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### Generational Aspects of U.S. Public Opinion on Renewable Energy and Climate Change

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#### Recommended Citation

Hamilton, L.C., J. Hartter and E. Bell. 2019. "Generational aspects of U.S. public opinion on renewable energy and climate change." Paper presented to workshop on Sharing the Burden? Public Values, Attitudes, and Preferences about Climate Policy, at the Institute for Future Studies in Stockholm, Sweden, February 21-22.

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February 22, 2019

## Generational Aspects of U.S. Public Opinion On Renewable Energy and Climate Change

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### Abstract

The topics of climate change and renewable energy often are linked in policy discussions and scientific analysis, but public opinion on these topics exhibits both overlap and divergence. Although renewable energy has potentially broader acceptance than anthropogenic climate change, it can also sometimes face differently-based opposition. Analyses of U.S. and regional surveys, including time series of repeated surveys in New Hampshire (2010–2018) and northeast Oregon (2011–2018), explore the social bases of public views on both issues. Political divisions are prominent, although somewhat greater regarding climate change. Such divisions widen with education, an interaction effect documented in other studies as well. We also see robust age and temporal effects. Younger adults more often prioritize renewable energy development, and agree with scientists on the reality of anthropogenic climate change (ACC). Across all age groups and both regional series, support for renewable energy and recognition of ACC have been gradually rising. These trends, together with age-cohort replacement and possible changes in age-group voting participation, suggest that public pressure for action on these issues could grow.

### Acknowledgments

Renewable energy and climate questions on the Granite State Poll have been supported by grants from the National Science Foundation (The Living Bridge IIP-1230460 and 1430260; New Hampshire EPSCoR EPS-1101245), and by the Carsey School of Public Policy and the Sustainability Institute at University of New Hampshire. The Communities and Forests in Oregon (CAFOR) project was supported by the Agricultural and Food Research Initiative, U.S. Department of Agriculture (2014-68002-21782 and 2010-67023-21705). The North Country survey was supported by a grant from the Neil and Louise Tillotson Fund of the New Hampshire Charitable Foundation. Support for the POLES surveys occurred through the PoLAR Partnership grant from the National Science Foundation (DUE-1239783). Any opinions, findings, and conclusions or recommendations expressed in this paper are those of the authors and do not necessarily reflect the views of supporting organizations.

## 1. Introduction

The topics of climate change and renewable energy often are linked in policy discussions and scientific analysis. Slowing our rush toward increasingly severe impacts from anthropogenic climate change (ACC) will require steep reductions in fossil fuel burning, and corresponding shifts to energy from renewable sources that produce less greenhouse gases—such as electricity generated by wind, solar or tidal power. Reduction of greenhouse gas emissions therefore becomes a key argument favoring renewable-energy development (e.g., Long & Steinbecker 2016). It is not the only argument, however. Renewable energy increasingly offers economic advantages including lower costs as well as new jobs, and income to producers or landowners. Compared with coal or oil, it tends to generate less pollution of land, air and water. Small-scale renewable energy such as rooftop solar also promises some degree of consumer independence. These non-greenhouse arguments appeal to many of the same people concerned about climate change, but they can also reach beyond, to some who reject the reality of ACC. At the same time, the potential impacts of larger scale renewable-energy developments such as wind farms can inspire local opposition from people who otherwise might support action on climate change (Bidwell 2013; Dreyer et al. 2017; Hall et al. 2013; Olson-Hazboun et al. 2016; Petrova 2016; Wolsink 2007). Thus, renewable energy has potentially broader appeal, but sometimes also broader-based opposition, compared with public concern about climate change.

Scientists who study this topic express overwhelming agreement that evidence shows humans are changing Earth's climate in dangerous ways (e.g., Cook et al. 2016; USGCRP 2017). Among U.S. political leaders and public, on the other hand, partisan divisions have been wide and persistent (Carmichael & Brulle 2017; Dunlap & McCright 2015; Hamilton et al. 2015a; Marquart-Pyatt et al. 2014; Shwom et al. 2015). Conservatives are far less likely than moderates or liberals to agree with scientists that ACC is occurring, or that anything should be done to slow it down. The association between climate-change views and sociopolitical identity is so strong, statistically, that climate-change questions could serve as proxies for political identity itself, with similar predictive skill to questions about ideology or political party. Renewable-energy opinions likewise correlate with sociopolitical identity, but this correlation is somewhat weaker for two reasons: renewable-energy cost, jobs or independence advantages appeal to some conservatives; and large-scale energy developments such as wind farms may stir resistance focused on local impacts, unrelated to views about climate. Appealing to mixed or conservative stakeholders, advocates for renewable energy consequently often prefer to emphasize cost and employment, income or decentralization benefits, downplaying those related to climate (Cohen 2017; Deaton 2016; Jackson 2017).

How similar or different are the social bases of support for renewable-energy development, compared with those for concern about climate change? Is public opinion shifting similarly on both topics? In a recent paper we explored these questions using data from four U.S. survey projects—three regional and one national in scope. The nationwide survey took place in 2016, with stages just before and after the presidential elections. The three regional surveys all involve places with recent and controversial wind energy developments, as described in Hamilton et al. (2018a). One of the regional surveys, in the North Country of northern New England, occurred in summer of 2017. The other two regional projects, in northeast Oregon and New Hampshire, each involved a series of surveys carried out over multiple years—2011 to 2015 in Oregon, and 2010 (climate) or 2012 (renewable energy) to 2017 in New Hampshire. For this paper we extend both timelines, and test for replication of earlier findings, using new Oregon and New Hampshire data from fall 2018. With additional data we can examine the social bases of

climate-change and renewable-energy views in finer detail. Results generally agree with earlier conclusions, while providing a sharper view of age-related differences and trends.

## **2. Four Survey Projects**

Data analyzed here come from four projects summarized in **Table 1**. For each project, trained personnel at the Survey Center of the University of New Hampshire conducted cell and landline telephone interviews with randomly-sampled participants. The nationwide POLES survey took place in two stages just before and after the 2016 presidential elections, with negligible differences between these stages in response patterns for environmental items (Hamilton et al. 2018a). The North Country survey took place in summer 2017, interviewing residents of four rural counties in northern New England (Hamilton et al. 2017, 2018b). Two other regional projects, covering New Hampshire and northeast Oregon, each involved a series of surveys carried out with independent random samples from 2010 or 2011 to 2018. Many papers present results from various years of the Oregon surveys up to 2015 (e.g. Boag et al. 2016; Hamilton et al. 2014, 2016a; Hartter et al. 2018) and New Hampshire surveys up to 2017 (e.g. Bolin and Hamilton 2018; Hamilton et al. 2016b). Results from the 2018 Oregon and New Hampshire surveys are presented for the first time in this paper.

**Table 1:** Four survey projects.

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*U.S. Polar, Environment, and Science (POLES).* The POLES survey involved random-sample telephone interviews (cell and landline) with respondents from all U.S. states, carried out in two stages: before the 2016 presidential elections (August,  $n = 704$ ) and immediately afterwards (November/December,  $n = 707$ ). Response rates in four subsamples of the POLES survey ranged from 15 to 30% (all response rates are calculated following AAPOR 2016 definition 3.) Several papers have focused on POLES results (Hamilton 2016a, 2018; Safford et al. 2019).

*New Hampshire Granite State Poll (GSP).* These landline and cell telephone surveys interview independent random samples of New Hampshire residents four times each year. Along with standard background and political questions, the GSP often carries items about environment or science. New Hampshire responses on environmental questions commonly fall close to national benchmarks. Some recent comparisons between New Hampshire and nationwide surveys are given by Hamilton (2016b) and Hamilton et al. (2015a). The GSP from April 2010 to October 2018 conducted 20,786 interviews that included our climate-change question, and from July 2012 to October 2018 conducted 7,707 with the question about renewable energy. Median response rate over this period was 21.5 percent.

*Northeast Oregon Communities and Forests in Oregon (CAFOR).* Under the CAFOR project, landline and cell telephone surveys involving independent random samples of northeast Oregon residents were conducted in four stages: September/October 2011 ( $n = 1,585$  from Baker, Union and Wallowa Counties); August/October 2014 ( $n = 1,752$ , from the same three counties along with Crook, Grant, Umatilla and Wheeler Counties); October/November 2015 ( $n = 651$ , repeating the seven counties from 2014); and September 2018 ( $n = 1,097$ ) in just the three original counties. Median response rate of the CAFOR surveys was 38 percent. For consistency, our analysis in this paper focuses on 3,782 interviews from only those counties (Baker, Union and Wallowa) that were surveyed in all four years. Voting patterns in all of these northeast Oregon counties tend to be politically conservative, and surveys find lower-than-national recognition of anthropogenic climate change (Hamilton et al. 2015a, 2018a).

*North Country.* In summer 2017, researchers with the Carsey School of Public Policy (University of New Hampshire) conducted this random-sample cell and landline telephone survey of 1,650 residents in four contiguous northern New England counties, collectively termed the North Country: Coös and Grafton Counties, New Hampshire; Essex County, Vermont; and Oxford County, Maine. Designed to assess changes in residents' perceptions of their rural communities, the 2017 survey (response rate of 19%) replicated some questions from earlier surveys, but also included new environmental and climate items. Results are analyzed in two papers by Hamilton et al. (2017, 2018b).

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Although research objectives varied across projects, and to a lesser extent across stages within each project, many surveys carried two standard questions asking about renewable energy and climate change. **Table 2** gives the wording of these *renew* and *climate* questions, along with codes used for modeling later. The surveys asked also about respondent background characteristics, for the most part with identical wording. One exception is that the New Hampshire surveys asked respondents for their ideological identification, here coded from  $-2$  (extremely or fairly liberal) to  $+2$  (extremely or fairly conservative). The Oregon surveys recorded political party identification but not ideology, so our analysis employs a simple three-party scheme from  $-1$  (Democrat) to  $+1$  (Republican) with these data. (Political and education variables are centered at zero for use with interaction terms later.) The independent variables also are summarized in Table 2.

**Table 2:** Energy, climate change and background questions asked on multiple iterations of the New Hampshire Granite State Poll (GSP) and northeast Oregon Communities and Forests in Oregon (CAFOR) surveys over 2011 to 2018; on two iterations of the nationwide POLES survey in 2016; and on the one-time North Country survey in 2017. Shown with codes used for logit regression analyses in Table 3.

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*Renew* — Which do you think should be a higher priority for the future of this country, increased exploration and drilling for oil, or increased use of renewable energy such as [tidal,] wind or solar? (Response order rotated in interviews. Reference to “tidal” energy occurred only in the New Hampshire surveys, where tests have shown that this word made no difference. The other surveys said “such as wind or solar.”)

Increased use of renewable energy such as [tidal,] wind or solar (1)

Increased exploration and drilling for oil (0)

don't know/no answer (0)

*Climate* — Which of the following three statements do you think is more accurate? (Response order rotated in interviews)

Climate change is happening now, caused mainly by human activities (1)

Climate change is happening now, but caused mainly by natural forces (0)

Climate change is not happening now (0)

Don't know/no answer (0)

*Age* — Respondent's age in years

*Sex* — Male (0) or female (1)

*Education* — High school or less (–1), some college or technical school (0), college graduate (1), or postgraduate (2).

*Ideology* (New Hampshire GSP surveys) — Extremely or fairly liberal (–2), somewhat or leaning liberal (–1), moderate not leaning (0), somewhat or leaning conservative (1), extremely or fairly conservative (2)

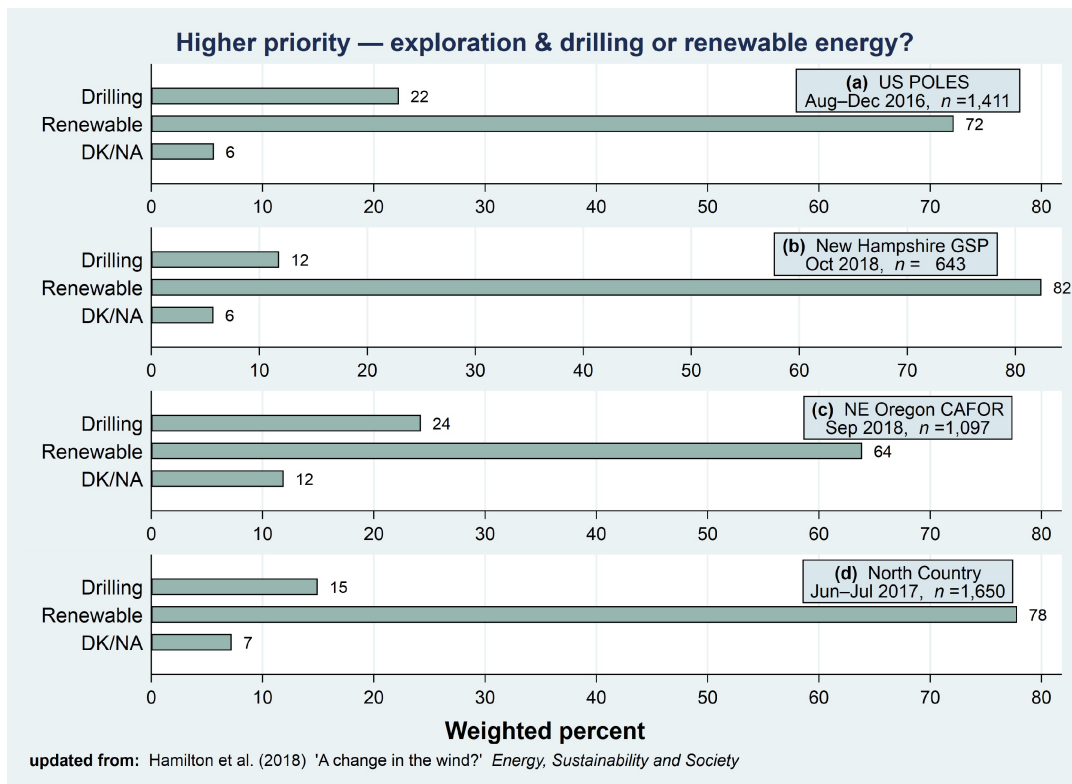
*Party* (Oregon CAFOR surveys) — Democrat (–1), Independent (0), Republican (1)

*Year* — Year of survey, from 2010 (New Hampshire) or 2011 (Oregon) to 2018

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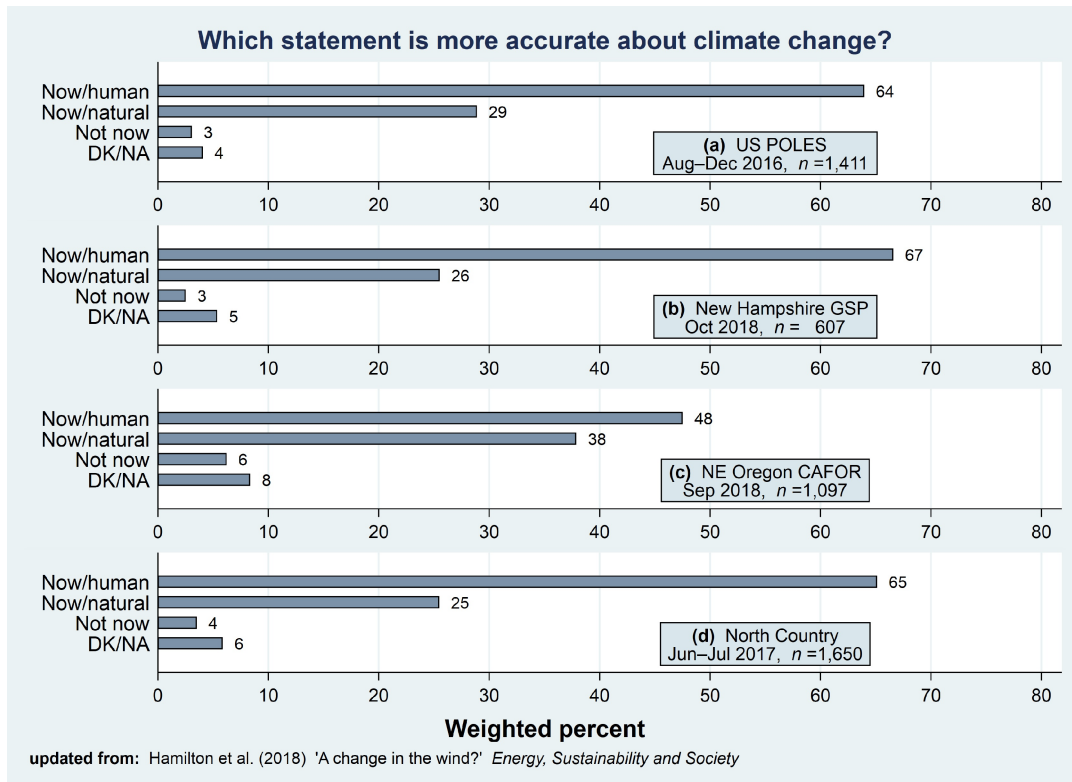
In the New Hampshire and Oregon series, as will be seen, response patterns on the renewable energy and climate questions both changed over time. **Figure 1** charts responses to renewable-energy (*renew*) responses from the most recent year of each project: 2016 for the U.S. POLES survey, 2017 for the North Country, or 2018 for northeast Oregon and New Hampshire. Large majorities of the respondents on each survey, between 64 and 82 percent, consider increased use of renewable energy to be a higher priority. The lowest number, 64 percent favoring renewable energy, represents northeast Oregon—politically a very conservative region, where 67 to 73 percent of the voters in each county supported Trump in 2016. Despite that region's general conservatism, support for renewable energy is only 8 points lower in northeast Oregon data compared with nationwide (64 vs. 72).



**Figure 1:** Should increased exploration and drilling for oil, or increased use of renewable energy such as wind or solar, be a higher priority for the future of this country? Results from the most recent years of four survey projects.

The two highest values in Figure 1, 78 or 82 percent favoring renewable energy, represent recent surveys in comparatively moderate and mixed regions: the North Country (counties voting from 38 to 57 percent for Trump) or New Hampshire (counties voting from 38 to 56 percent for Trump). The *renew* response “Increased exploration and drilling for oil” intentionally echos a Republican campaign slogan from 2012 and 2016 elections, “Drill baby drill.” Despite substantial Republican presence in every region assessed, however, this response was chosen by less than a quarter of the respondents.

**Figure 2** charts response to the climate-change question (*climate*) in parallel fashion. U.S., New Hampshire and North Country results are quite similar: 64 to 67 percent agreeing with the scientific consensus that climate change is happening now, caused mainly by human activities. In sharp contrast, just under half of the northeast Oregon respondents (48 percent) accept this consensus. The gap between northeast Oregon and U.S. views on this item is 16 points (48 vs. 64), double that we saw on renewable energy. The Oregon respondents are comparatively more likely to think climate is changing mainly for natural reasons (38 percent) or even that it is not changing (6 percent), despite summer warming that has worsened the wildfire seasons affecting their region (Hamilton et al. 2016a; Hartter et al. 2018).



**Figure 2:** Is climate change happening now, caused mainly by human activities? Is it happening now, but caused mainly by natural forces? Or is climate change not happening now? Results from the most recent years of four survey projects.

Comparing the renewable-energy and climate-change views in Figures 1 and 2 suggests that renewable energy development is viewed favorably by many people who do not believe that human activities are changing the climate. Moreover, the aggregate results imply that renewable energy views correlate less strongly with politics. The next section tests this proposition more directly, and explores what other respondent characteristics correlate with these views.

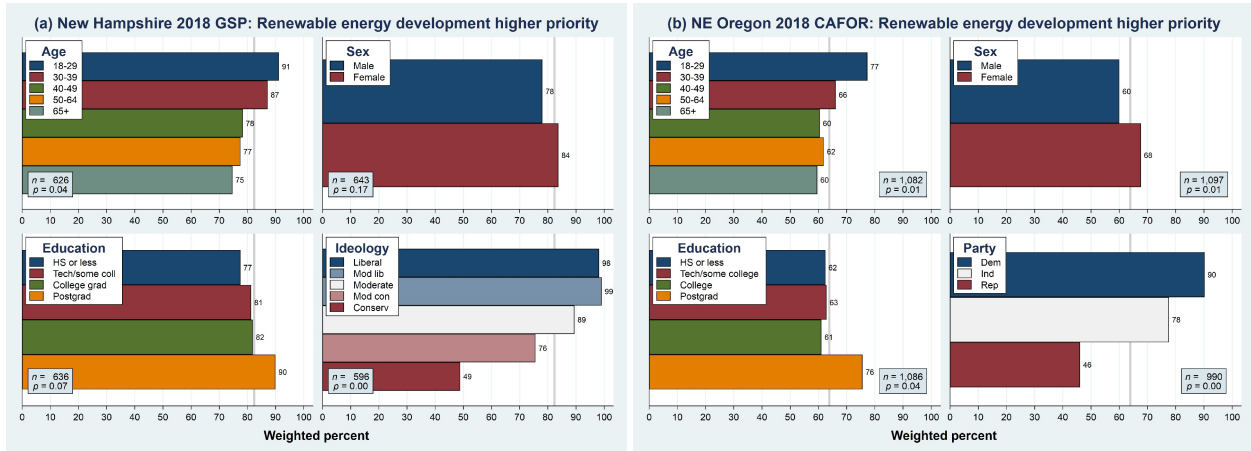
### 3. Social Bases of Energy and Climate Opinions

Decades of survey research on “the social bases of environmental concern” has established robust patterns with regard to respondent age, sex, education and politics. Concern about environmental problems, across many different topics, tends to be higher among younger, female and better educated respondents. In some data one or more of these effects may be relatively weak or not significant, but they almost always point in the same direction. More consistent and dominant predictors of environmental concern, however, are ideology or political identity: conservatives less often view environmental problems as serious or needing action.

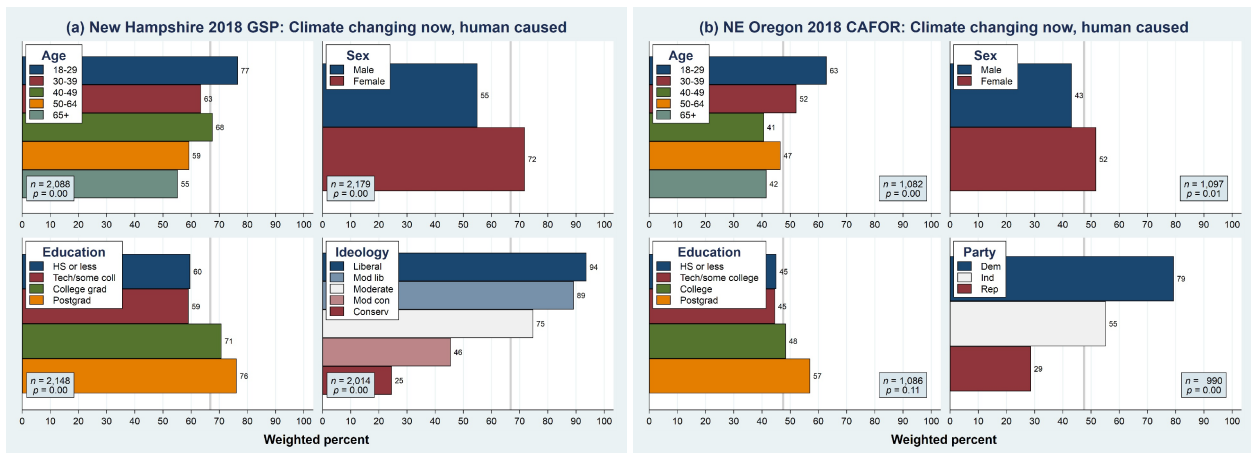
**Figure 3** and **Figure 4** show that these propositions apply to views on renewable energy and climate change. In each figure the (a) panel describes the most recent New Hampshire survey, and the (b) panel the most recent Oregon survey. Generally similar results also occurred in the North Country and nationwide surveys, and in earlier years from the New Hampshire and Oregon projects (not shown here,



but see Hamilton et al. 2018a). Younger, female and better educated respondents more often prioritize renewable energy, and more often agree that humans are changing Earth’s climate. Across each of these four panels, ideological or political indicators have by far the strongest effects, with liberal-conservative or Democrat-Republican gaps of 50 or 44 points on renewable energy, and 69 or 50 points on climate. Age is the second-most consistent, with significant although weaker effects in all four panels yielding young vs. old gaps of 16 or 17 points on renewable energy, and 21 or 22 points on climate.



**Figure 3:** Weighted percentages for “renewable energy higher priority” broken down by respondent age, sex, education and ideology or party on two surveys conducted in 2018: (a) statewide New Hampshire, and (b) northeast Oregon.



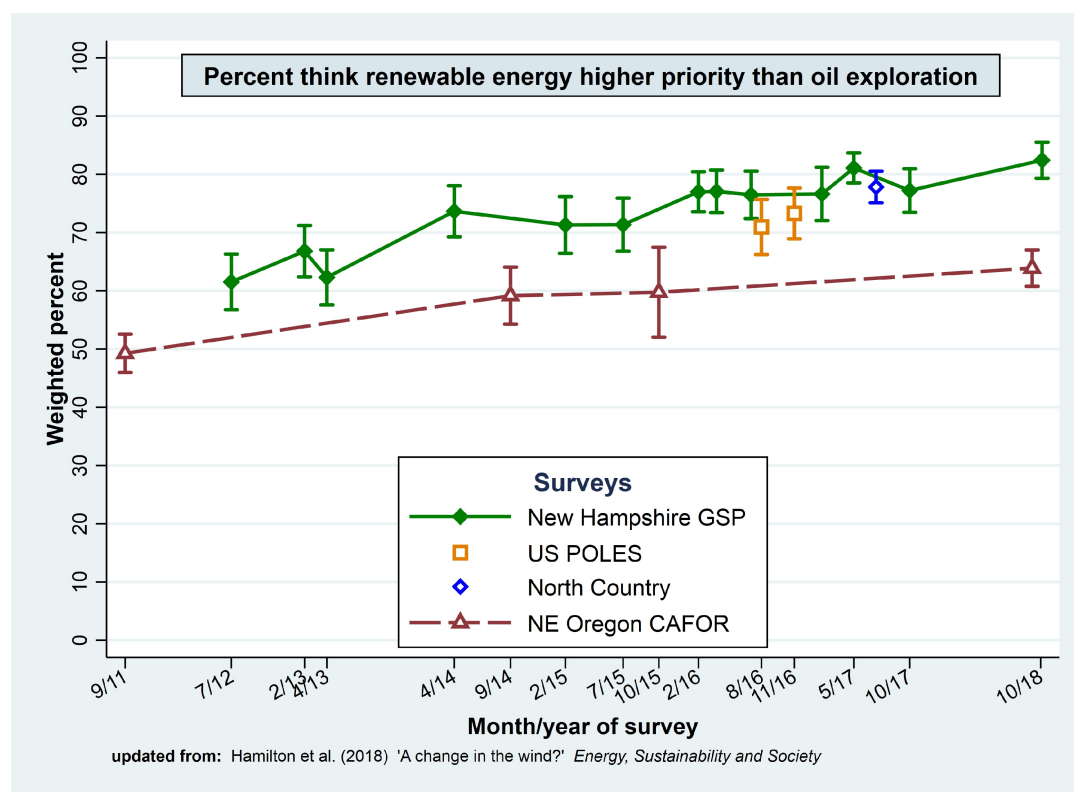
**Figure 4:** Weighted percentages for “climate change happening now, caused mainly by human activities” broken down by respondent age, sex, education and ideology or party on two surveys conducted in 2018: (a) statewide New Hampshire, and (b) northeast Oregon.

In general terms, Figures 3 and 4 contain no surprises: both renewable-energy and climate-change views have similar demographic predictors, in common with many other environment-related topics. Both exhibit strong political gradients, and weaker but also significant age gradients. In detail, however, this four-way comparison reveals something else. Although the ideological or partisan gaps regarding renewable energy on both surveys are wide, they are less wide than the corresponding gaps regarding climate change. So renewable energy opinions do strongly correlate with politics, but not as strongly as

climate-change opinions—as inferred indirectly from regional comparisons in the discussion of Figures 1 and 2.

#### 4. Trends Over Time

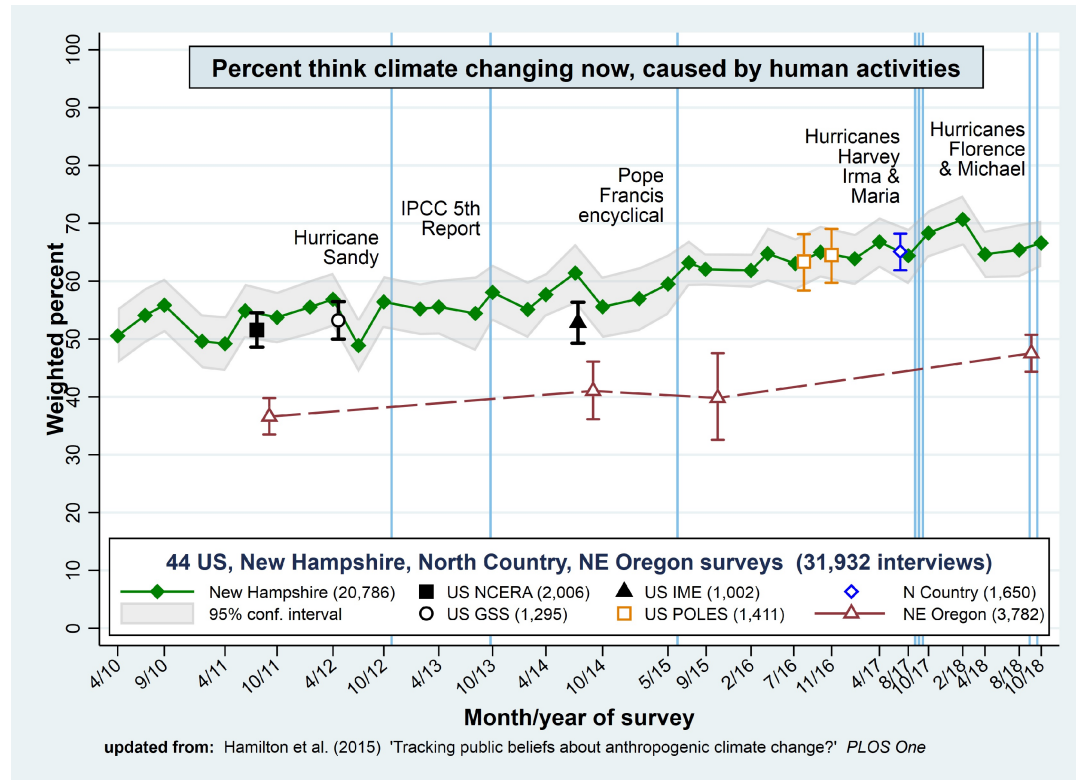
From 2012 through fall of 2018, 13 New Hampshire surveys with a combined total of 7,707 interviews carried the renewable-energy question, as did four northeast Oregon surveys (2011–2018) with 3,782 interviews. The upper line in **Figure 5**, drifting up about 21 points, tracks the percentage of New Hampshire respondents who prioritize renewable energy. The bottom line shows an upward drift of about 14 points among northeast Oregon respondents. Nationwide results from the U.S. POLES surveys (1,411 interviews) appear slightly lower than contemporary New Hampshire results; North Country results (1,650 interviews) match New Hampshire almost exactly. Error bars depict the 95 percent confidence intervals for each survey. We see minor survey-to-survey variations, within the range of sampling error, but the main impression is how replicable these findings are. Their short-term stability reflects use of consistent sampling and interview methods, repeating a straightforward question. An earlier paper based on Oregon data through 2015 and New Hampshire through 2017 observed similar upward trends, which newer 2018 data now confirm for both series (Hamilton et al. 2018a).



**Figure 5:** Weighted percentages and 95 percent confidence intervals for “renewable energy higher priority” on two nationwide and 18 regional (New Hampshire, North Country or northeast Oregon) surveys. Combined  $n = 14,550$ .

We have more data on the climate-change question, which has been asked on nationwide surveys in 2011, 2012, 2014 and 2016, along with 35 New Hampshire surveys. **Figure 6** tracks these regional and

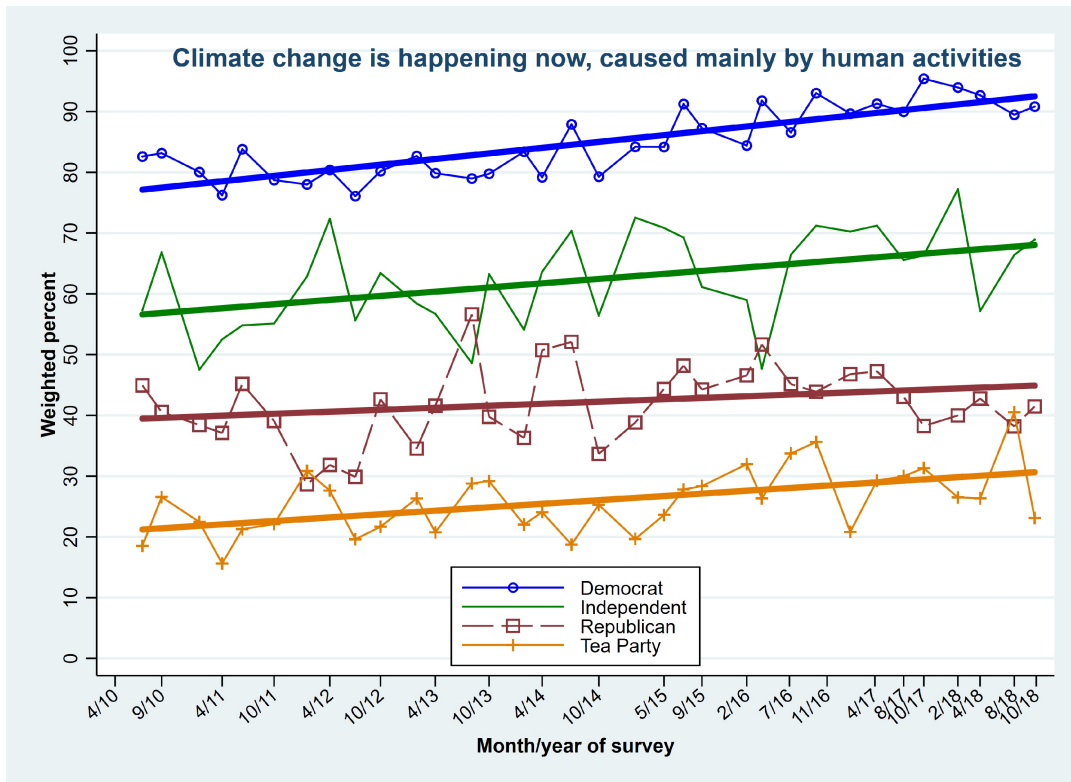
national results. On climate change, New Hampshire public opinion is never far from national, and might be viewed as a reasonable proxy. Hamilton et al. (2015a) describe the older national surveys in more detail, and track New Hampshire results through spring of 2015. Figure 6 updates that analysis with data from POLES 2016, North Country 2017, and New Hampshire and Oregon through 2018. As with the renewable-energy results in Figure 5, the climate-change results in Figure 6 exhibit minor survey-to-survey fluctuations, within sampling error bars. Overall, however, they show a high degree of consistency around upward trends. Northeast Oregon acceptance of ACC remains well below national or northeastern levels, but drifts similarly upward over this period. Multivariate analysis will later establish that the trends of both Oregon and New Hampshire series in Figures 5 and 6 are statistically significant.



**Figure 6:** Weighted percentages and 95 percent confidence intervals for “climate change happening now, caused mainly by human activities” on five nationwide and 40 regional surveys. Combined  $n = 31,932$ .

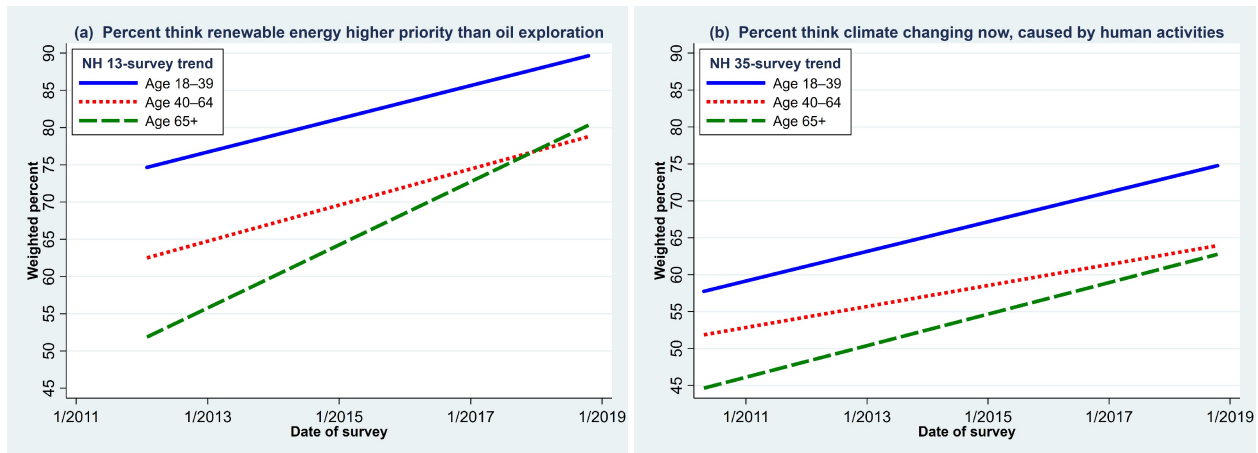
Vertical lines in Figure 6 mark U.S. landfall dates of hurricanes and several other events. Around the time each of these events occurred, it was widely speculated that they would influence public perceptions about climate change. In no case are immediate impacts from such events visible in the data, however. Instead we see a slow upward drift, plausibly reflecting the cumulative impact of science communication (Hamilton 2016b).

Replication of the overall percentages seen in Figures 5 and 6 extend to more detailed analyses as well, although sample-to-sample variation widens as we examine smaller subsamples. For example, **Figure 7** tracks climate-change percentages separately for each political party, across 34 New Hampshire surveys. All four parties exhibit roughly parallel upward trends. Separation into five levels of ideology from liberal to conservative, as seen in Hamilton (2016b), paints a similar picture as well.



**Figure 7:** Weighted percentages “climate change happening now, caused mainly by human activities,” by respondent political party on 34 New Hampshire surveys. Combined  $n = 19,020$ .

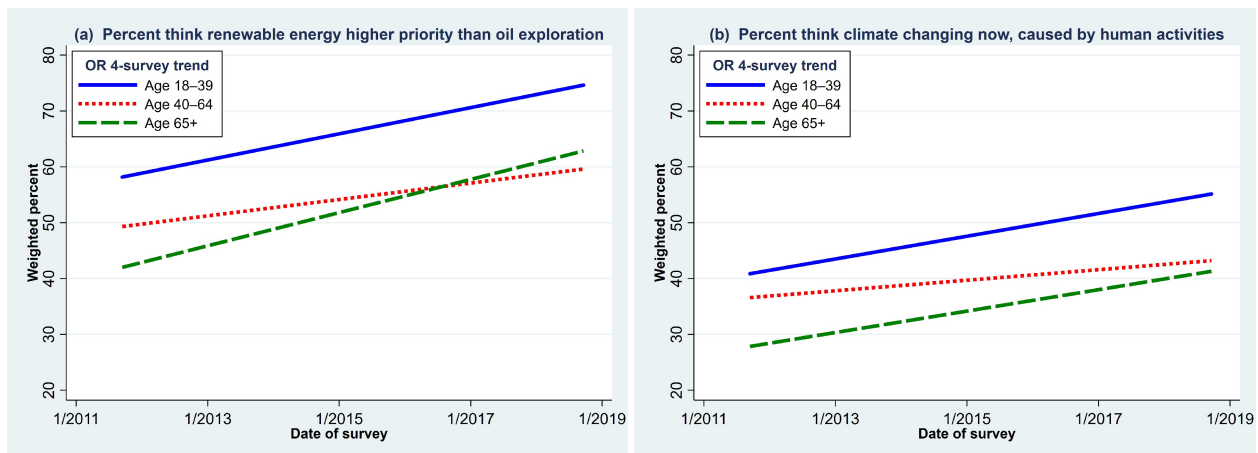
**Figure 8** takes a different approach, graphing New Hampshire renewable energy (13 surveys) and climate change (35 surveys) trends separately by age group. Linear trends rather than separate data points are shown here because survey-to-survey variations with small subsamples otherwise make the graph noisy and hard to read. The pro-environmental or scientific positions within each age group nevertheless show clear upward trends. Millennials, roughly age 18 to 39, stand apart at the top of each panel: they are consistently more likely than older age groups to favor renewable energy, or to think that humans are changing the climate. Moreover, the solidarity among Millennials has been rising steadily, now past 90 percent on energy and 75 percent on climate.



**Figure 8:** Linear (ordinary least squares) trends by age group on statewide New Hampshire surveys for (a) “renewable energy higher priority” 2012–2018, or (b) “climate change happening now, caused mainly by human activities” 2010–2018.

Respondents 65 and older start out this period below anyone else, but their trends climb upward as well, reaching 75 percent on energy and 60 percent on climate. Toward the end of this period, in both panels there appears to be a degree of convergence between old and middle-aged respondents. Middle-aged percentages started out halfway between young and old, but rose less steeply than the others.

In **Figure 9** we calculate similar age-group trends from the Oregon data. The wider gap between renewable-energy and climate views in this region is obvious from the different height of lines in Figure 9a and 9b. Renewable energy support rises more steeply than climate views in this region. A tertiary detail, in which Oregon results echo New Hampshire, is the apparent convergence of middle-aged and older views, as middle-aged views rise less steeply.



**Figure 9:** Linear (ordinary least squares) trends by age group on northeast Oregon surveys 2011–2018, for (a) “renewable energy higher priority”, or (b) “climate change happening now, caused mainly by human activities.”

## 5. Effects of Age, Education and Politics

Figures 3 and 4 chart bivariate relationships between renewable-energy or climate responses and four background factors that often predict environment-related views. Figures 5–9 track the upward drift in these views over time. **Table 3** pulls these different background and timing factors together, while testing the trends for significance. The columns give odds ratios from four weighted logistic regression models with individual background factors and yearly trend as predictors. Parameters of each model are estimated using all available data from the New Hampshire and Oregon surveys.

**Table 3:** Respondent characteristics and survey timing as predictors of high priority for renewable energy (*renew*), or think climate change is happening now, caused mainly by humans (*climate*). Values shown are odds ratios ( $e^b$ ) from probability-weighted logit regressions with either New Hampshire GSP or NE Oregon CAFOR survey datasets (3 original counties), pooled over all available years.

Predictor	Surveys and Dependent Variable			
	New Hampshire GSP 1. <i>Renew</i>	GSP 2. <i>Climate</i>	NE Oregon CAFOR 3. <i>Renew</i>	CAFOR 4. <i>Climate</i>
<i>Age</i>	0.983***	0.988***	0.982***	0.982***
<i>Sex</i> (female)	0.990	1.373***	1.069	1.079
<i>Education</i>	1.124**	1.203***	1.173**	1.225***
<i>Ideology</i>	0.485***	0.501***	...	...
<i>Education</i> × <i>ideology</i>	0.876***	0.827***	...	...
<i>Party</i>	...	...	0.348***	0.368***
<i>Education</i> × <i>party</i>	...	...	0.931	0.778***
<i>Year</i>	1.179***	1.070***	1.119***	1.102***
estimation sample	6,904	18,610	3,333	3,333
<i>F</i> statistic	133.58***	430.89***	58.94***	59.87
pseudo R <sup>2</sup>	0.197	0.210	0.150	0.165

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$  (Wald tests)

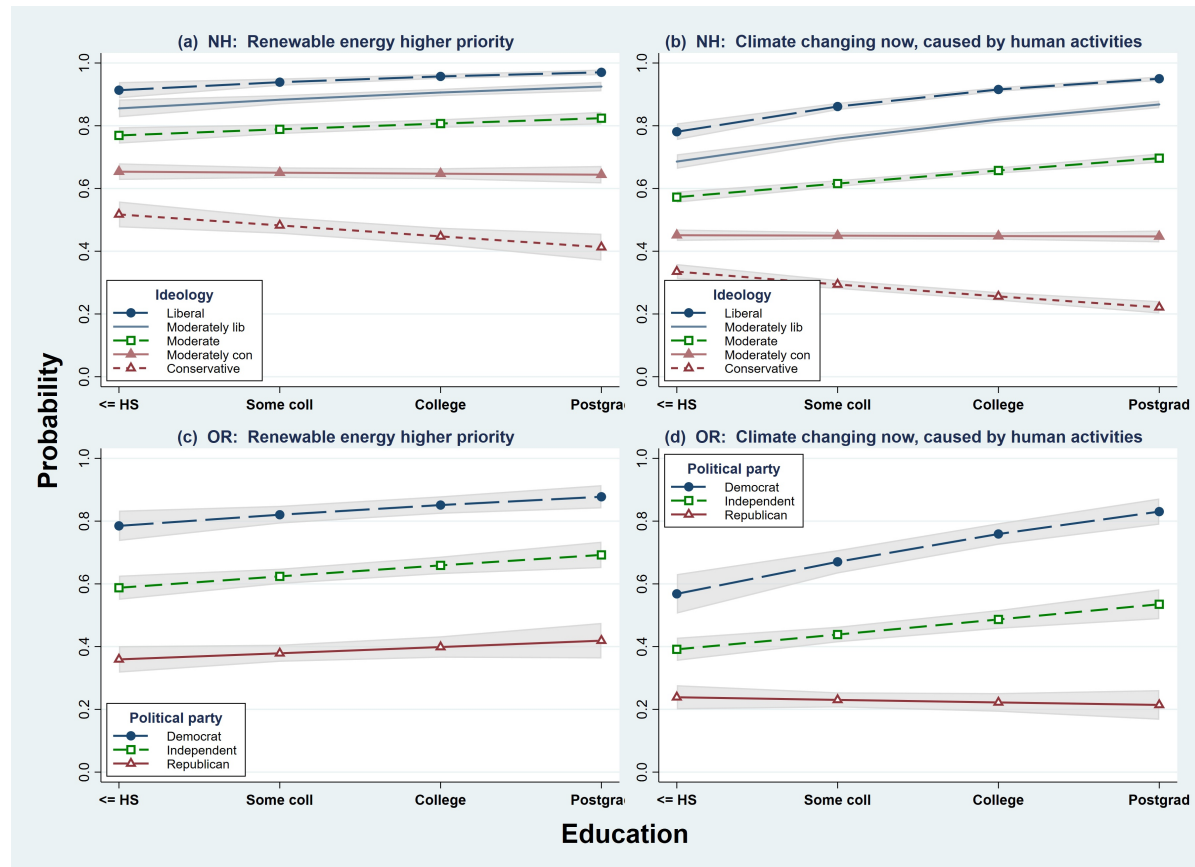
Odds ratios significantly above 1.0 for *year*, across all four models in Table 2, confirm the upward drift of support for renewable energy and acceptance of ACC in both New Hampshire and Oregon data ( $p < 0.001$ ). We also see odds ratios significantly below 1.0 for *age* across all four models ( $p < 0.001$ ). That is, older respondents in both New Hampshire and Oregon are less inclined to prioritize renewable energy, and also less inclined to believe that humans are changing the climate. (Note that age is entered as a measurement variable—simply, age in years—for the models of Table 2; but age had been grouped for readability in the figures.) The *year* and *age* effects in Table 2 agree with simpler results graphed in Figures 8 and 9: clear ordering and wide separation of response preferences by age regardless of trend, and upward trends regardless of age.

Women accept the reality of ACC at higher rates than men do in our New Hampshire data, but other sex differences in Table 2 are not significant. Education, like age and year, affects responses across all four models. Because *education* appears also in interactions with *ideology* or *party*, these main effects from *education* (with odds ratios significantly above 1.0) represent the positive influence of education among political moderates (*ideology* = 0) or Independents (*party* = 0). Moderates or Independents who have college educations are more likely than their peers to support renewable energy, and to think that ACC is



real. By similar reasoning, the main effects of *ideology* and *party* represent the effects of these characteristics among respondents who completed technical school or some college (*education* = 0).

The effects of education vary, however, depending on political identity. The *education* × *ideology* or *education* × *party* interactions in Table 2, significant ( $p < 0.001$ ) in all but model 3, replicate a result that has been widely noticed in survey research on environment or science-related topics: the partisan spread on many issues widens with education, so better-educated partisans stand the farthest apart. **Figure 10** visualizes these effects through adjusted margins plots, calculated from models 1–4 in Table 3. In both New Hampshire (top) and Oregon (bottom) data, this interaction is strongest regarding climate change. A similar though weaker effect can be seen in the New Hampshire responses on renewable energy, as well. These findings incorporating new data agree with earlier conclusions of Hamilton et al. (2018a).



**Figure 10:** Probability of prioritizing renewable energy, or recognizing the reality of anthropogenic climate change, by education and ideology (New Hampshire) or political party (northeast Oregon). Adjusted margins plots calculated from models of Table 2.

Each of the panels in Figure 10 shows that education has a positive effect on renewable-energy support, or acceptance of ACC, among liberals and moderates (or among Democrats and Independents). Education has a negative effect, however, on ACC acceptance among the most conservative, or among Republicans, in both New Hampshire and Northeast Oregon (Figures 10b and 10d). Education similarly has a negative effect on renewable energy support in New Hampshire: better-educated conservatives are less inclined to support it. Education effects on renewable-energy support in northeast Oregon are very weak.

The Figure 10 interaction results join a substantial list of other studies and datasets where analogous education×politics or information×politics-type effects have been found. Examples include Bolin and Hamilton (2018), Drummond and Fischhoff (2017), Hamilton (2008), Hamilton and Safford (2015), Hamilton et al. (2010, 2015a, 2015b), Kahan (2015), Kahan et al. (2011), McCright and Dunlap (2011) and Shao et al. (2014). The immediate precursor to this paper, Hamilton et al. (2018a), found essentially the same interactions in earlier data. The “right-facing megaphone” shape of polarization widening with education, as seen in Figures 10a, 10b and 10d, reflects a pervasive reality of current U.S. politics.

## 6. Discussion

The strong effect sociopolitical identity exerts on U.S. public opinion about climate change is well known. Despite divergence in the rationales regarding climate and renewable-energy development, sociopolitical identity has major impacts on the latter issue as well—albeit, somewhat less strongly. Moreover, the education×politics interaction effect, which leads to a partisan gap that widens with education, is less pronounced on renewable energy. Partisan polarization nevertheless slows U.S. renewable energy development, as it does other steps toward climate-change mitigation. Our analysis confirms these recognized conclusions.

Two other robust findings hint at future changes, however. First, there are consistent age effects. In the most recent surveys more than 90 percent of New Hampshire respondents age 18 to 29 favor renewable energy, as do 77 percent in northeast Oregon. Those fractions are 16 or 17 points higher than they are among people 65 and older. The generational gap is even wider (21 or 22 points) regarding climate change. Multivariate analysis of both datasets over all years of the study confirms that age has significant positive effects ( $p < 0.001$ ) on both climate and energy views, even after controlling for sex, education, political orientation and year of survey. Assuming no change in people’s individual views, gradual cohort replacement could raise public acceptance of renewable energy and other climate-change mitigation steps. If voter participation rates among young adults rise, as some observers expect, the balance might shift more quickly.

Another robust result is that, over the period of observation, support for renewable energy and acceptance of anthropogenic climate change have been gradually rising. For each series in both datasets, the increase exceeds 10 percentage points ( $p < 0.001$ ), with renewable energy climbing at slightly faster rates than climate. It is worth noting that these trends are established in models (Table 2) that already account for respondent age, so they do not reflect possible cohort shifts noted above. By the same token, the age effects estimated in those models are independent of overall trends. Figures 8–9 visualized the distinct age and temporal patterns in terms of separate upward trends within age groups. These trends add further reason, besides the certainty of cohort replacement and the possibility of more voting by young adults, to think that public support for action on these issues will grow.



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