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Biofuels Bonanza?: Exploring community perceptions of the promises and perils of biofuels production

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ABSTRACT

While the expansion of the biofuels industry has received scholarly attention with respect to environmental and food security concerns, little research has explored the impacts of biofuels industry on local communities where ethanol plants are located. Drawing on sociology of networks and flows theory to situate expansion of the industry globally, this paper uses a community case study approach to examine local community perceptions of benefits and burdens of the ethanol industry. Data from community level surveys, individual and focus group interviews in three case study communities in Iowa and Kansas in the Midwestern region of the United States are utilized to explore community perceptions. Results show that community members believe that ethanol plants have brought modest economic benefits to their community. Increased traffic and water competition were two areas of concern identified by residents with respect to local ethanol plants, but other environmental impacts were not prominently identified by community members. Widespread concerns were expressed about future viability of the ethanol industry and the devastating impacts that future declines in the industry would have on communities. This research highlights the social vulnerabilities that place-bound communities in biofuels regions are experiencing.

1. Introduction

In a recent paper, environmental sociologist Arthur Mol [1] argues that important social dimensions of biofuels production have been overlooked in recent debates that have been dominated by natural and environmental scientists. In fact, in addition to concerns about fostering energy independence in the context of depleting oil reserves, one of the primary reasons why many countries have been promoting and subsidizing biofuels production is in an attempt to reverse the ongoing social and economic crises affecting rural areas of many OECD countries, due to low prices and continued overproduction of agricultural commodities [2–4]. However, the expanded acreage and production of biofuels in many countries has led to heated debates about the environmental consequences, and more recently, to concerns about impacts on food security of the poor as land is diverted from food to fuel crops [5–10]. Many analysts realize that biofuels production presents an opportunity for agricultural producer countries, many of which are developing countries, but that higher food prices could threaten the food security of the poor in developing countries as well [4,11].

Applying a sociology of networks and flows approach to the analysis of the expansion of the biofuels industry globally,

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Mol characterizes biofuels regions as being either locally or nationally organized. In place of the focus on the static categories of states and societies as key actors in political-economic sociology, sociologists of networks and flows emphasize the importance of flows (of power, finance, technology, information) that define the contemporary era of globalization [12,13]. Sociology of networks and flows research suggests that power in these networks is in the 'space of flows' that are related to access to, inclusion in, and control over these flows, while the 'space of place' describes the place-bound location of production outside the network that is rendered essentially powerless [12,13]. While for Castells, the networks and flows mainly refer to information and technology, in Mol's formulation, the space of flows includes material and environmental flows, especially flows of energy [1,14]. While many poorer developing countries produce biofuels regionally for local consumption with limited state involvement, in countries such as Brazil and the US, biofuels (specifically ethanol) production has strong state involvement, well developed infrastructure, and is organized into national biofuels regions that are part of a globally integrated network [1]. In Europe, the state has also played a major role in stimulating biofuels (mainly biodiesel) production through policies subsidizing production and consumption, but recent critiques of social and environmental consequences from non-governmental organization (NGOs) have made a direct impact on renewable energy policies, leading to reductions in renewable energy targets from biofuels for the European Union [8,9,15] With the increasing concentration and global integration of ethanol production in national biofuels regions such as the Midwestern US, locally- and regionally-organized biofuels production, distribution, and consumption are increasingly sidelined from global circuits. Whether this is positive or negative in the long run remains to be seen.

However, even within nationally-organized biofuels regions, such as the US Midwest, there is considerable differentiation between communities in which biofuels production is located. While a great deal of attention has been paid to concerns about the environmental externalities of biofuels production, such as deforestation of tropical forests for biofuels crop production, and about vulnerabilities of the poor in developing countries due to rising food prices because of the shift from food to fuel crop production, little research has focused on the social vulnerabilities of communities hosting biofuels production within national biofuels regions. As specific communities are locales for biofuels production, there is a need to explore how communities are affected by the siting of grain-based ethanol plants, and what community members perceive and experience to be the promises, and the perils, of the emergence of biofuels industry. While integrated into global networks, the ethanol plants still have local impacts. Although many have assumed the rural development benefits of biofuels production, little research has examined empirically what social and economic benefits communities gain. This paper employs a community case study approach to examine community perceptions toward biofuels production in three rural communities hosting ethanol plants in the states of Kansas and Iowa in the Midwestern US. The paper is organized into the following sections. In the first section we discuss prior research on community level impacts of economic restructuring and how this informs the study of communities with ethanol plants. We then provide a description of the historical development of our three cases study communities. Following that description, we present a short description of the methods used and data drawn from community surveys, individual and focus group interviews in all three case study communities. We then present our findings and implications for other communities.

2. Rural community change

A recent study described results drawn from a nationwide survey of US rural residents that examined several factors that foster and/or challenge economic and social resiliency in rural communities [16]. This study confirmed that as globalization processes continue to restructure rural economies, increasingly agricultural and manufacturing jobs are being replaced by service sector employment. According to the typology they developed to characterize rural regions, most of the rural communities in the Great Plains and Midwest fall into the category of 'declining resource dependent' regions [16]. Even when compared with other declining and economically depressed rural regions, such as Appalachia or the Mississippi Delta, survey respondents from communities in the Great Plains and Midwest were *less* optimistic about the future of their communities and their future employment opportunities [16].

Rural sociology has a long tradition of studies examining community level impacts and responses to economic change [17,18]. In the 1940s, a series of case studies were completed in six rural communities by rural sociologists for the USDA to investigate the cultural and community factors that create willingness or resistance to change, and lead to instability or stability in communities [19]. These case studies were significant in fostering interest in the study of rural communities [17].

In the 1980s, sociologists focused on the community level vulnerabilities associated with rural resource dependent and extractive economies, in advanced industrialized and developing country contexts [20–22]. There were also a number of studies exploring the impacts of the 1980s Farm Crisis on rural communities and families [23–25]. Research in the 1990s examined how processes of economic restructuring and globalization have led to uneven development and economic decline for many rural communities [26–28]. Recent research focusing on rural communities range from those looking at the impacts of economic and demographic decline in agricultural communities in the Great Plains [29,30], ongoing and persistent rural poverty in Appalachia and Black Belt [31], and declines in resource dependent communities due to environmental restrictions on resource extraction [32]. Others detail the impacts of encroaching suburbanization in parts of the 'post-agrarian' rural Midwest [33], the influx of newcomers and retirees to high amenity rural regions [34], and the challenges associated with increasing ethnic diversity in traditionally homogeneous rural communities in the Great Plains and Midwest [35,36]. While a few of these studies are concerned with the social and cultural impacts of positive growth on

communities, the majority focus on the impacts of economic and demographic decline on rural communities. This research exploring the impact of biofuels on rural communities draws on this body of literature to examine rural community level responses to current economic restructuring.

3. The development of national biofuels regions

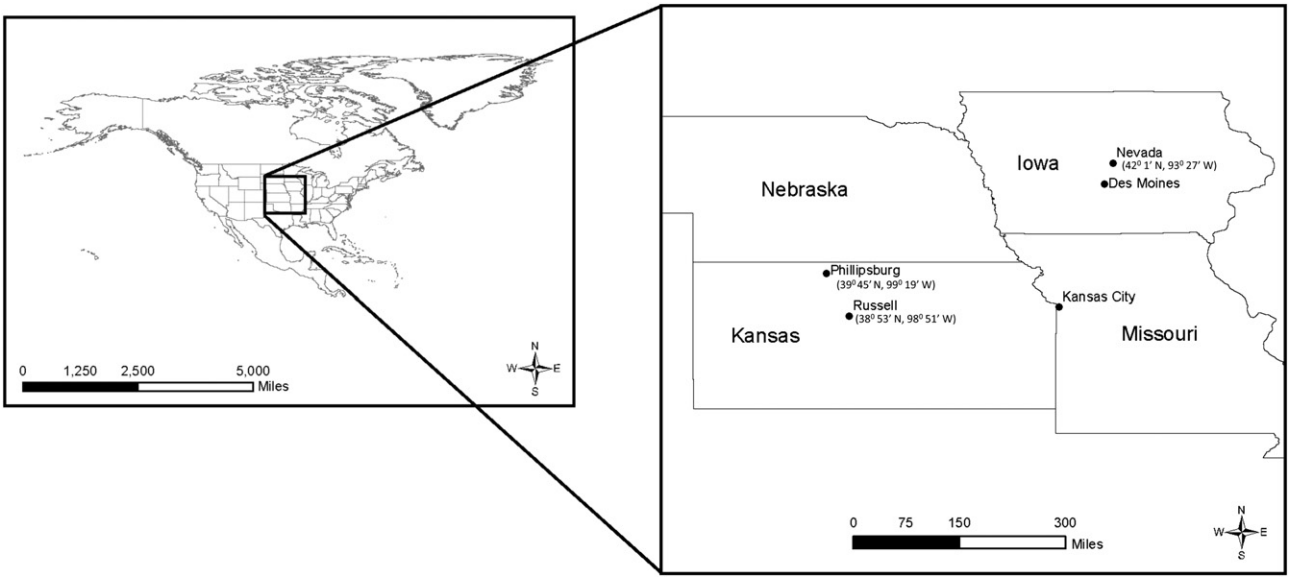
The expansion of biofuels development has been promoted as an opportunity for revitalization of stagnant and declining rural communities in the U.S. Since the 1980s Farm Crisis, continued low prices for agricultural commodities across the Great Plains and the Midwestern US have furthered ongoing farm loss, farm consolidation and economic decline. This has contributed toward dramatic population losses in large regions of the Corn Belt and Great Plains regions in the Midwest [29,37]. Counter to these trends, some rural communities within the states of Kansas and Iowa have achieved economic growth and population increases through attracting the construction of meat packing plants and related "upstream" industries such as cattle feedlots, many of which are now competing with biofuels production for feedstock and water supplies [35,36,38].

3.1. *The spatial distribution of ethanol biorefineries in the Midwest*

The vast majority of ethanol biorefineries are spatially concentrated in the Corn belt of the upper Midwest. The center of the industry is concentrated in the state of Iowa, which contains the largest number of ethanol plants (see Map 1). In 2009, there were 42 ethanol plants in operation in Iowa, including four plants under construction [39]. The state of Kansas represents the western edge of the geographic center of the industry and is also experiencing a rapid expansion in its ethanol production capacity (see Map 1). In 2009, Kansas had 11 existing ethanol plants in operation, two plants which are idled for reasons of bankruptcy, three under construction, and another three which are permitted or have permits pending but not yet under construction [40]. Several of the existing and planned plants are in western Kansas, where water availability depends on extraction from underground aquifers. The economy of western Kansas continues to be very dependent on agriculture, and therefore on water resources. This heightens the tension underlying the allocation of limited water supplies between food and fuel crops, for livestock and ethanol processing, and water for human consumption and development within affected rural communities. In sum, given their location in the center of the industry, the states of Kansas and Iowa provide excellent "laboratories" for studying the impacts of biorefineries on rural communities.

Despite the potential economic benefits of biofuel production for rural communities, anecdotal evidence suggests that the growth in construction of ethanol plants has been accompanied by an increase in organized opposition in some communities [41]. A key reason for opposing plant construction is the perceived negative impacts of ethanol plants on the quality of life in rural communities, especially through risks they pose to the safety of community residents, air pollution, increased heavy truck traffic and road congestion. Another key reason for the formation of opposition groups in some rural communities stems from the concern about the potential impact of these biorefineries on the availability of local water supplies [42].

It has been suggested that locally-owned biofuels plants are more likely to generate local income and employment, as opposed to absentee owned plants [3,43]. Related sociological research on resource-dependent 'boom' industries, such as mining or meat packing, suggests that because absentee owners are not connected to the community, they may be more likely to close plants and move elsewhere if profits decline. In turn this leads to cyclical economic 'bust' for local communities dependent on these jobs [35,44]. Of the 193 ethanol plants in operation in the US currently, 41 of them are



Map 1: Case Study Communities in Kansas and Iowa

farmer-owned [39]. In Kansas, only two of the existing plants are locally-owned, whereas in Iowa, nearly half of the 42 existing plants are locally owned [39]. The size and scale of an ethanol biorefinery can also be important factors influencing its social and economic impacts. For example, it has been suggested that smaller scale plants may offer more dispersed economic opportunities to many rural communities, as opposed to one larger-scale centralized plant [3]. However, the trend in the ethanol industry to date has been toward increasingly larger plants, which often makes it difficult for local investors and farmer-coops to mobilize sufficient capital for the level of investment required.

Because Iowa represents an early leader and widespread adopter of biofuels production and processing, and is also representative of several other Corn Belt states such as Illinois and Indiana in terms of water availability and cropping patterns, we will compare the adoption and expansion of biofuel production in Iowa to the situation in Kansas. Looking at how farmers and rural communities have been affected by the emergence and growth of the biofuels industry in Iowa and Kansas will provide important lessons for rural communities in other states where widespread expansion is being promoted.

3.2. *Selection of case study communities*

Case study communities were selected from non-metropolitan counties based on a combination of criteria. Three rural communities with ethanol plants in Kansas and Iowa were selected in order to gain some diversity in terms of time of plant establishment, size, location, and water availability, and ownership structure. Another three cases will be selected as part of the ongoing research project. These criteria for case selection are described in the table below for the communities. See Table 1.

Russell and Philipsburg, Kansas, both county seats, are small rural communities in central west Kansas that have been declining in population since the 1950s; the current population living in these communities is older than either the Kansas or US average, for rural and metropolitan areas. Crude oil transformed the City of Russell into one of the fastest growing communities in the country in the 1930s, and small scale oil extraction continues today, depending on the price of oil. Agriculture in Russell and Philipsburg is dominated by non-irrigated grain crops, especially sorghum and wheat, and livestock. The average farm size in both Phillips and Russell Counties is larger than the state average, but the value of crops grown in these counties is lower than the state average. Russell has a lower median household income ($35,549) and higher poverty rate (13.7%) than does Philips County ($41,735 and 10.9%, respectively), although the poverty rate in Russell is still lower than the average for US non-metro counties [45]. In the years leading up to the establishment of the ethanol plant, Russell experienced several crises: in 2000, an explosion destroyed the city's power plant and the town's largest private employer, a recreational vehicle manufacturing company, halted production. Job losses there were compounded by the closing in May 2001 of the wheat gluten factory that employed about 35 people. The prospect of an ethanol plant was greeted with enthusiasm in Russell, and as an incentive, City officials decided to build an advanced replacement power plant next to the biorefinery. In Philipsburg, Kansas, farmers in a local co-op decided to pool their resources to invest in an ethanol plant. Prairie Horizon Agri-Energy LLC ethanol manufacturing plant in Philipsburg is financed by 305 Investors, 13 Board of Directors (who are all investors), and 31 employees. The plant began operating in 2006, and produces 141 dams3 of ethanol, and wet and dry distillers grain for animal feed.

Lincolnway Energy, LLC (LWE) is located in the city of Nevada, the county seat of Story County, in central Iowa. Nevada has a population of approximately 6658 and Story County, also the location of Iowa State University, has a population of 78,000. Median annual household income in 2007 was $49,104, higher than the two communities in Kansas, although the percentage of the population below poverty in Story County was 14.4% [45]. The site for LWE was chosen because of its close location to a major national transportation corridor of Interstate 35 and US Highway 30 and adjacent to Union Pacific's class 1 Rail Road [46]. This facilitates transportation of the plant's inputs, such as corn and coal, and outputs of ethanol and dried distiller's grain (DDGS). As well, Mid-Iowa's agricultural landscape provides abundant corn to provide the feedstock for LWE. LWE was built adjacent to the Nevada branch of the Heart of Iowa Co-op (HOIC), which handles the plant's feedstock corn.

LWE is a locally-owned ethanol plant. Initially, the farmer-owned Heart of Iowa Co-op (HOIC) proposed to build an ethanol plant that would be owned and controlled by HOIC as a means to strengthen the economic viability of their members by providing a market for their corn. However, the co-op soon realized that they could not raise the tens of millions of dollars necessary to build a 189 dams3 plant, which they considered the minimum size to be competitive. Subsequently, the decision was made to change the ownership structure to a limited liability company but to ensure local control by restricting investment opportunities to Iowans and to prohibit any single shareholder from owning more than 2 percent. Half of the original investors were farmers.

Near Nevada, there are also several food manufacturing businesses as well as other industrial employers. As the local

Table 1 – Criteria for case selection.

Community	Population 2008	Plant Start Date	Plant Capacity	Feedstock	Ownership Structure	Community Support/ Opposition	Water Constraints
Russell, KS	4217	2001	189 dams3	Milo/wheat starch	Non-local	Support	Yes
Phillipsburg, KS	2367	2006	151 dams3	Milo/corn	Local	Support	Yes
Nevada, IA	6658	2006	189 dams3	Corn	Local	Support	No

government center of Story County, Nevada provides employment in its county administrative offices. Nevada is just 19 km from two large government employers, Iowa State University and the Iowa Department of Transportation both located in Ames, Iowa.

4. Sampling & Data Collection methods

The research design for this study employed a mixed methods approach using both quantitative and qualitative methods. The quantitative component of the research design employed survey research for the purpose of measuring the perceived impacts of the local ethanol plant among residents in each case study community. A random sample of households from each case study community was selected. Each sample was limited to households located within the city boundaries of the community in which the ethanol plant was located. The sample from Russell, Kansas included 454 households; the sample from Phillipsburg, Kansas included 500 households; and the sample from Nevada, Iowa included 600 households. The survey was targeted toward the head of household and self-administered by the respondent.

Each community survey was implemented by mail using a modification of Dillman's [47] Tailored Design method. Prior to sending out the surveys, sampled households in each case study community were notified that a community survey was being conducted. A postcard providing notification of the survey was sent to each sampled residence. Further, public notification of the survey was provided in the local newspaper. An initial survey packet was then mailed to each sampled household which included a cover letter, survey questionnaire and business reply envelope. A postcard reminding non-respondents to complete and return the survey was sent two weeks after the initial mailing. Finally, a second survey packet was mailed to non-respondents one month after the initial mailing. The community survey was conducted in Russell, Kansas during April/May, 2008, and in Philipsburg, Kansas and Nevada, Iowa during October/November, 2008.

The Russell, Kansas survey yielded 173 completed questionnaires. Excluding the 54 surveys returned due to undeliverable addresses and the 20 households that requested to be removed from the list of participants, the Russell survey produced a response rate of 45.5%. The Phillipsburg, Kansas survey produced 226 completed questionnaires. In total, 33 surveys were returned due to undeliverable addresses and 7 households requested to be removed from the list of participants. Excluding these households, a response rate of 40.4% was attained. The Nevada, Iowa survey yielded 262 completed surveys. Excluding the 26 surveys returned due to undeliverable addresses, a response rate of 45.65% was attained.

4.1. *Sample Composition*

Table 2 compares selected demographic characteristics from each sample with the place-level characteristics of each community drawn from the *2000 Census of Population and Housing* [45].

It is reasonable to assume that each community experienced some demographic changes in the eight intervening years since the census was taken and the surveys administered. Nonetheless, the data in Table 2 reveal some nontrivial differences between the characteristics of each sample and the broader community populations, at least as these populations were characterized in 2000. Each sample contained substantially higher percentages of households headed by middle-aged persons. Moreover, each sample contained a substantially higher percentage of community residents with college

Table 2 – Comparison of Sample Characteristics with Place-Level Data from the 2000 Census of Population and Housing.

	Russell, KS		Phillipsburg, KS		Nevada, IA	
	2000 Census %	Sample	2000 Census %	Sample	2000 Census %	Sample
Sex of Household Head						
Male	64.3	55.1	69.3	62.6	66.8	71.8
Female	35.7	44.9	30.7	37.4	33.2	28.2
Age of Household Head						
15–24 Yrs.	3.0	0.6	5.2	2.3	7.6	2.8
25–34 Yrs.	12.4	6.9	10.9	12.2	17.3	7.9
35–44 Yrs.	16.7	14.5	19.9	5.8	23.6	16.5
45–54 Yrs.	17.7	20.1	15.8	16.9	19.5	26.4
55–64 Yrs.	13.7	21.4	12.2	27.9	11.5	18.1
65–74 Yrs.	14.7	16.4	14.6	16.3	9.8	15.7
75+ Yrs.	21.9	20.1	21.3	18.6	10.7	12.6
Level of Education						
<H.S. Degree	21.1	5.7	14.9	2.3	14.0	1.9
H.S. Degree	34.9	38.0	36.9	35.6	34.0	36.8
Some College, but not 4 yr. degree	28.6	22.2	32.9	36.2	31.7	19.5
Bachelor's Degree or Higher	15.4	34.2	15.4	26.0	20.3	41.8
Household Income						
Less than $10,000	15.4	2.5	11.3	3.6	6.0	3.7
$10,000–$29,999	39.0	24.8	31.6	25.0	25.7	15.2
$30,000–$59,999	32.3	39.5	44.1	40.5	41.6	26.3
$60,000 and above	13.3	33.1	13.0	31.0	26.7	54.8

degrees. Finally, each sample contained a substantially higher percentage of households in middle-to-upper income groups. Taken together, these differences suggest that community residents with larger "stakes" in the community were more likely to respond to the survey. At the same time, however, these residents would be most likely to be knowledgeable about community affairs including issues surrounding ethanol plants. In turn, this would suggest that generalizations from the surveys should be limited to community residents who are larger stakeholders rather than the community as a whole.

4.2. *Qualitative methods*

The qualitative component of the research design involved the use of semi-structured interviews with stakeholder groups that held a vested interest of some type in the operation of the ethanol plant in each case study community. Focus group interviews were conducted with farmers, ethanol plant workers, and community business leaders. In addition, individual interviews were conducted with local government officials, school district administrators, municipal utility plant managers, and economic development directors. The purpose of these interviews was to collect in-depth qualitative data on the perceived impacts of the ethanol plant from the perspective of these community stakeholder groups. The focus groups and individual interviews were semi-structured and followed an interview guide. All interviews were tape recorded and transcribed verbatim, and interview data were sorted thematically. In the next section, we present an overview of the findings derived from the data.

5. Findings

Several questions on the survey elicited information about how community residents perceived the impacts of the plant on the community. In our analysis we only used data from city residents (not county residents) so that the data are comparable across all three communities. We asked community residents to rate the overall significance of the plant to the local economy and to rank various economic, social and environmental impacts of the plant on the community. Overall about one third of respondents thought the plant was 'very important' to the local economy, although the percentages varied considerably by location, with the greatest percentages (38%) of residents in Russell, Kansas, thinking it was very important, while Nevada, IA had the lowest percentage of residents (27%) responding that it was very important to the local economy. Nevada also has the most diverse economy of the three communities and is least economically dependent on the ethanol plant. See Table 3.

A high percentage (about 80%) of residents in all three communities agreed that the ethanol plant had added new jobs to the local economy, although the new jobs were **not** perceived to be *well paid* jobs. In all three communities the ethanol plant was seen as bringing jobs for *local* workers, although more so in the Kansas communities than in Iowa. Overall though, respondents felt that the ethanol plant had **not** made an impact in reducing poverty in the counties. See Table 4.

Table 3 – How important is the ethanol plant to the economy of the local area?.

	Russell, KS %	Phillipsburg, KS %	Nevada, IA %
Very important	38	31	27
Important	38	36	42
A little important	17	29	23
Not important	6	5	8

N for Russell = 171, For Phillipsburg =186 and for Nevada = 261.

When asked to rate the overall impacts of the ethanol plant on the local quality of life, community residents were very mixed in their assessments. About one third of residents in each community stated that they thought the costs and benefits of the plant were essentially equal. However, more than a third of residents in each community (41% in Russell, 39% in Philipsburg, and 41% in Nevada) did think the benefits *moderately or greatly* outweighed the costs. See Table 5.

In a separate question we asked residents to respond to a list of possible environmental and quality of life impacts of the plant on the community, and responses to this question are more telling in terms of specific impacts the plant is having in particular communities. The highest percentage of respondents in all three communities agreed that the plant produced noticeable odors, and a significant percentage of residents in all three communities expressed the opinion that traffic congestion had increased and local roads are deteriorating as a result of the truck traffic to the plant. While a small percentage of residents in all three communities believed that an overall decrease in the quality of the environment had resulted from the ethanol plant, a high percentage of residents in Kansas, especially in Russell (67%), were concerned about water resources used by the plant and whether water resources were being diverted from other important city needs. In Philipsburg, Kansas, over one third of residents (37%) expressed this concern about water use as well, while only 10% of Nevada residents were concerned about competition for water resources. The differences reflect the fact that the plants in Kansas are located in the central western, more arid part of the state; a drought had affected central west Kansas from 2001–2006, requiring watering restriction in many communities. About one third of residents in Nevada, IA, and Russell, KS, respectively, were also concerned about increased air pollution resulting from the ethanol plant. Despite considerable media attention to the links between food and

Table 4 – Jobs Added to the Local Economy.

	Russell, KS %	Phillipsburg, KS %	Nevada, IA %
Added *new* jobs to the local economy	81	80	79
Added *high paying* jobs to the local economy	37	30	23
Provided jobs for local workers	81	83	67
Reduced poverty locally	10	10	8

N for Russell = 171, For Phillipsburg =186 and for Nevada = 261

Table 5 – Costs and Benefits of the Ethanol Plant.

	Russell, KS %	Phillipsburg, KS %	Nevada, IA %
The benefits greatly outweigh the costs	19	17	17
The benefits moderately outweigh the costs	22	22	24
The benefits and costs are about equal	30	39	36
The costs moderately outweigh the benefits	14	10	14
The costs greatly outweigh the benefits	15	12	9

N for Russell = 171, For Phillipsburg =186 and for Nevada= 261.

fuel prices, there was disagreement between residents in all three communities over whether demand for grain for ethanol production was linked with increased food prices, and the highest percentage of residents expressing this concern were from Philipsburg (28%). A small percentage of residents in all three communities expressed concern about water pollution or increased health problems resulting from the ethanol plant. These are summarized in Table 6.

Finally in the community survey we asked an open-ended question: "How would you describe the current public sentiment about the ethanol plant?" In order to analyze responses to the question, we coded responses into four categories-positive, negative, neutral and don't know. Nearly half (46%) of residents in all three communities responded that current public sentiment about the plant was positive; 22% responded negatively; 13% responded neutrally; and 18% responded that they did not know.

Table 6 – How would you rate the impact of the ethanol plant on the local quality of life?.

	Russell, KS %	Phillipsburg, KS %	Nevada, IA %
Generate noticeable odors	69	55	25
Water resources have been diverted from other important needs of the city	67	37	10
Local roads show heavy wear	39	36	24
Changes in the crops planted by local farmers	37	52	44
Increase air pollution	32	18	30
Traffic congestion has increased	25	44	35
Local food prices have increased	22	28	17
A decrease in the overall quality of the environment	11	5	12
Other public services have been cut	7	2	5
Increased water pollution	6	3	5
Increased health problems among the local population	5	2	2

N for Russell = 171, For Phillipsburg =186 and for Nevada= 261.

When examining individual comments, we find that many of the positive comments reflected a sense of relief that their town was the site chosen for an ethanol plant because so many other neighboring rural communities were losing people and jobs. Comments included:

It smells and smokes but any job in this town is better than none at all. (R166)
Glad to have it, especially with several communities losing jobs in western Kansas. (R125)
We support it, we love it, we want it to stay here! (Have lived here 52 years!). (N1211)
I think most people like having it here. It brings more awareness to the availability of E–85 as an alternative to gasoline. (N1156)

Especially in the Kansas communities, concern was expressed in open-ended comments and in interviews about the plant's water use and the negative impacts of the plant on community water resources. In the community of Russell, where residents had faced water restrictions during a long term drought, many cited the plant as responsible for over-using local water supplies. Others expressed the sentiment that community members were not adequately informed about how much water the plant would require and would not have supported plant construction if they had known:

Very negative. Our water rates have gone up, while we are under severe water restrictions. The ethanol plant gets the water, the citizens get the bill. People in this community can't enjoy their own back yards. (R63)
It's pretty much a mixed bag. Many didn't really know the amount of water used or that the price of corn would go up. (R90)
Not good. There is not that much water and in a few years there is the possibility that our water sources will be gone. The people for the ethanol plant will leave with their money and we will be stuck without water. (R273)

In individual and focus group interviews, we explored some of these issues related to community impacts in greater depth. Focus groups were conducted with farmers, ethanol plant workers, and local business leaders; interviews were conducted with local government officials, economic development directors, school district administrators, County Extension staff, municipal utility directors, newspaper editors, local business owners/managers, and farmer co-op representatives. The findings can be summarized in several themes.

There was widespread agreement that the establishment of the ethanol plant had ***not*** led to population increases in these declining rural places, but it did have the effect of stabilizing the population. Sentiments were expressed that the town would have been 'worse off' without it, since nearby towns were continuing to decline. Focus group participants felt that because of the stable jobs offered by the plant, they were able to draw other people into the community.

In focus group discussions, local business leaders were very positive about the economic benefits that plant had brought, such as increasing demand for trucking contractors and demand for housing. Others expressed a more intangible 'mental' boost the plant had given the community, and that it had created a 'positive outlook' to know that their town had

been chosen to host a new plant. While residents in all the communities expressed some reservations about the ethanol industry as a solution to the nation's energy problems, they clearly stated that if the ethanol industry was going to exist, they wanted the ethanol plant in their town, because it gave their community an advantage.

Mixed sentiments about the ethanol industry were also expressed by farmers in the focus groups. One farmer said: "[It's] kind of a two-edged sword for the livestock industry. … I love it when I sell grain but when I buy cattle feed, it's killing me." Many farmers expressed concern about high grain prices and whether this would negatively affect both the ethanol and cattle feeding industry in the long term. Several also complained that local farmers had been promised they would be able to access the distillers' grain from the plant, but that the plant was selling everything to distant large cattle feedlots. They complained that some of the promised 'local' benefits from the ethanol plant were not forthcoming.

Because some studies suggest that the benefits of 'local' ownership may be greater to the community [43,48], we also probed residents about whether the plant was locally owned made any difference in terms of its relationship to the community. The plant in Russell was built and operated by US Energy Partners and subsequently sold to White Energy from Texas. In individual and focus group interviews, community members agreed that the company, though not locally-owned, was a good 'local' corporate citizen and had made substantial contributions to community organizations and causes. The fact that plant owners lived outside the state appeared to make no difference to local residents. In Philipsburg, the plant was started by local investors, and focus group participants also stated that the plant acted like a good corporate citizen in supporting many local community organizations.

In our interviews in Nevada, IA, participants identified individual shareholders —together with farmers— as the main beneficiaries of LWE. The opportunity to invest in the ethanol plant had created a great deal of excitement among those individuals in Nevada who had the financial resources to invest. In the first couple of years that the plant was operating this support was validated by healthy returns to shareholder and even as returns have declined support for the plant among investors remains high.

In terms of benefits to the broader community, however, most participants viewed ownership structure as largely irrelevant, in part because investors come from across Iowa and thus are viewed as having no particular allegiance to Nevada and its residents. One city official also explained that for the town it was irrelevant whether shareholder returns to townspeople came from LWE or some firm on Wall Street – money was money. Moreover, he argued that there was little evidence of any broader economic benefits of local ownership to the town, such as the development or expansion of new housing or businesses. From his perspective, the greatest economic impact on the community would be if local residents could benefit was being able to access locally manufactured ethanol more cheaply. This would benefit residents while lower transportation costs might create some broader economic stimulus. However, since ethanol is part of a national not local commodity chain, this is not the case.

LWE was also obliquely criticized by several community leaders for its lack of community engagement and for being one of the few companies in town that had not contributed to local causes. Apparently, company officials had explained that they believed that it would be unfair to investors outside of Nevada for them to support community organizations and events. Interestingly, a number of participants also believed that support for the plant among local investors and city officials had made it difficult to critique the plant or to question the costs and benefits of the plant to the community.

In short, whether it was locally or non-locally owned did not seem to factor into community members' perceptions about the plant's benefit and allegiance to the local community. The locally-owned plant in Iowa was perceived as less of a good 'local' corporate citizen than was the non-locally owned plant in Russell, Kansas.

Wide ranging concerns about the future viability of the ethanol industry were frequently voiced in open-ended comments on the survey and in interviews. They spanned from worries about financial volatility in the oil and ethanol industries, to concerns that ethanol is not a long term solution to rising energy demand, to concerns that first generation ethanol plants will be superseded by newer technology and/or new second generation feedstocks. Several negative comments about the ethanol plants were related to uncertainty about local benefits, and concerns about local burdens if the plants were to have financial difficulties or became outdated.

Comments from the survey and from interviews included:

It may soon close and we will be burdened with the tax load, as we already are and had no say about it; no election! We done this, now you taxpayers eat it. (R183)
Very frustrated with increase in traffic to/from the plant and a disappointment in the addition of jobs that are not available to the local residents (N1087)
Most people don't have any idea about who runs the plant and who benefits from it locally. (N1023)
The only problems I have with the ethanol plant is why should our county go into debt to build a paved road to the plant to make the investors money? (P434)
The downside that scares me to death is, we have built a lot of things around this plant and other towns have built around plants like it and the stroke of the market could shut them all down. The upheaval caused would be tremendous. A lot of money being lost in investment and… (R-FG)
[The future] well, we hope it'll be good (P-FG)

Other interviewees stated that they felt fortunate that the ethanol plant had opened during the boom a few years before the current downturn, because they see how tenuous the expansion of the ethanol industry has become in a short time. Overall many community members expressed discomfort about how the future of the ethanol industry would affect their community's fortunes.

6. Conclusions about social vulnerabilities

In recent years, the fragile nature of the current grain-based biofuels industry has been exposed. As of January 2009, throughout the US, 176 ethanol plants were operating, another 220 were planned, and 45 were under construction [39].

However, 28 plants were not producing, 19 were cancelled, and 33 were on hold [39]. In Kansas in the last year, two plants have gone bankrupt and the construction of many more have been stalled either temporarily or permanently due to downturns in the demand for ethanol. Some analysts suggest that the ethanol boom has already gone 'bust' [49]. For many rural community residents who thought that the biofuels industry offered a key to the revitalization of their economies, it has been a sobering reality to see ethanol plants in neighboring towns close down. This has led some community residents to speculate how fragile the industry is, and whether their community will also face an ethanol plant closure that may leave the community in a worse position economically. As one community member stated in one of our focus groups "there are a lot of things [in the world economy] that could go downhill or it could increase [demand for ethanol]."

Many respondents also expressed the feeling of being buffeted by international and national policy decisions, such as the US Energy Independence and Security Act of 2007 and the Renewable Fuel Standard, which while currently advantageous to ethanol production, may shift quickly in response to new demands and new concerns. For example, in April 2009, the European Union passed legislation that cut its 10% quota of transportation fuels coming from first generation biofuels under mounting criticism of rising food prices and biodiversity loss, and the questionable CO^2 reduction values [50]. The biofuels target for transportation fuels has been replaced by a target of 10% of transport fuels coming from all renewable sources by 2020, including biofuels, hydrogen, and green electricity, and at least 40% of that energy should come from non-food competing second generation biofuels [50]. These decisions are made within the circuits of 'global flows', but they have clear impacts in rural communities that inhabit the 'space of place'. This research has highlighted the social vulnerabilities that place-bound communities in national biofuels regions are experiencing.

Because the Kansas case study communities have less diverse economies and more direct environmental impacts from biofuels production in terms of water competition, these communities appear to be more socially vulnerable than does the community in Iowa at this juncture. While we cannot generalize the research findings from communities in Kansas and Iowa to all communities hosting ethanol plants, our community level research offers an important corrective to the ongoing assessments made by many policymakers and biophysical scientists that, while facing some serious environmental challenges, the biofuels industry at least offers an unquestionable economic opportunity to rural communities.

Some initiatives that are being developed to ensure that biofuels production does create some economic and social benefits for place-based producing communities are certification and labeling schemes [51]. Certification provides information to buyers about certain product characteristics, in this case sustainability. There are currently several NGOs, national and regional governments (such as the EU), international organizations, and private companies that are discussing criteria that should be included in the certification of sustainable biofuels, and indicators that could be developed to measure compliance with criteria. Importantly, the objectives and motivations for certification varies subtstantially between these four groups of actors.

While ecological criteria (such as reducing greenhouse gas emissions) and economic criteria (such as creating economic growth) seem to be fairly straightforward to develop and measure, the social indicators are proving to be the more challenging because they are wide ranging and more difficult to develop meaningful measures. Social criteria range from ensuring good labor conditions, to access to clean water to ensure quality of life, to equitable land ownership, and to capacity building. As with certification schemes such as Fair Trade or organic production, complying with these certification requirements does add an extra cost and burden for producers; therefore, it has been suggested that certification schemes make special effort to reduce the burdens and barriers to entry for smaller producers [51]. While many of these social criteria are being developed to protect workers and communities in the developing world, these have not yet been applied in the US context to biofuels producing communities. Clearly this research demonstrates that finding a way to incorporate social criteria would be very beneficial for place-based communities in nationally-organized biofuels regions in the US.

Currently other ideas for ensuring benefits for communities hosting energy production are being discussed in the US. For example, some communities and organizations are beginning to work on more distributed, decentralized alternative energy production systems that could bring direct benefits of lower cost energy to producing communities. Other stakeholders are beginning to develop long term agreements with energy companies to ensure that communities that are energy production sites are provided some public goods or benefits, such as long term lower cost energy. Such certification schemes and formal agreements hold the potential for ensuring that environmental and social interests are embedded in space of flows.

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