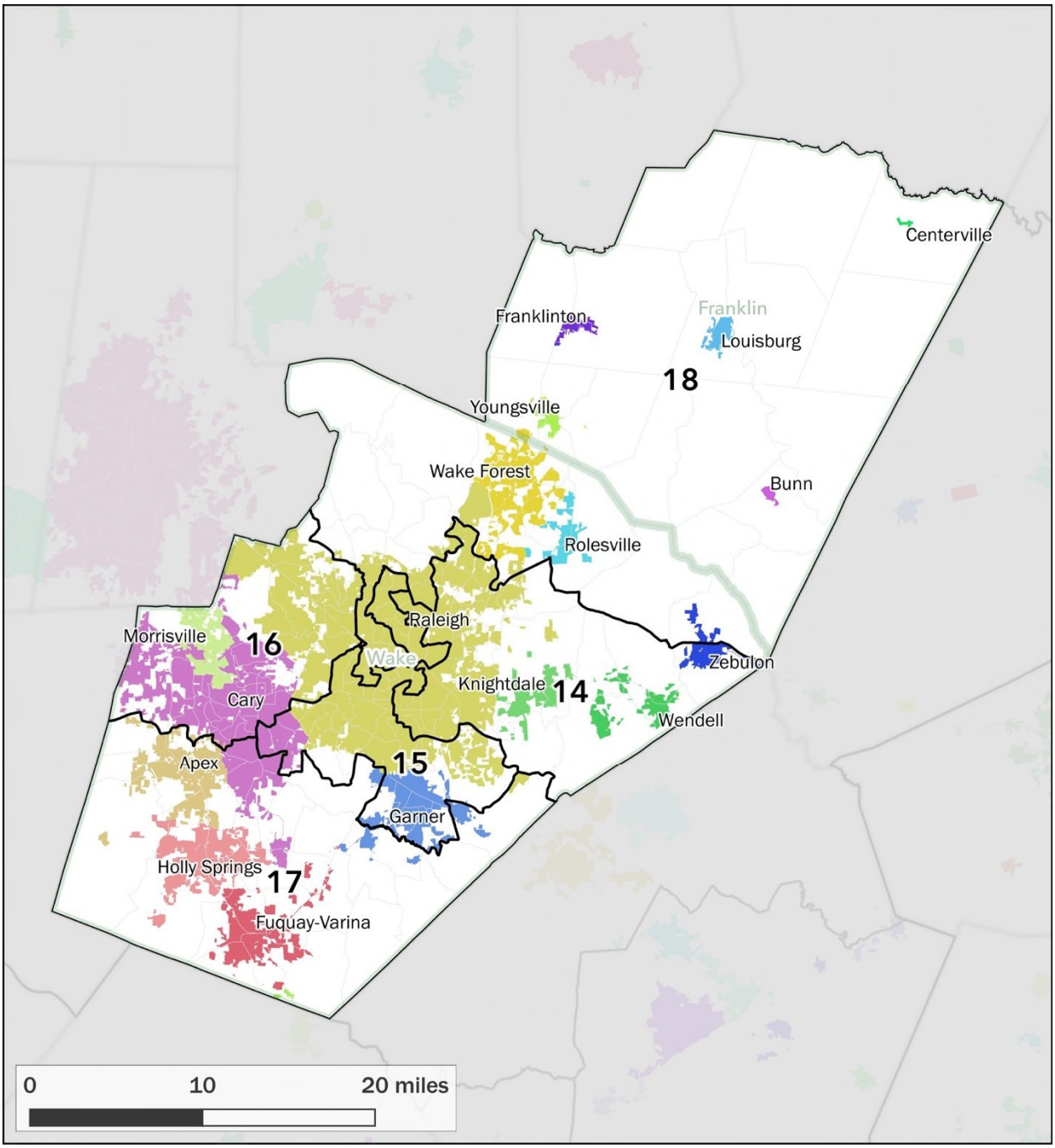
Senate Districts 14, 15, 16, 17, and 18



Senate Districts 14, 15, 16, 17, and 18 are contained within Wake and Franklin Counties. Wake County, home to Raleigh, is among the most Democratic-leaning counties in the state (the county commission has no Republicans and Stein's vote percentage was the 14th largest in the state) and Franklin County, which sits to its northeast, is more moderate, but still leans towards the Democratic Party (Stein's vote share was 38th highest in the state and the county commission has 4 Democrats and 3 Republicans). To create two Republican-leaning districts out of a county cluster that is heavily Democratic, the General Assembly packed Democrats into SD-14, SD-15, and SD-16.

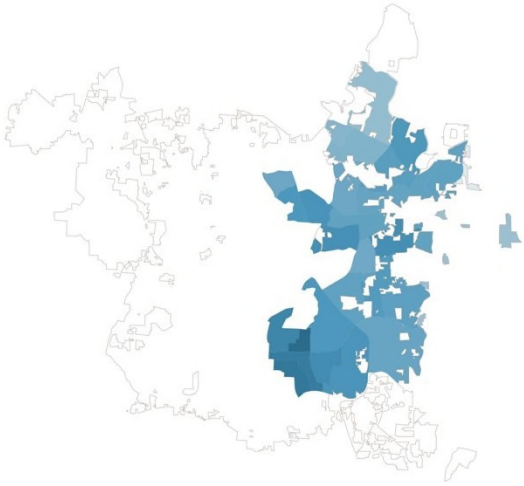
By packing Democrats into SD-14, SD-15, and SD-16, the current district boundaries make SD-17 and SD-18 much more competitive and Republican-leaning than they otherwise would be. Third party data reflect this. SDs 14, 15, and 16 are rated by Civitas as D+21, D+21, and D+11, respectively. SD-17 and SD-18, on the other hand, are considered R+3 and R+2. Similarly, NCFEF considers SD-14, SD-15, and SD-16 as "Strong Democratic," whereas SD-17 and SD-18 are both considered "Lean Republican."

These oddly shaped districts unnecessarily split municipalities, split a VTD, and clearly separate communities of interest with partisan consequences. For instance, to effectuate the gerrymander, heavily Democratic VTD 16-09 is split across SD-15 and SD-17 in order to squeeze more Democrats into SD-15. The municipalities of Cary, Raleigh, Garner, and Zebulon are also split across multiple districts, as the map below demonstrates.

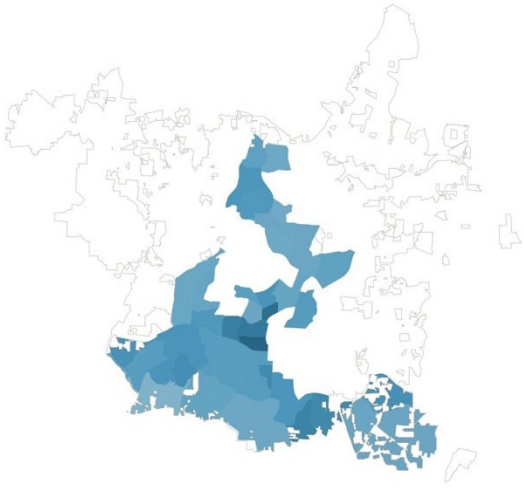


As the series of maps below demonstrates, the municipal splits have particularly important partisan consequences within the Raleigh city limits. By splitting Raleigh in such a manner, the current map ensures that SD-18 includes all of the most Republican-leaning VTDs that are within the Raleigh city limits.

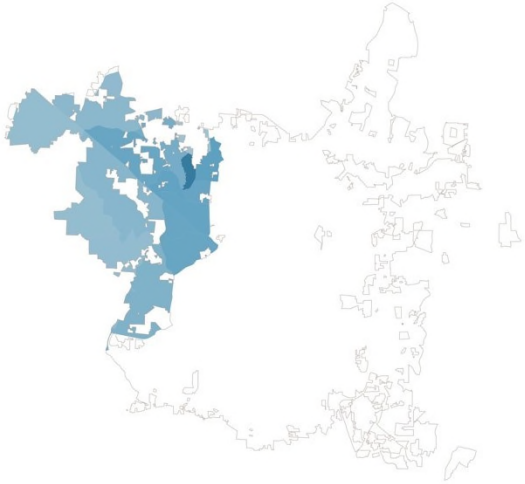
Portions of Raleigh City Limits (Shaded) in Senate District 14



Portions of Raleigh City Limits (Shaded) in Senate District 15

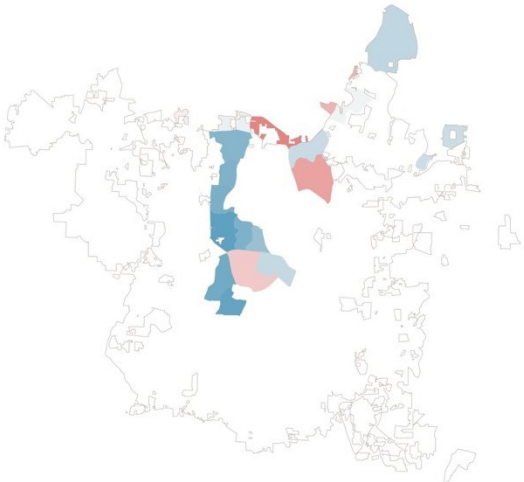


Portions of Raleigh City Limits (Shaded) in Senate District 16



Portions of Raleigh City Limits (Shaded) in Senate District 17

Portions of Raleigh City Limits (Shaded) in Senate District 18

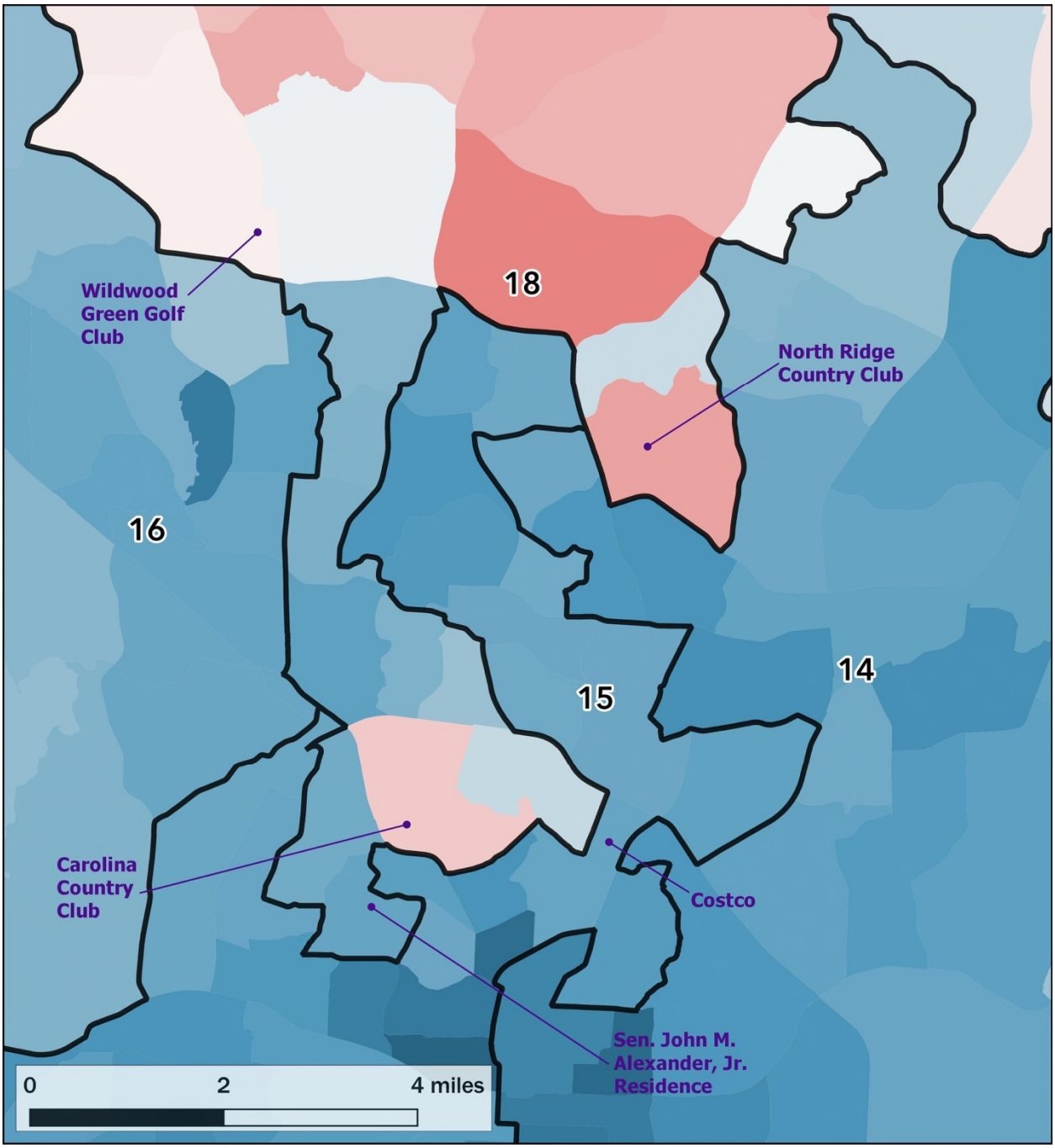


0 2 4 6 8 mi

At northwesternmost edge of Raleigh, small portions of incorporated area are in District 20, which is in Durham County.

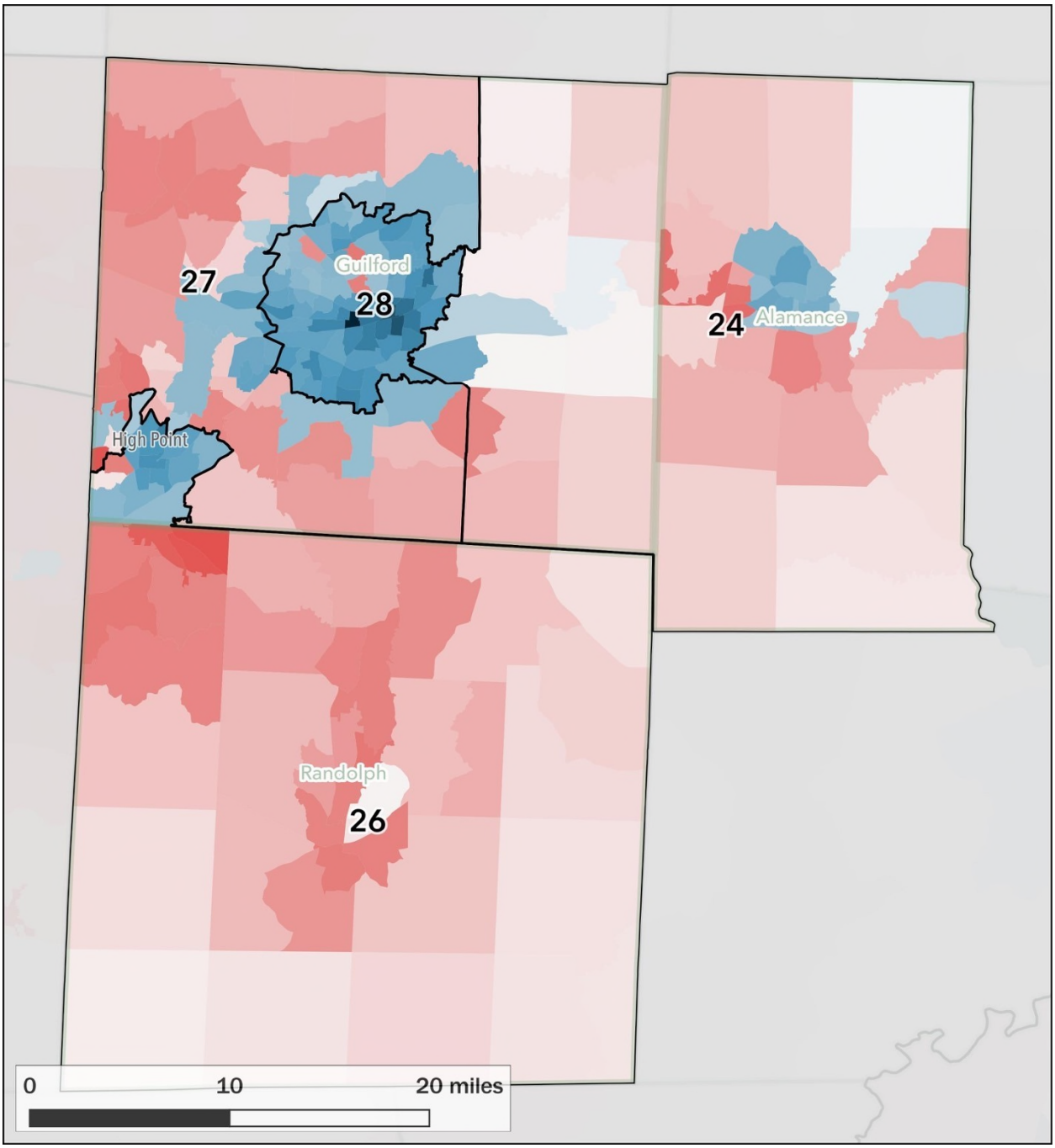
The extent of this gerrymandering is perhaps best exemplified by a 1.1 mile stretch that is completely contained within the Raleigh city limits (see the map below). Lynn Rd. begins in SD-16 at its westernmost intersection with NC-70, moves into SD-18, then SD-15, and then into SD-14, as it becomes Spring Forest Rd. The road then forms the border between SD-14 and SD-18, and ultimately ends once again in SD-14.

These serpentine district boundaries allow SD-18 to grab Republican VTDs in Raleigh, connecting three golf clubs in the process, and thereby join these Republicans voters with the Republican voters north of Raleigh, helping to tilt SD-18 toward the Republicans. It is also notable that incumbent John M. Anderson, Jr. lives near the oddly shaped southern border of SD-18. Similarly, SD-15 stretches through a narrow passageway that is only as wide as a Costco and its accompanying parking lot, in order to pack Democratic voters north of the passageway into SD-15 (and ensuring these voters are not in SD-18). See below for a map that places this Costco passageway in larger perspective.



Despite the blue wave in 2018, the gerrymander of this cluster partially held. SD-14, SD-15, and SD-16 all supported Democratic candidates by huge margins (thus wasting Democratic votes), while a Republican won SD-18 by a relatively small margin (49.9% to 47.35%) and a Democrat won SD-17 by a relatively small margin (50.6% to 46.35%).

Senate Districts 24, 26, 27, and 28

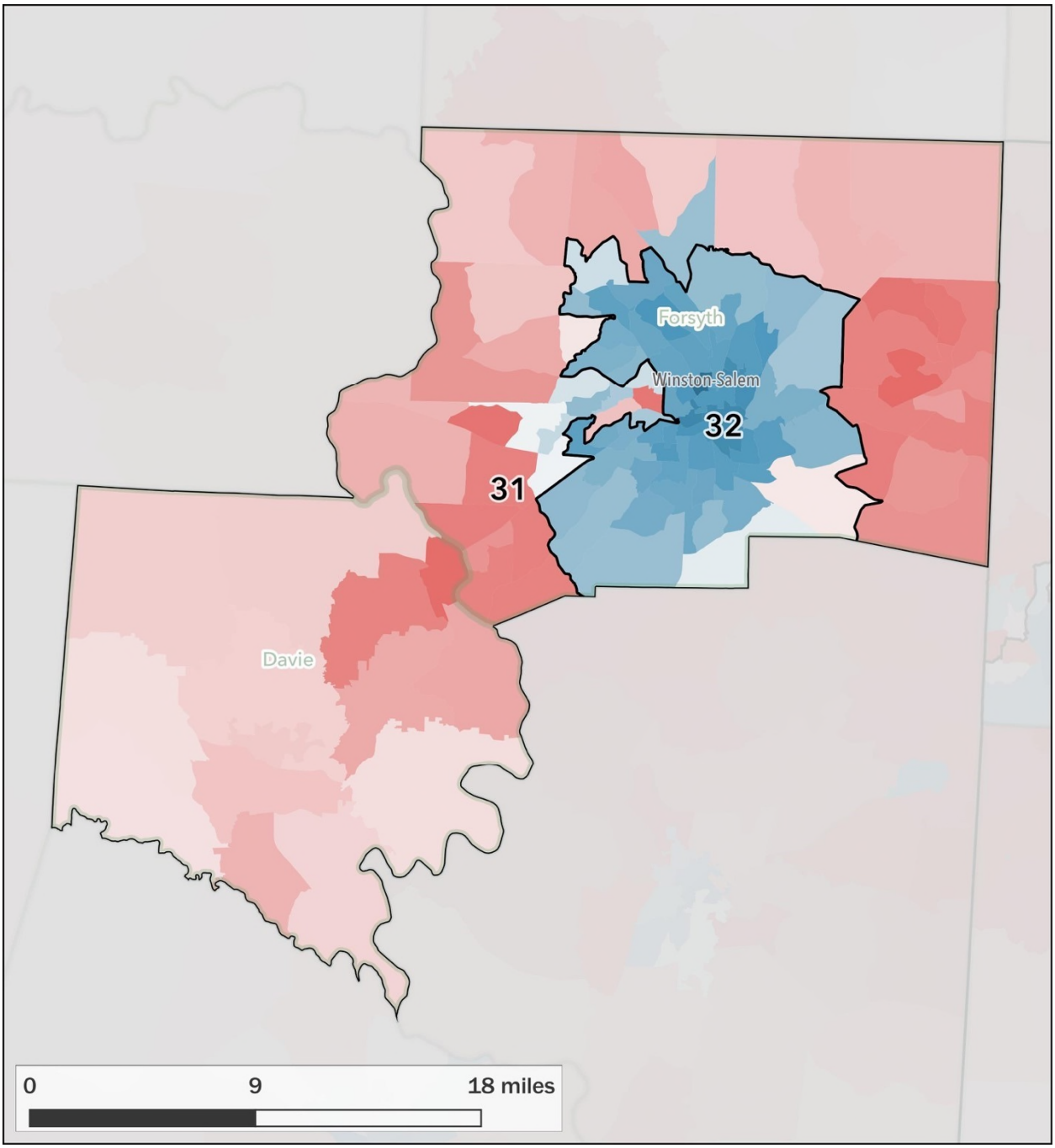


Senate Districts 24, 26, 27, and 28 are located in a three-country cluster located in the state's Piedmont region that includes Randolph, Guilford, and Alamance counties. Guilford County is heavily Democratic (with the 13th highest vote share for Stein) and includes the Democratic strongholds of Greensboro and High Point. Adjacent Randolph County leans strongly toward the Republican Party (Stein's vote share was 98th highest in the state). SD-28 was determined to be racially gerrymandered and was redrawn by the Special Master in the *Covington* lawsuit.

Randolph County includes slightly too few people to constitute its own district. In a textbook example of gerrymandering, rather than place the politically and culturally similar conservative areas of Guilford County in the same district as heavily Republican Randolph County, the current SD-26 lines capture the heavily Democratic areas of High Point—the only Democratic VTDs that lie on the Randolph/Guilford County border. Separating this Democratic area of Guilford County from SD-27 makes SD-27 a competitive district, while SD-26 remains a safe Republican district.

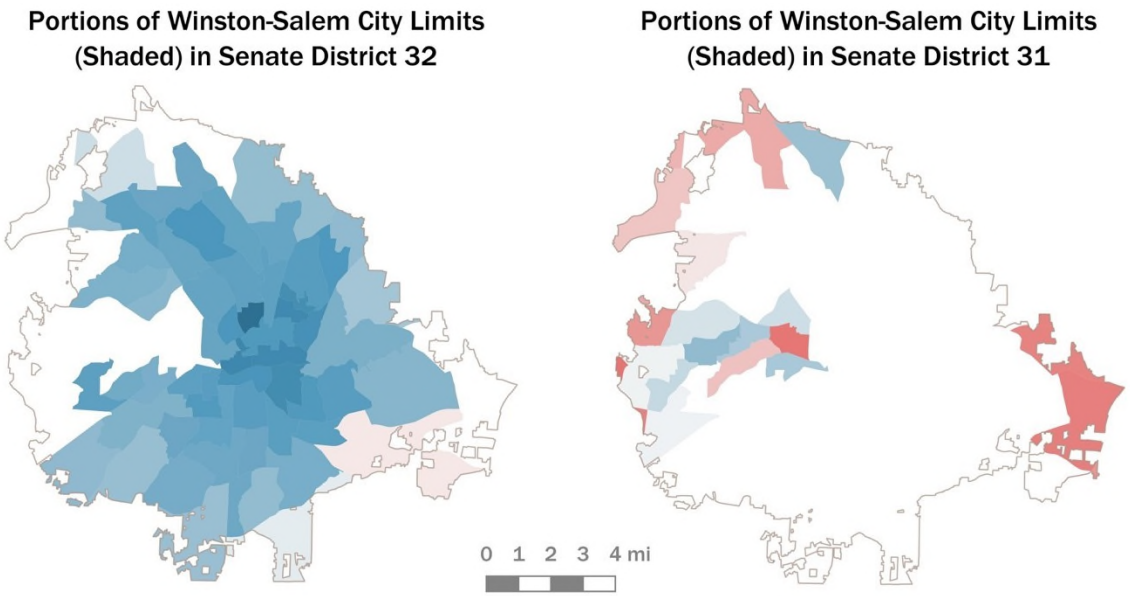
These conclusions about the partisan leanings of the districts are confirmed by examining third-party ratings of the districts. Prior to the 2018 election, Civitas ranked SD-26 as R+13 and SD-27 as R+3. Similarly, NCFEF rated the districts as "Strong Republican" and "Lean Republican," respectively. In the 2018 elections, Republicans won in SD-26, as expected, while a Democrat squeaked out a narrow (1 percentage point) victory in SD-27.

Senate Districts 31 and 32

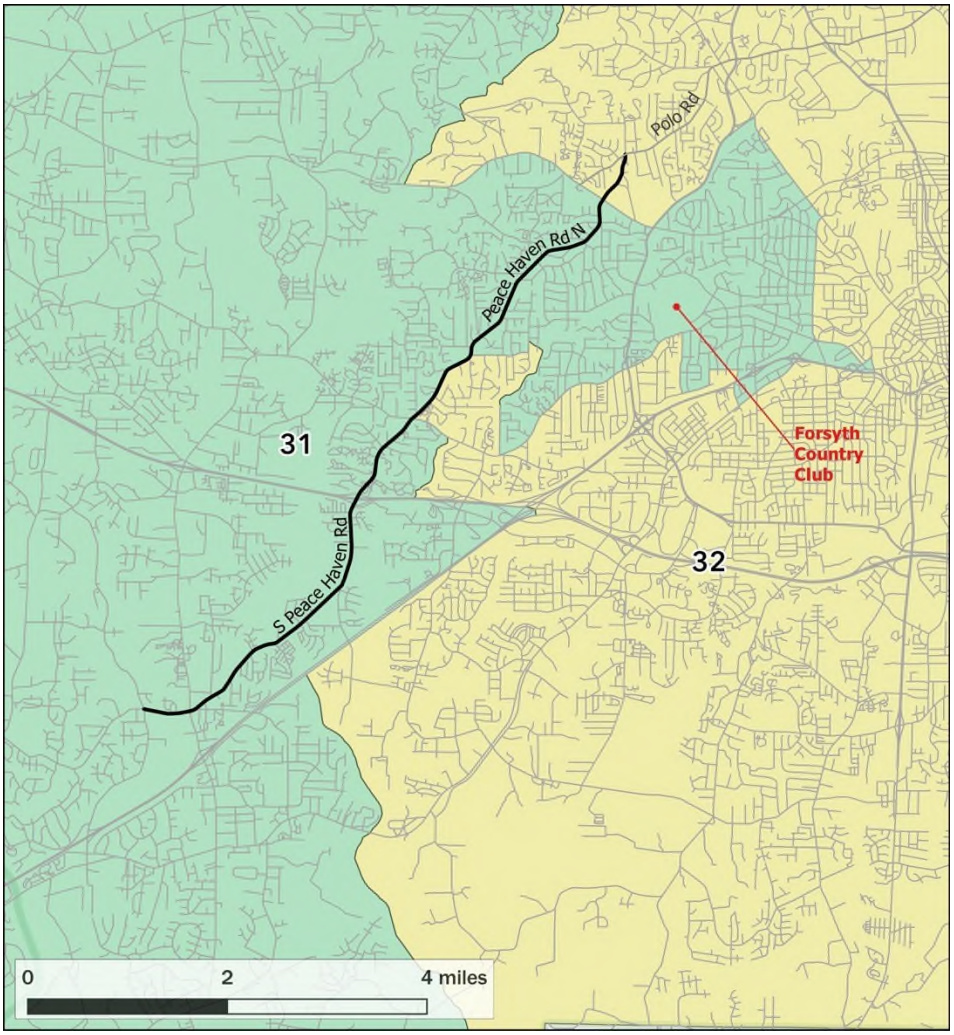


Senate Districts 31 and 32 are located in the Piedmont and are contained completely within Davie and Forsyth counties. Davie County is heavily Republican (the county commission is unanimously Republican and Stein's vote share was 89th highest in the state). Forsyth County, however, favored Stein in the 2016 Attorney General race (Stein's vote share in Forsyth was 20th highest in the state and the county commission has a partisan differential of just one vote).

To ensure Republicans would win one of these districts, the current plan packs the most heavily-Democratic areas of Winston-Salem into a single district (SD-32). At the same time, the largest concentration of Republican and competitive VTDs in Winston-Salem (on the city's western, northern, and eastern edges) are placed in SD-31, with the northeast portion of Forsyth County and the southwest portion of Davie County—connecting areas that are neither culturally, nor geographically proximate. The following map, which shows those portions of Winston-Salem that sit in each district, provides a clear illustration of this gerrymander.

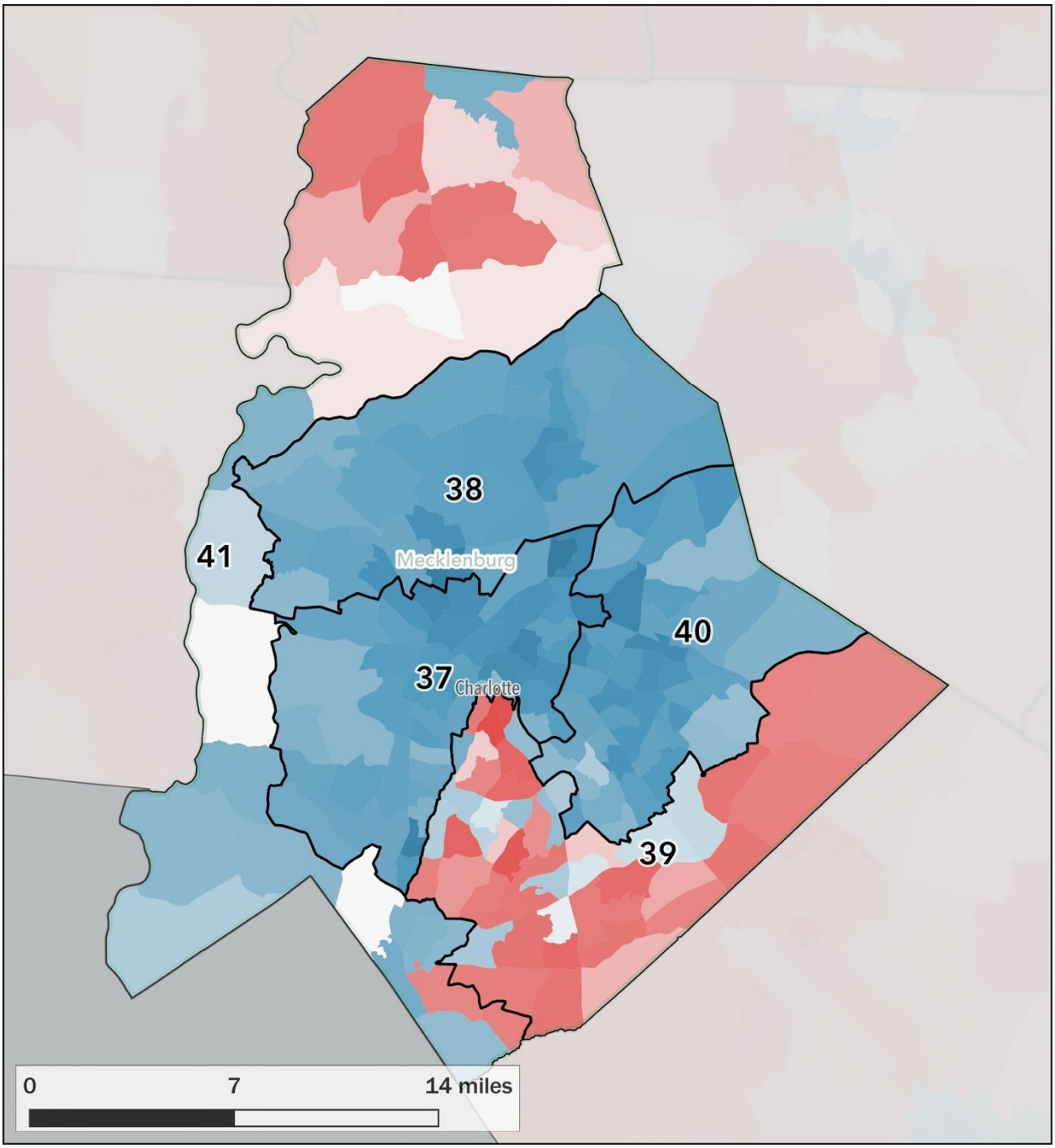


The partisan effects of this map are further illustrated in the next map, which focuses solely on the west side of Winston-Salem near Peace Haven Rd. In order to grab Republican pockets of western Winston-Salem for SD-32 while avoiding Democratic voters in the area, SD-31 travels up Peace Haven Rd. and includes areas east of the road, eventually reaching farther east to snag heavily Republican neighborhoods around the Forsyth County Club. Along the way, SD-31 avoids a heavily Democratic appendage to SD-32 that is shaped like a scorpion's tail.



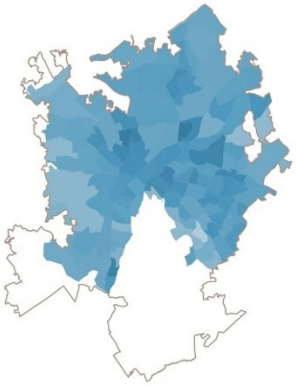
Once again, these lines have clear effects. Civitas rated SD-31 as R+13 and SD-32 as D+21, and NCFEF called SD-31 "Strong Republican" and SD-32 "Strong Democrat." The 2018 electoral outcomes reflected these tendencies as Democrat Paul Lowe won SD-32 by 45 percentage points, whereas Republican Joyce Krawiec won SD-31 by 22.4 percentage points.

Senate Districts 37, 38, 39, 40, and 41

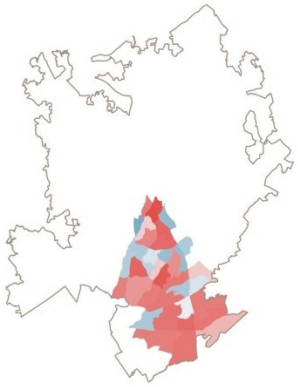


Senate Districts 37, 38, 39, 40 and 41 are located within Mecklenburg County, a county situated on the border with South Carolina. In Mecklenburg, Republican Donald Trump garnered only 32% of the vote, Republican Buck Newton garnered only 38% of the vote (10th highest vote share for Stein), and no Republican sits on the county commission. The intent and effect of the district lines in this cluster are clear. Senate Districts 37, 38, and 40 waste Democratic votes by packing Democratic voters into these three districts. SD-37 and SD-38 do not include a single Republican-leaning VTD and SD-40 includes just one competitive VTD. The result of this packing is to place many of the county's Republican and competitive VTDs into SD-39, helping to ensure one Republican victory in this cluster, and placing other Republican-leaning areas in SD-41 to make that district more competitive for Republicans. The graphic below shows how the mapmakers packed the most Democratic portions of Charlotte into SD-37, SD-38, and SD-40, while placing the most Republican areas of Charlotte in SD-39 and SD-41.

Portions of Charlotte City Limits (Shaded) in Senate Districts 37, 38, and 40

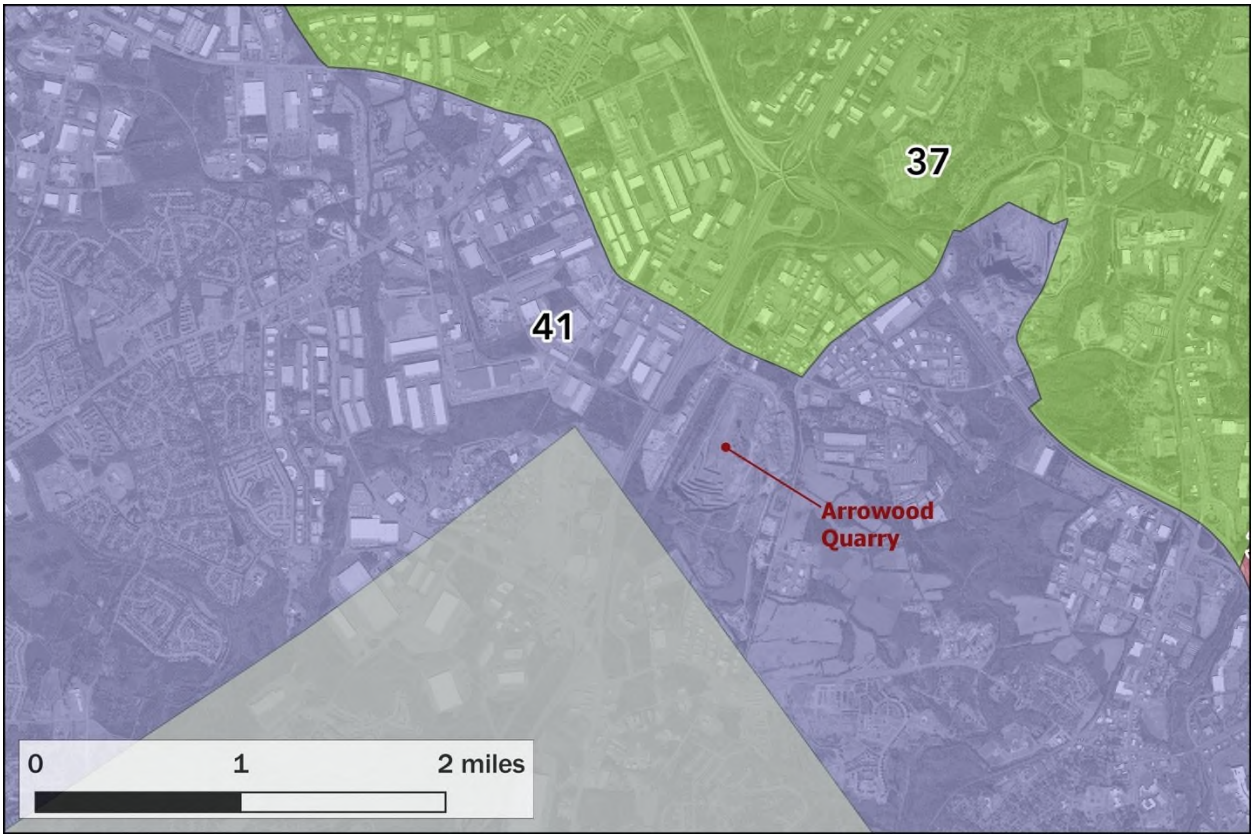


Portions of Charlotte City Limits (Shaded) in Senate District 39



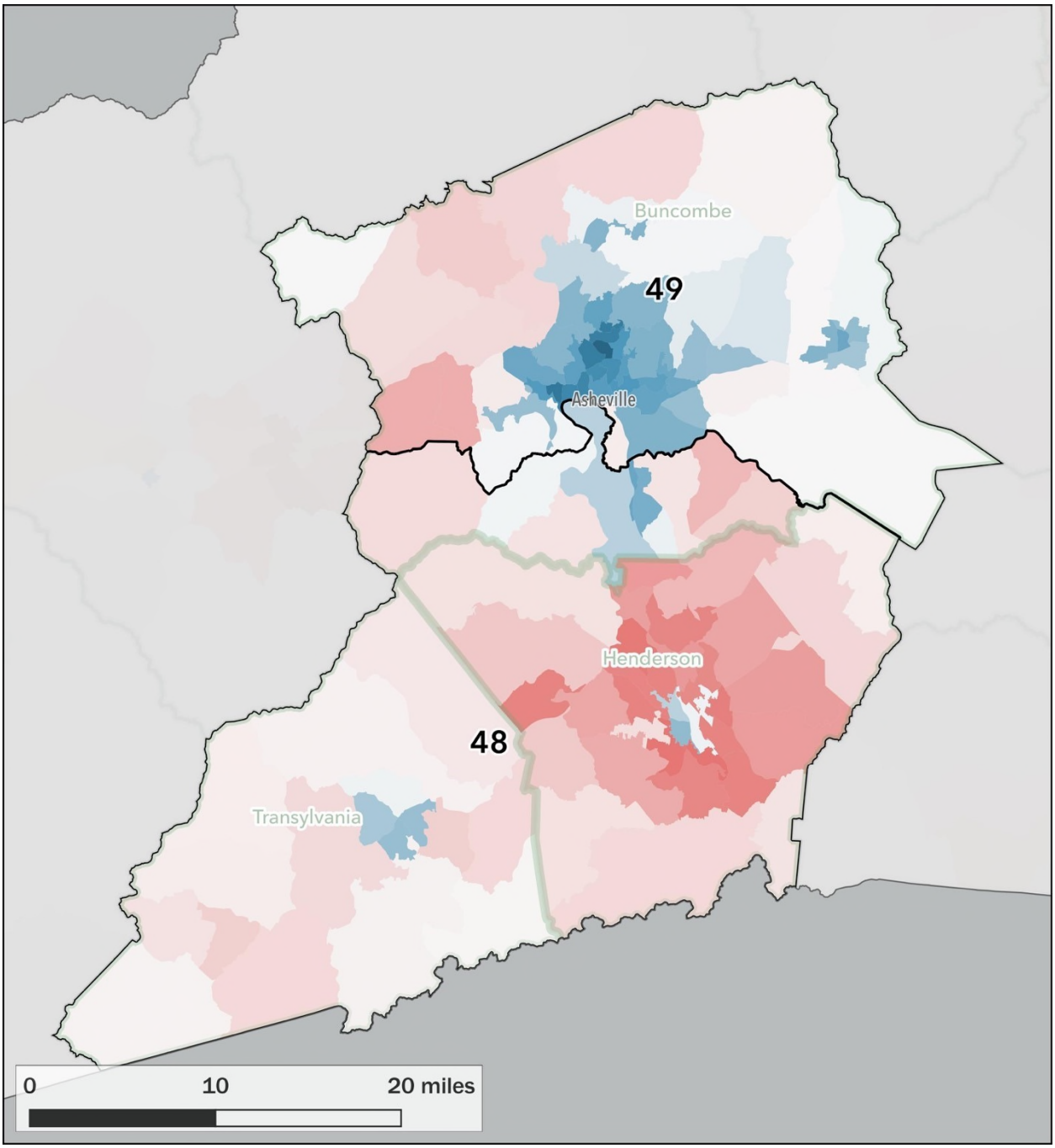
Portions of Charlotte City Limits (Shaded) in Senate District 41

SD-41 takes a particularly odd and meandering path throughout the county, connecting Mecklenburg's southernmost and northernmost points into a single C-shaped district that, as the following map suggests, is at one point scarcely larger than the Martin Marietta Arrowood Quarry (less than a mile wide). This shape is not only odd, but also electorally significant, since it pieces together Republican-leaning areas north of Charlotte with Republican-leaning VTDs in the southern tip of Charlotte.



Third-party assessments of competitiveness reinforce these conclusions. Senate Districts 37, 38, and 40 were rated as "Strong Democrat" by NCFEF and were rated as D+25, D+29, and D+24, respectively, by Civitas. In contrast, SD-39 was rated as "Strong Republican" by NCFEF and R+7 by Civitas, and SD-41 was rated as D+0 by Civitas and "Competitive" by NCFEF. The 2018 election results also reflected these assessments, with Senate Districts 37, 38, and 40 favoring the Democratic candidate by large margins (78% to 20%, 82% to 18%, and 76% to 24%, respectively), while SD-39 and SD-41 were more competitive, with Republicans winning SD-39.

Senate Districts 48 and 49



Senate Districts 48 and 49 are located in the southwestern portion of North Carolina, adjacent to the westernmost district in the state. This cluster is anchored by the Democratic stronghold of Buncombe County (Stein's vote share was 15th highest in Buncombe and the county commission has been majority Democratic since 2002) and also includes Republican-leaning Henderson and Transylvania Counties to the south and southwest of Buncombe, respectively (both strongly favored Newton and have had majority-Republican county commissions since 2002).

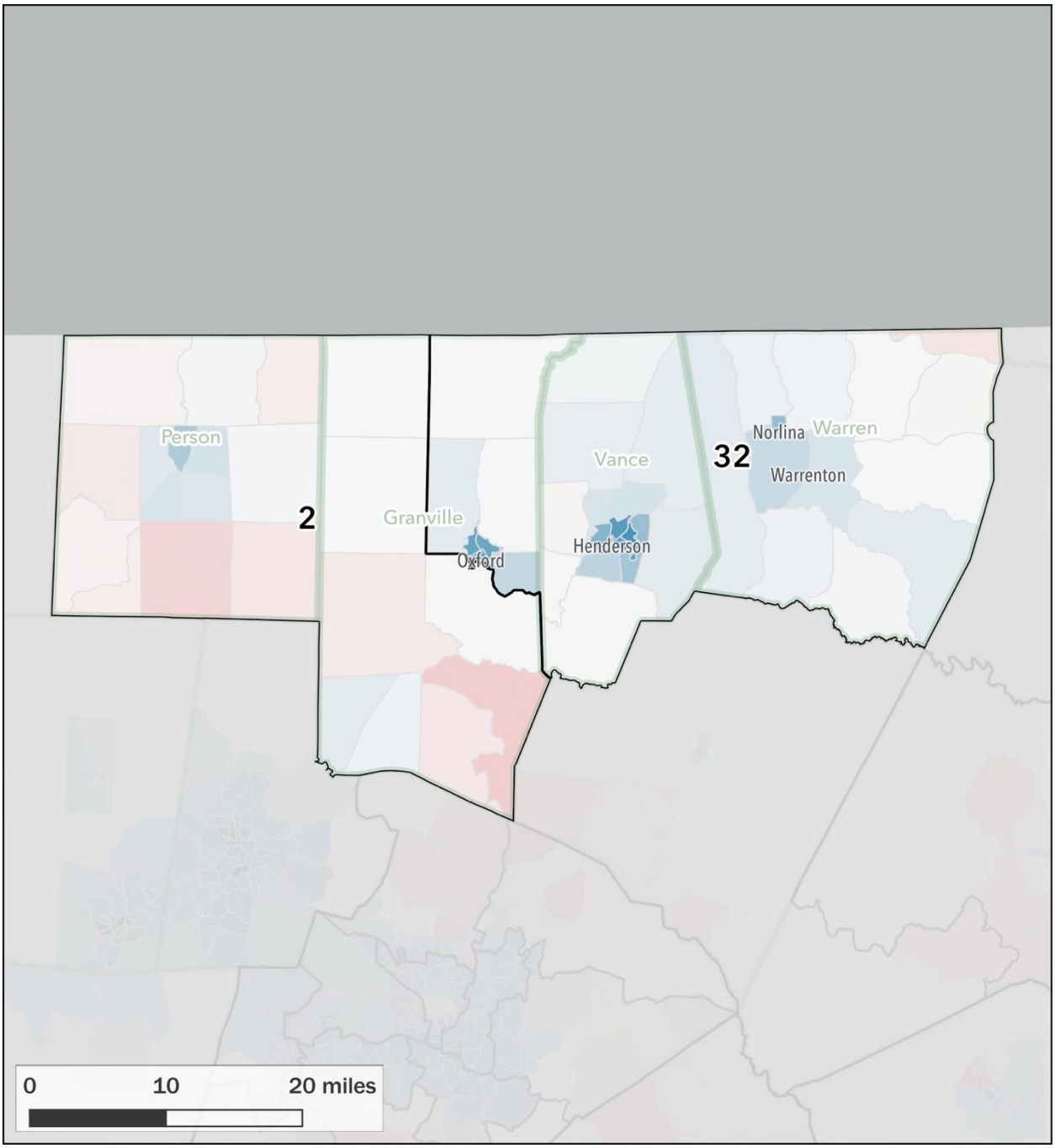
In the current map, SD-49 pairs Asheville's Democratic voters with Democratic VTDs in Swannanoa and Black Mountain, pairing the Democratic voters in the latter two heavily Democratic municipalities on the eastern portion of this cluster with most of Asheville, rather than placing them in SD-48 where they would make that district more competitive.

This gerrymander has been successful as Democrat Terry Van Duyn (and prior to her Martin Nesbitt) have consistently won SD-49 by large margins, whereas Republicans have won SD-48 in all four elections since the district was created in 2011 (these districts were not altered in 2017). Civitas and NCFEF analyses confirm that these elections are not anomalies—NCFEF rated SD-48 as "Strong Republican" and SD-49 as "Strong Democrat," and Civitas rated those districts as R+8 and D+12, respectively.

House Districts

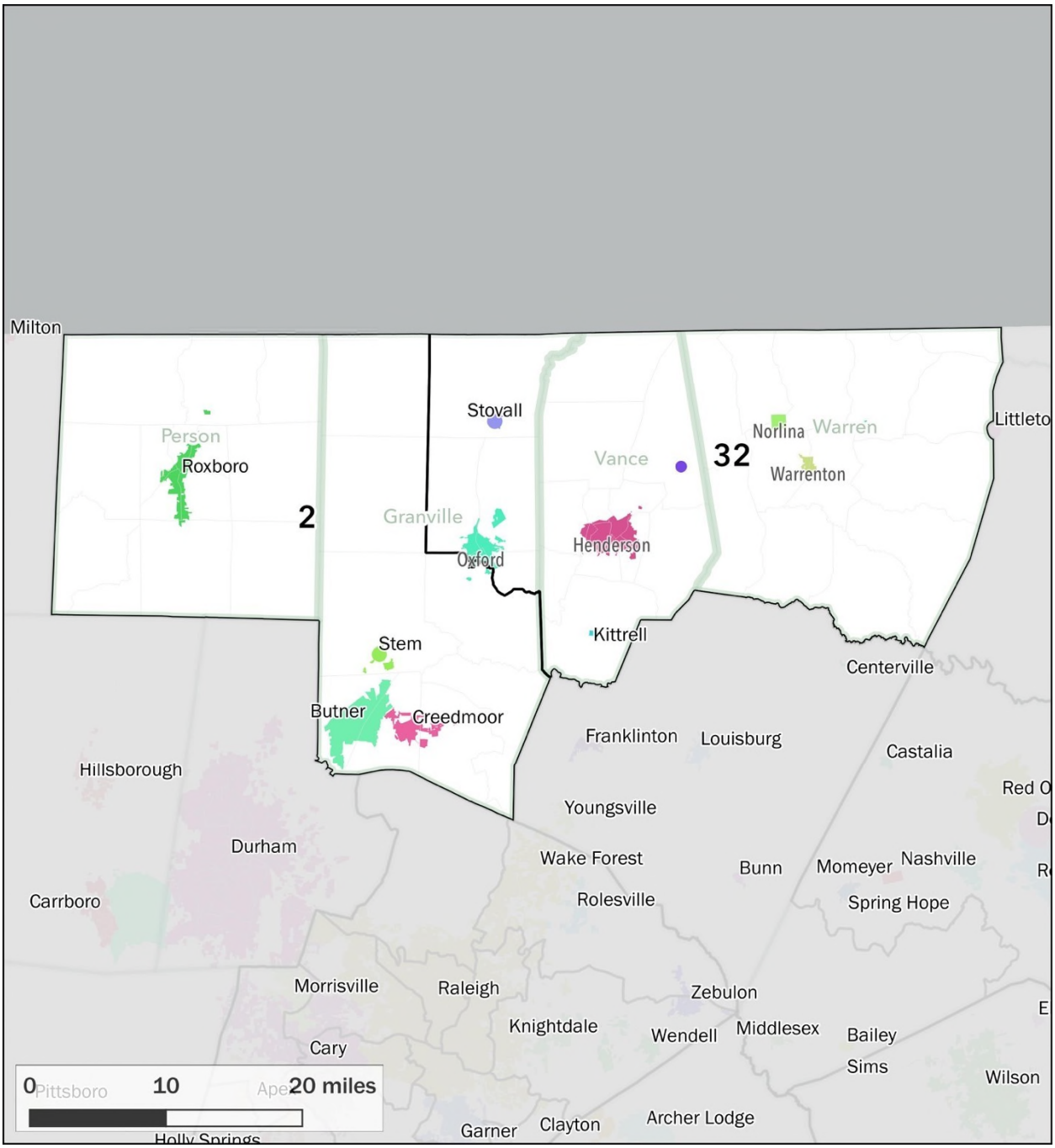
I continue my cluster-by-cluster analysis with House districts.

House Districts 2 and 32



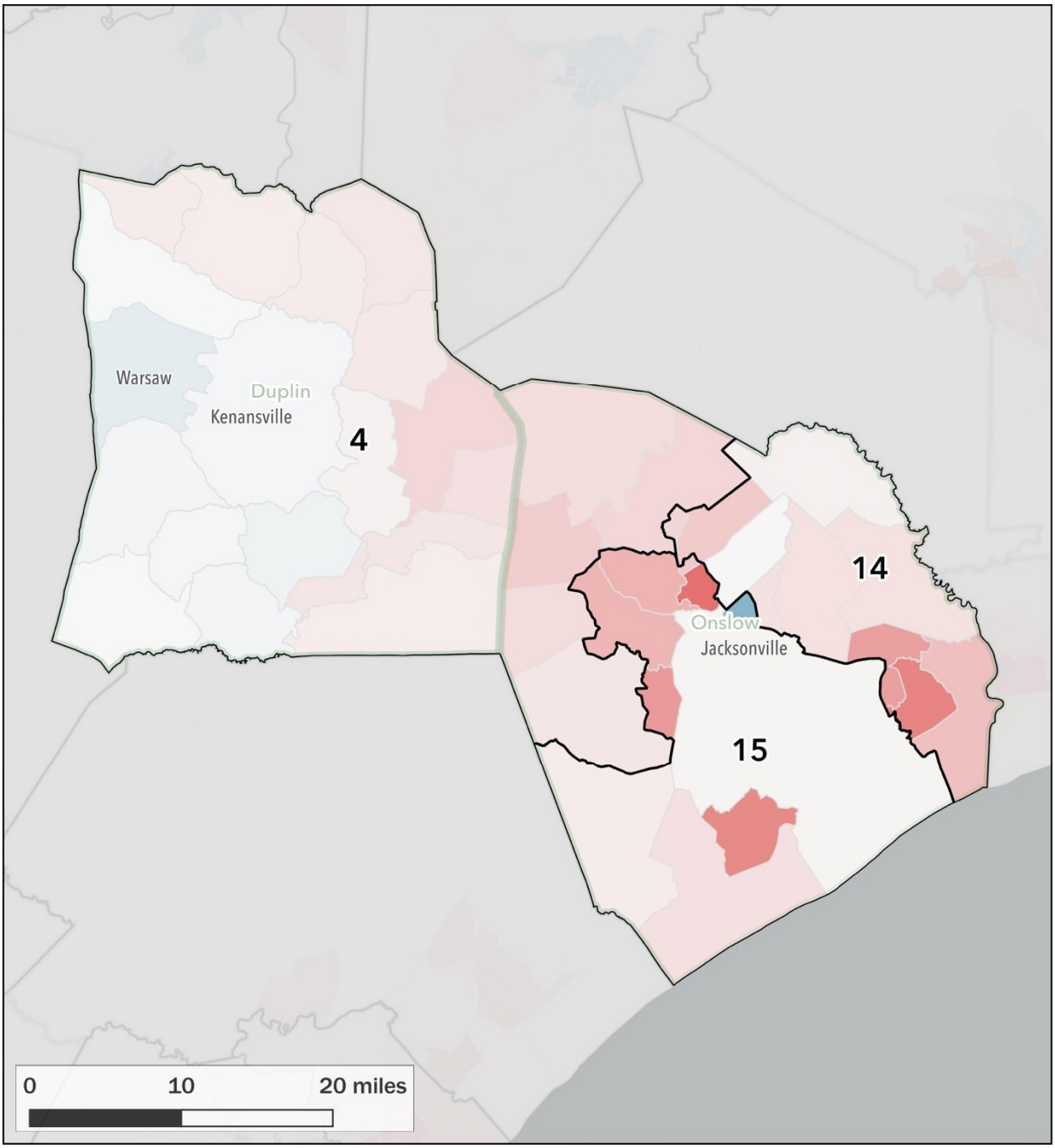
House Districts 2 and 32 rest on North Carolina's northern border and lie north and northeast of Durham. HD-2 spans Person and Granville counties while HD-32 includes all of Vance and Warren counties and a part of Granville County. Granville is among the most competitive counties in the state. Donald Trump won Granville by less than 700 votes in the 2016 election—an election where Democrat Roy Cooper carried the same county. Granville also supported Obama in 2012 (by a similarly small margin) and the Democratic Party has a one seat advantage on the Granville County Commission (a commission that they have controlled since 2002). Republicans have a one-seat majority on the Person County Commission (a commission that flipped partisan control in 2014) and Stein's vote share in Person was 43rd highest of any county in North Carolina. Warren and Vance are among the eight most Democratic-leaning counties in the state, according to the results of the 2016 Attorney General race, and both county commissions have been controlled by Democrats since at least 2002. In sum, this is a Democratic-leaning cluster of counties.

In creating two districts in this cluster, the General Assembly had a limited set of choices, as the decision essentially was limited to which portions of Granville to join with Vance and Warren and which portions of Granville to join with Person. Among its available options, the General Assembly chose the option that made HD-2 as favorable to Republicans as possible. In particular, by dividing Granville County across the two districts, the General Assembly placed the most Democratic areas of Granville (in and around Oxford) in HD-32, joining these voters with the heavily Democratic Warren and Vance counties. As illustrated on the following map, the current map splits the City of Oxford, but packs most of this Democratic stronghold into HD-32. The General Assembly then placed the more moderate and Republican-leaning areas of Granville in HD-2, shoring up HD-2 as a Republican district.



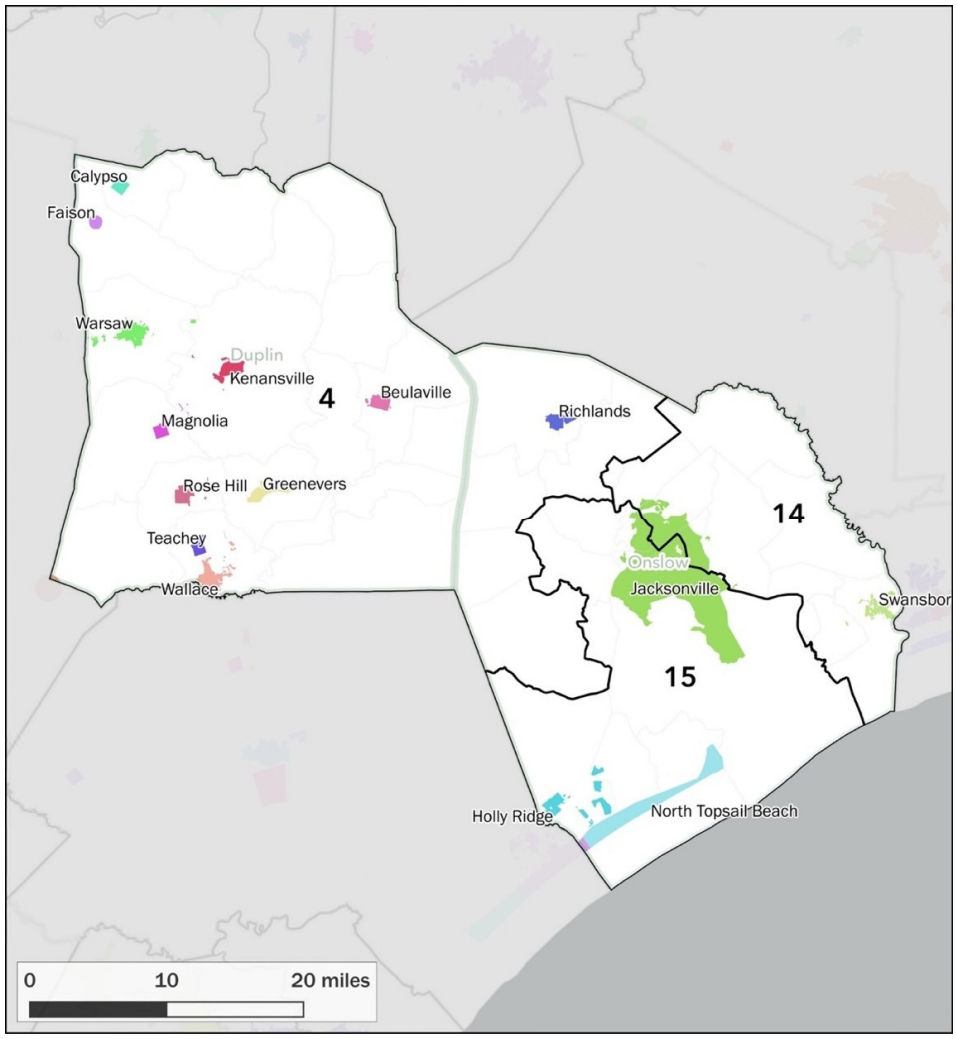
The effects of this strategy were confirmed by Civitas, which rated HD-2 as R+3 and HD-32 as D+17. Similarly, NCFEF rated HD-2 as "Lean Republican" and HD-32 as "Strong Democrat." The 2018 election results reinforced these expectations—Republican Larry Yarborough won HD-2 by more than 10 percentage points in 2018. The HD-32 lines have also been successful in wasting Democratic votes—Democrat Terry Garrison won by more than 25 percentage points in 2018.

House Districts 4, 14, and 15



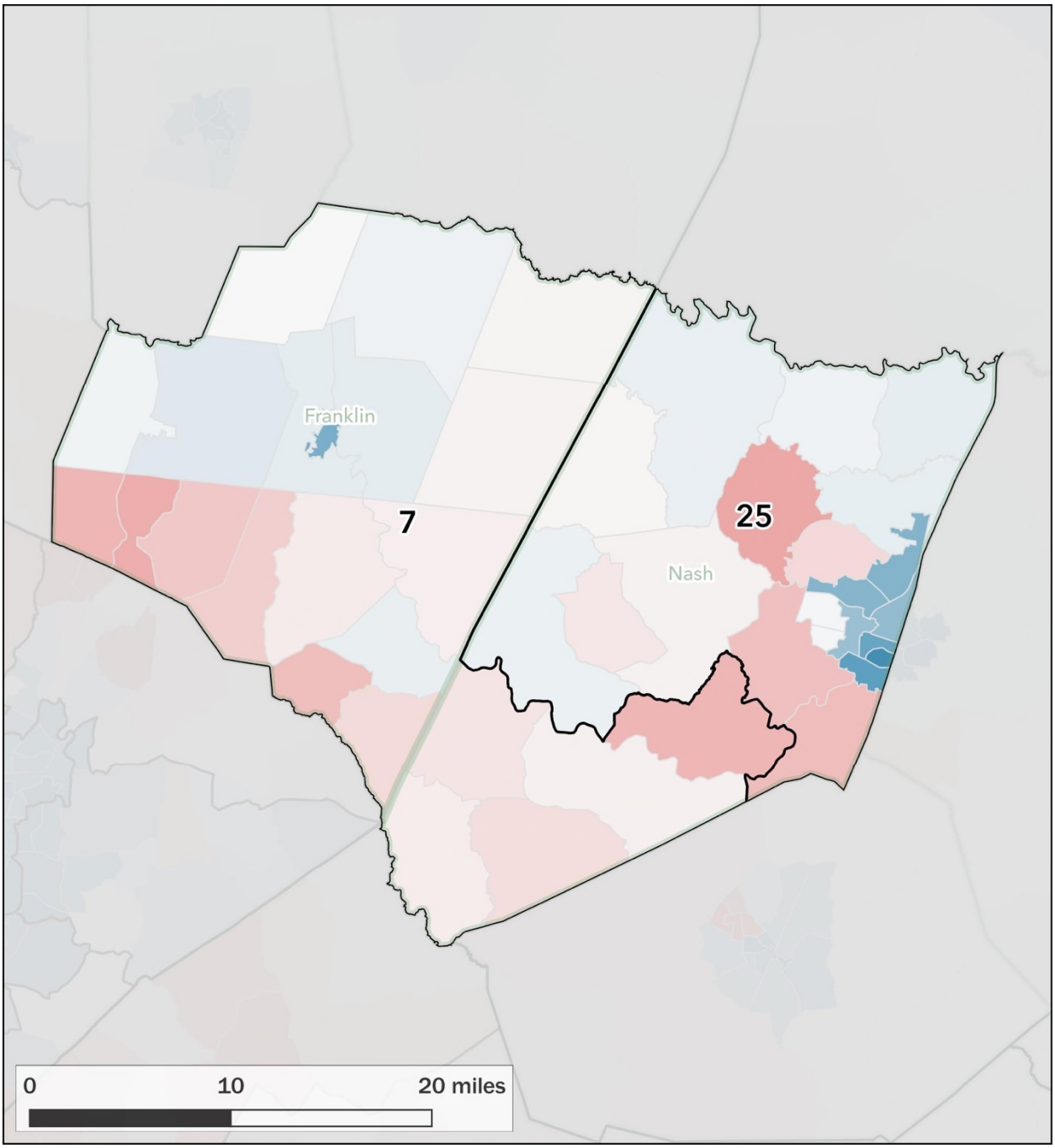
House Districts 4, 14 and 15 are located in eastern North Carolina (HD-14 and HD-15 are adjacent to the Atlantic Ocean) and include Duplin and Onslow counties. Onslow County leans heavily Republican (no Democrats currently serve on the county commission and the county provided the 76th highest vote share for Stein), while Duplin County is the definition of moderation (Stein's vote share was 50th highest in the state, Republicans hold a one seat margin on the county commission, and Democrats held majority control of the county commission from 2002 through 2014).

As the maps above and below demonstrate, to carve three reliably Republican districts out of a cluster that includes moderate and Democratic-leaning areas of Duplin County and Democratic areas near Jacksonville, the current district lines split Jacksonville between HD-14 and HD-15, and keep Jacksonville separated from the Democratic voters in Duplin County near Warsaw and Kenansville.



House Districts 4, 14, and 15 were rated as R+10, R+10, and R+16, respectively, by Civitas and as “Strong Republican” by the NCFEF. The 2018 election also reflected these predictions, with Republicans winning HD-4 with 62.87% of the vote, HD-14 with 58.82% of the vote, and HD-15 with 66.38% of the vote.

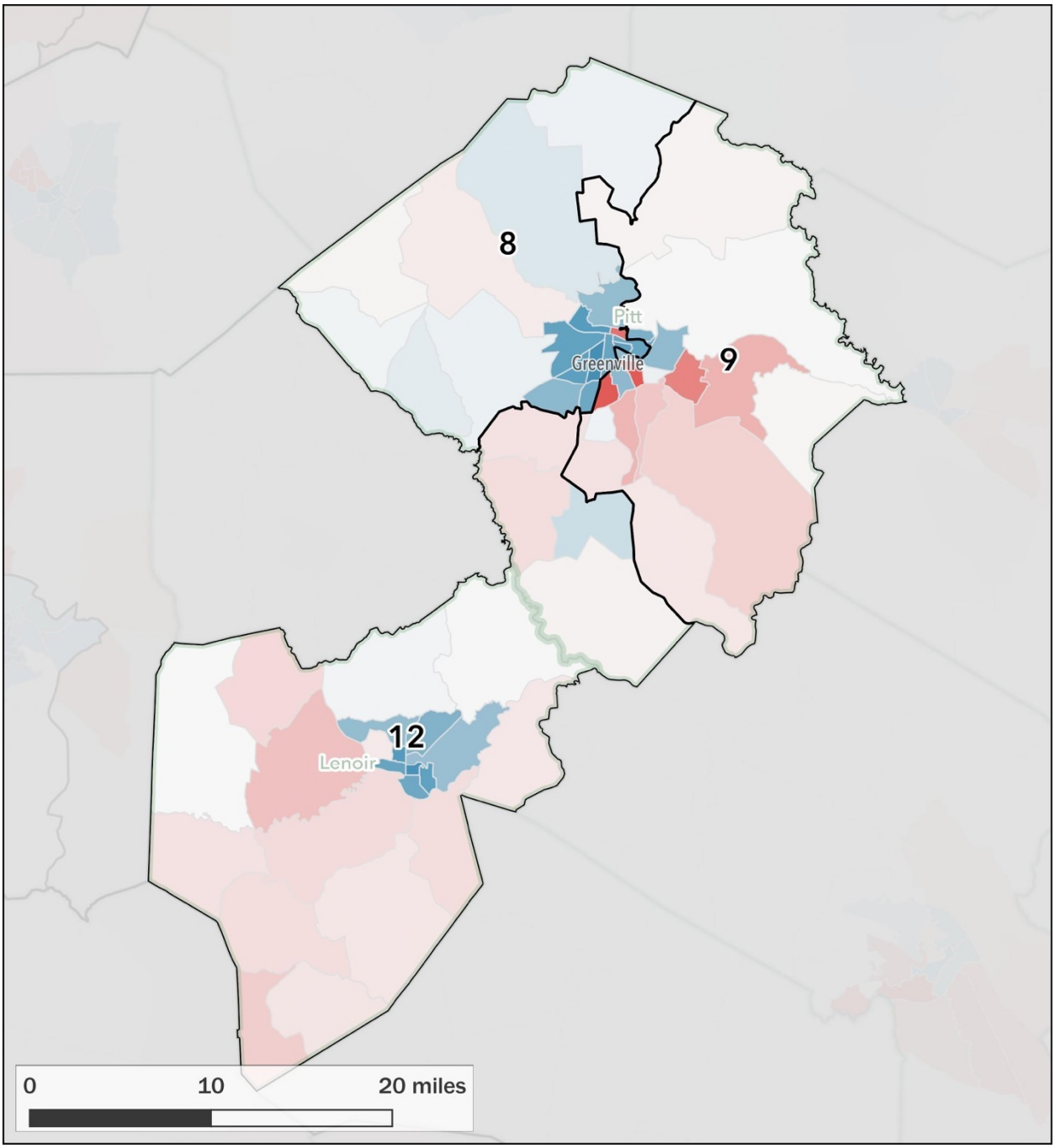
House Districts 7 and 25



House Districts 7 and 25 lie within Franklin and Nash counties, between Raleigh and the coast. Both Franklin and Nash counties are moderate counties. Democrats have held a majority on the Franklin County Commission since at least 2002, although Republicans have won more voters there in recent statewide elections. Conversely, Republicans hold a one-seat majority on the Nash County Commission, but Democrats have won slightly more votes there in recent statewide elections. In order to ensure that one of the two districts in this cluster would favor Republicans, the current maps are drawn so that HD-7 wraps around HD-25 to include one of the two most Republican VTDs in Nash County, which is also the most Republican VTD on the border between the two districts. If HD-7 took any other adjacent VTD in Nash County, HD-7 would be much more competitive. Including this VTD also renders HD-7 less compact and splits certain communities. For example, leaving downtown Nashville, NC, Highway 58 is in HD-25, then moves into HD-7, and then forms the boundary between HD-7 and HD-25 before leaving Nash County.

These boundaries clearly serve partisan ends. HD-7 was rated as R+4 by Civitas and "Lean Republican" by NCFEF. Republican Lisa Barnes beat incumbent Democrat Bobbie Richardson in 2018 by 16 percentage points. HD-25 was rated as D+7 by Civitas and "Lean Democratic" by NCFEF, and Democrat James Gailliard won HD-25 in 2018.

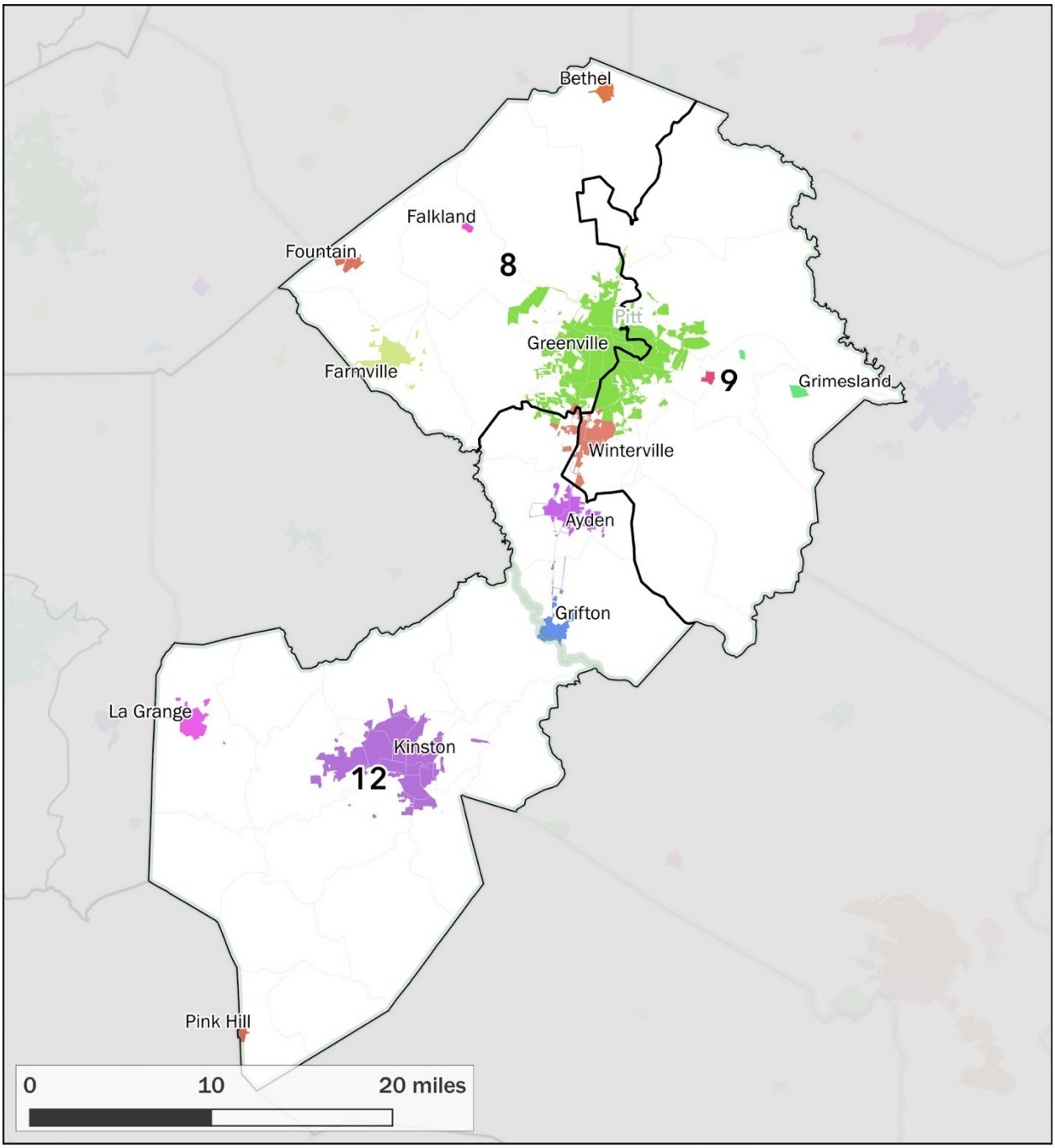
House Districts 8, 9, and 12

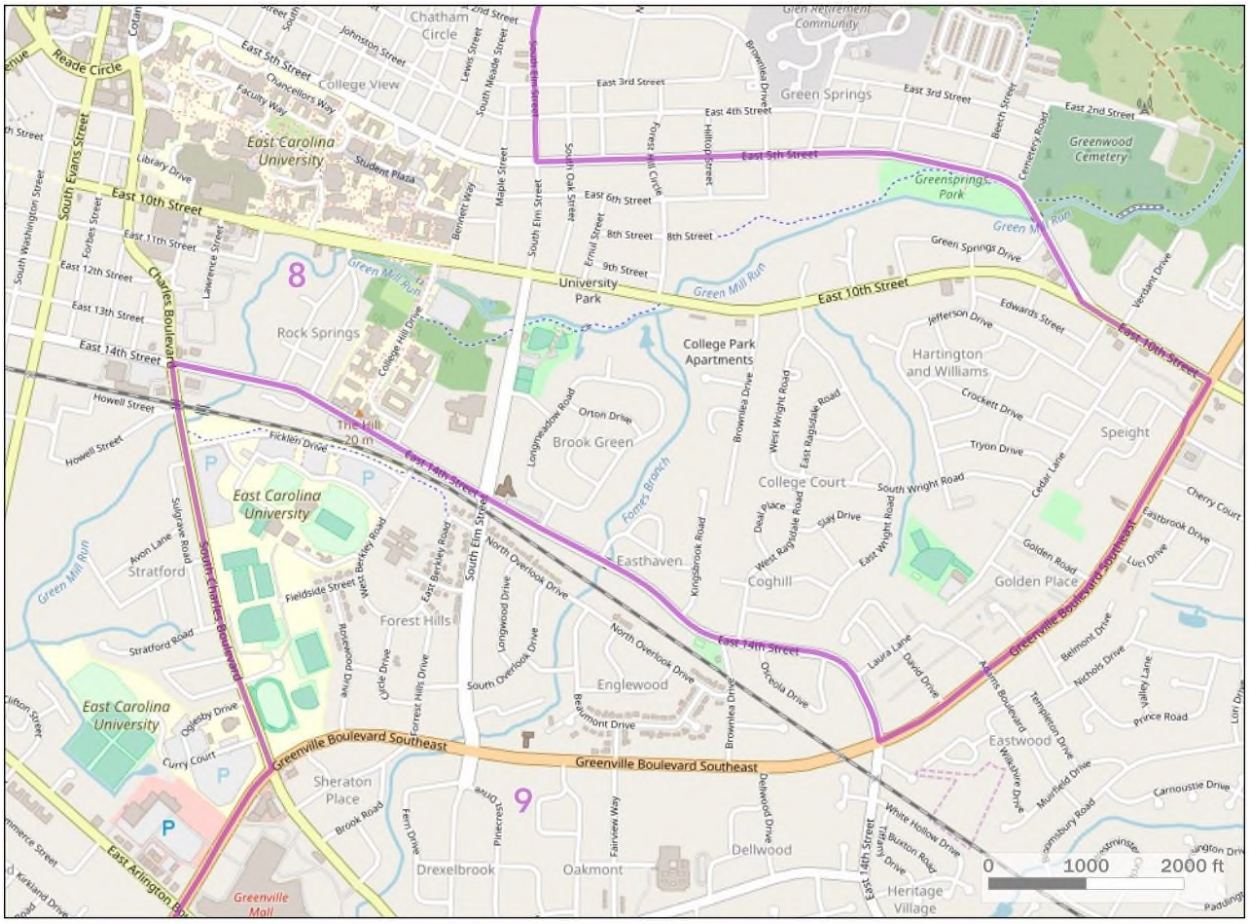


House Districts 8, 9, and 12 are located in the eastern third of the state, within a county cluster consisting of Pitt and Lenoir counties. Pitt ranked 22nd in the State in terms of Stein's vote share, whereas Lenoir ranked 32nd. Both county commissions have also been controlled by the Democratic party since 2002. This combination of counties seems apt to produce multiple Democratic-leaning House districts in the General Assembly. To combat this possibility, however, the current map packs Democratic areas of Pitt County into HD-8, creating an overwhelmingly Democratic district and allowing HD-9 and HD-12 to have a much greater chance of electing Republicans.

The current district lines produce several notable anomalies to achieve these results. For example, the district line separating HD-8 and HD-9 runs through the middle of Greenville—the home of East Carolina University and the county seat of Pitt County. Indeed, the campus itself is split between two districts, as HD-9 contains the portion of the university that includes Dowdy-Ficklen Stadium, while other portions of campus, including Faculty Way and Founders Drive, are in HD-8. This bisection of Greenville also evenly splits VTD 1507 (1507 Greenville #7), separating a clear community of interest and causing voter confusion, all in service of the effort to pack as many Democrats as possible into HD-8. The more Republican-leaning VTDs of Greenville were combined with other Republican VTDs, ensuring that HD-9 would favor Republicans. The maps below demonstrate the municipal splits and the bisection of East Carolina University in Pitt County.[18]

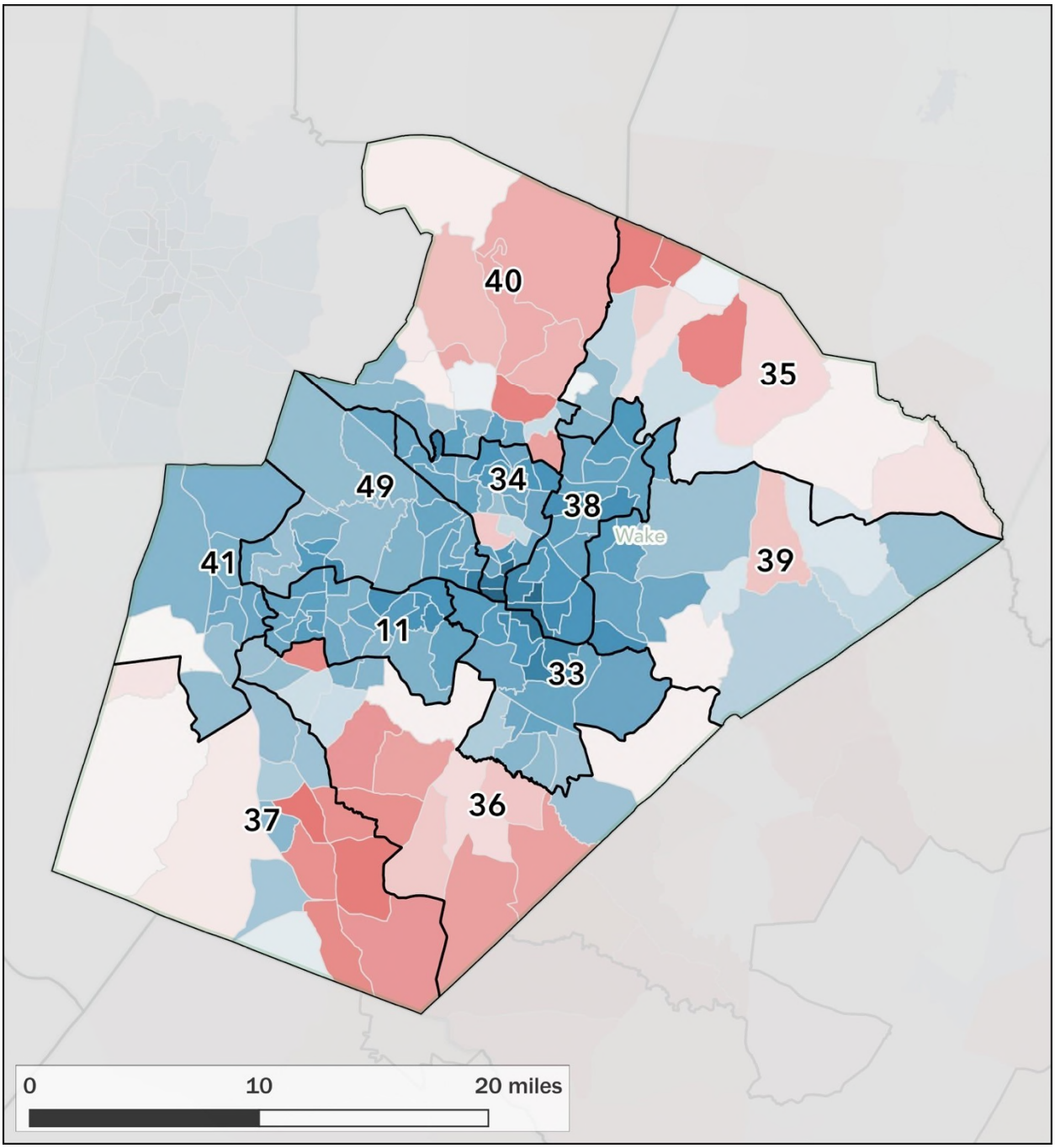
[18] Basemap of East Carolina University underlying the district lines obtained from https://www.openstreetmap.org.


Bethel
Falkland
Fountain
8
Pitt
Greenville
Farmville
9
Grimesland
Winterville
Ayden
Grifton
La Grange
Kinston
12
Pink Hill
0
10
20 miles



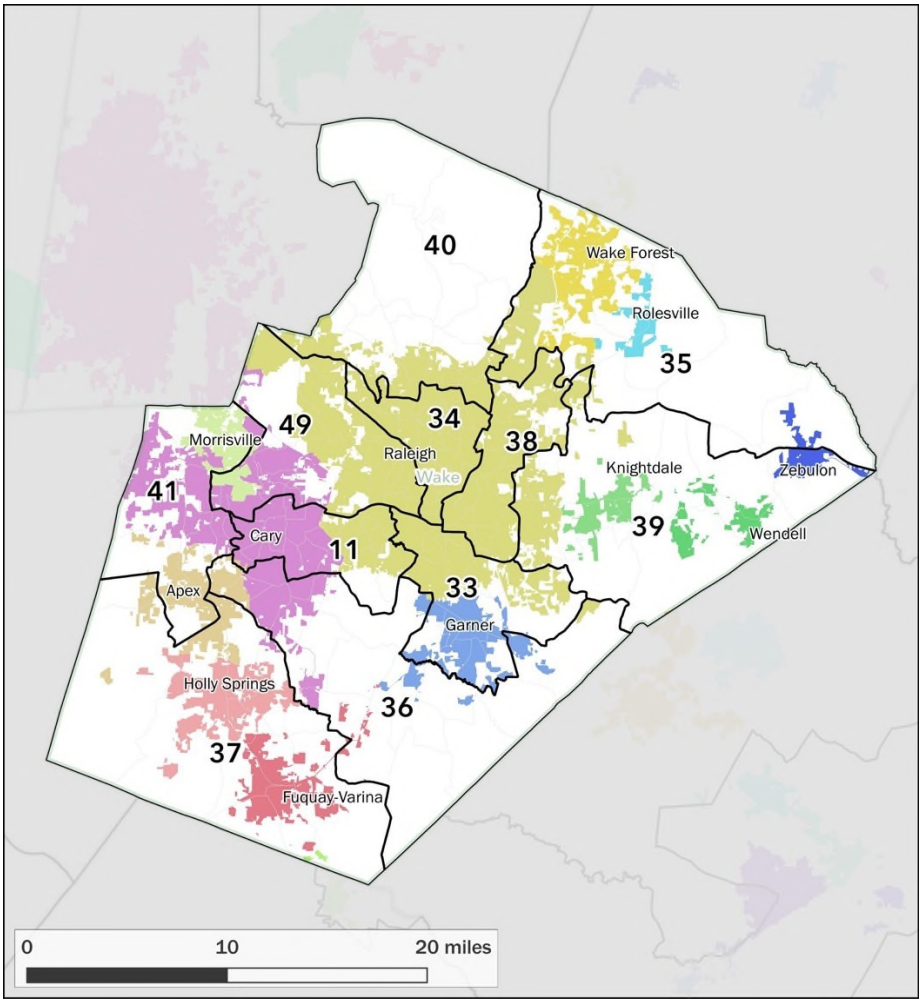
Third-party estimates corroborate the expected partisan consequences of these district boundaries. HD-9 was rated as “Strong Democrat” by NCFEF and D+17 by Civitas, whereas HD-9 was rated as “Lean Republican” by NCFEF and R+4 by Civitas and HD-12 was rated as “Competitive” by NCFEF and D+1 by Civitas. The 2018 election results played out consistent with the gerrymander. Democrat Kandie Smith won by almost 30 percentage points in HD-8, while Republicans won in HD-9 and HD-10 by much smaller margins.

House Districts 11, 33, 34, 35, 36, 37, 38, 39, 40, 41, and 49

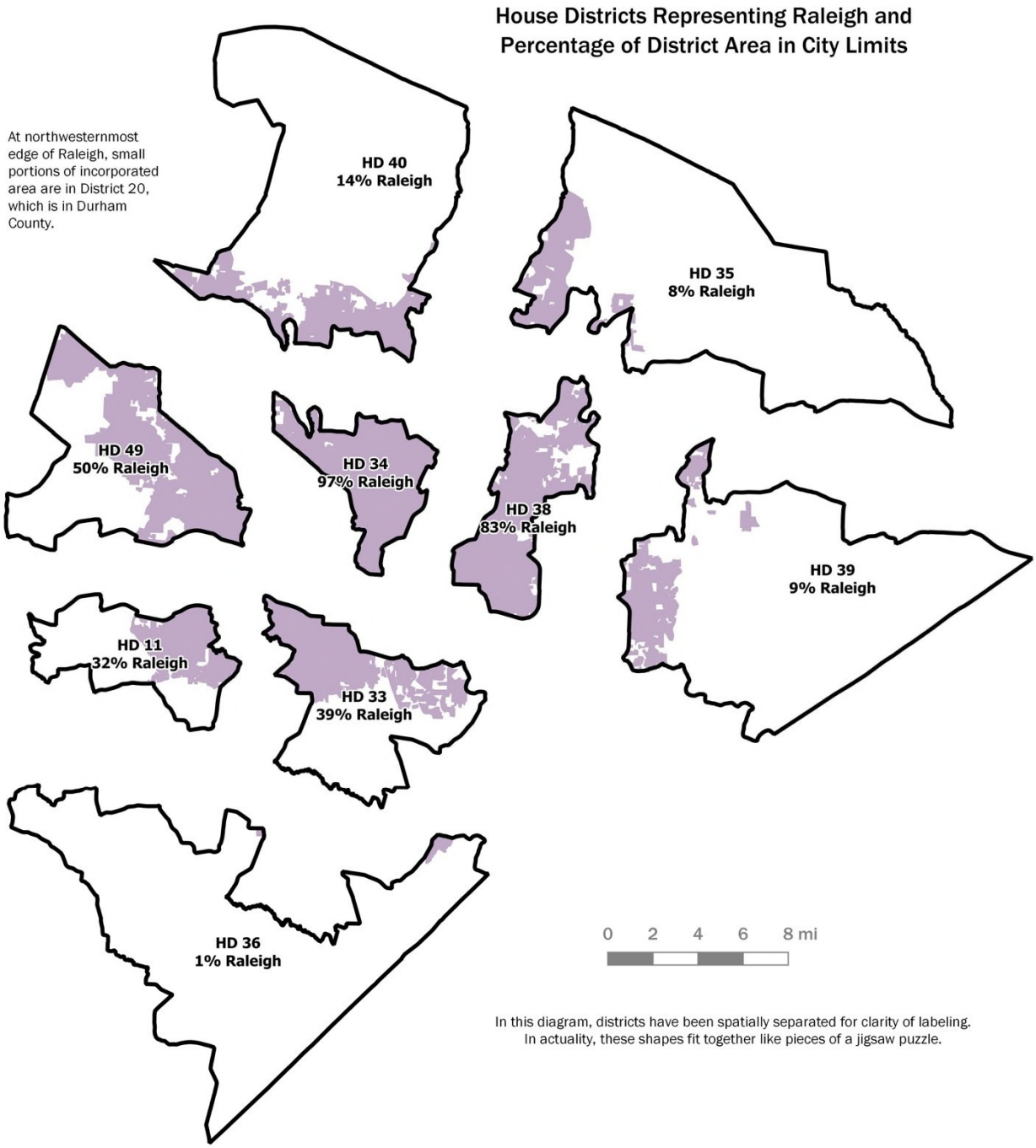


House Districts 11, 33, 34, 35, 36, 37, 38, 39, 40, 41, and 49 are all located within Wake County. Wake is the home of the state capitol, where Stein had his 14th largest victory (by percentage), and there are currently no Republicans on the Wake County Commission. In order to produce some Republican-leaning or competitive districts, the 2017 plans packed Democrats into HDs 11, 33, 34, 38, 39 and 49, in order to ensure that the remaining districts were as competitive for Republicans as possible. Based on *N.C. State Conf. of NAACP Branches v. Lewis*, 18 CVS 2322 (N.C. Super. Nov. 2, 2018), House Districts 36, 37, 40, and 41 were ordered to revert to versions approximating their initial 2011 lines, whereas House Districts 11, 33, 34, 35, 39, and 49 are currently defined by their 2017 boundaries.

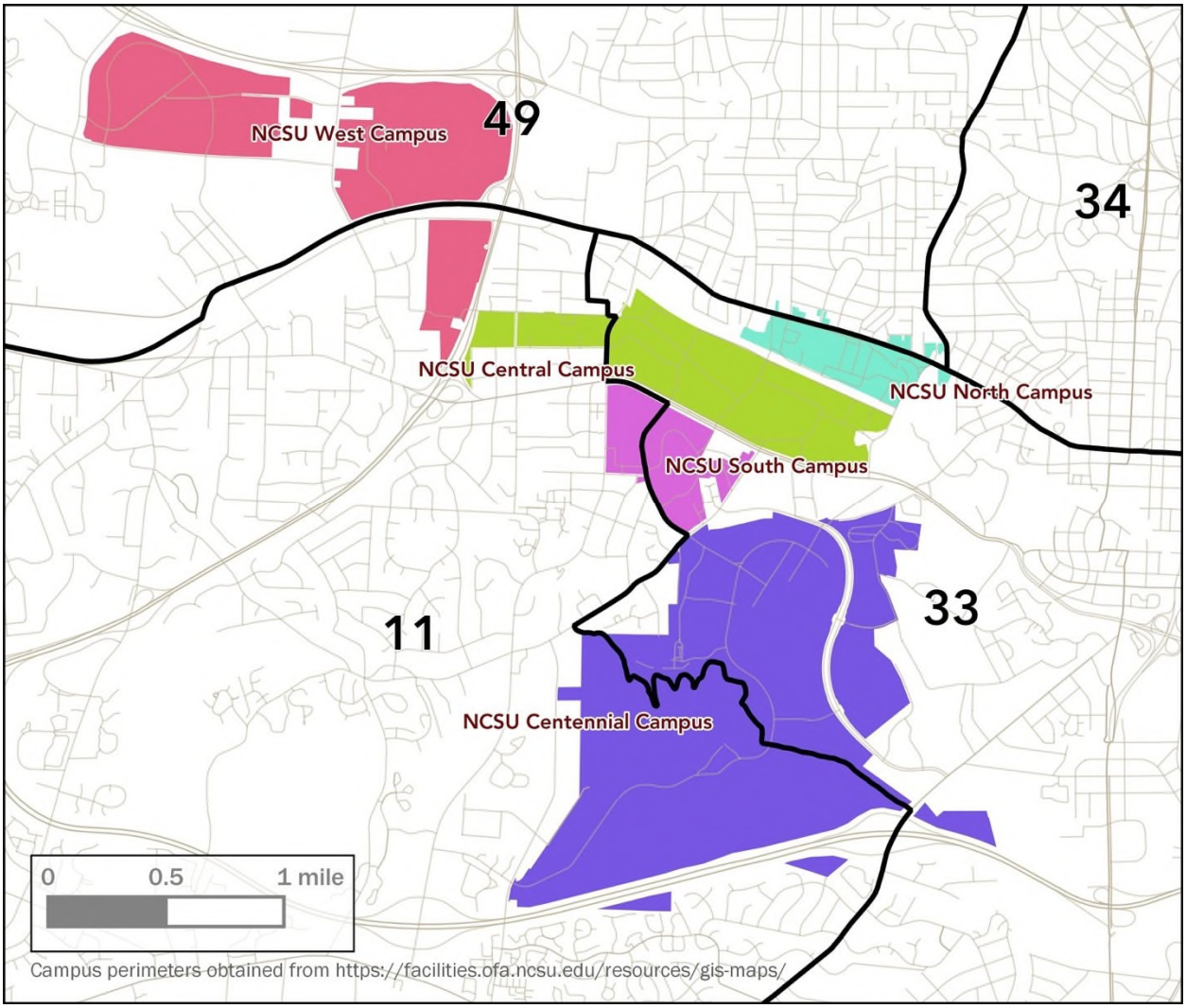
The 2017 district lines include four VTD splits: 12-05, 18-08, 10-02, and 16-09. As the map below demonstrates, the 2017 district boundaries also split a number of cities both large (Raleigh and Cary) and small (Zebulon, Garner, Apex, Morrisville, and Fuquay Varina) across multiple districts.



Of course, splitting Raleigh is inevitable as Raleigh's population is much larger than the target population for a district. With that said, the City of Raleigh could be drawn into six districts, yet, as the figure below illustrates, the current district lines instead split the City into nine districts.



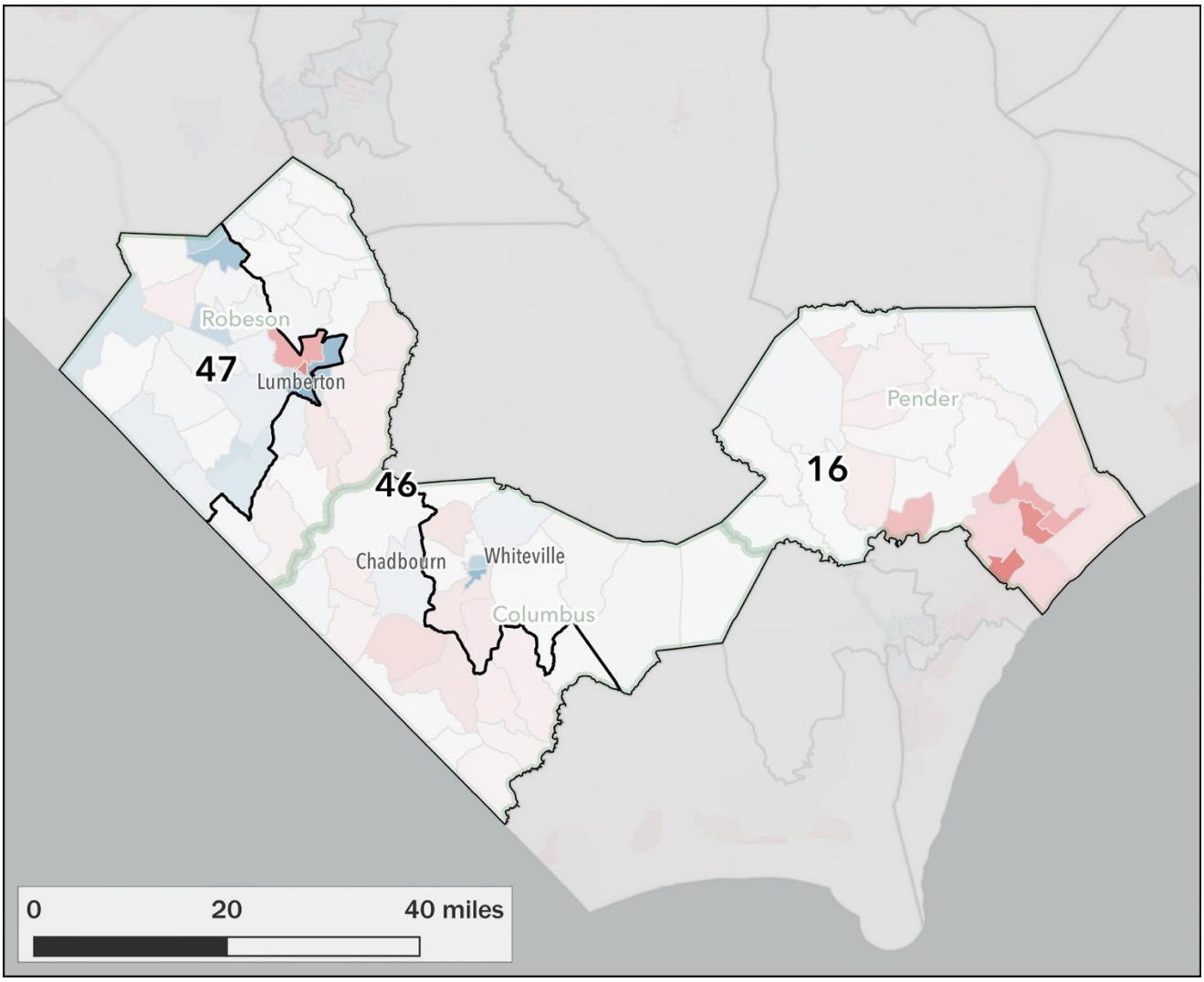
The 2017 district lines even divide the campus of NC State University. While most of the Central Campus lies in HD-33, the Lonnie Poole Course at NC State and even "Main Campus Drive" fall in HD-11 (as it leaves Gorman St.). Fraternity row is split across districts as Alpha Gamma Rho falls in HD-11, while the rest of the Greek Village falls in HD-22. The Centennial Campus, West Campus, South Campus, and North Campus are also split across multiple districts, as the map below demonstrates.



These creative district boundaries serve a clear partisan purpose as Democrats won House Districts 11, 33, 34, 38, 39, and 41 by large margins in 2018. Republican candidates won all three elections in HD-35, HD-36, and HD-37 under the 2011 versions of the districts, and it took the blue wave of 2018 for Democrats to eke out victories in these districts in 2018. HD-40

elected Republicans in two of the three elections under the 2011 version of the district boundaries.

House Districts 16, 46, and 47

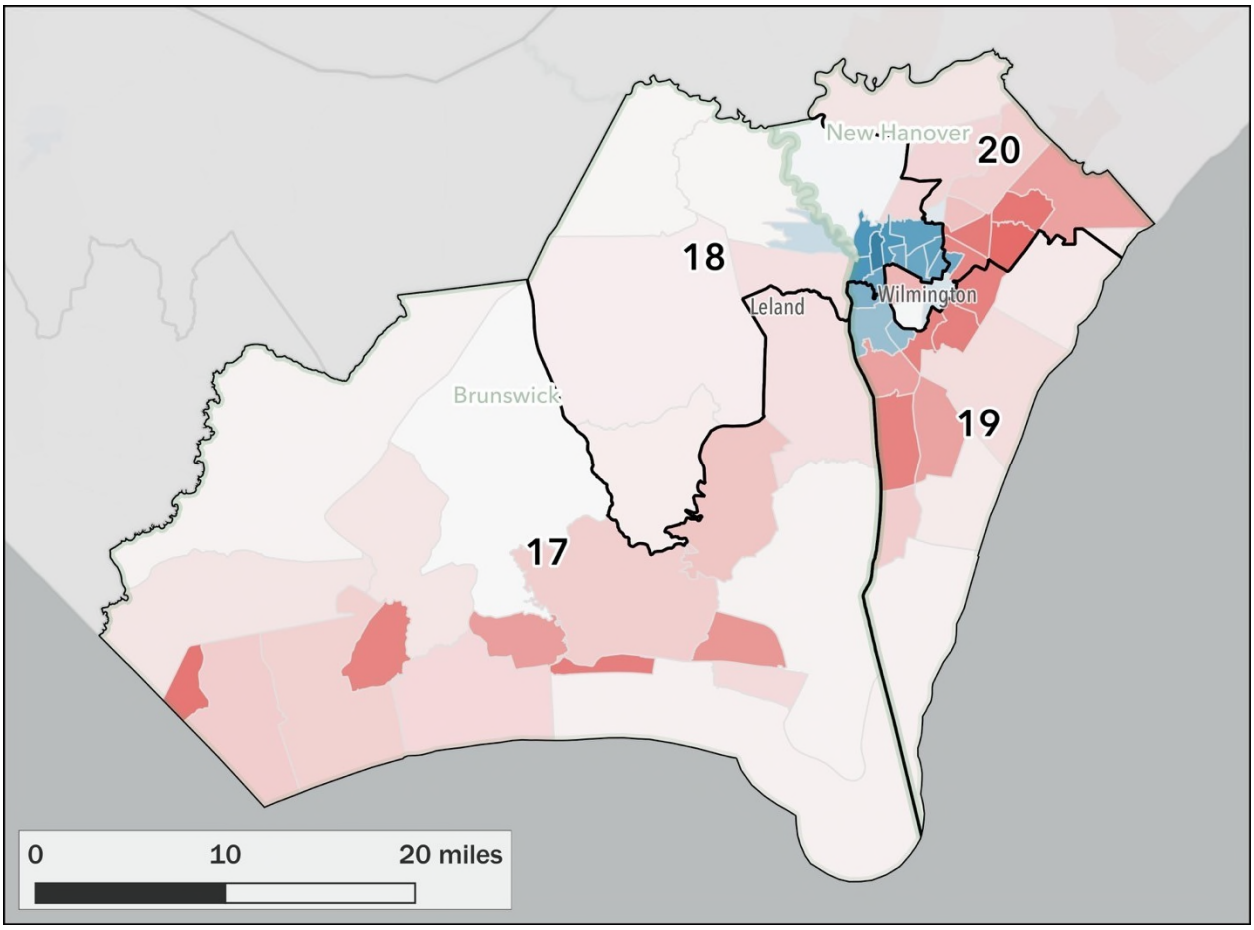


House Districts 16, 46, and 47 are located in the southeastern portion of the state, within Pender, Columbus, and Robeson counties. HD-16 spans both Pender and Columbus counties, while HD-46 connects the northernmost point of Robeson County with the southernmost point of Columbus County. HD-47 makes up a portion of Robeson County. In totality, Robeson is best described as a fairly liberal, Democratic-leaning county (it had the 21st highest vote share for Stein and has had a county commission controlled by Democrats since 2002), Columbus is best described as Democratic (with the 41st highest vote share for Stein and a county commission controlled by Democrats since 2002, including unanimous Democratic control currently), and Pender is best described as a fairly conservative, Republican-leaning county (with the 64th highest vote share for Stein and a county commission that has been Republican since 2010, with no Democratic members currently).

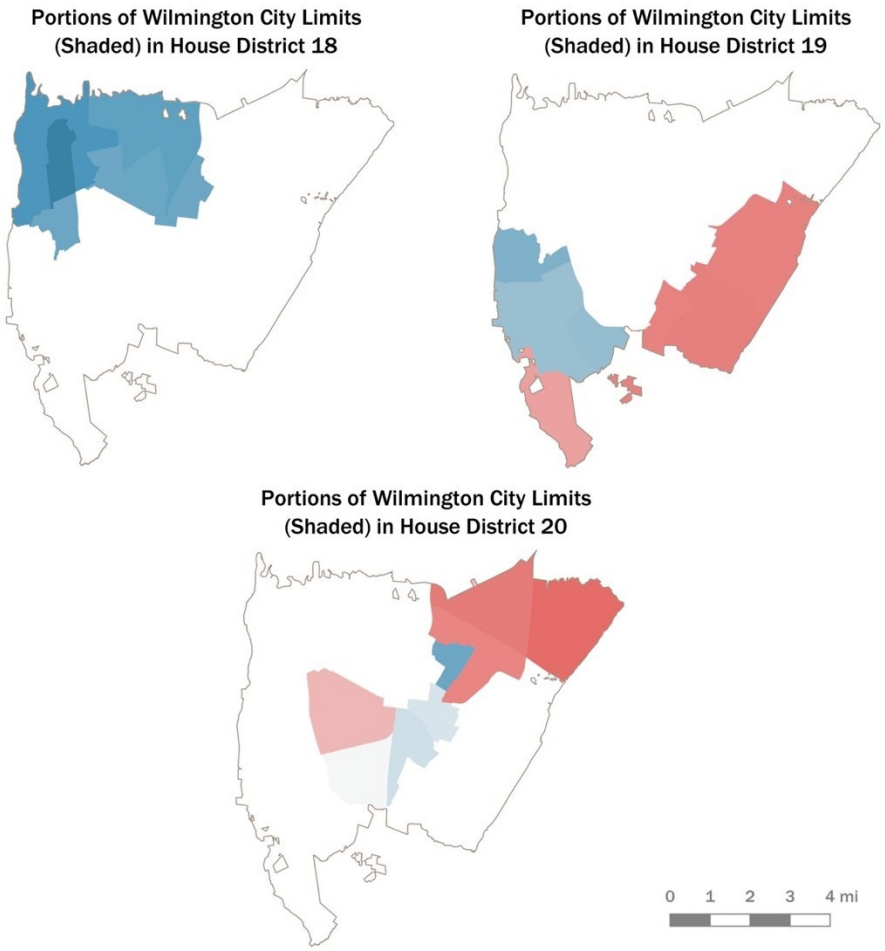
The current district lines pack Democratic VTDs (including those around UNC-Pembroke) into HD-47. To create a Republican-leaning HD-46, the current district lines piece together the Republican-leaning portions of both Columbus and Robeson counties, wrapping around and ultimately avoiding most of Lumberton. Meanwhile, the Democratic areas of Chadbourne are cracked from the Democratic voters in and around Whiteville, helping to ensure that neither HD-46 nor HD-16 would elect a Democrat.

This packing of Democratic voters into a single district was expected to be successful in ensuring particular partisan outcomes. Entering the 2018 election, Civitas rated HD-16 as R+8 ("Lean Republican," according to NCFEF), HD-46 as R+4 ("Competitive," according to NCFEF) and HD-47 as D+11 ("Strong Democratic," according to NCFEF). The mapmakers' strategy was ultimately successful, with Democrat Charles Graham winning the HD-47 election in 2018 by a healthy margin of almost 18%. Republican Carson Smith, Jr. won HD-16 in 2018 by 18.6% and Republican Brenden H. Jones won HD-46 in 2018 by 26.7%.

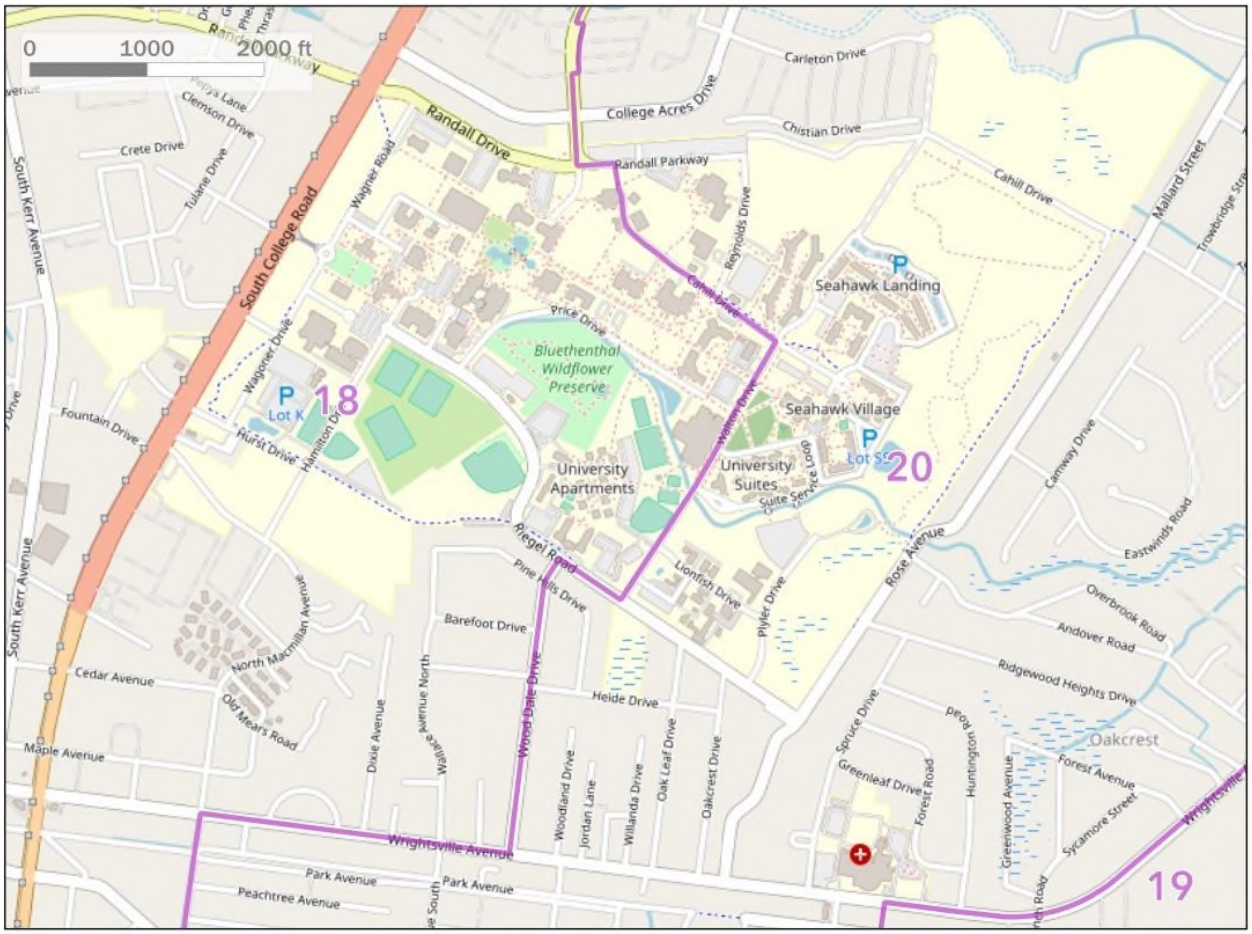
House Districts 17, 18, 19, and 20



House Districts 17, 18, 19, and 20 are located on North Carolina's eastern edge and include New Hanover and Brunswick counties. New Hanover County leans Democratic (with the 31st highest vote share for Stein and a slight Democratic majority in the county commission), while neighboring Brunswick County is considerably more Republican-leaning (with the 60th highest vote share for Stein and a majority-Republican county commission from 2002-2018). The voting patterns are unusually clear around Wilmington—Democrats dominate the areas in and around Wilmington, whereas Republicans win the less populated areas in the rest of this cluster. In order to create three Republican-leaning districts out of four total districts in this cluster, the current maps divide the City of Wilmington into three separate districts (HD-18, HD-19, and HD-20), as illustrated below. The General Assembly packed Wilmington's most heavily Democratic VTDs in HD-18, "wasting" these Democratic votes, while placing Wilmington's more moderate and Republican-leaning VTDs in HD-19 and HD-20.



This cracking of Wilmington bisects the University of North Carolina, Wilmington down the middle—with the eastern portion of the campus falling in HD-20 and the western portion falling in HD-18. See the map below for details.[19]



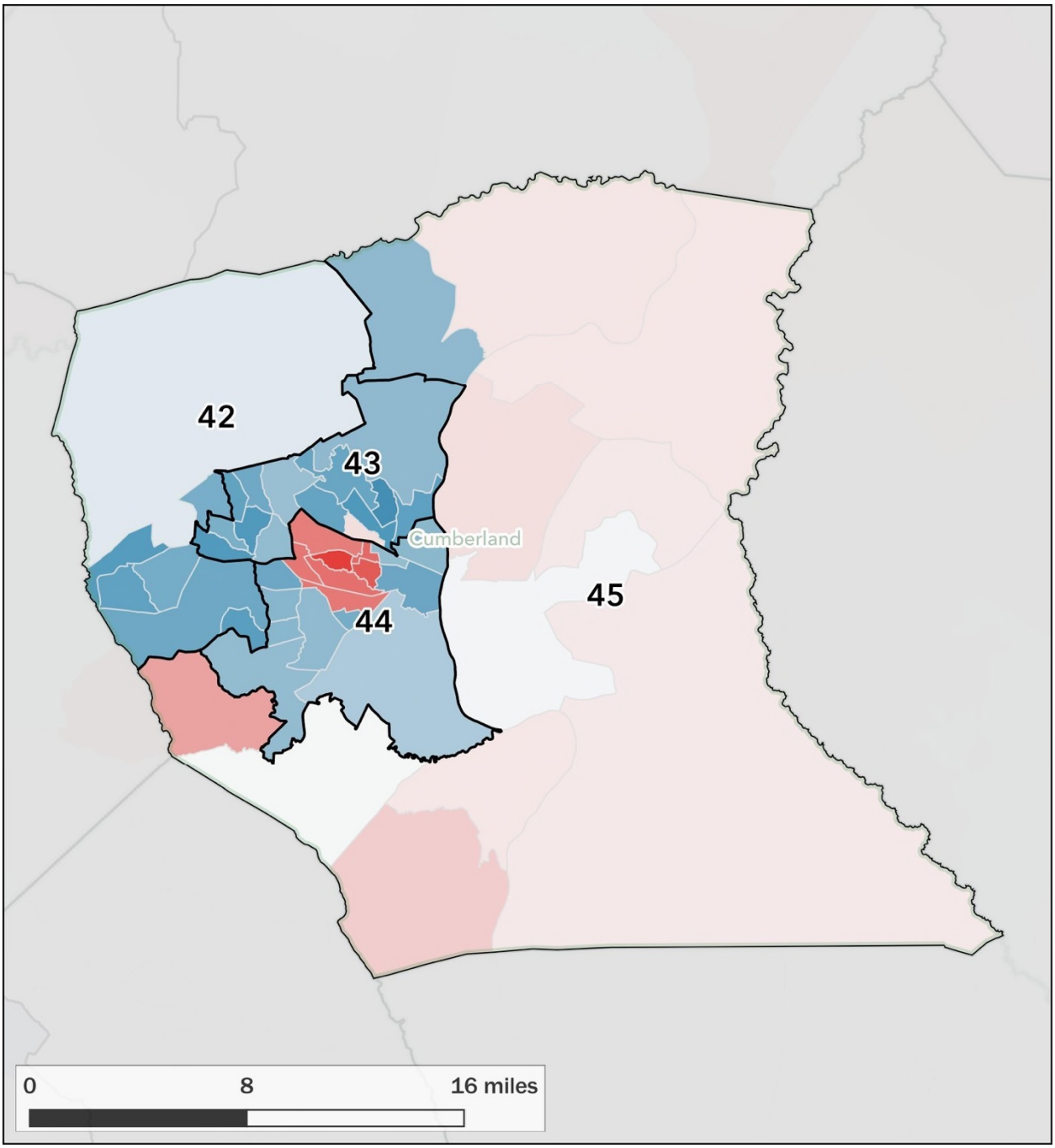
By dividing the campus in this manner, the district boundaries enable HD-20 to connect to Republican-leaning VTDs in the Wilmington area, creating a boot-like appendage in the southwest portion of HD-20. New Hanover also includes four VTDs that are split across more than one district—leading to voter confusion and splitting communities of interest.

This cracking and packing was expected to be electorally advantageous for Republicans. Civitas rated HD-17, HD-18, HD-19, and HD-20 as R+14, D+9, R+6 and R+7, respectively, and NCFEF rated the same districts as "Strong Republican," "Strong Democrat," "Strong Republican," and "Strong Republican." The electoral outcomes reflected these ratings;

[19] Basemap of University of North Carolina, Wilmington underlying the district lines obtained from https://www.openstreetmap.org.

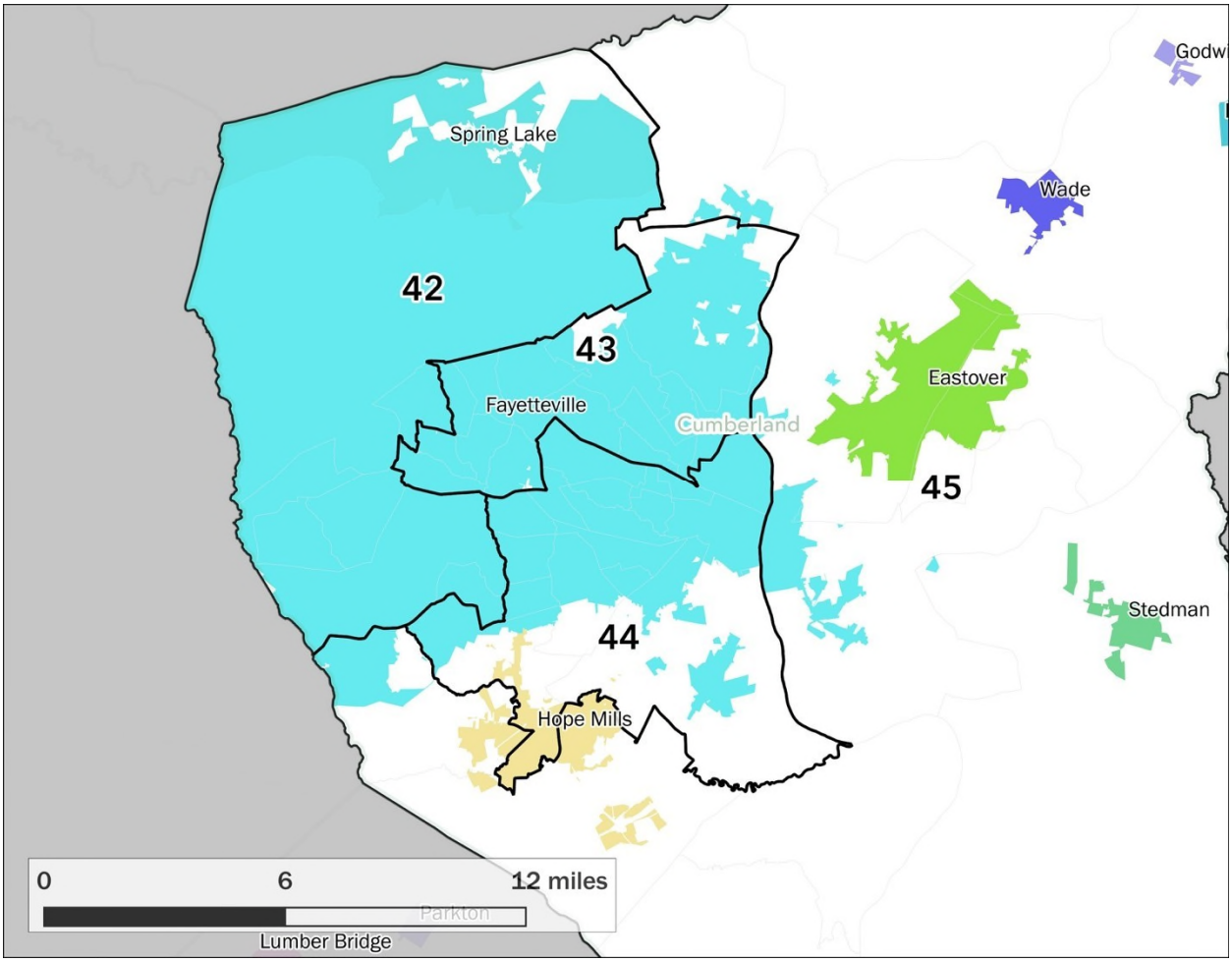
Republicans won every election in HD-17, HD-19, and HD-20 since these districts were created in 2011(with Republican Ted Davis, Jr. running opposed in HD-19 in 2014 and 2016 and Republican Holly Grange running unopposed in HD-20 in 2016), while Democrats have won HD-18 in each of these elections.

House Districts 42, 43, 44, and 45



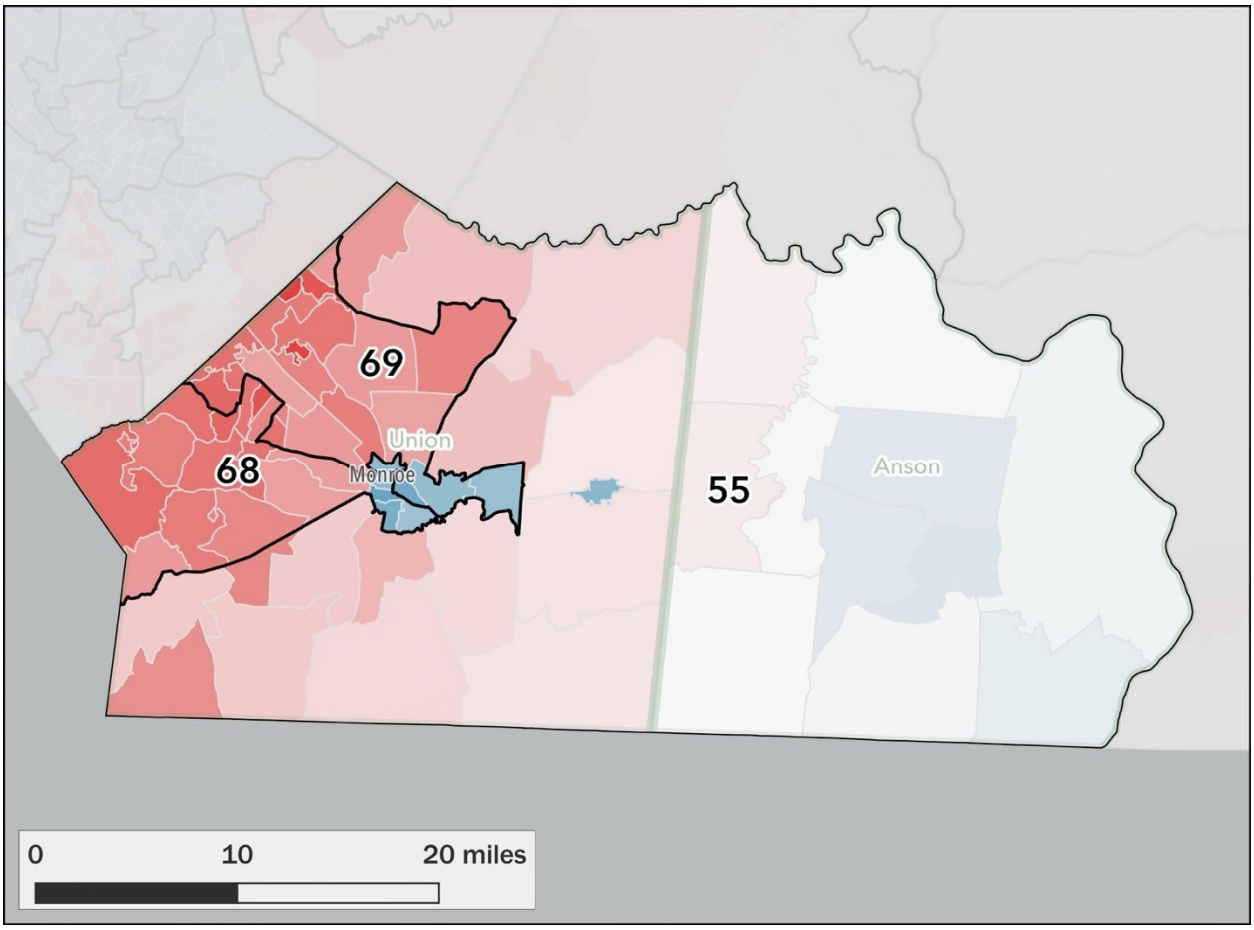
House Districts 42, 43, 44, and 45 are all located within Cumberland County, a Democratic stronghold (with the 16th highest vote share for Stein and a county commission that has been controlled by Democrats since 2002) near the state's border with South Carolina. Cumberland is dominated economically and culturally by the City of Fayetteville and Fort Bragg.

The current district map packs Democratic VTDs into HD-42 and HD-43, wasting Democratic votes. HD-44 is drawn to be somewhat more competitive, as it includes the most Republican VTDs in Fayetteville. But HD-45 is stitched together to create a district that leans heavily towards Republicans, by connecting the northeast and southwest portions of Cumberland County into a single district. As the following map shows, the current map splits the City of Fayetteville (shaded in teal) into four separate districts. The town of Hope Mills (shaded in gold) is also split across HD-44 and HD-45, with its Democratic areas in HD-44 and its Republican areas in HD-45.



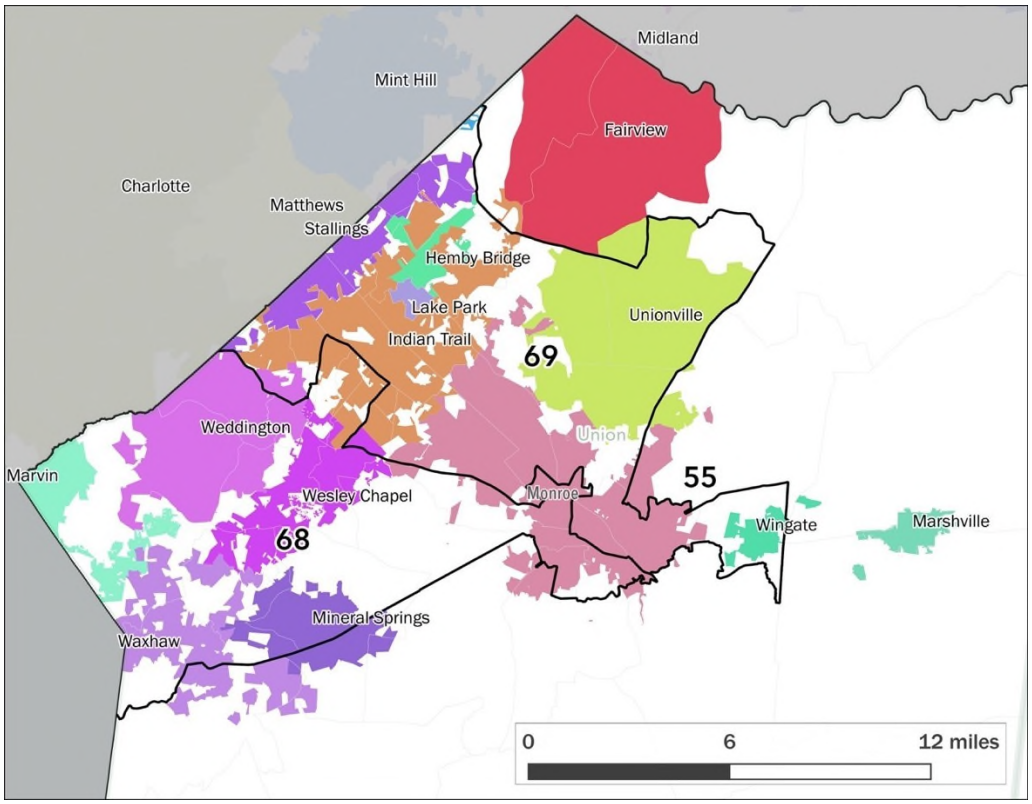
This strategy has achieved its intended partisan effects. NCFEF assessed HD-42 and HD-43 as “Strong Democratic” and HD-44 as “Lean Democratic,” whereas HD-45 was rated as “Strong Republican.” Civitas produced similar estimates, with HD-42 rated as D+24, HD-43 as D+23, HD-44 as D+7, and HD-45 as R+6. The 2018 election reflected these results, with Democrats winning HD-42, HD-43, and HD-44 by large margins, and the Republican candidate winning HD-45.

House Districts 55, 68, and 69

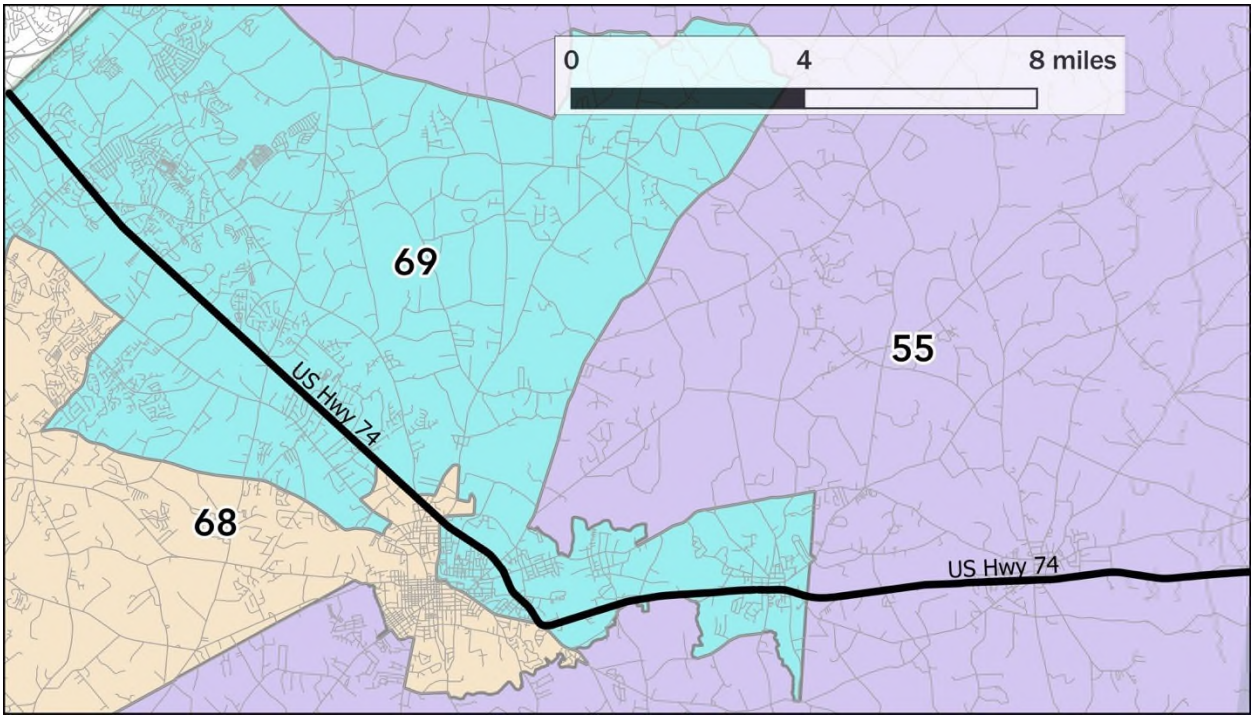


House Districts 55, 68, and 69 are located southeast of Charlotte, along the border with South Carolina and within a county cluster comprised of Anson and Union counties. These two counties, while geographically proximate, are political opposites. Anson County is heavily Democratic (with a unanimous Democratic county commission that has been controlled by Democrats since 2002) and Union County is heavily Republican (with a unanimous Republican county commission that has been controlled by Republicans since 2002).

The boundaries of all three of these districts take unusual paths that minimize the odds of a Democrat winning any of these three seats. In perhaps the most obvious example of cracking in this county cluster, the Democratic stronghold of Monroe is cracked across all three districts in the cluster (see the map of municipal splits below), pairing these Democratic VTDs with Republican VTDs bordering the Charlotte suburbs. The Republican areas on the northeast and western portions of Monroe, however, are joined in HD-55, creating a district that looks like a backwards "C." This allows HD-55 to avoid pairing the Democratic voters of Anson County (who are in HD-55) with the Democratic areas of Monroe (which are in HD-68 and HD-69). Union County also includes six VTD splits—the second most of any county in the state.

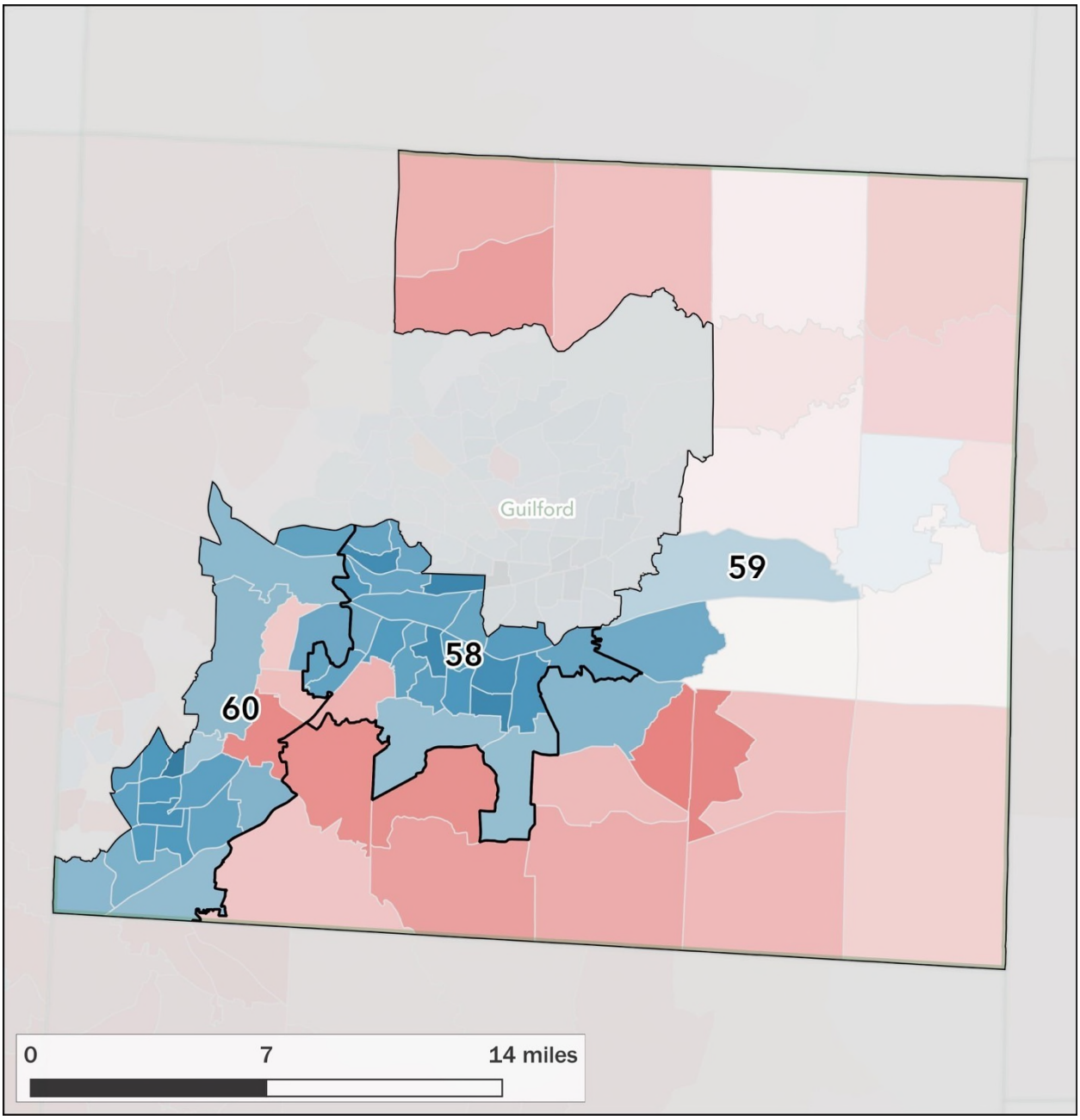


The bizarre nature of these gerrymandered boundaries is particularly evident if one follows the route of US Highway 74. As the map below illustrates, after entering Union County from the west, that road travels into HD-69 before crossing a part of HD-68, and then moves back into HD-69 before entering HD-55 to the east.



Third-party predictions were consistent with this gerrymander: HD-55, HD-68, and HD-69 all were rated as "Strong Republican" by NCFEF and were rated as R+12, R+13, and R+13 by Civitas, respectively. All three districts were won by Republican candidates in 2018.

House Districts 58, 59, and 60



House Districts 58, 59, and 60 are all located in Guilford County, a metropolitan county situated between Winston-Salem and Durham. Guilford is anchored by the Democratic strongholds of Greensboro in the center of the county and High Point near the county's southwest border.[20] Guilford gave Stein his 13th largest vote share in the 2016 Attorney General race and the Guilford County Commission was in Democratic hands from 2002-2010, while the Republicans have held a majority on the commission since then (currently one seat separates the Democratic and Republican totals).

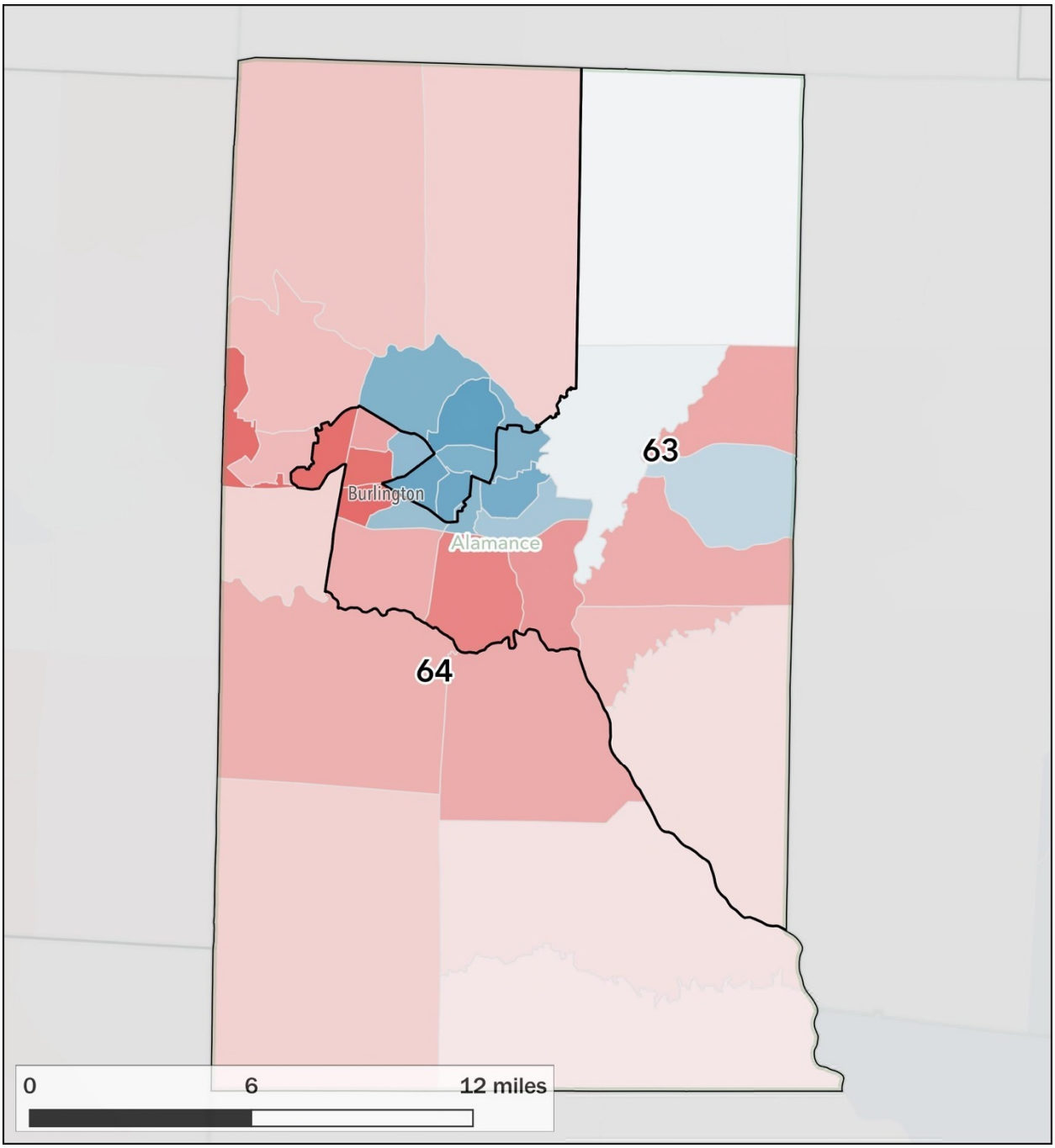
The current maps ensure that HD-59 will favor Republicans. To create this outcome, the Democratic VTDs south of Greensboro are packed into one heavily-Democratic district (indeed, only one VTD in HD-58 favored Newton in the 2016 Attorney General race). HD-60 is similarly dominated by Democrats with only one Republican and three competitive (defined as a difference of <100 votes in the 2016 Attorney General race) VTDs[21] situated within a sea of Democratic voters. This packing of Democratic voters in HD-58 and HD-60 leaves HD-59 as a heavily Republican district. In fact, 19 of the 21 Republican VTDs (with >100 vote share for the Republican candidate) across all three of these districts are in HD-59. This Republican stronghold in HD-59 pieces together the northern and southern borders of Guilford County into a single district that resembles a backwards "C."

Prior to the 2018 election, this map was expected to have a clear partisan slant. HD-58 was rated as D+25 by Civitas and "Strong Democrat" by NCFEF, HD-59 was rated as R+8 by Civitas and "Lean Republican" by NCFEF, and HD-60 was rated as D+19 by Civitas and "Strong Democrat" by NCFEF. These estimates were borne out in the 2018 election, where HD-58 and HD-60 elected Democratic candidates by large margins (53% and 38%, respectively), while HD-59 elected the Republican candidate by a healthy margin (13%), but one not so large as to waste an unnecessary number of Republican votes.

[20] This cluster also includes HD-57, HD-61, and HD-62, but I have been informed by Plaintiffs' counsel that Plaintiffs are not challenging those districts in this case because they were redrawn by the Special Master in *Covington v. North Carolina*.

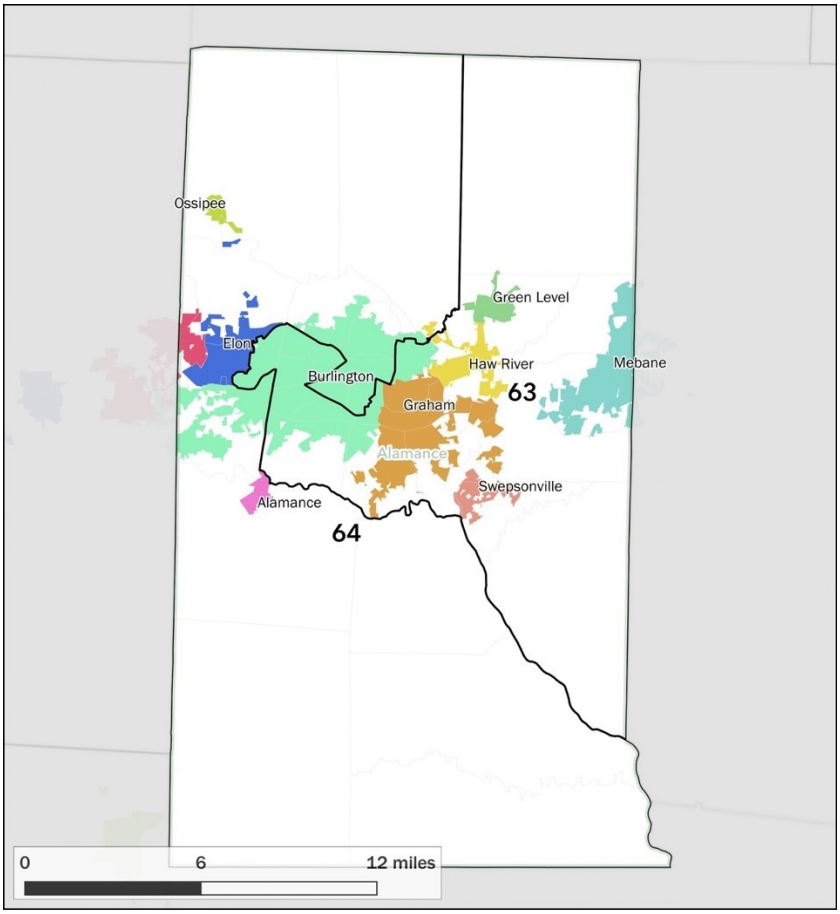
[21] H19B, JAM2, and FR2

House Districts 63 and 64

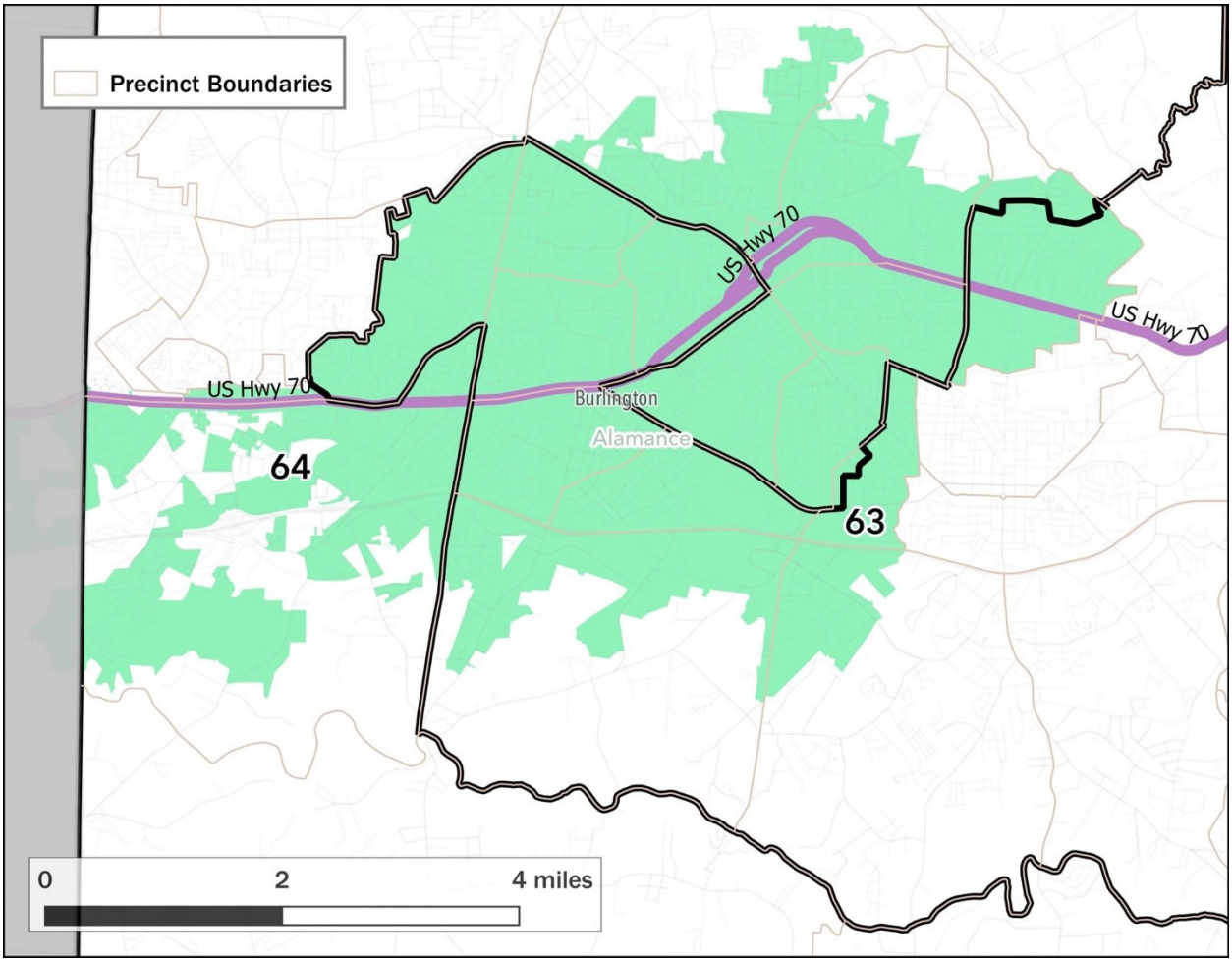


House Districts 63 and 64 are located within Alamance County—west of Research Triangle Park and east of Greensboro. Alamance County gave Stein his 46th highest county vote share in the 2016 Attorney General election and has a county commission that has been controlled by Republicans since 2002. The county's economic and cultural center is Burlington.

In order to create two reliably Republican districts in Alamance County, the current map cracks the Democratic areas of Alamance across the two districts, leaving five of the Democratic-leaning VTDs in the county in HD-64 and eight of the Democratic-leaning VTDs in HD-63 (see below for a map of the municipal splits). In particular, the General Assembly split the City of Burlington in two, leaving the western and southern sides of Burlington in HD-63 and placing most of the northeastern sides of the city in HD-64. The resulting appendage to HD-63, which resembles a rooster's head, includes Republican VTDs around the Alamance Country Club, but avoids the area around Elon University.

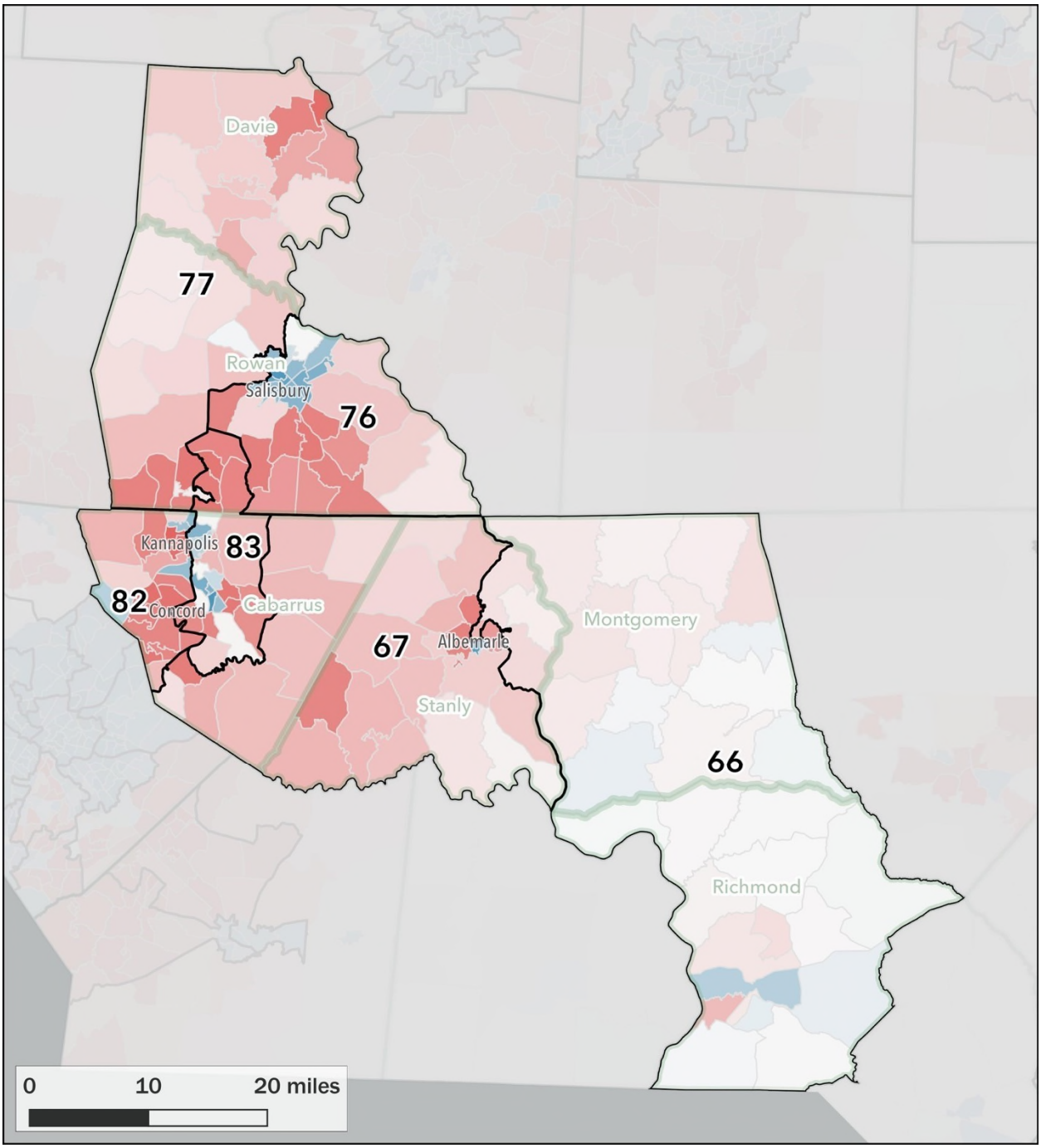


As the following map shows, as US Highway 70 (South Church St.) heads west, it crosses from HD-63 into HD-64 and back, twice, in less than a six mile span. These meandering boundaries also split three VTDs within this single county. The green area in the map below shows the City of Burlington, which has been carved up between these two districts.



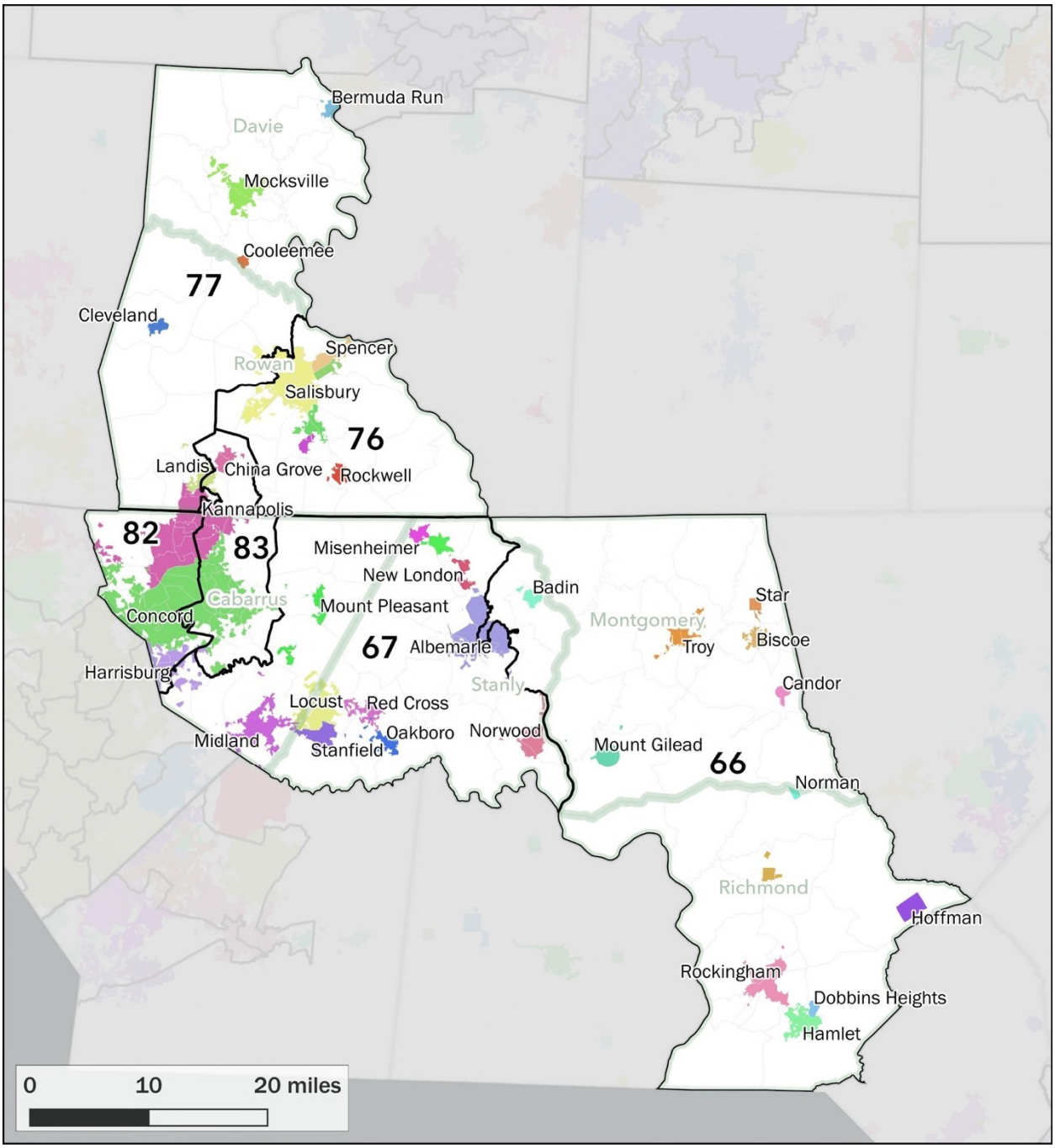
This odd formation was successful in producing Republican-leaning districts. Civitas rated HD-63 as R+3 and HD-64 as R+7; NCFEF rated HD-63 as "Competitive" and HD-64 as "Strong Republican." Both districts have elected Republican candidates in all four elections since the districts were created in 2011. Republican Stephen Ross ran unopposed in HD-63 in 2016 and Republican Dennis Riddell ran unopposed in HD-64 in both 2014 and 2016.

House Districts 66, 67, 76, 77, 82, and 83



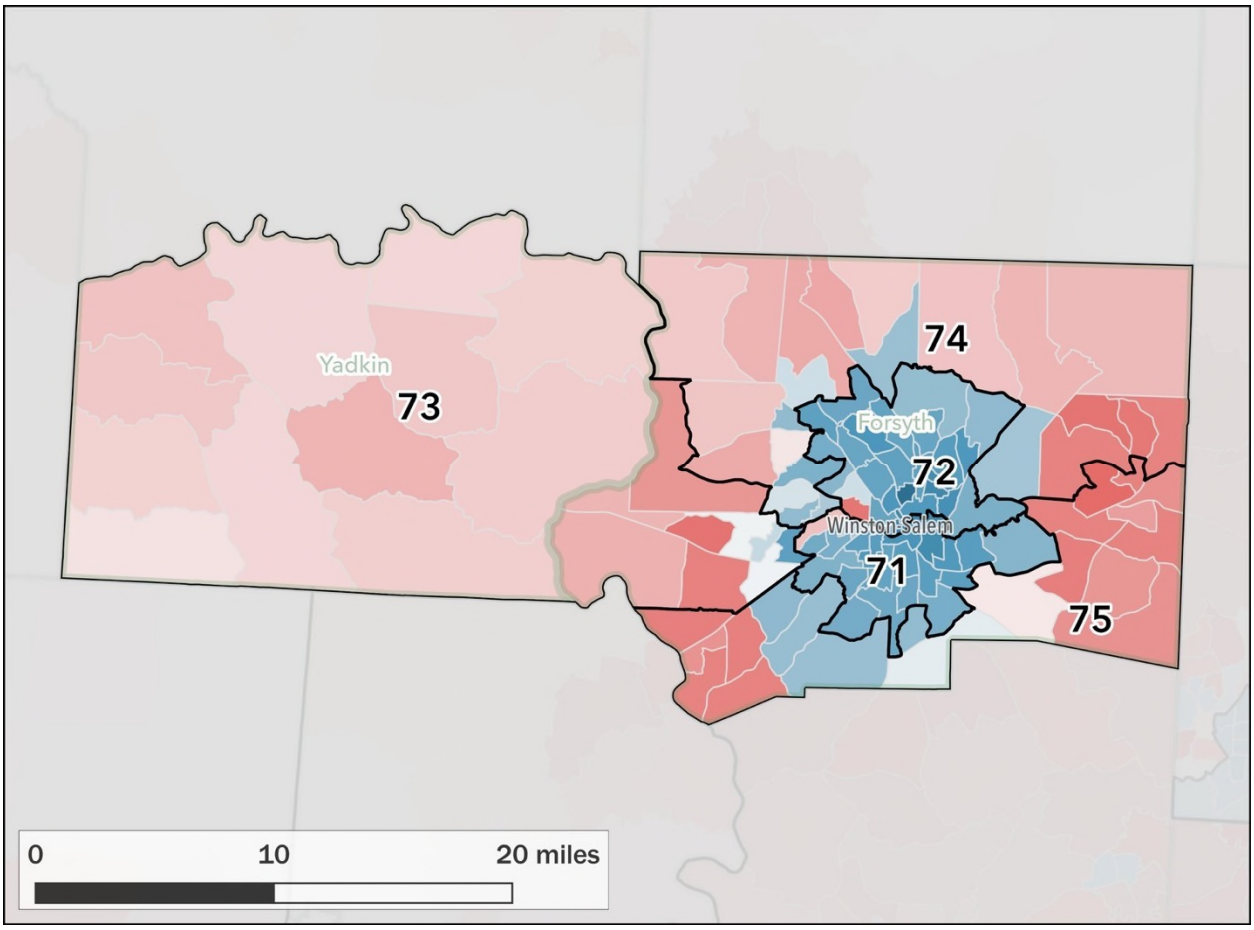
House Districts 66, 67, 76, 77, 82, and 83 are part of a county cluster that rests north and east of Charlotte, covering Richmond, Montgomery, Stanley, Cabarrus, Rowan, and Davie counties. Davie, Rowan, and Stanley counties are extremely conservative (all three county commissions were controlled by Republicans from 2002-2018 and all three supported Newton by relatively large margins in the 2016 Attorney General race); Cabarrus and Montgomery counties are moderate counties (with the 51st and 52nd highest vote share for Stein and Republican and Democratic-led county commissions from 2002-2018, respectively); and Richmond County displays Democratic-leaning voting patterns (with the 27th highest vote share percentage for Stein and Democratic control of the county commission from 2002-2018). The population centers in this cluster include Kannapolis, Concord, Salisbury, and Albemarle.

The current maps go to great pains to crack Democratic-leaning centers across multiple districts. For example, Kannapolis falls in three different districts (HD-82, HD-83, and HD-77). Democratic voters in Concord are similarly cracked across two districts (HD-82 and HD-83). The map that follows more clearly illustrates the relationship between municipality boundaries and district boundaries (the municipality of Kannapolis is colored pink and the municipality of Concord is colored green). Rather than placing Salisbury voters in HD-82 or HD-83, where they would be represented alongside residents of Kannapolis or Concord, the current map places them with overwhelmingly red areas of the county, ensuring that Republicans can still maintain an advantage in HD-76. Democratic VTDs in Albemarle were also placed in HD-67, just over the line from HD-66, in a small cut-out that serves the purpose of ensuring that HD-66 remains more competitive for Republicans.



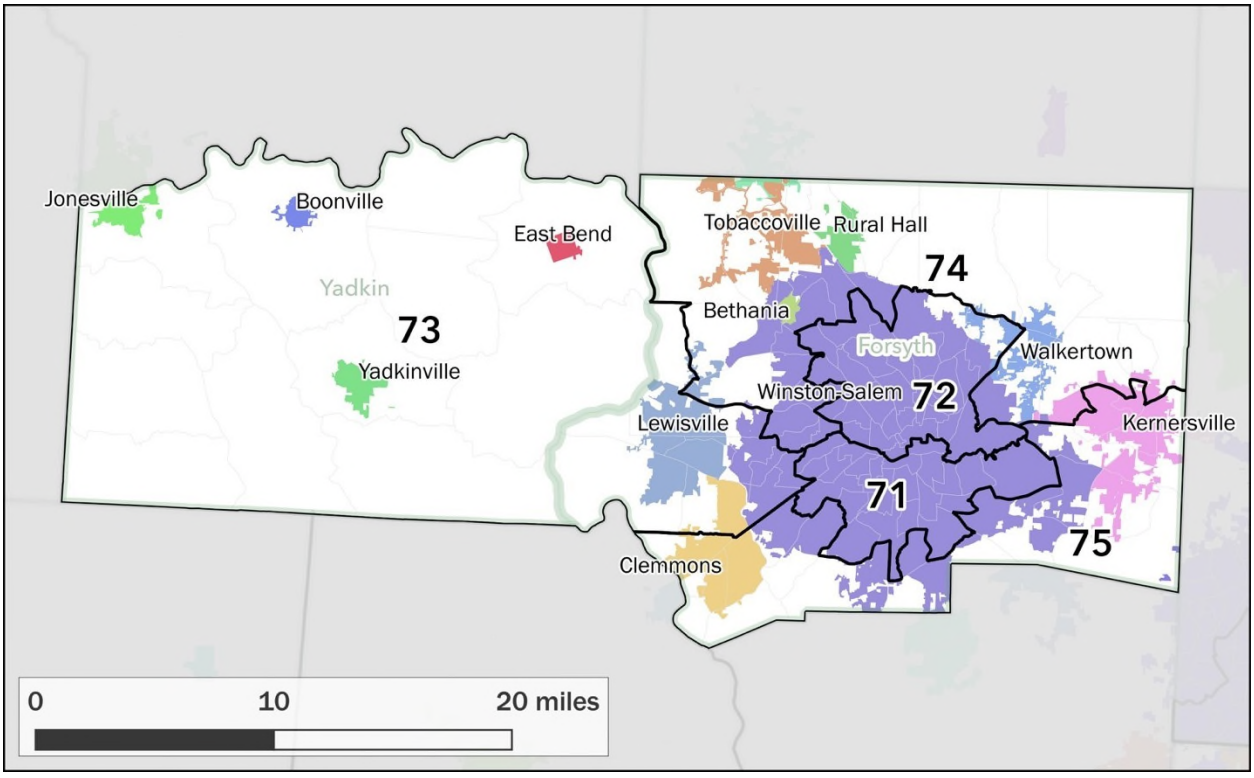
The boundaries of these districts have had a clear partisan outcome advantaging Republican candidates, who were favored in all six districts, according to Civitas (R+1, R+21, R+10, R+21, R+8, and R+6), and favored in five of the six, according to NCFEF (HD-66 was deemed to be "Competitive" while the others were rated as "Strong Republican."). Electoral outcomes support this conclusion, as only HD-66 was won by a Democrat in the blue wave of 2018—and even then, the Democrat won HD-66 by just a few points.

House Districts 71, 72, 73, 74, and 75



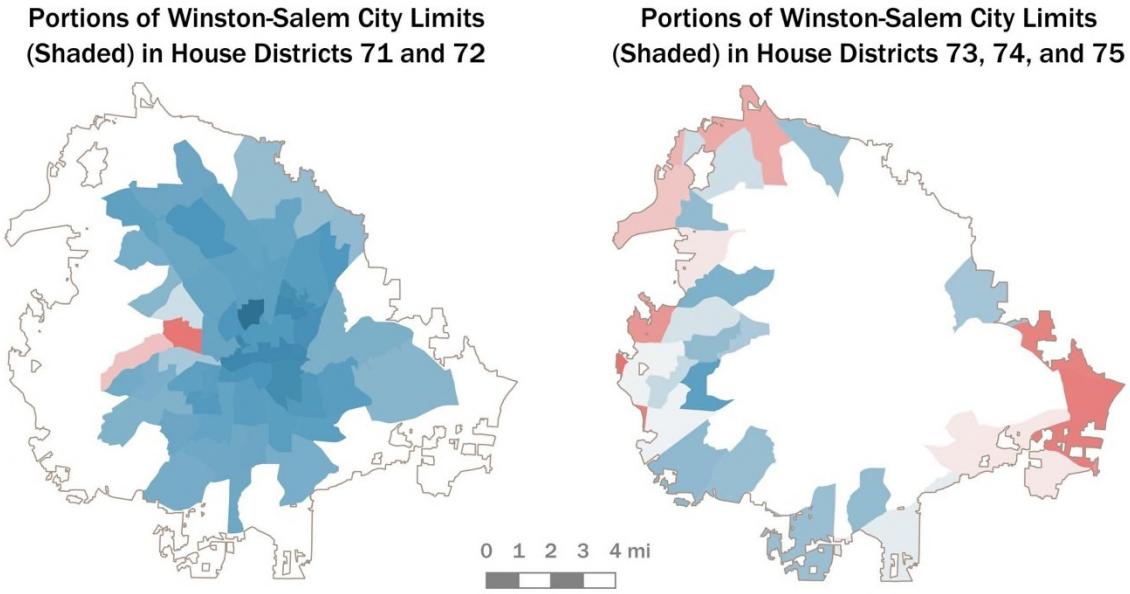
House Districts 71, 72, 73, 74, and 75 are located within Forsyth and Yadkin counties. Forsyth County is dominated by the cultural, economic, and political presence of Winston-Salem and leans Democratic (with the 20th highest vote share total for Stein and four Republicans and three Democrats serving on the county commission), while rural Yadkin County is one of the most conservative in the state (with the 100th highest vote share total for Stein, 78% vote share total for Trump, and a county commission that does not include a single Democrat).

Despite the fact that Winston-Salem's population could fit in three districts, the current map splits Winston-Salem across all five districts in this cluster (see the map below depicting split municipalities). Similarly, the Village of Clemmons[22] is split across HD-75 and HD-73. Walkertown is split across HD-74 and HD-72, Lewisville straddles the HD-73 and HD-74 boundary, and Kernersville is split across HD-74 and HD-75.



[22] Despite the "Village" moniker, Clemmons is home to a population of about 20,000. In North Carolina, there is no official designation for what size constitutes a Village, Town, or City.

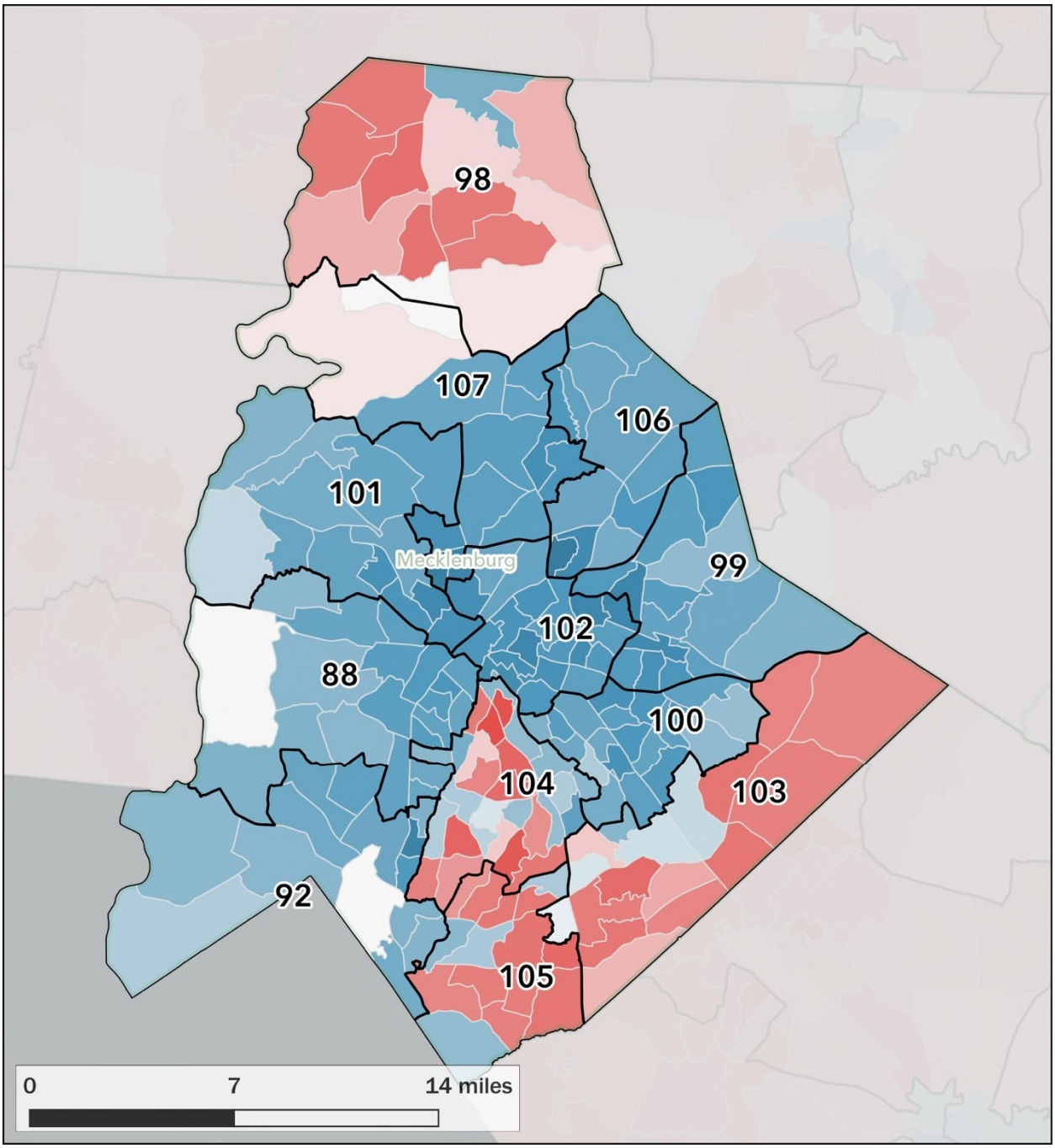
The partisan impact of this gerrymander is evident in the map below, which shows the portions of the Winston-Salem city limits that are within HD-71 and HD-72 (on the left) and the portions that are within HD-73, HD-74, and HD-75 (on the right). As the maps demonstrate, the General Assembly packed the most heavily Democratic areas of Winston-Salem into two districts (HD-71 and HD-72), while placing the less Democratic areas of Winston-Salem into the other three districts in the cluster (HD-73, HD-74, and HD-75) where they were paired with rural areas on the outskirts of Forsyth County to ensure that those districts elect Republicans.



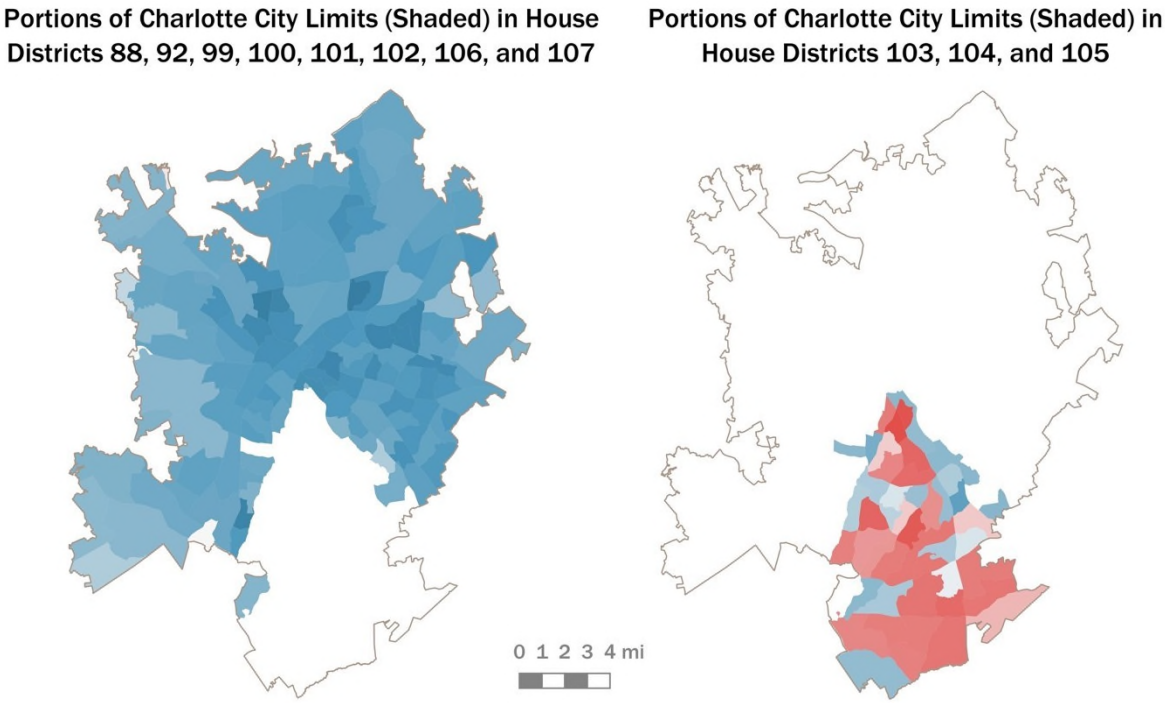
To connect the Republican strongholds on the eastern boundary of Forsyth County with the Republican-held areas on the southwest corner of Forsyth County, HD-75 is forced into a narrow passageway, less than a half of a mile wide, between the borders of HD-71 and HD-80 (HD-80 is to the south of this cluster).

These gerrymandered boundaries had a clear impact. NCFEF rates HD-71 and HD-72 as "Strong Democrat" and rates HD-73, HD-74, and HD-75 as "Strong Republican." Civitas assessments of this cluster were similar, with ratings of D+21, D+28, R+15, R+8 and R+6, respectively. These predictions held in the 2018 elections, as Democrats won HD-71 and HD-72 by large margins (thus wasting votes), while Republicans secured victories in HD-73, HD-74, and HD-75.

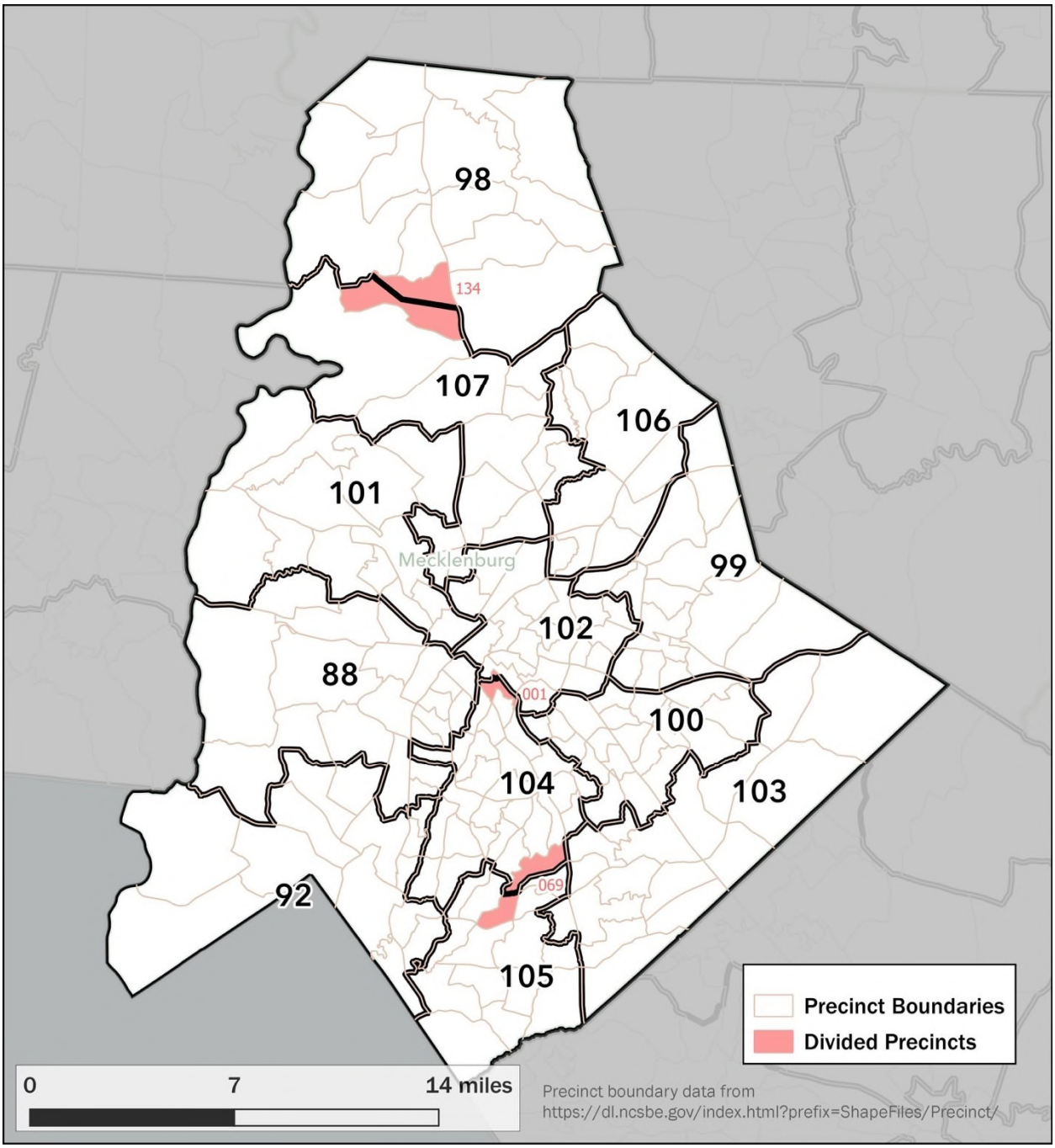
House Districts 88, 92, 98, 99, 100, 101, 102, 103, 104, 105, 106, and 107



House Districts 88, 92, 98, 99, 100, 101, 102, 103, 104, 105, 106, and 107 are all within Mecklenburg County, which is dominated by Charlotte. Charlotte and Mecklenburg County are Democratic strongholds (Mecklenburg County gave the 10th strongest support to Stein of any county in North Carolina and Democrats now have unanimous control of the county commission, having held majority control since 2002). To create as many Republican-leaning or competitive districts as possible, the General Assembly packed Mecklenburg's Democratic voters into HD-88, HD-92, HD-99, HD-100, HD-101, HD-102, HD-106, and HD-107 (the portions of which that are in the City of Charlotte are presented on the left side of the figure below). Indeed, there is not a single Republican VTD in House Districts 88, 92, 99, 100, 101, 102 or 106 and only two in HD-107. Packing Democrats into these eight districts leaves four remaining districts (HD-103, HD-104, and HD-105, all of which fall completely or partially in the Charlotte city limits, and HD-98 which sits north of Charlotte) that are potentially competitive and could, under the right circumstances, produce Republican victory.



The current district boundaries also unnecessarily split three VTDs within Mecklenburg County (001, 069 and 134). The areas shaded in red on the map depict these VTD splits.

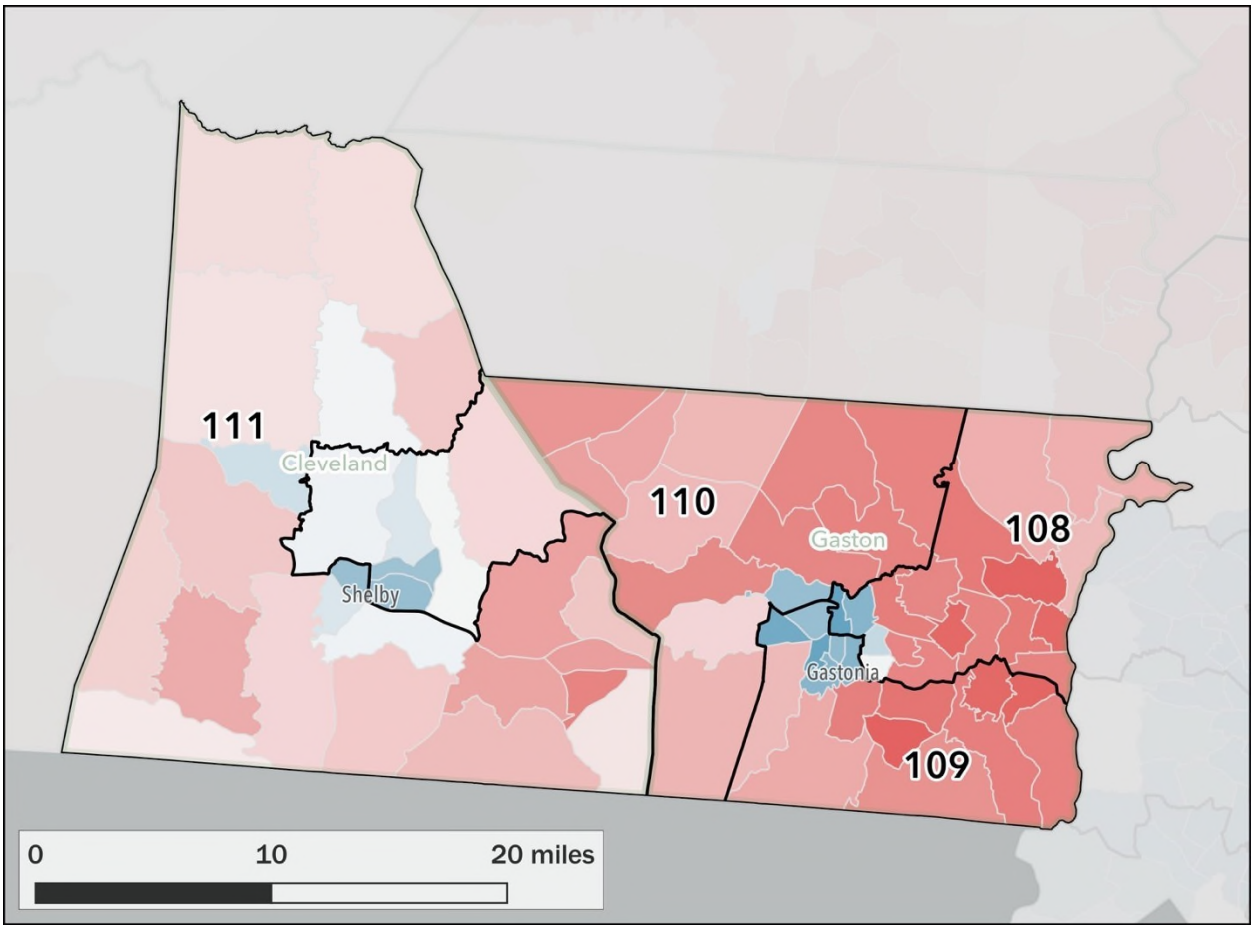


As the table below illustrates, Civitas and NCFEF ratings for these districts are consistent with the notion that the current district boundaries have clear implications for the partisanship of who serves in the General Assembly from this cluster.

House District #	Civitas Rating	NCFEF Rating
88	D+21	Strong Democrat
92	D+15	Strong Democrat
98	R+6	Strong Republican
99	D+30	Strong Democrat
100	D+18	Strong Democrat
101	D+26	Strong Democrat
102	D+30	Strong Democrat
103	R+7	Strong Republican
104	R+4	Lean Republican
105	R+4	Lean Republican
106	D+26	Strong Democrat
107	D+27	Strong Democrat

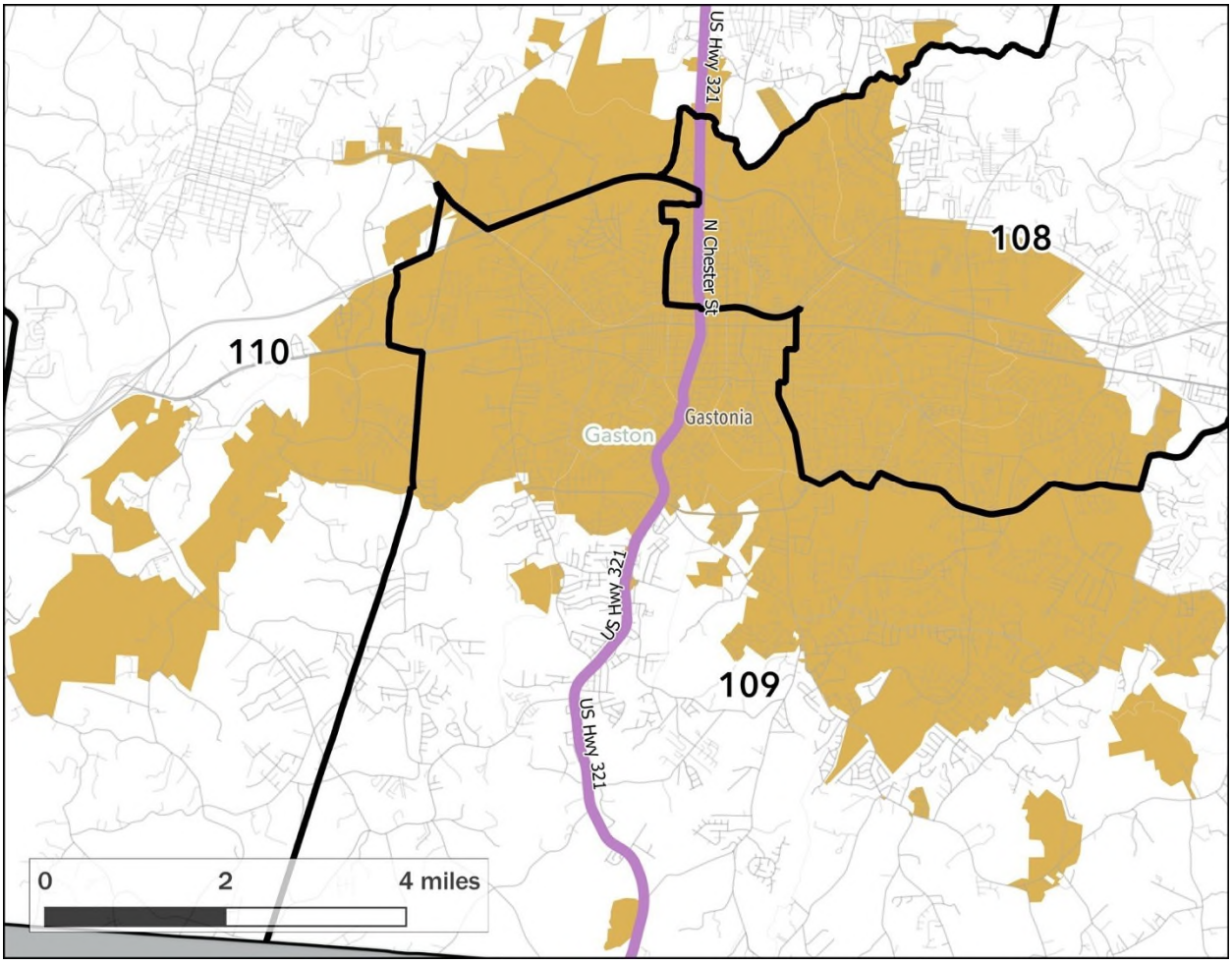
It took the blue wave of 2018 to allow Democrats to narrowly win the four districts that were rated as “strong” or “lean” Republican. In fact, HD-98 and HD-103 were decided by about a percentage point, and HD-104 and HD-105 were decided by less than five percentage points.

House Districts 108, 109, 110, and 111



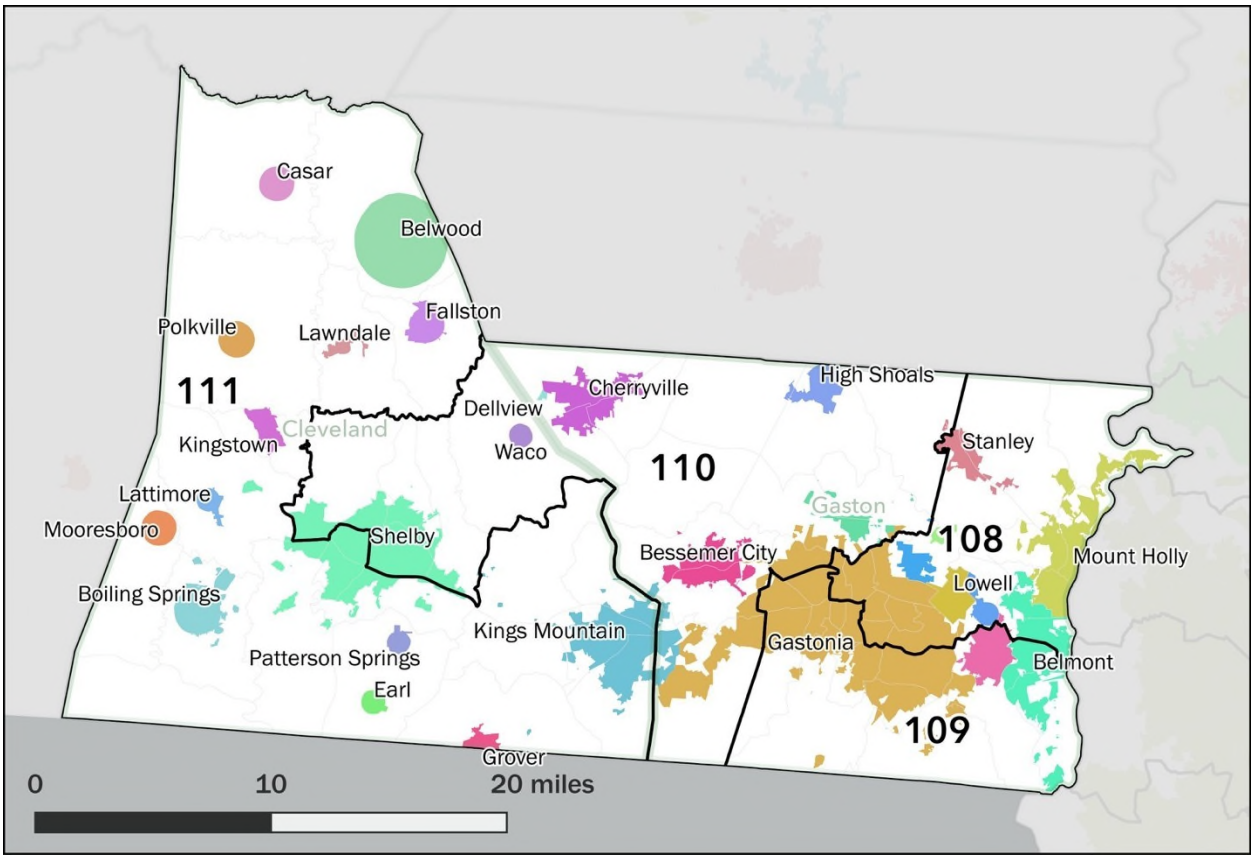
House Districts 108, 109, 110, and 111 are located in a county cluster of Gaston and Cleveland counties, both lying west of Charlotte. Both are Republican-leaning counties (Stein's vote share was 69th and 61st highest in the state, respectively) with strong Democratic pockets—Gastonia in Gaston County and Shelby in Cleveland County.

In order to reduce the power of these Democratic areas, the Democratic stronghold of Gastonia is split across three districts (HD-108, HD-109, and HD-110). Traveling north on U.S. Highway 321 in Gastonia, a car would pass from HD-109 to HD-108, before moving into HD-110. In addition to producing significant voter confusion, this cracking of Democratic voters decreases the likelihood that any of these districts will be represented by Democrats.



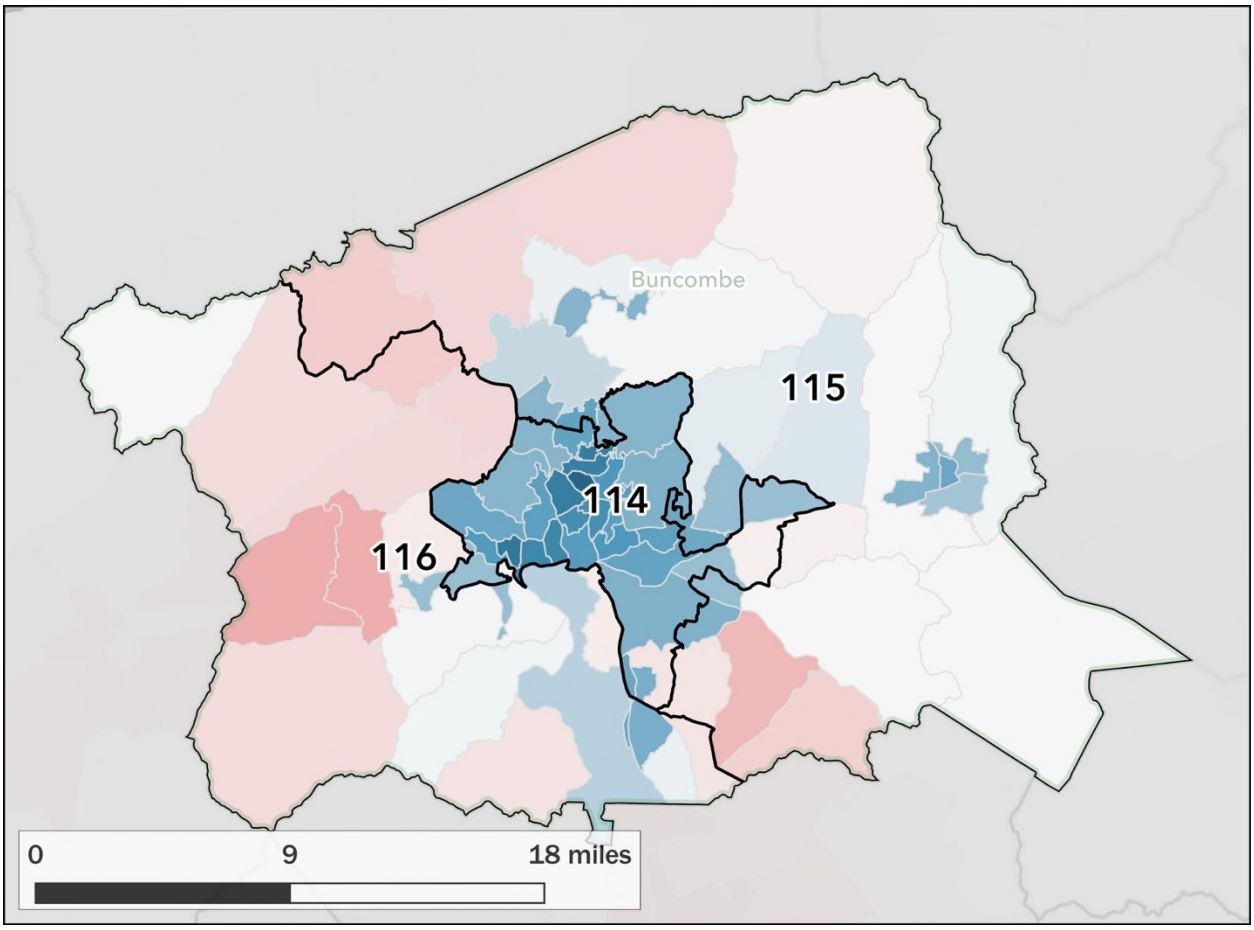
Similarly, the City of Shelby is split across two districts (HD-110 and HD-111) at its geographic center; the current lines even split the "Shelby Central" VTD.

Taken together, these choices clearly dilute Democratic influence across all of these districts, taking an area that should produce one or more competitive districts and ensuring that it contains only safe Republican districts. The map that follows shows the relationship between municipal and district boundaries in this cluster.



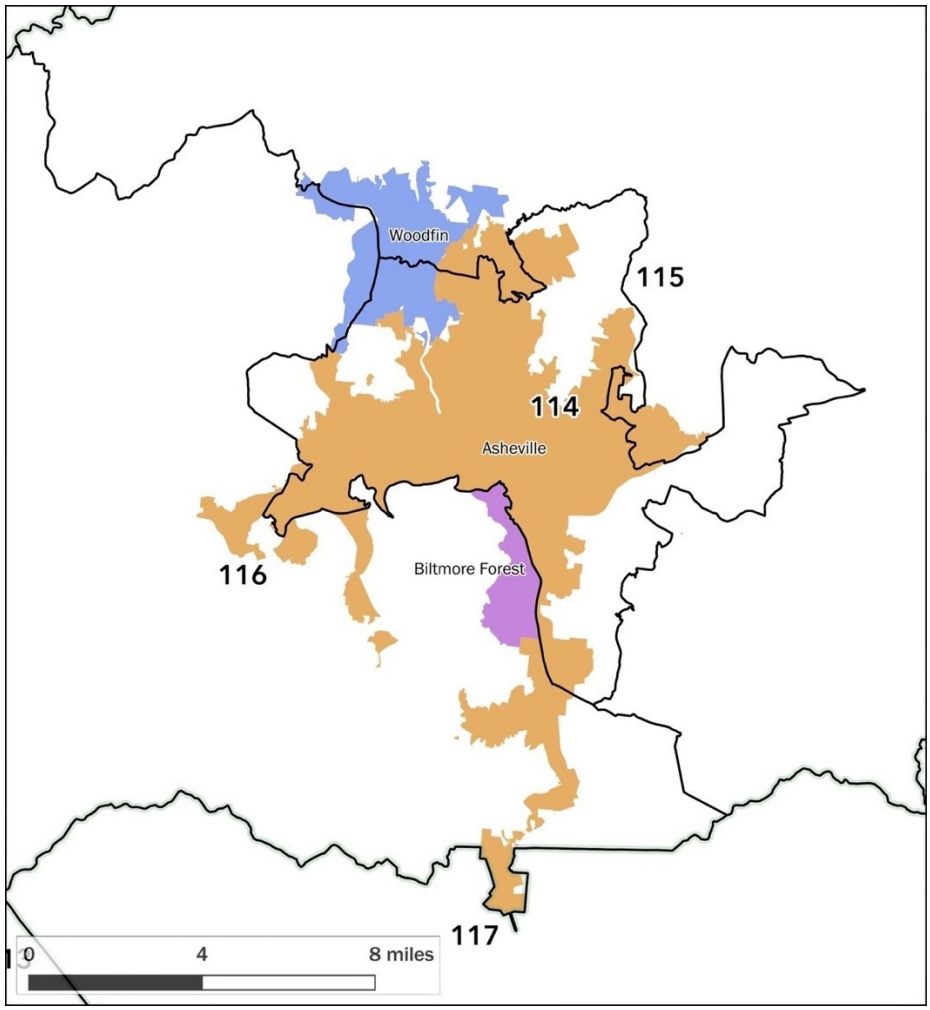
These boundaries were successful in achieving safe Republican districts, as all four of these districts are rated as "Strong Republican" by NCFEF. Civitas provided similar estimates of each district's partisan leanings, rating HD-108 as R+12, HD-109 as R+9, HD-110 as R+15, and HD-111 as R+15. Despite the blue wave of 2018, Republicans won all four of these districts by large margins in 2018 (the *smallest* of the four margins was 17.96 percentage points).

House Districts 114, 115, and 116

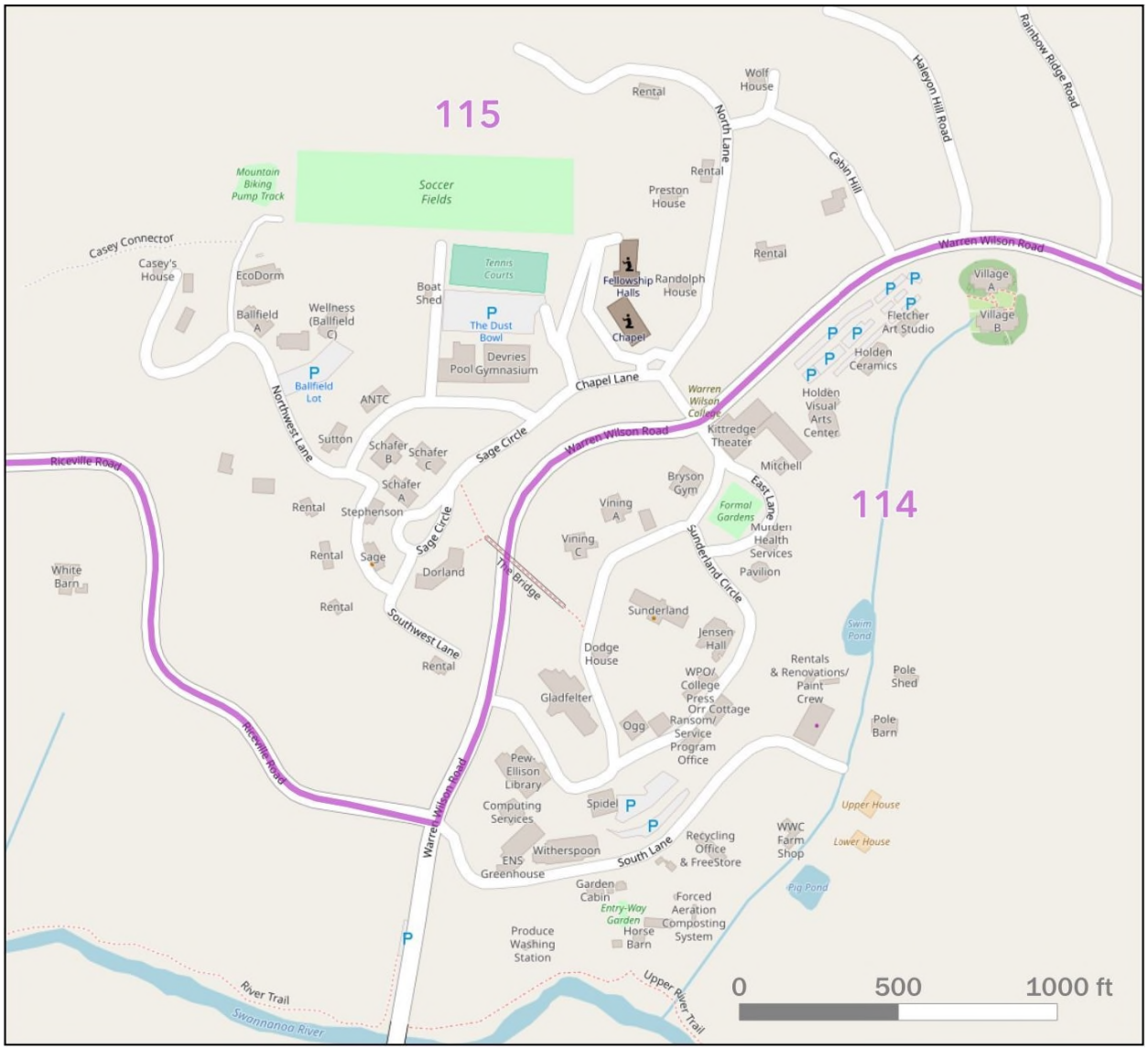


House Districts 114, 115, and 116 are located in Buncombe County, the most populous and most Democratic-leaning county in western North Carolina. The cultural, economic, and political center of Buncombe County is Asheville, an overwhelmingly and increasingly liberal city. Buncombe County, itself, is the 15th most Democratic county in the state, according to the vote share in the 2016 Attorney General race.

As the map that follows indicates, the current district boundaries split Asheville across all three districts in the cluster, packing Asheville's most Democratic areas into HD-114, while placing Asheville's less Democratic areas into HD-115 and HD-116 in order to make those two districts as Republican-leaning as possible. The Town of Woodfin (with a population of just over 6,000) straddles the boundaries between HD-114, HD-115, and HD-116, with the most-Republican leaning portions of the town in HD-116.



In one of the clearest examples of gerrymandering in this cluster, the line marking the barrier between HD-114 and HD-115 bisects Warren Wilson College, a residential private university focused on experiential and environmental education, at its midpoint—along Warren Wilson College Rd. This district line not only splits a small, residential campus into two, but also places the students' mailing address (mailboxes are located in Gladfelter Hall) in HD-114, while the majority of the student residences sit in HD-115. See below for a map demonstrating this unique gerrymander.[23]

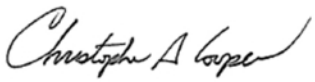


[23] Basemap of Warren Wilson College underlying the district lines obtained from https://www.openstreetmap.org.

The result of this gerrymandering is to turn a cluster of districts in a left-leaning area into one district rated “Strong Democrat” by NCFEF (D+27, according to Civitas), and two rated as “Competitive” by NCFEF (D+2 and R+1 for House Districts 115 and 116, according to Civitas). These patterns were reflected in the results of the 2018 elections, where Democrat Susan Fisher won HD-114 by over 60 percentage points, while Democrats Brian Turner and John Ager won, but by much smaller margins—and in races that cost the Democratic Party significant sums of money. These districts are so close that in 2014, Representative Ager won HD-115 by just 496 votes, and Representative Turner won by less than 1,000 votes and was forced to raise over $500,000 to win the seat. In 2012, immediately after the lines were drawn, Republican Nathan Ramsey won HD-115 and Republican Tim Moffitt won HD-116 by comparatively large margins.

Conclusion

After reviewing these county clusters in the North Carolina House and Senate, it is clear that the current General Assembly district lines advantage Republican candidates at the expense of Democratic candidates—and Democratic voters. This was done by virtually guaranteeing that the Democrats would win a few number of seats by large margins, while distributing the remaining Democratic voters in a manner intended to preclude Democratic victories outside of the packed districts. In contrast, the current district lines spread Republican voters more efficiently, thus increasing the odds that Republican candidates will win more seats by smaller margins. Not only do these district lines create partisan outcomes that are at odds with the wishes of the voters, but they also create substantial voter confusion. As indicated above, the current district lines unnecessarily split municipalities, college campuses, and VTDs. These district lines represent a partisan gerrymander.



Christopher A. Cooper

Exhibit A

Christopher A. Cooper

Stillwell 358
Department of Political Science & Public Affairs
Western Carolina University
Cullowhee, NC 28723

EDUCATION

Ph.D., University of Tennessee, Political Science (2002)
Dissertation: *Media and the State Legislature*

M.A., University of Tennessee, Political Science (1999)

B.A., Winthrop University, Political Science and Sociology (1997)

ACADEMIC POSITIONS

Professor of Political Science and Public Affairs, Western Carolina University (2014-Present)

Associate Professor of Political Science and Public Affairs, Western Carolina University (2008-2014)

Faculty Fellow, Institute for the Economy and the Future Western Carolina University (2002-2006)

Assistant Professor of Political Science and Public Affairs, Western Carolina University (2002-2008)

ADMINISTRATIVE POSITIONS

Department Head, Department of Political Science and Public Affairs, Western Carolina University (July 2012-present; Interim from July 2011-June 2012)

Director, Public Policy Institute, Western Carolina University (July 2008-July 2011)

M.P.A. Director, Western Carolina University (2005-2010)

AWARDS

North Carolina Professor of the Year, Carnegie Foundation for the Advancement of Teaching (2013)

Board of Governors Teaching Award, WCU (2013)

University Scholar, WCU (2011)

Chancellor's Award for Engaged Teaching, WCU (2007)

Teaching-Research Award, WCU (2006)

Outstanding Achievement—Teaching, Service Learning Department (2005)

Oral Parks Award for the best faculty paper presented at the 2003 meeting of the North Carolina Political Science Association.

Artinian Professional Development Grant, Southern Political Science Association (2004; 2006)

Provost's Citation for Extraordinary Professional Promise, University of Tennessee (2002)

ADDITIONAL TRAINING

Social Network Analysis course through the Inter-university Consortium for Political and Social Research, Chapel Hill, NC (2010)

Spit Camp, Salimetrics, Inc, State College, PA (2010)

Deliberative Polling Institute, Stanford University (2008)

Hierarchical Linear Model course through the Inter-university Consortium for Political and Social Research, Amherst, MA (2005)

Summer Institute in Experimental Methods, Yale University (2003)

Summer Institute in Political Psychology, Ohio State University (1999)

RESEARCH [# DENOTES STUDENT CO-AUTHOR]

BOOKS

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[Featured in the Durham Herald-Sun, Charleston City Paper, Statehouse Report (SC), Blue Ridge Public Radio (Asheville, NC), WFAE (Charlotte, NC), South Carolina Public Radio (Walter Edgar's Journal), WUNC (The State of Things), Georgia Public Radio (On Second Thought), Reviewed in the *Journal of Southern History*]

Cooper, Christopher A., and H. Gibbs Knotts, eds. 2008. *The New Politics of the Old North State*. Chapel Hill, NC: University of North Carolina Press.
[Featured in *Raleigh News and Observer*, Reviewed in *Journal of Southern History*, *North Carolina Historical Review*]

PEER-REVIEWED JOURNAL ARTICLES

Cooper, Christopher A., and H. Gibbs Knotts. "Do I Have to Take The GRE? Standardized Testing in MPA Admissions. *PS: Political Science & Politics*." Forthcoming.

Reinagel, Tyler, and Christopher A. Cooper. "Assessing the State of Mandatory Fees in America's Public Colleges and Universities: Causes and Consequences." *Social Science Quarterly*. Forthcoming.

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Menickelli, Justin, David Barney, Dan P. Grube, and Christopher A. Cooper. 2016. Disc Golf and Walking Benefits: A Pedometer Based Physical Activity Assessment. *International Journal of Physical Education, Fitness and Sports.* 5(1): 1-5.

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Cooper, Christopher A., and H. Gibbs Knotts. 2014. "Partisan Composition in Southern State Legislatures." *Southern Cultures.* 20: 75-89.

[Listed as One of *Southern Cultures*' "Top Ten Classroom Reads."]

Cooper, Christopher A., Dale Carpenter, Audrey Ranier,# and David M. McCord. 2014. "Personality and Job Satisfaction: Evidence from a Sample of Street Level Bureaucrats." *International Journal of Public Administration.* 37: 155-162.

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"Still Fighting the Civil War? Southern Opinions on the Confederate Legacy?" Presented at the Biennial Meeting of the Citadel Symposium on Southern Politics. March, 2018 (with M.V. Hood III, Scott H. Huffmon, Quentin Kidd, H. Gibbs Knotts, and Seth C. McKee).

"Leaving the (Political) Party in the South: Unaffiliated Voters and the Future of the Southern Electorate." Presented at the Auburn University Montgomery Southern Studies Conference. February, 2018.

"The Resilience of Southern Identity." Presented at the Biennial Meeting of the Southern American Studies Association. March, 2017 (with H. Gibbs Knotts).

"The Five Factor Model, Public Service Motivation, and Person-Organization Fit." Presented at the Northeastern Conference for Public Administration. Harrisburg, PA. November, 2016.

"Furling the Flag: Examining the Legislative Vote to Remove the Confederate Flag from the Statehouse Grounds in South Carolina." Presented at the Citadel Symposium on Southern Politics. March, 2016 (with Latasha Chaffin and H. Gibbs Knotts).

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"A 'Court' of Public Opinion Influence on Judicial Decision-Making in the U.S. Supreme Court." Presented at the Public Choice Society Conference. March, 2014 (with Todd Collins).

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"Unpacking Southern Identity." Presented at the Southern American Studies Association Meeting. Charleston, SC. February, 2013 (with Gibbs Knotts)

"Southern Identity Revisited." Presented at the Southern Political Science Association. Orlando, FL. January, 2013 (with Gibbs Knotts)

"Reassessing Case Salience." To be presented at the American Political Science Association. New Orleans, LA. August, 2012 (with Todd Collins). [Conference was cancelled due to Hurricane]

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"Trust in Government, Citizen Competence and Public Opinion on Zoning." Paper presented at the Annual Meeting of the North Carolina Political Science Association. High Point, NC. March, 2006 (with Gibbs Knotts and Kathleen Brennan).

"Casework in U.S. State Legislatures." Presented at the Annual Meeting of the Southern Political Science Association. Atlanta, GA. January, 2006 (with Lilliard Richardson).

"Voice of the People: Letters to the Editor in America's Newspapers." Presented at the Annual Meeting of the American Political Science Association. Washington, DC. August, 2005 (with H. Gibbs Knotts).

"Newsgathering in America's Statehouses." Presented at the 5th Annual Conference on State Politics and Policy. East Lansing, MI. May, 2005 (with Martin Johnson).

"Media Coverage of Scandal and Declining Trust in Government: An Experimental Analysis of 9/11 Commission Testimony." Presented at the Annual Meeting of the Midwest Political Science Association. Chicago, IL. April, 2005 (with Anthony Nownes).

"Beyond Dixie: Race, Region, and Support for the South Carolina Confederate Flag." Presented at the Annual Meeting of the North Carolina Political Science Association. Pembroke, NC. March, 2005 (with H. Gibbs Knotts).

"Media Bias and American Statehouse Reporting." Presented at the Annual Meeting of the Southern Political Science Association. New Orleans, LA. January, 2005 (with Martin Johnson).

"The Impact of Institutional Design on State Legislative Representation." Presented at the 4th Annual Conference on State Politics and Policy. Kent, OH. April, 2004 (with Lilliard Richardson).

"Defining Dixie: Searching for a Better Measure of the Modern Political South." Presented at the 2004 Citadel Symposium on Southern Politics. March, 2004 (with H. Gibbs Knotts).
[Also presented at the Annual Meeting of the North Carolina Political Science Association. Elon University. March, 2004.]

"Negotiating Newsworthiness: Organized Interests and Journalists in the States." Presented at the Annual Meeting of the Southern Political Science Association. New Orleans, LA. January, 2004 (with Anthony J. Nownes).

"State Legislators in the Internet Age." Presented at the Annual Meeting of the American Political Science Association. Philadelphia, PA. August, 2003. (with Lilliard Richardson).

"Descriptive Representation in Multi-Member Districts, 1975-2002." Presented at the Annual Meeting of the Midwest Political Science Association. Chicago, IL. April, 2003 (with Lilliard Richardson).

"The Consequences of Multi-Member Districts in the State Legislature." Presented at the 3rd Annual Meeting of the Conference on State Politics and Policy. Tucson, AZ. March, 2003 (with Lilliard Richardson).

"I Learned it From Jay Leno: Entertainment Media in the 2000 Election." Presented at the Annual Meeting of the South Carolina Political Science Association. Rock Hill, SC. February 2003 (with Mandi Bates). Also presented at the Annual Meeting of the North Carolina Political Science Association. Elon, NC.

"Do Advertorials Work?" Presented at the Annual Meeting of the Southern Political Science Association. Savannah, GA. November 2002 (with Anthony Nownes).

"Legislative Representation in the Face of Direct Democracy." Presented at the 2nd Annual Conference on State Politics and Policy. Milwaukee, WI. May, 2002 (with Lilliard E. Richardson).

"Local Citizen Groups." Presented at the Annual Meeting of the Western Political Science Association. Long Beach, CA. March 2002 (with Anthony J. Nownes).

"Internet Use in the State Legislature." Presented at the Annual Meeting of the Western Political Science Association. Las Vegas, NV. March, 2001.

"Media Consumption in the State Legislature." Presented at the Annual Meeting of the Western Political Science Association. Las Vegas, NV. March 2001.

"Media and the State Legislature." Presented at the Annual Meeting of the American Political Science Association. Washington, DC. September, 2000.

"Depictions of Public Service in Children's Literature." Presented at the Annual Meeting of the International Society for Political Psychology. Seattle, WA (with Marc Schwerdt). July, 2000.

"Former State Legislators in the U.S. Congress During the 1990's." Presented at the Annual Meeting of the Southern Political Science Association. Atlanta, GA. (with Lilliard E. Richardson). August, 1999.

CONTRACTS AND GRANTS

"Policymaking in the Shadows: Collaborative Governance, University Governing Boards and the New Politics of Higher Education." Graduate School and Research. $5000.

"Opt-In Survey." 2013. $8,896. Sponsor: Southwestern Commission.

"Public Opinion on the Town Square Property in Black Mountain, NC." 2010. $6,000. Sponsor: Town of Black Mountain.

"French Broad River Congestion Management Plan." 2010. Subcontract from The Louis Berger Group. $5000.

"Evaluating Health Risk in Yancey County Schools." 2010. $500.

"Know Your Region." Contract with the US Economic Development Administration. 2009. Co-PI with John Hensley. $50,000.

"American Youth Congress." 2009. NC Civic Education Consortium/Z Smith Reynolds. $6000.

"Voter Education Initiative." 2008. NC Campus Compact. $500.

"Citizen Satisfaction in Buncombe County." 2007. $16,577.

"Evaluating Health Risk in Yancey County Schools." 2007. $500.

"Regional Outlook Report." 2007. Internal Contract with the Institute for the Economy and the Future. $6,500.

WCU Summer Research Fellowship. 2007. $1500.

Co-Principal Investigator (with H. Gibbs Knotts). Sponsored contract with the city of Asheville, NC to consult about the design of a citizen satisfaction survey. $3,000.

WCU Summer Research Grant, 2001. $5000.

Yates Dissertation Fellowship, UTK, 2001. $5000.

Undergraduate Education Improvement Grant, UTK Department of Political Science, 2001. $1000.

Dissertation Fellowship, UTK Department of Political Science, 2001. $700.

TEACHING

COURSES TAUGHT AT WCU

State and Local Government
State and Local Governance
Political Parties, Campaigns and Elections
Simulation in American Politics
Research Methods in Public Affairs
Political Analysis
Public Policy Analysis Southern Politics
Election 2012
Interdisciplinary Approaches to the Study of Politics
Introduction to American Government
Mass Media and American Politics
Political Parties and Interest Groups
Civic Engagement
British Political Systems
The University Experience
Advanced Writing in Political Science
Public Administration
Internship in Political Science
Co-op in Political Science
Political Parties
MPA Internship Experience
Metropolitan Government
Public Affairs Capstone Experience
Public Affairs Administration

INTERNATIONAL TEACHING

Guest Lecturer, Ludwigsburg University of Education, Ludwigsburg, Germany (May, 2018)

Guest Lecturer, Middelburg Center for Transatlantic Studies, Middelburg, the Netherlands (December, 2009; June 2012)

THESIS & DISSERTATION COMMITTEES

Terry Bellamy (EdD, in Progress)
Christopher Franklin (EdD, 2016)
John Luke McCord (MA, Psychology, 2016, Chair)
Amy Jones (EdD, 2014)
Whitney Bridges-Campbell (MA, Psychology, 2013)
Kimberlee Cooper (MA, Psychology, 2013)
David Solomon (MA, Psychology 2012)
Christopher Holden (MA, Psychology, 2012)
Jenny Smith (MA, HHP, 2011)
Benjamin Locklair (MA, Psychology, 2011)
Brandon Rice (MA, English, 2010)
Andrew Johnson (MA, Psychology , 2010)

Heidi Turlington (MA HHP, 2009)
Joe Hurley (MA, History 2006)

SERVICE

SERVICE TO THE PROFESSION

Reviewer for [since 2010]:
Administration and Society
American Journal of Political Science
American Political Science Review
American Politics Research
American Review of Politics
American Review of Public Administration
American Sociological Review
Annals of the American Association of American Geographers
Congress and the Presidency
European Journal of Personality
Geography Compass
International Journal for the Scholarship of Teaching and Learning
International Review of Public Administration
Journal of Food Science Education
Journal of Information Technology and Politics
Journal of Political Science
Journal of Politics
Journal of Public and Nonprofit Affairs
Journal of Public Administration Research and Theory
Journal of Public Affairs Education
Justice System Journal
Legislative Studies Quarterly
National Science Foundation
Personality and Individual Differences
Political Behavior
Political Communication
Political Research Quarterly
Politics and Policy
PS: Political Science and Politics
Public Administration Review,
Public Opinion Quarterly
Public Budgeting and Finance
Public Management Review
Public Personnel Management
Public Performance and Management Review
Review of Public Personnel Administration
Social Science Quarterly
Social Forces
Southeastern Geographer
Social Problems
Social Science and Medicine
Social Science Journal
Southeastern Geographer

Southern Cultures
State and Local Government Review
State Politics and Policy Quarterly
Urban Affairs Review
Oxford University Press
Palgrave McMillan
CQ Press
Carnegie Foundation for the Advancement of Teaching

Section Head Duties at Conference

Section Chair for State and Local Politics Section of the Southern Political Science Association, 2008.

Discussant and Panel Chair Duties at Conferences

Discussant for panel on "Electoral Reform in North Carolina." North Carolina Political Science Association. February, 2011.

Chair for panel on "Economic Development Policies." North Carolina Political Science Association. Durham, NC. February, 2010.

Chair for panel on "The Future of State Politics." Southern Political Science Association. New Orleans, LA. January, 2008.

Discussant for panel on "Electoral Reform." American Political Science Association. Chicago, IL. September, 2007.

Discussant for panel on "Disaster: Politics and Policy." Policy History Conference. Charlottesville, VA. June, 2006.

Chair and Discussant for panel on "Issues in Electoral Politics." North Carolina Political Science Association. High Point, NC. March, 2006.

Discussant for panel on "Issues in American Politics." North Carolina Political Science Association. High Point, NC. March, 2006.

Discussant for panel on "North Carolina Politics." Citadel Symposium on Southern Politics. Charleston, SC. February, 2006.

Chair and discussant for panel on "State Policy." American Political Science Association. Washington, DC. September, 2005.

Discussant for panel on state politics. Annual Meeting of the Midwest Political Science Association. Chicago, IL. April, 2005.

Chair and Discussant for panel on "Electoral Politics." Annual Meeting of the North Carolina Political Science Association. Cullowhee, NC. March, 2004.

Discussant, "State Legislative Elections." Annual Meeting of the Southern Political Science Association. New Orleans, LA. January, 2004.

Discussant and Chair, "Highlighting Student Research." Annual Meeting of the South Carolina Political Science Association. Rock Hill, SC. February 2003.

Discussant and Chair, "Media Coverage of Elections and Representation." Annual Meeting of the Southern Political Science Association. November, 2002.

INVITED TALKS AND PUBLIC SPEAKING ENGAGEMENTS

"The Resilience of Southern Identity." Presented at the West Forum, Winthrop University. November, 2018.

"2018 Elections." Presented to the Foundation Board of Blue Ridge Public Radio. November, 2018.

"2018 Elections." Roundtable on NC Spin (UNC-TV)

"The Future of the Two-Party System." Presented at Leadership Asheville Foundation. October, 2018

"The 2018 Election" Presented at the Beth HaTePhelia Congregation Brotherhood Luncheon. October, 2018

"The 2018 Constitutional Amendments." Presented at the Cathedral of All Souls. Asheville, NC. October, 2018.

"Elections and North Carolina Politics in 2018." Presented at the NC Local Government Budget Officers Association Annual Summer Meeting. Atlantic Beach, NC. July 2018.

"State and Local Government in North Carolina." Leadership Asheville. December, 2018.

Moderated 11th Congressional District Democratic Primary Debate. Canton, NC. April, 2018.

"The Resilience of Southern Identity." Madstone Café and Books. September, 2017.

Moderated Asheville City Council Debate. Givens Estate. August, 2017.

"Politics in Western North Carolina." Presented at the Hinton Rural Life Center. June, 2017.

"Redistricting." Presented at the FairVote Forum, Haywood Community College. June, 2017.

"Redistricting." Presented to the Asheville Chamber of Commerce. May, 2017.

"Man is, by Nature, a Political Animal." Presented at the Science Café. Sylva, NC. March, 2017.

"State of State Politics." Presented to Leadership Asheville Foundation Luncheon. March, 2017.

"Raising Your Voice: Contacting Your Representatives in a Polarized Age." Presented at the Haywood County Library. March, 2017.

"Politics 2017." Presented to the NC City/County Manager's Association in Durham, NC. February 2017.

"Election 2016." Presented at the WCU Alumni Association Meeting in Charlotte, NC. October, 2016.

Speaker and Moderator for Buncombe County Commissioner Debate. October, 2016.

"Election 2016." Presented at the WCU Alumni Association Meeting in Atlanta, NC. October, 2016.

"Election 2016." Presented at the South Asheville Rotary Club. October, 2016.

"Election 2016." Presented at the Buncombe County Rotary Club. October, 2016.

"Election 2016." Presented at the Sylva Rotary Club. October, 2016.

"Election 2016." Presented at Beth Hatephelia Brotherhood Lunch. October, 2016.

"Politics 2016." Presented at Life@WCU. Cullowhee and Asheville. October 2016.

"Political Polarization." Presented to the Buncombe County League of Women Voters. June 2016.

"Congress Today." Presented at Life@WCU. Cullowhee, and Asheville. November, 2015.

"Politics 2015." Presented at the Highlands Leadership Series. Highlands, NC. July, 2015.

"Politics in North Carolina." Presentation to the Nonprofit Pathways Policy Conference. January, 2015.

"Polarization in Politics." Presented at the Givens Estate, Asheville, NC. June 2015.

"Politics Today in North Carolina." Presented at Leadership Asheville. Asheville, NC. February, 2015.

"North Carolina For Nonprofits." Presented at the Nonprofit Pathways Public Policy Briefing. January 2015.

"Regional Outlook Report." Presented at Lead WNC, Cullowhee, NC. November, 2014.

"North Carolina Politics." Presented at Leadership Asheville, Asheville, NC. November, 2014.

"Election 2014." Presented at Beth Hatephelia Synagogue. Asheville, NC. October 2014.

"Electoral Politics in the United States." Presented to the Finance Directors for America's Motor Speedways. October, 2013.

"The Current State of American Civics." 2nd Annual Social Work Conference: Citizenship and Civility: Working Together for Practical Adovcacy in a Polarized Era. May, 2013.

"Election 2012." Presented at Sylva Rotary Club. Sylva, NC, October, 2012.

"Election 2012." Presented at Leadership Asheville. Asheville, NC, October, 2012.

"Election 2012." Keynote address to the Motor Speedway Finance Officers. September, 2012.

"Election 2012 in North Carolina." Keynote address to the North Carolina Association of Electrical Cooperatives. September, 2012.

"Election 2012." Keynote address to the North Carolina City/County Manager's Association Summer Meeting. June, 2012.

"What Do The Data Tell Us About Hunger?" Presented at Leadership Asheville. Asheville NC, April, 2012.

"Public Opinion on Second Home Development." Presented at the Symposium on Second Home Development. Asheville, NC April, 2011.

"North Carolina Politics" (with Gibbs Knotts). Presented to the Association of North Carolina Budget Officers. Grove Park Inn, Asheville, NC. 2010.

"Engaged Scholarship and the Public Policy Institute." Presented to the Morehead State Leadership Institute, 2009.

"Progressivism in North Carolina Politics" (with Gibbs Knotts). Presented at Quail Ridge Bookstore. Raleigh, NC, June, 2008.

"Progressivism in North Carolina Politics" (with Gibbs Knotts). Presented at the John Locke Foundation. Raleigh, NC, June, 2008.

"Political Change in Western North Carolina." Presented at the Economic Forecast Forum, sponsored by the NC Association of Bankers and the NC Chamber of Commerce. Raleigh, NC, January, 2008.

"Multi-Member Districts." Electoral Reform: 2006 and Beyond Conference. Columbus, OH, January, 2007.

"Rhetoric on Representation." University of California, Riverside, November, 2006.

"The Importance of Undergraduate Research." Presentation to the Winthrop University Undergraduate Research Expo. February, 2006.

"Perspectives on Economic Development Research." Presentation to Business Librarians in North Carolina. August, 2005.

"The Importance of a Political Science Education." Presentation to Winthrop University Pi Sigma Alpha Chapter Keynote speaker, Pi Sigma Alpha initiation, Winthrop University, February 2003.

INVITED TALKS AND PUBLIC SPEAKING ENGAGEMENTS

Quoted over 1,000 times in such media outlets as CNN.com, *New York Times*, *National Public Radio, Christian Science Monitor*, *Washington Post, Wall Street Journal, ESPN.com, USA Today, Detroit Free Press, Raleigh News and Observer, Boston Herald*, *Asheville-Citizen Times, Charlotte Observer, Winston Salem Journal, National Journal, Rock Hill Herald, Smoky Mountain News, Hendersonville Times, Sylva Herald, Mountain Express, Yahoo Singapore News,* Blue Ridge Public Radio, WUNC, WFAE, CNN, FOX News, WLOS TV, WATV, WFSC, and KISS FM.

UNIVERSITY, COLLEGE, DEPARTMENT, AND REGIONAL SERVICE

Current and Continuing

- Mountain Projects Board of Directors
- Forest Stewards Board of Directors
- Editor, Faculty Forum (2016-)
- Dept. of Political Science, Tenure, Promotion and Reappointment Committee (2008-present)
- MPA Committee (2002-present)
- Student Assessment of Instruction Task Force (2018-)
- Task Force to Select New Assessment Software (2018-)
- Coulter Faculty Commons Advisory Board (2016-)
- College of Business Advisory Board (2016-)

Previous Service

- Regional Conference Planning Committee (2012-2016)
- COACHE survey task force (2015-2016)
- Facilitator, Leadership Summit (2015)
- Faculty Senate (2009-2015)
- SAI Standardization Task Force (2015)
- Academic Policy Review Council (2013-2015)
- Arts and Sciences Tenure, Promotion and Reappointment Committee (2008-2014)
- Chair, Search Committee for Public Administration Faculty (2015)
- Book Store Task Force (2014)
- Search Committee for Public Administration Faculty (2014)
- Search Committee to hire an Assistant Professor in Public Administration (2012-2013)
- Chair, search committee to hire a visiting assistant professor in International Relations
- Chair, search committee to hire a lecturer in American Politics and Global Issues
- Search Committee for Research Development Specialist (2014)
- Search Committee for Human Geography (2014)
- Chair, Search Committee to hire Comparative Politics Faculty (2013)
- Chair, Faculty Affairs Caucus (2010-2011; 2012-2013)
- Dean of Arts and Sciences Search Committee (2012-2013)
- Faculty Affairs Caucus (2009-2014)
- Faculty Senate Planning Team (2010-2011; 2012-2013)
- Chair, 2020 Commission Subcommittee on Community Partnerships (2012)
- Chair, Search Committee to hire an Administrative Support Associate in the Department of Political Science and Public Affairs (2012)
- Chair, Search Committee to hire a Research Support Associate in the Coulter Faculty Center (2011)
- Search Committee to hire an Assistant Professor in Parks and Recreation Management (2012)
- Search Committee to hire an Assistant Professor in Public Administration (2012)
- Search Committee to hire a Visiting Assistant Professor in Public Administration (2012)
- College of Business Research Award Committee (2012)
- Institutional Review Board (2005-2011)

- Mountain Heritage Center Program Assessment Team (201!)
- Chair, American Democracy Project (2010-2011)
- Arts and Sciences Program Prioritization Task Force (2011)
- Department of International Programs Assessment Team (2010)
- Cullowhee Revitalization Task Force (2010)
- Chair, Department Graduate Recruitment Committee
- Chair, Department Graduate Comps Committee
- Chair, Department Graduate Internship Committee
- International Relations Search Committee (2010)
- WCU/Dillsboro Partnership Task Force (2009-2010)
- QEP Assessment Committee (2007-2010)
- Arts and Sciences Teaching Award Committee (2009-2010)
- Co-Chair Social Science Research Forum (2007-2010)
- Chair, MPA Director Search Committee (2009-2010)
- Public Administration Search Committee (2009-2010)
- Chair, MPA Director Search Committee (2008-2009)
- Public Administration Search Committee (2008-2009)
- International Relations Search Committee (2008-2009)
- Chair, Graduate Research Grant subcommittee of the Research Council (2008)
- College Restructuring Task Force (2008-2009)
- Athletics Committee (2006-2009)
- Graduate Council (2006-2009)
- Research Council (2005-2008)
- Chair, Graduate Research Grant subcommittee of the Research Council (2008)
- Co-chair, Integration of Learning Award subcommittee of the Student Learning Committee (2008)
- Outreach and Engagement Committee for UNC-Tomorrow (2008)
- Humphrey Fellows Steering Committee (2007-2008)
- Chair, Public Administration Search Committee (2007-2008)
- Chair, Institutional Review Board (2005-2007)
- Chair, Public Administration Visiting Search Committee (2007)
- Public Law visiting assistant professor search committee (2006)
- International Relations visiting instructor search committee (2006)
- Congress to Campus Coordinator (2006)
- President, University Club (2006-2007)
- Arts and Sciences Strategic Planning Committee (2005-2007)
- Arts and Sciences Dean's Advisory Board (2006-2007)
- Committee Chair, National Youth Congress (April, 2005)
- Scholarship of Teaching and Learning Committee (2005-2006)
- Committee on Student Learning (2005-2008)
- ICPSR Representative for WCU (2004-2007)
- Created and Directed WCU faculty Quantitative Research Forum (2004-2005)
- Congress to Campus Coordinator (2004)
- Center for Regional Development Director Search Committee (2003)
- Public Administration Search Committee (2003)

- Co-op and Internship Coordinator, Dept. of Political Science, WCU (2002-2006)
- Webmaster, WCU Department of Political Science (2002-2007)

ON-CAMPUS SPEAKING

- "Politics 2018." Presented to Life@WCU (Cullowhee and Asheville, NC. 2018)
- "The 2018 Midterms." Presented to the Democracy Coalition. April 2018 (WCU).
  "Election 2014." Presentation to Life @WCU [presented twice] September, 2014
- "The Importance of Liberal Arts," Arts and Sciences Big Questions Series, March, 2014.
- "Regional Outlook" Presented to the 2013 Regional Conference. October, 2013
- "Public Education" Freshman Convocation Speech, WCU Freshman Convocation, August 2013.
- "Regional Outlook." Presented to the Chancellor's Leadership Council, August, 2013.
- "Public Education" Commencement Speech, WCU Graduate School Commencement, May 2013.
- "The Teacher-Scholar Model." Presented to the New Faculty at WCU. April, 2013
- Panel on Southern Stereotypes at the WCU Mountain Heritage Center. March, 2013
- "Book Panel: Madmen, Intellectuals, and Academic Scribblers." Sponsored by the Economics Club at WCU.
- "Election 2012 Wrap-Up." Speaker at Forum organized by the Department and the Public Policy Institute.
- "Political Psychology." Presented to WCU Psychology Department Colloquium. October, 2012.
- "Media Coverage of the Courts" Presented to Political Science Department Research Symposium. October, 2012.
- "Election 2012." Presented to WCU Resident Assistants. September, 2012.
- "How to be a New Department Head" Presented to the new Department Heads. August, 2012.
- "Personality and Public Administration" Presented to Political Science Department Research Symposium. April, 2012.
- "Should I get a PhD?" Presented to the GATE week, sponsored by the Coulter Faculty Commons. February 2012.
- "Personality and Public Administration" Presented to the Psychology Research Symposium. February, 2012.
- "Political Psychology." Presented to the Psychology Research Symposium. September, 2011.
- "New Approaches to Methodology." Presented to the Psychology Research Symposium. March, 2011.
- "Political Psychology." Presented to the Psychology Research Symposium. November, 2010.
- "Gauging Public Opinion." Seminar to the Local Government Training Program. Land of Sky, Asheville, NC (with Gibbs Knotts). February, 2010.
- "Assessing Public Opinion on the Confederate Flag." Presented at the 10th Annual Diversity Week. Western Carolina University. September, 2009.
- "Quantitative Analysis." Presented at the 2nd Annual SoTL Retreat. Waynesville, NC. February, 2009.
- "Reflections on the 2008 Elections" (with Gibbs Knotts). Presented to the WCU Foundation Board. November, 2008.
- "Appalachian Politics" (with Gibbs Knotts). Presented at the Appalachian Lunchtime Series. Mountain Heritage Center, Western Carolina University. October, 2008.
- "5 Myths About American Elections" (with Gibbs Knotts). Presented at the Sylva Rotary Club. September, 2008
- "10 Myths About America Elections" (with Gibbs Knotts). Presented at Mayland Community College, July 2008.

- "Quantitative Research and SoTL." Presentation to the SoTL Retreat, Western Carolina University, February, 2008.
- "Statehouse Reporters." Presentation at the Qualitative Research Group, Western Carolina University, April, 2007.
- "We're from the IRB and We're Here to Help You." Presentation at the Scholarship of Teaching and Learning (SoTL) Faire, Western Carolina University, April, 2007.
- "Voice of the People? Gender Representation in Letters to the Editor." Presented at the 6th Annual Gender Conference. March, 2007.
- "Using NSSE in your Teaching." January, 2007.
- "Civic Education." Presentation to Civic Place, WCU. September, 2006
- "IRB Promoting SoTL by Means of the Institutional Review Board." Presentation at the Scholarship of Teaching and Learning (SoTL) Faire, Western Carolina University. February, 2006.
- "Perspectives on Engaged Learning." Presentation to faculty and staff at Western Carolina University. September, 2005.
- "Representative Reporters?" Presentation to the Quantitative Research Group, Western Carolina University. September, 2005.
- "ICPSR: What it is and how do I use it?" Presentation to faculty, staff and students at WCU. September 30, 2004.
- "Stat Packages: The good, the bad and the ugly." Presentation to the Faculty Group on Computing in Research and Teaching, WCU. September 24, 2004.

Exhibit 3

- Pender-Columbus-Robeson
- New Hanover-Brunswick
- Cumberland
- Anson-Union
- Guilford
- Alamance
- Richmond-Montgomery-Stanly-Cabarrus-Rowan-Davie
- Forsyth-Yadkin
- Mecklenburg
- Gaston-Cleveland
- Buncombe

Senate:

- Bladen-Pender-Brunswick-New Hanover
- Sampson-Duplin-Johnston-Nash-Lee-Harnett
- Wake-Franklin
- Randolph-Guilford-Alamance
- Davie-Forsythe
- Mecklenburg
- Transylvania-Henderson-Buncombe

4 Quantifying intentional and excessive use of partisanship

My approach begins with a simple idea: I make small random changes to the boundaries of enacted plans (while maintaining districting criteria) and study the effect this has on the partisan bias of the map. More specifically:

- I begin from the enacted plan I am evaluating, and then repeatedly:
    1. Randomly select a geographical unit (e.g., a voting precinct) on the boundary of two districts, and check: if I change which district this geographic unit belongs to, will the resulting districting still satisfy the districting criteria laid out in Section 4.3.1? If so, I make the change.
    2. Using historical voting data as a proxy for partisan voting patterns, evaluate the partisanship of the districting resulting from the previous step.
- These two steps are repeated many times, resulting in a sequence of districtings, each produced by a small random change to the districting preceding it, with the enacted map I am evaluating as the starting point for the sequence.

This procedure is implemented as a computer algorithm which carries out trillions of the above steps for a districting map in a reasonable amount of time.

Exhibit 4

I previously submitted an expert report in Common Cause v. Rucho, No. 18-CV-1026 (M.D.N.C.) and Diamond v. Torres, No. 17-CV-5054 (E.D. Pa.), and was an expert witness for the plantiff in Common Cause. I am being paid at a rate of $400/per hour for the work on this case. Much of the work derives from an independent research effort, unrelated to this lawsuit, to understand gerrymandering nationally and in North Carolina specifically.

2 Overview

2.1 Overview of Findings

Using historic voting data, we compare election results under the enacted districting plans for the North Carolina House and North Carolina Senate with election results under a collection of non-partisan maps. One strength of this method is that it make no assumptions in advance about what structure an election should have such as a relation to proportional representation or some type of symmetry considerations. We examine both the number of seats that would have been won under these vote counts, along with the expected margins of victory. We see that the enacted plans are extreme outliers. Both the House and Senate plans systematically favor the Republican Party to an extent which is rarely, if ever, seen in the non-partisan collection of maps. Under many historic elections considered, the enacted maps in both the North Carolina Senate and House elect significantly fewer Democrats than the typical number of Democrats found in the collection of maps. At times the Democratic Party is denied a majority of seats when the overwhelming majority of maps in our collection would have resulted in a Democratic majority. In the North Carolina Senate, we find instances in which the Republicans would have gained a supermajority under the enacted plan, but would have lost a supermajority in nearly every map in our collection. In the North Carolina House, we find instances in which the Republicans won the supermajority of seats under the enacted plan but they would have not won the supermajority in the majority of maps in our collection. Again in the North Carolina House, we found an instance where the enacted map resulted in the chamber's seats being equally divided but a number of maps in our ensemble gave the Democratic Party a supermajority.

The extreme statewide tilt towards the Republican Party is the result of a significant number of truly independent choices at the level of the county-clusters into which the state is divided. The chance of making so many independent choices which bias the results towards the Republican Party unintentionally is astronomically small.

In addition to this systematic bias towards the Republican Party which when aggregated produces highly atypical results, the enacted plan also has highly atypical results in a number of county clusters even when viewed alone. Beyond often creating atypical results in terms of the number of seats won in a given cluster, our results also show a durability in the results in certain clusters under the enacted plans. By durable, we mean that the results remain atypically unchanged over a wide range of elections. This unresponsiveness to changes in vote counts is another problematic feature revealed by our analysis of the enacted plan.

2.2 Overview of Method

We generate a collection of alternative restricting maps using Markov Chain Monte Carlo methods, and use this collection to characterize what would be expected if only non-partisan redistricting criteria were used (see also [1, 2, 3]). No partisan information is used to construct this ensemble of maps; only the generally accepted districting criteria of approximately equal population per district, contiguous and relatively compact districts, reducing traversals, and keeping counties, precincts, and municipalities whole.

At the request of the plaintiffs, we used an ensemble of maps which did not modify districts drawn by the Special Master. In particular, the following districts were left unchanged: Senate districts 19, 21, 24, and 28, and House districts 21, 22, 57, 61, and 62.

We use the term *compliant maps* to refer to maps which satisfy certain minimal design criteria such as the number of counties split or the total population deviation being below accepted thresholds which is based on the values of the enacted plan. We will generally refer to our collection of compliant maps as the *ensemble of maps*.

To generate the ensemble of alternative maps, we define a distribution on all of the redistricting maps and then sample this distribution using a Markov Chain Monte Carlo algorithm; such algorithms are widely accepted for sampling high-dimensional distributions. The distribution is defined to be concentrated on districting plans that contain districts near the ideal district population based on one-person-one-vote. It is also designed to produce contiguous districts that are relatively compact and to reduce the number of counties and municipalities which are split. The distribution on redistricting plans is

Exhibit 5

definition?

A. It relies upon, number one, my expertise as a political scientist studying redistricting plans and then, number two, my reading of the adopted criteria as well as the transcript in which Representative Lewis listed out exactly how partisanship was to be measured.

Q. And that's it? That's where your definition of partisan intent comes from?

A. I said from my expertise and then from the documents that I reviewed, so yeah.

Q. What does the term predominant factor mean?

A. Sure. Predominant factor in the context of a partisan intent means the following to me: When I study an enacted plan or a proposed plan, I look at it in the context of -- here in the context of the non-partisan criteria that the General Assembly stated it was following, and so I asked the following question: Number one, did it produce -- did the enacted plan produce a partisan outlier compared to the sorts of plans that would normally be produced if one had pursued the non-partisan portions of the adopted criteria. And number two, if it did produce a partisan outlier, did it do so by subordinating

the non-partisan portions of the adopted criteria.

So I'm asking two questions there. I'm asking, one, whether partisanship predominated in the drawing of the plan and, number two, whether in doing so in the pursuit of this predominant partisan factor non-partisan criteria were subordinated in the pursuit of partisanship.

Q. What's the standard that you are using to decide if partisan intent predominated?

A. Well, I'm not using any sort of legal standard if that's what you're trying to ask. My standard is purely based on empirical social science, meaning that I use statistical tests. So I'm not going to be able to, say, layout for you some sort of legal standard as much as I'm just telling you about my statistical results and how I determine whether there's statistical significance in what I'm finding.

Q. And is that the same answer for subordinated, you don't offer a legal standard for what that means?

A. Exactly. When I use the word subordinate and when I use the word predominate, I have no legal

understanding of those terms. I'm purely answering the specific empirical questions that I just laid out for you.

Q. Can -- could a map drawer adopt what you describe as non-partisan criteria with a partisan intent?

A. I'll ask the court reporter to repeat the question.

(Record Read.)

THE WITNESS: I'm going to tell you how I interpret your question. I'm not sure this is what you were intending to ask, but I'm going to answer the literal question that you asked.

You said could a map drawer adopt non-partisan criteria. Now, I'm just going to stop there and qualify or explain to you that to my -- from my vantage point, adopting non-partisan criteria does not mean the same thing as actually following, strictly adhering to non-partisan criteria. So that's how I'm interpreting your question.

BY MR. FARR:

Q. Let me change my question.

A. I'm happy to abort my answer and I'll let you move on to another question, but I was just

Exhibit 6

districts. I talk about the creation of majority/minority districts. We talk about the argument pros and cons for majority/minority districts.

Q. All right. How do you define gerrymander?

A. When one party draws lines to benefit themselves at the expense of the other party.

Q. Is there a distinction between legal and illegal gerrymandering in your mind?

MR. CELLA: Objection to form.

A. I think that's for the court to decide.

Q. So you don't have an opinion about where that line is?

A. I don't think that's what I was asked to do here and I think that's why the court -- what the court's going to decide.

Q. Okay. Well, I'm asking if -- if you, based upon your professional experience, have any opinion on -- on where the line is between legal and illegal gerrymandering, and specifically I'm talking about political gerrymandering.

MR. CELLA: Objection, form.

A. I think that's for the court to decide.

Q. So you don't have an opinion about that?

Republican candidate won the race? You picked a race in which the Democratic candidate won the race. Why do that?

A. You -- again, you would have had essentially the same result given that we've got races that Republicans won here and we've got correlation coefficients ranging from .98 to .99.

Q. And then it looks like you calculated a correlation coefficient for the recent vote for voter ID legislation.

A. Uh-huh.

Q. And that was the lowest correlation that you had?

A. Yes.

Q. Okay. Why did you do that?

A. To see how well the vote share correlated to voter ID legislation.

Q. Okay. Now, in your report and in the -- the pages that follow here you use the terms packed and cracked several times. How did you define those terms for purposes of your report?

A. Packing involves diluting the vote of one party by ensuring that they win one race by a

large margin, thereby losing other races by smaller margins. Cracking involves diluting the representation of the other party by splitting them into multiple districts.

Q. Can Republican voters ever be packed?

A. Sure.

Q. Okay. They can be cracked?

A. Yes.

Q. Okay. Now, you have some charts on Pages, I guess, 19 and 20 here --

A. Uh-huh.

Q. -- about the distribution of Senate and House CPI scores.

A. Uh-huh.

Q. Can you explain what a CPI score is.

A. Sure. The Civitas Institute, which is a Raleigh-based nonprofit organization that fights to remove barriers to freedom, produces the CPI, a measurement that reveals which districts lean Republican or Democrat, and they illuminate significant trends. They calculate this measure by aggregating results from the prior council of state votes, placing each district on a scale of D+1 representing a -- a Democrat that has a