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## **DIFFERING PERSPECTIVES ON BIOFUELS: ANALYSIS OF NATIONAL, REGIONAL, AND STATE NEWSPAPER COVERAGE**

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### ABSTRACT

We examined national, regional, and Alabama newspaper coverage of biofuels development to observe variation in coverage and to understand the role of media on controversial issues of national importance. The years covered, 2007–2009, coincided with peak media interest in biofuels. Our focus on Alabama and the South is justified by the potential for biofuels development present in that state and region. We hypothesized that sources quoted would vary by topics, that article tone would vary depending on biofuel type and associated feedstock, and that tone would vary depending on whether the focus was on local economic impacts or broader issues related to biofuels. All three hypotheses were supported. We conclude that newspapers in this study have served as conduits for the views of local growth machine coalitions, but that when the focus extended to issues beyond the local realm, newspapers have played a different role, actively contributing to public discussion and policy debate.

The role of media in shaping public policy and the implications of media bias have both been subjects of numerous studies (Bennett 1990; Fitzgerald, Campbell, and Sivak 2002; Hornig Priest 1995; Kuzyk, McCluskey, and Ross 2005; McCombs 1997; Shanahan et al. 2008; Strömberg 2001; Terkildsen, Schnell, and Ling 1998). Despite contrasting views, clearly what the media say and how they say it are important in defining public debate. In this paper we examine how a set of state, regional, and national newspapers covered biofuels development between 2007 and 2009. During this period concerns over global warming and reliance on foreign oil, combined with rapid increases in the cost of gasoline and diesel fuel, led to important federal energy legislation (e.g., the Energy Independence and Security Act of 2007, and the Food, Conservation, and Energy Act of 2008) promoting biofuels development. Public debate on global climate change, spurred in part by publication of a series of reports by the Intergovernmental Commission on Climate Change (Pachauri and Reisinger 2007), increased interest in the use of biofuels to replace fossil fuels. National security concerns also favored promotion of biofuels in light of U.S. dependence on petroleum imports. Despite this apparent juggernaut of support for biofuels development, dedication of food crops to biofuel production

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attracted critics concerned with issues ranging from ecological impacts to higher food prices.

In short, from 2007 to 2009, biofuels development emerged as an important and controversial subject that attracted far more media attention than it had during the previous eight years (Figure 1). Our purpose here has been to examine how different newspapers dealt with biofuels development, focusing on sources of information used, subject content of articles, types of biofuel, geographic focus of coverage, and article tone (i.e., critical or supportive). We chose *The New York Times* (*NYT*) to provide a national perspective and *The Atlanta Journal-Constitution* (*AJC*) to represent a regional perspective for the southeastern United States. We also selected the three largest papers in Alabama (*The Birmingham News*, *Press-Register* of Mobile, and *The Huntsville Times*) as representative media voices in that state. The purposive process through which we selected these papers is described in detail in the Methods section.

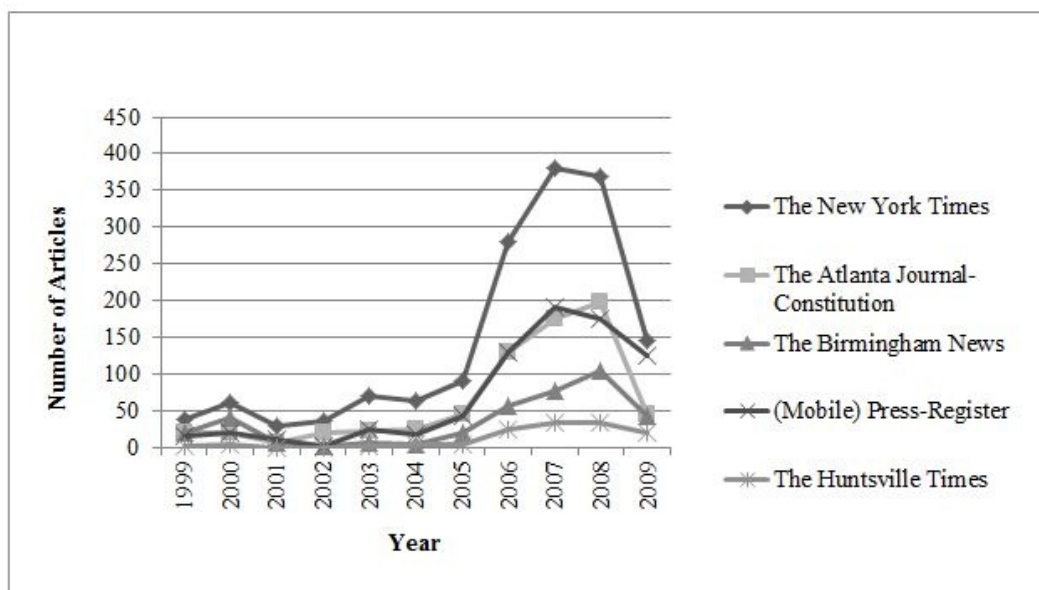


FIGURE 1. NUMBER OF ARTICLES GENERATED BY SEARCH TERMS IN NEWSBANK, 1999–2009.

Alabama and the South were chosen for this study because this state and region offer considerable potential for biofuels development based on cellulosic feedstocks rather than corn (Bailey, Dyer, and Teeter 2011). Alabama is 71 percent forested and the South as a whole is well more than 60 percent forested with more than 200

million acres in commercial timberland (Smith et al. 2009). Howell et al. (2010) and Porter et al. (2009) focused on potential production of perennial grasses (i.e., switchgrass) and short-rotation woody crops (e.g., hybrid poplars and willows) rather than the existing large timber resource to argue that the Midwest will continue to dominate biofuels development. These arguments notwithstanding, we believe that the South is likely to be the center of any future cellulosic biofuels industry due to the availability of abundant feedstock and an existing infrastructure that supports harvesting, transportation, and replanting. Moreover, wood-based biorefineries in the South could be established immediately, if bio-refining technologies prove commercially viable, rather than waiting for energy crops to be established. Timber harvests have lagged behind growth in 10 of 13 states of the South for nearly a decade and forestland owners are eager for new markets to be opened (Langholtz, Plate, and Monroe 2011; Paula et al. 2011).

The Energy Independence and Security Act of 2007 set a target of using at least 21 billion gallons of biofuels annually not made from corn starch by 2022. Because biofuels represent a potential growth industry in a state and region where industrial growth is highly sought after (Cobb 1993), we expected the tone of news and editorial coverage in state and regional newspapers to be supportive of biofuels development generally, and cellulosic biofuels development in particular. We anticipated that the *NYT* would be the least supportive of biofuels development as reflected in the tone of news and editorial coverage because the market audience for this paper is less tied to a specific regional or state economy that would benefit from such development.

The subject of biofuels development allows us to explore several important sociological questions centered around the role of the media. The media do not, of course, speak with one voice, and our selection of newspapers was designed to capture the diversity found in terms of readership and market. In the next section we draw on literature from the fields of communications and sociology, which allow us to explore a set of research questions and hypotheses that follow in the subsequent section. We present a detailed discussion of our methods before moving on to our results, discussion, and conclusions.

#### THE ROLE OF MEDIA AND THE GROWTH MACHINE

Newspapers can “set the tone of community dialogue on an issue” (Flora and Flora 2013:134), and this plays an important role in the social construction of reality (Berger and Luckmann 1966). Newspapers assist in promoting economic growth within their market area and can be understood as “business enterprises .

. . . whose futures are tied to the growth of the metropolis as a whole” (Logan and Molotch 1987:63). Metropolitan newspapers, in particular, “can play an invaluable role in coordinating strategy and selling growth to the public” (Logan and Molotch 1987:72). Newspapers are cheerleaders of growth, and often become referees among actors within what Logan and Molotch have defined as a “growth machine” made up of real estate owners and developers, unions, banks, local governments, utilities, and chambers of commerce. A newspaper’s editor or publisher may be “deferred to as a voice of reason” on matters of dispute among competing actors within the growth machine (Domhoff 1983:168). Newspapers are often champions of the growth machine because economic growth (e.g., industrial development such as a biofuels refinery) can lead to higher circulation figures and increased advertising revenues. In this paper we use the theory of the growth machine to understand how newspapers address an important public policy issue, an issue with significant implications for rural America (Bailey et al. 2011).

Newspapers play a critical role in communicating between members of the pro-growth coalition and the public. Newspapers are also businesses that act in much the same way as other members of the corporate system do – they too have products to sell (newspapers and advertising space) and services to provide (advertising, news gathering, and reporting). Newspaper owners and editors set limits for reporters (in terms of deadlines, article length, and placement in the paper), and package news in ways that support and legitimize the local growth machine. Empirical analysis of news media is often used to observe how issues are covered and the potential impact of such coverage, especially on policy. In the literature, there is debate about the role of media – whether they are a “conduit” of or a “contributor” to the policymaking process (Shanahan et al. 2008). Do the media simply transmit information and policy recommendations put forth by others, or do they “project their own thematic spins” (Terkildsen et al. 1998:45), thus influencing change and shaping public policy?

Bennett (1990) has adopted the “conduit” perspective in arguing that media coverage often mirrors the interests of dominant political and commercial powers. Media have a desire to protect business interests, and “will offer up the self-justifying drivel of politicians in place of real debate” (Bennett 1990:822). Kuzyk et al. have held that the media have become an important ally of policymakers and that “the prime target of political organization is control over the media” (2005:813). Other scholars have argued that the media more actively contribute to public debate. Strömberg (2001) argued that the media inform voters about politicians’ actions and stances on public programs and shape policy by affecting the weight

voters place on election issues. The strongest agenda-setting role of the media is not in determining opinions about an issue, but in influencing which issues capture public attention and become public agenda priorities (McCombs 1997).

Combining these two perspectives, Molotch and Lester have described media as “reflecting . . . the practices of those having the power to determine the experience of others” (1974:111). Newspaper articles reflect a “reality” constructed by the resources of three sets of actors: news promoters (politicians and individuals who identify newsworthy events), news assemblers (reporters, editors, etc.), and news consumers (readers). These actors, the authors stated, engage in this constituting activity and construct observable occurrences based on their own “purposes-at-hand” (1974:104). With the passage of time, new issues move to the forefront and take up media space (Kingdon 1984).

#### RESEARCH QUESTIONS AND HYPOTHESES

Our main research questions for this study are: (1) how does media coverage of biofuels issues vary among newspapers that cater to different geographic locations and circulation sizes, and (2) what can observed trends tell us about the role of media in influencing public perception and policy? Our intent is to reveal coverage patterns and relationships that might provide insight into variations in how different newspapers cover an important and often controversial topic. The preceding discussion of the growth machine and media roles provides the conceptual framework within which we tested a series of hypotheses.

Our first hypothesis was that sources directly quoted in coverage of biofuels by newspapers would vary by subject content, so that different stakeholder interests would be represented depending on the central focus of the news article. Hornig Priest (1995) stated that in the news production process, reporting is often shaped by sources rather than reporters, especially when covering complex issues (such as biofuels development). Not only who is used as a source, but how sources characterize issues, will affect readers’ perceptions of policies. We were interested not only in determining which voices are heard but also in identifying those that are not heard on questions of policy, environment, and other topics related to biofuels development.

Our second hypothesis was that not all biofuels are the same and that, therefore, the tone of newspaper articles would vary depending on the type of biofuel and associated feedstock. In particular, we hypothesized that coverage of first generation ethanol production (using corn for a feedstock) would have a more negative tone than second and third generation ethanol production (using wood and

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algae as feedstocks), because the latter do not compete directly with humans for food. Similarly, we anticipated that biodiesel would elicit negative commentary because it would be made from soy beans and other crops grown for direct or indirect (as animal feed) human consumption.

Our third hypothesis was that a more positive tone would be found in newspaper articles that focused on the potential economic benefits of biofuels development in that paper's service area. We expected newspapers to have been supportive of local economic growth but more critical in tone as coverage shifted to national and international subjects.

### METHODS AND DATA

#### *Sample*

Our analyses of the subject themes, volume of exposure, and tone found in print media coverage of biofuels and biofuel-related topics was based on relevance sampling of newspaper articles collected from NewsBank Access World News, a web-based database that advertises itself as “[t]he most comprehensive collection of full-text newspapers globally” (NewsBank, inc. 2010). Newspaper articles, the sampling units selected for inclusion in the analyses, were collected from one national paper (*The New York Times*), one regional newspaper (*The Atlanta Journal-Constitution*), and three important and widely-read Alabama newspapers (*The Birmingham News*, *Press-Register* of Mobile, and *The Huntsville Times*) for the years 2007, 2008, and 2009. These papers were chosen purposively, as described below. Our intent was not to generalize to other papers of similar size or with other similar characteristics.

*The New York Times (NYT)* is the flagship paper of The New York Times Company, which publishes 18 daily newspapers (The New York Times Company 2010). The company's business units also include more than 50 websites, many of which publish online editions of local newspapers, such as *The Tuscaloosa News* and *The Gadsden Times*, both in Alabama. The *NYT* has won more Pulitzer prizes and citations than any other newspaper (Dunlap 2009). The *NYT* is the number three paper in the United States in terms of circulation (hovering around one million), coming behind *USA Today* and *The Wall Street Journal* (Sutel 2008; Perez-Pena 2009). Each of these major national newspapers have somewhat different perspectives and markets that they serve. We chose the *NYT* over *The Wall Street Journal* because of the latter's heavier focus on economic issues compared with the broader focus on the *NYT*. We chose the *NYT* over *USA Today* because of depth and quality of coverage of the *NYT*.

*The Atlanta Journal-Constitution (AJC)* serves Atlanta, Georgia, and its suburbs. As the flagship newspaper of Cox Enterprises, the *AJC* is the largest daily newspaper in the southeastern United States and is considered “the most influential newspaper voice in Georgia” (Perry 2004). The *AJC* has a daily circulation of about 460,000 and a Sunday circulation of about 620,000 (Readership Institute 2010).

The three state papers selected for the study are the state’s largest daily newspapers (APA 2011). The publications provide coverage of cities that vary significantly in terms of geography, population, and economic profiles. The papers are considered “sister” papers: all are owned by Advanced Publications and they share an online home at [www.al.com](http://www.al.com), where articles and breaking news from each paper are uploaded continually. *The Birmingham News* and the *Press-Register* are both designated tier one newspapers by the Audit Bureau of Circulations (2009), which means the two papers meet certain reporting requirements. Print and online readership data were provided by Scarborough Research (a local-market research company accredited by Media Rating Council), and audited by the Audit Bureau of Circulations (ABC), a nonprofit industry organization that performs independent audits of print circulation, readership, and website activity.

*The Birmingham News* is the largest paper in the state, with a daily circulation of about 132,000 (APA 2011). In a 2009 report by a media relations company, it ranked 70<sup>th</sup> in the top 100 U.S. daily newspapers by circulation (BurrellesLuce 2009). Birmingham is an important business and industrial center for the state. The *Press-Register* is the state’s second largest paper, with a daily circulation of just less than 100,000 (APA 2011). In a 2009 report, it ranked 84<sup>th</sup> in the top 100 U.S. daily newspapers by circulation (BurrellesLuce 2009). Mobile is located on the Gulf of Mexico. While aerospace, manufacturing, and medicine are major industries in Mobile, it is also considered a cultural center and tourism plays an important part in the local economy. *The Huntsville Times* is the third largest paper in the state, with a daily circulation of about 52,000 (APA 2011). Huntsville is located in northern Alabama, along the Tennessee River, and its economy is largely driven by aerospace and military technology. The city is home to the Army’s Redstone Arsenal and NASA’s Marshall Space Flight Center. It has been recognized by Forbes Magazine and Kiplinger as a top city in the country in which to do business and live.

The study included only articles (including editorial content) related to production or consumption of biofuels (liquid motor vehicle fuels made from renewable resources) or biofuel feedstocks. Sometimes, the focus of the article was not directly related to biofuels, but to a topic with significant implications for



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biofuels (such as energy legislation). These articles were only included in the analyses if they mentioned liquid biofuels (as opposed to, for example, general blanket statements referring to renewable energy). Articles that made only minimal references to biofuels, but were not related to their production or consumption, were not included in the study.

The words “biofuel,” “ethanol,” and “biodiesel” were selected as search terms to retrieve articles for the study from NewsBank. During development of the methods, other terms, such as “bio-fuel” and “bioenergy,” were also tested, but they yielded no additional articles for the analysis period. A total of 606 articles published in the five newspapers described above during 2007, 2008, and 2009 were identified and analyzed.

### *Coding Procedure*

Data were collected on seven variables or variable groupings (where each variable within the series was coded separately as a dichotomous dummy variable), which represent the coding units used in our analyses. Variables included newspaper, article type, and geographic level of coverage. Variable groupings were fuel type (five dummy variables), topics (10 dummy variables), and sources quoted (eight dummy variables). Finally, each article was coded for tone (an ordinal variable with three levels). Context units consulted when defining or identifying coding units varied from a word or two (in the case of identifying article type) to the article as a whole (for article tone). Those coding units for which there were multiple, mutually exclusive categories (article type, geographic level of coverage, and article tone) were limited to a few categories to minimize criteria confusion. In the other coding units (groups of variables), operational definitions of the individual variables were based on presence (1) or absence (0) of criteria.

Articles were classified as news stories (written by newspaper staff or correspondents), wire copy (articles produced by a news agency, such as Associated Press, or by journalists at another newspaper), or editorial content (editorials, columns, or letters to the editor). These distinctions were made to observe patterns or differences between content or tone of articles generated in-house and those from another news source, and between news and opinion pieces. Letters were also coded as such in a separate variable, so tests could be run to observe potential differences between these and other articles.

The fuel type variables were based on the types of biofuels and associated feedstocks discussed in the article; sometimes more than one type of biofuel was discussed in an article. Biofuel types were identified as first-generation ethanol

(usually made from corn or sugarcane), first-generation biodiesel (usually made from plant oil, animal tallow, or waste cooking oil), second-generation cellulosic-based biofuels (made from non-food plant material), third-generation biofuels (for example, made from algae or municipal waste), and “all biofuels” (an article was coded 1 when it spoke about all liquid biofuels, without specifying a particular type). Geographic level of coverage refers to the geographic space that could be affected by biofuels development and was categorized as local, statewide, regional, national, or international. Only four articles (less than 1 percent) covered issues at a regional level, so we did not include this coverage of regional perspectives in the discourse analyses.

Topics included as dichotomous variables were: policy and legislation, funding availability and awards, food versus fuel issues, environmental impacts of biofuels development, global issues, social and cultural issues, technology, industry and investors, academic research, and municipal projects. Early in the coding process, topic variables were frequently added or adjusted. In each instance, previously-coded articles were revisited to ensure that appropriate codes were assigned. Dichotomous variables for sources quoted included: researchers, entrepreneurs, politicians or policymakers, industry representatives, municipality representatives, organization representatives, government agency representatives, or “no sources quoted.” There was a fair amount of discussion among the authors of this article regarding source type variables to establish more rigid criteria for coding articles. Again, as source types were added or better-defined, previously coded articles were revisited.

Coding for article tone was based on a scale with three measurements: -1, 0, and +1. Points on the scale were defined as -1 for negative or unfavorable tone, 0 for balanced or neutral tone, and +1 for positive or favorable tone. Determining article tone was a subjective process. To determine the tone of an article, consideration was given to the nature of vocabulary used in the text, the slant of the headline, and the presence of or attention given to quoted sources. Coding for tone raised theoretical and methodological questions. We consulted the literature (Fitzgerald et al. 2002; Kuzyk et al. 2005) to see how others have identified coding categories. When coding for tone, standard practice requires two independent coders. The first two authors separately coded each of the 606 articles for tone. The lead author is female and a U.S. citizen; she has a background in journalism, sociology, and forestry, as well as recent experience conducting research on social impacts of biofuels. The second author is a male international student; he has a background in sociology with experience conducting research on coal and bioenergy. During several

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discussions (before and during the coding process), it was decided that each would attempt to read the articles and evaluate their content as would a regular reader (one who reads newspapers regularly, but lacks extensive knowledge of biofuels). The main criteria when coding was how the article reflected on biofuels, biofuels policy, or the biofuels industry.

An article was coded -1 if it reflected negatively because it presented a one-sided critique or if the content of the story was unequivocally critical of biofuels development. An article would be coded -1 if it addressed a topic that by its nature and in the minds of many readers would have reflected poorly on biofuels or the biofuels industry (e.g., corn ethanol leads to increases in food prices adversely affecting global food supplies) even if the article itself was written objectively with equal attention given to various sources. Articles were coded 0 if there were no obvious leanings or if both sides of a story were presented. Articles were coded 1 if they (or the sources quoted) praised the biofuels industry, policies, or technologies; touted their benefits; did so unquestioningly; and did not present information on problematic issues associated with biofuels. Out of the 606 articles included in the study, the authors were in total agreement on tone in 480 cases (79 percent). The authors were in slight disagreement (one coded the article as “neutral” while the other coded it -1 or +1) in 20 percent of the cases. In only five cases (less than 1 percent of the articles) were the authors in complete disagreement about the tone of the article (one coding the article as -1 and the other coding it as +1).

An intercoder reliability analysis was performed using Cohen’s kappa. The analysis yielded a kappa of 0.684, which is statistically significant at the 0.001 level. This indicates substantial agreement between the two coders. With intercoder reliability verified, half the tone codes were randomly selected from the first coder and the second half came from the second coder. Code was treated in the analyses as an ordinal variable because there is a clear ordering of the categories, with higher order items (those coded +1) representing more of the quality extent (in this case, favorable portrayal of biofuels) represented by the variable “tone,” and lower order items (those coded -1) representing less (see Singh (2007) for definition of ordinal used).

Examples of “favorable” coverage include: the cutting-edge nature of technology, municipal projects providing economic and environmental benefits, and industrial development leading to creation of jobs. Below are excerpts and accompanying headlines from news articles coded by both authors as +1.

“Fuel from Plants May be State Bonanza” (*Birmingham News*): The woody twigs on the floor of Alabama’s forests, its empty fields of switchgrass and the waste from its chicken farms look increasingly like valuable raw materials in the nation’s hunt for fuel made from something other than oil. (Orndorff 2007:1A)

“Biofuel Plant Raises Hopes in Forestry Belt” (*Atlanta Journal-Constitution*): Rural Georgia’s economic salvation materialized Tuesday under a billowing white circus tent as politicians and businessmen extolled the renewable-fuel virtues of heretofore undesirable pine tree limbs. (Chapman 2007:C1)

“Turning Grease to Fuel, and Despair to Hope” (*New York Times*): [A]n organization that employs homeless people, many of them former drug addicts or people who have been behind bars . . . collects grease from restaurants free and sells it to North American Biofuels Company, a plant in Bohemia, on Long Island, that converts it to diesel fuel. (Heydarpour 2007:2B)

Examples of “unfavorable” coverage include: negative impacts on food security or the environment, lawsuits against biofuel producers, and corporate bankruptcies. Below are excerpts and accompanying headlines from news articles coded by both authors as -1.

“Study: Ethanol May Cause Increase in Smog, Deaths” (*Press-Register*): Nearly 200 more people would die yearly from respiratory problems if all vehicles in the United States ran on a mostly ethanol fuel blend by 2020, the research concludes. (Borenstein 2007:A3)

“VeraSun Shares Suspended” (*Atlanta Journal-Constitution*): Shares of VeraSun Energy Corp., which accounts for about 13 percent of the nation’s ethanol capacity, were suspended on the New York Stock Exchange as the company sought \$190 million to make payroll. (Staff and News Services 2008:C2)

“Biodiesel Plant Settles Lawsuit on Pollution” (*Press-Register*): Alabama’s first alternative fuel plant agreed to settle a federal lawsuit claiming it

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spoiled a west Alabama stream with oil and grease. (Associated Press 2008:B2)

## RESULTS

The study began with a summation of the number of articles in all five newspapers containing keywords identified above. The data (presented in Figure 1) provide a measure of media interest in biofuels and biofuels-related issues between 1999 and 2009. There is a clear trend, with numbers peaking in 2007 and 2008, followed by a sharp decline in 2009. In Figure 2, we see that the number of relevant articles generated by search terms peaked at 266 in 2008 before dropping in 2009 to a total of 89 articles. In 2008, one-third of all articles were editorial content, compared to 27 percent and 13 percent for years 2007 and 2009, respectively (Figure 2).

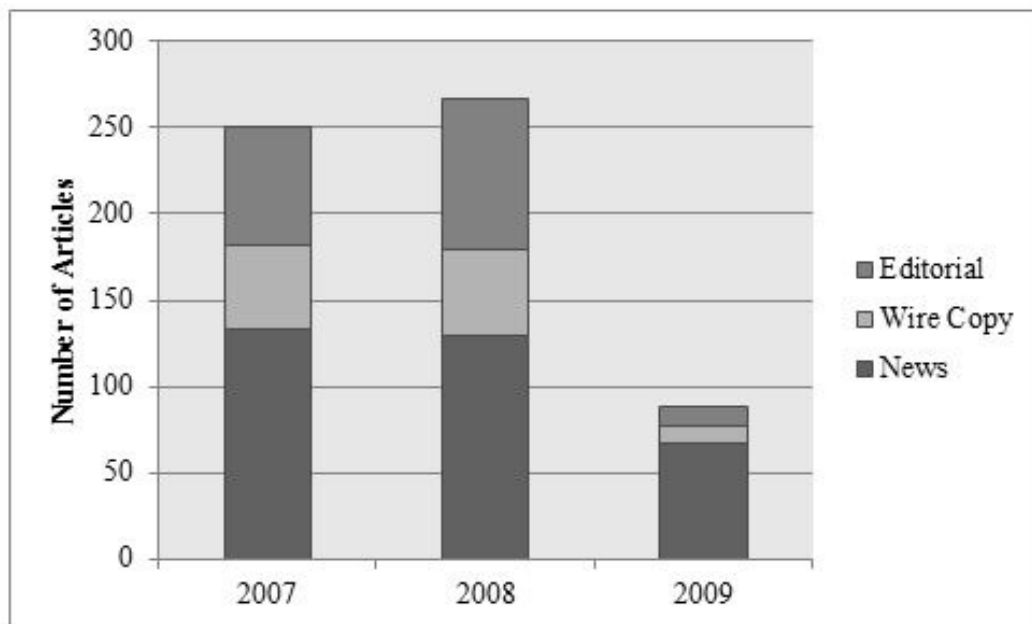


FIGURE 2. NUMBER OF ARTICLE TYPES BY YEAR

Below we present results of a content analysis examining types of sources quoted in news coverage of particular biofuels-related topics. We then detail our analysis of article tone related to (1) topic, (2) fuel types, and (3) geographic level of coverage. This is followed by a discussion of the differences in coverage observed among the five newspapers.

*Sources Quoted*

Our first hypothesis was that newspaper articles would cite different sources depending on the subject content of the article. For our study, seven common source types were identified: industry representative, academic researcher, organization representative (e.g., nonprofits, research firms), political source (e.g., politicians, policymakers), entrepreneur, municipal representative (e.g., mayor, city utilities representative), and government agency representative (e.g., EPA, state departments). For each article, source types were coded separately using dummy variables. An additional “no source” variable was added for those articles in which no one was directly quoted (49 percent of all articles). Frequently at newspapers (especially smaller ones), articles are published with content drawn heavily from press releases; bylines usually attribute the article to “staff.” In our study, 8.8 percent of the articles lacking quoted sources had “staff” or “staff reports” bylines. Letters to the editor accounted for 27.9 percent of the articles lacking quoted sources, followed by wire reports or news services (15.8 percent), and editorials (12.5 percent). Approximately 35 percent of the articles lacking quoted sources had bylines of reporters. For those articles with named sources, the most common source types were representatives of civic (generally nonprofit) organizations (“organizations”) and the biofuels industry, quoted in 20 and 18 percent of articles, respectively.

Chi-square correlations were used to identify the source types likely to be quoted in articles covering particular subjects (see Table 1); each source/subject combination was observed (for a total of 80 relationships). For articles that covered industry issues, there was a strong likelihood that industry representatives, organization representatives, and/or entrepreneurs would be interviewed. Articles covering policy issues often had no sources quoted, or the reporter interviewed representatives of civic organizations, or political sources. No statistically significant relationships were observed between source types and coverage of environmental issues. Coverage of funding was likely to include quotes given by academic researchers, political sources, or government agency representatives. Articles about research often quoted academic researchers. Coverage of social issues was likely to cite entrepreneurs or government agency representatives. Articles discussing technology were likely to quote industry representatives, academic researchers, and entrepreneurs. Coverage of global issues often included quotes from political sources and government agency representatives. Articles about municipal projects often had no sources quoted, or cited municipal representatives. Coverage of the food versus fuel debate often had no sources quoted, or cited civic

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organization representatives. Articles covering policy issues were *less* likely to quote industry representatives ( $p < 0.05$ ), academic researchers ( $p < 0.05$ ), entrepreneurs ( $p < 0.001$ ), or municipal representatives ( $p < 0.001$ ). Also, industry representatives were less likely to be quoted in coverage of municipal-level projects and the food versus fuel debate (both significant at the .01 levels). These findings support our first hypothesis.

TABLE 1. SOURCE TYPES LIKELY TO BE QUOTED BY ARTICLE TOPIC

Topic	Source Types
Industry (N=179). . . . .	Industry representative <sup>***</sup> Organization representative <sup>**</sup> Entrepreneur <sup>***</sup>
Policy (N=247).. . . . .	No sources quoted <sup>**</sup> Organization representative <sup>*</sup> Political source <sup>***</sup>
Environment (N=62). . . . .	(No significant relationships)
Funding (N=33).. . . . .	Academic researcher <sup>+</sup> Political source <sup>***</sup> Agency representative <sup>***</sup>
Research (N=29). . . . .	Academic researcher <sup>***</sup>
Social (N=57).. . . . .	Entrepreneur <sup>***</sup> Agency representative <sup>*</sup>
Technology (N=95).. . . . .	Industry representative <sup>+</sup> Academic researcher <sup>***</sup> Entrepreneur <sup>***</sup>
Global (N=78). . . . .	Political source <sup>***</sup> Agency representative <sup>**</sup>
Municipal (N=69). . . . .	No sources quoted <sup>***</sup> Municipal representative <sup>***</sup>
Food (N=105). . . . .	No sources quoted <sup>*</sup> Organization representative <sup>**</sup>

NOTE: Significance Levels based on Chi-Square correlations; <sup>+</sup> $p \leq 0.1$ , <sup>\*</sup> $p \leq 0.05$ , <sup>\*\*</sup> $p \leq 0.01$ , <sup>\*\*\*</sup> $p \leq 0.001$

*Tone*

Tests of correlations were first run to observe relationships between nominal variables and tone in all articles. After reviewing the findings, we decided to rerun the tests, excluding all letters to the editor, so that only copy written by newspaper staff or provided by wire services (including both news articles and editorial content) was included. Levels of significance for most of correlations remained the same. Because there were only a few exceptions to this, we decided for our discourse analysis to present results based on all articles. This allows us to analyze trends

among variables based on all copy deliberately made available to the public by the news assemblers – despite whether the copy was generated in-house, by another news source, or by the readers themselves. Using the Kruskal-Wallis test, newspaper, article type, and level of geographic focus all displayed statistically significant relationships with tone at the 0.001 level.

Mann Whitney U tests were run to observe differences in article tone between binary variable categories in the following three variable groups: fuel type, topic, and quoted source. The results of these tests are displayed in Table 2 and show that article tone differed significantly between groups. Higher mean ranks indicate variable categories with more favorable coverage. For example, articles that did not discuss ethanol (mean rank of 382.71) were more favorable in their coverage than articles that did discuss ethanol (mean rank of 239.00); this difference was significant at the 0.001 level. How article tone was influenced by several factors is examined in more detail below.

TABLE 2. DISTRIBUTION OF CODES FOR BINARY VARIABLES AND MANN WHITNEY U TESTS OF DIFFERENCES IN ARTICLE TONE BETWEEN FUEL TYPES, TOPICS, AND QUOTED SOURCES

VARIABLE		N	PERCENT (N=606)	MEAN RANK	Z-SCORE
Fuel Type					
Ethanol.....	Yes	334	55.1	239.00	-10.70***
	No	272		382.71	
Biodiesel.....	Yes	135	22.3	405.11	-8.14***
	No	471		274.38	
Cellulose-based.....	Yes	118	19.5	373.93	-5.19***
	No	488		286.46	
Third-generation.....	Yes	33	5.4	406.41	-3.70***
	No	573		297.57	
All biofuels in general....	Yes	94	15.5	271.81	-2.03*
	No	512		309.32	
Topic					
Industry.....	Yes	179	29.5	361.20	-5.59***
	No	427		279.31	
Policy.....	Yes	247	40.8	232.03	-8.88***
	No	359		352.67	
Environment.....	Yes	62	10.2	201.48	-5.16***
	No	544		315.13	



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TABLE 2. DISTRIBUTION OF CODES FOR BINARY VARIABLES AND MANN WHITNEY U TESTS OF DIFFERENCES IN ARTICLE TONE BETWEEN FUEL TYPES, TOPICS, AND QUOTED SOURCES (*Continued*)

VARIABLE		N	PERCENT (N=606)	MEAN RANK	Z-SCORE
Funding. ....	Yes	33	5.4	393.11	-3.22***
	No	573		298.34	
Research. ....	Yes	29	4.8	381.00	-2.60**
	No	577		299.60	
Social. ....	Yes	57	9.4	362.51	-2.85**
	No	549		297.37	
Technology. ....	Yes	95	15.7	386.74	-5.37***
	No	511		288.02	
Global. ....	Yes	78	12.9	242.34	-3.52***
	No	528		312.54	
Municipal. ....	Yes	69	11.4	443.02	-7.49***
	No	537		285.57	
Food v. Fuel. ....	Yes	105	17.3	175.29	-8.79***
	No	501		330.37	
Quoted Sources					
None. ....	Yes	297	49.0	266.81	-5.39***
	No	309		338.77	
Industry. ....	Yes	112	18.5	340.06	-2.61**
	No	494		295.21	
Research. ....	Yes	57	9.4	325.49	-1.06
	No	549		301.22	
Organization. ....	Yes	124	20.5	268.06	-2.69**
	No	482		312.62	
Policy. ....	Yes	71	11.7	337.35	-1.85 <sup>+</sup>
	No	353		299.01	
Entrepreneur. ....	Yes	70	11.6	405.34	-5.51***
	No	536		290.20	
Municipal. ....	Yes	45	7.4	468.62	-7.00***
	No	561		290.25	
Agency. ....	Yes	51	8.4	289.34	-0.64
	No	555		304.80	

NOTE: <sup>+</sup> $p \leq 0.1$ , \* $p \leq 0.05$ , \*\* $p \leq 0.01$ , \*\*\* $p \leq 0.001$ 

*Tone by fuel type.* Our second hypothesis was that tone of the articles (favorable, neutral, or unfavorable) would vary depending on type of biofuel and associated

feedstock. The tone of articles covering first-generation ethanol was largely negative, with the percent of articles coded -1 increasing throughout the three-year study period (Table 3). Tone of articles covering biodiesel and cellulosic-based biofuels remained largely positive during the study period, though in 2009 there was an increase in the percent of negatively-coded articles covering cellulosic-based biofuels. Coverage of third-generation biofuels such as algae-based remained largely neutral throughout the three-year period; interestingly, no articles covering this fuel type were coded -1 for tone. Coverage of biofuels overall was largely neutral in tone over the three-year period, though the percent of negatively-coded articles reached its highest point in 2008.

TABLE 3. ARTICLE TONE BY FUEL TYPE AND YEAR, BY PERCENT

	2007	2008	2009
Ethanol	(n=151)	(n=155)	(n=28)
Positive.....	14.6	9.0	10.7
Neutral.....	39.7	41.9	35.7
Negative.....	45.7	49.0	53.6
Biodiesel	(n=67)	(n=49)	(n=19)
Positive.....	73.1	38.8	47.4
Neutral.....	19.4	38.8	36.8
Negative.....	7.5	22.4	15.8
Cellulosic	(n=50)	(n=39)	(n=29)
Positive.....	44.0	48.7	48.3
Neutral.....	38.0	41.0	20.7
Negative.....	18.0	10.3	31.0
Third Generation	(n=9)	(n=15)	(n=9)
Positive.....	44.4	40.0	44.4
Neutral.....	55.6	60.0	55.6
Negative.....	0.0	0.0	0.0
All Biofuels	(n=34)	(n=46)	(n=14)
Positive.....	20.6	6.5	7.1
Neutral.....	61.8	47.8	64.3
Negative.....	17.6	45.7	28.6

Figure 3 shows article tone by topic covered in the articles. Articles coded as negative in tone (-1) usually covered policy, environmental issues, global issues, or the “food versus fuel” argument – four topics that are often intertwined. The subject with the highest percentage of articles negatively coded for tone (71.4 percent) was the food versus fuel argument, which often posits that feedstocks – or the land that

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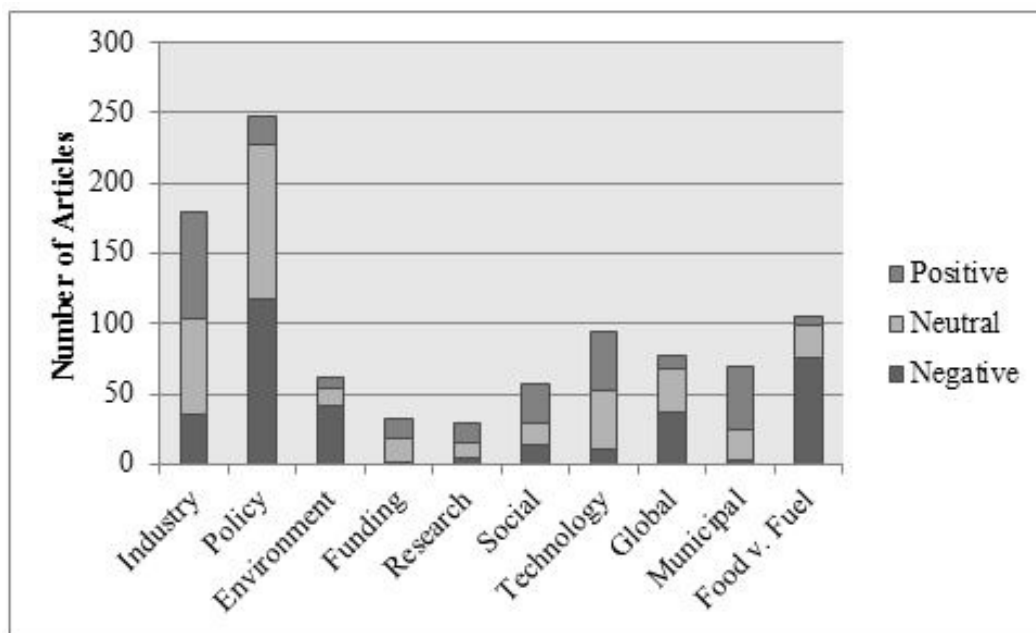


FIGURE 3. TONE BY TOPIC COVERED, 2007–2009

grows them – could be better utilized to feed people, both in the United States and abroad, than to produce biofuel. Reporting on environmental issues (for which 66.1 percent of articles were coded -1) included pollution (air and water), deforestation, and changes in land use. Articles reporting on policy (47.8 percent of which were coded negatively) included coverage of subsidies, impacts on food and fossil fuel prices, and tariffs. Articles covering policy topics were the most numerous of all articles, accounting for nearly 41 percent of the total (Table 2). Approximately 47 percent of articles covering global issues were coded negatively; these usually centered on food security, international relations, and land use changes in third-world countries. Taken as a whole, these findings support our second hypothesis, that article tone would vary based on type of biofuel.

*Tone and local economic growth.* Our third hypothesis was that article tone would vary depending on whether biofuels development was treated as a subject related to local economic growth or as a national or international issue. Tone varied greatly among articles covering events or subjects at different geographic levels (Figure 4). Articles covering issues at a local or state level were often positive in tone, with 52.5 percent and 61.9 percent coded +1, respectively. Local is defined here as encompassing community, city, or (less frequently) county populations. Those articles covering issues at the national level were often neutral (with 42.8 percent coded 0) or negative (with 42.1 percent coded -1). Coverage at the international

level was largely negative, with 46.3 percent of articles coded -1. International coverage had the smallest percent of articles coded +1 (9.3 percent). Articles at the local and state levels had higher levels of coverage of subjects such as municipal projects and industrial development, whereas those focusing on larger geographic levels often covered subjects such as policy, impacts on food markets, and the environment.

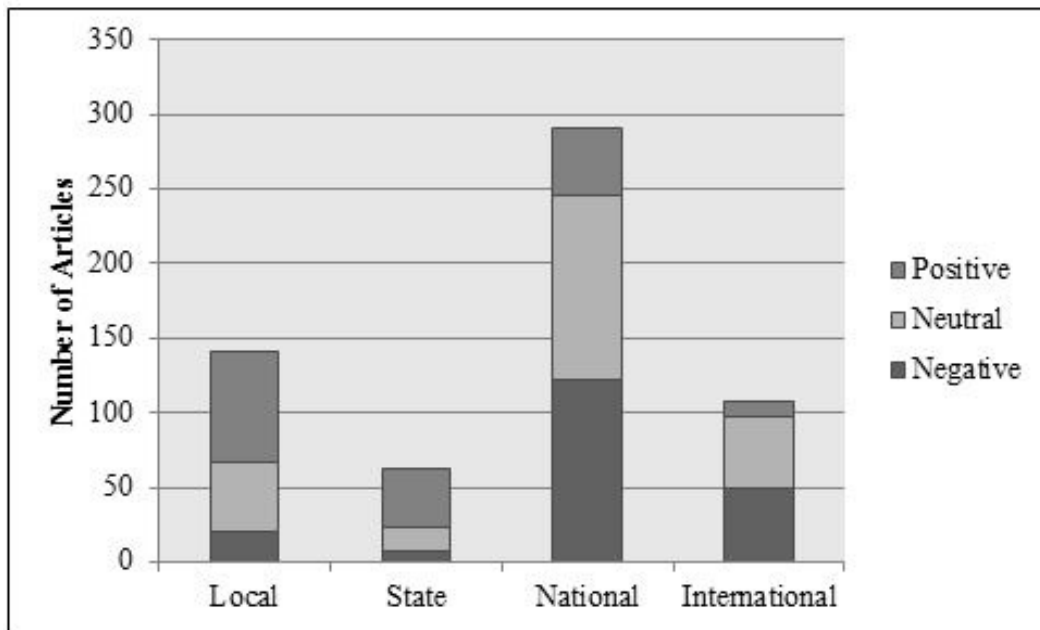


FIGURE 4. TONE BY GEOGRAPHIC LEVEL OF COVERAGE, 2007–2009

Articles for which tone was positive often covered industry, research, social issues, technology, and municipal projects. The highest percent of positively-coded tone (65.2 percent) was for articles reporting on municipal projects. An example of a municipal project would be when a city implements a program to collect waste vegetable oil to make biodiesel for its vehicles. Coverage of technology, for which 45.3 percent of articles were positive in tone, included topics such as new conversion technologies and innovative use of waste material as feedstock; articles which often had a local context. Industry development (with about 42 percent of articles coded +1) largely focused on investments, openings of biofuel plants or fueling stations, and industry potential to boost economies and feedstock markets. Approximately 47 percent of articles covering social issues were positively coded; this coverage included a wide range of topics, but articles favorably coded usually covered local issues, such as job creation, feedstock markets, and small-scale biofuel

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production. Coverage of funding was largely neutral, with 51.5 percent of the articles coded 0 for tone. Such coverage included announcements of government funding for academic research, municipal projects, and loans to refineries.

Approximately 45 percent of the articles in the *NYT* were coded as neutral in tone; approximately 35 percent were coded as negative. Tone of articles in the *AJC* was evenly split, with 33, 34, and 34 percent of articles coded as negative, neutral, and positive, respectively. For *The Birmingham News*, tone was largely neutral or positive, with each tone code yielding 43 percent of articles. Most of the articles appearing in *The Huntsville Times* (55.6 percent) were coded as neutral, with most of the remaining articles coded as positive. Only 3.7 percent of *The Huntsville Times* articles were coded -1 for tone. The only paper for which the highest percent of tone codes was negative was the *Press-Register* of Mobile (45.5 percent of articles were coded -1).

Except for the Mobile paper, state papers were generally more positive in tone than the larger papers. The *Press-Register* appears to defy the notion of smaller papers being more supportive of biofuels development, which led us to consider differences in how that newspaper treated issues related to biofuels at varying geographic levels. In that paper, coverage of biofuels development as it related to the local economy was coded positively 52.1 percent of the time and coverage of biofuels in the state was even more strongly favored (72.7 percent coded +1). Coverage at the national level by the *Press-Register* was largely negative (64 percent coded -1), while coverage at the international level was more neutral (52.4 percent coded 0). When only news articles (no letters or editorials) were included, at none of the geographic levels were most of the articles negatively coded for tone; local and state coverage remained mostly positive, while national and international coverage was largely neutral. Editorials and letters to the editor were largely responsible for the more critical coverage of biofuels development in the *Press-Register*.

Similar analyses of tone by geographic level were conducted for both the *NYT* and the *AJC*. These two papers serve major metropolitan areas that would benefit from industry development as well, and it turns out that both papers follow a similar pattern as the *Press-Register*, with coverage at local and state levels yielding mostly neutral or positive tones, and coverage at national and international levels yielding mostly neutral or negative tones.

When examining differences among newspapers, considering how coverage by topic differs among newspapers is important, which (based on significant differences between topical categories reported earlier) is likely to affect tone. More than half

(53.5 percent) of articles in the *NYT* covered policy issues and 42.2 percent of articles in the *AJC* covered policy. Policy was covered in 39.7 percent of articles in the *Press-Register*, but in only 12.3 and 18.5 percent of articles in *The Birmingham News* and *The Huntsville Times*, respectively. Environmental and global issues both accounted for higher percentages of coverage in the *NYT* and the *AJC* than in the three state papers. The *Press-Register* had the highest percentage of negatively-toned articles on the food versus fuel debate (21.8 percent compared with 21.2 and 14.7 percent of *NYT* and *AJC* articles, respectively). Coverage in all papers at the local and state levels focused on issues often positive in tone - namely industry and municipal projects.

## DISCUSSION

The rapid increase and equally rapid decline in the number of articles related to biofuels development displayed in Figure 1 reflects a common pattern of media coverage. We believe the issue of biofuels remains an important issue even if those who control editorial boards and decide which stories to pursue have moved on to new topics. There has been no shortage of important new issues, including the presidential election of 2008, the economic recession that emerged in the latter half of 2008 (which drove down crop and energy prices and therefore affected the urgency of what had seemed an energy crisis the year before), the health care debate, and, of course, wars in Iraq and Afghanistan.

Our first hypothesis was confirmed; presence (and absence) of quoted sources varied significantly by article topic. Though most of the correlations revealed expected relationships (e.g., articles about industry quoting industry representatives), they also highlighted how, for some subjects, potentially important stakeholders were not given a voice. It is difficult to say whether the absence of those actors was due to reporters' inability to locate sources, to disinterest in pursuing alternative perspectives, or to unwillingness of individuals to be interviewed. For example, experts quoted in articles on social issues were primarily entrepreneurs and agency representatives and not representatives of civic organizations. Representatives of those organizations, however, were the ones most likely to have commented on the impact of biofuels on food availability. Academic researchers were used as sources for articles on research, technology, and funding for biofuels development.

For the most part, the second hypothesis was confirmed. Articles addressing production of first-generation ethanol from corn or other food crops were negative in tone but articles covering biodiesel were more positive than we had anticipated.

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We attribute this to the number of articles covering biodiesel produced from waste oil (as opposed to being made from plants grown as biofuel feedstock). Second and third-generation biofuels were treated more positively by newspaper articles we analyzed.

Finally, our third hypothesis was largely confirmed – that newspaper coverage of biofuels development that had the potential for positive economic impact within their service area were often more positive than coverage of such development elsewhere. Articles for which tone was largely negative covered topics that are highly politicized, and were not tied to the immediate service area of the paper (i.e., were national or global in scope). All of the topics that were largely negative in tone (policy, environmental issues, global issues, and food versus fuel) were frequent subjects of editorial content, both from professional contributors and from the public.

Data from *The Birmingham News* and *The Huntsville Times* confirmed our expectation that state papers would be more supportive of biofuels development than regional and national papers (as represented here by the *AJC* and the *NYT*), with the regional paper being intermediate along the continuum from supportive to critical. Article type – whether news, wire, or editorial including letters – may be less predictive of article tone than topic and geographic level of coverage. The overall tone of the *NYT* and the *AJC* tended toward the negative because coverage at the national and international levels accounted for a larger percent of their total coverage than in *The Birmingham News* or *The Huntsville Times*. The *Press-Register* of Mobile was more like the *NYT* and the *AJC* than the other two state newspapers. Coverage of national and international topics usually raised critical questions and a negative tone on policy issues including global impacts, and food versus fuel.

Differences in treatment of biofuels development by the *NYT* and the *AJC* compared with the three state papers reflect differences in editorial perspective and market audience. The *NYT* considers itself as the “paper of record” for the United States, while the *AJC* takes on the role of the regional equivalent. In covering biofuels development, *The Birmingham News* and *The Huntsville Times* play the role of hometown papers while the *Press-Register* of Mobile has adopted a role more like the *NYT* and the *AJC*. Beyond these differences, however, when it comes to coverage of biofuels development oriented to local or state levels, coverage in all five papers had a positive tone consistent with their roles in local growth machine coalitions.

## CONCLUSION

Analyses of article tone revealed certain patterns. Articles often reflected favorably on cellulosic-based biofuels, municipal projects, technology, and issues covered at the state and local levels, particularly when they had the potential for positive local economic impacts. Articles reflected poorly on first-generation ethanol, policy, environmental and global issues, and issues covered at national and international levels. Correlations among geographic levels of coverage, quoted sources, and article tone offer support for Logan and Molotch's (1987) view of the media as supportive of local economic growth. Our analysis of media coverage does not allow us to examine the role of other actors in growth machine coalitions that may be supportive of biofuels development (e.g., industrial investors and owners of land that would be used to produce feedstock). Media support for local economic growth makes sense given that growth equates with job creation leading to population growth and possibilities of increased subscriptions (and consequent increases in advertising rates).

The belief that newspapers are neutral and objective is unrealistic as conscious decisions are made about the topics on which to report, who to use as sources, and how to present the information. News coverage changes with the emergence of new events, and according to the changing needs and experiences of news promoters, assemblers, and readers. An economic recession, for example, directly affects consumers as jobs are lost and personal financial security is threatened. It is reasonable to expect, then, that newspaper coverage would turn away from discussions of bioenergy policies and toward government bailouts and home lending programs. The heightened coverage levels of 2007 and 2008 coincided with major legislative actions. The lower profile of biofuels in 2009 implies loss of interest by media and readers. This could be due to fewer numbers of noteworthy events, decreasing salience of biofuels issues, or increasing salience of other issues.

Based on our analyses of national, regional, and state newspaper coverage of biofuels development, we conclude that for this issue the media played both conduit and contributor roles. When the subject was local economic growth opportunities, newspaper coverage supported the interests of growth machine advocates. This was true for newspapers we examined at national, regional and state levels. However, newspapers we analyzed were not merely passive conduits of information from stakeholders and vested interests. The rapid decline in coverage during 2009 reflected decisions on what was newsworthy and would attract the interest of readers as a new administration grappled with economic recession, health care reform, and two overseas wars. Newspaper coverage also varied depending on



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whether the focus was on local economic growth or broader issues such as food versus energy or the wisdom of subsidies. The *NYT* and the *AJC* adopted more critical views of biofuels development when the focus was not local, a pattern mirrored by the *Press-Register* of Mobile. In the end, we conclude that when local economic interests are at stake, newspapers often play the conduit role. The subject of biofuels development is not only a local issue, and when considering wider issues, newspapers we examined often played a stronger contributor role in shaping the terms of public debate.

Despite whether the newspapers are conduits or contributors, newspapers clearly play an important role in defining the salience of issues, and directing the agenda of public debate. While this study offers insight into the role of media in coverage of biofuels, it has led to as many questions as answers. How will reduction in coverage impact policy and industry development? What will be the long-term influence that media have on public perception of future technological development in the energy arena? Was the drop in 2009 an indication of stagnated interest that will rebound once the economy recovers or petroleum prices increase? What events or factors (e.g., petroleum prices, food prices, federal mandates) would ensure that the public remain aware of biofuels issues? What are the implications if media interest wanes while special-interest lobbies forge ahead? The answer to these questions may have important consequences for energy and climate policy in the United States and, by extension, for the world as a whole.

Changes in the newspaper industry call into question the role of print media in shaping public discourse. The three Alabama newspapers upon whose coverage we drew for this study all have announced that they will publish print editions only three times a week in favor of online publication. This reflects changing consumer preferences for online and customized news. Television news available 24 hours a day may also be affecting newspaper readership. These changes will represent challenges for future studies of media coverage. At this point, the ready availability of databases that allow for comparisons of newspaper treatment of an issue make possible the analysis provided here. Whether a shift to online newspapers will provide for comparable databases in the future remains to be seen. Creating practical research methods for analysis of news coverage on 24-hour television news channels or web-based news sources pose serious challenges for the future. We believe at this time that analysis of newspaper treatment of important subjects like biofuels development remains a valid approach, but whether this will be true in the future remains to be seen.

These challenges notwithstanding, we believe that sociologists should pay more attention to media coverage of issues like biofuels where technological change and public policies are likely to have profound societal impacts. As the lifeblood of economies, energy represents a material reality of central importance. That said, even the very material is subject to many interpretations through the social construction of reality. The media play a central role in the social construction of reality and do so not only as disinterested observers but often as active partisans in promoting local growth machine politics.

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