Technical Appendix to
Voting on Tribal Lands: Barriers to Native American Turnout[1]

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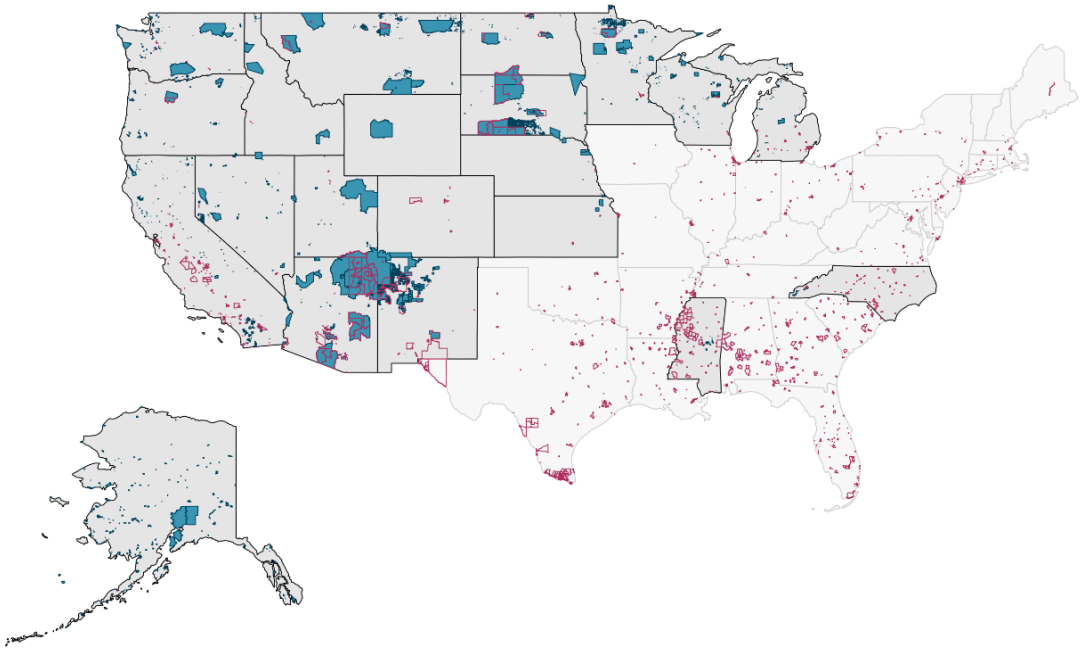
Table of Contents

A.1 Racially or Ethnically Concentrated Areas of Poverty

In the report, we reference the legacy of discriminatory policies in creating economic disadvantage among Native American communities. One measure of economic disadvantage is whether one lives in a Racially or Ethnically Concentrated Area of Poverty (R/ECAP). The Department of Housing and Urban Development designates census tracts as R/ECAPs when two conditions are met: 1) the population is greater than 50 percent nonwhite and 2) more than 40 percent of the population is living at or below the federal poverty line, or the poverty rate is three or more times the average tract poverty rate for the metropolitan/micropolitan area.[2]

Figure A1 overlays the geographic boundaries for R/ECAPs in the 50 states (outlined in magenta) with the federally recognized and census-designated tribal land boundaries for the 21 states included in this study (shaded in blue). In many of the study states, especially Arizona, Minnesota, Montana, New Mexico, North Dakota, and South Dakota, census tracts on tribal lands are designated as R/ECAPs. This further emphasizes the impact of historic extractive policies and demostrates the importance of policy interventions that improve the socioeconomic conditions for Native American communities.

Figure A1: Racially or Ethnically Concentrated Areas of Poverty and Tribal Lands in the Study



A.2 Snapshot Dates

As noted in the report, we used registered voter file snapshots between 2012 and 2022 to provide an accurate assessment of turnout on tribal lands. Voter files are subject to regular state-specific voter list maintenance practices that continually change the rolls, which can slightly alter turnout estimates; thus, we provide the dates of the voter file snapshots we used to assist with study replication. Voter file snapshot dates are missing for 2012 because Catalist, the vendor of that year's voter file, does not report that information. State snapshot dates between 2014 and 2022 were provided by L2.

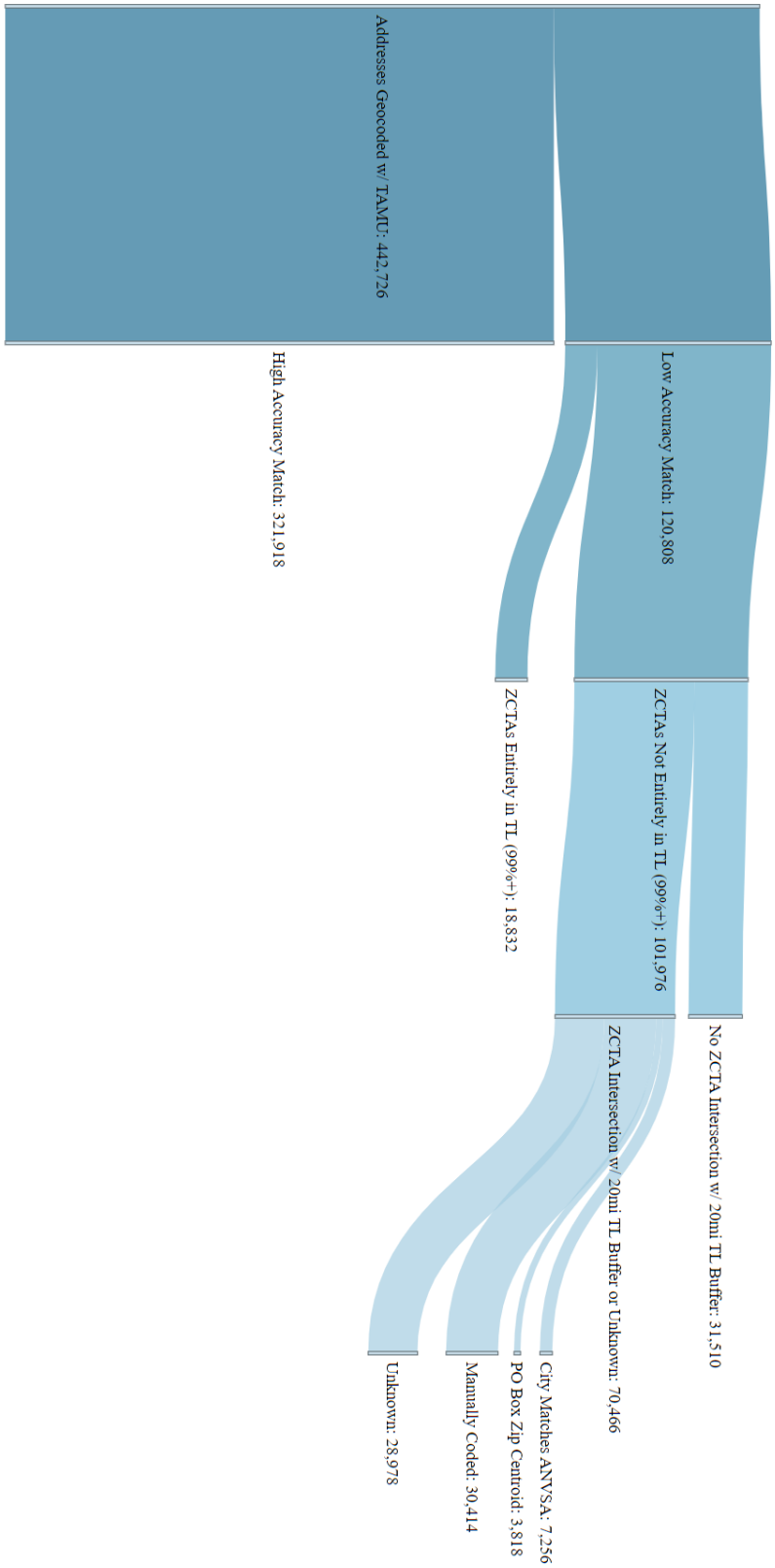
Table A1: Snapshot Dates

State	2014	2016	2018	2020	2022
AK	3/13/2015	1/27/2017	2/11/2019	2/3/2021	2/18/2023
AZ	4/22/2015	4/12/2017	9/7/2018	4/27/2021	3/21/2023
CA	5/21/2015	3/25/2017	1/31/2019	2/19/2021	12/19/2022
CO	5/5/2015	2/8/2017	8/31/2019	12/23/2020	12/19/2022
ID	2/23/2015	3/20/2017	3/4/2019	3/16/2021	4/20/2023
KS	2/26/2015	2/16/2017	1/31/2019	3/16/2021	4/1/2023
MI	2/28/2015	2/21/2017	3/22/2019	1/30/2021	2/25/2023
MN	3/3/2015	3/10/2017	4/2/2019	2/14/2021	4/1/2023
MS	3/17/2015	3/7/2017	3/11/2019	3/23/2021	4/20/2023
MT	3/27/2015	1/25/2017	2/7/2019	12/14/2020	2/25/2023
NC	7/29/2015	1/12/2017	2/1/2019	1/28/2021	2/18/2023
ND	4/15/2015	2/9/2017	3/22/2019	3/18/2021	3/15/2023
NE	3/25/2015	1/13/2017	1/10/2019	1/20/2021	1/16/2023
NM	3/19/2015	2/8/2017	2/22/2019	2/25/2021	4/1/2023
NV	1/30/2015	1/13/2017	1/23/2019	12/17/2020	2/4/2023
OR	4/16/2015	1/13/2017	2/24/2019	2/5/2021	3/11/2023
SD	3/13/2015	2/20/2017	1/14/2019	1/22/2021	2/25/2023
UT	3/6/2015	1/25/2017	3/7/2019	3/26/2021	2/18/2023
WA	5/5/2015	5/24/2017	1/8/2019	12/9/2020	1/20/2023
WI	3/3/2015	3/30/2017	2/1/2019	2/24/2021	2/18/2023
WY	3/30/2015	2/2/2017	4/2/2019	1/13/2021	4/20/2023

A.3 Assigning Registrants to Tribal Lands

To calculate turnout off and on tribal lands, we heavily relied on the coordinates for registrant addresses listed in the voter files. While the vast majority of addresses had latitude and longitude assigned to them using methods of geocoding with high levels of accuracy, such as using the centroid of a zip + 4 polygon, tax parcel boundary centroid, rooftop match, etc., a small percentage were assigned coordinates using methods with greater levels of uncertainty. Using voter files from the 2020 election in our sample states, we found that 99.98 percent of registrants with residence latitude and longitude had these coordinates assigned by geocoding methods with the highest levels of accuracy. Unfortunately, coordinate assignment accuracy codes were only added to the L2 voter files in 2020, while Catalist's 2012 files did not have a comparable geocoding accuracy identifier. With most voter files missing this identifier and the particularly high levels of geocoding accuracy, we made the decision to focus on remediating more than 440,000 unique addresses across the 21 states and six election years that were missing coordinates entirely. A Sankey diagram illustrating our process can be seen in figure A2.

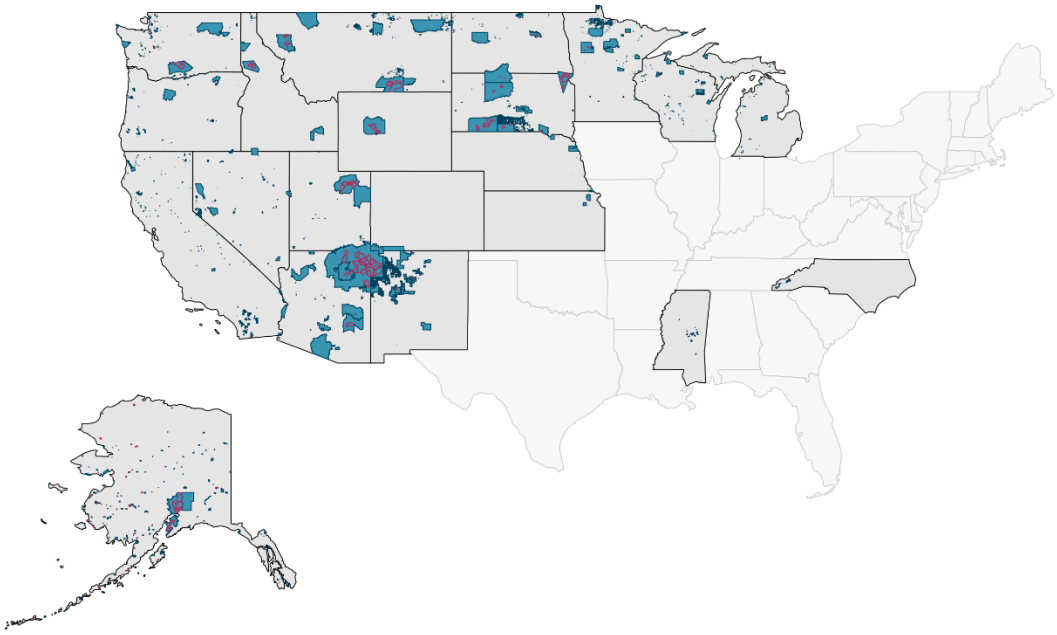
Figure A2: Rectifying Unique Addresses Missing Coordinates



Our initial step when designating addresses without coordinates as being on or off tribal lands involved the use of the Texas A&M (TAMU) GeoServices' geocoding service.[3] Each address was processed through the geocoding platform and returned with coordinates and accompanying North American Association of Central Cancer Registries (NAACCR) GIS Coordinate Quality Codes, which determine the level of accuracy for geocodes. Addresses that were assigned coordinates by address point matches, parcel location, and street segment interpolation — the highest levels of accuracy according to the NAACCR — were merged with the tribal land shapefiles to ascertain if they were on or off tribal lands, akin to the method used for addresses not missing coordinates in the voter file. Some 121,000 addresses remained without sufficiently precise coordinates for tribal land assignment.

To amend this gap in data, we used spatial matching based on address zip codes. Since zip codes are predicated on delivery points and are not used for mapping, we matched each of the remaining addresses' respective zip codes and election years to their corresponding ZIP Code Tabulation Areas (ZCTAs) defined in the Department of Housing and Urban Development's Office of Policy Development and Research crosswalk files.[4] ZCTAs are produced by the Census Bureau and provide areal representations of zip codes based on census blocks along with supplementary shapefiles. ZCTAs, like census blocks, change in accordance with decennial redistricting cycles; thus, each address had three ZCTAs assigned based on the election year (mid-decade ZCTAs were included due to instances of intercensal changes in geography). Using the ZCTA shapefiles, we spatially merged them with tribal land boundaries, and if the ZCTAs were entirely within a tribal land's boundaries all addresses within the ZCTA were assigned as being located within that respective tribal land. We included ZCTAs with 99 percent or more of their area located within a tribal land to this group as well. This appeared in instances when ZCTAs slightly shifted after the decennial census and did not align with the edges of the 2023 tribal land boundaries. About 19,000 addresses were located on tribal lands with the use of this spatial analysis method. ZCTAs that are contained within tribal lands are visually represented by the magenta outlines in figure A3.

Figure A3: ZCTAs Within Tribal Lands, 2023



Moreover, we used a process of spatial elimination that allowed us to confidently designate 32,000 addresses as being located off tribal lands. To eliminate any margin of error, we applied a 20-mile buffer around the individual geometries of each tribal land shapefile, as seen in figure A4, and spatially merged these enlarged multi-polygons with the remaining addresses' ZCTA shapefiles. Any ZCTAs that did not intersect with the buffered tribal lands were categorized as being located off tribal lands. After categorizing these addresses, 70,000 addresses missing ZCTAs or with ZCTAs that intersected the tribal land buffer remained, as seen in figure A5 (ZCTAs in magenta).

Figure A4: 20-Mile Tribal Land Buffer, 2023

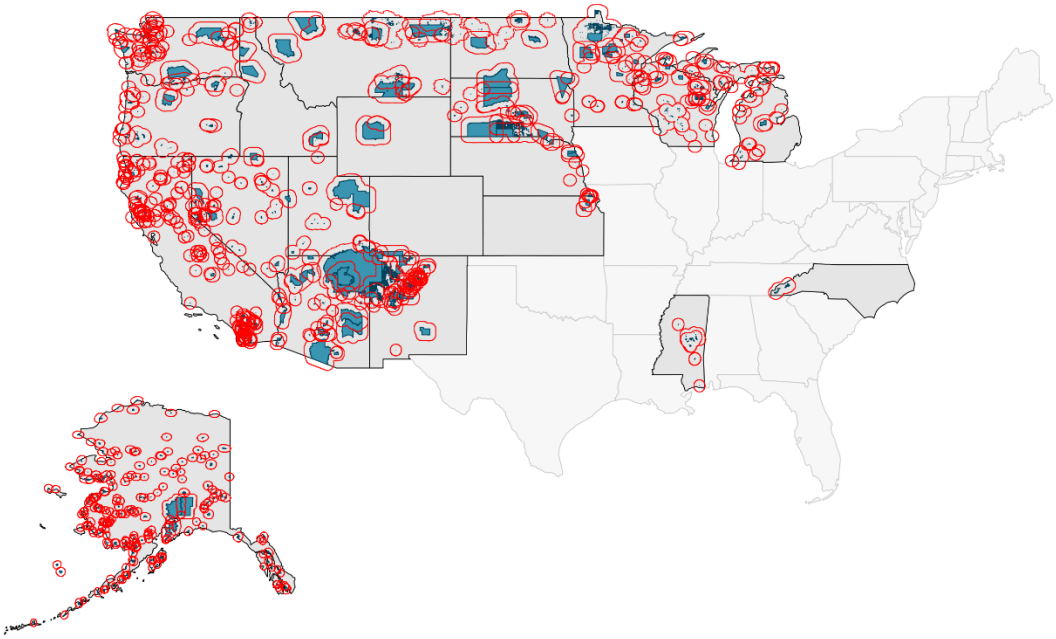
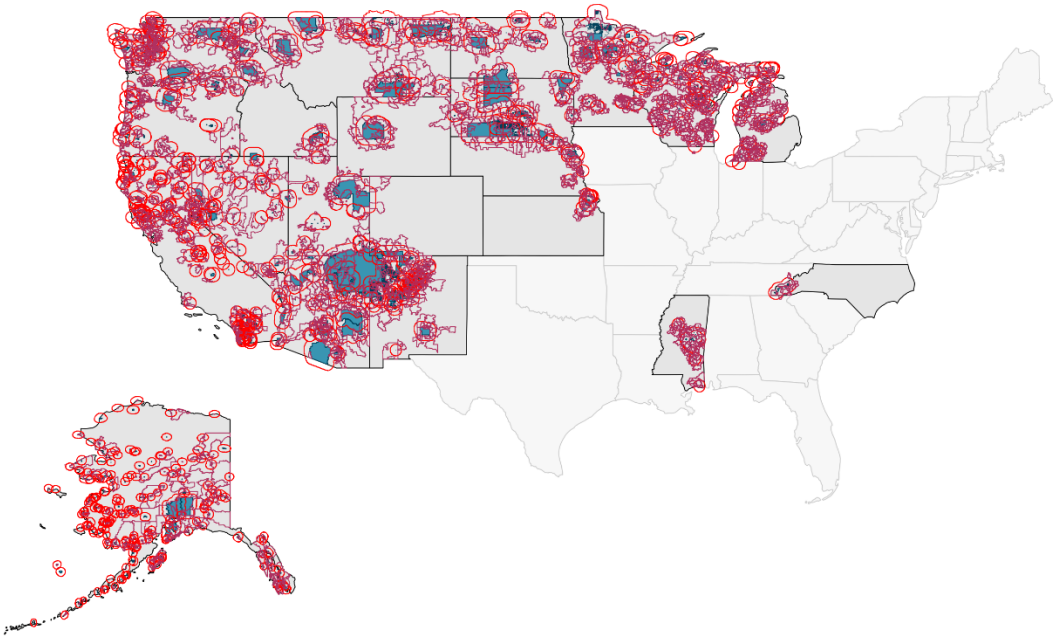


Figure A5: ZCTAs Intersecting 20-Mile Tribal Land Buffer, 2023



We remediated the gaps in geographic locations through multiple methods. First, addresses with ZCTAs that did not intersect with tribal lands or P.O. boxes were coded as being outside of tribal lands. There were a number of addresses linked to military bases, cities located

more than 20 miles from any tribal lands, and dormitories at colleges off tribal lands, which were all coded as being off tribal lands. Among the remaining addresses, we noticed city names that were much more common than others. These were often located in Arizona and New Mexico and could be matched to Navajo Nation chapters. Using the Navajo Nation's list and map of the different chapters, we assigned addresses as being within the Navajo Nation if their listed chapter was within the bounds of the Nation, but did not overlap with the "checkerboarding" prevalent in the East.[5] This enabled us to decrease any margins of error associated with this matching method. We similarly matched address cities to corresponding tribal areas for Hopi villages, a Tohono O'odham village, the Pueblo of Zuni, a census-designated place in the Pine Ridge Reservation, a community in the Cheyenne River Reservation, and census-designated places in the Uintah and Ouray Reservation. We were able to geocode more than 30,000 addresses using these methods. Likewise, when matching cities in Alaska addresses to Alaska Native Village Statistical Areas, we were able to assign more than 7,000 addresses to their corresponding Alaska Native villages.

Additionally, any remaining P.O. box addresses that were provided a "PO Box Zip Centroid" (coordinates of a zip code's geographical center) from TAMU's geocoding service and spatially intersected with any tribal land shapefiles were assigned to their respective tribal lands. In total, our varied approaches to ascertaining whether registrants were located on or off tribal lands left us with fewer than 29,000 addresses (less than 7 percent of the total addresses missing coordinates) that we could not rectify. These remaining addresses were all coded as being off tribal lands, since we could not confidently match them to any tribal lands.

A.4 Average Voter Turnout on and off Tribal Lands

In the body of the report, we delimit the measures taken to provide the most defensible estimation of turnout on and off tribal lands between 2012 and 2022. This includes providing conservative estimates of tribal land CVAP prior to 2020 by not including any blocks with spatial incongruities. This is more prevalent where tribal land borders changed after the 2010 redistricting cycle. While CVAP estimates for blocks that partially encompass tribal areas can to some extent be remediated through areal interpolation, these estimates have large errors in less densely populated areas due to residents being more heterogeneously distributed. Compounded with the census's undercount of Native populations living on reservations, the denominator for our turnout calculation and the resulting tribal land turnout rate is conservative.

The least conservative estimates for our denominator involve counting every 2010 block that intersects with tribal lands toward our total calculation of tribal land CVAP. Under this assumption, the entirety of a block's population is located within the area that intersects any tribal land. This scenario is likely impossible; however, calculating turnout with this inflated measure of CVAP underscores that the difference between this method and the most conservative is small. This margin of error when aggregating average turnout is best understood visually in figures A6 and A7, which plot turnout using both methods of calculating CVAP on tribal lands prior to 2020. In the figures, the gray dashed lines represent turnout on tribal lands when using the upper threshold for CVAP as the denominator. Using the upper bound for tribal land CVAP depresses turnout 2 to 3 percentage points more than our conservative estimates between 2012 and 2018 when aggregated

across all 20 states and between an additional 1 and 3 percentage points when aggregating turnout by region. Alaska is not included in these figures for reasons described in the main body of the report. The change in CVAP is insignificant off tribal lands and does not change turnout, which is the reason for the exclusion of upper bound turnout lines in figures A6 and A7.

Figure A6: Average Voter Turnout on and off Tribal Lands, 2012–2022

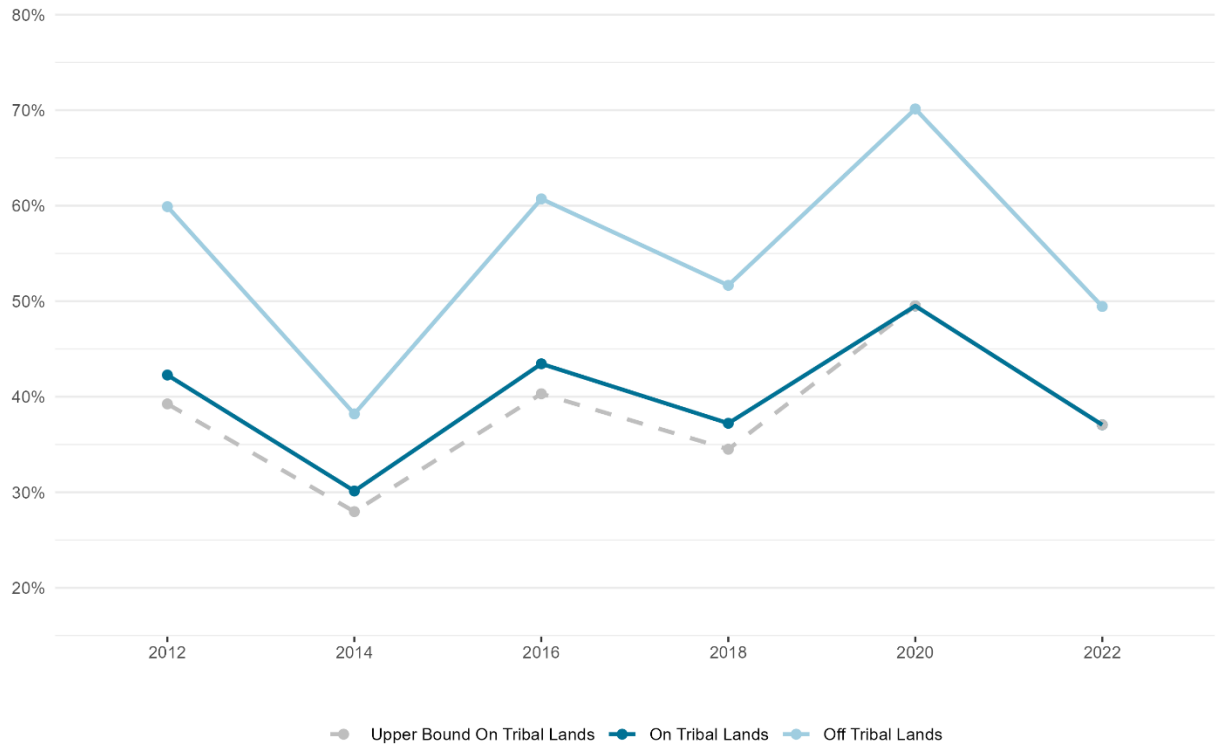


Figure A7: Average Voter Turnout on and off Tribal Lands by Region, 2012–2022

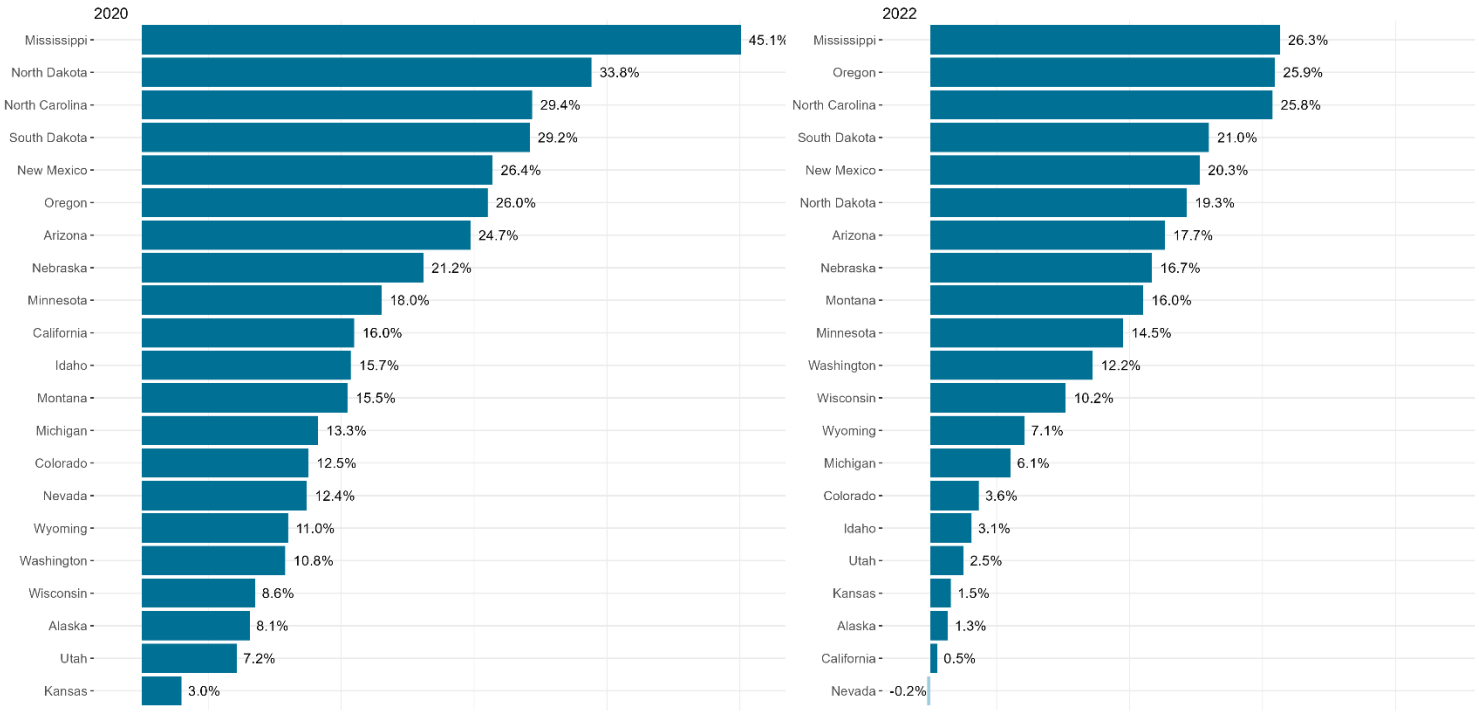
A.5 Turnout on and off Tribal Lands by State

As illustrated in figures A6 and A7, aggregating turnout across states or regions, regardless of methods, lowers turnout by only a few percentage points at most on tribal lands between 2012 and 2018. The same cannot be said when disaggregating turnout down to the state level. The larger margins of error between the most conservative and least conservative calculations of CVAP in conjunction with sometimes small tribal land population sizes make it difficult to understand which states have the most disproportionate turnout rates on tribal lands. Therefore, we only delineate the off-on tribal land turnout gap at the state level for 2020 and 2022, seen in figure A8. Across all 21 states and both elections, there is only a single instance of tribal land turnout surpassing off tribal land turnout—the 2022 election in Nevada—which sees a difference of only 0.2 percentage points. Besides this outlier, most of the states have a turnout gap of at least 10 percentage points, with 13 instances of gaps greater than 20 percentage points across the elections.

Expectedly, South Dakota has one of the largest turnout gaps in both elections. As Jean Schroedel et al. describe, the state has a particularly grievous legacy of discriminatory policies directed at undermining Native American civil rights.[6] Nevada, in comparison, does not have the same history of doggedly disenfranchising Native people within the state.[7] In fact, the state expanded voting access on tribal lands in 2020 and had one of the lower turnout gaps in 2020 and

reached parity in 2022.[8] While state-level off-on tribal land turnout gap data doesn't provide causal evidence that restrictive voting policies targeting Native voters leads to larger turnout gaps, testing the significance of these correlations in a future experiment would be beneficial.

Figure A8: Off-On Tribal Land Turnout Gap by State, 2020–2022



A.6 Relationship Between Tribal Land Turnout and Native CVAP Share

To understand the relationship between tribal land turnout and a tribal land's Native CVAP share, our respective dependent and independent variables, we conducted a series of OLS regressions. Three distinct models were run across all 21 states, all states except Alaska, and Alaska alone to see how the full sample results are driven by Alaska. Each model was weighted by a tribal land's CVAP, while tribal lands with a CVAP below 50 were removed due to the high errors incurred when measuring turnout in areas with a very low population. Additionally, turnout was capped at 100 percent in instances where turnout was above 100 percent. These are likely due to 5-Year ACS estimates not reflecting the most recent year's CVAP estimates and the undercount of populations on tribal lands by the Census Bureau.

Models 2, 5, and 8 include relevant covariates—median age, median household income, population with at least a bachelor's degree, and population density—a proxy for rurality. CVAP and covariates were provided by ACS five-year estimates at the American Indian Area/Alaska Native Area with last years of the estimates matched to the corresponding election year observation. Models 3 and 6 have two-way fixed effects (TWFE) applied at the state and election year levels. For tribal lands that intersect with the borders of multiple states, the tribal land's 2020 CVAP (same methodology used for the tribal land turnout denominator) was disaggregated at the state level, and then the tribal land was assigned to the state in which a greater proportion of the CVAP resided. This was done to ensure that no observations of a tribal land intersecting a unique group of states would be dropped when applying state fixed effects. For our TWFE models, standard errors were clustered at the state level. Model 9, which only includes observations from Alaska, had fixed effects applied only at the election year level with standard errors clustered there. Models 4 and a version of model 7 are featured as scatter plots in the report. The results of all regression models are presented in table A2.

All models show a strong, statistically significant relationship between turnout on a tribal land and Native share of the tribal land CVAP. Some of the effects are moderated by population density, share of the population with at least a bachelor's degree, and the inclusion of fixed effects. These are also the models with the highest R^2. Model 3 is our most comprehensive, as it includes all states and fixed effects. As plotted in figure A9, it demonstrates a strong and statistically significant negative relationship between turnout and Native CVAP on tribal lands.

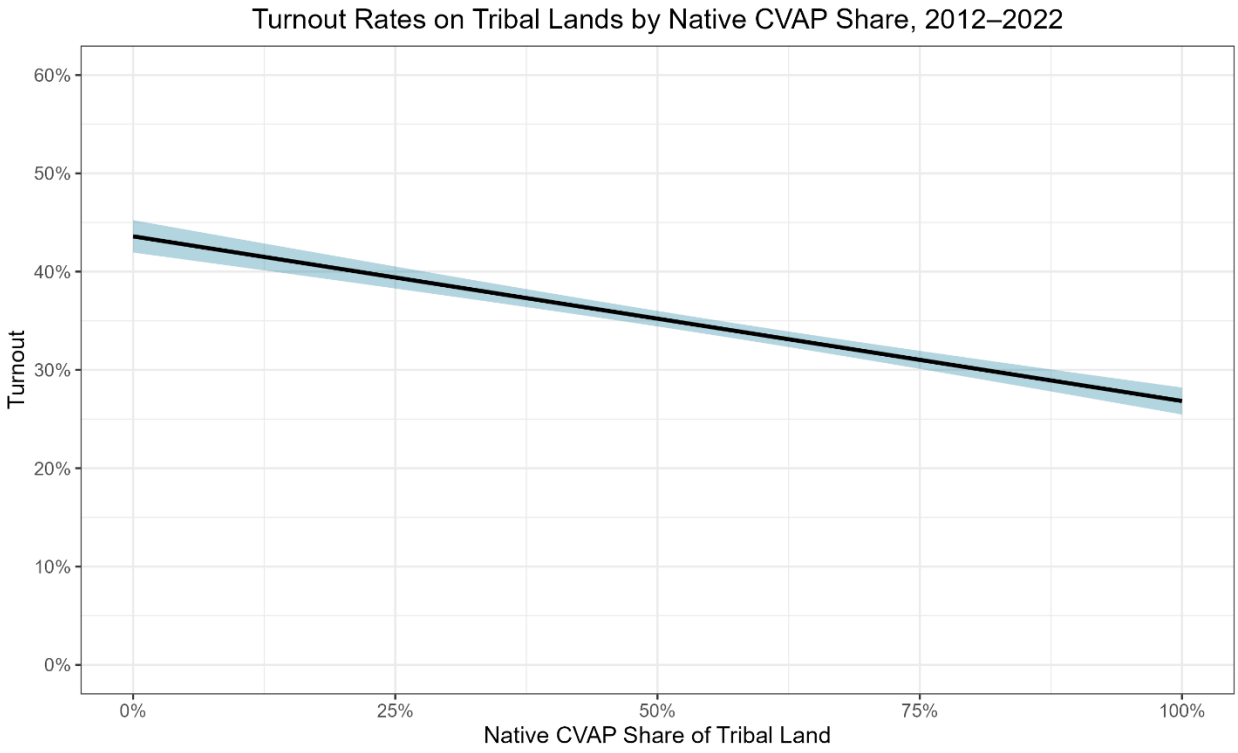
When comparing models 3, 6, and 9, we see that the negative relationship in model 3 is inflated by the inclusion of Alaska, as model 9 has a much larger coefficient than model 6, where we exclude Alaska. Model 9 tells us that for every one percentage point increase in the Native CVAP share of an Alaska tribal land, turnout drops by 0.352 percentage points, all else being equal. The coefficient drops to 0.079 when not including Alaska, which stresses how much more depressed turnout is on Alaskan tribal lands, where Native CVAP is concentrated. Overall, all results, regardless of the state grouping pattern and covariates, underscore that a significant negative relationship exists between voter turnout and a tribal land's Native CVAP share.

Table A2: OLS Regression for Tribal Land Turnout and Native CVAP Share

	All States			All States Except Alaska			Alaska		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Share Native	−0.331***	−0.169***	−0.167***	−0.306***	−0.124***	−0.079**	−0.411***	−0.332***	−0.352***
	[−0.345, −0.316]	[−0.194, −0.143]	[−0.209, −0.126]	[−0.325, −0.287]	[−0.155, −0.092]	[−0.130, −0.029]	[−0.441, −0.382]	[−0.379, −0.285]	[−0.412, −0.293]
Median Age		0.001*	0.004***		0.002**	0.007***		−0.002	−0.002
		[0.000, 0.002]	[0.002, 0.006]		[0.001, 0.003]	[0.005, 0.008]		[−0.004, 0.000]	[−0.005, 0.000]
Median Income		0.000**	0.000		0.000*	0.000*		0.000***	0.000***
		[0.000, 0.000]	[0.000, 0.000]		[0.000, 0.000]	[0.000, 0.000]		[0.000, 0.000]	[0.000, 0.000]
Share with Bachelor's Degree or Higher		0.689***	0.605***		0.693***	0.495***		0.818***	0.803***
		[0.585, 0.792]	[0.440, 0.770]		[0.558, 0.828]	[0.311, 0.679]		[0.654, 0.982]	[0.526, 1.079]
Population Density		−5.044*	−3.489***		−4.039	−3.155***		−130.090**	−130.673*
		[−9.798, −0.289]	[−5.030, −1.948]		[−9.311, 1.233]	[−4.351, −1.960]		[−209.503, −50.677]	[−245.945, −15.401]
Intercept	0.570***	0.318***		0.553***	0.254***		0.603***	0.614***	
	[0.561, 0.579]	[0.268, 0.368]		[0.541, 0.565]	[0.194, 0.314]		[0.591, 0.614]	[0.504, 0.724]	
Num.Obs.	2266	2266	2266	1307	1307	1307	959	959	959
R2	0.464	0.528	0.681	0.431	0.517	0.731	0.445	0.497	0.581
R2 Adj.	0.464	0.527	0.676	0.430	0.515	0.725	0.444	0.495	0.577
RMSE	0.22	0.22	0.21	0.18	0.17	0.16	0.26	0.27	0.26
FE: year			X			X			X
FE: state			X			X			

* p < 0.05, ** p < 0.01, *** p < 0.001
95% confidence intervals shown below estimates.

Figure A9: Turnout Rates on Tribal Lands by Native CVAP Share, 2012–2022



Covariates include a tribal land's median household income, adult population with at least a bachelor's degree, median age, and population density. Results are weighted by a tribal land's CVAP. State and year fixed effects are applied. Tribal lands with a CVAP below 50 were removed due to the high errors incurred when measuring turnout in areas with a very low population.

Endnotes

[1] The full report can be found here: https://www.brennancenter.org/our-work/research-reports/voting-tribal-lands.
[2] Department of Housing and Urban Development Office of Policy Development and Research (hereinafter HUD PD&R), "Racially or Ethnically Concentrated Areas of Poverty (R/ECAPs)," accessed July 1, 2024, https://hudgis-hud.opendata.arcgis.com/datasets/HUD::racially-or-ethnically-concentrated-areas-of-poverty-r-ecaps/about.
[3] TAMU GeoServices, "TAMU GeoServices," 2016, https://geoservices.tamu.edu/.
[4] HUD PD&R, "HUD USPS ZIP Code Crosswalk Files | HUD USER," 2022, https://www.huduser.gov/portal/datasets/usps_crosswalk.html.
[5] Navajo Election Administration, "Navajo Nation Chapters by Districts," accessed October 7, 2024, https://navajoelections.navajo-nsn.gov/Portals/0/FILES/chapters%20by%20districts%20_2_.pdf; and Navajo Nation Addressing Authority, "Navajo Nation ASC Map," accessed October 7, 2024, https://www.nnaa.nndcd.org/navajo-nation-asc-map/.
[6] Jean Schroedel et al., "Political Trust and Native American Electoral Participation: An Analysis of Survey Data from Nevada and South Dakota," *Social Science Quarterly* 101, no. 5 (2020): 1885–1904, http://dx.doi.org/10.1111/ssqu.12840.
[7] Jean Schroedel et al., "Political Trust and Native American Electoral Participation," 1894.
[8] Jean Schroedel et al., "Political Trust and Native American Electoral Participation," 1887.